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Title: The Application of an Experimental Food Label Applied to Food Served in the Selected Secondary Schools in Greater London and its influence on Adolescent Food Choice.

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March 2022

Abstract

Background: Adolescent obesity is more prevalent in the United Kingdom than in almost any other higher income nation. Providing nutritional information in the form of a food label (FL) is one strategy that has the potential to reduce obesity. School food can theoretically provide a third of an adolescent's daily calorie intake, yet schools in England have no legislation that guide pupils to the healthiest food choices.

Objectives: The study had three objectives. First, to design an experimental FL in the form of a nutritional food score. Second, to apply the FL to the food on offer in four secondary schools in Greater London and explore if it influences adolescents to select healthier food choices. Third, to appraise which factors adolescents rank as having the greatest influence on their food choice at school to better understand their behaviour.

Methods: Using a pragmatic approach, this study deductively explored through the collection of quantitative survey data at three time points for a total of nine weeks if the FL influenced food choice. Additional survey data revealed which factors adolescents ranked as the most important when selecting food at school. Using an inductive approach with focus groups and thematic analysis the research sought to better understand adolescents' interpretation of the FL and to comprehend their reasons for ranking these factors.

Results: Quantitative results indicated that there was no significant effect on a change in food choices with the application of the FL at any of the four schools and adolescents ranked taste, hunger, health, and nutrition as the most influential factors in their food choices. Qualitative results indicated that adolescents did not understand the FL and using Story et al`s., (2002) conceptual model of adolescent eating behaviour the study identified that there is reciprocal determinism between behaviour and the school environment in both directions.

Conclusion: The FL design did not influence adolescents to select healthier food choices, possibly due to a lack of understanding of the design. Food choices are predominantly based on taste and made using automatic behaviour, but adolescents can be influenced by the individual and social influences, and the effect of the physical environment.

Story, M., Neumark-Sztainer, D. & French, S., (2002). Individual and environmental influences on adolescent eating behaviors. *Journal of the American Dietetic Association*, 102(3 Suppl), pp. S40–S51.

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The biggest thank you goes to my husband Chris and to my family and friends for listening to relentless hours of me talking about my journey yet, all they really wanted to know was ` have you finished yet? `

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Abbreviations

BHF - British Heart Foundation

BMI – Body Mass Index

BNF - British Nutrition Foundation

BBC - British Broadcasting company

DfE - Department for Education

DEFRA - Department for Environment, Food and Rural Affairs

FAO - Food and Agricultural Organization

FL - Food Label

FSA - Food Standards Agency

GDA - Guideline Daily Amount

HoCHC - House of Commons Heath Committees

Kcal - Kilocalories

kJ - kilojoules

NDNS RP - National Diet and Nutrition Survey Rolling Programme

NHS - National Health Service

NCD - Non-Communicable Disease

Ofcom - Office of Communications

OMQI - Overall nutritional quality index

PHE - Public Health England

SACN - Scientific Advisory Committee on Nutrition

UK - United Kingdom

USA - United States of America

WHO - World Health Organization

Publications and Presentations

Chapter four results from School Three have been accepted to be published in The International Journal of gastronomy and Food Science, (2022) 28, June, (in progress).

Chapter four results from School Three have been accepted to be presented at the 12th ICCAS International conference on culinary arts and Sciences. June 2022.

Sustainable meal systems worldwide:
Challenges for Culinary Arts and Sciences
Institute Paul Bocuse, Lyon, France

Chapter 1: Introduction

1.1 Background to the study

In 2017 the World Health Organization (WHO) revealed the findings from the Lancet study on the global estimates of child and adolescent obesity. The figures from this study (*n=130 million*) indicate that the number of obese children and adolescents has risen from 11 million in 1975 to 124 million in 2016 (WHO, 2017). Adolescents (age 10-24 years) make up a fifth of the United Kingdom (UK) population and obesity is more prevalent in the UK in older adolescents (age 15-19 years) than in almost any other higher income nation. Obese adolescents tend to remain obese into adulthood and therefore, interventions to reduce obesity during this lifespan are important as they can lay foundations for a healthier life in adulthood. This in turn brings better social, health and economic benefits to the UK (Shah et al., 2019). One strategy that aims to reduce obesity, is to provide a food label (FL) which can potentially educate, inform, and guide consumers as to which are the healthier food choices. Paradoxically, food provided in schools in England can hypothetically supply one third of an adolescent's daily calorie intake, but there is no legislation, guideline, or requirement to apply any form of labelling to the food on offer. Consequently, adolescents are not informed as to which are the healthier food choices amongst the food on offer at school.

The research explored whether an experimental FL in the design of a nutritional `food score` when applied to food on offer in four secondary schools could guide adolescents to select healthier food choices. However, the factors influencing adolescent eating behaviour are not fully understood because eating behaviour is multi-faceted. Therefore, alongside this experimental FL, the research aimed to measure (quantitatively) the importance adolescents placed on the factors that influence their food choices through a validated food choice questionnaire and elucidate the interpretation of these factors through focus group discussions. The purpose was to measure the effectiveness of the experimental FL as a tool to guide adolescents to select healthier food choices and to evaluate if specific factors need greater integration into public health strategies that aim to reduce adolescent obesity.

1.2 Obesity

Since 1975, global obesity has tripled (WHO, 2021). Currently, in the UK nearly a third of children aged between two and 15 are overweight or obese and these children are becoming obese earlier and are staying obese for longer. In addition, one in five adolescents in the UK (age 11-15) are obese, and yet these figures exclude those adolescents in the overweight bracket, which could indicate that there may be an underestimation of the problem in this population (GOV.UK, 2017; Shah et al.,

2019; Buck, 2020). Between 2014 and 2015, the UK National Health Service (NHS) spent £6.1 billion on tackling the issue of overweight and obesity related health problems. However, this figure does not include the wider financial cost to society through absenteeism at work because of problems caused by obesity, which is estimated to cost the economy £27 billion per annum (GOV.UK, 2017). The total cost may be even still higher, as these figures do not take into consideration that being overweight or being obese is negatively associated with psychological comorbidities, such as depression, emotional and behavioural disorders, and lower self-esteem (Rankin et al., 2016; NHS; 2019; Buck 2020). Yet, obesity is complex and has many overlapping drivers and despite the rising obesity crisis and the associated financial challenges, there is no single solution to solve the problem.

1.3 Obesity and food choices

Key factors that contribute to obesity include low income, social deprivation, and ethnicity (Shah et al., 2019; Marmot Review, 2020). Major health inequalities show that obesity is more prominent amongst more socially deprived children compared to the least deprived children (House of Commons Heath Committees (HoCHC), 2015; Buck, 2020). The HoCHC (2015-2016) stated that evidence of campaigns from Public Health England (PHE) that aim to reduce obesity in the younger generation are targeted towards the higher socioeconomic class. However, evidence suggests that this sector of the population is already more engaged with health and healthier food choices, thus these campaigns further widen health inequalities and the obesity gap. GOV.UK (2017) suggested that other factors that contribute to obesity include culture, genetics, personal behaviour, and the obesogenic environment. Hobbs et al., (2020) described the term obesogenic environment as an environment that encompasses both the influence of the surroundings and an individual's conditions of life and points out that there is an increase in affordable accessible highly marketed energy dense food that is currently available. McPherson et al., (2007) compiled the Foresight report, which acknowledges the challenge of maintaining calorie balance due to the array and availability of calorie-rich food on offer but stressed that making healthier food choices is down to an individual's behaviour and decision-making. The Foresight report suggested that, to address the obesity crisis, interventions assessing food choices need to encompass key elements. These elements include nutritional awareness, changes in the food environment and a change in human behaviour.

Despite this array of contributors to this complex problem, the overarching cause of obesity and being overweight is an imbalance between energy consumed and energy expended (WHO, 2021). Chadwick (ND) suggested that the relationship between diet and health are advancing, and populations are more aware of nutritional advice. Yet figures for adolescents from Public Health England (2020) National Diet and Nutrition Survey Rolling Programme (NDNS RP) (2020) do not

agree. The NDNS RP provides nationally representative data on the type and quantities of food consumed by the general population aged one and a half and over, living in private households in the UK for the period of 2016-2019. The cross-sectional study involved 500 adults and 500 children divided into seven age groups. Individuals submitted a 4-day estimated diet diary, physical measurements, blood, and urine samples and took part in an interview. Results indicated that those aged 11 – 18 years had the highest consumption of sweetened sugar beverages (142g/day); they consume 12.3% of their total energy from free sugars, whereas the government's recommendation which is based on the National Health Service (2020) is no more than 5%. They exceed saturated fatty acid consumption at 12.6%, although the government's recommendation is no more than 10% of total energy. Additionally, 19% were below the recommended intake of vitamin D (25 nmol/L). This age group also consumed only three out of the required five portions of fruit and vegetables a day and fibre intake was below recommended intakes for all age groups.

The Food and Agricultural Organization (FAO) (ND) indicated that food consumption (expressed in kilocalories (kcal) per capita per day), showed that between the mid-1960s to late 1990s, there has been a substantial increase of 450 kcal/per capita globally, and 600 kcal/per capita in developed countries. The amount of energy or calories per gram of food is termed `energy density`. High energy density foods are inclined to have more fat and a lower water content. Examples of high energy dense foods are confectionary, butter, cheese, or crisps; alternatively, low energy density foods contain a higher proportion of water, or these foods will absorb water when they are cooked. Examples of low energy dense foods are fruits, vegetables, pasta, rice, soups, or stews. Consuming lower energy density foods tends to result in fewer calories consumed and a higher nutrient intake (British Nutrition Foundation (BNF), 2016). Nutrient density is defined as the ratio of nutrients present in relation to the food's calorific value (Medical Dictionary, 2009). Therefore, an ideal diet should be based on consuming low energy dense foods that provide a high nutrient density content.

Food consumed out of the home is regularly more energy dense than food prepared at home (BNF, 2018; Tremblay, 2018) and the UK eating out industry grew by 23% between 2014 and 2019 (Mintel, 2019). These eat out food choices are associated with being energy dense, high in calories, fat, saturated fat, and salt, which are all contributing factors to the rising levels of obesity (PHE, 2017). PHE (2017a) developed a strategy to encourage healthier out of home food provision. It identified how food providers can make the food on offer at community level, including cafes, take away shops, leisure centres, and market stalls, healthier. However, even though this strategy covers nurseries and children's centres, school food is not included in this forward-thinking strategy.

One third of an adolescent's daily calorie intake can be consumed at lunchtime. Main meals provided at school in England must comply with the Department for Education (DfE) Standards for

School Food (DfE, 2015 updated 2021). The standards function as a framework and state that there must be a provision of good quality meat, poultry or oily fish, fruit and vegetables, and bread or other cereals and potatoes. These standards replaced the 2006-2009 guidelines, which required menus to meet specific and complex nutritional guidelines that required a computer programme to calculate the nutrients (School Food Plan, 2014). However, the Office for Standards in Education (Ofsted) are responsible for correlating all other guidance to support pupils on informed food choices and healthy eating. Ofsted inspectors assess healthy food provision in classrooms and canteens and assess the effect of the food on pupils' behaviour (School Food Plan, 2015; Food for life.org, 2018). Despite Ofsted inspections and the School Food Standards, there is no guidance or education for pupils as to which food items on offer are the healthiest or the least healthy. Applying a FL to the food choices at school can provide nutritional information which can potentially inform and guide adolescents' as to which foods are the healthier choices (Arambepola et al., 2008; Chiuve et al., 2011; Arsenault et al., 2012; Food Standards Agency (FSA), 2020). Changes in adolescent food choices will impact on the quality of their overall diet and lead to modifying behaviour which is an effective strategy to reduce the obesity trend (Atun, 2014; PHE, 2017; WHO, 2021).

1.4 Food labelling for better informed consumers

Since 13th December 2016, all prepacked food in the UK must display mandatory nutritional information on the back of a FL (Appendix F). The information is per 100g/ml or per portion of the product. It displays energy in kilojoules (kJ), and kilocalories (kcal) and the number of grams of fat, saturated fat, carbohydrates, protein, and salt (FSA, 2021). Nutritional information on the front of all prepacked food is voluntary. FL`s on prepacked food in a retail environment can be either `nutrient specific`, or a `summary system` (FSA, 2021). A nutrient specific format displays total energy, fat, sugar, and sodium/salt per serving (Hersey et al., 2011; Hodgkins et al., 2012; NHS, 2018). An example of a nutrient specific FL is the UK traffic light label (Appendix G) that displays total fat, saturated fat, sugar, salt, and energy in kJ and kcals per 100g or per serving which are colour coded (NHS, 2018a; FSA, 2020; BNF, 2021). Red indicates that the food product contains a high amount of one or more of these nutrients and the recommendation is to cut down or to consume less of the product. Amber signifies that the product contains a medium amount of the nutrient and that you can consume foods with mostly amber most of the time, and green shows that these are healthy food choices (NHS, 2021; FSA, 2021).

A summary system indicates either an overall score or a symbol that confirms that the food conforms to a pre-determined nutritional standard. An example of a summary system label is the Nordic Keyhole (Öhrvik and Lagestrand Sjölin, 2018) (Appendix A). The Keyhole symbol is applied to

foods that guarantee a reduced amount of one or more of total fat, saturated and trans fatty acids, added sugars, salt, and/or a high amount of fibre (Lobstein & Davies, 2008; Öhrvik and Lagestrand Sjölin, 2018a). The United States of America (USA) apply a star rating to the food in supermarkets, known as a graded summary system (Appendix B). The patented algorithm analyses the foods against a point criterion. The Guiding Stars® algorithm calculates nutrients that people are encouraged to consume such as vitamins and minerals, fibre, whole grains, omega-3 fatty acids, and monounsaturated fatty acids (MUFA) (MUFA; for fats and oils only). The algorithm also calculates nutrients that people are discouraged to consume or should limit consumption of, such as trans fatty acids, saturated fatty acids, added sodium, added sugars, and artificial colours or food dyes (Guiding Stars, 2018, p. 1). From this algorithm, foods are ranked from one star as `good` nutritional value, two stars as `better` nutritional value, and three stars indicating the `best` nutritional value (Hersey et al., 2011; Guiding Stars, 2021). The higher the food is ranked, the greater the nutritional value. If a product does not have a star, it can be because it does not reach the nutritional specification, or that it has not been rated, or that it has less than five calories per serving. What is of interest is that the traffic light, the Keyhole and Guiding stars are voluntary; therefore, manufacturers have the choice if they want to apply it to their products. As these voluntary labels are not applied to all products, comparisons between products in a supermarket environment is a challenge for the consumer.

A summary specific FL that does allow a comparison of the nutritional facts on all products in specific supermarkets is NuVal in America. NuVal was pioneered by a group of nutrition and public health scientists who developed and compiled an overall nutritional quality index (ONQI). Using an algorithm, foods are numerically scored based on 30 macro- and micro-nutrients, along with `*weighted coefficients representing epidemiological associations between nutrients and health outcomes*` (Katz et al., 2010 pg. 1102s). These health outcomes include obesity, diabetes, and heart disease. Cass (2011) interviewed NuVal's senior director of nutrition who explained that NuVal is based upon `factors that have a positive impact on health: vitamins, fibre, omega-3 fatty acids. In the denominator are factors that have a negative impact: sodium, sugar, saturated fat and trans fats.` (Cass, 2011 no page number). This scoring system scores food on a scale of one to 100. Fruit, vegetables, and legumes score high numbers, whereas processed salty foods score lower numbers. NuVal charged a fee to calculate and score all the retailers` products. These numerical scores were placed on supermarket shelf tags that allowed for a quick visual comparison of the food products (Katz, 2010; Chiuve et al., 2011; NuVal, 2014). An example of NuVal is in Figure 1. Ealey (2014) and Nikolova and Inman (2015) suggested that applying a summary score is a useful tool to guide consumers to healthier food choices and that the numbers allow for easy comparisons between products. According to Katz (2017), whilst the nutrition behind NuVal was extensive, as a business

the NuVal model was flawed as the retailer had to pay for this FL. What is significant is that these back of pack FLs that are applied to products in supermarkets are governed by law, unlike food purchased to eat away from home.

Figure 1 Anand, P. (2016) https://www.wsj.com/articles/how-to-improve-nutrition-labeling-on-food-1455592269. A visual representation of a NuVal food Score as seen on the left-hand corner of the label.

1.5 Calorie labelling in restaurants

The Department for Environment, Food and Rural Affairs (DEFRA) (2020) categorise consumers eating out into those that consume food at cafes, restaurants, and canteens. Food that is not prepared at home is associated with larger portion sizes, less healthy cooking techniques and an increase in energy intakes (Roberto and Khandpur 2014; Robinson et al., 2018; Hoy et al., 2021). According to the BNF (2018) there is a positive correlation between the occurrence of consuming these foods with both body fatness and fat intake. Murphy et al., (2020) collected data in 2016 on the levels of calories, saturated fat, and sugar from 10,285 menu items from 90 restaurant chains including fast food and sit-down restaurants in Canada. The data revealed that entrees contained 52% of the daily intake for sodium and 45% of the daily intake of fat and deserts were high in sugar and Murphy et al., (2020) suggested that the government should increase transparency of the nutritional content of food served out of home.

Before the pandemic, the UK was seeing a steady rise in consumers eating out (Mintel, 2019). In the UK, around one-fifth (21%) of the population eat at a restaurant more than once a week, 22% order take away food and males eat out more frequently than females. Barclay (2012) stated that the UK Government's Public Health Responsibility Deal (2011) encouraged catering establishments to display voluntary calorie information. This calorie information allows consumers to make healthier food choices, but evidence is nonconclusive regarding the effectiveness of providing this information.

In America, the Health Care and Education Affordability Reconciliation Act (2010) enforced calorie labelling to foods sold in restaurant chains that have more than 20 outlets, but this act was not mandatory in all states. In November 2014, the Food and Drug Administration (FDA) ruled that all covered establishments must provide on request (and on menus and notice boards) nutritional information on total calories, calories from fat, saturated fat, trans fatty acids, cholesterol, sodium, total carbohydrates, fibre, sugar, and protein (FDA, 2014). Stein (2011) suggested that providing this information is not the way to progress and consumers need educating. The average person does not have the knowledge to make sense of or apply the nutritional information that is provided. Stein (2011) proclaimed that consumers dine out as a special occasion and therefore food consumed in a restaurant is often associated with indulgence and the consumer does not want to know the calorie content. Burton et al., (2006) surveyed 193 adults in a restaurant environment in America (median age 39, 60% female). Burton et al., (2006) found that participants significantly underestimated the fat, the energy content and saturated fat and actual levels were twice that were predicted. Not only do consumers underestimate these facts for a single item as referred to here but also this becomes more complex when ordering a sequence of foods as mental arithmetic is a skill that is declining. Combining an underestimation of calories, purchasing multiple foods and poor numerical skills raises questions as to whether providing calorie information is the way to success.

The effectiveness of providing calorie information on FLs in various restaurant establishments are inconclusive. A systematic review by Krieger and Saelens (2013) evaluated consumer food choices in a restaurant setting both before and after the application of calories and labelling on the menu. Of the 46 studies, 24 studies (*n=7114*) were hypothetical food choices in laboratories, 22 studies (*n=14,239,959*) were from cash register receipt transactions in a restaurant/cafeteria environment, and 13 of all these studies were on the effects of calories alone. The evidence reviewed by Krieger and Saelens (2013) is inconclusive regarding the effectiveness of a FL, or in a reduction of calories purchased, and menu items selected. In simulated laboratory settings, studies showed that providing calorie information had a greater impact on reducing calories consumed and/or purchased compared to a live restaurant setting. However, the evidence from this review showed an overall reduction of between 10 - 20 calories per meal. Moreover, if the greatest calorie reduction came from simulated studies, this skews the results. This questions if additional information is required alongside calories alone.

The systematic review and meta-analysis by Cantu-Jungles et al., (2017) evaluated the effect of providing nutrition labelling for both calories and nutrients. They measured food choices ordered or consumed in both a laboratory and away from the home environment in the United States of America (USA) both before and after the labelling. From the 14 studies that met the Cochrane

criteria, five were laboratory studies (*n=847*), six were fast food restaurants (*n=546,884*) and three were full-service restaurants (*n=4088*). Menu labelling in a live setting did not show any notable change on calories, total fat, saturated fat, sodium, or carbohydrate ordered or consumed among American adults. However, there was a significant reduction of 115.2 calories ordered and consumed in laboratory settings. Both Krieger and Saelens (2013) and Cantu-Jungles et al., (2017) systematic reviews concluded that when calories are positioned on food selected in a simulated environment this has a greater effect on food behaviour than a live setting. Despite these results from these systematic reviews, displaying calories on a FL in a school setting has been a consistent choice in which to measure changes in food choice behaviour.

1.6 Food labels in a school setting

To date, three known published studies and one unpublished study have evaluated the effect of applying a nutritional FL in a secondary school setting. (Appendix C outlines the systematic review process and the PRISMA diagram). These studies all compared calories and fat both pre and post the application of a FL, but there were no conclusive outcomes from these studies. The three published studies were all American and short in duration. The study by Hunsberger et al., (2015) was conducted in a public rural middle school (ages 11-13). The FL which displayed the number of calories and fat per portion was positioned on the sneeze screen above the food for both hot and cold food items. The food on offer was weighed pre- and post-service, and the calculated values of fat and calories were divided by the number of children served per day. The study measured gross calories and fat purchased per day for 17 days in January before the application of the FL and for 17 days in February with the application of the FL. The study found a decrease of an average of 47 gross calories purchased/day and a reduction of an average of 2.1 grams of fat/day and the authors suggested that the FL caused pupils to take smaller portions of food.

The study by Rainville et al., (2010) investigated how adolescents select their food, and sought to determine if these food choices changed with the provision of nutritional information. Twenty schools took part in the study that compared 1508 menu days over eight weeks of pre-intervention baseline sales from September to October, and eight weeks of intervention sales from January to February. Rainville et al., (2010) measured calories and fat per serving in main course dishes purchased pre - and post the application of the FL. Results indicated an increase of 6.6 calories per menu item in the intervention group and decreased calories selected in the control group. From the focus groups' discussion, eight out of nine pupils stated that they noticed the nutritional label, but some pupils stated that they did not want to know what nutrients were in the food. Results suggest that vegans were the most interested in the FL information and that females were more interested

in the FL than males. The participants in the interviews expressed that providing calorie information was important to them.

Another study by Conklin et al., (2005) took place in six high schools in Pennsylvania. Pupils were from ninth to twelfth grade aged 14-17 years old. The study applied a FL to main course dishes at the point of sale. The FL displayed serving size, calories, total fat, saturated fat, cholesterol, sodium, total carbohydrate, fibre, protein, vitamin A and C, calcium, and iron per serving. The study measured calories and fat from both production sheets and sales for six weeks pre- the application of the FL and six weeks post-intervention with the application of the FL. Results indicated that when supplying nutritional information pupils selected food choices lower in fat and calories, but the differences were slight to moderate. The number of servings of cheese pizza increased significantly ($p < .05$) and the less healthy pepperoni pizza fell significantly ($p < .05$), vegetable and hamburgers increased significantly ($p < .05$) and the less healthy cheeseburgers and bacon and cheeseburgers fell significantly ($p < .05$). Conklin et al., (2005) concluded that pupils selected the same category of food choices such as pizza or burger, the small difference being that they chose the healthier options that were lower in fat and or in calories.

One study that was undertaken but not published (Fresques`., 2013) researched the effect of providing a FL displaying both calories and fat on the menu in one high school in Arizona in three stages. Stage one measured sales from production sheets over a four-week experiment pre-intervention baseline, and an eight-week post-test intervention. In stage two students self-reported the use of calorie information provided at two points (pre-test/post-test). Stage three was a focus group (*n=14*) to look for variables that may influence their purchasing decision. The participants consisted of 42% white, 43% Hispanic, 7% black, 4% Asian/Pacific Islanders and 1% American Indian and 45% were eligible for free or subsidised school lunches. Results indicated that daily calories per student between pre-intervention baseline and intervention data decreased from 602 to 596 but this was not significant, and fat remained at 23g both pre and post the intervention. Survey stage two identified that 64% of the participants did notice the nutritional information and 33% did not notice the nutritional information. However, 43% of the participants stated that the information did not influence their food choices, 33% said it did some of the time, 10% said it affected their purchasing most of the time, and 10% said it affected their purchasing every day. In stage three, two thirds of the focus group (*n=14*) reported noticing the information, one participant said that they did not notice the nutritional information and three participants said they did not use the cafeteria. Two out of the five participants in the focus group that stated that they had noticed the information reported that it did change their behaviour and the other three participants said that they purchased the same foods as before the intervention; therefore, the intervention did not affect their food

choice behaviour. When asked if there was anywhere where they would like to see nutritional information, every student expressed an interest in seeing nutritional information in restaurants. However, the making calorie and fat information available does not mean that this will affect choice.

Collectively, the results of these studies (Conklin et al., 2005; Rainville et al., 2010; Fresques, 2013; Hunsberger et al., 2015) cannot verify that providing information for either calories or fat influences adolescent food-choice behaviour at school. Moreover, providing calorie information on food in a school setting may not be the most appropriate FL format. Many adolescents employ dietary restraint to strive to conform to `thinness,` which may lead to nutritional vulnerability (Shepherd and Dennison, 1996). Due to this possible vulnerability, a more overarching holistic FL is needed to guide young people to healthier food choices in the UK.

1.7 The Ofcom attempt to regulate food.

In conjunction with a rise in childhood obesity a House of Commons select committee enquiry on obesity resolved that junk food marketing needed to be controlled to prevent diet related disease. This led to the government requesting the Office of Communications (Ofcom) who is the UK regulator for broadcast media to look at options to restrict the advertising of junk food targeted at children (House of Commons Health Committee (2004). In 2009, Ofcom requested the assistance from the UK Food Standards Association (FSA) to produce a set of criteria to assess whether food items intended to be advertised to children on television were nutritionally balanced (Rayner et al., 2009). The FSA commissioned the British Heart Foundation (BHF) to design a nutrient profile model. This model produced a numerical score for any given food product per 100g. In this model, a food score of four points or more classified the food as `less healthy`. Only foods that scored below four from the healthy category could be advertised on television during children's viewing times. The technical guidance for the Ofcom score is in Appendix D (Department of Health, 2011). Rayner et al., (2009) suggested that this profile can also be used as a quality criterion for products supplied to school meals, hospitals, and the armed forces and for health impact assessments of meal service policies. Rayner et al., (2009) stated that `the model can be adjusted so that points for foods and drinks fall on a scale from 1 to 100 where 1 is the least healthy and 100 is the most healthy product using a simple formula: NEW SCORE = (-2) *OLD SCORE + 70` (Rayner et al., 2009 pg. 8). This score is based upon per 100g of any given dish. Healthier food choices are calculated from their percentage per 100g from vegetables, fruits, seeds, nuts, legumes and per 100g from protein and fibre. Foods that are less healthy are calculated as foods that contain saturated fat, sodium, total sugars per 100g and kJ energy content per 100g. Overall, foods that scored 64 and below are `less healthy` and foods that scored 65 and above are `healthy`.

What is of interest, is that scoring food has only been used in retail with NuVal and to regulate food being advertised in television. Currently, there are no known published studies that have used a FL with a food score in a live setting. The known published studies that analysed the impact of a FL in a high school setting indicated both calories and fat, were inconclusive as to the effectiveness of providing this nutritional information. Therefore, future research in a school setting should either consider a unique FL that provides different nutritional information or consider a different format. The purpose of this current study was to use the algorithm from the Ofcom nutritional profiling model that produced a food score from one to 100 as the basis of the experimental FL. The full details of each step taken to calculate the food score is outlined in section 3.2.2. This study was the first to apply this experimental FL to food on offer at four secondary schools in Greater London and to evaluate if this design influenced adolescents to select healthier food choices. There is a need for an intervention in a real school restaurant operation and a requirement to better understand the reasons as to why the FL is, or is not, successful. However, eating behaviour is complex and there are numerous drivers and interrelating factors that affect an individual's food choice. This study investigated if adolescents' eating behaviour encompassed other more meaningful levels of influence and assessed if these influences need more consideration in public health strategies that aim to reduce the current obesity levels.

1.8 Adolescent food habits and behaviour

Story et al., (2002) identified that there is reciprocal determinism between behaviour and the school environment in both directions. During adolescence, individuals become more self-regulating and take more control over their food choices and health behaviour (Gilmour et al., 2020). Conflict can arise between a pursuit for independence, yet a need for acceptance amongst their peers (Turconi et al., 2003; Hagel, 2015; Gilmour et al., 2020). At present, adolescent dietary habits are poor; 17% of British secondary school children (aged 11-15) reported a daily consumption of foods high in fat, salt, or sugar, and 13% reported a daily consumption of sugary carbonated drinks. Due to these dietary habits, young adults in western countries are gaining weight faster than their parents, and they are more likely to gain weight than any other cohort (Munt and Partridge, 2017; Shah et al., 2019). The significance of their dietary practice is that the behaviour and habits formed at this age tend to persist into adult life, and poor diet can have consequences for both their current and future health (Turconi et al., 2003; Demory-Luce and Motil, 2016: Shah et al., 2019). WHO (2020a) has published its latest report compiled by the International Health Behaviour (HSSC) in school aged children (*n=227,441*) from 45 countries. The focus of the study was on health behaviour in school aged children at age 11, 13, and 15. WHO (2020a) reported that levels of obesity and overweight are still rising and currently affect one in five adolescents, with higher levels in boys and younger

adolescents. Two out of three adolescents fail to meet the current nutritional recommendations with one in four consuming sweets daily and one in six consuming sugary drinks.

A systematic review by Shepherd and Ratts (2006) found a circular relationship in that older females have a greater knowledge of healthy eating than males and that knowledge improves healthy eating. In agreement with this, Sichert-Hellert et al., (2011) reviewed adolescents (*n=3546*) in a cross-sectional study (aged 12.5-17.5) across 10 European cities. Sichert-Hellert et al., (2011) found that nutritional knowledge modestly increased with age and established that females had a greater knowledge of nutrition than males. Mirmiran et al., (2007) studied Tehranian adolescents (*n=7669*) aged 10-18 on their nutritional knowledge and the application of knowledge. Mirmiran et al., (2007) found that 82% girls and 75% boys had good nutritional knowledge, yet only 25% boys and 15% girls applied this knowledge. Collectively 85% of the adolescents knew that soft beverages were high in sugars but only 4.5% did not drink them, 89% knew that crisps were unhealthy snacks yet 45% still consumed them. This study concluded that overall, nutritional practice did not correlate with nutritional knowledge in either gender.

Nutritional practise is often correlated with the influence of friends. Salvy et al., (2012) evaluated the literature on the influence of peers and friends on both childhood and adolescent eating behaviour. They suggested that when seeking peer acceptance, adolescents may consume more fast food more often and that in school the males who consume the most energy dense snacks are the most popular. They concluded that involving peers in the promotion of positive behavioural health approaches is of value in interventions, but there are complex factors to consider. These factors include the direction of eating - such as the influence to increase or decrease the quantity consumed - and the closeness of the relationship between the peers. A systematic review by Chung et al., (2017) identified that adolescents' diet and exercise behaviours are significantly associated with their peer's behaviour in most studies. When adolescents are with friends they consume more energy dense foods, more snacks and soft drinks and are less likely to select healthier food choices. At school they are more likely to share unhealthy food and exchange unhealthy food. Friends support was positively associated with nutritional self-efficacy not dietary behaviour.

Social cognitive theory (SCT) focuses on how people learn through observing others. The theory postulates that people influence the environment, and that people are influenced by the environment (Vinney, 2019). Peers can affect the behaviour of others through observational learning, as the knowledge that is retained can be replicated, and this behaviour plays an important role in the socialisation process (Cherry, 2019).

1.9 The conceptual model of adolescent eating behaviour

Story et al., (2002) merged SCT with an ecological perspective that considers people and their environment (outlined in detail in 2.15) to produce a conceptual model of adolescent eating behaviour. Story`s model comprises four levels of influence that can interact within the framework. The first level is intra-personal, which is based upon a person's individual characteristics that influence their eating behaviour. This includes psychosocial influences `*such as attitudes, beliefs, knowledge, self-efficacy, taste, and food preferences - as well as biological factors such as hunger*` (Story et al., 2002 pg. S41). The behavioural aspects encompass the frequency and type of food consumed and attitudes to weight management. Other aspects include the availability of time, money, and convenience. The second level is the interpersonal factors that consider the influence of family, friends, peers, and neighbours. These can have a considerable impact on eating behaviour through the psychology of perceived norms, modelling, social support, and reinforcement. The social environment considers the effect of adolescents' demographics, which include differences in age, gender, ethnicity, education level and culture. The third level is the physical environment in the community where food is accessed away from the home, and the effect this has on influencing perceived norms regarding eating behaviour; however, this thesis will focus specifically on the school environment. The last level of influence is the macro-system, which consists of media and advertising.

1.10 Problem statement

The problem to be addressed through this thesis is that of the rise in adolescent obesity in the UK. Adolescent obesity is more prevalent in the UK in older adolescents (age 15-19 years) than in almost any other higher income nation (Shah et al., 2019). School food can in theory provide a third of their daily calorie intake yet schools in England have no legislation that guide adolescents to healthier food options. Providing nutritional information in the form of a FL is one strategy that can theoretically reduce obesity. A FL can educate and inform consumers on the nutritional content of the food and guide them to healthier food choices (Arsenault et al., 2012). There is a lack of consensus as to what FL design is the most effective in guiding consumers to healthier food choices and Campos et al., (2011) recommended that to capitalise on the potential of FLs, `*governments will need to explore new formats and different types of information content to ensure that nutrition information is accessible and understandable*` (Campos et al., 2011:1496). Results from known published studies that have applied a FL that displayed calories and fat in high schools in a live setting have been inconclusive (Conklin et al., 2005; Rainville et al., 2010; Hunsberger et al., 2015). Darweish (2012), Driessen et al., (2014) and ALjaraedah et al., (2019) stated that schools are a prime

target for obesity interventions. Ensaff et al., (2015) points out that eating behaviour in a time pressured school environment is often automated and dependent on non-cognitive processing. Thus adolescent food choice behaviour at school is more susceptible to robotic decision making and a reliance for familiar food choices. Coleman and Hagell (2015) suggested that there needs to be more research with an emphasis on adolescents' reactions to interventions, their food choices, and their health behaviour. A school setting merges intra-personal factors, in conjunction with the social and physical environment, which can jointly influence an adolescent's eating behaviour (Story et al., 2002). Studies that have sought to understand adolescent food choices often use focus groups and discuss retrospective food choices (Neumark-Sztainer et al., 1999; Stevenson et al., 2007; Gilmour et al., 2020). These choices may be subject to bias recall and peer group pressure.

If the individual, social, and physical environmental factors can be better understood, this knowledge can then be considered by public health strategists who aim to reduce the current adolescent obesity crisis. The contribution to knowledge of this thesis is to investigate the effectiveness of the experimental FL in terms of changing adolescents' real food choices in a live secondary school setting and to identify which factors need greater integration into public health strategies. To date, there are no published studies with an experimental food score in a school setting. This study is unique in combining adolescents' understanding and ranking of the factors that influence their eating behaviour in conjunction with their actual food selected. No other studies have collectively researched the effect of an intervention alongside reasons for adolescent food choices in a school setting. The purpose of this thesis is to answer the following research questions and to prove or disprove the hypotheses:

1.10.1 Research questions

RQ1 - How effective is the experimental food label at influencing adolescents' dietary behaviour in a secondary school restaurant?

RQ2 - What factors have the greatest influence on adolescent food choice and do these factors differ between genders?

1.10.2 Research Hypotheses

As outlined in the problem statement (1.10) one in five adolescents in the UK (age 11-15) are obese (Shah et al., 2019). A FL is one strategy that can potentially reduce obesity as it provides nutritional information that indicates which are the healthier food choices (Arsenault et al., 2012). However, there are no food labels or guidance as to which are the healthier food choices served in schools in England. Results from the three known published studies that have applied nutritional information to the food on offer in a live setting do not concur (Conklin et al., 2005; Rainville et al., 2010;

Hunsberger et al., 2015). All of these studies measured the effect of displaying calories which may not be the most applicable for this age group (Shepherd and Dennison, 1996). There are no known published studies that have designed a holistic food label and applied it to food in a school setting. Therefore, this research will calculate a nutritional food score and apply the food score in the form of an experimental food label to test the effectiveness of the design on food choices (H01). It is predicted that adolescents will select food with higher nutritional food scores thus indicating that they select healthier food choices.

> H01: To test the hypothesis: `an experimental food label applied to food served in secondary schools in Greater London will influence adolescents to select healthier food choices`.

The literature has indicated that adult female consumers use a FL more than males (Hieke and Taylor, 2011; Stran and Knol, 2013). Talagala and Arambepola (2016) stated that female adolescents are significantly higher FL readers than males yet Haidar et al., (2017) found no difference in adolescent gender and FL use. The literature advocated consumers who seek nutritional information have the knowledge to apply it (Grunert et al., 2010). This thesis sought to test if female adolescents notice the food score and if they self-report that the food score influences their food choices more than males (H02).

> H02: To test the hypothesis: `females are more likely than males to both notice the food score and to self-report that the food score affects their food choices`.

The literature suggested that adolescent food choices are determined by taste, yet these studies often report the definition of taste incorrectly. The literature has also documented adolescents seek self-regulation and greater autonomy over their food choices through a combination of increased independence away from the family and a need for acceptance by peer groups (Neumark-Sztainer et al., 1999; Story et al., 2002; Stevenson et al., 2007; Haidar et al., 2016; Ronto et al., 2020; Gilmour et al., 2020; Gilmour et al., 2021). Gilmour et al., (2020) found that at school friends selected the same food choices as each other. Deslippe et al., (2021) noted that females would fit in with the group food choice decision rather than follow their own personal food choices. This thesis wanted to test if adolescents report that peer pressure has more influence on their food choices at school than the sensory aspects of food (H03).

> H03: To test the hypothesis: `adolescents will report that their food choices are more influenced by their peers, than the sensory aspects of food`.

Studies conferred females engage in more health promoting behaviour than males. Females consume more fruit, vegetables, dairy, and fibre than males. These food choices can be construed as being linked to both weight concerns and health. This study sought to test if female adolescents place more importance on health when making their food choices in school than males (H04)

> H04: To test the hypothesis: `there will be a significant association between adolescent gender and the importance placed on health when making food choices`.

1.11 Study aims and objectives

This study aimed to explore through quantitative data if an experimental food score can influence adolescents to select healthier food choices. Further survey data aimed to evaluate what factors adolescents rank as the most important when selecting their food choices at school. Using focus groups this study aimed to appraise adolescents' understanding and comprehension of the food score and to encourage adolescents to expand on their reasons for ranking the factors that influence their food choices. These findings could be influential in future public health strategies that aim to reduce adolescent obesity. To achieve the purpose of the study, and answer the stated research questions, four main objectives have been set:

Objective One

> To conduct a literature review to evaluate which food label design has the greatest impact on consumer food choices.

Objective Two

> To select or adapt a pragmatic food label as the basis of the experimental food label for a school setting.

Objective Three

> To apply this experimental food label to food served at four secondary schools in Greater London to evaluate if this label guides adolescents to healthier food choices.

Objective Four

> To appraise what factors, have the most influence on adolescent food choice at school.

1.12 Overview of the thesis

The research presented is as follows:

Chapter 2 provides an overview of the literature pertinent to the thesis.

Chapter 3 presents the methodology used for the experiment and the strategy, approach, and design of the study is outlined. It also presents the tools used to evaluate the data to answer the research questions.

Chapter 4 presents the quantitative analysis and findings from the experimental food score label and the factors affecting adolescent food choice.

Chapter 5 offers the qualitative analysis and findings, which supports the reasons for adolescent food choices.

Chapter 6 forms the discussion of the findings compared with the published literature. The quantitative data are used to evaluate the effect of the experimental food score on food sales and to appraise which factors have the most effect on adolescents' food choices. The qualitative data can reveal adolescent thoughts on the food score and appraise their reasons for ranking the factors that influence their food choices.

Chapter 7 will critically evaluate the findings within the existing literature and theory, answer the research questions and hypothesis and conclude the thesis. These findings will be beneficial for the UK`s future health policies related to the current adolescent obesity crisis. This chapter also presents the strengths and limitations of the study, makes recommendations for future policy, and suggests areas for future research in this subject area.

Chapter 2: Literature Review

2.1 Introduction

To establish the relevance and potential impact of this work, this chapter will commence with an overview of the risk factors related to adolescent obesity. Because of these risks, reducing obesity is a priority for this age group. One method to reduce obesity is to provide a food label (FL) that displays the nutritional content of the food product. This allows consumers to compare food products which can theoretically guide consumers to make healthier food choices. FLs are designed through nutrient profiling (NP) which ranks or classifies food according to its nutritional composition (WHO, 2011; WHO, 2015; WHO, 2015a). There are a profuse number of NP models, and some are country specific. Every model has stages of decision making (Figure 2), which has resulted in a plethora of FL designs. This literature review will appraise studies that have applied a FL to evaluate the effectiveness of the labels in changing food choice behaviour.

Regardless of the influence of a FL the theory of food choice is complex and is comprised of multiple interacting factors that require consideration when determining adolescent eating behaviour. The aim of this chapter is to appraise studies that align to the conceptual model presented by Story et al`., (2002). Story`s model merges the social cognitive theory and the ecological perspective, which aims to better understand factors that influence adolescent food choice behaviour. These factors combine the individual influences, the social influences, and the macrosystems level as well by the physical environmental influences.

2.2 The prevalence and impact of obesity

To highlight the immensity of obesity, this chapter includes non-communicable diseases (NCDs). NCD, also termed `chronic diseases`, are an outcome of a combination of genetic, physiological, environmental, and behavioural factors (WHO, 2021b). Atun, (2014) indicated that in 1990, it was estimated that 26.6 million people would die from NCDs. Today NCDs cause 41 million deaths annually which corresponds to 71% of all deaths globally (WHO, 2021b). The main NCDs are cardiovascular disease, which includes heart attacks and strokes, cancer, respiratory disease, and diabetes. The key drivers of NCD are from tobacco use, harmful alcohol intake, physical inactivity, and unhealthy diets, which are all modifiable `behaviour risks` (Kim and Oh, 2013; WHO, 2021c). Specific metabolic risk factors affect four specific metabolic changes that increase the risk of NCD. These metabolic risk factors include raised blood pressure, hyperglycaemia (increased blood glucose), hyperlipidaemia (elevated blood lipids) and overweight/obesity (Atun, 2014; Public Health England, 2017; WHO, 2021b). Children and adolescents affected by NCD are under reported but

public health actions focus on the importance of prevention and detection rather than treatment (NDC Child, 2019).

Unhealthy diets can change through modifying behaviour and specific metabolic risk factors such as obesity are preventable. Since 1975 worldwide obesity has tripled (WHO, 2021). Obesity is defined as having a body mass index of over 30 and overweight is defined as having a body mass index between the ranges of 25-29.9 (NICE, 2017; WHO, 2021). Globally, in 2016, 1.9 billion people aged 18 and over were overweight of which 650 million were classified as obese. In 2020, 39 million children under the age of five were overweight or obese and in 2016, 340 million children and adolescents aged five to 19 were overweight or obese (WHO, 2021). According to the Centres for Disease, Control and Prevention (CDCP), (2021) the percentage of obese children aged six to 11 in the United States of America (USA) stands at 20.3%, and the proportion of obese adolescents aged 12 to 19 stands at 21.2% and these figures exclude children in the overweight bracket.

Reported figures for adolescent obesity or overweight have no consistency as to what ages form the terminology of `adolescents`. WHO (2021d) reported obesity data on children five years and younger, and children aged between five and 19, yet WHO defined adolescents as people aged between 10 and 19. The CDCP (2021) reported obesity data on children aged between two and five, six and 11 and adolescents aged between 12 and 19. Sawyer et al., (2018) suggested that `adolescence` is a period of the life span between a child and an adult but they now reach puberty earlier than before; alongside this, they stay in education for longer and marry and have children later, thus elongating the life span of adolescents. Sawyer et al., (2018) defined adolescents as aged between 10 and 24. The differences in age ranges makes it challenging to compare reports and could potentially conceal even higher figures.

The overarching cause for being overweight or obese is an imbalance between energy consumed and energy expended. This imbalance can be due to an increased intake of energy dense foods in combination with a decrease in physical activity (WHO, 2021); however, other causes can also be related to endocrine or genetic disorders and certain medications (National Heart Blood and Lung Institute, 2018). Opposing this, the Endocrine Surgeon (2021) stated that the genetic or endocrine element is rarely the cause of obesity. In the last 50 years there has been a significant increase in obesity, yet genetics have not changed within this same period (Endocrine Surgeon, 2021). It is also well documented (Hamilton-Shield and Sharp, 2015; Shah et al., 2019; NHS Digital, 2021; Nuffield Trust, 2021) that parental obesity is a predictor for children to become obese later in life and obese children and adolescents are more likely to remain obese into adulthood.

As adolescents transition from children to adulthood they seek greater self-regulation and autonomy over their food choices, independence away from their family and a need of acceptance by their peer groups (Neumark-Sztainer et al., 1999; Story et al., 2002; Stevenson et al., 2007; Haidar et al., 2016; Ronto et al., 2020; Gilmour et al., 2020; Gilmour et al., 2021). Adolescents prefer to eat food whilst they are on the move and they select taste over nutritional concern which impedes the quality of their diet (Ruxton and Derbyshire, 2011). The BNF (2019) indicated that adolescents' intakes of saturated fatty acid, non-extrinsic sugars, and salt are above recommended government guidelines. Adolescents in western countries gain weight faster than any other generation due to their food choices (Munt et al., 2017), and, more importantly, dietary behaviour formed at this age has a significant consequence for both their current and future health (Demory-Luce and Motil, 2016). Public Health England (PHE) (2018) recommended that the British public need to eat and drink more healthily and be more active, but Ruxton and Derbyshire (2011) indicated that adolescents cannot relate to being older and therefore cannot see the importance or impact of their diet on their health. Nevertheless, there are consequences of a poor-quality diet at this stage of their lives. These dietary intakes are laying the building blocks to conditions such as elevated blood lipids and high blood sugar that can result in longer term chronic diseases such as diabetes and cardiovascular disease. Adolescents' nutritional needs differ from any other life stages due to their physiology which includes rapid growth, changes in body composition and their hormonal changes; therefore a varied diet is essential to ensure that they receive the correct energy and nutrient intake (Neumark-Sztainer et al., 1999; Croll et al., 2001; Story et al., 2002; Ruxton and Derbyshire, 2011; BNF, 2019; Ronto et al., 2020).

2.3 Nutritional requirements for adolescents

Alongside adolescents' physical development, their transition is dynamic, combining a shift in social change, and cognitive processing, which can impact on their eating behaviour (Trew et al., 2006., Ronto et al., 2020). The Newport Academy (2019) stated that an adolescent brain's development is under constant construction. The development of the prefrontal cortex which controls reasoning, emotion, and self-regulation is the last to develop and due to this late development adolescents can be impulsive and emotional. In addition, the prefrontal cortex engages in forward planning and decision making, focusing attention, prioritising information and being able to ignore external distractions. This can indicate that although adolescents understand the principles of health, they lack self-regulation to enforce this knowledge.

There are guidelines for eating well for adolescents. The Caroline Walker Trust (CWT) (2010) developed a practical guide to eating well specifically for adolescents aged between 12 and 18 that

highlighted the need for a high calorie intake. Despite this high level of calories adolescents require nutrient rich foods rather than energy dense foods to enable them to generate lean body mass as a proportion of the energy they consume (Lobstein et al., 2015). Poor nutritional intake correlates with delayed physical and sexual development, poor bone and dental health, and can have an effect on eating disorders and obesity (Story et al., 2002). Bone development requires adequate intakes of calcium, vitamin D, and protein (Ruxton and Derbyshire, 2011) but females in this age group have low intakes of dairy which can impact on bone growth (European Food Information Council (EFIC), 2006). Females' iron requirements are related to the start of menstruation and sexual maturation as well as growth spurts, yet 21% of females aged between 11 and 18 have a low iron status (BNF, 2019). There is national guidance on how to meet the dietary intake for the UK population above the age of two from the NHS in the form of The Eatwell Guide (Appendix E). This guide is a visual representation for the categories and proportions of food to consume for a healthy diet (NHS, 2019a). It contains messages such as `try to eat five portions of varied fruits and vegetables a day and eat foods that are high in fat, sugar, and salt less often`. A method to classify foods as high in fat, sugar and salt is through nutrient profiling (NP).

2.4 Nutrient profiling (NP)

According to WHO (2011) `*Nutrient profiling is the science of classifying or ranking foods according to their nutritional composition for reasons related to preventing disease and promoting health. Nutrient profiling can be used for various applications, including marketing of foods to children, health and nutrition claims, product labelling logos or symbols, information and education, provision of food to public institutions, and the use of economic tools to orient food consumption*` (WHO, 2011:1). NP allows foods to be described and categorised such as `low in fat` (less than 3 grams of fat/100g) or `high in salt` (more than 1.5gram/100g) (NHS, 2018). These classifications can generate definitions to support dietary interventions (Scarborough et al., 2010). NP can also score the healthiness of individual foods and generate definitions such as `unhealthy` or `healthier` which describes the effect of consuming that food on an average person's health (Arambepola et al., 2008; Townsend 2010; WHO, 2010; Rayner, 2013; Arora and Mathur, 2014). NP can also provide information for FLs that can in theory educate and guide consumers as to healthier food choices (Arambepola et al., 2007; WHO, 2011; Chiuve et al., 2011; Arsenault et al., 2012). NP can also be used to regulate foods that can be marketed to children (Rayner et al., 2009; Rayner, 2013). Multiple NP models exist which differ according to their purpose, yet each profile is meticulously planned (Tetens et al., 2007; Arora and Mathur, 2014).

Planning requires a series of stages (Scarborough et al., 2006; Rayner et al., 2009; Arsenault et al., 2012). Stage one (Figure 2; stage 1) considers the classification of foods. Assessing food on the same nutritional criterion, for example, low fat (less than 3g/100g food), is applied to all foods in all categories and is termed `across the board`. Conversely, for claims such as `lower in fat` or `reduced fat` this is relative to foods within the same category; for example, in the category of dairy, this is termed `food category` (Scarborough et al., 2006; Scarborough et al., 2007; Tetens et al., 2007). Aziais-Braesco et al., (2006) assessed four across the board NP models and stated that each model gave an overall similar ranking of foods for fruits, vegetables, and fatty foods, but numerous discrepancies existed between every NP model, regarding the sugar content.

Stage two (Figure 2; stage 2a and stage 2b) identified nutrients in the NP model that are beneficial to health such as Vitamin A and nutrients that are negative to health (apart from energy) such as saturated fat, or the model could include both (Scarborough et al., 2006). The NP model should clarify if it is suitable for all food and beverages or for just food alone. Stage three should specify if the NP model is measuring the nutritional information calculated per 100g, or per portion in grams, or per 100 Kilocalorie/Kilojoule. Stage four determined the presentation of the results e.g., as a `threshold` or a `score` (Figure 2 stages 3 and 4). A threshold approach compares foods against a predetermined threshold e.g., low in sodium (1.5g/100g food) which governs health claims of FLs (Scarborough et al., 2006; Arora and Mathur, 2014). The score approach applies a formula to calculate a numerical value for each food product to rank it against comparable products.

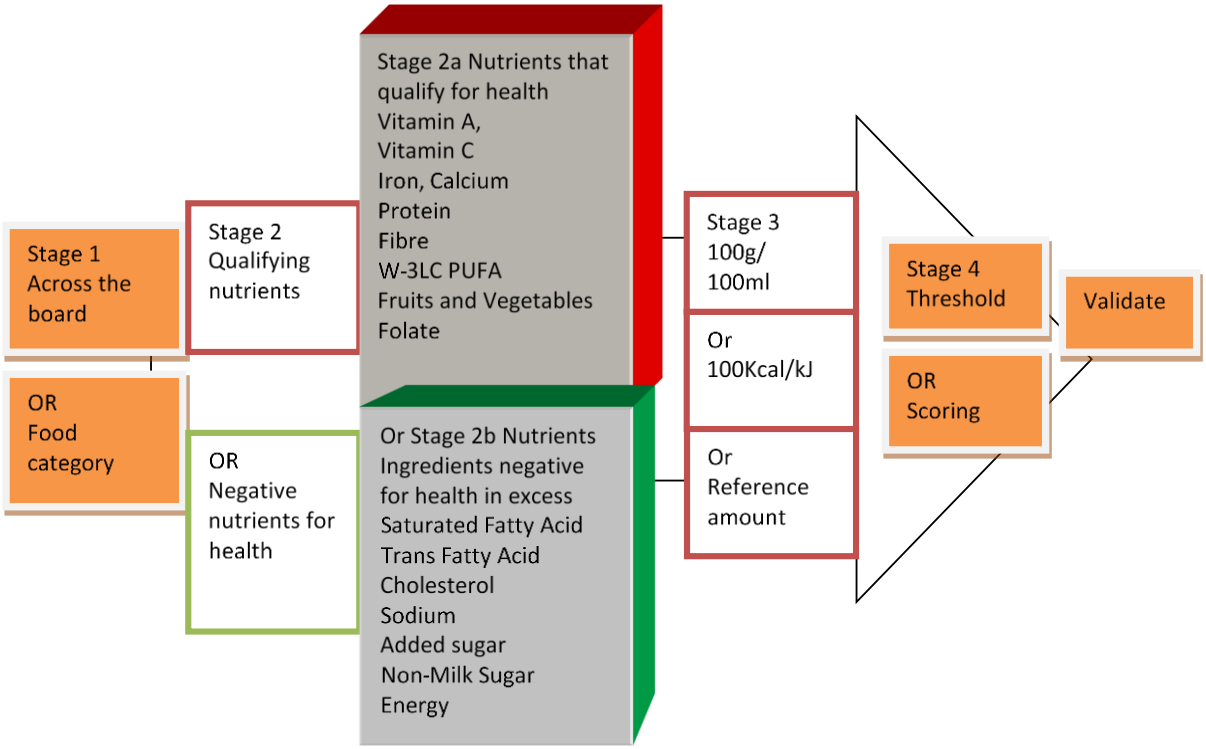


Figure 2 A visual model indicating each stage and the choices to be made to develop a nutritional profile (Verhagen and van den Berg 2008).

Darmon et al., (2018) proclaimed that global NP schemes can judge the quality of the food product based on its nutritional content and summarised the roles as follows. One role is to certify if a food meets the certification required by Ofcom to allow the food to be marketed to children on television. NP can evaluate if foods meet an eligibility for health claims such as Australia and New Zealand's NP scoring criterion, similarly, to enable a food to carry a positive front of pack logo such as the Nordic Keyhole, the Finish Heart symbol or Choice's logo. Other uses of NP include an aggregated evaluation of healthy/less healthy or certified and uncertified food products. Other NPs for front of pack logos separate specific nutrients. However, difficulties exist in comparing NPs as the steps selected differ due to their designed purpose. Table 2.1 compares the existing schemes through the choice of stages that indicates the different possibilities and the single similarity (fibre).

Table 2.1 A comparison of NP inclusion and exclusion from the planning stage. Green indicates the stages selected from each plan (Adapted from Verhagen and van den Berg, 2008).

	Ofcom (UK)	Unstated (Netherlands)	Choices (Private)	FDA (USA)	Keyhole (Sweden)	Clover (Denmark)
Food category						
Across the board						
Total Fat						
SAFA						
TFA						
Cholesterol						
Sodium						
Added Sugar						
Non milk sugar						
Energy						
Vitamin A						
Vitamin C						
Iron						
Protein						
Calcium						
Fibre						
W-3 LC PUFA						
Fruits & Vegetables						
Folate						
Per 100g/100ml						
Per Kcal						
Reference amount						
Threshold						
Score						

2.5 Nutrient profiling for nutrient specific food labels

In 2016 it became mandatory to display the nutritional information on the back of all prepacked food (FSA, 2021). The nutritional information is per 100g/ml or per portion and specifies energy in both kilojoules (kJ) and kilocalories (kcal), grams of fat, saturates, carbohydrates, sugars, protein, and salt. If there is a health claim on the product's label regarding a specific nutrient that is not in the mandatory list, the nutrient must be declared. Non-compulsory information includes monosaccharides, polysaccharides, starch, fibre, vitamins, or minerals (BNF, 2021). The back of pack nutritional information is shown in Appendix F. Nutritional information on the front of pre-packaged food in a retail setting is voluntary. The voluntary nutrient information can be either `nutrient specific` or `summary systems` (Hersey et al., 2011).

The UK supports the traffic light FL. An example of the traffic light FL is shown in Appendix G. The traffic light label is nutrient specific, and displays total fat, saturated fat, sugar, salt, and energy per 100g or per serving (BNF, 2016c; NHS, 2018; FSA, 2013; FSA, 2020). The profile for each stated nutrient is colour coded to indicate if the food/product is high (red), medium (orange), or low (green) in these nutrients. The definition of high, medium, and low taken from BNF, 2021 are specified in Appendix H. The aim of the colours is to visually display the nutritional healthfulness of the food/product to allow consumers to make a more informed choice of product (FSA, 2020).

Nutrient specific nutritional information can also be in the form of displaying the reference intake. The reference intake provides information regarding the maximum number of calories and nutrients a person should consume based on a female's 2000 calorie diet. Reference intakes are not targets but they provide guidelines for energy, total fat, saturates, carbohydrates, total sugars, protein, and salt (BNF, 2016a; NHS, 2020). Appendix I displays the daily reference intake guides (BNF, 2021). Temple and Frazer (2014) suggested that an additional circle indicating the overall health value would be beneficial for the consumers.

2.6 Summary system front of pack labels

A summary system provides an overall score or a symbol if the food meets a predetermined nutritional standard. Examples of summary systems are the Healthy Choices symbol used in the Netherlands (Appendix J) Smart Choices tick, used in USA (Appendix K) and the Nordic keyhole symbol (Appendix A). In 1989 Sweden introduced a Swedish Keyhole FL. In 2009 it was introduced in Denmark and Norway, in 2013 it was introduced in Iceland and Lithuania and in 2015 it was introduced in Macedonia. The now termed `Nordic Keyhole` is only allocated to a product, if it guarantees a reduced amount of one or more of the following nutrients compared to other foods of the same product. The nutrients include total fat; saturated and trans fatty acids; added sugars, salt, and/or a high amount of fibre (Lobstein and Davis, 2008). Öhrvik and Lagestrand (2018) stated that the Nordic Keyhole is easy to understand and does not require nutritional knowledge or language skills and the products with the Nordic Keyhole contribute to a healthy diet. The objectives of providing a Nordic Keyhole are to guide consumers to make healthier food choices and to encourage manufacturers to reformulate their products to meet the criteria. Michail (2018) concluded that, although the logo is free to use, manufacturers choose not to apply it to their products. This is due to the complexity of the nutritional criteria, the additional cost to the manufacturer of including the Nordic Keyhole on their packaging, and that it adds no value to the company. Opposing the criticism from manufacturers, the Nordic Council of Ministers (2015) proclaimed at their `Keyhole milestone conference` that, from studies in the countries that use the Nordic Keyhole, consumers are eating a healthier diet, but they do not state what these studies are. The ministers stated that when consumers use the Nordic Keyhole, the consumption of wholegrains increase, saturated fat intake decreases by 40%, added sugar decreases by 9%, and calorie intake reduces by 10%. Overall, the Council suggested that the Nordic Keyhole empowers consumers to select healthier products yet at a milestone Keyhole conference you would expect little less than praise for its effectiveness.

Unlike the Nordic Keyhole whereby products must meet a reduction in specific nutrients (apart from fibre) the USA and Canada apply a graded summary system. In 2006 the USA developed the Guiding

Stars nutritional system FL whereby a product is awarded points for specific nutrients consumers need to consume more of; vitamins, mineral, fibre, whole grains, and omega three, and points are deducted for nutrients that are less needed to consume; saturated fat, *trans fat,* added sugars, sodium, and artificial colours (Guiding Stars, 2021) (Appendix B). Guiding Stars (2021) proclaims that the label is objective and impartial to brand, the manufacture, or the cost of the product. One star is good, two stars are better or three is the best.

Between 2006 and 2008 Sutherland et al., (2010) conducted a natural experiment in 168 branches of a supermarket chain in New England and New York. It aimed to identify if the number of foods with stars purchased increased after the implementation of the Guiding Stars scheme, and to measure the effect, if any, of the Guiding Star's label on consumers' diets based on ready to eat cereals. From the company purchasing database, foods had a `star` or `no star. ` The ready to eat cereals purchased were entered into a nutritional facts panel and nutrient database. Results indicated that there was a significant change in consumer purchasing on the implementation of the Guiding Stars, which continued after both one and two years. Sutherland et al., (2010) concluded that the Guiding Stars gave `clear, concise, and simplified nutrition information to guide consumer food and beverage choices` (Sutherland et al., 2010 pp 1090S).

However, when the USA Food and Drug Administration (FDA) updated their algorithm to include omega three and artificial colours (to commence as of January 2020), 3,000 products changed star values, 1,400 gained stars and 1,700 lost stars. This change added additional cost to the manufacturers in printing costs of their labels or to reformulate their products (Crawford, 2018). Even though Guiding stars commenced in 2006 the program is only in 1,900 stores out of a possible 40,000 in the USA (Guiding Stars, 2021).

Another rated summary label is the five-star awareness program that was launched in Australia in 2014. Lawrence and Pollard (2015) advocated that this star rating is flawed from the start. They infer that this voluntary system benefits the manufacturers, because manufacturers can choose when to apply the star rating to their products. Therefore, the opportunity to market unhealthy foods that meet this rating can result in confectionary having have more stars than yoghurt. Lawrence and Pollard (2015) suggested introducing health warnings on products not included within the Australian Healthy Eating Guide. They proposed that because of the health warnings, manufacturers will reformulate these products. When a FL is applied on a voluntary basis, manufacturers can choose whether to display the label, which does not provide the consumer with a fair comparison of the facts.

In place of stars, Nutri-Score (Appendix L) calculates the nutritional value of each product through a scientific algorithm developed by the British Food Standards Agency (also called the FSA score). The score ranges from minus 15 up to 40 and is based on 100g of the food product (Ducrot, 2020). The algorithm deducts points for calories (kJ), saturated fatty acids (g), sugars (g), and salt (mg), and adds points for protein (g), fibre (g,) fruits, vegetables, nuts, seeds, olive, nut, and colza oils (%) (Nutri-Score, 2020) The final score is depicted as five letters from A to E, and colour grades these from green to red (Colruyt, 2020). A is green and depicts the healthiest food product. The five-colour coded scale is applied to 3,500 products produced by Colruyt on their private label called Boni, and France has signed a decree backing this voluntary score. According to Southey, (2021), Public Health France conducted a survey between April 2018 and September 2020 and found that 94% of the French public were in favour of Nutri-score and 37% said they had changed one or more purchasing habit, 35% of this figure changed brands for the same product, and 36% stated they selected a product with a better score. The European Commission will propose a mandatory front of pack label by the end of 2022 but despite the reported success of Nutri-score there are no clear indications what this front of pack label will be.

To add more information to a FL Temple (2020) outlined a recent addition of `warning labels` that aims to identify if a food is high in detrimental nutrients such as sugar or salt. Warning labels are on food for sale in Mexico and supporters of warning labels claim that they can help people to make more informed choices (White and Barquera, 2020; Cruz-Casarrubias, et al., 2021).

Summary system provide a simpler FL in the form of a symbol which takes less time to process and compare products. However, Emrich et al., (2015) were sceptical about summary systems from food companies and suggested that they are often a form of marketing. Emrich et al., (2015) evaluated 10,487 packaged food products in ten food categories and 60 subcategories, comparing calories, saturated fat, sodium, and sugar in products with front of pack nutrient rating systems and symbols to products without summary symbols. Results indicated that food products with summary symbols were not uniformly lower in calories, saturated fat, sodium, or sugars per reference amount of the product than food products without summary labels, and Emrich et al., (2015) suggested that these symbols are marketing features and there needs to be a minimum nutritional standard for products using these symbols. However, a point to consider is that these symbols are voluntary and not all products display them which make comparing products more challenging. If one symbol could be applied to all products in each retail store this can alleviate this concern.

In 2003 David Katz founded NuVal (Figure 1). NuVal applies a score from one to 100 (100 being the healthiest) to all foods in supermarkets and displayed on supermarket shelf tags to allow a quick visual comparison between all products (Katz, 2007; Katz, 2010; Chiuve et al., 2011; NuVal.com,

2014). This system avoids the classification of foods as either good or bad and allows consumers to select foods on the basis on nutritional quality. Within this algorithm there is a weighted coefficient that represents epidemiological association between nutrients and health outcomes such as diabetes, obesity, and heart disease (Katz, 2010) but this detail is not disclosed. A panel of experts in public health, nutrition, and medicine and cancer research designed and developed the overall nutritional quality index (ONQI) algorithm which underwent further consumer research and then validation testing. Katz et al., (2009) suggested that the ONQI is a sophisticated system that can potentially improve dietary patterns and therefore improve public health.

Katz et al., (2010) stated that NuVal avoids conflict of marketing from manufacturers as the algorithm design is from a multidisciplinary team who have no vested interest in any brand of product. Katz (2010) proclaimed that NuVal could potentially become a universal method to guide consumers to healthier choices but as Katz is the leading author of NuVal this could be biased. As a business, NuVal peaked when it featured in 1,600 stores in 31 states of the USA but now NuVal has changed direction. Despite no formal communication from NuVal, the information on their web site (NuVal, ND) indicated that NuVal focuses on an `attributes program` which guides consumers to specific foods such as gluten free, organic, and low sodium. Watson (2017) gathered feedback on NuVal from a registered dietician in Las Vegas who believed that a score can potentially guide consumers to better health choices but pointed out that formulas can become outdated as scientific nutritional knowledge advances. Watson (2017) postulated that NuVal is not in all retail stores and therefore it cannot provide a consistent education. However, even if a consumer is educated and understands the NuVal concept this does not mean that their understanding will transition into a change in behaviour. Ealey (2014) studied the effect of an education intervention pre-post-test on consumer ability to select healthier products specifically using NuVal. After the education, 63.3% of consumers improved their ability to select healthier products, however, Ealey (2014) did not specify what this education consisted of. What is significant here is that NuVal was in a retail setting and yet its holistic view of providing one score to demonstrate the healthiness of a product could be a solution in influencing food choice in a time pressured busy restaurant such as a school.

2.7 Design of the food label (FL)

Within the plethora of FLs, studies concentrate on the format and design with regards to capturing attention, consumer understanding, and the impact the FL has on influencing healthier food choices. Hieke and Taylor (2011) reviewed 47 studies on the preferred FL design. Hieke and Taylor (2011) proclaimed that nutrient specific information is preferred over summary systems, but cognitive processing is low for consumers with low literacy skills, thus suggesting that nutritional information

may be too complex for many consumers to either understand or use. Babio et al., (2013) stated that nutritional information on the FL is highly informative when used by health professionals, but consumers find this information difficult to interpret or apply to their food choices.

Hersey et al., (2011) conducted a systematic literature review on which front of pack, either `nutrient specific` or `summary systems`, captured consumer attention (individuals devoting thinking time towards the stimulus). Findings indicated that consumers preferred colour graphics such as the traffic light, single symbol, or graded stars over monochrome symbols such as the Guideline Daily Amount (GDA) (now termed Reference Intake). Contrary, to this, Bailkova and van Trijp (2010) and Bialkova et al., (2013) stated that monochrome food label captured the most attention, but these studies were small in participant numbers and cannot be generalised to all population groups. The studies agreed that adult consumers who use FL are more likely to be well educated than non - FL users and that females are more likely to read a FL than males (Hieke and Taylor, 2011; Stran and Knol, 2013). However, as these studies look at behaviour in a retail environment it could question the gender validity if possibly more females usually shopped for food than males.

De la Cruz-Góngora et al., (2017) aimed to explore Hispanic consumers' understanding and acceptability of four FLs; logos, rated stars, GDAs, and the multiple traffic light labels. Results from parents (*n=135*) who took part in focus groups in Mexico stated that logos were the most preferred and the easiest to understand and the GDA was the hardest to understand, took the longest time to read, and required nutritional knowledge. Participants thought the rating stars were ratings for the quality of the product and not the product's healthiness. When evaluating the traffic light symbol participants liked the colours but were indecisive about the meaning of amber. De la Cruz-Góngora (2017) concluded that consumers need a simple front of pack label and research must explore a new design that indicates the overall nutrient profile of the food product.

Despite the lack of consensus regarding the preferential FL design, Grunert et al., (2010) observed consumers' interest in reading the nutrition information, and then through an in-store interview (*n=2019*) established consumers' understanding of the nutritional information. From the 27% of consumers who looked at the nutritional information on a FL, consumers' understanding was high and 87.5% of consumers could identify the healthiest product from the given three choices. There appears to be a relationship with those that seek the information and having the knowledge to apply it. A survey by Graham et al., (2011) found that consumers who self-reported reading nutritional information valued healthy eating and were associated with a higher engagement in both healthy dietary intakes of foods and eating related attitudes (the feelings regarding preparing and eating healthy food). However, according to Grunert et al., (2010) consumer research on reading FL and implementing the information to influence their purchasing decisions is from self-reported

retrospective behaviour which can lead to over reporting behaviour that is regarded as socially desirable.

In summary, studies cannot concur which FL design has the greatest influence on adults selecting the healthiest product. Nutritional information from a nutrient specific FL requires knowledge to understand and apply this to food choices. Overall, more educated females read FLs and there is a connection between consumers that read FLs in that they value healthy eating and engage in healthy dietary practise.

2.8 Calories on a food label (FL)

The aim of providing calorie content information is to help people make healthier food choices when eating out. Saunders and Irdam (2017) published a NatCen Social Research report for the FSA on calorie labelling on menus in Northern Ireland. They compiled a four-wave biennial random probability cross sectional survey in 2010, 2012, 2014 and 2016. Findings revealed that 80% of all participants believed that it is important to eat within the guidelines of calories per day. However, most people did not correctly report the daily calorific guidelines for either men or women per day, 30% did not know, one third underestimated calories required for all genders daily and 10% overestimated for men and 5% overestimated for women. People over the age of 55 years were less likely to know the intake for either gender. None the less 78% of people wanted more nutritional information on display in a restaurant setting.

Stein (2011) stated that calorie information is not standardised and there are even inconsistencies between chain restaurants for the same food item at the same price. The method of cooking and the addition of condiments added at the table can also affect the total calories consumed. Powers et al., (2011) points out that accurate nutritional information requires knowledge and skill far beyond a database and that standardisation is the key to reporting calories and nutrient content of each dish. Stein (2011) outlines the American Dietetic Association views on posting calorie information in restaurants and they advocate that there is a need to focus on education and to focus on positive ways to select healthy food.

Evans et al., (2015) evaluated adolescents' use of menu labels when eating out. Evans recruited participants from two recreational communities: a public recreation centre in a lower income community consisting of black females (*n=26*) and a private recreational centre in a higher income area consisting of non-Hispanic white females (*n=15*). Participants in both groups reported that menu labelling did not influence their food choices. Participants in the lower income area were influenced more by price, taste, familiarity and being able to walk to the establishment, whereas those in the higher income area based their food choices on quality. Both groups recommended that

the most effective way to present a food label is through providing the amount of physical activity needed to burn the calories consumed. Participants were recruited through posters and verbally by the staff within the recreational centres, which could suggest that these participants may have an interest in sport.

According to Movementum (2021), the Royal Society for Public Health is pursuing the `physical activity calorie equivalent` (PACE) (Figure 3). PACE is a food label that indicates the amount of activity; running, walking, swimming, or cycling, in minutes needed to burn the equivalent number of calories in a serving of food. PACE aims to highlight the number of calories a person is consuming in the food product. The calories are calculated by an algorithm for an average person and do not account for differences between gender, physique, age, height of a person, or the intensity of the activity.

Figure 3 An example of PACE indicating hours and minutes in both walking and running

A systematic review and meta-analysis by Seyedhamzeh et al., (2018) evaluated studies that compared the effects on health behaviour, with either calories displayed on the FL or a physical activity symbol alongside the calories on food purchased. Results suggested that the addition of a physical activity symbol produced no significant difference in calories purchased when compared with providing information on the calories alone. In addition, the PACE formats in this meta-analysis differed as studies identified calories per mile whist others identified calories used per minute, it is also possible that some people may feel that they must burn this number of extra calories whereas these calories include the basal metabolic rate. This questions if the general population understand calories.

Studies that have evaluated the impact of calorie labelling on menus are not conclusive as to its effectiveness in guiding consumers to more healthy choices. Findings from studies that applied calories to their menus suggested that if an effect of reducing calories consumed existed it is small in magnitude (Harnack & French, 2008; Dumanovsky et al., 2011; Stein, 2011; Ellison (2014) cites Swartz et al., 2011; Krieger and Saelens, 2013; Sinclair et al., 2014; Kisko et al., 2014; Cantu-Jungles et al., 2017). They also agree that real world studies do not show a reduction in calories ordered at population level.

2.9 Adolescent food label use in their decision-making process

Studies have evaluated how adolescents use a FL in their decision-making process for their food choices. Babio et al., (2013) compared adolescents' ability to select healthier food choices from two FL designs. From the 81 adolescents aged 14 and 16 from Spain, findings indicated that adolescents significantly increased the nutritional quality of their diet when using the traffic light FL rather than the monochrome GDA. However, participants were only shown two design options which cannot substantiate that the traffic light is the most effective FL to influence adolescents to select healthier food choices. The study was in a single school and therefore results may not be generalisable, and, as it took place in a non-real food environment, and actual food choice may differ if these choices were to be consumed.

Haidar et al., (2017) stated that 60.5% out of 6716 adolescents in 8th and 11th grades in Texas use a FL. Talagala and Arambepola (2016) stated that 74.6% of 542 Sri Lanka adolescents aged 16-17 were frequent FL readers, with females (79.2%) being significantly higher readers than males (70.0%). Saha et al., (2013) evaluated adolescent knowledge and use of a FL and results from 316 Indian adolescents aged 13-16 revealed that 88% read the FL. In contrast to these findings, Norazmir et al., (2012) found that 53.6% of 295 Malaysia young adults mean age 21±1.745 do not read FLs and that 69.5% do not understand the FL and the most consulted part was the ingredients list.

From the studies that indicated that adolescents were high FL users in their decision-making process the results were from self-reported FL use. In Talagala and Arambepola's (2016) study the most consulted information was the price, expiry date and brand name. In Saha et al.'s (2013) study participants consulted the date of manufacture, use by date and best before date. Martini and Menozzi (2021) indicated that although a FL is in place to guide consumers to healthier food choices, the array of information is a form of marketing which in turn can influence consumer purchasing. It is proposed that the term FL includes numerous items and therefore studies need to focus on adolescent use and understanding of nutritional information on the FL.

In a study by Haidar et al., (2017) use of nutrition labels did not differ with gender but did differ with age, body mass index and socio-economic status. Adolescents' nutrition label use differed significantly between ages with 65% of grade 8 adolescents (age 13) reporting using nutrition labels yet only 55% of grade 11 (age 16) pupils. Overweight, or obese pupils used the nutrition labels more than pupils of a normal weight. Pupils from lower socio-economic status used a nutrition label more than middle or higher SES groups. Measuring nutrition label `use` was found by asking if they use a FL, with choices of answers consisting of three variations of yes and one category of no. All the `yes` answers formed one answer and the one `no` formed the second category which distorts the figure that adolescents use nutrition labels to make their food choices.

Studies that explored adolescents' understanding and knowledge of nutritional information on a FL in respect of influencing their food choices do not align. Talagala and Arambepola (2016) judged the ability of adolescents to select the healthier snack food from three pairs of hypothetical FLs. Results indicated that 65% of participants did select the healthier food option, yet their justifications for their selection were ambiguous. Despite 43.7% who self-reported that they always read the nutritional information and 38.4% who self-reported that they always use the nutritional information the reasons adolescents gave for selecting the healthier product included attractive label, reasonable price, local product, and that the higher price indicated that it would be a better product. This raises the question of whether selecting the healthiest product was by luck, or there were so few products to choose from, or that they do not read the nutritional information as much as they profess to.

Jefrydin et al., (2019) explored Malaysian adolescents (*n=34*) aged 13-16 adolescents' views, knowledge, and perceptions on reading nutritional information. Findings revealed that 90.9% recognised that nutritional information is a list of nutrients that can help consumers to identify healthier food choices, but actual usage of the nutritional information was low. Barriers towards using nutritional information included a lack of interest, and self-belief in their knowledge because, as they frequently bought the same product therefore, they considered they already knew this information. Other barriers included the time to read the nutritional information, hunger because they need to buy it and eat it immediately, plus adolescents selected food that tasted or looked good. Adolescents that did look at nutritional information consulted the FL due to specific health reasons such as losing weight or avoidance of a specific nutrient such as sugar or fat.

In summary, the literature that evaluated adolescents' preferred FL design cannot agree as to which is the best design to influence food choice behaviour, which could be due to the difference in the range of countries and cultures that were involved in the studies. Studies that evaluated the influence of a FL on food choices in a laboratory setting may not provide robust evidence due to the

hypothetical nature of food selected. Studies that suggested adolescents are frequent FL readers indicated that the information they seek is the expiry date, manufacturing date, brand, and price. There appears to be barriers to using nutritional information on a FL such as apathy, time, hunger, or a self-belief in their own nutritional knowledge. Overall, adolescent FL use is poor due to a lack of understanding which requires education to provide trustworthy knowledge.

2.10 Education as an instrument to inform dietary choices

According to Lawson (2013) the teaching of food and nutrition has not belonged to a specific subject for a century. Historically, females studied subjects such as food studies and home economics, whilst males studied design and technology or crafts. Currently, all pupils in secondary school in England study food technology in year seven, eight and nine. Rutland and Owen-Jackson (2013) aimed to understand the purpose of food technology. Food technology covers designing and making food products, the science of food cooking and nutrition, the exploration of food technology, sustainability and the role of the consumer, the food industry and the government in development in the food eaten. Rutland and Owen-Jackson's (2013) study found that 64% of teachers, and 87% of pupils (87%) agree that they want to study food technology in year seven and 57% of teachers and 91% of pupils agreed that design strategies were important, yet pupils wanted more variety and choice in the food they cook. However, only 21% of teachers thought that pupils learnt about healthy eating and teachers felt that this was missing from the curriculum. The study concluded that the lack of time on the curriculum is the key issue in teaching food technology.

Public Health England (PHE) (2015) prepared a framework of knowledge and skills for teaching food technology produced by the BNF for secondary schools in England. Food - a Fact of Life (2021) developed schemes of work for food technology for years seven, eight and nine. One aim of food technology is to develop pupils' knowledge of ingredients and healthy eating. In week three the teaching and learning overview is as follows: -

`To describe the principles of The Eatwell Guide and relate this to their own diet. To name the key nutrients provided by The Eatwell Guide food groups. To explain and apply the 8 tips for healthy eating, the 5 A Day message and portion size. To compare and evaluate existing products`. (Food - a Fact of Life, no page 2021)

Each lesson is fifty minutes long. There is a total of twenty minutes to teach and complete the activity for the Eatwell Guide thus highlighting the lack of time being an issue in teaching food technology. In year seven pupils use FL`s to compare dairy free or reduced sugar products but these food choices may not engage this age group. In year eight they create a FL for a dish. In year nine they investigate what information is available on a FL to the consumer. As with the Eatwell Guide the

evidence suggested that despite the number of resources available to cover these tasks the time to complete and understand them warrants a longer teaching period. It could be suggested that less information should be imparted but be taught in more depth which may bring about a better understanding.

Lawson (2013) emphasised that teaching food technology is an expensive subject due to teaching pupils in smaller numbers and highlights that, due to the limited allocated time, this reduces the number, the type and complexity of dishes that can be cooked. Barlex (2020) discussed the issues surrounding teaching food in secondary schools in the UK and concluded that the curriculum is too broad, pupils spend considerable time designing the food dish rather than following a recipe and making the dish. Barlex (2020) implied that culture and home shape taste preferences and food choices and yet, in British society the curriculum cannot accommodate all cultures. There are other issues to consider regarding learning about food and nutrition. Adolescents seek social media messages which are not always composed by experts, there are multiple home food delivery companies vying for attention and an abundance of ready meals on the supermarket shelf which do little to engage adolescents to learn to cook. The time it takes for teachers to cover this broad curriculum needs attention. Adolescents should have the opportunity to apply their learning when selecting their food choices at school.

2.11 The effect of nutritional knowledge on adolescent food choices

Grunert et al., (2010) measured adult consumers' nutritional knowledge through evaluating 921 self-reported questionnaires. Consumers were asked a comprehensive list of 99 questions (adapted from Parmenter and Wardle, 1999). The study concluded that there is a relationship between FL usage and an interest in health, and consumers who understand FLs have a greater nutritional knowledge. However, even though consumers may understand nutrition this does not mean that they apply their knowledge into practice.

Studies that evaluated adolescent nutritional knowledge have no consistency regarding the instrument they use or the questions they ask to measure `knowledge`. Talagala and Arambepola (2016) reported that 84.1% of 542 adolescents had good nutritional knowledge. The 10 questions were broad and covered colours, additives, preservatives, best before date, serving size, fats, fibre, natural products, and a definition of the recommend daily allowance (RDA). The majority could interpret the best before date and interpret high in fats, only 51% could identify a serving size, 47.5% could identify unhealthy fats, while the most incorrectly answered question was the RDA.

Haidar et al., (2017) asked four multiple choice questions to ascertain adolescents` nutritional knowledge. Question one asked 'How many total cups of fruits should you eat each day?' Question

two asked 'How many total cups of vegetables should you eat each day?' Question three asked `Which food per 100g contains the most calories` and question four asked - If I am overweight, I am more likely to have health problems` with the answers being true, false and I don't know. Results of the study implied that adolescents who read nutritional information on a FL have greater nutritional knowledge and healthier dietary behaviour, but this is a bold statement from such basic questions.

2.12 Interventions applied at work and schools to support healthy eating

According to Van Cauwenberghe et al., (2010) schools are important environments to promote healthful behaviour because they can potentially reach most school ages, ethnicities, and socioeconomic groups. Van Cauwenberghe et al., (2010) systematically reviewed European school-based interventions that aimed to promote a healthy diet in children aged six -12, and adolescents aged 13-18 between January 1990 and December 2007. From the 42 studies that met the criteria 29 studies involved children and 13 studies involved adolescents. From the five adolescent studies on educational interventions alone evidence in one was strong, one was moderate and three were weak. From the two studies that measured environmental interventions, one found a positive long-term effect on dietary behaviour, and one did not, thus equating to inconclusive evidence on environmental interventions alone. From five multicomponent interventions that combined nutritional education and interventions that applied changes in school lunch, effectiveness was found in four and one study reported mixed results, thus indicating multicomponent studies have a positive impact on self-reported dietary behaviour but multicomponent studies tend to involve multiple people which requires joint effort.

Melo et al., (2013) conducted semi structured interviews to evaluate the promotion of healthy eating and lifestyle from the school healthcare perspective in Portugal. Results highlighted that when there were numerous separate promotional activities these had a low level of joint effort from all members of the school. Reasons given were teachers lack time or interest or there was a lack recognition that food choices need to be changed and that teachers have numerous responsibilities that include extra curriculum activities. The study concluded that despite health education being compulsory in Portugal there were idiosyncrasies amongst the school's environment, including the surrounding external environments, school polices, family and fellow teachers as role models and the study recommended that total interaction is key to promote healthier eating.

Mackison et al., (2016) assessed the feasibility of engaging worksites in a healthy eating intervention in Scotland. Thirty-seven workplaces were invited to take part, four showed an interest in the intervention and only two accepted. The aim was to engage staff and consumers in promotions of healthy eating and provide a reduced cost healthy main meal for 10 weeks. Sales of the main meal

were monitored pre and post the promotion of promotional items which included displaying posters, stickers, weekly and daily point of service menus, electronic bulletins, and nutritional analysis of dishes. Food habits were assessed by questionnaire pre and post the meal promotion and catering staff and consumers participated in a focus group regarding the acceptance of the healthy main meal. Mackison et al., (2016) concluded that healthy eating interventions increase the workload of catering staff, and a significant effort is required to engage consumers in interventions; there was a poor response to the questionnaire and posters were not effective in engaging consumers and the use of the internet would have been more effective. do Amaral e Melo et al., (2017) systematically reviewed studies that implemented technology as their main characteristic for the nutritional interventions. From the 11 studies that met the criteria they all concluded that games and smart phones had positive outcomes regarding changing behaviour.

2.13 The application of food labels applied in schools and their impact on food choices

Despite the rise in adolescent obesity and that school meals can significantly contribute to calories consumed there are limited studies that apprise the impact of a FL in a secondary school setting. According to the PRISMA figure (Appendix C) there are three known published studies that have applied a FL in a live setting and each study had limitations. The study by Hunsberger et al., (2015) found a decrease of 45 gross calories purchased a day and a reduction of 2.1 grams of fat per day and suggested that pupils took smaller portions of food. The limitations of this study are that it was a short duration of one-month pre and one-month post the provision of nutritional information which cannot conclude the stability of these results longer term. The application of the FL was in one school and therefore the results of this study may differ given broader demographics. There was no gender differentiation in their analysis, yet the results showed that females tend to choose less calorific meals than males, and therefore the effect of gender on these results may be significant. Alongside the application of the FL the school was also running nutritional education lessons; therefore, it is not evident if the FL affected pupils' food choices or if the effect was due to the nutritional education. The Marmot Review (2020) and The Marmot Review (2020a) indicated that important drivers that contribute to obesity are low income, social deprivation, and ethnicity. This school was in a low-income area; 32.5% of the students were obese, 79% of the pupils had free or subsidised meals and 64% were from ethnic minorities. This questions if results would be different if the study was implemented in a more affluent area.

The research by Rainville et al., (2010) aimed to establish how adolescents select their food and if these food choices changed with the provision of nutritional information. Results found a 6.6 calorie increase per menu item in the intervention group and decreased calories selected in the control

group which gives concern over the sampling and the methods of data collection. The study was conducted in three phases. Phase one consisted of four focus groups (*n=73*) 38 female and 35 males, with ninth and tenth grade (ages between 14-15 and 15-16) and eleventh and twelfth grade (ages between 16-17 and 17-18). Phase two was the intervention of the FL which displayed calories and fat per serving at the point of service. Phase three was to interview the school nutrition directors to determine both the approval and barriers regarding posting the nutritional information. Results indicated that students in the focus groups considered nutritional information would affect their food choices. However, data from the sales indicated that the nutritional information did not affect their food choices.

The school nutrition directors were positive regarding the intervention. In total 20 high schools and 1508 menu days were assessed across six USA regions. The school nutrition directors supplied the sales data for the main course for two months prior to the experiment in September and October. There were 11 control schools and nine intervention schools. During January and February, the school displayed the FL. There were differences at pre-test which is the major limitation of the study. At pre-test the control group were offered entrees with lower calories and fat and offered more food choices than the intervention groups and had larger participant numbers. At post-test the control group decreased the calories and fat content of their main course dishes. Opposing this, the intervention schools increased their calories and fat during the post intervention. This should not have been the case as the menu planning guidelines are the same for all school in all the districts. However, there were not only differences in the control and the intervention but there were differences in high school districts, with larger districts offering less fat and fewer calories at the point of sale.

The mean calories per entrée in the small districts were 347.7, in the medium district 359.7 and in the large district 305. The mean grams of fat in the small districts were 15.4, the medium district 15.7 and the large district 12.8. There were significant differences in variables pre-test in both the number of entrees on offer, the number of pupils in each school and the number of pupils entitled to free school meals. Pre-test the control schools offered fewer calories and less fat, but more choices of entrees and more students participated in the lunch program. It was the control groups that decreased the calories and fat in their menu post-test and the intervention schools increased the level of calories and fat. This questions if the control groups pre-empted pupils will want unhealthy food choices and made more of these dishes. The eight-week pre-intervention baseline was from September to October and the eight-week intervention operated from January to February. There is considerable difference in weather temperatures during these periods, which

could have prompted pupils to select more hot food in the colder months, which could have contributed to the evidence of consuming different food items.

Research by Conklin et al., (2005) found a difference before and after the FL, but these differences were slight to moderate. Pupils selected the same food choices such as pizza or burgers, but they chose healthier options. Sales of pepperoni pizza dropped significantly, and sales of cheese pizza increased significantly. The strengths of the study were that there was one control school and three intervention schools, the duration was six weeks pre and post and schools differed culturally. The weakness of the study was that there were no discussions with the participants as to why these changes occurred.

A study that was undertaken but not published (Fresques`., 2013) researched and measured the effect of providing a FL that displayed calories and fat on a high school menu in Arizona. The data collection was in three parts. Part one collected baseline data of sales for four weeks prior to applying the nutritional information. The intervention involved placing laminated cards that displayed the calorie and fat content of each menu item on the menu board and positioned in front of each food counter at five service points. The eight-week intervention was to evaluate if a change would occur with Sardella`s pizza meal, Super Nacho meal, Chick Fil-A meal and the meal offering at the grab and go. Part two evaluated students' self-reported use of the nutritional information both pre and post the intervention. The first survey contained nine questions which included age, gender, ethnicity, and their eligibility for reduced cost or free school food. The remainder was an inventory of the food they would consume and a range of questions asking if nutritional information were to be available would this guide their food choices. The second survey contained 10 questions which were the same as the first survey with the addition of how much the nutritional information changed their food choice (if at all). The final part was a focus group (*n=14*). The results of the study did not show any significant change in student food choices when students saw the information on the calories and fat in the food on offer. One strength of this study was that the author conducted weekly visits to the school to oversee the implementation of the intervention. The limitation of this study was that the meals were in the fast-food category and therefore there were not large enough variances of the calorie and fat content between the food choices. It would also have been interesting to have identified if this intervention affected certain genders more than others.

The studies that applied a nutritional label in high schools were inconclusive. However, given that these FLs have not been shown to influence behaviour it could be that studies that seek to identify factors that affect adolescents' food choice alongside their actual food purchases would be more robust in terms of their findings.

2.14 The factors that affect food choice behaviour

The question of `why individuals eat the food they do` is multifaceted and consequently several fields of research contribute to this body of knowledge. Food choices consist of a series of complex human behaviours that are influenced by several factors (Bisogni et al., 2003; Arganini et al., 2012). Food choices play a significant part in symbolical, economic, and social aspects of a person's life through expressing identity and cultural meaning. The food choice process includes both conscious reflection and automatic habitual subconscious decisions (Furst et al., 1996). An individual's choice of food has a direct impact on the nutrients that the body receives, and certain food choices can become lifelong habits (Conner and Armitage, 2006). Furst et al., (1996) identified several pioneers who have studied the aspects of food choices, some pioneers focus on specific areas such as taste, health, social status, and cost. Others focus on cognitive factors or motivation. Food choices are not founded on nutritional physiological needs but are centred on individual behaviour which can be swayed by social and cultural influences (Shepherd, 1999). Conner and Armitage (2006) suggested that social psychology research provides the best explanation for choices. Social psychology studies a person's thoughts, feelings, and behaviour that may be influenced by the presence of others and the social context in which they occur.

There is a need to understand what factors influence adolescents` choice of food. Poor food choices can become integrated into personal lifelong habits that can be difficult to correct. More positively adolescents who do develop healthy eating are more likely to maintain their healthy choices in later life and have a reduced risk from chronic disease (Sobal et al., 2006; Hagell, 2015; Ronto et al., 2020). Food choices encompass variable factors, and a conceptual framework can be used to describe how these variables relate to each other. A framework can help to clarify the dynamics of health behaviour and the effects of external factors on that behaviour (Story et al., 2002; Fox et al., 2018; Gilmour et al., 2020). There is a plethora of conceptual models of food and nutrition and the process of food choice.

2.15 The conceptual model for food choice efficacy

The selected model was proposed by Story et al., (2002) and is based on the `social cognitive theory and the ecological perspective for understanding factors that influence adolescent eating behaviours' (Story et al., 2002 no page). Story et al., (2002) advocated that adolescent food choices are not in accordance with the USA dietary guidelines, being low in fruits, vegetables, and calcium rich foods and high in fat. Story et al., (2002) suggested that there are multiple levels of influence and proposed that there is reciprocal determinism between an individual's behaviour and the school environment in both directions. Social cognitive theory infers that knowledge is acquired through

observing others in a triadic manner (Cherry, 2019; Gilmour et al., 2020). Learning happens in a social situation with an active shared interface between a person, the environment, and their behaviour (Boston University School of Public Health, 2019). Conforming to peer pressure and social norms is synonymous with being an adolescent (Gilmour et al., 2020). The ecological perspective considers how people interact within their environment at four levels, the microsystem (family and home, the mesosystem (neighbourhood and school), the exosystem (community and mass media) and the macro system (culture, and values) (Gilmour et al., 2020). Story et al., (2002) proposed a conceptual model consisting of four levels. The individual influences (intrapersonal), the social environmental influences (interpersonal), the physical environmental influences and the macrosystemic influences (societal).

The individual influences (intrapersonal) focus on the individual factors that influence adolescent food choice behaviour. These psychosocial factors (social factors combined with individual factors) incorporate food preferences, taste and sensory perceptions, health, the meaning of food, self-efficacy, and knowledge. Biological aspects include hunger and behavioural factors which encompass meal and snacking patterns and attitude to weight behaviour. Lifestyle factors can be seen as perceived barriers which encompass cost, time, convenience which can also be construed as personal influences that impact on eating behaviour. The social environmental influences are interpersonal factors that consider relationships and communication. These factors included family, demographics, family meals, food availability and peers. The third level of influence encompassed the physical environmental influences and, in this research, focused on the school environment. The final fourth level of influence was the macrosystem including media and advertising. It can be suggested that as these factors are so numerous and bidirectional, it is challenging to ascertain which factor has the greatest impact on eating. The first individual influence from Story et al., (2002) is food preferences.

2.16 Parameters that influence food choices in adolescent years

Food preferences form because of complex multifaceted interactions from early childhood eating experiences, exposure to food groups, positive and negative conditioning and genetics, and self-reported food preferences are according to Story et al., (2002) the strongest predictor of food choices. Food preferences include a person's opinions and feelings towards food which is why people select one food choice over another (Meiselman and Bell, 2003). Studies often evaluate how a food is liked, disliked, or preferred and are often reported on a hedonic scale which can be analysed regarding numerous demographic factors.

Ensaff et al's, (2012) study sought to evaluate adolescents' food preferences (*n=2660*) at two secondary schools in Yorkshire. Results from the seven-month intervention indicated that sandwiches, pizza, or desserts were the most preferred food choices, yet the most nutritionally valuable main meal accounted for only eight percent of sales in both schools. Caine-Bish and Scheule (2009) identified food preferences with respect to gender of school aged children and adolescents in Ohio. Participants ranked their preferences for 80 different foods on a five-point scale. From the 1418 returned surveys results indicated that males significantly preferred foods such as fajitas, tacos, fish, casseroles, and meat (beef, pork, and poultry) and BBQ. Females significantly preferred starches and sweets such as French fries, muffins and doughnuts, and fruits and vegetables. A food preference is different to food choices and Story et al., (2002) stated that the individual influence of taste and sensory aspects are the most important influences on food choices.

Food choice is an interdisciplinary topic defined as how people select the food they eat (European Food Information Council (EUFIC) (2021). The EUFIC (2006) identified six determinants that comprise of biological (hunger, appetite, and taste), economic (cost, income, and availability), physical determinants (access, skills, and education), social determinants (culture, family, and peers), physiology, (mood, stress, and guilt) and attitudes and beliefs. The EUFIC (2021) suggested that food choice varies between people dependent upon culture, price, or personal factors such as mood, appetite, time available, familiarity or taste.

2.16.1 Taste

Story et al., (2002) stated that within the conceptual framework of individual influences that taste, and appearance were the most discussed factors on food selection and authors agree (Neumark-Sztainer et al., 1999; Shannon et al., 2002; Fitzgerald et al., 2010; Ensaff et al., 2015; Ronto et al., 2020; Bawajeeh et al., 2020; Gilmour et al., 2020). Taste is the sensation detected by taste cells on the tongue and mouth. The cells attach with molecules from the food and signal to the brain which perceives these signals as salt, sweet, bitter, sour and umami (dos Santos et al., 2017; Fifth Sense, 2021). Taste and smell work together to create flavour, and therefore smell is the determinate of flavour (Merriam-Webster, 2021).

The study by Neumark-Sztainer et al., (1999) aimed to identify what factors most influenced adolescent food choices. Results from adolescents (*n=141*) in grade seven (age 12 years) and grade 10 (age 16 years) who took part in focus groups (*n=21*) in Minn, USA, identified hunger and food cravings, the appeal of food, and time as the most cited factors that affected their food choices. The appeal of food encompassed taste, as food had to taste good, and participants knew it tasted good because they had eaten it before, and they were familiar with these choices. Other factors included

smell, appearance, how it is served and the combination of foods together on a plate. Participants wanted healthy food to taste and look `better`; specific examples were to serve vegetables with a dip or a cheese sauce, stir frying, or not serving bruised fruit. They wanted fruit, vegetables, and dairy foods to be more accessible, bags of baby carrots, celery and raisins, milk had to be cold, and salads prepacked. Participants suggested to make healthy food the only available option, but this could result in adolescents bringing in their own food or taking their custom elsewhere (Addis and Murphy, 2018; Ronto et al., 2020). Shannon et al., (2002) aimed to ascertain what factors influenced high school pupils' food choices in Minn. A survey was distributed to pupils in grades 10-12 that contained 18 questions, and 12 of them were specifically on what factors influenced their food choices at school. From the 294 returned surveys 93.7% of the participants select food due to the taste but the study did not identify what taste means to them.

Ensaff et al`s., (2015) study sought to ascertain adolescents' attitudes and perceptions of plant-based foods. Through semi structured focus groups (*n=29*), with adolescents aged 14-15 in Yorkshire four categories were identified from the data; the first category established adolescents' food choice parameters of how they select their food at school. Adolescents either identified attributes (taste and appearance) or habits and experience (familiarity, peers, convenience, and price). Taste and appearance were the principal factors in their decision making. However, the words used to express taste were vague such as `tastes good`, and food needs to have a `nice taste` so does little to develop knowledge on adolescent eating behaviour and any association to `taste`. Food had to look good for them to buy it, but they selected foods they know, food that is familiar which links to home. There was a division regarding the influence of friends but if a friend said it tasted good, they were more likely to try the food. However, the only study that did identify taste correctly is Gilmour et al., (2020). Adolescents identified `taste preference` as the most significant intrapersonal factor that influenced their food choices and they identified two of the five flavours; they liked carrots, broccoli, and cucumber due their `sweetness`, and they disliked peas, sprouts and cauliflower due to being slimy or `bitter`.

Studies have identified taste as a barrier to healthy eating because healthy food is tasteless (Shannon et al., 2002; McKinley et al., 2005; Stevenson et al., 2007; Ensaff et al., 2015a; Ronto et al., 2020; Gilmour et al., 2020; Voi et al., 2020; Azizan et al., 2021). Vegetables were negatively associated with taste (Ensaff et al., 2015a; Gilmour et al., 2020; Gilmour et al., 2021), yet Gilmour et al., (2021) implied that adolescents have little experience of vegetables and do not know what varieties are. Ensaff et al., (2015a) found that meat was associated with flavour, and that meat dishes looked better than plant-based foods, but this was not reported with regard to gender.

Participants in Stevenson et al`s., (2007) study polarised foods into tasty and tasteless. Tasty foods were foods they preferred such as burgers, chips, processed foods, pizza, chocolate, sweets; tasteless foods were foods they disliked such as fruit, vegetables, unprocessed meat, and seafood. In Azizan et al`s., (2021) study Malaysian participants (*n=68*) perceived healthy food at school as tasteless due to a lack of salt, or they deemed healthy foods to be sour. Ahmad et al., (2021) indicated that salt is important in cooking Malaysian food and is correlated to their culture. Health and taste need to be seen as synonymous; healthy food needs to have flavour, be tasty and be filling.

From a biological perspective, males implied healthy foods do not satiate hunger compared to foods with a lower nutritional value (McKinley et al., 2005; Ronto et al., 2020; Gilmour et al., 2020; Voi et al., 2020; Azizan et al., 2021). Story et al., (2002) stated that between 15-20% of an adult's body weight is gained during adolescence and that hunger as a physiological drive must be considered. It is interesting to note that both Steptoe at al., (1995) and Ooi et al., (2015) adolescent food choice questionnaire does not consider hunger as a factor.

Neumark-Sztainer et al`s., (1999) study identified the most cited factor that affected adolescents' food choices were hunger and cravings, and they wanted filling food. The problem is adolescents' food preferences as cited by Stevenson et al., (2007) are more calorific with a lower nutritional density compared to foods they disliked. To further add to the identity of healthy food, these foods are more expensive to purchase and less available in schools than unhealthy food (Ronto et al., 2020; Azizan et al., 2021). Azizan et al`s., (2021) study postulated from a food operators' perspective that healthy food is more expensive to purchase, requires more manpower to prepare it, is more perishable than energy dense food, mostly requires refrigeration and if the item does not sell it is less profitable for the business. Food operators are being challenged to produce a healthy, tasty, filling, flavoursome, cheap product that looks good and makes a profit.

Many studies identify appearance as a predominate factor that influences adolescent eating behaviour (Neumark-Sztainer et al., 1999; Fitzgerald et al., 2010; Ensaff et al., 2015a). Wu et al., (2021) identified that visual properties of food affected the perception of how fresh and healthy the food is, and how it should taste. Opposing this, when food is presented badly, messy, or not neat, the food is liked less as it is perceived not to have been prepared with care.

In summary, the literature suggests that taste, appearance, and hunger are key drivers in adolescent food choice at school. Healthy food is not synonymous with taste or satiation which are barriers in influencing adolescent food choice. However, Story et al., (2002) proposed that, within the

conceptual framework of individual influences, health and nutrition, self-efficacy, knowledge, and the meaning of food also affect food choice behaviour.

2.16.2 The meaning of food for adolescents

Story et al., (2002) advocated adolescents view food as symbolic that is intertwined with self-identity, friendship, and security. Eating `junk food` is synonymous with pleasure, friends, weight gain, guilt, and independence. There is a dichotomy between junk food and healthful eating. Verstraeten et al., (2014) and Gilmour et al., (2020) highlighted adolescents' negative terminology towards `junk food` and energy dense food. Participants split foods into good or bad categories rather than looking at a more holistic view of dietary and lifestyle behaviour. They fiercely disagreed with the consumption of take away and fast food and were critical of people who select them but contradicted themselves when they stated that they craved unhealthy foods, due to the taste. Stevenson et al`s., (2007) participants preferred food that was categorised as bad-food and junk food and they disliked foods termed `good for you`. Gilmour et al`s., (2020) participants traded feeling guilty they allowed themselves to consume unhealthy foods if they had consumed healthy choices. Other health consciousness participants wanted to keep fit, lose weight, or they cited self-efficacy as they did not allow themselves to consume junk food suggesting that adolescents' autonomy at school did not result in unhealthy food choices.

Story et al., (2002) and Nobel et al., (2003) identified that `healthy foods` were synonymous with weight loss, parents, and home. Healthy foods included fruit, vegetables, and salads (Croll et al., 2001; McKinley et al., 2005; Fitzgerald et al., 2010; Verstraeten et al., 2014). More specifically, Croll et al`s., (2001) participants associated healthy food with greens, and celery. Fitzgerald et al`s., (2010), participants stated that the terms 'organic' and 'wholemeal' had positive connotations such as good for energy, strength and staying slim.

Verstraeten et al`s., (2014) participants specified that chips, candy, and junk food were unhealthy choices. In a study by McKinley et al., (2005) fish was negativity discussed unless it came from a chip shop, pasta was popular and healthy and associated with sport, crisps were a favourite, but some participants mentioned spots and putting on weight. Chocolate, chips, and cakes were foods associated with weight gain and vegetables and foods that are `not nice` were associated with health. Gilmour et al`s., (2020) participants stated that healthy foods were readily available at school, and this was not a barrier to healthy eating, yet they wanted healthy foods such as fruit and vegetables to be more aesthetically appealing. The vegetables looked `nasty` and fruit in bowls looked `old and mouldy` and about to go off. Participants indicated that they readily select fruit at home when it looks fresh.

Studies have proposed that adolescents prefer unhealthy foods despite their knowledge of heathy eating (McKinley et al.,2005; Stevenson et al., 2007; Fitzgerald et al., 2010; Verstraeten et al., 2014; Ronto et al., 2020; Voi et al., 2020; Calvert et al., 2020). Croll et al., (2001) indicated that adolescents have a significant amount of knowledge of healthy eating; they knew that they should not consume unhealthy food, but they did not care because they were young. In agreement, Lai Yeung (2010) studied eating behaviour of adolescents (*n=836*) aged 11-18 in secondary schools in Hong Kong and identified that taste, appearance, and cost are the main motivators for food choices, and despite some knowledge of healthy eating, short-term food enjoyment was sought rather than long term health. A study by Verstraeten et al., (2014) also found that adolescents reported having a positive `attitude` towards healthy eating, yet they admitted that they had no self-control, despite their awareness that these foods were of poor nutritional value. Most participants in Verstraeten et al`s., (2014) reported that their food choices were habitual and unhealthy foods were readily available at school. Healthy eating is associated with a healthy lifestyle and physical activity; however, females are more concerned with eating well due to their personal appearance, whereas males wanted to eat healthy foods due to their interest with sport (Wardle et al., 2004; McKinley et al., 2005; Arganini et al., 2012; Voi et al., 2020).

Stevenson et al., (2007) and Azizan et al., (2021) disagree with the studies that suggest adolescents' have knowledge of healthy eating and proclaimed that adolescents do not fully understand what heathy eating is. Yet, adolescents in these studies deemed that it is not about knowledge because their eating habits were difficult to change. Gilmour et al., (2020) discovered that although most adolescents admitted that they do not meet the guidelines for fruit and vegetable consumption, they could not identify how to improve this which either indicates that adolescents do not fully understand what healthy eating is or that they cannot apply their knowledge.

In summary adolescents polarise food into good or bad, healthy, or unhealthy. Healthy food is synonymous with fruit, vegetables, salads, sport and staying slim. Despite their knowledge of what constitutes as unhealthy foods; unhealthy foods are seen as tasty, readily available, and habitual food choices. Adolescents may be aware of what constitutes healthy eating, but their knowledge is not translated into healthy behaviour, though there are gender differences in healthy behaviour.

2.16.3 Gender and eating behaviour

Story et al., (2002) suggested that within the conceptual framework of individual influences the biological influences of gender impacts on food choice behaviour. Females consume less fruits, vegetables, dairy and take in less vitamins and minerals than males and are more likely to miss eating breakfast. Males eat a larger quantity of food in general and therefore meet their energy

needs, but their diets are higher in fat and saturated fat compared to females. The systematic review by Arganini et al., (2012), although not specifically for adolescents, discovered gender differences in food choice and consumption of Western country consumers, and `the relationship between eating habits and health consciousness, and between eating behaviour and weight control` (Arganini et al., 2012 p.85). Females are reported to engage in more health promoting behaviour and have heathier lifestyles than males and males report having less interest in health than females (Shannon et al., 2002; Wardle et al., 2004; Arganini et al., 2012; Li et al., 2012). Arganini et al., (2012) claimed that vegetables, fresh fruit, and dairy are associated with femininity which does not agree with Story et al., (2002), whilst red meat, alcohol and generous portion sizes are associated with masculinity.

A Norwegian study by Kubberød et al., (2002) explored adolescents' (*n=30*), aged 16-17, attitudes to consuming meat and found that males consumed more red meat than females, although both genders described a sensory liking for meat due to taste, smell, and juiciness. Females associated red meat with disgust due to being raw and bloody, with visible fat, and because it has a fatty feel. Females construed meat to be a heavy food which negatively impacts on their body. However, the sample size was small, and therefore these findings cannot be generalised across population groups. Stevenson et al., (2007) also discovered that females were morally disgusted at the thought of eating meat that contained bones or fish with skin, yet they would happily consume processed meats where these were not visible.

Arganini et al., (2012) indicated that males associate food with habit and fuel and are sceptical about nutritional guidelines despite having knowledge of them. Overall males prioritised health lower than taste and convenience. Females showed that their health behaviour increased with an increase in age and higher education attainment, and they demonstrated superior knowledge of nutrition compared to males. Alternativity, Wardle et al., (2004), Afifi et al., (2002) and Arganini et al., (2012) proclaimed that there is a substantial gender difference in food choice behaviour in that females were more concerned about weight control and dieting than males. Females consume more fruits, vegetables, and fibre because these food choices are associated with weight control. Li et al., (2012) pointed out that these foods matter because they are key components for health. Lai Yeung (2010) studied gender perspectives on eating behaviour of adolescents (*n=836*) aged 11-18 in secondary schools in Hong Kong. Across both genders fruit and vegetable intake was below recommendations, and almost half did not consume breakfast which agrees with Story et al., (2002). Females in this study had a greater dissatisfaction about their body weight, yet these participants were under weight.

Deslippe et al., (2021) noted gender-based body ideals where female adolescents aspired to be thin and talked of food restriction which parents noticed, yet parents encouraged males to consume

larger portions and more meat to become strong and build muscle. Stevenson et al., (2007) stated that female adolescents associate healthy eating with `dieting` and that dieting is good for their health and suggested that adolescents need to understand what healthy eating is, which in turn can shape their health food choice behaviour.

To summarise, overall females engage in more health promoting behaviour than males which increases with age and higher education attainment. Some studies indicate that females consume more fruit, vegetables, dairy, and fibre than males which is correlated with weight concerns. Males are less interested in health behaviour and consider food as fuel. Males consume a larger quantity of food, more meat and food with a higher fat content. Despite differences in gender and eating behaviour food choices can be influenced by social factors.

2.17 Social influences

According to St Onge et al., (2003) there are considerable environmental, economic, and social changes that impact on childhood food consumption. Current eating environments are obesogenic (Hobbs et al., 2020), which includes 24-hour fast food outlets providing foods options that are highly energy dense. Parents are working longer hours resulting in less home cooking and fewer meals eaten together as a family. Fitzgerald et al., (2010) advocated that family meals are important in influencing adolescent food choices, but adolescents identify several barriers to eating meals with the family. These barriers include time allocated to playing sport, parents' working times, extracurricular activities and being with friends.

At this stage of life, adolescents increase their autonomy over their food choices (Neumark-Sztainer et al., 1999; Story et al., 2002; Stevenson et al., 2007; Haidar et al., 2016; Ronto et al., 2020; Gilmour et al., 2020; Gilmour et al., 2021). According to Fitzgerald, (2010) adolescents eating becomes more of a social activity with friends rather than with the family. Social eating is more prevalent at the weekend where adolescents report making less healthy food choices. Fitzgerald et al., (2010), Verstraeten et al., (2014) and Ronto et al., (2020) agree that in a school environment as adolescents financial autonomy increases the purchase of less healthy food at school also increases, yet, at school, fitting in with friends is deemed an important factor in adolescents' food choice behaviour.

Story et al., (2002) stated that friends have an influence on behaviour by creating acceptable norms. Eating is deemed as socialisation and recreation. Simultaneously adolescents desire peer approval yet seek autonomy and individuality and believe there is no influence from their friends. Studies that have researched the relationship of psychosocial factors regarding adolescent food choices do not agree. Stok et al., (2014) found that friends can motivate others to consume more healthy food choices and consume less unhealthy products. Azizan et al., (2021) postulated that adolescents

considered changing their food choices to healthier options was easier when done with friends. Ensaff et al., (2015) suggested that friends can provoke imitating behaviour by advising others that a food `tastes good` encouraged them to try different food. Ellison, (2014) looked at the effect of a FL on students' food choices in a full-service restaurant. Results indicated that individuals wanted to be different but not too different and they selected the same category of food. Ellison (2014) concluded that eating with a healthier friend has a greater influence in influencing healthier food choices than a FL.

Gilmour et al., (2020) identified that adolescents were adamant that friends had no influence on their food choices and fiercely declared that they were individuals who made their own choices. Participants emphasised that they made independent food choices which were not judged by their peers which could be identified as fitting in with the group behaviour. In disagreement Verstraeten et al., (2014) stated that subjective norms around eating healthy foods differed. Most participants felt peers would mock them if they selected the healthy options, this would be embarrassing, and they would call them freaks or weird. This is similar with Calvert et al., (2020) who stated that females felt judged or teased by males if they selected healthier food choices. Verstraeten et al., (2014) indicated that consuming unhealthy foods could express belonging to the group and may be a protective factor.

Unlike Verstraeten et al., (2014), the results from Gilmour et al`s., (2020) five focus group discussions (*n=42*) with adolescents aged 11-13 years of age from three secondary schools in Wales found participants strongly denied any embarrassment if they ate or selected healthy foods, and they disputed conforming to peer group norms. Gilmour et al., (2020) found an unusual relationship between peers and food choices at school. Participants articulated that selecting the same option of food meant that they could queue together. They explained that if they selected a big meal that is healthy, and their friends selected fast food their friends would finish eating before they did and would be left in the canteen eating on their own. Although this was a novel finding the findings are primarily from middle-class adolescents which may not be generalised to other adolescents from various socioeconomic backgrounds.

Studies have also indicated that the presence of friends is associated with higher intakes of energy dense food (Rageliene and Grønhøj, 2020; Vio et al., 2020). Rageliene and Grønhøj (2020) conducted a systematic review to examine if siblings and peers influenced adolescent eating (86.2% peer and 6.9% evaluated siblings). They concluded that peers negatively influence eating behaviour due to an increase in energy dense, nutrient poor food choices. There was greater support to consume unhealthy food, alongside a liking for unhealthy food, and an adaptation to the eating habits of

peers. Voi et al., (2020) indicated that adolescents' increase of fast-food consumption is at the weekend when socialising with their friends.

Watts et al., (2015) explored the perceived barriers to healthful eating at school from overweight adolescents (*n=22*) at a school in Vancouver. Participants took photographs of the perceived barriers and discussed the barriers that they identified in semi structured interviews. The themes that emerged were the availability of unhealthful food, peer influence, convenience, price, classroom practice and online influences. The influences from peers encompassed four themes. When friends ate less healthy food choices this triggered an urge to also want less healthy foods which were readily available in school, participants wanted to fit in with the group and further pressure was to share their food choices with others; therefore, to fit in with the group they needed to share unhealthy food choices.

Deslippe et al., (2021) noted considerable differences in gender behaviour and peers. At an interpersonal level moving to elementary school prompted new social relationships. Females would fit in with the group food choice decision rather than follow their own personal food choices; they would also share less healthy foods and adopt a friend's eating behaviour. Females used food to forge relationships. Males are more willing to try new foods if they see their friends eat it, but the major difference is that only one male indicated that friends affect their food choices. All other males will follow their personal food preferences rather than fit in with the group behaviour. However, it must be noted that this research reports differences on gender eating by their biological sex and not by their gender expression.

To summarise the influence of friends on food choices at school is inconclusive. Adolescents is a time when individuals have greater autonomy, access to money and there is less parental control. Some studies state that adolescents are adamant that friends have no influence on food choices, yet others disagree. Some studies suggested that selecting healthy food choices is mocked, whilst others indicted that food is planned to avoid being left in the canteen by themselves at school. Studies that assess factors in a school environment imply that behaviour is also influenced by food availability and positioning which are both factors to consider at policy level.

2.18 The school environment

Story et al., (2002) stated that the food on offer at schools in America consists of high calorie, high fat, and sugar food choices. Croll et al., (2001) stated that the barriers to eating well at school in Minn (USA) include a lack of time at break times and a limited choice of healthy options. Despite Ronto et al., (2020) being a recent study, adolescents in Southeast Queensland Canada also found a high availability of unhealthy food at school. In 2001 the poor nutritional value of school meals was

highlighted by Jamie Oliver who was fighting to transform the image of school food, and there had been progress in serving nutritious food in schools (British Broadcasting Company (BBC), 2015). Addis and Murphy (2018) held seven focus groups in four secondary schools in Wales to discuss the new menu that was designed to meet the `Appetite for Life 2008 Guidelines` which focus on meeting nutritional guidelines. Results from the focus groups indicated that the menus were not a success and the pupils stated that they had little consultation. Addis and Murphy (2018) concluded that participants want more food on the go and greater negotiation power and the impact of these suggested menus will result in pupils taking their custom elsewhere, which will affect the contract-catering revenue. There must be a balance with what is provided and acceptance of these foods, so it may be that the way to proceed is to make healthy fast food.

Gilmour et al., (2021) looked at factors that influence food choices at school from the perspective of the catering staff. The catering staff pointed out that even though there are food choices that are perceived as unhealthy such as brownies and cakes these are regulated and formulated to provide the healthiest product. The catering staff referred to healthy eating as health by stealth as cauliflower was pureed into gravy and beans were blended into pizza toppings.

Deslippe et al., (2021) stated that as children transition to adolescence there is a decline in their dietary practice. This study evaluated if the school environment, family, and peers influence dietary behaviour during this transition from elementary school to secondary school and if there were differences or similarities in gender experiences. The study recruited participants from 10 schools in a culturally diverse suburban community in Vancouver. Results from the semi structured interviews (*n=54*) (one parent and one adolescent in each separate interview) suggested that both genders experience changes in school, family, and peers, but these experiences differ. At secondary school there is greater freedom and new opportunities to frequent new fast-food environments surrounding the school. Due to limited seating in the cafeteria adolescents use these fast-food outlets more frequently. Males prioritise sport during school break times over food and females consider sedentary socialisation as more important than eating. Both adolescents and parents expected greater autonomy in food choices.

Ronto et al., (2020) explored adolescents' perceptions of the school food environment with a view to identifying strategies to help them make more healthy food choices. From the 15 focus groups (*n=131*), with adolescents aged 12-17 years from three high schools in Southeast Queensland, four themes became evident; food availability, policy, nutritional education, and attitudes. Adolescents thought that the school provided some healthy food in the canteen, but they found it difficult to select these food choices due to peer pressure and a greater availability of unhealthy food. Participants felt that the school can help more by providing more healthy appealing food and making

these food choices cheaper, despite confessing to liking unhealthy food which they consider taste better and are more filling. From the theme 'food availability' adolescents identified numerous unhealthy food options and mentioned that there was an occasional salad. From a policy perspective, participants mentioned that the schools have an infrequent small sign that says eat healthy. Education was positive but they wanted more education in food and nutrition with more classes and for nutrition to be compulsory. However, despite acknowledging their preference for unhealthy tasty food they suggested minimising the availability of unhealthy food would be beneficial. However, participants could name the food providers near schools which could impact on unhealthy food behaviour and if schools remove unhealthy options, this could raise the question as to whether pupils would frequent these providers more often.

Many studies have identified convenience as a significant factor in eating behaviour (Steptoe et al., 1995; Neumark-Sztainer et al., 1999; Story et al., 2002; Arganini et al., 2012; Verstraeten et al., 2014; Ensaff et al., 2015a; Watts et al., 2015; Ronto et al., 2020; Gilmour et al., 2020). Neumark-Sztainer et al`s., (1999) participants did not want to spend time preparing food because they professed to have no time, they would miss breakfast to sleep for longer and did not want to wait in queues at lunchtime. Gilmour et al., (2020) identified a relationship between peer pressure and convenience. Adolescents in Gilmour's study opted for the similar options of food to enable them to leave the canteen at the same time and not to be left sitting on their own. Gilmour et al., (2020) stated that by creating healthy main meals that included vegetables in a food to go option will increase the healthy food choices.

2.18.1 Food choice architecture (FCA)

The presentation and placement of food and its influence on an individual's decision making, and consequent behaviour is becoming more widely investigated. According to Ensaff et al., (2015a) food-choice-architecture includes all aspects of framing food choice. Choice architecture allows individual choice within controlled parameters. Eating behaviour is bidirectionally, being influenced by the environment and contextual cues which can maximise sales by strategically placing and promoting purchases (Cohen and Babey, 2012). School is a time pressured environment and pupils rely on their food choices by an automatic habitual non-cognitive process rather than through controlled behaviour (Ensaff et al., 2015a). Cohen and Babey (2012) found that when people make rapid decisions, they rely on heuristic devices thereby making a complex process simple; they rely on appearance, familiarity, shapes, sizes, logos, brands, and price. However, these heuristic cues that guide food choice often result in selecting food with higher calorie content. Ensaff et al., (2015a) compiled a six-week intervention (one intervention and one control) in two similar secondary schools in Yorkshire. For 29 weeks, sales of food recorded the baseline, followed by a six-week

intervention and three-week post intervention. Both schools used the same contract caterer and operated the same three-week cycle menu. The intervention consisted of changes in choice architecture specifically focusing on plant-based food. The architecture consisted of disposable pots for main meals, stickers on sandwiches containing salad, posters promoting sandwiches containing salad, fruit pots, pyramid displays of fruit and renaming and describing vegetarian foods with attractive adjectives. Results highlighted the positive influence of food-choice-architecture, in that pupils were significantly more likely to select the designated food items.

In summary, Story et al., (2002) stated that a school environment must be a safe environment where healthy eating is normative and is in accordance with education. Currently school food in England must meet set nutritional standards. The studies that implied that there was a limited availability of healthy options did not take place in this country, the studies in England did not concur with these findings. Through producing attractive healthy food choices to eat on the go can allow adolescents more time to socialise and play sport. By positioning these foods in a prominent place, could possibly influence adolescents' decision making.

2.18.1.1 A theoretical framework to identify factors that influence adolescent food choice behaviour at school

From the literature it can be suggested that food choice behaviour is influenced by numerous interrelating factors as identified in Figure 4. The physical environment of a school is a time pressured environment which is synonymous with long queues and a crowded dining area. The caterers need to consider the position of the food to allow food choices in a controlled environment. The food must be presented well and there has to a provision of healthy choices. Females are reported to consider health more than males. Nutritional education is described as passive with a considerable time spent on design of the dish they will prepare and cook. Adolescents' actual nutritional knowledge is reported as being poor but there is a myriad nonstandard approach in which to measure their knowledge. Knowledge is often described as being gained from their parents.

Most studies indicate that adolescents read FL`s but this does not include the nutritional element of the label, with females being higher FL readers than males.

Taste is described as an important factor in adolescent food choice behaviour, yet studies seldom outline or describe the actual terminology of sweet, sour, salt, bitter or umami in their analysis. The influence of friends is often denied but females have a higher tendency than males to fit in with the group food choice decision rather than follow their own personal food choices. Unhealthy food is epitomised as filling, tasty and having greater satiation when adolescents are hungry.

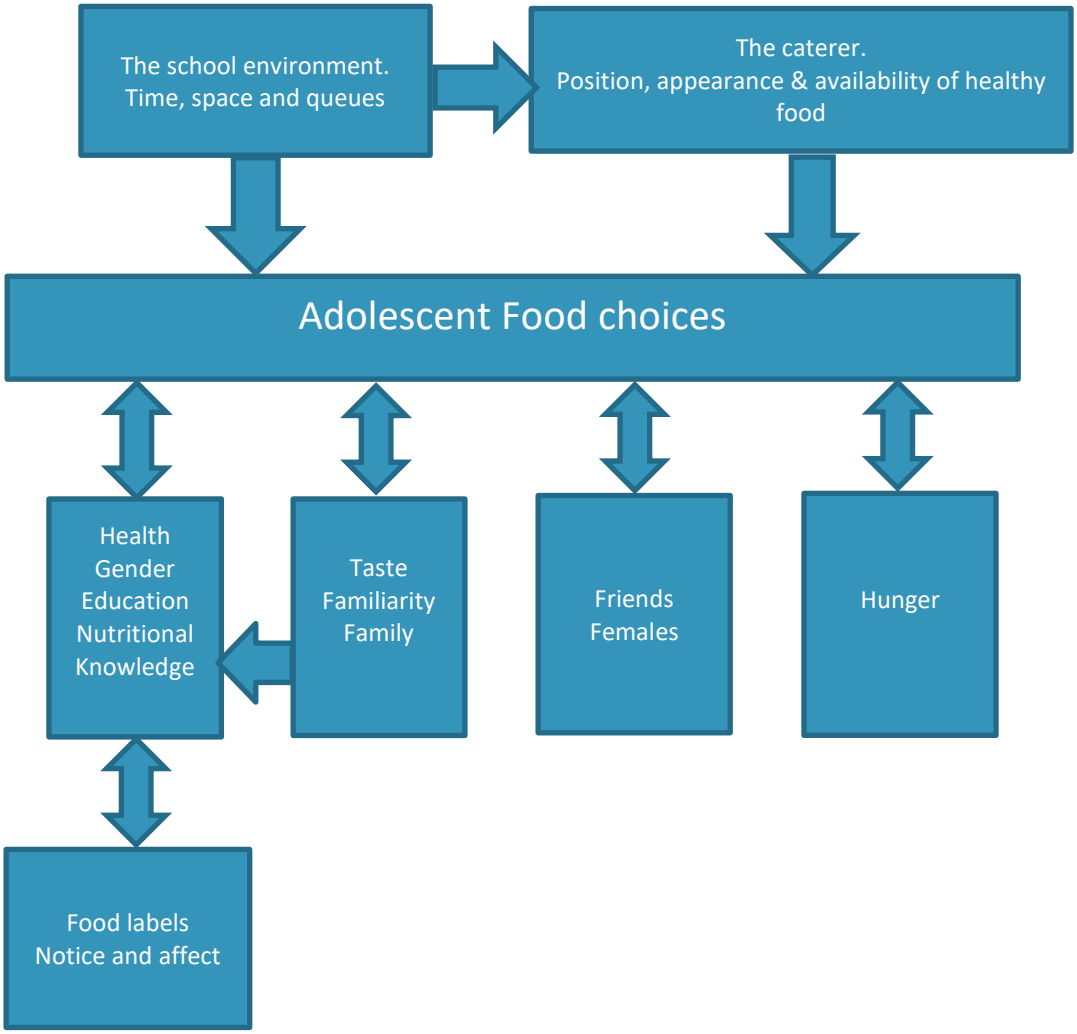


Figure 4 A theoretical framework to identify factors that influence adolescent food choice behaviour at school

In concluding the literature review, the evidence indicated that adolescents in western countries are gaining weight faster than any other generation due to their food choices and lifestyle. Adolescents' physical development is dynamic, and they require nutrient dense foods. Nutrient profiling can provide nutritional information that can be displayed on a FL, which has the potential to guide consumers to healthier food choices. FLs can be nutrient specific, summary score or a graded summary format. Nutrient specific format requires knowledge to be able to apply it to identify healthier food choices. The literature identified that educated females read and use FLs more than the rest of the population and that the use of FLs is related to an interest in health. Studies that have evaluated the influence of calories on a FL are inconclusive as to their effectiveness, in both a school and restaurant setting. The literature suggested that adolescents `use` FLs, but this `use` did not include the nutritional information. The literature also identified that adolescents have good nutritional knowledge, but the questions posed within the studies in which to measure their knowledge contain wide parameters. In England adolescents are taught food technology but these

lessons are time pressured, and it is challenging for them to cover such a vast subject area. With the current health issues of adolescents, policy needs to focus on increasing adolescents' knowledge of health and nutrition.

Studies that identify the factors that influence adolescent food choices imply that taste, appearance, and hunger are the most important factors but many of these studies do not identity taste correctly. Adolescents polarise food into healthy and unhealthy which can act as barriers in food choice behaviour. Unhealthy food is deemed as tasty, satiating, readily available and cheaper than healthy food choices. Despite this polarisation, some studies imply that adolescents do seem to understand what healthy eating is, yet their behaviour is not always in accordance with their knowledge. In the secondary school environment adolescents have greater individual autonomy over their food choices which are not influenced by their parent's views. The effect of peers is inconclusive, but females are more likely to fit in with group eating behaviour than males. The length of the queue and pressurised time at school breaks negatively impact on adolescents' food choices or eating. Food choices at school are generally made via an automatic non-cognitive process rather than through deliberate controlled behaviour. Nevertheless, evidence from the literature suggested that by changes in food choice architecture through the positioning, promotion, and display of food, has the potential to influence adolescents to select healthier food choices.

Chapter 3: Methodology

This chapter presents six steps as outlined in Table 3.1. Step one describes the various theoretical approaches to research and justifies the philosophical direction taken. This research viewed ontology and epistemology from both a positivist and a interpretative approach. It combined the positivism paradigm with a deductive approach that tested the hypotheses with quantitative data analysis. Additionally, it utilised an interpretative paradigm with an inductive approach to interpret the qualitative data to construct knowledge. Fundamentally, this research relied on a pragmatic approach which utilised the strengths of both approaches, whilst they each counteract the weaknesses of the others. The mixed methods research methodology reflects the choices made in the collection, analysis, and integration of both qualitative and quantitative research. The rationale for selecting a quasi-experimental research strategy is outlined.

Step two outlines the stages of the pre-intervention phase. This includes the sampling process, the steps taken to calculate the experimental label (FL) in the form of a nutritional food score and outlines how the food sales were recorded to form the pre-intervention baseline. Step two also identifies how the food score was launched in the awareness phase and provides the rationale for the pre-intervention focus group that seeks to understand the factors that influence adolescents' food choices.

Step three identifies the stages of the post-intervention phase. This includes describing how the food sales for the post-intervention phase one (weeks four, five and six) were recorded and step three will justify the design of the food choice questionnaire.

Step four identifies the stages of the post-intervention phase two. This includes describing how the food sales for the post-intervention phase two (weeks seven, eight and nine) were recorded. Step four will provide the rationale for selecting a further focus group to be able to understand adolescents' thoughts as to the effectiveness of the experimental FL. Step five outlines how both the quantitative and qualitative data will be analysed. Finally, step six will indicate ethical considerations of working with adolescents for this research.

Table 3.1 An overview of the methodological steps taken in this research

STEP ONE	***The philosophical direction of the research***
Purpose:	**To provide a rationale for the philosophical direction of the research**
Objective 1	To justify the use of a pragmatic approach
Objective 2	To explain the use of the inductive and deductive approach
Objective 3	To specify the research design
Objective 4	To identify the research strategy
Objective 5	To validate the mixed methods approach
STEP TWO	***The pre-intervention phases***
Purpose:	**To outline the stages of the pre-intervention phase**
Objective 1	To verify how the schools were selected
Objective 2	To specify how the food score was calculated
Objective 3	To explain how the food sales were recorded
Objective 4	To specify the recruitment process and the aim of the focus group
Objective 5	To describe how the awareness phase was implemented
STEP THREE	***The post-intervention phase one***
Purpose:	**To identify the stages of the post-intervention phase one**
Objective 1	To describe how food sales were recorded for weeks four, five and six
Objective 2	To justify the design of the food choice questionnaire
STEP FOUR	***The post-intervention phase two***
Purpose:	**To identify the stages of the post-intervention phase two**
Objective 1	To describe how food sales were recorded for weeks seven, eight and nine
Objective 2	To explain the reasons for a post intervention focus group
STEP FIVE	***Data analysis***
Purpose:	**To outline how the data will be analysed**
Objective 1	To detail how the quantitative data will be analysed
Objective 2	To clarify how the qualitative data will be analysed
STEP SIX	***Ethical considerations***
Purpose	**To indicate ethical considerations of working with adolescents for this research**
Objective 1	To detail the ethical considerations for this research

3.1 The philosophical direction of the research

As outlined in Table 3.2, the purpose of step one was to provide a rationale for each step of the research which contained five objectives.

Table 3.2 Step One: The philosophical direction of the research with five objectives

STEP ONE	***The philosophical direction of the research***
Purpose:	**To provide a rationale for the philosophical direction of the research**
Objective 1	To justify the use of a pragmatic approach
Objective 2	To explain the use of the inductive and deductive approach
Objective 3	To specify the research design
Objective 4	To identify the research strategy
Objective 5	To validate the mixed methods approach

3.1.1 Step One: The philosophical direction of the research: objective one

Step One, objective one was to justify the use of a pragmatic approach (Table 3.3).

Table 3.3 Step One: The philosophical direction of the research: objective one

STEP ONE	***The philosophical direction of the research***
Purpose:	**To provide a rationale for the philosophical direction of the research**
Objective 1	To justify the use of a pragmatic approach

All research commences with a paradigm, which is how researchers interpret the world and how they connect to the object they are studying. Paradigms are related to individual life experiences, which consequently influence the researcher's beliefs, values, and morals (Rameseook-Munhurrun and Durbarry, 2018). Whisker (2019) proposed that a paradigm ultimately guides the researcher's actions. Therefore, the philosophical orientation influences the research design and the selected methods because they stem from how they believe knowledge is constructed or imparted and how they make sense of that knowledge (Bowling, 2009; Veal, 2018; Whisker, 2019). Ontology signifies how an individual assumes reality and epistemology is how individuals know these are reality (Rameseook-Munhurrun and Durrarry 2018). From this stance, there are two possible approaches - a positivist paradigm and an interpretivist paradigm. The philosophical orientation of the researcher and the way in which the researcher views ontology and epistemology frames the overall research strategy and these in turn influence the way that the evidence is generated, analysed, and evaluated to reach an answer to the research questions or test a hypothesis (Altinay et al., 2016). According to Kumar (2019) the four major philosophical approaches comprise of positivism, interpretivism, critical approaches and post positivism. This research combined both approaches.

3.1.1.1 Positivism and Interpretivism

A positivist paradigm proposes that laws, facts, and science are reality and therefore there is a single objective truth. Reality obtained from quantifiable data gained from evidence through experiments, statistical facts, laws, or truth indicates that the knowledge that is constructed is objective. Through positivism researchers strive to identify what factors, if any, affect any results. They seek to identify a cause and effect and to be able to measure the magnitude of the effect as they look for patterns and causality (Mason, 2010). Positivism is objective, factual and can formulate a hypothesis from which to test the facts using large-scale empirical evidence, and ideally, there is a degree of control to allow for replication (Brunt et al., 2018). This philosophy assumes that the research phenomenon can produce results that must be measurable and is therefore associated with deduction and quantitative research (Business Research Methodology, ND). In positivism the researcher is independent neutral, distanced, and unbiased from the data collected (Altinay et al., 2016). Using a positivist approach alone would be most likely to be from realist ontology and an objective epistemology, so the worldview comes from facts and the generated knowledge is impartial. An opposing approach to the positivist method is an interpretive approach.

Ontology from an interpretive perspective of the paradigm could suggest that there are several subjective truths, and that different people may see reality from different perspectives and therefore reality is construed individually (Wisker, 2009; Mason, 2010). The researcher can seek to gain knowledge through interacting and engaging with the participants to reveal their attitudes, behavioural traits, and opinions (Mason, 2010). Positivism and phenomenology remain viewed as opposed to each other as they centre on different perspectives of the social world and as such utilise different research methods (Bowling, 2009). Interpretivism (also referred to as constructivism, naturalism, and humanism) relies on people's views, perceptions, feelings and focuses on how people construe meanings, and therefore uncovers social meaning. As such, it is subjective in its approach. It seeks to understand individual interpretation of what reality is, and yet human interpretations becomes shaped by individuals' culture, background and life experiences resulting in extensive individual interpretations of what is reality (Brunt et al., 2018). Phenomenology refers to data that comes from words or from observation and the interpretation of the words and/or observational data is personal to the individual. Researchers become part of the observation and find themselves immersed in the research itself (Wisker, 2019). Phenomenology is socially constructed, and human interest drives the science, it uses small sample sizes but seeks to find a greater depth of the phenomenon. The knowledge found is fluid and continuous and answers the research question as ideas developed through an inductive process (Business Research Methodology, 2019).

The benefits of using the interpretivist approach are that as participants have varied life experiences, that can provide extensive rich data. This data continually evolves, and therefore knowledge continues to develop as the research progresses. There are however some limitations to the interpretivist approach because it is subjective, therefore replication of the results can be limited. As an interpretivist, the researcher will have a relativist ontology and a subjective epistemology and as such, the phenomena studied influence other phenomena that are connected though subjectivity.

3.1.1.2 Post-Positivism

Post-positivism is considered a standalone paradigm and is not considered as a mixture of positivism and interpretivism. It is a paradigm which favours the positivist approach yet, allows a researcher to articulate their beliefs (Gershan, 2017; Brunt et al., 2018). It emphasises a deductive logical approach, therefor there is a hypothesis, and the data are from experiments and surveys, but the research can still include observed human behaviour (IGI Global, ND). This paradigm allows for explanations and can make predictions, and yet favours the positivist approach due to maintaining control over the research (Brunt et al., 2018). The author considered this method for this research, as the basis is to prove a hypothesis, but this research requires qualitative and quantitative in equal parts and therefore required a more pragmatic approach.

3.1.1.3 Pragmatism

This research used a pragmatic approach. Pragmatism is seen as less ridged than either the positivism or interpretive approaches alone and is sometimes referred to as the `peace paradigm` (Glogowska, 2011). Pragmatism can select positivism and interpretivism, and unlike post-positivism does not favour one approach more than the other. Pragmatism focuses on expanding the understanding of the research problem and is fundamentally a practical approach to answering the research questions in the real world that underpins the mixed methods approach (Creswell, 2013; Darracott, 2016; Rameseook-Munhurrun and Durbrarry, 2018). This combination of methods complements the strengths and overlapping weaknesses of using either single method on its own and the author can select the appropriate quantity of either qualitative or quantitative methodology in their research.

This pragmatic thesis consists of two distinctive sections but the findings from each section will be analysed in conjunction with each other. Using the positivist approach this research aimed to evaluate if an experimental FL in the design of a nutritional food score could influence adolescent eating behaviour to select healthier food choices. It also wanted to evaluate what factors adolescents' rank as important in their food choice behaviour. However, if the research only selected a positivist approach it could prove or disprove the outcome of the food score statistically but, it

could not measure human thoughts, feelings and subjective motives and therefore could not understand the reasons for the success or failure of the food score. It could also provide evidence as to which factors adolescents' rank as the most important in their food choice behaviour, but it could not substantiate why they selected these factors or how they interpret these factors.

3.1.2 Step One: The philosophical direction of the research: objective two

Step One, objective two was to explain the use of the inductive and deductive approach (Table 3.4).

Table 3.4 Step One: The philosophical direction of the research: objective two

STEP ONE	***The philosophical direction of the research***
Purpose:	**To provide a rationale for the philosophical direction of the research**
Objective 2	To explain the use of the inductive and deductive approach

3.1.2.1 Deductive and Inductive approaches

The aim of research is to test a theory and/or answer a single or multiple research questions. This research has established its paradigm and identified the ontological and epistemological perspectives and considered the philosophical approaches. It will now consider a few methodologies that include the dichotomy of choosing a deductive or inductive approach and selecting a qualitative or quantitative method as a basis for data collection (Brunt et al., 2018).

A deductive approach develops one or more hypotheses which must be tested through verifiable evidence. This leads to an acceptance or rejection of the hypothesis allowing for modification of the theory first made (Altinay et al., 2016; Bradford, 2017). This study has four hypotheses as detailed in 1.10.2.

An inductive approach seeks to identify a pattern from observations and develops explanations to generate a theory. This approach creates learning from experience and as such is free to modify the direction of the study to reach a conclusion (Gabriel 2013, Business Research Methodology, ND). Looking at ontology from an interpretivist approach this study provided data in the form of words, that emphasised adolescents' reasons for, and views on, their food choices and their thoughts on the food score. The pre-intervention (Appendix M1) and post-intervention focus group questionnaire guides (Appendix M2) were designed to get an insight into their thoughts. Through using the phenomenological philosophy, an inductive and qualitative research approach this research sought to understand adolescent behaviour that takes place when adolescents select their food choices in a school setting.

3.1.3 Step One: The philosophical direction of the research: objective three

Step One, objective three was to specify the research design (Table 3.5).

Table 3.5 Step One: The philosophical direction of the research: objective three

STEP ONE	***The philosophical direction of the research***
Purpose:	**To provide a rationale for the philosophical direction of the research**
Objective 3	To specify the research design

3.1.3.1 Research design

The research design should reflect the purpose of the study and research can often have more than one purpose (Babbie, ND). Kumar (2019) stated that research design is a procedural plan used by the researcher to answer the research questions objectively and accurately. Kumar (2019) implied that when looking at research the researcher must look at it from the perspectives of its objectives which are classified as descriptive, correlational, explanatory, or exploratory. Descriptive research has no control over any of the variables. It attempts to describe and identify various aspects of the phenomenon and to validate its findings, and is associated with observational studies, case studies and surveys (Business Research Methodology, ND). Exploratory research is defined as an initial study into a hypothetical or theoretical idea which has not been widely studied. Correlational research determines or establishes if there is a relationship between two or more variables (Kumar, 2019).

Explanatory research is conducted when the researcher seeks to connect ideas and to understand or identify the reasons and causes for any change. The advantages of explanatory research design are that they can assess the impact of change on existing norms and may offer opportunities to replicate the study. The limitation of explanatory research design is that any perceived changes in outcomes in a cause-and-effect study may be due to coincidence, and if there are multiple variables it may be difficult to ascertain which of the factors had the greatest influence on any change in outcome, therefore causality cannot always be inferred due to this limitation (Business Research Methodology, ND). Exploratory research lays the groundwork which can lead to future studies or conclude that the phenomenon being observed can be clarified through an existing theory or concept.

The objectives of this research are exploratory. It describes (descriptive) the current obesity crisis and the effectiveness of the food score on food choices. It establishes if there is a correlation (correlational) between the food score and a change in food choice behavior. It goes on to explain why (explanatory) the food score was or was not effective in changing food choice behavior and why.

3.1.4 Step One: The philosophical direction of the research: objective four

Step One, objective four was to identify the research strategy (Table 3.6).

Table 3.6 Step One: The philosophical direction of the research: objective four

STEP ONE	***The philosophical direction of the research***
Purpose:	**To provide a rationale for the philosophical direction of the research**
Objective 4	To identify the research strategy

3.1.4.1 Research strategy

A research strategy logically integrates all the components of the research process to address the research problem. A strategy, is an overarching plan that indicates how to collect, measure, and analyse the data and provides a framework, which directs the research in a systematic way (de Vaus, 2001). Some strategies have greater alignment to the inductive approach that aims to generate a new theory that emerges from the data, alternatively, other strategies align more to the deductive approach that aims to test a theory (Altinay et al., 2016). Whichever choice of strategy is selected it must be able to achieve the objectives of the study.

The study design that was selected for the quantitative research was an experimental design. In an experimental design the researchers implement the intervention which is thought to cause `change` (Kumar, 2019). This experimental design address's objective three. Objective three was to `apply this experimental FL to food served at four secondary schools in Greater London to evaluate if this label guides adolescents to healthier food choices`. An experiment is a scientific research strategy (Veal, 2018). For the results of the thesis to be objective and valid there must be meticulous planning of the experiment (see Step Two for full details). The independent variable (time) was measured at three points, to measure any effect on the dependant variable (food score), (Field, 2009). Food sales of specific food items with the numerical food score were measured pre the application of the experimental food score to provide the pre-intervention baseline sales over three weeks. The same food on offer then displayed the food score to enable the researcher to measure if there was a change in food sales and consequently a change in the food score. The food score is the tool that generated numerical data of the food sales. If the mean score of food sales increases the food score will be a success in changing food choice behaviour. If the mean score stays the same or decreases, there is no effect on food choice behaviour. This study aims to apply a food score to test the alternative hypothesis: `an experimental food label applied to food served in secondary schools in Greater London will influence adolescents to select healthier food choices`.

Bryman (2012) stated that an experimental design is of superior standing due to the strength of the causal findings and the strength of internal validity. A true experiment must contain one or more control groups and randomly assign the participants to the control or the experimental groups. This study could not practically randomly assign participants to groups as it is not physically possible. The design of this study was an experimental study in a natural environment (the school) where groups of participants are the same both before and after the implementation of the experiment with no control group. According to Kowalczyk (ND) an experiment without a control group is termed a quasi- experiment because there is no randomly assigned group. The results are not expected to be comparable between schools as each school had slightly different food choices and have unaccountable variables such as teacher training days and celebratory days for example Halloween. To reduce this limitation this research measured the mean food score both pre-intervention and post-intervention and removed data that could have impacted on the results, such as sales from half a day's training when only the staff consumed lunch. This research explored the effect of an intervention on a specific population and used a Pre-test/Post-test design. Salkind (2010) defines a Pre-test/Post-test design as a measure established as a baseline that is before any intervention takes place, followed by a measure after the intervention has occurred. This strategy produced numerical data that proved or disproved the hypothesis and utilised a quantitative approach. However, as this thesis wanted to find the reasons for the success or failure of the food score label and adolescent attitudes regarding eating behaviour the research employed both quantitative and qualitative approaches.

3.1.5 Step One: The philosophical direction of the research: objective five

Step One, objective five was to validate the mixed methods approach (Table 3.7).

Table 3.7 Step One: The philosophical direction of the research: objective five

STEP ONE	***The philosophical direction of the research***
Purpose:	**To provide a rationale for the philosophical direction of the research**
Objective 5	To validate the mixed methods approach

3.1.5.1 Quantitative and qualitative research approach

There are three approaches to research, namely quantitative, qualitative, and mixed methods research. Quantitative and qualitative approaches represent different ends of the scale (Creswell and Creswell, 2018; Whisker, 2019). Generally, research tends to lean more to one continuum than the other, but mixed methods traverse the divide (O`Leary, 2017).

The quantitative approach

Quantitative research is the most utilised approach for sciences, social science, and humanities (Fox et al., 2018). This approach is best suited to test objective theories through investigating relationships between variables. These are then measured, and statistically analysed, that enables the researcher to either accept or reject the hypotheses (Creswell and Creswell, 2018). Most quantitative research is sequential in nature and has a planned approach (Veal, 2018). Kumar (2019) suggested that quantitative research is classified into three groups, cross sectional studies, before and after studies (also referred to Pre-test/Post-test design) and longitudinal studies. This research used the Pre-test/Post-test design that collected sets of data on the same population to explore if there was a change in the variables between the points in time. The research also implemented a questionnaire survey (detailed in 3.3.2.1) which Veal (2018) defined as a process of designing and conducting a study that incudes gathering information from several subjects. The survey presented in this thesis consisted of a questionnaire which was a structured list of questions designed to collect data on the importance adolescents placed on factors affecting their food choices. Ramseook-Munhurrun and Durbarry (2018) indicated, that it is important how the data from surveys is collected and what statistics are applied as this can influence how the phenomena is explained.

The qualitative approach

Qualitative methods rely on words, images, and sound as units to analyse, and therefore have no numerical meaning. Researchers seek to answer the research questions and construct reality through their understanding (Crossman, 2018). This form of research focuses on people's perceptions and behaviour and as such is descriptive rather than predictive. The researcher can probe to uncover more rich data from participants that goes further than their initial reply and their body language and voice intonation can be a valuable addition alongside their spoken word (Qualitative Research Consultants Association, 2018). Although qualitative research can use a range of methods; in-depth interviews, focus groups, biographical methods, ethnographic approaches, participant observations and analysis of text this research used focus groups. Qualitative research tends to be recursive in its approach unlike the sequential approach that quantitative research typically follows. This research used qualitative methods to collect detailed deep and rich information from a small number of participants that allowed the researcher to be fully involved in the situation so that it could be described in detail (Veal, 2018).

There are several advantages of using qualitative data. The researcher can focus on subtleties within the information which allows more opportunities to glean insights; therefore, material develops, and this can be evaluated in detail. As information is gathered, the process can change direction and

become fluid as important clues appear throughout, rather than conforming to pre-set questions. This allows the researcher to use their instinct and to open different routes of investigation. Individual experiences are unique, and this can generate different perspectives, thus producing deep, rich, and diverse information. It is particularly important to note that emotional responses often drive people's decisions, and this influences their behaviour (Vittana, 2017). However, according to Ramseook-Munhurrun and Durbarry (2018), who cites Tashakkori and Teddlie (1998) using either purely quantitative or qualitative as a single method can compromise the research as it weakens the connection between the paradigm and the method and by using both methods together produce a more robust thesis.

The mixed methods approach

Mixed methods research allows for integrating both quantitative and qualitative data which can provide a better understanding of the phenomenon than either method can produce alone. This approach is most suited when the results from one of the methods corroborate with those of the other method (Fetters and Molina-Azorin, 2021). Through quantitative measures, this study aimed to measure the effect of the nutritional food score on food choice (measuring the food score sales pre and post the intervention). Additionally, this study measured which factors adolescents' rank as the most important in their food choices at school. However, through qualitative themes that can be drawn from the focus groups, the study can probe to uncover adolescent attitudes towards both the food score to understand why the food score is either successful or not and to uncover why adolescents rank these factors the way they do.

Johnson and Onwuegbuzie (2004: 17), cited by Cameron (2009: 141), summarise the philosophical position of mixed methods as offering:
`an immediate and useful middle position philosophically and methodologically; it offers a practical and out-come orientated method of inquiry that is based on action and leads, iteratively, to further action and the elimination of doubt; and it offers a method for selecting methodological mixes that can help researchers better answer many of their research questions.`

3.2 The pre-intervention phases

As outlined in Table 3.8, the purpose of step two was to outline the stages of the pre-intervention phase which contained five objectives.

Table 3.8 Step Two: The pre-intervention phase with five objectives

STEP TWO	***The pre-intervention phases***
Purpose:	**To outline the stages of the pre-intervention phase**
Objective 1	To verify how the schools were selected
Objective 2	To specify how the food score was calculated
Objective 3	To explain how the food sales were recorded
Objective 4	To specify the recruitment process and the aim of the focus group
Objective 5	To describe how the awareness phase was implemented

3.2.1 Step Two: The pre-intervention phase: objective one

Step Two, objective one was to verify how the schools were selected (Table 3.9).

Table 3.9 Step Two: The pre-intervention phase: objective one

STEP TWO	***The pre-intervention phases***
Purpose:	**To outline the stages of the pre-intervention phase**
Objective 1	To verify how the schools were selected

The choice of sample develops from the research design and the selected methods, but most importantly sampling must be meticulously planned. The sample provides the basis of the findings of the research and therefore generates the conclusion; consequently, the research is only as good as the originated sample (Altinay et al., 2016). The selected target population must align to the subject of the thesis and the evidence produced from the general population must be able to meet the aim of the study (Laerd Research, 2012). Sampling is a progressive selection of individuals, selected from a total population that represent a subset or part of a total population to be studied However, the key condition of the sample is that it is unbiased by either over or under representation of the subset of the population (David and Sutton, 2011). There are two classifications of sampling techniques; namely probability sampling and non-probability sampling, and each of these techniques have subdivisions. The technique used depends upon the nature of the research problem, the availability of a sample frame, financial implications, the preferred level of accuracy and the method by which the data were collected (De Vaus, 2002).

The target population for this research was adolescents. This is because there is a lack of previous research on this population group's food choices at school. The characteristics were adolescents in English state secondary schools. The term `state` schools include community schools, foundation schools, and grammar schools controlled by the local government or academies run by a governing body (GOV.UK, ND). The term secondary school (also referred to as a high school in some countries)

educates students between the ages of 12 and 16, students can go onto sixth form from the ages of 16 and 18 years old (Internations, 2020). The exclusion criteria consisted of special educational needs secondary schools because an individual's food choices may include additional factors. The geographical area was identified as the boroughs in London (*n=33*) as they are accessible to the researcher.

The four poorest boroughs were initially selected (Ealing, Brent, Newham and Barking and Dagenham) (London`s Poverty Profile, 2018). The link between poverty and childhood obesity is well documented (Webb et al., 2006; Gosis et al., 2016; Cohen, 2018) therefore, if the food score proved successful in changing adolescent food choice behaviour this would be an important finding for public health policies (Gosis et al., 2016). The four boroughs' councils web sites were analysed to establish who operated the school catering provision. This sampling was non-probability typical case purposeful sampling as the selection is made with a purpose in mind and can be based on a demographic background (Fox et al., 2018).

The researcher contacted the caterers to ascertain if they were interested in the study. The caterers from Newham showed an interest in the research. The borough of Newham has one company that provides school food to all state schools in the borough. The borough of Ealing comprises of an Ealing Schools Catering Consortium who are contracted by Ealing Education contract services (Ealing Grid for Learning, 2020). The Ealing Schools Catering Consortium comprises of eight catering companies. One of the caterers is an industry partner for the University of West London (icharm, 2020) who agreed to take part in the study. Brent, and Barking and Dagenham did not respond.

The catering contractors were asked to select the schools where the intervention would take place based on the following criteria:

1. The school had a cashless payment system, to record sales, which will minimise additional operational work for the caterer,
2. The school was a mixed gender school as the thesis sought to identify gender differences in food choices,
3. The client (who is the contact between the school and the caterer) has agreed to the study.

The contract caterers from both boroughs each suggested four schools that met the criteria. The researcher approached the clients at the suggested schools and presented the aim of the study. Each school was given a time plan as to when each stage of the experiment would take place (Appendix N). Term three (Easter to July) was not included in this research due to the number of pupils who would not be at school due to exam revision or were on work experience and therefore not using the restaurant. If the study was measuring food sales pre the intervention before Easter and comparing food sales after Easter, the numbers of pupils partaking of school food would not be

comparable.

The caterer for Ealing only supplied school meals to primary schools in Ealing but suggested four other schools in Greater London. The final schools' locations from both caterers were confirmed as: -

Reading (Berkshire), Ofsted: Good, number of pupils 1135, 9.8% eligible for free school meals,

Maida Vale (Westminster), Ofsted: Outstanding, number of pupils 1063, 22.3% eligible for free school meals,

Bromley (Kent), Ofsted: Outstanding, number of pupils 1602, 5.4% eligible for free school meals,

Ilford (Newham), Ofsted: Outstanding, number of pupils 1444, 26.5% eligible for free school meals (GOV. UK, 2021).

3.2.2 Step Two: The pre-intervention phase: objective two

Step Two, objective two was to specify how the food score was calculated (Table 3.10).

Table 3.10 Step Two: The pre-intervention phase: objective two

STEP TWO	***The pre-intervention phases***
Purpose:	**To outline the stages of the pre-intervention phase**
Objective 2	To specify how the food score was calculated

This research aimed to identify if an experimental FL in the form of a nutritional food score had the potential to guide adolescents to select healthier food choices in four secondary schools in Greater London. Figure 5 indicates the steps taken to produce the food score.

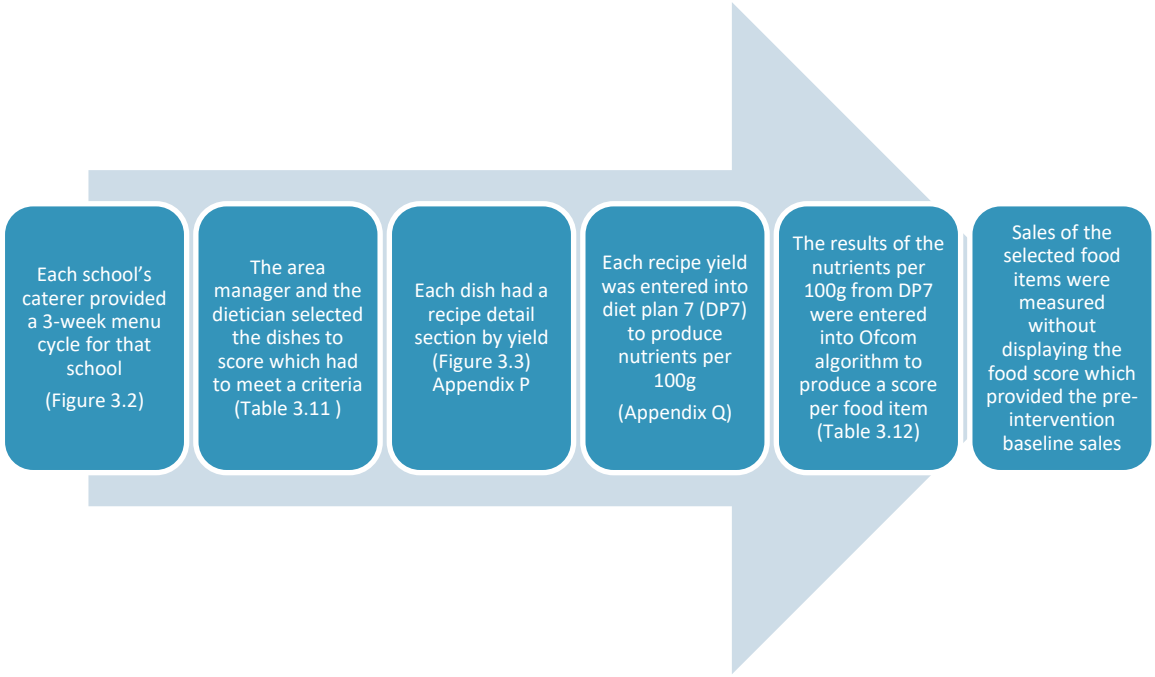


Figure 5 A Flow Diagram Indicating the Food Score Process

The research aimed to measure if the food score was effective at changing food choice behaviour. The study compared the average means of the food score from pre-intervention baseline, which took place in weeks one, two and three and at post-intervention phase one which were recorded in weeks four, five and six and post-intervention phase two recorded in weeks seven, eight and nine. If the mean food score increased in the post-intervention phase one or post-intervention phase two the food score was successful in changing adolescent food choices to healthier options. If the mean score decreased or remained unchanged in the post-intervention phases, the food score was not deemed successful in changing adolescent food choices. From this point in this research the nine weeks will be referred to as pre-intervention baseline, post-intervention phase one and post-intervention phase two.

Nutritional breakdown

The area managers from the contract caterers provided the three-week autumn menu cycle for each school (the school selection is outlined in section 3.2.1). School One week one menu is shown in Figure 6. Other school's menus are in Appendix O.

Due to the limited space in the schools' restaurants not all food items could display a food score. The selected food items had to meet the following criteria:

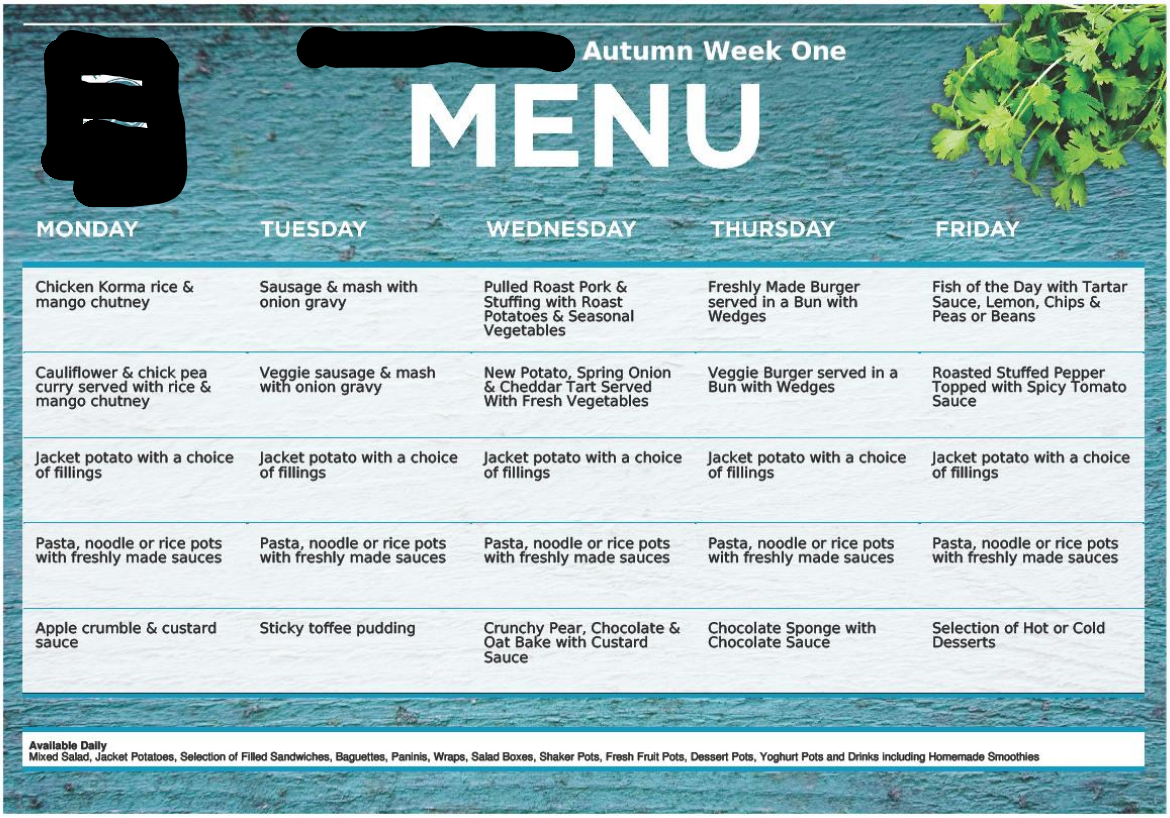
1. The food item was in the top 20 highest sales from the previous menu cycle to reflect current eating behaviour,

2. The food item had to be pre-coded into the till,
3. The selected food items were as similar as is possible across schools,
4. The selected food items were agreed with the area manager and dietician.

The final food items that were selected are indicted in Table 3.11

Table 3.11 Step two: Indicates the foods that were selected

School One 16 foods	School Two 16 foods	School Three 14 foods	School Four 12 foods
Main meal 1	Main meal 1	Main meal 1	Main meal 1
Main meal 2	Main meal 2		Main meal 2
Pizza	Pizza	Pizza	Pizza
Cakes	Cakes	Cakes	Cakes
Sandwich simple range	Sandwich simple range	Sandwich simple range	Sandwich simple range
Jacket potato	Jacket potato	Jacket potato	
Sandwich mid-range	Sandwich mid-range	Sandwich mid-range	
Pasta	Pasta	Pasta	
Fruit	Fruit	Fruit	
Vegetarian pizza	Vegetarian pizza		
Pastries	Pastries	Pastries	
Panini	Panini	Panini	
Pastry sausage roll	Pastry sausage roll	Pastry sausage roll	
Sausage in a roll		Pitta pizza	
Popcorn		Cookies	
Burrito			
	Wraps		Wraps
	Patties		
	Doughnuts		
		Nachos	
			Lite bite menu option
			Deli rolls
			Burgers
			Salad
			Cheese and crackers



[redacted] Autumn Week One

MENU

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Chicken Korma rice & mango chutney	Sausage & mash with onion gravy	Pulled Roast Pork & Stuffing with Roast Potatoes & Seasonal Vegetables	Freshly Made Burger served in a Bun with Wedges	Fish of the Day with Tartar Sauce, Lemon, Chips & Peas or Beans
Cauliflower & chick pea curry served with rice & mango chutney	Veggie sausage & mash with onion gravy	New Potato, Spring Onion & Cheddar Tart Served With Fresh Vegetables	Veggie Burger served in a Bun with Wedges	Roasted Stuffed Pepper Topped with Spicy Tomato Sauce
Jacket potato with a choice of fillings	Jacket potato with a choice of fillings	Jacket potato with a choice of fillings	Jacket potato with a choice of fillings	Jacket potato with a choice of fillings
Pasta, noodle or rice pots with freshly made sauces	Pasta, noodle or rice pots with freshly made sauces	Pasta, noodle or rice pots with freshly made sauces	Pasta, noodle or rice pots with freshly made sauces	Pasta, noodle or rice pots with freshly made sauces
Apple crumble & custard sauce	Sticky toffee pudding	Crunchy Pear, Chocolate & Oat Bake with Custard Sauce	Chocolate Sponge with Chocolate Sauce	Selection of Hot or Cold Desserts

Available Daily
Mixed Salad, Jacket Potatoes, Selection of Filled Sandwiches, Baguettes, Paninis, Wraps, Salad Boxes, Shaker Pots, Fresh Fruit Pots, Dessert Pots, Yoghurt Pots and Drinks including Homemade Smoothies

Figure 6 Autumn menu week one School One

The contract caterers' dieticians provided a standardised recipe from their nutrition database for each dish on each three-week menu. An example of one recipe is shown in Figure 7. A range of other standardised recipes are presented in Appendix P1. The contract caterers provided a list of their suppliers. The suppliers were contacted for the nutritional specification of any of their products for any pre-made food item that was not made in the kitchen but could be consumed as part of the meal. Examples are vegetable burgers, bread rolls, popcorn, breakfast pastries and other premade foods (Appendix P2).

[redacted]

11-Oct-2017 16:50 fd h

Recipe Detail Section By Yield HC_JGRAD1

R09610 **UWL Roasted Vegetable lasagne with herb bread**

Ingredients

Description	8 Ptn
Peppers Mixed	320g
Onions Red	150g
Puree Garlic	10g
Mushrooms Cup	200g
Carrots	200g
Margarine	125g
Flour Plain	100g
Milk Semi Skimmed	750ml
Salt Table	5g
Pepper Black Ground	5g
Dried Herbs Mixed	2g
Cheese Cheddar Mature	150g
Tinned Tomato Paste	50g
Pasta Lasagne	220g
Oil Vegetable	75ml
*Herb Bread	8ptn

** Recipe information displayed on separate page.*

Recipe Tags

Nutrition

Standard Size: Ptn		
Nutrient	**Per Portion**	**Per 100g**
Energy (kJ)	>31.03 kJ	>9.63 kJ
Energy (kcal)	>567.58 kcal	>176.12 kcal
Fat	31.06 g	9.64 g
Satd FA /100g fd	>9.47 g	>2.94 g
Carbohydrate	>56.29 g	>17.47 g
Non Milk Extrinsic Sugar	(0.21) g	(0.07) g
NSP (Fibre)	>4.43 g	>1.37 g
Protein	18.27 g	5.67 g
Iron	2.46 mg	0.76 mg
Zinc	(2.33) mg	(0.72) mg
Calcium	(534.95) mg	(166.00) mg
Vitamin A	(869.94) µg	(269.95) µg
Vitamin C	52.30 mg	16.23 mg
Folate	>60.39 µg	>18.74 µg
Sodium	654.92 mg	203.23 mg
Salt	1.64 g	0.51 g
Total sugars	>9.77 g	>3.03 g

DetRecSectionY: Recipe Detail Section By Yield Page 1 of 3

Figure 7 Example of a Recipe Breakdown for Each

This research relied upon the contract catering staff to display and change the food score label. To minimise additional work certain food items displayed a mean score that did not need to be changed daily. For example, pasta pots had five different fillings over the week (e.g., pasta with tomato sauce, pasta with tuna and sweetcorn), the same with jacket potatoes, (e.g., jacket potato with beans and jacket potato with cheese). The other dishes that displayed a mean score were cakes, cookies, fruit, and salad. Each recipe for each dish was calculated, and a mean score from the recipes was calculated. This mean score was constantly displayed all week for these food items.

The sandwiches in Schools One, Two and Three were divided into two categories: a mid-range (e.g., ham and salad) and a simple range (e.g., cheese and pickle). Each sandwich type was analysed though the same process as the pasta pots and jacket potatoes and a mean score was calculated for each range. In School Four the lite bite food option changed every day, so a mean figure was calculated and displayed for these food choices.

Each recipe was input into Diet Plan 7 software (DP7) which produced a breakdown of nutrients per 100 grams (a range of these recipe DP7 breakdown are in Appendix Q). DP7 is a nutrition software package for dietitians and nutritionists (foresoft.com, 2021). The calculated figures per 100g from DP7 were input into the Ofcom algorithm (An example is in Table 3.12). The calculation of fruits nuts and seeds followed the Ofcom guidance an example is in Appendix D. Once these figures were entered in the algorithm this generated a food score from one to 100. The higher the score the more nutrient dense the food item, which is categorised as healthier.

To ensure standardisation across all four schools the dietician or the area manager from both contract caterers checked and confirmed each stage of the analysis. An example of this standardisation procedure was the agreement between the dietitians to calculate the main dish including the accompaniment, for example, the chicken korma dish included rice and mango chutney, so all accompaniments were included in the analyses across all menu items. The Ofcom Algorithm computing the food score classified a food item to be unhealthy at number 64 and below.

Table 3.12 Ofcom Algorithm Computing the Food Score

Product Name	Food/Drink	F&V content (%)	F&V WXYfm	Energy (kJ per 100g)	Energy WXYfm	Protein (g/100g)	Protein WXYfm	Total sugars (g/100g)	Total sugars WXYfm	Saturated Fat (g/100g)	Sats WXYfm
Formula -			0		0		0		0		0
chicken balti	Food	0	0	527.5606	1	6.72	4	1.05	0	0.74	0
veg balti	Food	0.7	2	244.7222	0	1.95	1	1.44	0	0.24	0
beef lasagne	Food	0	0	439.19	1	7.54	4	2.2	0	1.86	1
veg lasagne	Food	0	0	538	1	4.8	2	3.3	0	2.8	2
roast chicken	Food	0	0	609.8598	1	10.2	5	0.38	0	1.49	1
pea risotto	Food	0.5	1	569	1	2.7	1	0.73	0	1.24	1
thai noodle	Food	0.5	1	639	1	9.32	5	2.39	0	0.65	0
veg noodle	Food	0.7	2	224	0	4.07	2	4.24	0	0.44	0
ratatouille	Food	0.7	2	540	1	3.64	2	1.74	0	2.05	2

Fibre (g/100g)	Fibre WXYfm	Sodium (g/100g)	Sodium WXYfm	WXYfm A score	WXYfm C score	WXYfm score	1-00 score	WXYfm cat
	0		0	0	0	0	70	Healthier
0.23	0	0.12409	1	2	4	-2	74	Healthier
0.73	1	0.12194	1	1	4	-3	76	Healthier
0.75	1	0.0885	0	2	5	-3	76	Healthier
1.0	1	0.19	2	5	3	2	66	Healthier
0.94	1	0.059	0	2	6	-4	78	Healthier
0.9	1	0.13282	1	3	3	0	70	Healthier
1.67	2	0.7817	8	9	8	1	68	Healthier
2.35	3	0.44	4	4	7	-3	76	Healthier
1.68	2	0.17824	1	4	6	-2	74	Healthier

3.2.3 Step Two: The pre-intervention phase: objective three

Step Two, objective three was to explain how the food sales were recorded (Table 3.13).

Table 3.13 Step Two: The pre-intervention phase: objective three

STEP TWO	***The pre-intervention phases***
Purpose:	**To outline the stages of the pre-intervention phase**
Objective 3	To explain how the food sales were recorded

During the pre-intervention phase, each school recorded daily sales of the selected food items that had been allocated a food score. The score was not displayed during this three-week period. The daily sales were collated by the caterer and emailed to the researcher on a weekly basis (Appendix R). The daily sales from the caterer were transferred from each school into Excel. An example of one weeks recorded sales in Excel for School One for menu cycle number two is shown in Table 3.14. An example of a daily total is shown in Table 3.15. An example of a record of daily totals that formed the pre-intervention baseline sales data is shown in Table 3.16.

Table 3.14 One week's baseline sales record for School One

School	***Week No***	***Day***	***Dish***	***Food Score***	***Sales***	***Total score***
School 1	2nd Oct	Monday	Cakes	42	205	8610
School 1	2	Monday	Breakfast pastry	34	20	680
School 1	2	Monday	Panini	48	82	3936
School 1	2	Monday	Veggie pizza	78	44	3432
School 1	2	Monday	Pizza	64	62	3968
School 1	2	Monday	Sausage in a roll	48	25	1200
School 1	2	Monday	Pastry sausage roll	36	31	1116
School 1	2	Monday	Burrito	60	13	780
School 1	2	Monday	Popcorn	70	67	4690
School 1	2	Monday	Chicken Balti	74	85	6290
School 1	2	Monday	Vegetable Balti	76	1	76
School 1	2	Monday	Jacket potato	74	20	1480
School 1	2	Monday	Pasta pot	75	51	3825
School 1	2	Monday	Fruit	76	34	2584
School 1	2	Monday	Sandwich simple	52	23	1196
School 1	2	Monday	Sandwich mid-range	72	60	4320
School 1	3rd Oct	Tuesday	Cakes	42	204	8568
School 1	2	Tuesday	Breakfast pastry	34	19	646
School 1	2	Tuesday	Panini	48	74	3552
School 1	2	Tuesday	Veggie pizza	78	50	3900

School 1	2	Tuesday	Pizza	64	58	3712
School 1	2	Tuesday	Sausage in a roll	48	30	1440
School 1	2	Tuesday	Pastry sausage roll	36	27	972
School 1	2	Tuesday	Burrito	60	13	780
School 1	2	Tuesday	Popcorn	70	63	4410
School 1	2	Tuesday	Beef lasagne	76	87	6612
School 1	2	Tuesday	Vegetable lasagne	66	0	0
School 1	2	Tuesday	Jacket potato	74	10	740
School 1	2	Tuesday	Pasta pot	75	32	2400
School 1	2	Tuesday	Fruit	76	28	2128
School 1	2	Tuesday	Sandwich simple	52	27	1404
School 1	2	Tuesday	Sandwich mid-range	73	49	3577
School 1	4th Oct	Wednesday	Cakes	42	202	8484
School 1	2	Wednesday	Breakfast pastry	34	18	612
School 1	2	Wednesday	Panini	48	72	3456
School 1	2	Wednesday	Veggie pizza	78	44	3432
School 1	2	Wednesday	Pizza	64	65	4160
School 1	2	Wednesday	Sausage in a roll	48	30	1440
School 1	2	Wednesday	Pastry sausage roll	36	29	1044
School 1	2	Wednesday	Burrito	60	14	840
School 1	2	Wednesday	Popcorn	70	60	4200
School 1	2	Wednesday	Roast Chicken	78	81	6318
School 1	2	Wednesday	Pea risotto	70	1	70
School 1	2	Wednesday	Jacket potato	74	15	1110
School 1	2	Wednesday	Pasta pot	75	38	2850
School 1	2	Wednesday	Fruit	76	29	2204
School 1	2	Wednesday	Sandwich simple	52	26	1352
School 1	2	Wednesday	Sandwich mid-range	73	65	4745
School 1	5th Oct	Thursday	Cakes	42	183	7686
School 1	2	Thursday	Breakfast pastry	34	19	646
School 1	2	Thursday	Panini	48	81	3888
School 1	2	Thursday	Veggie pizza	78	49	3822
School 1	2	Thursday	Pizza	64	52	3328
School 1	2	Thursday	Sausage in a roll	48	31	1488
School 1	2	Thursday	Pastry sausage roll	36	26	936
School 1	2	Thursday	Burrito	60	11	660
School 1	2	Thursday	Popcorn	70	50	3500
School 1	2	Thursday	Stir fried chicken thai	68	97	6596
School 1	2	Thursday	Stir fried vegetable	76	0	0
School 1	2	Thursday	Jacket potato	74	12	888
School 1	2	Thursday	Pasta pot	75	31	2325
School 1	2	Thursday	Fruit	76	32	2432
School 1	2	Thursday	Sandwich simple	52	15	780
School 1	2	Thursday	Sandwich mid-range	73	45	3285
School 1	6th Oct	Friday	Cakes	42	182	7644

School 1	2	Friday	Breakfast pastry	34	21	714
School 1	2	Friday	Panini	48	55	2640
School 1	2	Friday	Veggie pizza	78	31	2418
School 1	2	Friday	Pizza	64	58	3712
School 1	2	Friday	Sausage in a roll	48	24	1152
School 1	2	Friday	Pastry sausage roll	36	29	1044
School 1	2	Friday	Burrito	60	0	0
School 1	2	Friday	Popcorn	70	60	4200
School 1	2	Friday	Fish	74	172	12728
School 1	2	Friday	Ratatouille	74	1	74
School 1	2	Friday	Jacket potato	74	24	1776
School 1	2	Friday	Pasta pot	75	47	3525
School 1	2	Friday	Fruit	76	22	1672
School 1	2	Friday	Sandwich simple	52	17	884
School 1	2	Friday	Sandwich mid-range	73	39	2847

All total daily sales were recorded for the three-week menu cycle at each school as shown in Table 3.15.

Table 3.15 An example of the total daily sales

School	Date	Day	Food	Food score	Number sold	Food score total
School 1	2nd Oct	Monday	Cakes	42	205	8610
School 1	2	Monday	Breakfast pastry	34	20	680
School 1	2	Monday	Panini	48	82	3936
School 1	2	Monday	Veggie pizza	78	44	3432
School 1	2	Monday	Pizza	64	62	3968
School 1	2	Monday	Sausage in a roll	48	25	1200
School 1	2	Monday	Pastry sausage roll	36	31	1116
School 1	2	Monday	Burrito	60	13	780
School 1	2	Monday	Popcorn	70	67	4690
School 1	2	Monday	Chicken Balti	74	85	6290
School 1	2	Monday	Vegetable Balti	76	1	76
School 1	2	Monday	Jacket potato	74	20	1480
School 1	2	Monday	Pasta pot	75	51	3825
School 1	2	Monday	Fruit	76	34	2584
School 1	2	Monday	Sandwich simple	52	23	1196
School 1	2	Monday	Sandwich mid-range	72	60	4320
TOTAL						48183

Each Schools total daily sales were recorded School One is indicted in Table 3.16.

Table 3.16 Pre-intervention baseline scores for School One

	Pre-intervention baseline score	
2nd Oct	Monday2	48183
3rd Oct	Tuesday2	44841
4th Oct	Wednesday2	46317
5th Oct	Thursday2	42260
6th Oct	Friday2	47030
9th Oct	Monday3	89713
10th Oct	Tuesday3	45566
11th Oct	Wednesday3	44683
12th Oct	Thursday3	45622
13th Oct	Friday3	44595
16th Oct	Monday1	45499
17th Oct	Tuesday1	39608
18th Oct	Wednesday1	43995
19th Oct	Thursday1	41098
20th Oct	Friday1	48613
Totals		**717623**

All schools' results were checked for exceptional data figures. Schools with exceptional figures due to either a promotion day, a celebration day or half a day due to teachers training were removed across the entire Schools three data sets.

3.2.4 Step Two: The pre-intervention phase: objective four

Step Two, objective four was to specify the recruitment process and the aim of the focus groups (Table 3.17).

Table 3.17 Section Two: The pre-intervention phase: objective four

STEP TWO	***The pre-intervention phases***
Purpose:	**To outline the stages of the pre-intervention phase**
Objective 4	To specify the recruitment process and the aim of the focus groups

Focus groups are facilitated organised discussions that are conducted within a selected group of participants. The focus is on communication between the participants which generates data (Kitzinger 1995; Veal, 2018). The principal reasons for conducting focus groups are to understand participants' perspectives on a defined area of interest and to explore their knowledge and experience, but more explicitly to discover how and why they think in that way (David and Sutton, 2011). In focus group discussions participants can communicate between themselves, which can

expose different attitudes, and this has the potential to emphasise any subcultural values and group norms (Robert Wood Johnson Foundation (RWJF), 2008). However, the difficulty in running focus groups is that some participants may not contribute to the discussion or there could be participants that overpower the discussion, which requires skilled facilitation management (Krueger and Casey, 2015).

An alternative method to collect qualitative data are to use individual interviews. Individual interviews are appropriate to collect in-depth information on feelings, thoughts, opinions, and experiences (Easwaramoorthy and Zarinpoush, 2006). Individual interviews tend to be carried out with a small number of individual respondents that explore their viewpoints on a topic (Boyce and Neale, 2006). This method provides detailed data, and the researcher can both direct, control and clarify any misunderstanding throughout the interview process. However, individual interviews can be lengthy to conduct and there may be bias in the results if the sample is not designed well (Business Research Methodology, ND).

This study selected focus groups because it wanted participants to voice their individual opinions and hear each other's opinions on their understanding of the food score and its perceived effect on their food choices. It also wanted to expand on the factors that affect their food choice. During the focus group the researcher could also probe for more detail if some of the questions required more detail such as cultural and gender values (Marshall, 1996). Kitzinger (1995) suggested that within focus groups it is best to use a naturally occurring sample, but this study used purposive sampling as it had to rely upon the judgment of the school to select members of the population to participate in this research (Laerd Research, 2012).

For the purposive sampling in this research, the author requested that the schools select the participants for the focus groups. The researcher requested if it were possible to include a range of ages, genders, and ethnicities. Purposive sampling is the most frequently used method in qualitative research as it can identify individuals who are knowledgeable on the topic, that they can adequately express themselves, and are willing to participate (Fox et al., 2018).

The client at each school asked the members of the school council to take part in the study. `A school council is a formal group of pupils within a school who are elected by their peers to represent them and their views` (Department of Education, 2014). The school client sought and gained parental consent for each pupil to take part in the study.

The researcher asked each school client to organise and collate the following -

1. For the pre-intervention focus groups. To select approximately 14 pupils from the school council to take part in two pre-intervention focus groups per school, consisting of

approximately 7 pupils in each group (*n=14*) per school. The aim of the pre-intervention focus group is to define and expand on adolescents' views on the factors that affect food choices. The 14 pupils should ideally consist of a mixture of genders, ages, and ethnicities.

2. Gain parental consent for all pupils to take part in the pre-intervention study and post-intervention study. These pupils may not be the same pupils that took part in focus group one and two.
3. For the post-intervention focus groups (identified in 3.4.2) to select approximately 14 pupils from the school council to be part of two post-intervention focus groups per school, consisting of approximately 7 pupils in each group (*n=14*) per school. The aim of the post-intervention focus group is to review the success or failure of the food score and to investigate adolescents' thoughts on the use and understanding of FLs. The 14 pupils should ideally consist of a mixture of genders, ages, and ethnicities.

The school's clients were asked to recruit two groups, for each focus groups and each group to consist of seven participants. The suggested sample number of seven is small enough to allow opportunities for all members to contribute to the topic, yet large enough to provide diversity (Krueger and Casey, 2015). In summary the clients were asked to provide two focus groups per school seven pupils per group *n=14* per school, *n=56* in the pre-intervention focus group and *n=56* post-intervention, *n=112* pupils in total. The focus groups followed ethical protocol as outlined in section 3.6.

Table 3.18 Participant numbers that attended the pre- and post-focus groups

Schools	*Males*	*Females*	*Total number in the focus group*
School 1 Pre intervention 1	4	3	7
School 1 Pre intervention 2	4	6	10
School 2 Pre intervention 1	2	5	7
School 2 Pre intervention 2	3	4	7
School 3 Pre intervention 1	1	5	6
School 3 Pre intervention 2	2	4	6
School 4 Pre intervention 1	6	3	9
School 4 Pre intervention 2	3	4	7
Total Pre intervention	25	34	59
School 1 Post intervention 1	4	5	9
School 2 Post intervention 1	5	5	10
School 3 Post intervention 1	1	6	7
School 3 Post intervention 2	4	3	7
School 4 post intervention	0	7	7
Total Post intervention	14	26	40
Total Pre and Post intervention	39	60	99

The aim of the pre-Intervention focus group

At the start of each focus group, participants were informed of the ground rules, confidentiality and that it was voice recorded (the transcripts are in Appendix T). Each participant was asked to select a letter from the alphabet and a number between one and nine. This code was used as their identity during the interview and no names were used in the interviews, examples were J7, K4 etc. When these were transcribed, participants were identified as the number allocated to each school, one to four, the first or second interview followed by their gender M or F and their unique code. As an example, in School Two for the second interview a male participant who selected J7, was coded as 22MJ7.

The pre-intervention focus group interview guides are in Appendix M1. Initially each participant was asked when they preferred to eat at school and why they preferred this time (breakfast, mid-morning or at lunchtime). These questions allowed each participant to speak and to reflect in more detail on their individual reasoning (Kruger and Casey, 2015). The aim of the pre-intervention focus group was to better understand the factors that influence eating behaviour and was guided by Story et al., (2002) conceptual framework of adolescent eating behaviour. The framework consists of four levels of influence as outlined in Figure 8. By using this framework, the researcher can gain deeper knowledge of adolescent's thoughts regarding the individual, social environmental and physical environmental influences in a school setting. Through thematic analysis, the research aimed to identify common themes that extend across the pre-intervention focus groups (Vaismordi et al., 2013).

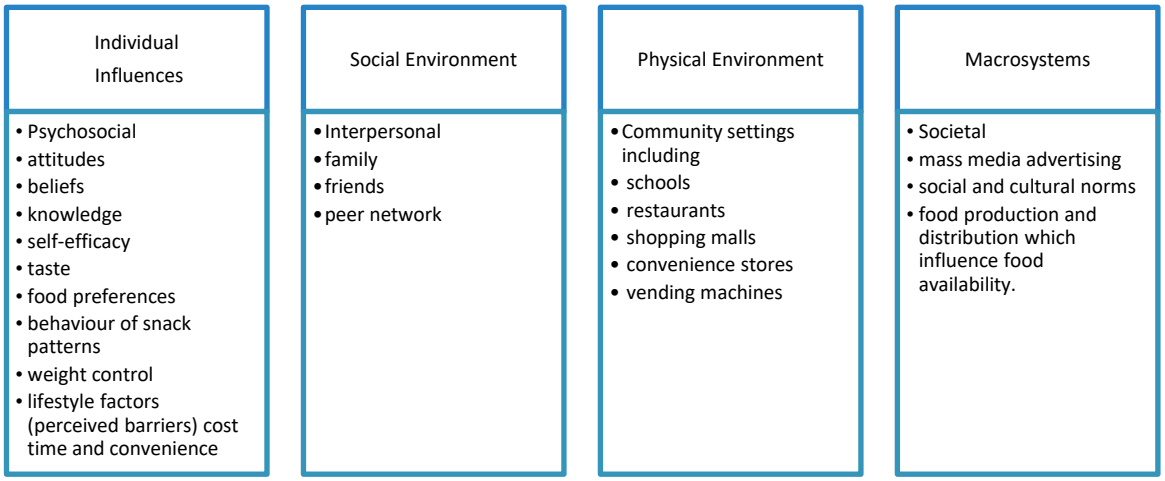


Figure 8 A representation of Story et al., (2002) Conceptual framework of Individual and Environmental influences on adolescent eating behaviour

3.2.5 Step Two: The pre-intervention phase: objective five

Step Two, objective five was to describe how the awareness phase was implemented (Table 3.19).

Table 3.19 Section Two: The pre-intervention phase: objective five

STEP TWO	***The pre-intervention phases***
Purpose:	**To outline the stages of the pre-intervention phase**
Objective 5	To describe how the awareness phase was implemented

The researcher collated `understand your food score` awareness packs that consisted of two items. The awareness pack consisted of a single tutor information sheet (Appendix U) and a pack of 35 A6 post cards which outlined how to understand your food score (Appendix V). The tutor information sheet asked tutors to hand out a post card to each pupil in their tutor group and recite how the food was scored. The aim of the tutor sheet was to standardise a consistent message of the higher the number the healthier to food across all year groups. The message was the `food label shows you ONE NUMBER...the higher the number the healthier the food...it is calculated for you`.

After the pre-intervention baseline sales were gathered and the post-intervention sales began each school had A3 printed posters delivered (identical to the post cards) to each school. The posters were displayed in each school's cafeteria (Illustration 3.1). Each school had their own policy on what information was permitted on the walls of each school and therefore the researcher did not have approval to place the posters in the most prominent positions. For School One and School Two the researcher positioned the posters. In Schools Three the caterers positioned the posters and in School Four the area manger positioned the posters.

The researcher delivered four boxes to each of the school's caterers. In one box were the mean scores for the food items that did not need to change during the post-intervention phase one and post-intervention phase two. The food scores were placed in laminated holders (Illustration 3.2 and 3.3). Each of the other three boxes were labelled according to the menu cycle. In each of the three boxes were the food scores with the name of the food item and several laminated holders to display the food score for each service point for each school. In School One the chef applied the food score labels to the food items, in School Two, Three and Four the catering staff applied the food score labels to the food items.

Illustration 3.1 Posters on display

3.3 The post-intervention phase one

As outlined in Table 3.20, the purpose of step three was to identify the stages of the post-intervention phase one which contained two objectives.

Table 3.20 Step Three: The post-intervention phase one with two objectives

STEP THREE ***The post-intervention phase one***

Purpose:	**To identify the stages of the post-intervention phase one**
Objective 1	To describe how food sales were recorded for weeks four, five and six
Objective 2	To explain the design of the food choice questionnaire

3.3.1 Step Three: The post-intervention phase one: objective one

Step Three, objective one was to describe how food sales were recorded for weeks four, five and six (Table 3.21).

Table 3.21 Step Three: Food sales for weeks four, five and six

STEP THREE ***The post-intervention phase One: objective one***

Purpose:	**To identify the stages of the post-intervention phase one**
Objective 1	To describe how food sales were recorded for weeks four, five and six

The food scores were placed in holders and positioned on the sneeze screen above the food item or next to the food as shown in illustration 3.2 and 3.3.

Illustration 3.2 Food scores on display School Four

Illustration 3.3 Food scores on display School One

Weekly sales record

Weekly sales for weeks four, five and six were recorded with the food score on display as outlined in 3.2.3. School One post-intervention phase one sales are in Appendix S.

3.3.2 Step Three: The post-intervention phase one: objective two

Step Three, objective two was to justify the design of the food choice questionnaire (Table 3.22).

Table 3.22 Step Three: Post-intervention phase one: objective two

STEP THREE	***The post-intervention phase one: objective two***
Purpose:	**To identify the stages of the post-intervention phase one**
Objective 2	To explain the design of the food choice questionnaire

3.3.2.1 Food choice questionnaire

The primary method for data collection in social, health and epidemiological research is a survey questionnaire (Bowling, 2009). This study initially aimed to use a voluntary online questionnaire using Bristol Online (now Jisc) which is an online survey tool designed for academic institutions to research (Jisc Online surveys, 2019). The online survey is in Appendix W. However, there were logistical problems completing the survey online due to vast number of pupils at each school and the availability of IT facilities in the schools. Therefore, the study used a voluntary self-administered paper-based questionnaire that was distributed to all pupils in tutor time at each school (Appendix X).

The researcher distributed the paper-based questionnaire through the form tutors. Packs of questionnaires were made up for each tutor group in all years. Each pack of questionnaires contained a tutor guide (Appendix X1) for them to read out in form time and packs of questionnaires (Appendix X2). During form time pupils were asked to complete the questionnaires. After completion, each tutor collected and returned the questionnaires to a designated area that the client had organised at each school. As this was a paper-based questionnaire the researcher manually input the completed replies into Bristol Online (*n=2236*). With any mode of completion there are potential influences on individual responses and the researcher had to consider peer pressure and the effects on the quality of the data returned (Bowling, 2005). To minimise peer pressure within the introduction there was a section that requested that the pupils complete this individually and if they did not know the answers to tick that they were `not sure` rather than to guess the answer.

The questionnaire consisted of five parts. The first part requested demographic information; age, gender, and ethnicity. The second part asked how they prefer to eat at school, part three asked on a five-point Likert scale if the pupils noticed the intervention and on the same scale if the food score affected their food choice. A Likert scale measures attitudes or opinions on a topic and can be on a five, seven- or nine-point agreement scale. Multiple item measures are characteristically more stable and are subject to less random variability (Statisticshowto.com, 2015). These questions provided data from which to measure if there was a significant difference in gender that noticed the food score and if by noticing the food score the score influenced their food choices.

Steptoe et al., (1995) developed and validated a food choice questionnaire that measured motives for food choices. The food choice questionnaire systematically addresses both health related and non-health related motives from adults (*n=358*) from the ages of 18-87. Steptoe et al., (1995) identified nine factors encompassing health, mood, convenience, sensory appeal, natural content, price, weight control, familiarity, and ethical concern which consisted of 36 questions (see table 3.23). Ooi et al., (2015) modified Steptoe`s version and validated a questionnaire to measure the various dimensions of food choice motives for adolescents. Adolescents (*n=306*) aged 15-17 years attending three randomly selected secondary schools in Penang Malaysia completed a modified self-administered food choice questionnaire. Ooi et al., (2015) identified six factors encompassing health and nutrition knowledge, price and convenience, media, mood and sensory appeal, peers, and parents, which consisted of 36 items (see table 3.23). Not all the items from either food choice questionnaire were relevant to assess food choices at school, so these were not included in the final questionnaire.

Part four of the questionnaire asked participants to rank on the five-point scale which factors from the combined FCQ from Steptoe et al., (1995) and Ooi et al., (2015) had the greatest influence on adolescent food choice. Each of the twenty-one questions started with `it is important to me that the food I eat on a typical day at school (tick one answer from the five-point scale from one being not important to five being very important from each line).` An example of the types of questions includes `it is important to me that the food I eat on a typical day at school (tick one answer from the five-point scale from one being not important to five being very important from each line` `is similar to foods chosen by my friends,` `looks nice` or `tastes good.` This quantitative data enables the identification of any statistically significant differences in the importance adolescents place on factors affecting their food choice. Two additional questions were included. Hunger was identified as a top factor from the pre-interventions focus group, therefore, how important was `*keeps me full*` was included. The literature identified that adolescents reveal that they are interested in nutrition,

and that they understand that they should consume five portions of fruit and vegetables. This questionnaire wanted to ask the importance of food containing `lots of fruits and vegetables`.

Part five of the questionnaire asked participants about their knowledge of food groups adapted from Parmenter and Wardle (1999). There were six questions that asked participants to rank a list of foods if they were `high` `low` or that they were `not sure`. As an example, do you think that these foods are high or low in `salt` and participants were given a list of six foods (sausages, pasta, smoked mackerel, red meat such as beef, lamb and steak, frozen vegetables, and cheese).

Table 3.23 Table to indicate the selected factors for the questionnaire

Steptoe et al., (1995)	***Ooi et al., (2015)***	***School Questionnaire***
Contains a lot of vitamins and minerals	Contains vitamins and minerals	Contains vitamins and minerals
Keeps me healthy	Keeps me healthy	Keeps me healthy
Is nutritious	Is nutritious	Is nutritious
Is high in fibre	Is high in fibre	Is high in fibre
Is high in protein	Is high in protein	Is high in protein
Is good for my skin/teeth/hair/nails		NA
Contains no artificial ingredients	Contains no artificial ingredients	NA
Is low in calories	Is low in calories	Is low in calories
Is low in fat	Is low in fat	Is low in fat
Helps me to control my weight	Helps me to control my weight	Helps me to control my weight
Contains natural ingredients	Contains natural ingredients	NA
Contains no additives		NA
Is cheap	Is cheap	Is cheap
Is not expensive	Is not expensive	NA
Is easily available in shops/supermarkets	Is easily available in shops/supermarkets	NA
Takes no time to prepare	Takes no time to prepare	NA
Can be cooked very simply	Can be cooked very simply	NA
Can be bought in shops near to where I live/study	Can be bought in shops near to where I live/study	NA
Is easy to prepare	Is easy to prepare	NA
Is good value for money	Is good value for money	NA
	Is the focus showed in the advertisement	NA
	Is as promoted in advertisement in the media	NA
	Is advertised in the media (television, radio internet etc.)	NA
	Is suitable for the image as advertised in the media	NA
Helps me cope with stress		Helps me cope with stress
Makes me feel good	Makes me feel good	Makes me feel good
Cheers me up	Cheers me up	NA
Helps me relax	Helps me relax	NA
Smells nice	Smells nice	Smells nice
Looks nice	Looks nice	Looks nice
Helps me cope with life	Helps me cope with life	NA
		Keeps me full
Tastes good	Tastes good	Tastes good
Keeps me awake/alert		Keeps me awake
Has a pleasant texture		Has a pleasant texture
		Includes lots of fruit and vegetables
Is what I usually eat		Is what I usually eat
Is familiar		Is familiar
Is like to food I ate as a child		NA
Comes from countries I approve of politically		NA
Has the country of origin clearly marked		NA
Is packaged in an environmentally friendly way		NA
	Is recommended by my friends	NA
	Is preferred by my friends	NA
	Similar to those consumed by my friends	Similar to those chosen by my friends
	Is encouraged by my friends	NA

Is preferred by my father/mother	NA
Is recommended by my father/mother	NA
Is prepared by my father/mother	NA

3.4 The post-intervention phase two

As outlined in Table 3.24 the purpose of step four was to identify the stages of the post-intervention phase two which contained two objectives

Table 3.24 Step Four: The post-intervention with two objectives

STEP FOUR ***The post-intervention phase two***

Purpose:	**To identify the stages of the post-intervention phase two**
Objective 1	To describe how food sales were recorded for weeks seven, eight and nine
Objective 2	To explain the reasons for a post intervention focus group

3.4.1 Step Four: The post-intervention phase two: objective one

Step Four, objective one was to describe how food sales were recorded for weeks seven, eight and nine (Table 3.25).

Table 3.25 Step Four: The post-intervention phase two: objective one

STEP FOUR ***The post-intervention phase Two***

Purpose:	**To identify the stages of the post-intervention phase two**
Objective 1	To describe how food sales were recorded for weeks seven, eight and nine

Weekly sales for weeks seven, eight and nine were recorded with the food score on display as outlined in 3.2.1. Post-intervention phase two sales for School One are in Appendix S.

3.4.2 Step Four: The post-intervention phase two: objective two

Step Four, objective two was to explain the reasons for the post-intervention focus groups (Table 3.26).

Table 3.26 Step Four: The post-intervention phase two: objective two

STEP FOUR ***The post-intervention phase Two***

Purpose:	**To identify the stages of the post-intervention phase two**
Objective 2	To explain the reasons for a post intervention focus group

Post-intervention focus group

The post-intervention focus group semi structured guides are in Appendix M. The post-intervention focus group explored four sections. The aim of the first section was to establish how successful the awareness phase had been (see 3.2.5), the second was to examine participants understanding of the food score FL and to establish if participants believed that the food score had or had not altered their food choice behaviour. Section three explored different FL designs and encouraged participants to discuss which design they felt would be the most effective in affecting their food choices. Section four focused on the results from each school's food choice questionnaire and aimed to add words and meanings to the statistics. An example of this was: `57% rated that food *is nutritious* is very important and 61% rated *keeps me healthy* as very important` so, what will guide you to eat more healthy foods? The answers were analysed using thematic analysis as outlined in 3.5.2.

3.5 Data analysis

As outlined in Table 3.27, the purpose of step five was to identify how the data was analysed which contained two objectives.

Table 3.27 Step Five: Data analysis with two objectives

STEP FIVE	***Data Analysis***
Purpose:	**To outline how the data was be analysed**
Objective 1	To detail how the quantitative data was analysed
Objective 2	To clarify how the qualitative data will be analysed

3.5.1 Step Five: Data Analysis: objective one

Step Five, objective one was to detail how the quantitative data was analysed (Table 3.28).

Table 3.28 Step Five: Data analysis: objective one

STEP FIVE	***Data analysis***
Purpose:	**To outline how the data was be analysed**
Objective 1	To detail how the quantitative data was analysed

Primary measures

The primary quantitative measurement is the difference in the mean nutrient density score at all four schools measured at three-points, each measurement point was three weeks apart. Using SPSS 24, produced statistical data that was analysed at specific points: pre-intervention baseline, (weeks one, two and three), post-intervention phase one (weeks four, five and six), and post-intervention phase two (weeks seven, eight and nine). Nine weeks in total. Participants were not aware of the food score label during the pre-intervention baseline data collection. Ultimately this data provides the answer to research question one ` *How effective is the experimental food label at influencing adolescents' dietary behaviour in a secondary school restaurant*` and can test an alternative hypothesis *`an experimental food label applied to food served in secondary schools in Greater London will influence adolescents to select healthier food choices`.*

Quantitative data analysis

The data gathered from the four schools that investigated the effect of the experimental FL were analysed individually. The rationale is that each school had a slightly different menu and each school had their own calendar regarding inset days, therefore schools could not be compared on a like for like basis. Each food item had a computed food score as calculated in section 3.2.2.

The success or failure of the food score was assessed by examining the differences of the mean scores for each school's three-week menu cycle. The mean scores measured sales at the pre-intervention baseline, post intervention phase 1 and post-intervention phase 2. SPSS 24 was used to compute the weekly mean scores.

The differences in mean scores tested hypothesis one *`an experimental food label applied to food served in secondary schools in Greater London will influence adolescents to select healthier food choices`.* If the food scores significantly increased, the test could prove the hypothesis, if the scores decreased or remained unchanged the thesis can disprove the alternative hypothesis. The independent variable was `time` which had three conditions, the pre-intervention baseline, the post intervention phase one where the intervention had been in place for three weeks and post intervention phase two where the intervention had been in place for a total of six weeks. The dependent variable was the `food score` which was measured at each of the same time points indicated above. A one way within groups ANOVA was conducted that tested the overall difference in group means. In each school, Mauchly's was examined for Sphericity. If Sphericity was not assumed, then the Greenhouse-Geisser correction was used. In each case a test was accepted as significant if $p < .05$.

Hypothesis two tested that `females are more likely than males to both notice the food score and to self-report that the food score affects their food choices`. These statistics provide concise descriptions of the data to identify the main features. Gender was measured as categorical data which allowed for the reporting of numbers or percentages of individuals in each category. This thesis used the mean and standard deviation for the food score. Pearson`s Chi-Squared tested the relationship between the categorical variables to evaluate if one gender noticed the score more than the other or felt that the food score affected their food choices more than the other.

Hypothesis three tested a complex hypothesis: `adolescents will report that their food choices are more influenced by their peers, than the sensory aspects of food`. The importance to food choice was measured at two conditions, the first being similarity to foods chosen by friends, and the second condition being the sensory properties of food. Sensory properties were measured as a mean score of four factors; tastes good, smells nice, has a pleasant texture, and looks nice.

Hypothesis four states `there will be a significant association between adolescent gender and the importance placed on health when making food choices`. Health and nutrition included factors; contains vitamins and minerals, is nutritious, is high in fibre, is high in protein, is low in calories, is low in fat, helps me control my weight, keeps me healthy and includes lots of fruit and vegetables. Chi square analyses were used to assess these associations.

3.5.2 Step Five: Data analysis: objective two

Step Five, objective two was to outline how the qualitative data was analysed (Table 3.29).

Table 3.29 Step Five: Data analysis: objective two

STEP FIVE	***Data analysis***
Purpose:	**To outline how the data was be analysed**
Objective 2	To clarify how the qualitative data was analysed

Qualitative data analysis

The approach selected for this research was thematic analysis. Braun and Clarke (2006) stated that both content analysis and thematic analysis are descriptive in nature which aim to identify, report, and analyse patterns, categories, or themes within the data. Braun and Clarke suggested that `… a theme captures something important about the data in relation to the research question and represents some level of *patterned* response or meaning within the data set` (Braun and Clarke, 2006 p. 82). Content analysis is a broad term that encompasses numerous strategies to analyse text,

it systematically codes and seeks both trends and the frequency of categories and themes (Vaismordi et al., 2013).

Thematic analysis seeks to identify patterns and themes in detail from either within the text so that it is directly observable (Nowell et al., 2017), or at a latent level underlying the phenomenon being studied (Braun and Clarke, 2006). Braun and Clarke (2006) suggested that thematic analysis is widely used but poorly defined because it does not follow a pre-existing framework. However, they set out to address this issue in their paper. They go further and stated that it is a flexible approach to the analysis of qualitative data due to its theoretical freedom, but researchers must be clear in `what` they are doing, `why` they are doing it, and `how` they will analyse their data. Nowell et al., (2017) stressed that it is the responsibility of the researcher to ensure rigour within their analysis to enable the findings to be trustworthy and valid.

Braun and Clarke (2006) recommend that the researcher must make four decisions before they analyse the data. Firstly, the researcher must determine what counts as a theme and decide if these themes will be coded and analysed broadly across the entire data set or coded specifically in detail in a specific area of interest. Secondly researchers need to choose if the themes will be identified inductively or deductively. Thirdly they need to consider if themes will be identified at a semantic or latent level. Finally, the researcher will need to consider their epistemology as thematic analysis can be constructed within an essentialist or a constructivist paradigm.

For this research, a theme is classified as any patterned response that indicates an effect on food choices at school across the entire data corpus; therefore, the themes are an accurate indication of the entire transcript. The themes were identified through an inductive approach so that themes were linked to the data and not theory driven, therefore codes were not identified within a theoretical framework. The analysis was performed at a latent level, thus seeking to identify underlying meanings as to the factors that affect food choice in an interpretative manner. The final choice of epistemology was to conduct the thematic analysis within a constructionist framework to theorise both the physical, environmental, and social setting that impacts on food choices (Braun and Clarke, 2006). The data from the qualitative focus groups were compartmentalised into the conceptual module of adolescent food choice behaviour as defined by Story et al., (2002) (Figure 3.4) to better understand the influences of food choice within social and environmental parameters.

The thematic analysis followed the six phases as identified by Braun and Clarke (2006) (Figure 3.5) who postulated that researchers need to be clear as to how they generate their themes.

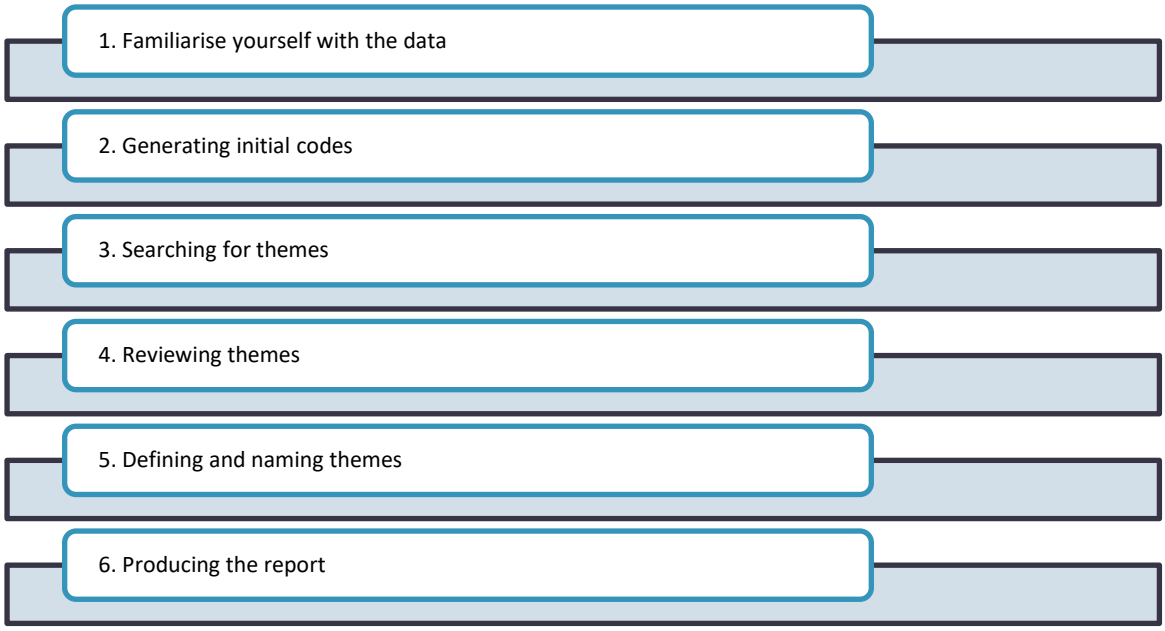


Figure 9 Braun and Clarke (2006) phases of thematic analysis

Two focus group interviews were held at each school. The first focus group interview was before the experimental food score was applied and the second focus group interview was after the experimental food score was applied. The questions asked at all the focus group interviews were standardised across each school. The narrative from each recorded focus group interviews (*n=13*) was transcribed verbatim (Appendix T). The researcher used NVivo 12.0 pro which is a computerised package that allows researchers to manage the data from an array of sources, manage ideas from their data, visualise their data and report the findings from the data (Jackson and Bazeley, 2018; NVivo QSR International, 2018).

Every participant was coded as a unique speaker (as detailed in 3.2.4: The pre-intervention phase: objective four and evidenced in Appendix T). All transcripts were then imported into NVivo as files (transcripts from here onwards are referred to as files). In NVivo 12.0 each unique speaker was labelled as a case that classified the participant demographics as to gender and school. All files were read several times to become familiar with the data (Figure 9 stage one). From these readings a mind map was designed as an initial thematic coding framework that indicated the researcher's initial thoughts as to the direction of the project. The mind map was converted to create nodes (Wiredu, 2020). All files (transcripts) were read line by line allowing the researcher to label the data and drag them into codes (referred to as nodes in NVivo), this process is termed open coding (Figure 9 stage two). La Trobe University, (2020) stated that coding is the analytical process of categorising data. A code can be either a word, a label or a phrase that encapsulates that proportion of the data,

it can also be a unit of analysis or a summary of the text (Wiredu, 2020). This open coding process generated broad open codes which allowed the data to be coded in multiple places. At this stage all the data were coded, even if items did not appear applicable. Jackson and Bazeley (2018) stated that during this point of coding, an emergence of the relationships between codes can become evident (Figure 9 stage three). The researcher then reviewed and defined each code (Figure 9 stage four). Once the open coding was completed the codes were clustered (cut and merged) into related ideas, themes, and sub themes to create a thematic coded framework. All themes were reviewed to search for a coherent pattern. From using NVivo three domains and nine themes emerged from analysing the data (Figure 9 stage five). Each theme was considered in relation to the entire data corpus (entire transcripts). These steps allowed the data to produce the evidence even if the evidence was not considered in the initial theoretical framework.

Thematic analysis confirmed that adolescent food choices were underpinned by three key themes: HEALTH, WHY THESE FOODS and THE ENVIRONMENT. HEALTH comprised of four sub themes, *the experimental food label, food labels, nutritional knowledge,* and the *meaning of food.* WHY THESE FOODS comprised of three sub themes: *I like, the social environment and mood*. THE ENVIRONMENT comprised of three sub themes, *school, break time and the caterer*. Full details are in Table 5.2 the thematic analysis of factors that affect adolescent food choices at school.

3.6 Ethical considerations

As outlined in Table 3.30, the purpose of step six was to indicate the ethical considerations of working with adolescents for this research which contained one objective.

Table 3.30 Step Six: Ethical considerations with one objective

STEP SIX	***Ethical considerations***
Purpose	**To indicate the ethical considerations of working with adolescents for this research**
Objective 1	To detail the ethical considerations for this research

3.6.1 Step Six: Ethical considerations: objective one

Step Six, objective one was to detail the ethical considerations for this research (Table 3.30).

Ethics are a code of conduct that distinguishes between acceptable and unacceptable behaviour and even though society has laws that govern, behavioural ethical norms tend to be broader. It is important to adhere to ethical norms in research that promote knowledge and truth and minimise error so that the data promotes truthful findings. Ethics should promote fairness in all aspects and protect both data sharing policies and confidentiality. The researcher must be accountable for the

research. They must ensure that it is honest, carried out with integrity and that there is no conflict of interest. Finally research ethical norms need to be followed that promote moral and social responsibility ensuring that the researcher is aware of human and animal rights, compliance with the law, and public health and safety (Resnik, 2018). Research involving humans raises complex legal, social, and political issues. There are three objectives when protecting human participants, these consist of conducting the research that serves the interests of society, to seek ethical soundness to minimise risk and maximise protection and confidentially and to ensure consent (Walton, ND). Research should strive for honesty, from the start of the procedure through to collecting data and reporting it. It must be objective, strive to avoid bias in experimental design, be sincere and be open to critics (Shamoo & Resnik, 2015).

The Institute of Medicine published guidelines on ethical recommendations that involve participants under the age of eighteen. The report stated that the design must have the intention to better the health of children and future generations, children cannot feel burdened by the research and each participant must be protected (Crane and Broome, 2017).

This thesis followed the ethical informed consent format as outlined by Silverman and Lemarie, (2006). The questionnaires clearly stated that their participation was voluntary, and that data was anonymous. The school took the responsibility of gaining informed consent from the school council pupils to take part in the focus groups. Each pupil that took part in the focus group was informed that their participation was voluntary and that they cannot be identified, they could have access to the transcripts should they require, that they were free to leave at any time, and that they could request that their contribution to the interview be removed (Silverman and Lemarie, 2006). All pupils identified themselves by a letter from the alphabet and a number between one and nine and they were to use these labels during the interview process. The University of West London (UWL) has standards of behaviour when conducting research particularly when the research involves adolescents under the age of consent. An application for ethical approval was submitted in accordance with UWL protocol. It was reviewed and granted by the UWL ethics board.

In conclusion, this research used a pragmatic approach that deductively explored if an experimental numerical food score when applied to food in four schools in Greater London influenced adolescents to select healthier food choices. Additional survey data identified which factors adolescent rank as the most impotent in their food choice behaviour. The positivist paradigm concentrated on measuring the effect of the numerical food score that was provided from data from sales of food items. The food score was calculated and assigned to specific food items. If the mean score increased this indicated that adolescents were selecting healthier food choices, alternatively if the mean food score decreased this indicted that adolescents were purchasing the less healthy options,

while if the mean score was unchanged this signified that the food score had no impact on their eating behaviour. The results allow the thesis to accept or reject the alternative hypothesis that the food score will affect adolescent food choice. Through observation and facts, the researcher can objectively measure and analyse the data from a neutral unbiased position.

The thesis aimed to understand adolescent food choice behaviour and sought to uncover any meaning of the factors that affect their food choices. Through using the phenomenological approach this facilitated the researcher's immersion in the words that adolescents used when describing their understanding of the food score and their reasons for their food choices. The phenomenological paradigm enabled the researcher to compare these findings with Storey et al., (2002) conceptual model of adolescent eating behaviour and inductively construct knowledge of the factors they rank as the most influential in a school eating environment. Through combining both positivism and a phenomenological approach, the numerical data produced by the food score was combined with adolescents' thoughts and understanding which bought a greater understanding of the food scores success or failure.

Chapter 4: Quantitative results from the experimental food score from each school

This chapter reveals the quantitative findings from two sets of data. Part one presents the results from the data collected on food choices before and after the application of the experimental food score to validate or reject hypothesis one. Part two presents the results from the data produced from the food choice questionnaire to validate or reject hypothesis two, three and four.

Part One: Hypothesis One

1. To test an alternative hypothesis: `an experimental food label applied to food served in secondary schools in Greater London will influence adolescents to select healthier food choices`.

The experimental FL is a calculated nutrient density food score, whereby higher scores indicated greater nutrient density and indicate healthier food choices than lower scores (as shown in section 3.2.2). The caterers from each school emailed their weekly sales to the researcher during the nine-week experiment. The nine-week experiment consisted of sales for three weeks (weeks 1, 2 and 3) to be recorded as pre-intervention baseline sales. The pre-intervention baseline was compared to a repeat of the three-week menu cycle at post-intervention phase one (weeks 4, 5 and 6) and post-intervention phase two (weeks 7, 8 and 9). Sales were compared to establish if the intervention influenced food choice behaviour and to evaluate if any effect would be sustained. An example of one day's sales from School Three is in Table 4.1. The total daily sales scores for the pre-intervention were calculated as a baseline score as shown in Table 4.2. Examples of the total sales for nine weeks pre and post the intervention for School One are in Appendix S.

Table 4.1 An example of one day's sales from School Three

School 3	2nd Oct	Monday	Cakes	42	276	11592
School 3	2	Monday	Cookies	32	64	2048
School 3	2	Monday	Pain au choc	34	52	1768
School 3	2	Monday	Panini	48	122	5856
School 3	2	Monday	Pitta Pizza	58	56	3248
School 3	2	Monday	Pizza	64	96	6144
School 3	2	Monday	Nachos	50	85	4250
School 3	2	Monday	Sausage roll	36	10	360
School 3	2	Monday	Fruit	76	30	2280
School 3	2	Monday	Sausage mash	64	17	1088
School 3	2	Monday	Jacket potato	74	7	518
School 3	2	Monday	Pasta pot	75	44	3300
School 3	2	Monday	Sandwich simple	52	32	1664
School 3	2	Monday	Sandwich mid-range	72	75	5400
	2	Monday	TOTAL			49516

Table 4.2 School Three pre-intervention baseline sales

Pre-intervention baseline total score		
2nd Oct	Monday2	49516
3rd Oct	Tuesday2	50291
4th Oct	Wednesday2	48260
5th Oct	Thursday2	30812
6th Oct	Friday2	23658
9th Oct	Monday3	32195
10th Oct	Tuesday3	49351
11th Oct	Wednesday3	49421
12th Oct	Thursday3	54415
13th Oct	Friday3	29721
16th Oct	Monday1	56872
17th Oct	Tuesday1	52267
18th Oct	Wednesday1	53925
19th Oct	Thursday1	53152
20th Oct	Friday1	26552
Totals		**660408**

It was expected that the mean scores of the foods selected would increase after the application of the experimental food score, indicating that adolescents had selected healthier foods, and the alternative hypothesis would be accepted. Alternatively, if the mean food score remained the same or decreased after the application of the food score then the experimental food score did not influence adolescent food choices and the alternative hypothesis must be rejected. Table 4.3 presents the mean and standard deviation (SD) for each school at each time point.

Table 4.3 Indicates the Mean and Standard Deviation (SD) of the Food scores at baseline, three weeks, and six weeks for each school

School	TIME 1 Pre-intervention Baseline Food Score (weeks one, two and three) 3 weeks	TIME 2 Post-intervention phase one Food Score (weeks four, five and six) 3 weeks	TIME 3 Post-intervention phase two Food Score (weeks seven, eight and nine) 3 weeks
School One (mean)	44850.71	44206.29	44147.29
School One SD	(2523.61)	(4262.54)	(2533.21)
School Two (mean)	19988.25	19787.67	19972.58
School Two SD	(2196.66)	(2308.26)	(3327.75)
School Three (mean)	43587.21	47473.93	46454.64
School Three SD	(11961.31)	(8332.01)	(9126.66)
School Four (mean)	84580.25	64102.83	75675.42
School Four SD	(9511.74)	(4018.25)	(2508.50)

4.1 Food score analysis

Table 4.3 demonstrates that, in School One, the mean food scores from pre-intervention baseline (weeks 1, 2 and 3) (44850.71) to post-intervention phase one (week 4, 5 and 6) (44206.29) decreased by 644.42 and from post-intervention phase one (44206.29) to post-intervention phase two (weeks 7, 8 and 9) (44147.29) decreased by a further 59. The total reduction in the food score from pre-intervention baseline to the end of post-intervention phase two was 703.42 Mauchly`s test indicated that sphericity of the data could be assumed, and an ANOVA found that the slight decrease in mean scores across the three time points was not significant ($F(2, 26) = 2.53$, $p > .05$). This indicates there was no significant difference in food scores between pre-intervention baseline, and post-intervention phase one and post-intervention phase two.

Table 4.3 demonstrates that, in School Two, the mean food scores from pre-intervention baseline (weeks 1, 2 and 3) (19988.25) to post-intervention phase one (week 4, 5 and 6) (19787.67) decreased by 200.58 but increased from post-intervention phase one (19787.67) to post-intervention phase two (weeks 7, 8 and 9) (19972.58) by 184.91. The total reduction in the food score from pre-intervention baseline to the post-intervention phase two was 15.67. Mauchly`s test indicated that sphericity of the data could be assumed, and an ANOVA found that the slight decrease in mean scores from pre-intervention baseline to post-intervention phase one and the slight rise from post-intervention phase one to post-intervention phase two was not significant ($F(2, 22) = 0.22$, $p > .05$). There were some inset days and, therefore, there was some missing data at this school.

Table 4.3 demonstrates that, in School Three, the mean food score from pre-intervention baseline (weeks 1, 2 and 3) (43587.21) to post-intervention phase one (week 4, 5 and 6) (47473.93) increased by 3886.72 then decreased from post-intervention phase one (47473.93) to post-intervention phase

two (weeks 7, 8 and 9) (46454.64) by 1019.29. The total increase in the food score from pre-intervention baseline to the post-intervention phase two was 2867.43. Mauchly`s test indicated significance at 0.002, so the Greenhouse Geiser adjustment was used, and an ANOVA again indicated that, although the mean suggests an upward trend no significant difference was present ($F(2, 26) = 2.194$, $p > .05$).

Table 4.3 demonstrates that, in School Four, the mean food scores from pre-intervention baseline (weeks 1, 2 and 3) (84580.25) to post-intervention phase one (week 4, 5 and 6) (64102.83) decreased by 20477.42 and from post-intervention phase one (64102.83) to post-intervention phase two (weeks 7, 8 and 9) (75675.42) increased by 11572.59. The total reduction in the food score between pre-intervention baseline and the post-intervention phase two was 8904.83 Mauchly`s test indicated significance at 0.006, so the Greenhouse Geiser adjustment was used, and an ANOVA found that the decrease in mean scores from pre-intervention baseline to post-intervention phase one and the slight rise from post-intervention phase one to post-intervention phase two was not significant ($F(2, 22) = 31.092$, $p > .05$).

Comparisons of the results between the individual schools were not possible due to the differences in sample sizes. Overall, the descriptive statistics suggest that there is no consistent difference in the mean scores from pre-intervention baseline and post-intervention phase one or post-intervention phase two, and the inferential tests confirm that there was no significant difference between the weeks in any school. The thesis can therefore reject the alternative hypothesis that `an experimental food label applied to food served in secondary schools in Greater London will influence adolescents to select healthier food choices`. From the quantitative data results, it can be evidenced that the experimental food score was not effective in changing dietary behaviour.

4.2 Genders and noticing the food score

Hypothesis Two

To test a complex hypothesis: `females are more likely than males to both notice the food score and to self-report that the food score affects their food choices`.

From the data from the food choice questionnaire (outlined in 3.3.2.1), the research sought to detect that there will be an association between gender and noticing the food score in that females' report noticing the food score more than males. Additionally, there will be an association such that females self-report that the food score affected their food choices more than males. The following results from the data are divided into two sections. These sections are, `gender` and `noticing the food score`, and `gender` and the `self-reported effect the food score had on their food choices`.

Question five on the food choice questionnaire asked pupils to tick one answer on a 5-point Likert scale questionnaire as to how much they `noticed` the food score on a scale from 1, indicating `I did not notice the food score` to a score of 5, indicating `I did notice the food score`. Most participants responded at either end of the scale and those answering 2-4, indicating uncertainty, were not included in the following analyses.

Table 4.4 Indicates the gender and frequency of responses to each category of notice the food score

School	*Gender*	*% that selected Score 1*	*Number of responses*	*% that selected Score 5*	*Number of responses*	*Chi Square Value*	** Indicates Significant results*
One	Females	43.5	114	20.2	53	2.31	
	Males	41.4	103	21.7	54		
Two	Females	48.5	66	8.1	11	7.10	
	Males	40.6	78	15.1	29		
Three	Females	57.2	198	15.6	54	1.46	
	Males	56.7	186	18.6	61		
Four	Females	57.7	116	10.0	20	13.14	
	Males	48.3	126	18.0	47		

* Significant at the .05 level.

In School One, 575 pupils responded to the question `Did you noticed the food score`. After removing the incomplete data for gender declaration, 511 complete responses remained. In total 42.4% did not notice the food score and 20.9% did notice the food score. Table 4.4 indicates from the 262 female responses, 114 (43.5%) selected score 1 and 53 (20.2%) selected score 5. From the 249 male responses, 103 (41.4%) selected score 1 and 54 (21.7%) selected score 5. In School One there was a non-significant association between participants gender and participants reporting noticing the food score, χ^2 (4) = 2.31, $p > .05$.

In School Two, 389 pupils responded to the question `Did you noticed the food score`. After removing the incomplete data for gender declaration, 328 complete responses remained. In total 34.8% did not notice the food score and 12.2% did notice the food score. Table 4.4 indicates from the 136 female responses, 66 (48.5%) selected score 1 and 11 (8.1%) selected score 5. From the 192 male responses, 78 (40.6%) selected score 1 and 29 (15.1%) selected score 5. In School Two, there was a non-significant association between participants gender and participants reporting noticing the food score, χ^2 (4) = 7.10, $p > .05$.

In School Three, 744 pupils responded to the question `Did you noticed the food score`. After removing the incomplete data for gender declaration, 674 complete responses remained. In total

57% did not notice the food score and 17.1% did notice the food score. Table 4.4 indicates from the 346 female responses, 198 (57.2%) selected score 1 and 54 (15.6%) selected score 5. From the 328 male responses, 186 (56.7%) selected score 1 and 61 (18.6%) selected score 5. In School Three, there was a non-significant association between participants gender and participants reporting noticing the food score, χ^2 (4) = 1.46, $p > .05$.

In School Four, 528 pupils responded to the question `Did you noticed the food score`, After removing the incomplete data for gender declaration, 462 complete responses remained. In total 52.4% did not notice the food score and 14.5% did notice the food score. Table 4.4 indicates from the 201 female responses, 116 (57.7%) selected score 1 and 20 (10%) selected score 5. From the 261 male responses, 126 (48.3%) selected score 1 and 47 (18%) selected score 5. In School Four, there was a non-significant association between participants gender and participants reporting noticing the food score, χ^2 (8) = 13.14, $p > .05$.

4.3 Genders and the effect the food score had on their food choices

The following results from the data will identify if there is a significant association between gender and the self-reported effect that the food score had on their food choices. Question six on the food choice questionnaire asked pupils to tick one answer on a 5-point Likert scale questionnaire if they `considered` that the food score affected their food choices, where a score of 1 indicated `It did not affect my food choice` and a score of 5 indicated `It did affect my food choice`. Responses from 2-4, indicating uncertainty, were again removed.

Table 4.5 Indicates the gender and frequency of responses to each category of 'self-reporting if the food score `affected their food choices

School	*Gender*	*% that selected Score 1*	*Number of responses*	*% that selected Score 5*	*Number of responses*
One	Females	65.7	167	3.9	10
One	Males	62.2	155	7.2	18
One	Mean		(161)		(28)
Two	Females	53.3	67	5.6	7
Two	Males	50.0	93	7.0	13
Two	Mean		(80)		(20)
Three	Females	63.7	216	7.4	25
Three	Males	67.1	216	5.9	19
Three	Mean		(216)		(16)
Four	Females	59.5	116	4.6	9
Four	Males	49.8	123	8.5	21
Four	Mean		(119.5)		(15)

In School One, 503 pupils responded to the question `Did the food score affect your food choices?` Table 4.5 indicates, from the 254 female responses, 167 (65.7%) selected score 1 and 10 (3.9%) selected score 5. From the 249 male responses, 155 (62.2%) selected score 1 and 18 (7.2%) selected score 5. In School One, there was a significant association between the food score and the effect on food choices, χ^2 (4) = 10.47, $p < .05$. Overall, more males identified that the food score affected their food choices than females.

In School Two, 312 pupils responded to the question `Did the food score affect your food choices?` Table 4.5 indicates from the 126 female responses, 67 (53.29%) selected score 1 and 7 (5.6%) selected score 5. From the 186 male responses, 93 (50%) selected score 1 and 13 (7%) selected score 5. In School Two, there was a non-significant association between pupils' gender and pupils reporting that the food score had a perceived effect on their food choices, χ^2 (4) = 2.89, $p > .05$.

In School Three, 661 pupils responded to the question `Did the food score affect your food choices?` Table 4.5 indicates from the 339 female responses, 216 (63.7%) selected score 1 and 25 (7.4%) selected score 5. From the 322 male responses, 216 (67.1%) selected score 1 and 19 (5.9%) selected score 5. In School Three, there was a non-significant association between pupils' gender and pupils reporting that the food score had a perceived effect on their food choices, χ^2 (4) = 1.36, $p > .05$.

In School Four 442 pupils responded to the question `Did the food score affect your food choices?` Table 4.5 indicates from the 195 female responses, 116 (59.5%) selected score 1 and 9 (4.6%) selected score 5. From the 247 male responses, 123 (49.8%) selected score 1 and 21 (8.5%) selected score 5. In School Four, there was a non-significant association between pupils' gender and pupils reporting that the food score had a perceived effect on their food choices, χ^2 (4) = 5.47, $p > .05$.
In conclusion, there was a non-significant association between gender and noticing the food score from all four schools. In Schools Two, Three and Four there was a non-significant association between pupils' gender and pupils reporting that the food score had a perceived effect on their food choices; however, in School One, more male adolescents identified that the food score affected their food choices than females. Therefore, we can reject the hypothesis `females are more likely than males to both notice the food score and to self-report that the food score affects their food choice`.

4.4 Factors affecting adolescent food choice

Hypothesis Three

To test a complex hypothesis: `adolescents will report that their food choices are more influenced by their peers, than the sensory aspects of food`.

From the data from the food choice questionnaire (outlined in 3.3.2.1), this research sought to identify the factors adolescents classified as important to them when eating at school. In the food choice questionnaire, there were 21 individual factors as listed in Table 4.6. Pupils were asked to tick one answer on a 5-point Likert scale questionnaire as to how important they perceive each factor when eating at school. Each question started with `It is important to me that the food I eat on a typical day at school` (tick one answer from score one, not important, to score five being very important, from each line).

Table 4.6 Indicating the percentage of answers from pupils as to the importance of the 21 factors by both genders

School	*1*	*1*	*1*	*1*	*1*	*2*	*2*	*2*	*2*	*2*	*3*	*3*	*3*	*3*	*3*	*4*	*4*	*4*	*4*	*4*
Likert scale 1-5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Contains vitamins and minerals	16.9	15.2	31.4	17.2	19.2	10.8	5.4	24.3	32.4	27	18.5	13.3	30.8	19.7	17.6	10	10.2	27.3	20.3	32.2
Is nutritious	11.8	12.7	34	22.4	19.2	5.4	2.7	37.8	27	27	14.8	12.5	29.3	23.1	20.3	9.1	8.9	30	20.7	31.3
Is high in fibre	16.7	19	34.4	16.5	13.4	5.7	11.4	37.1	22.9	22.9	21.6	18.5	32.5	15.3	12.1	11.4	15.4	29.7	19.8	23.8
Is high in protein	13.3	16.6	30.4	23.7	16	8.1	5.4	29.7	27	29.7	17.7	16.2	30.5	21	14.6	10.8	9.2	28.1	23.5	28.7
Is low in calorie's	18	16.5	33.6	16.5	15.3	14.7	20.6	20.6	20.6	23.5	19.6	18	32	16.8	13.6	12.9	15.7	30.7	17.9	22.7
Is low in fat	14.9	18.4	29.6	19.5	17.6	16.7	19.4	22.2	22.2	19.4	19	17.1	31.1	18.7	14	12.3	12.9	30	19.1	24.9
Helps me control my weight	17.8	17.8	28.3	15.6	20.7	25	8.3	22.2	13.9	30.6	24	16.9	28.8	14.7	15.4	13.8	13.4	25.1	15.2	28.5
Keeps me healthy	9	12.7	24.1	23.7	30.6	10.8	5.4	21.6	29.7	32.4	12.9	9.6	23.5	24.8	29.2	9.3	8.7	22.3	21.9	37.7
Includes lots of fruit and vegetables	21	19.9	31.2	15.7	12.2	13.9	22.2	27.8	19.4	16.7	21.9	22.2	31.6	12.6	11.7	18.1	16.5	30.5	13.7	21.1
Is what I usually eat	13.9	17.8	32	20.2	15.7	13.9	19.4	27.8	19.4	19.4	17.9	15.1	29.9	20.8	16.3	14.5	11.9	32.5	18.2	22.8
Is cheap	15.1	16.6	20.4	18.4	19.4	25	13.9	27.8	16.7	16.7	15.4	12.7	22.8	19.2	29.9	22.6	12.8	22.2	13.2	29.3
Makes me feel good	13.7	10.9	31.3	19.1	25	16.2	10.8	21.6	21.6	29.7	15	12	28.9	21.1	23	10.6	8.8	26.5	19.7	34.3
Smells nice	13.8	15.4	25	23	22.7	10.8	8.1	18.9	21.6	40.5	15.3	12.1	21.2	25.4	26	11	8.6	25.4	22.6	32.4
Looks nice	10.7	11.4	25.2	26.3	26.4	5.6	11.1	16.7	41.7	25	10.8	9.5	22.6	28.3	28.9	10.2	10.4	21.4	23.6	34.3
Keeps me full	9.3	8.5	22	26.5	33.8	8.1	13.5	21.6	24.3	32.4	9	9	22.9	26.2	32.9	8.8	6.2	22.4	25	37.7
Keeps me awake	19.9	14.9	25.7	19.9	22.6	16.2	21.6	8.1	24.3	29.7	19.5	14.6	23.4	17.3	25.2	14.8	11.8	22.4	20.2	30.8
Has a pleasant texture	15.4	14.1	29	18.8	22.6	13.5	10.8	35.1	16.2	24.3	12.9	14	29.1	21.8	22.2	14.6	11.6	26.8	19.1	28
Helps me cope with stress	33.1	17.6	24	11.1	14.2	35.1	16.2	24.3	16.2	8.1	31.3	17.6	25.3	11.6	14.2	25.7	14.2	23.2	15.8	21
Tastes good	6	5.6	10	21.4	57.1	2.7	8.1	13.5	27	48.6	4.8	2.3	11.5	16.5	64.9	6.9	5.9	17.2	16.2	53.9
Is familiar	19.2	15.7	26.6	20.3	18.2	5.4	10.8	27	35.1	21.6	19	14.8	33.7	17.1	15.4	16.1	9.5	31.6	19.1	23.7
Is similar to foods chosen by my friends	62.1	17	13	4.9	3.1	31.4	14.3	22.9	11.4	20	66.5	15.1	13	3.2	3.2	51.5	14.2	16	7.2	11.2

To test for hypothesis three, the importance to food choice was measured at two conditions, the first being similarity to foods chosen by friends, and the second condition being the sensory properties of food. Sensory properties were measured as a mean score of four factors; tastes good, smells nice, has a pleasant texture, and looks nice.

In School One, results indicated that the median score for the importance of friends (*Mdn* = 1) was much lower than the median score for the importance of sensory properties (*Mdn* = 3.5). Although a Wilcoxon signed-rank test indicated that this difference was statistically significant, $T = 122722$, $Z = -18.207$ $p < .001$, this was not in the predicted direction. Therefore, the hypothesis that `adolescents will report that their food choices are more influenced by their peers than the sensory aspects of food` has been rejected for School One, and the null accepted.

In School Two, results indicated that the median score for friends (*Mdn* = 1) was again much lower than the median score for sensory properties (*Mdn* = 3.75). Again, this was statistically significant, $T = 42847.5$, $Z = -13.161$ $p < .001$, but was not in the predicted direction. Therefore, the hypothesis that `adolescents will report that their food choices are more influenced by their peers than the sensory aspects of food` has been rejected for School Two, and the null accepted.

In School Three, results showed the same pattern, $T = 191673$, $Z = -20.918$ $p < .001$, in the opposite direction to that predicted, with median scores being exactly the same as in School Two (Friends *Mdn* = 1; sensory properties *Mdn* = 3.75). The null hypothesis was therefore also accepted in this case.

In School Four, results also showed the same pattern, $T = 79061{,}50$, $Z = -15.681$ $p < .001$, in the opposite direction to that predicted, with median scores being exactly the same as in School Two and School Three (Friends *Mdn* = 1; sensory properties *Mdn* = 3.75). The null hypothesis was therefore also accepted in this case.

Table 4.6 displays the factors that adolescents from all four schools rated. The factors that all four schools rated as score five were `taste`, `keeps me full` and `keeps me healthy`. A mean figure of 56.1% of pupils from all four schools rated `tastes good` at score five; 34.2% of pupils from all four schools rated `keeps me full` at score five and 32.5% of pupils from all four schools rated `keeps me healthy` at score five. A mean figure of 52.9% pupils from all four schools rated `is similar to foods chosen by my friends` at score one.

In conclusion, while it was hypothesised that similarity to foods chosen by friends would be more important than sensory factors, not only was there no significant difference between these factors, but the medians (see table 4.6) also indicate a trend in the opposite direction, that sensory factors are rated more highly than similarity to friends. The hypothesis that `adolescents will report that

their food choices are more influenced by their peers, than the sensory aspects of food` has been rejected for all schools and the null accepted.

4.5 Gender and importance placed on health and nutrition

Hypothesis Four

1. To test a null hypothesis `there will be a significant association between adolescent gender and the importance placed on health when making food choices`.

The research sought to test for hypothesis four. Health and nutrition included factors; contains vitamins and minerals, is nutritious, is high in fibre, is high in protein, is low in calories, is low in fat, helps me control my weight, keeps me healthy and includes lots of fruit and vegetables.

Table 4.7 Indicates the significant association between gender and reporting on the importance placed on health when making food choices for School One

School One				
Gender	Factors			
M	Is high in protein			
F		Is low in fat	Helps me control my weight	Keeps me healthy

In School One, there was an association between gender and specific health and nutrition factors. From 541 participants (283 female and 258 male), males are more likely than females to indicate that `high in protein` is important to their choices, $\chi2(4) = 12.99$, $p < .05$. From 542 participants (284 females and 258 males), females are more likely than males to indicate that `low in fat` is important to their choices, $\chi2(4) = 12.53$, $p < .05$. Fewer females, 28 (9%) rated this factor as score 1 in comparison to males, 50 (19.4%). From 544 participants (284 females and 260 males), females are more likely than males to indicate that `controlling their weight` is important to their choices, $\chi2(4) = 13.58$, $p < .05$. Less females, 36 (12.7%) selected score 1 in comparison to males, 60 (23.1%). From 545 participants (284 females and 261 males), females are more likely than males to indicate that `keeps me healthy` is important to their choices, $\chi2(4) = 12.01$, $p < .05$.

Table 4.8 Indicates the significant association between gender and reporting on the importance placed on health when making food choices for School Two

School Two					
Gender	Factors				
M	Contains vitamins and minerals	Is high in Fibre	Is high in protein	Is low in fat	Helps me control my weight

In School Two, there was a significant association between gender and specific health and nutrition factors. From 359 participants (148 female and 211 male), males are more likely than females to indicate that `contains vitamins and minerals` is important to their choices, $\chi2(4) = 10.3$, $p < .05$. 63 (29.9%). From the same number of participants and in the same ratio, males are more likely than females to indicate that `high in fibre` is important to their choices, $\chi2(4) = 12.97$, $p < .05$. From 207 males, 59 (28.5%) selected score 5 and score 3 as equally high, whereas from 145 females 56 (38.6%) scored 3 as the highest score. Males are more likely than females to indicate that `high in protein` is important to their choices, $\chi2(4) = 13.6$, $p < .05$. Males selected score five as the highest score, 69 (33.3%), followed by score 4, 58 (28%). Females rated score 3 as the highest score, 47 (32.2%) followed by score 4, 33 (22.6%). Males are more likely than females to indicate that `low in fat` is important to their choices, $\chi2(4) = 18.7$, $p < .05$. From 353 (146 females and 207 males), males are more likely than females to indicate that `helps me to control my weight` is important to their choices, $\chi2(4) = 9.65$, $p < .05$.

Table 4.9 Indicates the significant association between gender and reporting on the importance placed on health when making food choices for School Three

School Three					
Gender	Factors				
F	Contains vitamins and minerals	Is nutritious	Is low in calories	Is low in fat	Keeps me healthy

In School Three, there was a significant association between gender and specific health and nutrition factors. From 689 participants (361 female and 328 male), females are more likely than males to indicate that `contains vitamins and minerals` is important to their choices, $\chi2(4) = 10.4$, $p < .05$. Females are more likely than males to indicate that `is nutritious` is important to their choices, $\chi2(4) = 11.17$, $p <.05$. Females are more likely than males to indicate that `is low in calories` is important to their choices, $\chi2(4) = 9.62$, $p < .05$. Females are more likely than males to indicate that `is low in fat` is important to their choices, $\chi2(4) = 11.09$, $p < .05$. Score 3 was the highest rated score by both genders, 109 (30.6%) females and 101 (31.6%) males. The second highest score by females, 82 (23%), was score 4 but males, 70 (21.9%) second score was score 1. Females are more likely than males to indicate that `keeps me healthy` is important to their choices, $\chi2(4) = 21.38$, $p < .05$. Females, 116 (32.5%) highest selected score was score 5 followed by 101 (28.3%) that selected score 4. Males, 91 (28.1%), highest selected score was 3 followed by 83 (25.6%) that selected score 5.

Table 4.10 Indicates the significant association between gender and reporting on the importance placed on health when making food choices for School Four

School Four			
Gender	Factors		
M	Is high in protein	Is what I usually eat	Looks nice

In School Four, there was a significant association between gender and specific health and nutrition factors. From 498 participants (218 females and 280 males), males are more likely than females to indicate that `is high in protein` is important to their choices, $\chi2(4) = 11.49$, $p < .05$. From 491 participants (215 females and 276 males), males are more likely than females to indicate that `is what I usually eat` is important to their choices, $\chi2(4) = 19.99$, $p <. 05$. From 495 participants (217 females and 278 males), males rate `looks nice`` significantly more highly than females, $\chi2(4) = 11.29$, $p < .05$.

4.6 Summary of gender differences

In all Schools there was a non-significant association between gender and the importance placed on health. In School One, males rated `high in protein` significantly more highly than females, but males did not significantly rate any other factor. In School One, females rated `low in fat` `controls my weight` and `keeps me healthy` significantly more highly than males. In School Two, males rated `high in vitamins and minerals,` `high in fibre,` `high in protein,` `low in fat` and `controls my weight` significantly more than females. In School Two, females did not significantly rate any factor higher than males. In School Three, females rated `high in vitamins and minerals,` `is nutritious,` `is low in calories, `is low in fat` and `keeps me healthy` significantly more highly than males. In School Three, males did not significantly rate any factor higher than females. In School Four, males rated `high in protein,` `is what I usually eat` and `looks nice` significantly more highly than females. In School Four, females did not rate any factor more highly than males.

The commonalities from each school between the genders and specific factors are not conclusive. In School One, School Two and School Four the data suggest that male's rate `high in protein` significantly more highly than females; however, results from males in School Three do not identify with this factor. Females in School One and School Three and males in School Two rate `low in fat" significantly more highly than the other genders at each school. Females in School One and females in School Three rate `keeps me healthy` significantly more highly than males, but there were no significant results from

School Two or School Four. All other factors as identified in Table 4.6 were not significant regarding gender differences. The thesis can reject the hypothesis `there will be a significant positive association between adolescent gender in food choice and the importance placed on health` and the null accepted.

Chapter 5: Qualitative results from the focus groups

This chapter presents the qualitative results from the focus groups. Each focus group (both pre- and post- the intervention) were asked the same semi structured questions (further information is in section 3.2.4). Both pre- and post-intervention semi structured guides are in Appendix M1 and M2. In most schools the participants who took part in the pre-intervention focus group were not the same as participants in the post-intervention focus groups. All participants in the pre-intervention focus groups were asked to describe the factors that have the greatest influence on their food choices and to expand on their reasons for this influence. All participants in the post-intervention focus groups were asked if they noticed and understood the experimental food score and if they thought that the food score influenced their food choice behaviour. A total of 99 participants took part in thirteen focus groups as outlined in Table 3.18. From the 99 participants, 61% were female and 39% were male; no ages or ethnicities were identified or recorded (further information and participant recruitment is presented at section 3.2.4).

5.1 Themes associated with adolescent food choice behaviour

Thematic analysis (described in section 3.5.2) established that adolescent food choice behaviour in a secondary school setting was underpinned by three themes of, HEALTH, WHY THESE FOODS and THE ENVIRONMENT (Table 5.2).

Theme One, HEALTH, comprised of four *sub themes*, *(i) The experimental food label, (ii) Food labels, (iii) Nutritional knowledge,* and *(iv) The meaning of food. Sub theme (i) The experimental food label* revealed that most participants did not receive their post cards in the awareness phase (further information of the awareness phase is in section 3.2.5) and therefore did not understand the purpose of the experimental food score. *Sub theme (ii) Food labels* disclosed a lack of consensus regarding the most popular FL design, but many participants would like some form of FL to be applied to food served at school. *Sub theme (iii) Nutritional knowledge* revealed that nutritional education at school is delivered in food technology in year seven; yet adolescents infer that their knowledge is principally shaped by their parents. *Sub theme (iv) The meaning of food* demonstrated how adolescents negatively categorise unhealthy food.

Theme Two, WHY THESE FOODS, comprised of three *sub themes*, *(i) I like, (ii) The social environment* and *(iii) Mood. Sub theme (i) I like* revealed that flavour, the appearance of food and familiarity have the greatest influence on adolescents' food choices at school. Females prefer sweet foods and males choose main meals and meat dishes. *Sub theme (ii) The social environment* established that adolescents report that friends do not affect their food choices; however, friends can impact on the

category of foods selected to enable pupils to have more time to socialise. *Sub theme (iii) Mood* disclosed that adolescents associate main meals and carbohydrate foods with hunger; females expressed that sweet, warm, foods make them feel good, whereas males prefer heavy or fried foods. Both genders specified that energy drinks keep them awake.

Theme Three, THE ENVIRONMENT, comprised of three *sub themes*, *(i) School, (ii) Break times* and *(iii) The caterer. Sub theme (i) School* exposed that the length of the queues, and the pressure of exams, greatly influences adolescents` food choice and that more choices of healthy `food on the go` could be of benefit to the school and to adolescents. *Sub theme (ii) Break times* disclosed that main courses were the most popular food choice, and that the mid-morning break is associated with a greater variety of snack foods. *Sub theme (iii) The caterer* revealed the importance of both the position and the presentation of the food item on adolescent food choices.

Table 5.1 Thematic analysis of factors that affect adolescent food choices at school

Theme One	*Sub theme*	Categories	Description FEMALE	Description MALE
HEALTH	*(i)* *The experimental food label*	Awareness phase	I think I had a post card I kind of understood it	I didn't understand it
			We did not get the post card	
		The food score	I did not understand the food score - it was confusing They were too small I didn't know there was a food score Use technology to give a monthly score	It was on some foods but not on others 1 is healthy 10 is food to eat on occasions
			1-10 is better We will still choose foods we like	
	(ii) *Food labels*	Food label design	Symbols are easy to see but must be visible A solo label is straight forward Unaware of daily calorie needs	A simple tick would have a massive impact
			More kids would engage with the physical activity label Red don't eat it, green is good	
		Effect on food choices	It would not affect my food choices It depends if you care about what you eat	There is no information at school we need to be made more aware
	(iii) *Nutritional knowledge*	Categories	Description FEMALE	Description MALE
		The role of school in education	Nutrition is taught in primary school The Eatwell Guide in food tech year 7	
			Focus messages on positive eating	
			A week of workshops, active days with experts to tell us the benefits	
			Nutrition is learnt from parents	
		We know	Chicken is a protein food	
			We get our sugar knowledge from food labels	We use sugar apps and watch documentaries
			Pepperoni pizza is high in fat but it tastes good so we will still eat it	
			Sausages and chips are high in salt, but they taste good	
			Fibre is on the food label	
	(iv) *The meaning of food*	Categories	Description FEMALE	Description MALE
		Unhealthy food	Over the top food Sugar and fat	Food you eat for the sake of eating Revolting, hate, butters, normal food Fatty, greasy, more fat and carbs than you need
			Unhealthy, bad, junk, fast food	
		Stereotype eating by gender	Genders eat in accordance with body size and emotions	Males eat more and eat bigger portions
			Males eat more meat	Females eat more salad Women do weight watchers
			Males know about protein, they do more sports, lift weights to build muscle	Males are pressured to lift weights to look bigger
Theme Two	*Sub theme*	Categories	Description FEMALE	Description MALE
WHY THESE FOODS	*(i)* *I like*	Taste	Food that is eaten often	Food that will be eaten again
			Taste is flavour and seasoning	
		I like these foods	Sweet foods, sponges, custard Pasta, pizza, Simple, not posh, quick, and easy food	Main meals, hot food, chicken, meat, burgers Simple food
			Vegetables	

			Familiar foods that I have tried before Safe food choice	
		Appearance	It must look good, neat not messy	It must be colourful
	(ii) *The social environment*	Categories	Description FEMALE	Description MALE
		Friends	Food choices are not affected by peers	
			Food choices are planned to socialise Togetherness	
			If my friends like it, I will try it	Food envy
	(iii) *Mood*	Categories	Description FEMALE	Description MALE
		Hunger	Pasta, jacket potato Hot meals Fill me up Fruit is just not filling Carbohydrates and starchy foods	Hot meal and pudding Pizza, baguettes Filling Bigger portions we eat a lot
		Feel good food	Sugary foods, chocolate, warm food	Heavy foods, fried foods, and curry
		Foods that keep them awake	Energy drinks, caffeine, coffee	
Theme Three	*Sub theme*	Categories	Description FEMALE	Description MALE
THE ENVIRONMENT	*(i)* *School*	Queues	Queues take up most of the break time Queueing means you have no time to socialise I will miss eating any food just to be with my friends	
		Exams	Food choices are compromised as exams take precedence	
		Food on the go	More freedom to do as you want The school doesn't let you take out hot food	
	(ii) *Break times*	Categories	Description FEMALE	Description MALE
		Breakfast	Eat before I learn	Energy to start the day
		Mid-morning	More variety of snacks	
		Lunch	More time to eat Food choices are more filling	
			When we are most hungry Hot meals, main meals, best choices Sell better food	
	(iii) *The caterer*	Categories	Description FEMALE	Description MALE
		Position and the presentation of the food	It must catch your attention Make a quick decision Pick the first thing you see	
			Fruit section is in one position, and it is the busiest Fruit in bowls does not look good	
			It is all about the presentation Sliced watermelon shards, pineapple, grapes look good	
		Not enough food	Teachers take the salad Make more food	
			At the end the food runs out	

5.2 Theme One: HEALTH

Theme One, HEALTH, comprised of four *sub themes*, *(i) The experimental food label, (ii) Food labels, (iii) Nutritional knowledge* and *(iv) The meaning of food.*

5.2.1 Theme One: HEALTH, sub theme *(i) The experimental food label*

Theme One, HEALTH, disclosed *sub theme (i) The experimental food label* which embraced two categories, the awareness phase, and the food score. The descriptions revealed that most participants did not receive the post card which was the major component of the awareness phase and that most participants did not understand the purpose of the food score.

Table 5.2 Thematic analysis indicating the subtheme: *The experimental food label*

Theme One	*Sub theme (i)*	Categories	Description FEMALE	Description MALE
HEALTH	*The experimental food label*	Awareness phase	I think I had a post card I kind of understood it	I didn't understand it
			We did not get the post card	
		The food score	I did not understand the food score - it was confusing They were too small I didn't know there was a food score Use technology to give a monthly score	It was on some foods but not on others 1 is healthy 10 is food to eat on occasions
			1-10 is better We will still choose foods we like	

5.2.1.1 *Sub theme (i) The experimental food label:* Awareness phase

For sub theme *(i) The experimental food label,* participants were asked about the awareness phase (detailed in 3.2.5) and the food score (detailed in 3.2.2). The awareness phase comprised of a tutor pack which consisted of a tutor information sheet and a post card for each pupil. The tutor was asked to read the information as to how the food was scored (Appendix U) and hand each pupil a post card detailing how to understand the food score (Appendix V). Posters depicting identical information as the post card were displayed in the restaurants (Illustration 3.1).

Participants were asked if they had received their awareness post cards in tutor time and if they had understood it. In School One and School Four, all participants in each focus group claimed that they had not received a post card from their tutors. In School Two and Three, most participants stated that they had not received the post cards, a few had, and a small number of participants were uncertain.

> *can't remember (23FE3: p. 99; L3181)*
>
> *don't think so (23FP2: p. 99; L3182)*

When asked if they understood the post card, participants were vague, `a little`, `kind of` and `not really`.

it was confusing (33FP6: p. 114; L3670)

not at all (34MF5: p. 124; L3991)

Posters depicting `understand your food score` (Illustration 3.1) were placed in all schools' restaurants. The placement of the posters differed in each school due to the school`s policy of information allowed to be displayed on the walls (See 3.2.5). Adolescents' responses suggested that the posters were ineffective as no one noticed them. Only a few said they had seen the poster; others were not sure.

A little bit (34FJ1: p. 124; L3995)

It can be suggested that the awareness phase was ineffectual. Therefore, this possibly led to a misunderstanding of the purpose of the food score.

5.2.1.2 *Sub theme (i) The experimental food label:* The food score

For sub theme *(i) The food score,* participants were asked if they had noticed the food score and if they considered the food score influenced their food choices. The food score was positioned either next to certain food items (as shown in Illustration 3.2) or on top of the sneeze screen (as shown in Illustration 3.3) or When participants were asked if they had noticed the food score, they implied that the food score was too small and that there were inconsistencies in the positioning of the score.

They were like quite small actually like on the counters you didn't really take much notice (34FR4: p. 124; L3996)

somethings I understood but some things it wasn't there. So, on the main dishes I didn't see it but on like the little fruit pots I could see it (23MT4: p. 100; L3198)

There was a lack of awareness regarding the food score, and some participants were oblivious as to its presence.

are they card with numbers like 85? I didn't know what they were about (43FS8: p. 133; L4296)

I didn't know this food score existed until now (23FP2: p. 100; L3208)

Participants were asked if they considered that the food score had influenced their food choices. Only female participants expressed how the food score made them feel.

The higher the number made you feel weird buying it; it was a bit confusing at the start. But I guess we have had it for a while now, so we have got used to it (13FC6: p. 88; L2838)

it kinda of made me feel like I should like eat kinda of eat healthier, it did kinda work, but it did make me feel like I should be eating something a little more healthier (13FC6: p. 89; L2843)

One male suggested that there were some small changes in his food choices.

a little but not much (23MA6: p. 99; L3190)

Responses also indicated that the food score did not change their food choices.

I don't think it would change what people would eat, like I only like specific things in the canteen so if some of the food scores were low, I wouldn't change what I eat and what I like (23FE3: p. 100; L3225)

they would still choose what their gut feeling tells them to pick. I don't really think it would change the way they eat (43FH7: p. 134; L4325)

One male participant stated that he understood the food score, but it would not affect his food choices.

Yeah, but nobody cared about it (23MK7: p. 99; L3186)

There were suggestions that the food score should be from one to ten. The score of `one` being the best food choice and the score of `ten` indicates that the food is a less healthy choice. Females wanted to use the food score with their phones and calculate a total score for the week. However, this was not possible as pupils are not currently allowed to use their mobile phone at school.

I would think so because instead of 100 which sometimes can go into percentages then 1-10 it tells you straight forward how healthy the food is rather than 100 (23MF6: p. 101; L3250)

A few responses suggested that participants interpreted the food score as calories.

I think 1, as in calorie wise 1 is the lowest and 10 would be the highest (23MT4: p. 101; L3254)

Yeah, I agree with that like if a food is bad for you its normally got more calories so like change it round it's kind of confused people to pick up something that's like 1 thinking it's really good for them just because they think the lower the numbers are .. (34FJ1: p. 125; L4036)

The researcher explained how the food score was calculated and then asked participants retrospectively if they felt it would affect their food behaviour.

Yeah, if it was there, I would look at it (34FS8: p. 125; L4034)

if I understood what it was and how it affects us, then yeah probably (33MQ7: p. 114; L3684)

To recapitulate, the awareness phase was unsuccessful in informing participants as to the aim of the nutritional food score or how the food score was calculated. Therefore, the food score was not

understood by most pupils which could suggest that the lack of understanding could be one reason why the food score did not influence them to select healthier food choices. Some participants implied if they had understood the food score it could have prompted a change in their food choices. Opposing this, other participants specified that the food score would have no effect on their food choices because they will select foods that they like to eat. Yet, some participants agreed that they would like some form of guidance in the form of a FL as to which are the healthier food choices on offer at school.

5.2.2 Theme One: HEALTH, *sub theme (ii) Food labels*

Theme One, HEALTH, disclosed *sub theme (ii) Food labels. Food labels* embraced two categories, food label design, and the effect of a FL on food choices. The descriptions revealed a lack of consensus regarding both the design of a FL in a school setting and if a FL would influence their food choices.

Table 5.3 Thematic analysis indicating the subtheme: *Food labels*

Theme One	*Sub theme (ii)*	Categories	Description FEMALE	Description MALE
HEALTH	*Food labels*	Food label design	Symbols are easy to see but must be visible A solo label is straightforward Unaware of daily calorie needs	A simple tick would have a massive impact
			More kids would engage with the physical activity label Red don't eat it, green is good	
		Effect on food choices	It would not affect my food choices It depends if you care about what you eat	There is no information at school we need to be made more aware

5.2.2.1 *Sub theme (ii) Food labels:* Food label design

There is a plethora of FL designs and this study sought to determine which FL design would potentially guide adolescents to select healthier food choices. Participants were handed a chart with a range of images of front of pack (FOP) designs; these included a summary design, a graded summary design and a nutrient specific design (Appendix A, B, G and H), and a physical activity design Figure 3.

Participants who preferred the physical activity FL identified it to their sport. The physical activity calorie equivalent (PACE) displays a picture of a person with the number of minutes walking (or other activity) to burn off the kilojoules in a serving of that food (Hartley, Keast and Liem, 2018).

> *I go on a run once a week so I can see here if I have a ham sandwich and go on a 23-minute run I can burn it off (13FT5: p. 89; L2873)*

One participant felt that the physical activity would appeal to *`kids`* whilst only females suggested that portraying calories could result in people counting calories and therefore restricting their eating. Generally, there was a lack of agreement regarding displaying calories on food on offer at school. There was a suggestion that it was important to know how many calories you need to burn off when doing an activity, whereas others disagreed, and some did not know how many calories they need daily.

> *I don't know how many calories I eat a day, but I think I am healthy with the amount I eat so it doesn't really come to my head (13FC6: p. 89; L2869)*

One female suggested that displaying calories would be detrimental.

> *I think it could lead to people counting calories and restricting themselves (34FS8: p. 125; L4028)*

There were also mixed reactions regarding the use of single symbols as FLs.

> *I`d say like mainly do an icon like a star is good for you and a broken heart is bad for you (23FA3: p. 113; L3642)*

Other pupils stated that this was *`cheesy`*. However, a thumbs up and a thumbs down was approved by many participants with the stipulation that the symbol had to be big enough on the food to be noticed. In School Four, there was the most discussion and variation as to the preferred design. Four participants favoured the `choices` symbol because it is simple with nothing to read. Two participants selected the `guiding stars`. Two participants preferred the `traffic light` because it provided comprehensive nutritional information, but this was contended because most participants inferred that the traffic light design was too complex.

> *I don't think we are going to look at the traffic lights and read them and if we just look at these we will see that yes this is healthy and I think because of our age we are not really concerned about going that deep into how healthy it is and what about it is healthy (43FS8: p. 138; L4469)*

Despite the array of FL designs, there are no known published studies that identify which design influences adolescent food choices in secondary school the most. Whichever FL design is selected, it is important to consider both the school restaurant environment which offers numerous food options, limited counter space to display the FL and it is a time pressured environment.

5.2.2.2 *Sub theme (ii) Food labels:* Effect on food choices

When asked in general if a FL will influence their food choices some participants suggested that it

depends on several factors, one of these factors being that some people might not care about healthy eating.

> *It depends, what school and what environment you are in, because some signs some people do not understand because it is too complicated, and some people are not bothered and do not care about healthy eating, so it depends (43FH2: p. 137; L4418)*

Another factor could be if you are interested in health.

> *it sort of depends on the type of person that you are, like if you are somebody who doesn't really care about what you eat (33FP6: p. 115; L3689)*

Others suggest that knowledge is not necessarily translated into a change in behaviour.

> *it is because we know it is really important for us, but when it comes to it, we don't really do it. (43FE3: p. 139; L4495)*

Participants were asked whether they would be interested in designing their own FL and if they felt that this would influence their eating behaviour. Participants were united in that designing their own FL would have no impact on their food choices.

To summarise, a single symbol was the favoured design to influence healthier food behaviour, but there was no consensus as to which one. Participants who chose the physical activity design implied that they have more interest in sport, but there were mixed reactions towards displaying calories. Whichever design participants state they `*prefer*` will not necessarily change their eating behaviour because eating comprises of many levels of influences. According to Grunert et al., (2010) and Campos et al., (2011) there is a strong correlation between consumers that use a FL with being better educated, even though this does not indicate that this will change behaviour. This questions how adolescents are taught about nutrition and what role the school has in educating them.

5.2.3 Theme One: HEALTH, *sub theme (iii) Nutritional knowledge*

Theme One, HEALTH, disclosed *sub theme (iii) Nutritional knowledge* which embraced two categories, the role of school in nutritional education, and we know. Participants stated that they learn about healthy eating at primary school and learn about the Eatwell Guide in food technology at secondary school. The Eatwell guide is a diagrammatic circle that depicts how much food should be consumed from each food groups to achieve a healthy balanced diet (NHS, 2019) (Appendix E). However, most nutritional knowledge was reported as being attained from their parents. Participants have a limited amount of nutrition knowledge, some of which is gained through FLs, documentaries, technology, and the media.

Table 5.4 Thematic analysis indicating the subtheme: *Nutritional knowledge*

Theme One	*Sub theme (iii)*	Categories	Description FEMALE	Description MALE
HEALTH	*Nutritional knowledge*	The role of school in education	Nutrition is taught in primary school The Eatwell Guide in food tech year 7	
			Focus messages on positive eating	
			A week of workshops, active days with experts to tell us the benefits	
			Nutrition is learnt from parents	
		We know	Chicken is a protein food	
			We get our sugar knowledge from food labels	We use sugar apps and watch documentaries
			Pepperoni pizza is high in fat but it tastes good so we will still eat it	
			Sausages and chips are high in salt, but they taste good	
			Fibre is on the food label	

5.2.3.1 *Sub theme (iii) Nutritional knowledge:* The role of school in education

The descriptions in the category the role of school in education identified the primary school as the first point of their nutritional education.

> *…mixture as you get information from your parents, and you get information from school as well. Like from the lower years you get your information especially from primary school (13FC6: p.92; L2949)*

One participant implied that this knowledge from primary was discussed with the family.

> *As 13FC6 said like primary schools. My little sister is doing stuff when she has got to fill in a chart and she is telling us basically what they have done. They told her green is good and red is bad. So, they know when they buy food in the bottom corner it says sugars and it says 5 and its orange and fat and it is 0 and it is green, so my little sister is checking (13FT5: p. 92; L2953)*

One participant detailed that they planted vegetables in primary school, but no one else mentioned this.

> *mostly I learn from my parents and sometimes in lessons in primary we did all sorts of planting vegetables in the garden (33FH4: p. 119; L3830)*

Another participant suggested that nutrition is taught at primary because that is the time to concentrate.

> *I think maybe around year 5 to year 6 to year 7 to year 8 because that is the time when we are actually growing and that is the time when we start concentrating (43FS8: p. 141; L4567)*

This was disputed by other participants who suggested that at secondary school you need to be more focused on your GCSE`s but stated that the issue is that you cannot retain this knowledge from primary school and implement it at secondary school.

yeah, a bit because it is the nature of teenagers to rebel and forget what they kinda learn in primary, especially in primary as it is such a young age and when you walk into secondary it all goes in the bin and it's all kinda gone (43FS2: p. 142; L4576)

Several participants recalled that they were forced to eat all their food at primary school, and that there is greater freedom over their food choices at secondary school.

I remember in my primary school they used to force us like to eat, they introduced this new thing year, think it was 'cos of Jamie Oliver, first they make us stop having ketchup yeah and then like in year 5 they introduced this new rule where they forced us to have vegetables like we had a salad bar yeah and they forced us to put vegetables on it and we weren't allowed to leave until we ate like a substantial amount of vegetables. And that had a bad effect on me 'cos when I came to secondary school, I literally just choose whatever I wanted, and I literally didn't have vegetables (23FP2: p. 105; L3364)

There appears to be a disjointed approach towards nutritional education at secondary school. One participant recalled learning about food in geography at secondary school.

I got taught it in primary and I just sort of remembered it as we don't really get taught it, we had like a project in geography where we did food. We were doing the food- where it is from, how it is made and the economics of it and we also looked at the nutrition, so it sort of just slips into lessons sometimes (33FA1: p. 118; L3793)

Some stated that they had learnt nutrition in science.

'cos in science lessons they dedicated topics to learn all about food, like I remember this year in science we learnt about like what foods are most important and even did this food pyramid which said that carbohydrates are like important, so is protein, and we should have sugar less. They basically teach us like, our science teachers basically become dieticians and they lead us as to what we should be putting in our bodies and what is good for what will help us grow (23FP2: p. 103; L3314)

Food technology was the most cited source of nutritional education. Education centred around the Eatwell Guide, but from participants' responses the guide was neither effective nor memorable.

we did have some food plate diagram things (13MJ7: p. 93; L2981)

the eat well plate then that was in food tech and in science they had like the food table it was like a circle and half of it was meat and it shows you the type of food (33MQ7: p. 118; L3810)

It's like the food pyramid, it's a big pyramid and it's broken into sections. So, at the top you have sugars which is a small section and then below it it's like carbohydrates and fruit and veg so it's kind of like a triangle (13FT5: p. 92; L2970)

In School One, a few participants talked about food pyramids being taught in science. Pyramids were first introduced in Sweden in 1972; later the USDA introduced a food pyramid in 1992 (Smallwood, 2013). In the UK, the balance of good health was launched in 1994, updated to the Eatwell plate in 2007 and currently known as the Eatwell Guide 2016 (British Nutrition Foundation, 2016b). Participants want nutritional education to be more practical and less passive.

also, when people are learning the eat well cycle it was mostly bookwork, so looking at it drawing it out the teacher teaching you, like I think the way people would learn it more if it was more practical. Like if say you look at the food and you do something to the food like measure how much sugar a food has got. So more practical (33MQ7: p. 119; L3838)

Other participants suggested that food technology lessons need to be healthier as there is more focus on sweet foods than main meals.

in food tech we did more deserts, like we did a fruit salad, but we did more deserts than we did actual main dishes or fruit stuff. So, think it would be better if you did more healthy food in food tec so when you do it you kind of want to do it at home if you like it. So, if we did more stuff like that people would want to eat it more (33FP6: p. 119; L3845)

When asked about how adolescents are taught about nutrition, many stated that they were demotivated with negative messages, and they want education to focus on positive messages towards health.

if you focus more on the positive it will kind of, go in more as we are just told the negatives and it becomes just a repetitive cycle of being told this is what happens, and you get nothing positive, so it doesn't motivate anyone to really take part in it (33FA1: p. 119; L3835)

I think sometimes to get us to eat healthy, you need to focus on the positives rather than the negatives, cause if you talk about how bad it is for you people could get quite scared that they are eating the wrong stuff (33FM6: p. 116; L3752)

more people talk about carbohydrates and fats, and someone would say don't eat that it has too much fats in it, so you don't really point out the good stuff so you see someone eating a vegetable pizza with lots of vegetables on, they would go it's got lots of vegetables on but people would go its full of fat and stuff. So, people point out the bad stuff (13FT5: p. 95; L3046)

There was a suggestion to have an active day or a week of workshops by experts to tell them the benefits of healthy eating.

> *I think we should have a whole week where it is just like a whole week and it is just workshops teaching children and nutrition and stuff and I feel like people should come in, like experts, and should teach children and make power points about why it is important for like you to eat healthy and the benefits that could come with it (23FP2: p.106; L 3411)*

Only one male wanted to see a negative message.

> *if you let people know about the consequences that is going to come after eating not healthy food, like in the canteen you should put little messages saying like if you eat too much of this you could get heart attack (23MS1: p. 104; L3358)*

Other participants disagreed with negative messages and stated that no one would see these messages as they are in a queue and are hungry.

Not all participants were interested where they gained their knowledge from.

> *I don't really care I just eat what I eat to be honest (34MC5: p. 126; L4066)*

Despite the disjointed approach to educating adolescents in nutrition most participants stated that they get their knowledge from their parents.

> *my parents and also last year we did this food table or whatever it is, with the protein and those types of stuff, like vitamins, in science. It was like this one is healthy, I forgotten what it is I don't remember it (33MQ7: p. 118; L3806)*

> *I get it from my parents, but we also did it in science with that food plate thing. Also, when I am bored, and I am drinking a bottle of water or eating a packet of crisps I have a look at the label and see what is in it. (33FM8: p. 118; L 3818)*

However, this is not to say parents know about nutrition themselves.

> *at home with my mum if I put a little pinch of salt my mum says don't put any more salt on those chips or whatever I am putting it on as I think salt causes diabetes (23MT4: p. 108; L3496)*

The results from the questionnaire on their nutritional knowledge (as outlined in section 3.2.2.1) were read to each schools focus groups to ascertain what and how they know about food and nutrition. An example of one question in the questionnaire was `do you think these foods are high or low or do not know in protein? ` Then there was a list of foods, chicken, cheese, fruit, baked beans, butter, and cream. The results from each school were read to the focus groups. As an example, 86%

of the pupils at your school knew that chicken was a high protein food, so how did you know that chicken was a high protein food?

5.2.3.2 *Sub theme (iii) Nutritional knowledge:* We know

Most participants in each school knew that chicken was high in protein, but they did not know that cheese or beans were high in protein. When asked how they knew that chicken was high in protein they stated that chicken tastes good and that meat and chicken are always depicted as a protein food in any food guide.

> *because in the food chart they usually show like meat for protein not eggs and stuff (23MF6: p. 107; L 3463)*

One participant knew that beans were high in protein because of the advert on television.

> *I know that beans is high in protein cause straight away I thought of the Heinz add on TV, the dad is like I have eaten loads of chicken and the mum was like or we could eat a pack of Heinz beans. So, I know beans are high in protein cause of the advert (23FE2: p. 108; L3469)*

Participant`s implied that their knowledge of sugar was acquired through media via the Change for Life sugar app. The free app is developed by Public Health England and works by scanning the bar codes of food products which shows the total sugar, saturated fat, and salt (Public Health England, 2015). The aim is to visually illustrate the number of sugar cubes in each product.

> *kinda, people keep telling us about sugar and about apps to check for sugar and how much sugar is in what products (23MA6: p. 106; L3427)*

> *change for life change it changes items like sugary items like a can of coke into blocks of sugar and it tells you how much sugar is in it so that makes you worry a bit (34MD2: p. 129; L4143)*

Participants implied that they knew that consuming excess sugar is unhealthy. Their knowledge is gained from Netflix and documentaries on television.

> *for a science lesson and you are watching documentary about it you normally learn a bit more, cause when you're in class and the teacher is teaching about it, it is normally the same thing over and over again, but when we watched a documentary, they will be really into it. (33MQ7: p. 120; L3868)*

Some participants think that if you taste a food and it is sweet it is obvious that it contains sugar.

It can be suggested that adolescent's knowledge of sugar is good, and interaction with technology to gain knowledge is a possible way forward to learn about nutrition. However, adolescents' knowledge of salt was limited, and participants inferred that salt is seldom discussed. Some participants knew

that salt is in preserved meats such as bacon, and sausages and others knew that salt is often added to chips, but their knowledge does not override `taste` because they will eat chips anyway because chips taste good.

> *nobody really knows about salt as we thought it was diabetes and stuff like that, but that's sugar. I heard that salt increases cancer and something especially when it is on microwaved popcorn, but I don't know that could be something different (23FE2: p. 109; L3515)*

Additionally for salt, fibre was also not fully understood but it was described as food such as cereals or bread.

> *I always see high in fibre, but I don't even know what it is about (23FE3: p.109; L3525)*
>
> *the only place in see fibre is on bread, like the 50/50 ones (23MF6: p. 109; L3526)*
>
> *fibre helps you to clean away rubbish, your waste products. It helps you to get rid of it. Weetabix and that. I learnt that in my sports day class. Weetabix even says on the box high on fibre (43FH2: p. 144; L 4676)*
>
> *I had a fibre bar in my lunchbox, and I was eating it and my friend said don't eat fibre it is full of crushed tablets you shouldn't be eating that. So, I think people of our generation do not have a proper understanding of it because I knew what I was eating, and I knew it didn't have crushed up tablets in it, but my friends clearly don't. (13FZ3: p. 94; L3040)*

In summary, for *sub theme (iii) Nutritional knowledge*, adolescents' nutritional education in England is covered in food technology in year seven, eight and nine at secondary school. Education is centred on the Eatwell Guide which is seldom cited correctly. Adolescents were critical regarding passive teaching and implied that food technology requires a greater practical application with more focus on preparing healthy food dishes. Participants would like to gain their nutritional information through positive messages rather than negative messages and would like nutrition to be delivered through workshops or by experts in the field. However, many participants gain their nutritional information from their parents which may not be accurate. It could be suggested that there is a need to develop a practical nutrition curriculum and if adolescents` nutritional knowledge improves it could empower adolescents to select healthier food choices through understanding how to read a FL. Overall participants' knowledge of food groups was limited but they did engage with the internet, media and some stated that they do look at FLs. However, adolescents' preferred food choices are often associated with poor nutrition, and unhealthy food; therefore, participants were asked how they classify and describe unhealthy food.

5.2.4 Theme One: HEALTH, *sub theme (iv) The meaning of food*

Theme One, HEALTH, disclosed the *sub theme (iv) the meaning of food,* that embraced two categories, adolescent's terminology of unhealthy food, and stereotype eating by gender. The descriptions revealed that adolescents consider unhealthy food in a negative manner, and they believe some categories of food and certain behaviour to be gender specific.

Table 5.5 Thematic analysis indicating the subtheme: *The meaning of food*

Theme One	*Sub theme (iv)*	Categories	Description FEMALE	Description MALE
HEALTH	*The meaning of food*	Unhealthy food	Over the top food Sugar and fat	Food you eat for the sake of eating Revolting, hate, butters, normal food Fatty, greasy, more fat and carbs than you need
			Unhealthy, bad, junk, fast food	
		Stereotype eating by gender	Genders eat in accordance with body size and emotions	Males eat more and eat bigger portions
			Males eat more meat	Females eat more salad Women do weight watchers
			Males know about protein, they do more sports, lift weights to build muscle	Males are pressured to lift weights to look bigger

5.2.4.1 *Sub theme (iv) The meaning of food:* Unhealthy food

Story et al., (2002) identified the meaning of food as being a dichotomization between two groups of foods; those that are healthy and those that are unhealthy. Unhealthy food was associated with friendship, weight gain, pleasure, independence, affordability, and guilt. Healthy food was linked to family meals and being at home. Participants were asked what terminology they apply to food that is not healthy. Participants suggested that these were foods that are excessive.

> *probably like over the top food (22FZ4: p. 42; L1378)*

> *stuff like more than you need inside it (31MZ8: p. 57; L1861)*

Participants used short words such as `*unhealthy*`, `*bad*` *and* `*junk*`, although only one male participant referred to food that is not healthy as `*normal food*`.

> *I just call it bad food (31FU5: p. 57; L1866)*

> *I just think its revolting (32MR1: p. 61; L2002)*

Participants also used words that described the nutrient content

> *like more fat or more carbs, than you need. (31MZ8: p. 57; L1861)*

> *like food high in too much sugar and fat (22FZ4: p. 42; L1378)*

It can be suggested that most participants self-report unhealthy food in a negative manner, but they do associate food behaviour and categories of food with stereotype eating by gender.

5.2.4.2 *Sub theme (i) The meaning of food:* Stereotype eating by gender

Participants were asked if they thought that people who identify with being male or female eat differently to each other. Males suggested that males eat more food and bigger portions of food than females.

> *I don't know really, maybe portions sizes like men would normally go for bigger portion sizes. Normally if you go in restaurants, you see men with bigger portions (12MA1: p. 14; L455)*

This was disputed by one male who suggested that females eat more than males.

> *if I'm honest I think girls eat more than boys like they take - I've seen like in front of me I was taking something small well I thought I was getting something quite big and it's not the girl in front of me got twice as much as me (31MZ8: p. 53; L1738)*

Females contended this point and stated that genders do not eat differently or consume a larger portion because eating is down to emotion or the person`s physiology.

> *erm just depends on what the person is feeling on what they will eat it doesn't matter what gender they are (11FZ3: p. 4; L126)*

> *I don't think it depends on gender, but I think it depends on how big they are they might need to eat more food if they're bigger (31FU5: p. 53; L1747)*

One female suggested that the reason girls eat more is because males want to play football; therefore, males eat at the mid-morning break. This can be linked to the preferred time to eat, where 83% of the participants who stated that they preferred to eat at mid-morning were male.

> *I think that girls eat more in general than boys because in our school, boys they play football during lunch, so they eat at break instead, so they prioritise other things over food. (41FR3: p. 68; L2209)*

Certain foods were associated with gender. Females thought that males eat more meat and females eat desserts.

> *men eat more like meat stuff like sometimes they eat more meat than salads and stuff (12FK5: p. 15; L474)*

> *when females are depressed, they usually eat deserts, I don't know why (11FB8: p. 4; L129)*

Males thought that females eat healthier than males and males like fatty foods. Females eat more salad and are more concerned with weight issues than males are.

> *they eat more salad and stuff (11MB9: p. 4; L136)*
>
> *yeah, women do weight watchers. Boys don't do weight watchers (11MX1: p. 4; L122)*
>
> *I don't think boys care as much about their weight as girls (11MJ9: p. 5; L144)*
>
> *boys don't mind what they eat, but girls will fuss over it. So, if a girl buys a pizza their friend may call them fat. So, they eat less (41MJ2: p. 67; L2180)*
>
> *.. truthfully speaking females are more cautious about their weight gaining (41MD9: p. 67; L2184)*

Participants were asked if they thought that there was any difference in the genders` knowledge or consumption of protein and, if so, why did they think this was. Females thought that males knew more about protein because males were associated with strength training.

> *I thought it would be more boys, stereotypically boys are the ones who work out more and they are the ones who do heavy lifting so most of them would have proteins shakes (33FA1: p. 121; L3893)*

Interestingly one male participant confessed that he felt pressurised.

> *men tend to care a lot more and have all the pressure from their friends and stuff especially at our age, that they need to go and lift weights and stuff to try and make themselves look bigger, so they probably think that taking protein is a good way to do that (13MR4: p. 93; L3006)*

In summary, for *sub theme (i) the meaning of food,* all participants except for one male self-reported negative words regarding unhealthy food. Females are described as eating more salad, more desserts and are more conscious of their weight. Males suggested that they eat a larger quantity of food than females and females suggest that males eat more meat. Males did report in the category of `I like these foods` a preference for meat, and they also reported in the category of hunger that they wanted bigger portions. Males were associated with both eating more protein and knowing more about protein due to working out at the gym. Notwithstanding adolescents' negative expressions regarding unhealthy food, it is valuable to identify what food choices adolescents like to eat and to investigate if these equate to healthy choices.

5.3 Theme Two: WHY THESE FOODS

Theme Two, WHY THESE FOODS, comprised of three *sub themes*, *(i) I like (ii) The social environment* and *(iii) Mood.*

5.3.1 Theme Two: WHY THESE FOODS, *sub theme (i) I like*

Theme Two, WHY THESE FOODS, disclosed *sub theme (i) I like* which embraced three categories, taste, I like these foods and appearance. The descriptions revealed that the sensory aspect of `taste` is often incorrectly used and participants used the term flavour when describing what food tastes good to them. Females` preferred sweet food, males preferred main meals. Despite gender differences with the foods that they liked both genders associate familiar foods with safe food choices. The sensory attribute of appearance was an important factor in their decision-making process.

Table 5.6 Thematic analysis indicating the *subtheme*: *I like*

Theme Two	*Sub theme (i)*	Categories	Description FEMALE	Description MALE
WHY THESE FOODS	*I like*	Taste	Food that is eaten often	Food that will be eaten again
			Taste is flavour and seasoning	
		I like these foods	Sweet foods, sponges, custard Pasta, pizza Simple, not posh, quick, and easy food	Main meals, hot food, chicken, meat, burgers Simple food
			Vegetables Familiar foods that I have tried before Safe food choice	
		Appearance	It must look good, neat not messy	It must be colourful

5.3.1.1 *Sub theme (i) I Like:* Taste

The taste of food is frequently cited as a major factor in adolescent food choice (Blakemore et al., 2010). Taste receptors on the tongue can identify five tastes, salt, sweet, bitter, sour and umami (dos Santos et al., 2017). When participants were asked `what food tastes good`, only females used the terminology of `sweet` as taste.

> *I like sweet foods I don't know why but I really do (22FZ3: p. 39; L1276)*

> *I kind of prefer sweet things (32FG3: p. 59; L1922)*

Just as taste is identified from senses in the mouth, aroma is the sense of smell (Nargi, 2018). Smell was not a dominant description from participants, but smell crossed into different categories. Smell crossed into `appearance` as food that looks good, smells good. It crossed into the category of `queues` as the smell of a food can persuade you to buy it when you queue up, and it crossed into

the category of `mood` as the smell of a roast dinner makes you feel good. One participant related smell to culture and one participant stated that they can smell if food has chilli in it. However, flavour is a combination of both taste and aroma (Nargi, 2018). When participants were asked what food tastes good to them, a few participants used the words `flavour` in place of taste.

> *taste means it has a lot of taste it has a lot of flavours and textures I like a lot of things so I can't say much but maybe like something with a broad variety of textures and taste (31FQ7: p. 50; L1641)*

> *I like stir-fries because you can add sweet flavours to it and soy sauce as well vegetables and salt and pepper (22FZ3: p. 39; L1280)*

> *because they are sort of healthy and just the flavours, I don't know (11MX1: p. 3; L76)*

> *food that have a lot of seasoning in them because there's lots of different flavours you can taste (22FZ3: p. 39; L1276)*

A few participants implied that food at school needs to have more flavour, more particularly `spice` and `chillies` which they suggest is shaped by culture and home.

> *if you are Asian then your mum would put spice in it (42FA5: p. 76; L2452)*

> *I think its food that is too mild, it doesn't have any meaningful flavour or spice to it. Generally, I like warm foods (41MD9: p. 67; L2155)*

> w*hen my mum makes a main course, it always seasoned to the best it can be I'm used to food with a lot of spice and lots of flavours going in (22MY7: p. 40; L1289)*

Seasoning was often associated with flavour. When asked how to get food to `taste good` some participants stated that the food at school needed salt.

> *add salt (13MM4: p. 96; L3107)*

> *and if you don't put salt, it doesn't have a lot of flavour in it and a lot of seasoning have salt in them (23FE3: p. 109; L3503)*

> *no salt and pepper in it, so I won't eat it (41MR9: p. 66; L2129)*

Participants suggested that they did not like `*bland food*`, which was also associated to `a lack of *seasoning*`. Participants stated that there were not enough spices and seasoning at school.

> *bland food anything with a lack of seasoning is a big no for me (22MY7: p. 46; L1501)*

> *bland food like jacket potato (22FZ3: p. 46; L1500)*

The word `*fresh*` was denoted when referring to food that tastes good. Frozen food was likened to tasteless watery food. One participant suggested that vegetables taste good because they are fresh, and another alluded to freshly baked doughnuts or waffles with `*fresh syrup*`. One participant suggested that food had to be freshly cooked to taste good.

> *something that hasn't been like, been cooked for long and like, put away and then Monday evening you cook it and then just give it to me (21FE1: p. 23; L734)*

Some participants described taste as food they want to eat frequently, or repeatedly.

> *taste means to me something I look forward to eating something that I would go again to eat something that I would pay more to eat something I would eat again and again. (22MJ7: p. 40; L1302)*

> *taste is something I enjoy eating more than once (41FT4: p. 65; L2105)*

Adolescents were particular regarding food that they did not like. Examples of specific foods included `sun dried tomatoes`, `pickles in jars`, `Marmite`, `black pudding` and `olives`. Other reasons were associated with the texture of the foods, mushrooms, courgettes, rice pudding and porridge were sloppy and mushy, pasta was watery and soggy, and peas were hard.

There was considerable difficulty in adolescents expressing what tasted good to them and instead they used the terminology of `*I like*`.

5.3.1.2 *Sub theme (i) I Like:* I like these foods

Although taste as a concept was a clear theme in the data, the actual term `taste` was seldom mentioned, and participants frequently used the terminology of `*I like*`.

> *well, I like everything (11FJ2: p. 3; L96)*

> *well, I like a lot of things, (11FB8: p. 3; L93)*

There were clear gender differences in foods they liked. Female food choices included pasta, pizza, jacket potatoes and sweet foods; they referred to foods they `like` as easy food when they have limited time at lunchtime and described pasta as:

> *I think it's just nice, like it looks good, tastes good, it's something quick and easy to get (21FN4: p. 24; L770)*

They like simple food which was identified as pasta, chips, pizza, and a cheese sandwich.

> *I prefer something simple to more than more than posh (31FU5: p. 50; L1632)*

Most male participants liked the main meals, hot meals, and baguettes. More specific food choices

included meat, steak pie, burgers, chicken, pasties, and roast dinners, pizza must have meat on it.

I like meaty sumptuous juicy food. (22MX3: p. 41: L1320)

like a nice big burger, you can dig into that over and over again I love them (22MX3: p. 41; L1322)

it has normally got to have some meat on it, like pizza, like I like pizza because it is kind of colourful (11MJ9: p. 2; L51)

I like chicken as well (21MV1: p. 25; L799)

When asked why they liked these foods, many participants found articulating their thoughts challenging.

dunno just food (11MX1: p. 3; L71)

I dunno, I just really like pasta (21FN4: p. 24; L768)

No one articulated that they specifically liked vegetables but when questioned about how to increase vegetable consumption it became apparent that vegetables were seen positively.

I like vegetables because I just like a lot of variety because I don't like eating the same things over and over again (22FA8: p. 40; L1310)

I like most vegetables, (31FU5: p. 51; L1674)

More participants did like vegetables than did not. Vegetables were described as `fresh` with `lots of variety`, they liked `actual lettuce` and cucumber and wanted these to be available choices for the salad bar. They liked roast dinners and added with `seasonal vegetables` roast dinners were seen as healthy, lasagne was mentioned served with green beans, they liked stir fries with sweet flavours and vegetables and they wanted lettuce and onion with the burger and not just bread and meat. Participants stated that vegetables should be added to unhealthy food or added to soup to make the soup more filling, they described vegetables as filling. Some linked vegetables to home cooking as Mum makes vegetable curry and Dad adds vegetables to the slow cooker and as one participant succinctly articulated if you have been brought up eating vegetables you will eat them.

I don’t think there is any way you can make people eat more vegetables I think it is based on a question parents have been asking for years and years like how do I get my children to eat vegetables I think the point is if you are raised eating vegetables you will eat them, and if you are not and you are raised with a take away every week then you are not going to eat vegetables (34MC5: p. 127; L4105)

There were a few comments about not liking vegetables. Comments were made about the `risk to try` them because they do not know what they are, they are not aware of the variety and cannot tell the difference between a courgette and cucumber and a cabbage and a cauliflower. Adolescents like food that they know they will like the taste of.

One participant suggested that he would select the pasta because he has eaten it before, and it was a safe choice, with familiarity being more important than taste.

> *even if it's not the best tasting thing it's definitely not going to be something, I can't eat (22MY7: p. 38; L1250)*

Participants relate familiar foods as safe food choices and an avoidance of risk of selecting an unknown food.

> *I would go for the pasta as it's familiar and a safe choice (22MY7: p. 38; L1247)*

> *For example, a muffin I have tasted before so I know what it is like, so I wouldn't take those risks at school (41FR3: p. 65; L2095)*

> *I just wouldn't, I just don't, I just pick what I know (41FR3: p. 65; L2099)*

Familiarity was likened to the importance placed on money; participants would rather select food that they know they like, than select a new food choice which they may not like.

> *I like stuff that I am used to eating I don't like trying new stuff because if I don't like it. I'm just wasting my money and simple stuff too (31MZ8: p. 50; L1647)*

Both genders stated that the appearance of food was an important factor in their decision making.

5.3.1.3 *Sub theme (i) I Like:* Appearance

Females declared that the importance of appearance alludes to the shape and the neatness of food.

> *it is just in the border around the* plate *(11FZ3: p. 2; L62).*

> *I don't know I just like something that isn't all over the place (12FK5: p. 12; L374)*

> *it's not like too messy (21FN4: p. 24; L772)*

> *So, there's like stuff like er, peach crumbles and I just don't like the appearance of it and the way it looks (21FN4: p. 26; L834)*

> *what I don't like is salad because what I don't like is it is all mixed together, I like it separately (11FB8: p. 3; L93)*

> *it has to look neat and presentable (42FH7: p, 80; L2579)*

When asked about appearance, males referred to the importance of colour.

> *if I can see something like a pizza for example, I like the stuff like the tomatoes and all the green stuff that's included sometimes (42MA7: p. 80; :2566)*

> *I like pizza because it is kind of colourful (11MJ9: p. 2; L51)*

Occasionally, when one participant described their thoughts, other participants within the same focus group tended to remain on the theme as can be seen in the previous line above (51) which was then followed by lines 57, 59 and 61, all relating to males discussing the importance of colour.

> *so, like bread yeah you can have lettuce that is green, then like a burger which is brown (11MM4: p. 2; L57)*

> *erm pineapple and watermelon because it is colourful (11MB9: p. 2; L59)*

> *colourful and it is not just bland and all the same colour (11MX1: p. 2; L61)*

Most participants agreed that appearance was an important factor in the decision-making process. Although a few males disagreed and stated it is all about the taste.

> *when you're in line you have to make a quick decision like, like, if you don't like it, you can't give it back, so I think it needs it catch your attention when you first see it. (21FG8: p. 24; L777)*

> *if a dish doesn't look good you aren't going to go and buy it even if it tastes good (12ML8: p. 13; L399)*

> *.. but if the appearance of it like I don't like it then I'll know I don't like it (31FL4: p. 52; L1706)*

In summary, for *sub theme (i) I like*, female participants identified `*sweet*` as one sense of taste, yet the actual term `taste` was seldom cited. Adolescents describe taste as flavour, spice, chilli, and seasoning, particularly salt, which they infer is shaped by their culture and home. Participants frequently used the terminology of `*I like*` and both genders liked generic foods such as pasta and main courses, yet female choices were predominately sweet foods, quick, easy, simple food and males selected main meals with an emphasis on meat dishes. Adolescents choose foods that are familiar, and they are reluctant to select foods that they have not tasted before; familiar foods are seen as safe food choices. The appearance of food was an important factor in their decision-making process; both genders liked food to be colourful, but females prefer food to be neat.

5.3.2 Theme Two: WHY THESE FOODS, *sub theme (ii) The social environment*

Theme Two, WHY THESE FOODS, disclosed *sub theme (ii) The social environment* that exposed the category of `friends`. Most participants initially self-reported that friends do not affect their food choices, but then it becomes clear that friends can influence the category of food to select (main

meal, pasta, sandwich etc.) which allows them to have more time to be together; therefore, despite adamantly denying that friends influence food choices friends do affect the food they select.

Table 5.7 Thematic analysis indicating the subtheme*: The social environment*

Theme Two	*Sub theme (ii)*	Categories	Description FEMALE	Description MALE
WHY THESE FOODS	*The social environment*	Friends	Food choices are not affected by peers	
			Food choices are planned to socialise Togetherness	
			If my friends like it, I will try it	Food envy

5.3.2.1 *Sub theme (ii) The social environment:* Friends

Thematic analysis identified that the influence of friends on food choices was related to one of three components. In component one, both genders strongly denied that friends had any influence on their food choices. Females in this component stated that friends had no influence and most started with the prefix of `*no because*`.

> *no because I don't really care what they eat to be honest, as long as I like it, I don't really care what they think of it (11FJ2: p. 5; L167)*
>
> *no because we just, like if you do that to eat the same foods as your friends, basically you are showing like you just want to be like them and not just friends with them, so I don't, and my friends don't like sharing food (11FZ3: p. 6; L173)*
>
> *no because my friends have their own taste and I have my own taste (21FE1: p. 28; L906)*
>
> *no because I don't really think it matters what you choose (31FU5: p. 52; L1698)*

Other females stated it is about the food that they `want`.

> *it's basically your opinion whatever you want is what you want is not what your friends want just be you (22F12: p. 46; L1521)*
>
> *well, I just take what I want because erm because most of my friends don't actually really like what I like so erm it is really their problem (11FB8: p. 6; L170)*

Males in this component stated that peers had no influence and most used the word `*no*`.

> *no, I won't have peer pressure on the food I eat that comment seems ridiculous if you have selected something to eat, I don't see why you would even think of choosing anything that you would not want just because of your friends (22MX3: p. 46; L1514)*
>
> *no, you don't need to eat the same foods to be like friends with someone you can eat what you want (11MX1: p. 6; L177)*

no, no, no influence at all (31MZ8: p. 52; L1708)

I really don't care what my friends eat at all (22MY7: p. 46; L1519)

In component two, females implied that time with friends was important and specified that their friends did have some effect on the category of their food choices.

if most of your friends, so if you're in a group of 5 people and most of them are getting pizza and baguettes, you're not going to be the only one getting a main meal (42FS5: p: 84; L2724)

because they are all picking a snack, they might not wait for you and that might like affect you so you might not pick a big meal (42FS9: p. 85; L2749)

One female conveyed that food choices are planned to enable them to spend more time together, implying that specific food choices are not influenced by friends, but categories of food can be considered as a factor influencing their choices, with the main word being about `*together*`.

it's like they decide together, like say we are going to do this so let's just quickly grab a snack then tomorrow we will get a meal. It's like togetherness (42FS5: p. 85; L2752)

if my friends want to go and do something, I may choose something more quick so we can be together (21FG8: p. 29; L917).

This togetherness is not always about planning food choices, it is about agreeing to wait for each other.

I have friends that if one person gets a hot meal and one gets a snack, we all agree that we wait for each other (42FA5: p. 86; L2763)

In component three, males used words like `*not really*`, `*sometimes*`, they may try a different food choice, but it is still `*their individual choice*`. For males, food choice is more aligned to food envy rather than trying to fit in with their friends.

if I see my friends eating something yeah and it looks nice, I`d be like I want to eat that (11MM4: p. 6; L180)

just because I see them have it and I am just like I want it (12MD7: p. 17; L541)

sometimes yeah because as soon as I see someone else eat it, I have a craving for it (11MB9: p. 5; L156)

Component three suggested that friends did influence their food choices but for different reasons. Females revealed that friends could influence the decision-making process due to liking the same

foods. If their friends are selecting the food, it must taste good because they like similar foods to each other. Therefore, friends can influence food choices due to having a similar taste in food.

> *because me and my friends are really similar in like what we like and what we dislike so if I say you really like this, and I like and then I will really try and like it (31FJ5: p. 52; L 1700)*

> *if I'm queueing up with all my friends and they want to try something, and I think it looks nice then yes, I'll have that because if they're taking it then it must taste good so yes I will I'll go for it (31FQ7: p. 52; L1709)*

However, this was contended by one participant who stated that most of their friends do not like what they like, others stated that they have their taste, and they have their own.

In component three only `one male` participant stated that his friends did influence his food choices to fit in with the group behaviour and not wanting to feel left out.

> *peer pressure or something that like you don't want to feel left out of awkward out of the group (42MH1: p. 85; L2746)*

In summary, for *sub theme (ii) the social environment*, in component one, most participants denied any affect from friends on their food choices. In component two, females plan the category of food to be `*together*`, whereas, for males, the effect of peers on food choices is more aligned to food envy; if someone is eating food that looks good, they decide that they must have that food. In component three, females felt that peers had some influence on food choices, because they have the same taste in food. Only one male suggested that he may feel pressurised to select the same food as his friends to fit in with the group.

5.3.3 Theme Two: WHY THESE FOODS, *sub theme (iii) Mood*

Theme Two, WHY THESE FOODS, disclosed *sub theme* (*iii) Mood* which embraced three categories, hunger, feel good food and foods that keep them awake. The descriptions disclosed that both genders associate carbohydrate foods and main meals with when they are hungry because they are filling. There were considerable differences in foods that make them feel good. Females preferred sugary and warm foods, whilst males stated that fried or heavy foods make them feel good. Both genders link energy drinks, caffeine and coffee with drinks that keep them awake.

Table 5.8 Thematic analysis indicating the subtheme: *Mood*

Theme Two	*Sub theme (iii)*	Categories	Description FEMALE	Description MALE
WHY THESE FOODS	*Mood*	Hunger	Pasta, jacket potato Hot meals Fill me up Fruit is just not filling Carbohydrates and starchy foods	Hot meal and pudding Pizza, baguettes Filling Bigger portions we eat a lot
		Feel good food	Sugary foods, chocolate, warm food	Heavy foods, fried foods, and curry
		Foods that keep them awake	Energy drinks, caffeine, coffee	

5.3.3.1 *Sub theme (iii) Mood:* Hunger

As adolescents experience rapid growth and increased energy needs, hunger is advocated as a leading factor on adolescent food choice (EUFC, 2006). Participants stated that they were the hungriest at lunchtime because lunch was midway between eating breakfast and eating dinner. Lunch was part of their routine, where the school served the best hot food choices, and it was the longest break period. When asked what foods they select when they are hungry, many participants used the term *`hot meal', 'main meal`,* or *`hot food`*. Females gave examples such as, roast dinners, fish and chips, curry and chapatis as opposed to snack type food.

> *because it is more filling than getting little snacks (42FS5: p. 81; L2617)*

Females advocated a preference for starchy carbohydrate foods that included pasta and jacket potato; jacket potato is simple, warm, and filling, pasta fills them up and pizza is their favourite food.

> *I would like to get a jacket potato because it is a simple meal, but it is also something that will fill me up (21FZ7: p. 29; L931)*

> *a jacket potato coz its warm and fills me up (42FS9: p. 81; L2623)*

> *I would eat rice or pasta that's filling like carbohydrates as that fills you up (22FZ3: p. 43; L1421)*

Males preferred main meals when they were hungry; they used words such as `a lot` or `a main and a pudding`. Males' used words such as *`fill me up`*, or *`eating a lot',* some mentioned specific dishes, chicken and rice, fish, and chips with a side of coleslaw and beans on toast. However, male responses suggested that they wanted bigger portions, or more of it.

> *one thing on its own doesn't usually fill me up, like I have to have another thing as well. Like if I get a hot meal, I have to have something else too (11MX1: p. 4; L110)*

> *if I'm really hungry I will get a main meal and maybe a pudding (21MT8: p. 29; L934)*

A few participants stated that they would select fruit such as apples because they are easy to eat, popcorn or fruit as a snack to tide them over until they can eat their lunch. This was disputed by other participants who inferred that you must consume a lot of fruit to fill you up, so it is about the quantity of carbohydrates.

> *mainly carbs and protein I feel like for some people they have seen a mountain of food and like this will make me full but like sometimes like more of one food and less of another will give the same feeling like I`m full or not full (34MF5: p. 130; L4195)*

> *I think it's like carbohydrates like bread and then a bit of fruit and veg with it something like that (34MD2: p. 130; L4198)*

A common reply from both genders was they wanted food that *`fills me up`, is `filling`* and *`full`;* however, there were no similarities regarding foods that adolescents associate with feeling good.

5.3.3.2 *Sub theme (iii) Mood:* Feel good food

There were differences in the vocabulary genders used regarding foods that made adolescents feel good. Females identified with *`sugary foods`,* warm food that has been in the oven*, `fresh food`, `warm brownies`, `warm apple pie with custard`,* a warm sausage roll after PE when it is cold outside, a warm meal now it is cold, and baguettes are more summary.

> *something that has been in the oven and is very nice to have as it is warm (33FA1: p. 123; L3968)*

Males also used the temperature when describing food, hot paninis were good and when food is hot it is ready. Yet they were not always correct in their statements, hot food was identified as more filling and has more calories. Males said that feel good food is heavy food, such as burgers, fried food, take aways, curry, and roast dinner.

> *it's not really like healthy stuff its generally feel good to me is like fried stuff like a take away or like a curry something like that because that's what I enjoy eating that what I have always eaten like in my house like we have curry twice a week and it's what I am used to (34MF5: p. 131; L4232)*

> *heavy food like burgers (33MQ7: p. 123; L3971)*

There were differences in food choices that genders identify with feel good food but both genders agreed on the types of foods that kept them awake.

5.3.3.3 *Sub theme (iii) Mood:* Foods that keep them awake

There was robust agreement from all participants that drinks such as coffee, tea, caffeine, Lucozade, energy drinks and fizzy drinks were associated with keeping them awake. Food that keeps them awake was identified as cheese, dark chocolate, coffee cake, chocolates, or sugar.

> *sugary drinks will keep you more awake so things that are sugary that give you a lot more energy. I personally become more like jittery when I am on sugar (43FS8: p. 146; L4715)*

However, it was established through further discussion that energy drinks are not sold at these schools. The drink that is allowed for sale is `Radnor` which is a fruit drink that contains 45% fruit juice and sparkling water which meets the government guidelines for schools (Radnor, ND).

Some participants mentioned foods that made them feel sleepy or tired. Filling foods were identified as making them feel sleepy and fried food makes you tired.

> *fried food, like deep fried makes you more tired (43FS2: p. 146; L4714)*

To summarise the *sub theme (iii) mood,* main meals and carbohydrate foods are the preferred food choices when adolescents are hungry. Food choices differed according to gender; when alluding to foods that make them feel good and were aligned to their foods in the *sub theme* of, *I like it,* females favoured sweet foods and males preferred savoury. Both genders associate energy drinks and caffeine with drinks that keep them awake.

5.4 Theme Three: THE ENVIRONMENT

Theme Three, THE ENVIRONMENT comprised of three *sub themes, (i) school, (ii) break times* and *(iii) the caterer.*

5.4.1 Theme Three: THE ENVIRONMENT, *sub theme (i) School*

Theme Three, THE ENVIRONMENT, disclosed *sub theme (i) School,* which embraced three categories, queues, exams, and food on the go. The descriptions revealed that the length of queues impedes on participants' time to socialise; females disclosed that the pressure of exams influences their food choices, and most of the schools do not allow hot food to be taken outside of the canteen.

Table 5.9 Thematic analysis indicating the subtheme: *School*

Theme Three	*Sub theme*	Categories	Description FEMALE	Description MALE
THE ENVIRONMENT	*(i) School*	Queues	Queues take up most of the break time Queueing means you have no time to socialise I will miss eating any food just to be with my friends	
		Exams	Food choices are compromised as exams take precedence	
		Food on the go	More freedom to do as you want The school doesn't let you take out hot food	

5.4.1.1 *Sub theme (i) School:* Queues

The length of the queues was commonly cited as impacting on their food choices. For some participants it was the duration of time spent in the queue, for others it was the disruption to their time to socialise. Some participants mentioned that the length of the queue resulted in them not eating any food during their lunch break.

> *you only get 50 minutes and sometimes when you line up, that's the longest bit which takes up about 20-30 minutes (41MJ2: p. 70; L2274)*

> *I think there is not enough time if you are going to be eating the school's food as there are usually big queues that you have to wait for, one time I was waiting for half my lunch in the queue (31FU5: p. 56; L1839)*

Other participants suggested that it is all about how the breaks are staggered between the years and which year is allowed into the dining area first.

> *when I was eating in the canteen in year 7 there wasn't enough time as you do have to get there first, and you do have to wait in the hall as it depends on who goes first (31FL4: p. 56; L1833)*

Other participants of both genders suggested that time is an issue, as they do not get time to be with their friends.

> *when the line is long the time it takes to line up takes up the time I could spend outside with my friends (41FT4: p. 71; L2290)*

> *by the time you are in the line and queued up you get only 10 minutes, so you don't really get any time to socialise with friends (11MJ9: p. 7; L227)*

The queue did affect some participants food choices and they either chose not to use the dining facility, not to eat at school or they missed eating any food during their lunch break.

> *sometimes I don't eat at school because of how long it takes to line up and you line up outside for 15 minutes then line up again and then you must get your lunch and sit down and eat it and your lunch is over (41FR3: p. 70; L2278)*

> *if you get there early and you sprint to the canteen you still don't get there first as year eight go first on a Monday and last on a Thursday. It all depends on the day. So that's usually the reason I skip meals a lot of the time as usually you don't get enough time to eat and then enjoy yourself at break (31MZ8: p. 56; L1825)*

by the time I get there, because most of my classes they get let out late, so by the time I get there the line is so long and sometimes I just don't have time so I just skip it because I can't be bothered to wait so long (11FJ2: p. 7; L224)

One male participant proclaimed they did have enough time, but people need to use their time wisely. In School four the caterer had set up a kiosk which sold cold options, so if the pupils used the kiosk for these choices, they could avoid the queue.

yeah 50 minutes is enough time for me, as I know getting into the lunch hall lining up it is long, but I have seen people buying just a drink or a sandwich and they are not managing their time very well as outside there is a little window that sells the exact same things. So, I go out there rather than inside wasting my time (41MD9: p. 71; L2316)

One participant suggested that the number of pupils in the school is increasing but the physical space remains the same: therefore, more pupils queue for lunch within the same time frame for lunch.

I think with the whole thing about some people not getting enough time to eat and being rushed, is because as the years go by the school must accept more people. (21FN4: p. 35; L1120).

5.4.1.2 *Sub theme (i) School:* Exams

Females stated that the pressure of exams impacted on their food choices. The decision to select quick and easy to eat food, or food that can be taken to the sixth form were commonly cited in females' decision-making process.

when you start getting to the older years, and you start to realize how important your exams are, I will grab a salad and sandwich pot and take it into the sixth form room because I have to catch up on work or do something- so I feel like now I don't have much time to eat and sit down with a knife and fork and eat like year 7s and 8s do. So, I have put my exams first before my food, because I don't really have enough time (21FN4: p. 33; L1060)

personally, I buy something I can eat whilst I can do my work whilst I'm studying, I might have a test the next lesson so eat, and move and revise at the same time (22FZ4: p. 44; L 1440)

if you're in the older years, and you have exams and revision and stuff I will know I will have to go somewhere at lunchtime, I will probably get a salad or sandwich or something I can take away because I know that I can go to the place I need to go but also still have lunch (21FG8: p. 32; L1043)

I skip a meal so I can do more work as I can't do both at the same time (21FG8: p. 35; L1142)

5.4.1.3 *Sub theme (i) School:* Food on the go

Females' food choices are compromised due to the pressure of work and therefore they select food on the go. Other participants conveyed a sense of freedom regarding food that can be eaten away from the canteen.

but if it is in a container, you can walk around and go where you want (12FE2: p. 16; L521)

it depends, because as I would rather have food that I can hold in my hands as I like to go out (11MJ9: p. 6; L192)

how fast you can eat it there is no fuss there is no mess and when you're done you can do whatever (22MX3: p. 44; L1431)

To others food on the go was about saving time.

we are quite restrained for time especially as you go up to year groups you will find you have less and less time so yeah definitely if you can save 10 or 15 minutes that would be amazing (22MY7: p. 44; L1451)

A common response to food on the go was that they are not allowed to take hot food outside.

I would like to move around and eat so for example if they had benches outside or somewhere to sit down it would be really good as there is fresh air outside and it is really hot in the dining hall so you would get to sit outside and enjoy the fresh air (41MA1: p. 73; L2360)

One participant stated that if you want to eat hot food, you are unable to take it away from the canteen. Therefore, more people must use the canteen which results in limited space that could link back to long queues.

To summarise *sub theme (i) school,* the length of the queue affects many pupils' food choices. The time spent waiting hinders pupils' opportunity to socialise, and therefore some participants choose not to use the canteen or *`skip eating`* which could impact on their learning. Some females stated that the pressure of their exams took precedence rather than eating at the canteen, and they select food that can be eaten whilst they study. Some participants associated food on the go with greater freedom to do what they want to do during lunchtime, or an increased time for lunch. It can be suggested that there needs to be a greater quantity and more variety of food options for `food on the go`. These could include salads in sustainable take away containers or pots which are neat, or rice bowls or hummus and vegetables. If adolescents are allowed to take these foods away from the canteen to a designated seating areas this could generate more space in the canteen, possibly

reduce the time spent in a queue, increase uptake, and allow more time to socialise which could benefit all concerned.

5.4.2 Theme Three: THE ENVIRONMENT, *sub theme (ii) Break times*

Theme Three, THE ENVIRONMENT, disclosed *sub theme (ii) Break times,* which embraced three categories, breakfast, mid-morning, and lunch. The descriptions revealed how adolescents view their food purchasing as being structured and they associate specific foods with these eating times.

Table 5.10 Thematic analysis indicating the subtheme: *Break times*

Theme Three	*Sub theme (ii)*	Categories	Description FEMALE	Description MALE
THE ENVIRONMENT	*Break times*	Breakfast	Eat before I learn	Energy to start the day
		Mid-morning	More variety of snacks	
		Lunch	More time to eat Food choices are more filling	
			When we are most hungry. Hot meals, main meals, best choices Sell better food	

5.4.2.1 *Sub theme (ii) Break times:* Breakfast

From the 99 participants in the focus groups only seven stated that breakfast was their preferred time to eat. The main descriptions were around energy and learning, the others were its `free`, `cheap` and `nice`.

> *I like breakfast because it gives me the energy to start my morning (41MK3: p. 64; L2071).*

> *because I don't normally have breakfast at home, and it lets me have something to eat before I learn (31FJ5: p. 49; L1600)*

Most participants stated that they ate breakfast at home before school, and some implied that they did not eat breakfast at school because of a lack of time in the morning. Typical breakfast food such as beans on toast and bacon were mentioned, whereas mid-morning food choices were described as snack food.

5.4.2.2 *Sub theme (ii) Break times:* Mid-morning

From the 99 participants in the focus groups only six participants (five male and one female) selected mid-morning as their preferred time to eat. The food that was associated with this break time was described as snack food. However, one male referred to snacks at mid-morning break times but went further and described snacks as an apple or banana.

> *it's because, like, there's a variety of snacks. And when it's like lunch time, you just get the one you just get the one course, it's the same for everyone else (21FZ7: p. 21; L647)*

> *mid-morning because there is a variety of food snacks and drink (22MJ7: p. 37; L1192)*

Male's identified specific foods such as sausage rolls, `hot paninis`, pizza or that they could buy the type of food they like.

because there is more variety at break it's like the sort of stuff, I prefer (31MZ8: p. 49; L1606)

Most participants identified the lunch break as their preferred time to eat at school.

5.4.2.3 *Sub theme (ii) Break times:* Lunch

Lunch was the most popular time to eat at school and this was underpinned by three descriptions: the time that they were the hungriest, the best food choices and the longest break time.

because I am like the most hungriest at lunch (11MM4: p. 1; L18)

probably lunch because that's when I am hungry (12FE2: p. 11; L335)

Participants stated that at lunchtime there were more food choices such as hot meals and roast dinners. In School Three, participants mentioned that at their lunch break they could buy fruit.

because they normally have fruit and stuff (32MR1: p. 58; L1908)

because they normally sell better things, because they normally have fruit in the canteen and that's what I would go for (32FY6: p. 58; L1891)

The third description was that the lunch break was the longest break time, females suggested that they had longer to eat, it was part of their routine and lunch was mid-way between breakfast and dinner so an obvious time to eat. One male suggested that by this time of the day he was tired after all the lessons and needed a break.

because I think that all lessons that we do first we get tired, and we want to have a break and have lunch so that's the most important part (41MR4: p. 64; L2065)

To summarise *sub theme (ii) break times,* the few participants that selected breakfast as their preferred time to eat stated that they needed energy at the start of the day to learn, the few that selected mid-morning break was due to the variety of snack foods. Lunch time was the most popular time to eat due to participants being the most hungry, greater food choices, main meals and fruit and the lunch break was the longest break time. It is important to capitalise on this preference for food choices. All the food choices are provided by the school's caterer.

5.4.3 Theme Three: THE ENVIRONMENT, *sub theme (iii) The caterer*

Theme Three, THE ENVIRONMENT, disclosed *sub theme (iii) the caterer,* which embraced two categories, the position and presentation of the food, and not enough food. The descriptions

revealed that food positioned near to the front of the queue influence their food choice behaviour. Food must be well presented, and fruit should be sliced and ready to eat.

Table 5.11 Thematic analysis indicating the subtheme: *The caterer*

Theme Three	*Sub theme (iii)*	Categories	Description FEMALE	Description MALE
THE ENVIRONMENT	*The caterer*	Position and the presentation of the food	It must catch your attention Make a quick decision. Pick the first thing you see	
			Fruit section is in one position, and it is the busiest. Fruit in bowls does not look good	
			It is all about the presentation Sliced watermelon shards, pineapple, grapes look good	
		Not enough food	Teachers take the salad Make more food	
			At the end the food runs out	

5.4.3.1 *Sub theme (iii) The caterer:* The position and the presentation of the food

Participants were asked for their views on how to get adolescents to eat healthier food choices. The position (where the food is placed or what participants see when they line up), the presentation and the variety of fruit on offer were the most cited by School Three.

> *.. if there is like a line you`re going to see paninis there and you fancy one of those you are going to pick up and if the fruit is at the end, you have already got your panini or this unhealthy thing that you are going to want to eat because you have decided on that you are not going to put it down (34FR4: p. 130; L4179)*

Some female participants suggested that there needs to be more availability of fruit.

> *I think there is one section where there is a bowl of fresh fruit and that's literally it throughout the whole canteen the rest of it there is like one part the only part where there is fruits salad and grapes and actual oranges the rest of it the main canteen is just like brownies, paninis and that ….. (34FS8: p. 125; L4041)*

> *when I go to the stall with the fruit it is always one of the busiest and sometimes, they run out so there isn't enough on offer (33FA1: p. 117; L3756)*

The appearance, presentation and quality of the fruit were deemed as important in their decision making.

> *like we have got watermelon shards now and I like them they look good, and they are all nice and easy, and they are not that expensive where if you look down a little you have the bowl of fruit there is not a lot in there it's all in one place or its kinda a bit bruised and battered (34FS8: p. 129; L4173)*

I feel its presentation as well because I would much rather have a nice yellow banana rather than with one with black bits all over it or strawberries or grapes if they are all manky you don't want to take it but if they are all nice then you do it's like presentation (34MD2: p. 130; L4176)

Participants preferred more exotic varieties of fruit. Sliced fruit in pots was more popular than whole fruit positioned in a bowl.

a section or slice and a section of non-sliced fruited. Then one section could be a box of single fruit like blueberry or strawberry or something like that (33FM6: p. 116; L3742)

we do have sliced fruits like grapes and watermelon, but we also have a bowl of fruit by the sandwich bit in the canteen, but I don't think I have ever seen people take fruit from there (33FM8: p. 116; L3745)

There was limited agreement from other schools, but it was noted in School Four.

you know our food choices they are affected by the taste, so like what happened recently is they give us fruits and bags and depending on the weather and the fruits they are, like when they have watermelon, pineapple and melons then loads of people tend to take them, but when they are apples and oranges people don't actually tend to take them (43FS8: p. 136; L4388)

Another participant suggested that it comes back to experience, knowledge, and familiarity because adolescents will not select food that they do not recognise.

I don't feel it's the taste that matters, I feel like when we are talking about taste, but we need to consider the variety of food that people risk to try. Not many students are aware of their fruits and vegetables, last week we were testing people on if they could recognise the fruit or vegetables without looking but a lot of people did not know what was inside the box. That is because they were not aware of the food choices, they have (43FT4: p. 136; L4398)

5.4.3.2 *Sub theme (iii) The caterer:* Not enough food

Participants described break time as *`rushing`* to get lunch because the food *`runs out really quickly`* and suggested that the caterer should produce *`more food`*. It must be noted that this evidence is predominately from School Four.

sometimes the food runs out really quickly so at break time everyone always really rushes to the queue (42MH1: p. 83; L2664).

I think the whole point of us having queue is because if the children go in and there's a lot of chaos as children rush for their food because the food runs out that is why everyone rushes. (42FH7: p. 84; L2706)

They suggested that the caterer needs to produce more food, extra food and they want a choice.

I don't really think the queue is the problem, as it is there for a reason and without it there would be chaos in my opinion. But if you just make more food or more hot food then even if they are late, they wouldn't run out of food (42FS5: p. 84; L2695)

So, if they make extra food or more food then maybe no one would have to like rush in, and everyone would actually line up and go in and get their food (42FH7: p. 84; L2707)

so, there's this procedure where you have to line up that takes up the majority of our lunch time, which is really annoying and the food runs out and it just whatever is left over you have to choose from which I believe is not right as if you are paying for your food you should have the right to choose from all the food (42FS9: p. 83; L2687)

we have 20 minutes so let's say that's 15 minutes as you have to line up and everything and at lunch, we do have a lot of time, but sometimes the food that you might want might be finished so you just have to pick what is left (42FH7: p. 83; L2675)

In School Two one female stated that they like to select salads and sandwiches but there appears to be some issues between the availability, quantity, and the variety of food on offer.

well, I really like the salads in school, but more of the teachers opt for the salad and they only put certain thing inside salads. So, a lot of the time students want to go and get the salad but there isn't enough variety. I think a lot of people see that because a lot of the teachers and sixth formers have to run in and out of places to do things, they tend to go for the salad options but there is either not enough quantity of food there or there is not enough to pick out from (21FN4: p. 33; L1071)

To summarise the *sub theme (iii) the caterer,* the positioning of more healthy food choices is an important factor when proposing a change in food choice behaviour at secondary schools. The emphasis must be on variety, quality, appearance, and presentation of the food items. Caterers should consider producing more dishes that are packaged and presented which is similar to the fruit as these are popular and healthy. These dishes could potentially impact on behaviour when adolescents select the same category of food to be together. A suggestion is to increase the variety of food that is produced at School Four because running out of food at the end of service affects

participants' food choices as there is not the full range of food items available. In School Two selling salad pots may be a profitable way to promote healthy food choices and enlarge the variety of food.

5.5 Summary

In summary, this chapter has discussed the results from the qualitative data which have indicated that the experimental FL in the form of a nutritional food score did not influence adolescent food choice behaviour. Participants indicated that most of them did not receive their post cards and that they did not understand the nutritional food score which could be one reason why the food score did not influence adolescents to select healthier food choices. A single symbol was the favoured FL design but there was no consensus as to which specific one. Participants that preferred a nutrient specific FL sought more nutritional information and had a higher engagement in health.

Adolescents believed that their nutritional knowledge was good, yet this was not substantiated during their discussion of food groups, however, they positively engaged with learning and technology. Participants were critical towards the passive teaching in food technology, and they want to gain their nutritional information through positive messages.

There was a definite stereotyping of eating by gender. Females were associated with eating more salad, desserts and are more conscious of their weight. Males were reported as eating more and consuming more meat which was associated with sport. Gender differences were also identified in their food preferences, females preferred foods that are quick, easy, simple food such as pizza, pasta and sweet food and males selected main meals with an emphasis on meat dishes. Participants alluded to the same food choices when they described food that made them feel good. Both genders would select main meals and carbohydrate foods when they were hungry. Males in particular liked food to be colourful, but females prefer food to be neat `*not messy*` in appearance.

Most participants adamantly denied any influence from friends on their food choices at school. However, friends did influence females who select the same type of food to socialise and to be `*together*`. The school environment affected food choice behaviour due to the length of the queue the pressure of exams and limited space. Some participants associated `food on the go` with increased time to socialise at lunchtime. If adolescents were allowed to take foods away from the canteen to a specific seating area this could possibly create more space in the canteen, reduce the queue, increase uptake, and allow more time to socialise which could benefit all concerned.

Lunch time was the favoured time to eat. Lunchtime was synonymous with being the most hungry, better food choices, tasty filling main meals, the provision of fruit and the longest break time. Fruit

in bags and pots highlights the importance adolescents place on the presentation of food and this needs to be emulated for other food choices.

Chapter 6: Discussion of findings

The overarching aim of this study was to explore whether an experimental food label (FL) in the form of a nutritional food score would influence adolescents in four secondary schools in Greater London to select healthier food choices. However, it must be considered that adolescents' food choices are also influenced directly and indirectly by a multiple range of extrapersonal and intrapersonal factors, (Chapter 2 section 2.15), (Neumark-Sztainer et al., 1999; Story et al., 2002; Stevenson et al., 2007; Gilmour et al., 2020). This research sought to better understand if there are specific factors that are pivotal in guiding adolescents to select healthier food choices.

The results from this study indicated that the experimental food score did not persuade adolescents to select healthier food choices, but it did support the theory that eating behaviour at secondary school is both positively and negatively influenced in a bidirectional manner across individual, social, and the macrosystems levels as well as by the physical environment.

6.1 The experimental food label

This chapter will commence with a triangulation of evidence from the quantitative findings with the qualitative findings. According to Nobel and Heale (2019), triangulation increases validity and accuracy of the phenomenon being studied which offers a more balanced explanation of the results. Each of the triangulation tables displays each hypothesis with the results from the two sets of data. It will then identify the qualitative results and put forward an explanation for these results. Table 6.1 triangulates the results for hypothesis one.

Table 6.1 Triangulation of the results hypothesis one

Hypothesis	*Quantitative Results*	*Qualitative results*	*Explanation of both the results*
H01: To test the hypothesis: `an experimental food label applied to food served in secondary schools in Greater London will influence adolescents to select healthier food choices`.	Overall, the descriptive statistics suggest that there is no consistent difference in the mean scores from pre-intervention baseline and post-intervention phase one or post-intervention phase two, and the inferential tests confirm that there was no significant difference between the weeks in any school.	We did not receive the post cards, We did not understand the food score.	The awareness phase was seen to be ineffective as most participants did not receive their post cards which could be why there was a lack of understanding of the food score. This highlights the importance of education and the whole school approach in interventions.

The findings from quantitative data (Chapter 4 section 4.1) established that the experimental food score did not influence adolescents' food choice behaviour in any of the four secondary schools in Greater London. There were no significant differences between the mean food scores from the pre-

intervention baseline to post-intervention phase two in any of the four schools. In School Three the mean food score increased from pre-intervention baseline to post-intervention phase one, then decreased from post-intervention phase one to post-intervention phase two. However, the total increase of the food scores from pre-intervention baseline to post-intervention phase two was not significant, but it did suggest an upward trend. There are three factors that most likely impacted these results, from all four schools including the awareness phase and adolescents' interest and knowledge of health and nutrition.

The awareness phase consisted of a prepared pack for each tutor in all four schools. The pack contained an A6 post card for each pupil and a letter for the tutor (Appendix U and V). The letter requested tutors to read to their tutor group how to understand the food score and then to hand out a post card to each pupil (Chapter 3 section 3.2.5). The awareness phase aimed to standardise communication to pupils with respect to understanding the food score, to be aware that the more nutritious foods have higher numbers and for this information to be reiterated on the post card.

In this study, theme one, `health`, contained four sub themes, `the experimental food label`, `food labels`, `nutritional knowledge`, and `the meaning of food` (Chapter 5 section 5.2). The experimental FL comprised of two categories, the awareness phase, and the food score. Within the category of the awareness phase participants in the focus groups discussed the post cards (Chapter 5 section 5.2.1.1). In School One and School Four all participants disclosed that they had not received the post card. In School Two and School Three, replies varied but most did not receive the post card. There could be several reasons why the awareness phase was unsuccessful. The school client might not have disseminated the intervention effectively to the tutors, and the tutors may not have understood or been engaged with the intervention. Nevertheless, as so few participants received the post card this could have resulted in a lack of understanding about the experimental food label.

Melo et al., (2013) highlighted that limited tutor engagement in health initiatives could be due to reasons such as, a lack of recognition in the need to change the food on offer, a disinterest in health or the intervention itself or because tutors are responsible for numerous extra curriculum activities and do not have the time. Melo et al., (2013) emphasised that schools can often run separate healthy diet promotions and that collaboration is key to success but Melo et al., (2013) did not address how to overcome a lack of collaboration.

From the three published studies (as identified in Appendix C) that did implement a FL in a live school setting, none of the authors identified how they initiated their studies, or how they informed the pupils. Only Hunsberger et al., (2015) found that, in the presence of calorie and fat labelling, there was a mean decrease of 47 gross calories consumed/day and a reduction of an average of 2.1

grams of fat/day. Hunsberger et al., (2015) stated that the success of the nutrition labelling was due to the daily reminder of calorie information and may also be partially due to the school curriculum nutritional education lessons. The study did not specify if there was any information given to the pupils before the intervention or what the nutritional education consisted of in this period; therefore, these results cannot verify if the FL or the education had a greater effect on adolescent food choices. Conklin et al., (2005) and Rainville et al., (2010) did not convey if they implemented any education or awareness phases, and both studies' results differed. Rainville et al., (2010) found an increase in calories consumed in the control group, and Conklin et al., (2005) found students selected healthier options of the same category food. There is a lack of evidence regarding the best practise in communicating a nutritional intervention to adolescents and ascertaining if adolescents understand the intervention. Despite the benefit of NuVal`s simplicity in displaying a number to represent the healthiness of the food it is possible that in this current study adolescents and tutors did not understand this intervention, thus highlighting the importance of education.

In a study by Ealey (2014) consumers (*n=101*) took part in an education intervention informing the consumers how NuVal food scores worked. Results after the education intervention demonstrated that 63.3% of consumers significantly improved their ability to select healthier products using the NuVal food score label. However, there was no information as to what the four-week education consisted of.

In this current study, A3 posters (Illustration 3.1) depicting identical information to the post cards repeated the message that `*more nutritious food have higher scores*`. Posters are a non-intrusive way of disseminating information and were displayed in the dining area either by the catering staff, the area manager, or the researcher (Chapter 3 section 3.2.5). At Schools Three and Four the researcher did not have permission to position the posters. In this study, participants in the focus groups were asked if they noticed the posters. In School One all but one male participant verified that they did see the posters but in the three other school's participants did not. The evidence from this study indicates that most adolescents were unaware of the posters. This lack of awareness could emphasise adolescents' automatic behaviour in their food choices as suggested by Ensaff et al, (2015) in that school is a time pressured environment and pupils rely on their food choices by an automatic non-cognitive process rather than through controlled behaviour.

The literature does not agree as to the effectiveness of using posters to convey messages in health promotion. Mackison et al., (2016) stated that interventions increase the workload for catering staff, and that posters were ineffective in interventions to promote healthier eating as no one notices them. Mackison et al., (2016) suggested that messages via other forms of technology can provide more standardised information to reach all pupils, staff, and the catering staff. Opposing this, Ensaff

et al., (2015a) used several approaches to change the food choice architecture in a school setting to promote healthier food choices. Designated healthier food choices were either `promoted` using posters and stickers, or `displayed` using pyramid fruit bowls, disposable pots for fruit, main courses, and salads. Results from the intervention indicated that adolescents were 2.5 times more likely to select these designated healthier food choices, but the study did not identify if the result was due to the posters and stickers or the display or a combination of both, that had the greatest effect on changing food choices in school. Table 6.2 triangulates the results for hypothesis two.

Table 6.2 Triangulation of the results hypothesis two

Hypothesis	*Quantitative Results*	*Qualitative results*	*Explanation of both the results*
H02: To test the hypothesis: `females are more likely than males to both notice the food score and to self-report that the food score affects their food choices`.	There was a non-significant association between participants gender and participants reporting noticing the food score, in all schools. There was a non-significant association between gender and noticing the food score from all four schools. In Schools Two, Three and Four there was a non-significant association between pupils' gender and pupils reporting that the food score had a perceived effect on their food choices; however, in School One, more male adolescents identified that the food score affected their food choices than females.	The food scores were too small and were not on all foods, They did not see the posters. Symbols are easy, straight forward a simple tick is straight forward. It depends if you care. Some participants will still choose foods they like. The Eatwell Guide is taught in food tech year 7 Focus on positives, It tastes good we will still eat it.	The dining area is a time pressured environment adolescents use automatic non cognitive behaviour in food selection. Participants who understood the food score had a higher interest in health and health behaviour and sought more information from a food label than those who preferred symbols. Nutritional knowledge is poor, and health needs to be taught in its entirety. It needs a focus on positive messages which use technology to engage them.

Previous studies have indicated females are more likely to read and use FLs than males (Shepherd et al., 2006; Rainville et al., 2010; Heike and Taylor 2011; Sichert-Hellert et al., 2011; Stran and Knoll, 2013; Talagala and Arambepola, 2016), (Chapter 2 section 2.6). However, in this study the quantitative results from all four schools indicated that there was a non-significant association between noticing the food score and gender (Chapter 4 section 4.2).

A question in the questionnaire asked if adolescents believed that the food score influenced their food choices (Chapter 4 section 4.3). The study sought to identify if the food score had a perceived effect and if this differed between genders. In Schools Two, Three and Four there was a non-significant association between pupils reporting that the food score had a perceived effect on their food choices and pupils' gender. In School One there was a significant association between the food

score and the effect on food choices and, overall, more males identified that the food score affected their food choices more than females, a finding that has not been identified in previous studies.

In this study, the sub theme 'the experimental food label' comprised of a second category, the 'food score'. Participants in the focus groups discussed their understanding of the food score and considered its influence on their food choices (Chapter 5 section 5.2.1.2). The qualitative results in the category of the food score identified that participants stated that they did not understand the food score. Participants described the food score as confusing, it lacked consistency as it was on some foods and not others, some participants did not know it was there and it was too small. There are similarities with Hunsberger et al`s., (2015) study where participants discussed the font size, colour, the size, and positioning of the FL and one pupil stated `*when we see it big, we want to know what that is because you notice it more*` (Hunsberger et al., 2015 p. 5).

Overall, in this current study' evidence suggests that there was a lack of awareness of the food score which can be attributed to either adolescents' automatic non-cognitive behaviour or the lack of awareness could be due to the impact of the time pressured environment in a school restaurant. As a pupil in Hunsberger et al., (2015) stated *`nobody would really have time to stop right there and look at it because you have to keep on going`* (Hunsberger et al., 2015, p. 5).

The qualitative results in the same category of the food score (Chapter 5 section 5.2.2.1) indicated that participants in this study would have liked the food score to be from one to ten with `one` being the healthiest food choice and `ten` the least healthy. They referred to the numbers as being like calories with number one indicating the better food choice as it has less calories. However, adolescents` knowledge regarding calories in this study was poor as was also evidenced in the studies by Hunsberger et al., 2015; Saunders and Irdam, 2017; and Seyedhamzeh et al`s, 2018. Hunsberger et al., (2015) identified that, despite nutritional education, adolescents could not identify their energy requirements and did not understand energy balance. However, participants in Hunsberger et al`s, (2015) study stated that they wanted to see calories at school, but they implied that it was only useful to those that read them, yet those that did not read them did not mind them being there. It would have been interesting for Hunsberger et al., (2015) to have explored if these replies differed between genders.

The current study identified that females were not in favour of displaying calories and proposed that this could lead to people restricting their food intake which agrees with observations from Shepherd and Dennison, (1996) who emphasised that many adolescents employ dietary restraint to strive to conform to being thin. The studies by Conklin et al., (2005), Rainville et al., (2010) and Hunsberger et al., (2015) that displayed calories and fat on a FL in a live school setting were inconclusive as to their

effectiveness in influencing healthier food choices. Therefore, a FL displaying calories may not be favourable with this age group or in the school environment and more emphasis should be on health.

This study identified that the participants' who reported noticing and understanding the experimental FL can be identified across the entire data set with having a positive attitude to healthy eating in general. The same participants understood the Eatwell Guide and the traffic light FL, they revealed that the family cook with lots of vegetables and discuss nutrition, they were interested in health, or that they liked vegetables and fruit. Graham et al., (2011), also observed that consumers who take note of nutritional information valued healthy eating and were associated with a higher engagement in preparing and eating healthy food.

6.2 Food labels

In this study theme one, `health`, contained sub theme `food labels` and a category of `food label design` and ` effect on food choices` (Chapter 5 section 5.2.2.1). When discussing the FL design there was no agreement as to which was the favoured design. Participants who preferred nutrient specific traffic light FL`s sought comprehensive nutritional information and showed an interest in health or looked at nutrition for a specific health reason. They disliked symbols due to their over-simplification and the lack of nutritional information that symbols imparted. Specifically, participants referred to two colours, with green indicating that the food was good, and red indicating not to eat that food; participants did not discuss amber. Adolescents in this study found logos the easiest to understand and favoured a single symbol in the form of a simple tick, or the `choices` symbol because there was nothing to read. Those that could relate to sport favoured PACE (Figure 3) but that did not signify that they understood calories. Overall, participants stated that they did not want a complicated FL.

The literature indicated similar findings to this current study regarding the FL designs. Studies agree that adolescents who prefer nutrient specific FL have a greater interest in health (Stevenson et al., 2007; Jefrydin et al., 2019). Other studies state that adolescents find the traffic light design confusing (Babio et al., 2013; Saha et al., 2013). Participants in the study by De la Cruz-Góngora et al., (2017) evaluated the multiple traffic light FL and the findings of that study concur with the current study in that participants associated the colour red as bad and the colour green as good, with amber being too complex to decipher. In addition, participants in the De la Cruz-Góngora et al., (2017) study also preferred logos which participants considered were the easiest to understand. Evans at al., (2015) found a correlation with those that took part in sport favouring the PACE logo. However, in Evans et al's., (2015) study, females from the higher income community had more knowledge of calories and showed an interest in learning more. Adolescents in the lower income

area had little knowledge of calories and had mixed feelings regarding learning more. In the study by Saha et al., (2013) more than one third of adolescents would prefer a symbol that indicated that the food was `unhealthy` whereas in this current study only one male would like to see this symbol. Evidence suggests that studies that have explored adolescents' understanding and knowledge of nutritional information on a FL in respect of influencing their food choices do not align. This could be because these studies took place in different countries and the countries' approach to the importance placed on nutritional education may be varied.

From the quantitative data on the effect of the FL on food choices overall, more males identified that the food score affected their food choices than females, a finding that has not been identified in previous studies. From the qualitative data in the category of `effect on food choices` (Chapter 5 section 5.2.2.2) several participants acknowledged that, regardless of a FL, they would still select the foods they liked which is in accordance with Ruxton and Derbyshire (2011), Hunsberger et al., (2015) and Jefrydin et al., (2019). A pattern that emerged was that even if a food had a low score, they would still select that food, because they select the same food, they cannot see the consequences of consuming unhealthy food at this stage of their lives and they would not change their behaviour, a factor also noted by Croll et al., (2002), Yeung, (2010) and Ruxton and Derbyshire, (2011). Participants in this study believed that the food score influences food choices if a person is interested in health and an interest in health stems from the family.

6.3 Nutritional knowledge

In this study, theme one, `health`, contained sub theme `nutritional knowledge`, a category of `the role of school in education` and `we know`. This study identified that when discussing the role of school in education adolescents profess to acquire their nutritional knowledge through food technology at secondary school, primary school, and from their parents. Adolescents learn about The Eatwell Guide in food technology, in year seven which is recapped in years eight and nine. However, adolescents in this study were unclear what the Eatwell Guide was. It was referred to it as a `big pie chart`, a `big plate`, a `food plate diagram thing` a `food table where half of it is meat`, and a `big triangle` and the `eat well cycle` (Chapter 5 section 5.2.3). Participants in this study did not agree with making food technology compulsory; some stated it is an important subject, others disagreed which was also observed by Gilmour et al., (2020). Participants in the current study wanted to make and cook more healthy food and less desserts which concurred with the findings of Rutland and Owen-Jackson (2013). A novel finding was that participants wanted to cook more healthy dishes, ones they would want to make at home which they implied would encourage them to eat more healthy food. Participants wanted food technology to be more practical, such as finding

out the quantity of sugar in a food, and favoured having less passive book work, design, and drawing, which was also observed by Barlex, (2020). Against this, and in favour of design strategies, Rutland and Owen-Jackson (2013) stated that 57% of teachers and 91% of pupils felt that design strategies were important in food technology. Lawson (2013) looked at the history of teaching food which was historically a subject for only females. In this current study females in School Four implied that boys are not interested and do not care about food technology; however, the females in School Four implied that they need to be aware of nutrition which was related to their future maternal role.

Adolescents in this study stated that they also obtain their nutritional knowledge from home including from parents and siblings (Chapter 5 section 5.2.3.1). However, there were numerous inaccurate nutritional statements debated. There appears to be a strong relationship between nutritional knowledge and the family environment in that healthy eating is dependent on the nutritional practice of both parents and siblings, which is in accordance with Hunsberger et al., (2015).

In the literature, some studies have indicated that adolescent nutritional knowledge is good (Talagala and Arambepola, 2016). Gilmore et al., (2020) stated that adolescents' good knowledge stemmed from food technology. Other studies which have reported that adolescent nutritional knowledge is 'respectable' are based on self-reported opinions. Yet, measuring knowledge for these studies have used a non-standard criterion (Chapter 2 section 2.11). Talagala and Arambepola's (2016) study of adolescents' knowledge was based on ten questions, and Haidar et al's., (2017) study asked four multiple choice questions. Grunert (2010) used an adapted questionnaire from Parmenter and Wardle (1999) which consisted of three parts and a total of 99 questions. Perhaps when reporting adolescent nutritional knowledge, knowledge requires a more standardised approach from a standardised set of questions by which to judge the quality of their knowledge. However, according to Croll et al., (2001); McKinley et al., (2005); Mirmiran et al., (2007); Fitzgerald (2010) and Verstraeten et al., (2014), and The Newport Academy (2019) adolescents may have a significant amount of knowledge regarding healthy foods, but their behaviour is not in accordance with this knowledge.

In this study, theme one, `health`, contained sub theme `nutritional knowledge` and a category of `we know`. Participants were confident of their opinions which developed this category (Chapter 5 section 5.2.3.2). They were interested in protein; they believed that chicken is a protein because it tastes good, and food guides depict chicken and meat as a source of protein. Only one participant in the focus group identified that baked beans were a source of protein due to an advert, even though alternative sources of protein are covered in food technology (Food as a Fact of Life, 2021). Sugar

was correlated to the Change for Life sugar app (Public Health England, 2015). Using the app, participants liked to be able to visually identify the number of sugar cubes in the food product. Participants recognised that processed meats were high in salt yet stated that chips taste good with salt. When participants discussed foods they liked, they liked food that has flavour which they identified as salt and pepper and they wanted more salt in food at school. There were mixed reactions as to the effects of consuming too much salt, with incorrect statements that salt causes cancer, especially from microwaved popcorn, and it causes diabetes. However, participants implied that the effect of salt was not important for this age group, also noted by Ruxton and Derbyshire (2011) who stated that adolescents cannot relate to being older and therefore cannot see the importance or impact of their diet on their health. Participants' knowledge of fibre was poor but those that did understand fibre gained their information from cereals and bread because it was on the packaging. It could be positive that they read the nutritional information, but it transpires that it is the nutritional claim that they notice. What is of interest is that no one stated that they had learnt any of these facts on protein, sugar, salt, or fibre from food technology. For a generation who want more interaction in their learning the use of media and apps are the way to engage.

Summing up nutritional knowledge, food technology is the most important source for adolescents to learn about nutrition. The literature identified that teachers have access to schemes of work and lesson plans, but lack of time is the major barrier to teaching this broad topic and indeed actual cooking. Technology has progressed rapidly yet passive learning, limited time spent on healthy eating and considerable time spent on design may not be the most effective method for teaching nutrition in the twenty first century. Adolescents readily engage with media and documentaries suggesting that interaction is key to gain knowledge. Studies that measure adolescents' nutritional knowledge have no standardisation and, therefore, have limited meaning. Numerous studies identified that adolescents have a significant amount of knowledge regarding healthy foods and unhealthy food, but practice is not in accordance with this knowledge.

6.4 The meaning of food

Table 6.3 triangulates the results for hypothesis four

Hypothesis	*Quantitative Results*	*Qualitative results*	*Explanation of both the results*
H04: To test the hypothesis: `there will be a significant association between adolescent gender and the importance placed on health when making food choices`.	The commonalities from each school between the genders and specific factors placed on health are not conclusive. The factors from all four schools 56.1% rated `taste` 34.2% `keeps me full` and 32.5% `keeps me healthy` at a score of five (Table 4.6). In School one, Two and Four males rated `high in protein significantly more than females but males in School Three did not identify with this factor. Females in School One and Three rated 1 and males in School Two rated `low in fat` significantly more highly than the other genders. Females in School One and Three rated `keeps me healthy` significantly more than males but there were no significant differences from School two or Four.	Males eat more than females, larger portions, more protein, do more sport, lift more weights. Females eat more salad and do weight watchers. Unhealthy food is junk, bad food.	The quantitative data results indicted that there were no specific health factors from either gender were therefore inconclusive. However, the qualitative data did indicate that people who identify with being male, or female eat differently to each other. Unhealthy food was reported as junk and polarised into good or bad food. Unhealthy food was associated with taste and being filling yet in 5.3.3.1 hunger was associated with carbohydrate by females and main meals by males.

In theme one, `health`, participants identified how they related to certain food which developed into the sub theme of `the meaning of food` (Chapter 5 section 5.2.4). Within the sub theme, two categories emerged which were `unhealthy food` and `stereotype eating by gender`. The current study highlighted participants clearly understood what constitutes unhealthy food; this was labelled as `junk food` and was referred to in a negative manner as being associated with fat, sugar, bad food and food that you eat for the sake of eating. `Fast food` was described as fatty, greasy, and revolting. Adolescents in this study acknowledged that certain foods are high in salt, or fat, but these foods were tasty and, despite the negative connotation regarding unhealthy food, they proclaimed that they would still eat them. A finding in this study highlighted the paradox between taste and perceived health of food; they openly categorised and demonised unhealthy food yet described energy dense unhealthy food as tasty and filling. In Gilmour et al's., (2020) study adolescents disagreed with the consumption of take away and fast food and were critical of people who selected them yet contradicted themselves when they stated that they craved unhealthy foods because they tasted good. Gilmour et al's., (2020) participants categorised food into good or bad and suggested

that associating certain foods with being `healthy` can be a barrier to healthy eating as dietary behaviour needs evaluating in its entirety. Other studies (McKinley et al., 2005; Fitzgerald et al., 2010; Verstraeten et al., 2014) concur with these beliefs in that unhealthy food is more tasty than healthy food, it is cheaper to buy, has a better flavour, provides greater satiation, and represents the most preferred food choices. These studies go further to state that unhealthy food at school is readily available, but it must be noted that these studies are not English and more recent English studies state that healthy food options are readily available (Gilmour et al., 2020; Gilmour et al., 2021). However, availability does not necessarily mean that these foods are selected.

Findings from the current study on the category of 'stereotype eating by gender' (Chapter 5 section 5.2.4.2), related to the differences between the quantity of food and specific foods that were associated with a particular gender. In this study, most males stated that they eat more food and consume bigger portions than females, which was also articulated within the theme of mood and hunger. Females in this study disagreed and stated that portion size is in relation to a person's physiology as people might need to eat more food if they are larger. Females suggested that males like to eat more meat, do more sport, know more about protein, and lift weights to build muscle, even though one male stated that he felt pressure to look bigger. Females also considered that females eat more desserts. Meanwhile, males in this study associate females with eating salad and making food choices based on weight control. In the study by Displippe et al., (2020) it is the parents that encouraged males to consume larger portions and eat more meat to build muscle which could indicate that stereotyping eating by gender commences at home. Maybe stereotyping eating by gender is a barrier to food choice in secondary schools with genders pressurised into conforming to social norms. However, when adolescents identified what food tastes good to them there was a similar pattern.

The quantitative results (Chapter 4 section 4.5) tested if there was a positive association between gender and the importance placed on health. Health and nutrition included factors such as contains vitamins and minerals, is nutritious, is high in fibre, is high in protein, is low in calories, is low in fat, helps me control my weight, keeps me healthy and includes lots of fruit and vegetables. However, the commonalities from each school between the genders and specific factors were not conclusive. Despite three schools identifying that male's rate `high in protein` significantly more highly than females this was not found in one school which did not identify with this factor. Females in three schools rated `low in fat" significantly more highly than the other gender at each school. Females in two schools rated `keeps me healthy` significantly more highly than males, but there were no significant results from the other two schools. All other factors as identified in Table 4.6 were not significant in relation to gender differences as indicted in Table 4.7, 4.8, 4.9 and 4.10.

In summary, participants polarise food into good and bad which can be a barrier to healthier eating. However, unhealthy food is deemed to taste better, be more satiating, be more available and is cheaper. Females implied that there is no difference in gender eating regarding the quantity of food whereas males stated that they eat more and eat bigger portions. In the twenty first century females stereotype eating by gender and associate males with eating more meat, protein and lifting weights and they themselves with eating more desserts but these results were not substantiated by the quantitative data.

6.5 I like

Table 6.4 triangulates the results for hypothesis three

Hypothesis	*Quantitative Results*	*Qualitative results*	*Explanation of both the results*
H03: To test the hypothesis: `adolescents will report that their food choices are more influenced by their peers, than the sensory aspects of food`.	It was hypothesised that similarity to foods chosen by friends would be more important than sensory factors, not only was there no significant difference between these factors, but the medians (table 4.6) also indicate a trend in the opposite direction, that sensory factors are rated more highly than similarity to friends.	Taste is flavour and seasoning, not bland, familiar choices, Females like sweet choices, carbohydrates, males prefer main meals, and meat, which are filling. It must look neat and colourful. Food choices are not influenced by my friends, We choose categories of food to socialise If my friends like it, we will try it. Food envy.	Taste was only correctly reported as food that is sweet. Tase to adolescents was food that had flavour, seasoning and was not bland, it was simple familiar and not posh. There were gender differences in foods that they liked, females preferred carbohydrate and sweet foods, males preferred main courses and meat. These food choices were also declared more filling and their choices when they are hungry. This goes against the literature that suggest adolescents consume unhealthy food choices. There were gender differences in appearance of food females liked neat well presented foods man males liked foods to be colourful. The influence of friends was strongly denied in both the focus group and ranked the lowest score (score one) from the questionnaire. Yes it was evident that friends did influence females to select the same category of food in order to socialise.

The quantitative results from the questionnaire (Chapter 4 section 4.4) used in this study identified that adolescents rate taste as the highest sensory attribute that influences their food choices. In the focus groups when participants were asked to select their top three factors, they also identified taste as the top factor. Several studies agree with this finding (Neumark-Sztainer et al., 1999; Shannon et al., 2002; Fitzgerald et al., 2010; Verstraeten, 2014; Ensaff et al., 2015a; Jefrydin et al., 2019; Ronto et al., 2020; Bawajeeh et al., 2020). However, taste is technically a sense experienced in the mouth and on the tongue that identifies sweet, bitter, sour, salty, and umami (dos Santos et al., 2017; Fifth Sense, 2021). Flavour develops when taste combines with smell (Science of Cooking, ND). Flavour embraces taste, smell, mouth feel and memory. The studies that identified `taste` as the most cited factor do not give any description regarding `taste` which provides little evidence to progress knowledge on eating behaviour. Neumark-Sztainer et al., (1999) concluded that food must taste and look better to engage adolescents to select healthier food choices. Only one study, by Gilmour et al., (2020), correctly used the term taste and identified that adolescents like carrots, broccoli, and cucumber due their sweetness, whereas they disliked the taste of peas, sprouts and cauliflower as they were slimy or bitter.

In this study, theme two `why these foods` contained the sub themes `I like`, `the social environment` and `mood`. Within `I like` was the sub theme of 'taste', 'I like these foods', and 'appearance'. In the category of taste the current study identified that adolescents described taste incorrectly and proclaimed it to be food they eat frequently or food to eat again (Chapter 5 section 5.3.1.1). More correctly they implied that they like to add `sweet` flavours to stir-fries, soy sauce `umami` and `salt`. Food that tastes good had flavour and seasoning, lots of salt and pepper. Food that tasted good had spicy flavours, in particular spicy chillies, and was seen as warm food. However, spice is not technically a taste but is more aligned to culture. Opposing this, bland and mild food had no flavour. Participants disliked foods that lacked seasoning, in particular no salt and pepper. When asked how to make food taste better at school the answer from one participant was to add salt.

In the category of `I like these foods` participants described food they liked as specific food items such as pizza, pasta, chicken, burgers, custard, or more generic food such as main meals, meat, hot foods, and sweet foods, as they taste good to them (Chapter 5 section 5.3.1.2). Participants liked the main courses they were identified as filling and tasty. Overall, they acknowledged that they liked vegetables, they were described as fresh and had lots of variety and were filling. Consuming vegetables was associated with the way that you were brought up, as 34MC5 so succinctly pointed out `*I think the point is if you are raised eating vegetables you will eat them, and if you are not and you are raised with a takeaway every week then you are not going to eat vegetables*`.

There was, however, a gender difference in the category of `I like`. Although females stated their liking for main meals, they preferred sweet foods, pasta, pizza, and jacket potatoes and males preferred main courses, hot food, meat, and burgers. Comparable results are from the study by Caine-Bish and Scheule (2009). In Caine-Bish and Scheule's (2009) study, females significantly preferred food in the starches and sweets, and fruits, and vegetables categories, and males significantly preferred the category of ethnic foods that included fajitas, tacos, and the category of fish and casseroles and beef, pork, and poultry and barbeques. However, Caine-Bish and Scheule's (2009) study was an American study from one rural school that was 95.7% Caucasian. Results were from a self-administered questionnaire which could differ if the study were in a city with a greater diversity of ethnicities. The study by Ensaff et al., (2012) stated that sandwiches, pizza, or desserts were the most preferred food choices for both genders and the most nutritionally valuable main meal only accounted for eight percent of sales in both schools. The strength of this study was that it measured actual food sales for seven months. However, the study took place in two schools in Yorkshire between 2010 and 2011; the food standards in England and Wales were formed in 2010 but not enforced until 2014, so food preferences may now differ due to different foods being on offer.

In this study, in the category of 'I like these foods', participants liked simple foods (Chapter 5 section 5.3.1.2). Females identified chips, pizza, and a jacket potato as simple foods and only one male identified simple food as a cheese sandwich. However, simple food was food that was familiar, a food that they had tasted before. Although food choice at secondary school is largely automatic, participants stated that they would not try new foods; they did not want to `risk` trying new foods as they did not want to waste their money.

In School Four participants stated that pupils will not risk trying certain foods but, it is because they do not know enough about the variety of fruits and vegetables on offer. They could not identify what a sweet potato was or tell the difference between a courgette and a cucumber or between a cabbage and a cauliflower. Studies agree with the importance of food being familiar in adolescent food choice behaviour (Neumark-Sztainer et al., 1999; Gilmour et al., 2020; Gilmour et al., 2021). Gilmour et al., (2021) agree with the findings of this study and suggested that adolescents do not try new foods and in particular vegetables because they have no knowledge of the types of vegetables available. Perhaps, food technology could include using a greater variety of vegetables and demonstrate how to make them tasty in the cooking element of the curriculum.

The category of 'appearance' identified an unusual finding. Females proclaimed that food being 'neat' was an important factor in their food choices (Chapter 5 section 5.3.1.3). The comments were from different focus groups, thus highlighting this finding. Females highlighted that they disliked the

salad being mixed up; they wanted items separately. They also noted that the fruit crumble had no definitive shape, and they disliked messy borders on food. General phrases included that the food must look neat, `neat not messy`, or 'I dislike messy food', but they also stated they were `picky eaters`. Wu et al., (2021) suggested that messy food is associated with not being prepared with care. However, these female adolescents in the current study could not describe why this attribute `puts them off`.

Males referred to colour and the appearance of food; they liked colourful pizza, and they wanted lettuce with the burger, watermelon and pineapple were all stated as important in their food choices. However, these three comments were all from the same focus group (Chapter 5 section 5.3.1.3), suggesting that when talking about a theme participants could influence other members, as was observed by Krueger and Casey (2015). However, as each member could give examples this could strengthen the point. A female participant in this study highlighted the importance of appearance of food at school, stating that whilst lining up you decide on a food based on appearance and once you have selected it you cannot hand it back.

In conclusion the key findings from this study indicate that `taste` is cited as a major factor in food choice behaviour yet is often referred to incorrectly. Taste when combined with smell produces flavour which is technically more correct. This study identified that participants like flavours and seasoning, in particular salt, but adolescents used the word to describe the foods they `like`. Females liked pizza, pasta, jacket potato and sweet foods and males identified with hot food choices, main meals and meat which is in accordance with the literature. There is a paradox in the literature between the terminology of taste and healthy food, in that healthy food is seen as tasteless. Yet, in this study adolescents like main meals and describe them as tasty, filling, and best food choices which demonstrates that this is not a concern for these caterers. Females like food to be neat and tidy and dislike messy food. Simple and familiar food choices are popular, but this is associated with not wanting to spend money on a food they may not like. Although food preferences, taste and sensory perceptions of food are individual influences they cross bidirectionally into the conceptual framework of social influences from family, culture, food availability and friends including the physical environmental influence of school. Food preferences and food availability at school may differ to what is on offer at home. Taste, flavour, and seasoning correlates to home and culture and adolescents expect food at school to taste the same as food at home. However, in the physical environmental influences of school, friends can influence taste.

6.6 The social environment

The literature has consistently documented adolescents seek self-regulation and greater autonomy over their food choices through a combination of increased independence away from the family and a need for acceptance by peer groups (Neumark-Sztainer et al., 1999; Story et al., 2002; Stevenson et al., 2007; Haidar et al., 2016; Ronto et al., 2020; Gilmour et al., 2020; Gilmour et al., 2021). Shepherd, (1999) stated that social and cultural influences can sway food choices.

Within the sub theme of the 'social environment' there is the category of 'friends`. In this study the quantitative results from all four schools indicated that adolescents self-reported that friends do not affect their food choices (Chapter 4 section 4.4). To expand further, the qualitative results were compartmentalised (Chapter 5 section 5.3.2.1). There were three components; in component one participants adamantly denied any effect from friends on their food choices, and they stated that they select their food choices independently. This is consistent with Gilmour et al., (2020) who stated that adolescents made independent decisions and that peers did not care or comment on the food choices of others. This is inconsistent with Calvert et al., (2020) who stated that females expressed males would judge or tease them if they selected healthier food choices and Verstraeten et al., (2014) who claimed if adolescent's selected healthy food choices they were mocked and called freaks.

Component two, in the category of friends, exemplified the importance females placed on socialisation which was also found in the study by Displippe et al., (2020). Participants in the current study decided on the categories of food because they wanted to be together; they stated that you don't think separately you think as a team, it's about `togetherness`. It was also about time, they chose foods `*more quickly*` or they agreed if they did select different food categories, they would wait for each other (Chapter 5 section 5.3.2.1). Gilmour et al., (2020) identified a similar finding whereby adolescents opted for similar choices, which allowed them to queue together, but they specifically selected similar options so that they were not left to eat in the canteen alone. Gilmour et al., (2020) found that adolescents who selected fast food options would finish first and leave the others behind on their own. In both this study and Gilmour et al., (2020) the reasons given for selecting the same foods, was to be together and not be left behind. These findings are the same as Displippe et al., (2020) who proclaimed that females would conform with the group food choice decision rather than follow their own personal food choices. The difference in this study and Displippe et al's., (2020) study is that females would also share less healthy foods as a sign of fitting in with friends and adopting a friend's eating behaviour, whereas females in this study proclaimed

that they do not share their food with each other. What this study does agree with in relation to that of Displippe et al., (2020) is the importance females place on socialisation at school.

In component three, in the category of friends, females emphasised that if their friends are eating a food that looks nice, they will try that food. Females would try that food because they have similar taste to each other so they know they will like it which is in accordance with Ensaff et al., (2015a) and Displippe et al., (2020). Males highlighted a craving or food envy, and they wanted that food `now` when they saw others consuming a particular food. There was one standalone comment about `peer pressure` but this terminology was not used by any other participant (Chapter 5 section 5.3.2.1).

Summing up the effect of peers on food choice behaviour, there was strong denial that peers influenced food choices at school, and this was reiterated by all participants except for one male. This denial could be seen as either a sign of adolescents stating their independence or fitting in with the group. However, the importance females place on socialisation is not a new finding and food choices are made to fit in with group behaviour. Overall, within the theme of 'why these foods' and the 'social environment', despite group denial, females' food choices are influenced by their friends due to the importance of socialisation.

6.7 Mood

The sub theme of 'mood' identified how adolescents described `hunger`, 'feel good foods` and `food that keeps them awake`. Participants in this study described what foods they would eat if they were hungry (Chapter 5 section 5.3.3.1). Both genders identified that hot meals filled them up and they both use the word 'filling' or 'fill me up'. However, males wanted a main meal plus a pudding, and they wanted bigger portions, `more of it`. Females referred to jacket potatoes, pasta, hot food, and carbohydrates. This suggests that adolescents make healthy choices when they are hungry which contradicts studies whereby unhealthy food with a lower nutritional value is synonymous with satiating hunger (McKinley et al., 2005; Ronto et al., 2020; Gilmour et al., 2020; Voi et al., 2020; Azizan et al., 2021).

There were considerable gender differences in foods that made them feel good (Chapter 5 section 5.3.3.2), but these choices are aligned to the foods that they `like` with females advocating their preference for sweet foods and chocolate (Bawajeeh et al., 2020) and males for savoury foods (Caine-Bish and Scheule, 2009). Both genders associate energy drinks and caffeine with drinks that keep them awake (Chapter 5 section 5.3.3.3), but, due to school policy, energy drinks are not allowed to be sold in the school restaurants; therefore, they can only affect food choices outside of the school environment.

To sum up, in relation to the individual influences of mood and the biological influences of hunger, adolescents focus on wanting filling main courses which contradicts the literature. Views about 'feel good foods' highlighted gender differences and keeping awake was associated with caffeine and caffeine energy drinks.

6.8 School

In theme three, `the environment`, there were three sub themes, `school`, `break times` and `the caterer`. Within the sub theme of `school` three categories emerged in this study. These categories consisted of `queues`, `exams`, and `food on the go`. In the category of queues most participants in this study agreed that the lunchtime queue was too long, and consequently took up most of their lunch break (Chapter 5 section 5.4.1.1). Missing lunch due to the length of the queue was common across genders at all schools which agrees with the findings from Gilmour et al., (2020) and Payán et al., (2021). A few adolescents said that if there was an option between eating or spending time with their friends, they would select friends and socialising. Another participant stated that by lunchtime you are hungry but by the time you have waited in the queue you have lost your appetite, resulting in being hungry for the rest of the day; this he suggested made him `moody`. Payán et al`s., (2021) study identified time constraints, the length of the queue and there being a limited quantity of their preferred food items available as barriers to eating school food. Gilmour et al., (2020) agreed with Payán et al`s., (2021) findings and stated that queues deterred adolescents from consuming food in the school canteen, which resulted in more adolescents bringing in their own packed lunch. According to Ensaff et al., (2012), food brought in from home is less nutritious than a school meal. Yet, in both of these studies and in the current study, adolescents (in School Four) implied that if they queued later in the lunch break the food options they wanted had gone.

In the `exams` category (Chapter 5 section 5.4.1.2), only females prioritised schoolwork over consuming food. These participants indicated that they would select salads and a sandwich to take back to the sixth form room to catch up on work, and they put the importance of exams before food. As the sixth form was identified with this pattern this finding indicates that selecting salads and sandwiches are applicable to older females because only sixth formers can take food away from the school dining area. No males identified with this finding.

In the category of 'food on the go' (Chapter 5 section 5.4.1.3), this study identified that only sixth formers can take food away from the school dining area, but this does not include hot meals. Females in sixth form used phrases such as eat, move, and study but they proclaimed that although they currently select salads or sandwiches, as indicated above, they would like to be able to take away the main meal as they are more filling. Pasta is served in sustainable take-out pots but without

lids so making it less convenient. Some participants described food to take out as a good option because it saves time in conjunction with freeing up space in the dining area. Others suggested having benches outside as it would be good to have fresh air, yet others declared this would make it challenging to keep the school clean. One participant suggested that the school needed more seating with larger tables, but the main issue was lack of space. As one participant stated:

> *As the years go by the school must accept more people. And I have noticed, especially this year, when I come out from getting my food I go outside and I see a huge queue with year 7 and 8 and younger years, and I think by the time they get in and get their food how are they going to have time. So, there has been a problem with people not getting enough time to get the food and being rushed (21FN4: p. 35; L1125)*

It could be proposed that having an additional designated area to consume main meals, served in a sustainable take away container, could encourage the selection and consumption of a nutritious main meal, reduce queues, allow more time to eat, and enable adolescents to socialise. If the consumption of a main meal at lunchtime became normalised this could enhance how adolescents view their food purchasing.

To sum up the physical environment of school, queues are the major barrier to both eating well and eating at lunchtime, sometimes resulting in hunger. More emphasis needs to be on take away food that is healthy and nutritious that can be consumed in a suitable designated area.

6.9 Break times

The theme of the environment included a sub theme of 'break times' and there were some original findings in this study as to how adolescents associate specific foods with each break. Most participants stated that they ate breakfast at home before school but those that did consume breakfast at school viewed their food choices as providing energy to start the day and eating before they learn (Chapter 5 section 5.4.2.1). As most participants ate breakfast at home this could be why they associated the mid-morning break with snack items. From the five males in the focus groups that preferred to select food at the mid-morning break they identified specific foods such as sausage rolls, hot paninis, pizza or that they could buy the type of food they like (Chapter 5 section 5.4.2.2). Mostly adolescents preferred the lunchtime break, and it was synonymous with filling food choices as was found in the study by Gilmour et al., (2021). Participants in this current study liked hot meals, main meals, best choices, selling better food and lunchtime was the longest break (Chapter 5 section 5.4.2.3). Gilmour et al., (2021) found that younger adolescents preferred snack food due to greater autonomy and freedom over their food choices than when they were at primary school, but this current study did not identify ages for the five participants who preferred the mid-morning break so

cannot corroborate this finding. However, in contrast to this finding, Gilmour et al's., (2020) participants shunned hot main meals, but the evidence presented did not indicate if this was due to taste preference or convenience.

6.10 The caterer

In theme three, `the environment` was a sub theme of `the caterer`; there were two categories, the 'position and the presentation of the food', and 'not enough food'. In this current study participants stated that the caterer provided healthy options and they were readily available (Chapter 5 section 5.4.3.1). Many studies have identified specific barriers to eating well at school, one of which is that there is a limited availability of healthy options (Croll et al., 2001; Ronto et al., 2020: Displippe et al., 2020) but none of these are English studies. Opposing this, Gilmour et al's., (2020) Welsh study specified that there were always healthy options available. Gilmour et al., (2021) revealed that unhealthy food choices such as brownies and cakes are prepared and regulated according to a nutritional specification to provide the healthiest product whilst at the same time giving a choice. However, Addis and Murphy (2018) and Gilmour et al., (2021) point out that by only offering healthy food, pupils may take their custom elsewhere. Nevertheless, it is not just the availability of healthy food, but presentation is as important. The term 'food choice architecture' includes all aspects of framing food, which allows adolescents food choices but within boundaries (Ensaff et al., 2015a).

The findings of this study indicated that the position and the presentation of food can influence food choice behaviour. Females stated that the food must catch your attention, yet other adolescents declared that they select the first food they see. A finding of this study was that adolescents talked about the importance of the position, presentation, and the freshness of fruit. There was evidence that the fruit section is always busy, it was available at lunchtime and that it often runs out. If fruit is positioned at the end of the counter, participants declared that if they had often already made their food selection, and they could not then put that food choice down and change their minds. This evidence could imply that unlike studies that suggest healthy food should be positioned by the till, this may be different in secondary schools and healthy food promotion should start at the point where pupils start to queue. In this study one participant suggested that fruit should be positioned next to the cakes which could encourage healthier choices.

In this current study participants stated that fruit in `bowls` was unpopular and was described as bruised and battered, bananas need to be yellow without `black bits` and they did not want `manky` looking grapes and strawberries (Chapter 5 section 5.4.3.1). This finding is consistent with the study by Gilmour et al., (2020) who stated that fruit bowls lacked presence and fruit lacked aesthetic appeal. Adolescents in the current study stated that fruit such as watermelon shards, pineapple,

melon, and grapes all looked good, and pupils select these fruits when they are presented in bags to go or disposable pots which mirrors the findings of Ensaff et al., (2015a). Participants in this current study were less interested in apples and oranges, but they did not state why. Opposing this, a study by Payán et al., (2017) found that, despite fruit and vegetables always being available, adolescents stated that they were expensive, and poor quality but mostly participants were not motivated to select them. However, Payán et al`s., (2017) study did not state how the fruit was presented or where it was positioned which could impact on motivation.

One female in this study indicated that teachers and sixth formers go into the canteen early and they opt for the salad. When the rest of the school go to the canteen and want to select salad, there is often a lack of variety, and the remainder is of inferior quality. They wanted actual lettuce and cucumber and less mixed food salad options. Salad was unappealing due to it being messy which does not encourage healthy food choices. The study by Ensaff et al., (2015a) indicated that pupils were seven times more likely to select a salad when served in pots and positioned correctly. If salad was to be served as aesthetically appealing food on the go this could also speed up service.

Only in one setting, School Four (Chapter 5 section 5.4.3.2), was there a reoccurring theme that the caterers should make more portions. Lining up takes up their lunch break and the food runs out. Participants in this study stated that if they are paying for the food, they should be able to choose from all the options.

To conclude, within the theme 'the importance of the caterer', food choice architecture allows adolescents to make food choices but within certain boundaries. Positioning and presenting food to adolescents in an attractive way can encourage healthier food choices, but food must be excellent quality and served ready to eat. There is a potential to increase sales of salads and healthy food options and display them in prepared pots/bags.

6.11 Summary

In summary, this chapter has discussed the results from both the quantitative and the qualitative data which have indicated that the experimental FL in the form of a nutritional food score did not influence adolescents to select healthier food choices. Most adolescents did not receive the post card, did not notice the posters, and did not understand the food score. Contrary to the literature which stated that females would notice FL more than males, this study found no gender difference. The literature suggested that a FL would have a greater effect on female food choices, but the quantitative self-reported data indicated that the food score had a greater effect on the food choices made by males. There was no consensus as to which FL design would have the most impact on changing adolescent food choices but adolescents' that sought more information from a

summary FL showed a greater interest in health. Nutrition is taught in food technology, but this generation want more active lessons, to cook healthier meals, and to focus on positive messages. Adolescents are confident in their nutritional knowledge which is often derived from their parents and is often incorrect. Adolescent nutritional knowledge is often reported to be good, but studies that measure adolescents' nutritional knowledge have no standardisation and, therefore, have limited meaning. This study identified that their nutritional knowledge was poor. However, adolescents are aware of what constitutes unhealthy food, and are disdainful of people consuming it but have little self-control and will still consume it. The study identified that this generation stereotype eating by gender which itself can be a barrier to food choices but the findings from the qualitative data were not substantiated by the quantitative results.

Taste was identified as the most important factor that influences adolescent food choices. However, taste is often reported incorrectly regarding the terminology, and the word flavour or more specifically food preferences, can identify their liking for certain foods. Adolescents like flavour and seasoning and dislike bland food. Females prefer sweet food and carbohydrate foods whereas males prefer main meals and protein which does little to reduce stereotyping by gender. Appearance was important for females who did not like food to look messy, but they could not expand on the reason for this view. Despite the impact of friends on their eating behaviour being strongly denied, females plan food choices to be able to socialise and females believe that if their friends like a food they would be more inclined to like it too, because they have similar taste.

Adolescents like main meals when they are hungry, but females identify carbohydrates fill them up. There were gender differences in feel good food which mirrored their food preferences. Older females will select food that enables them to study, but the impact of the queue, which can take up most of their break, can result in pupils not eating at lunchtime. Schools need to designate additional space and provide more food on the go options which can reduce the queue and potentially encourage healthy food choices. Lunch was the most preferred time to eat as it has the best food choices, especially the main meals, and the mid-morning break was associated with snack foods. The caterer should consider the presentation and positioning of food which allows choice but in a controlled environment. Fresh fruit is popular when it is presented in pots or bags which could also be an option to present salads and other healthy food choices. The most important factors are taste, appearance, positioning, and presentation.

Chapter 7: Conclusion

The aim of this study was to design and apply an experimental food label (FL) in the form of a nutritional food score. It aimed to measure the effectiveness of the FL in influencing adolescents to select healthier food choices in four fully operational secondary school restaurant settings in the Greater London area. The effectiveness of the FL was measured at three-points, each measurement point was three weeks apart. It was expected that the mean scores of the foods selected would increase after the application of the experimental FL, which would indicate that adolescents had selected healthier foods, and the alternative hypothesis would be accepted. Conversely, if the mean scores of the foods selected remained the same or decreased after the application of the FL this would indicate that the FL did not influence adolescents to select healthier food choices and then the alternative hypothesis must be rejected.

This study used a mixed methods approach. Quantitative data was produced from adolescents' actual food choices (mean score) from four fully operational restaurants in four secondary schools. Using a modified version of Ooi et al's., (2015) food choice questionnaire, this measured the importance that adolescents gave to specific factors that influence their food choice behaviour. Qualitative data was produced through focus groups and analysed using thematic analysis. The aim was to evaluate adolescents' interpretation of the experimental food score, and to better understand how and why adolescents rank the factors that affect their food choice behaviour in a school setting.

By integrating these two methods, this research aimed to measure the effect of the experimental FL on influencing adolescents to select healthier food choices. Moreover, adolescents' eating behaviour comprises numerous types of influence and this thesis concludes as to whether there are specific influences that need more consideration for future health policies to reduce the current obesity crisis.

To achieve the purpose of the study, and answer the research questions, four main objectives were set. This chapter will address each objective, answer the research questions, and accept or reject each hypothesis. The chapter will conclude with a statement of the summarised findings. Finally, the strengths and limitations of the study will be addressed, recommendations for future policy given and areas for future research will be highlighted.

7.1 Objective One

To conduct a literature review to evaluate which food label design has the greatest impact on consumer food choices.

The findings from the literature review identified that multiple nutrient profiling models exist yet each model differs according to their purpose. One purpose of nutrient profiling is to provide information for FLs. Each nutrient profile is meticulously organised and follows several stages of planning. However, difficulties exist in comparing nutrient profiles as the steps selected differ due to their designed purpose (see Chapter 2, Figure 2). As a result, a plethora of FL`s exist, and each FL differs. The findings from the literature review did not concur as to which FL has the greatest impact on consumers food choices (Chapter 2 section 2.7). However, the literature did corroborate the theory that adult and adolescent consumers who use FL have a greater interest in health and nutrition and tend to have a more positive attitude to choosing more nutritious healthy food. These consumers favoured a nutrient specific FL design over a summary design and sought more complex nutritional information from the FL. Adult consumers who use a FL and favour more nutritional information were more likely to be female, well-educated and have a higher socioeconomic status. There appears to be a relationship between being educated, seeking nutritional information, and having the knowledge to apply it. In addition, consumers with low literacy skills were found to have low cognitive processing when using a nutrient specific FL, thus suggesting this format may be too complex for many consumers. As outlined in Chapter 2 section 2.7, these consumers prefer single summary symbols whereas consumers who prefer the nutrient specific format find these symbols too simplistic.

As indicated in Chapter 2 section 2.9, the studies that looked at adolescents` preferred FL design did not agree with each other. From studies that evaluated FL use, results indicated that usage was high in this age group, but adolescents focused on sell by dates and the ingredients' lists. They also identified that adolescents do not understand the nutritional information on a FL. One study by Babio et al., (2013) (see Chapter 2 section 2.9) indicated that adolescents selected healthier food choices with a nutrient specific FL, but that study had its limitations. A limitation from Babio et al`s., (2013) study was that the study only evaluated the effect of two designs on adolescent food choices and therefore could not substantiate these findings. In addition, adolescent food choices were hypothetical therefore may not be the actual food they would normally consume. The other study by Evans et al., (2015) (see Chapter 2 section 2.8), identified adolescents' preference for a physical activity symbol (PACE) (Figure 3). PACE is a FL that indicates the amount of activity; running, walking, swimming, or cycling, in minutes needed to burn the equivalent number of calories in a serving of food. The study by Evans et al., (2015) contained a bias in that participants were recruited from sports centres and therefore would possibly have more interest in a sports related FL than other adolescents.

To summarise, there is no consensus as to the most influential FL that impacts on food choices. Consumers who seek nutritional information on a FL have more interest in health and a greater understanding and knowledge of the nutritional information. Since studies are undertaken in multiple countries and each country has a different approach to nutritional education, it is a challenge to single out the most effective FL in influencing adolescents to select healthier food choices. What must be noted is that most FLs are designed for a retail setting, and there is no standardisation as to what format should be used in a restaurant setting when multiple food choices are made in a time pressured environment.

7.2 Objective Two

To select or adapt a pragmatic food label as the basis of the experimental food label for a school setting.

The literature review could not identify a favoured FL design for use in a school setting. Some studies (Conklin et al., 2005; Rainville et al., 2010; Hunsberger et al., 2015) applied a FL which measured calories alone or calories and fat, but the results were not consistent regarding the effect of the label. However, the use of calories (as outlined in Chapter 2 section 2.8) as a FL design in a secondary school setting was rejected for this study due to the vulnerability of this age group in terms of the possibility of calorie restriction or even more serious eating problems. Therefore, this study required a pragmatic approach in selecting a FL design.

The selected design must consider the school restaurant setting. The nutrient specific traffic light FL was rejected because it was considered too complex to compare multiple food products in a time pressured environment. Some summary systems that display a single symbol or graded symbols such as one star, two stars or three stars (as outlined in Chapter 2 section 2.6) could present a challenge in gaining access to their algorithms.

However, in the UK, the Food Standards Association commissioned the British Heart Foundation to design a nutrient profile model for Ofcom (Chapter 1 section 1.7). Using the Ofcom model, any given food product generated a numerical score per 100g. If a food scored four points or more the food was classified as `less healthy` and the product was not allowed to be advertised on television. NuVal also scored food, but these foods were scored from one to 100 where one is the least healthy and 100 is the healthiest product. This simple score gives consumers a quick visual comparison between products in a retail setting.

For this research, NuVal was approached to request their assistance to score multiple foods, but this was declined. The director of the British Heart Foundation, Professor Rayner, stated (by personal communication) (Appendix Y) that the Ofcom model can be adjusted so that points for foods and

drinks can fall on a scale from one to 100 where one is the least healthy and 100 is the healthiest product. Professor Rayner was approached, and a request was made to use the adjusted formula which provided the basis of the FL. What is significant is that NuVal was only used in a retail setting and yet its holistic view of providing one score to clarify the healthiness of a product could be an approach that could influence food choice in a time pressured busy restaurant such as at a school.

In conclusion, a summary food score that was adapted from an already available British algorithm from the Food Standards Association provided a pragmatic holistic FL which had not been tested in an applied setting with adolescents.

7.3 Objective Three

To apply this experimental food label to food served at four secondary schools in London and the Greater London area to evaluate if this label guides adolescents to healthier food choices.

To test the effect of the experimental FL in the form of a nutritional food score the mean scores were measured at three-points, each measurement point was three weeks apart. It was predicted that the mean score would increase after the application of the experimental food score, which would indicate that adolescents had selected healthier foods.

Results from all four schools indicated that there was no significant difference in food scores between pre-intervention baseline, and post-intervention phase one and post-intervention phase two (Chapter 4 section 4.1).

In conclusion, the experimental FL in the design of a food score when applied to food served at four secondary schools in Greater London area did not guide adolescents to healthier food choices.

7.4 Objective Four

To appraise what factors, have the most influence on adolescent food choice at school.

All adolescents at all four schools were asked to complete a paper-based questionnaire (Table 3.23). The questionnaire asked pupils to rank on a five-point Likert scale which factors from the adapted food choice questionnaire from Steptoe et al., (1995) and Ooi et al., (2015) had the greatest impact on their food choices (a score of 1 indicating the least impact, and a score of 5 indicating the greatest impact) (Chapter 4 section 4.4). The quantitative data derived enabled the identification of any statistically significant differences in the importance adolescents place on factors affecting their food choices.

Results from the completed questionnaire (*n=2236*) indicated that pupils from all four schools rated `taste`, 'keeps me full', and 'keeps me healthy' as the highest factors. A mean figure of 56% of the

pupils over four schools gave the highest rating (i.e., score five) to 'tastes good' and a similar proportion (53%) gave the lowest rating (i.e., score one) to 'chosen by my friends', indicating that the latter factor was not deemed important in their decision making.

Results from the qualitative data (as outlined in Chapter 5 section 5.1, Table 5.2), indicated that the factors that influence adolescents' food choices are also impacted directly and indirectly by a wide range of extrapersonal and intrapersonal factors. Adolescent eating behaviour at secondary school is affected, both positively and negatively, by individual, social, physical environmental and macrosystems' influences. The most important factors that had a bearing on adolescents' food choices at school were taste, health and nutrition (individual influences), hunger (biological influences), school (physical environmental influences) and friends and family (social influences).

In both the survey and the focus groups adolescents stated that sensory aspects of food are important factors that influence their food choice behaviour. The factor of appearance was particularly important to females who disliked messy food; it had to be neat and well presented with clean lines (Chapter 5 section 5.3.1.3). There was a dislike of bland food and an emphasis on flavour and seasoning which were associated with culture and home (Chapter 5 section 5.3.1.1). Females preferred food to taste sweet or be carbohydrate based such as pizza, pasta, and jacket potatoes. Males preferred main meals, and meat, but these are foods they `like` and are not aligned to the terminology of taste. Foods they like were simple familiar foods which could be due to automatic behaviour at school and familiarity which was associated with home, and if they had eaten these foods at home this influenced their perception of how a food should taste.

Adolescents rated 'keeps me healthy' as an important factor in the questionnaire (Chapter 4 section 4.4 Table 4.6). Whilst adolescents understood that certain foods were high in salt and fat, they described them as tasty and thus declared that they would still eat them even if they were unhealthy. This could be due to adolescents not seeing the long-term health implications, or that knowledge is not in accordance with their behaviour. Adolescents polarised food into healthy and unhealthy and they demonised fast food and junk food, but this could have been to fit in with the group's denial. Opposing this unhealthy food was described as tasty, with better flavour and the type of foods that adolescents prefer; they are cheaper than healthy food and provide greater satiation. On the other hand, when participants were asked what foods, they would select from the menu or what foods they liked, they generally favoured main meals and healthy food choices.

Hunger was also deemed an important factor (Chapter 5 section 5.3.3.1). They wanted food to fill them up and be filling, males wanted bigger portions and females wanted carbohydrates and starchy foods. When adolescents were asked what food, they would select when they were hungry, both

genders favoured the main meal, pasta, and jacket potatoes. However, when discussing the classification of unhealthy foods adolescent's and the literature stated that unhealthy foods were more filling than healthy foods.

Despite nutrition being covered in school, food technology was not seen as an influencing factor on adolescent food choice at school. This type of education (Chapter 5 section 5.2.3.1) was deemed to be passive with too much time spent on drawing, whereas adolescents relate more to media, documentaries, and apps. Although the classes involved looking at FL these were for dairy free, or sugar reduced products which may not engage this age group.

There appears to be a strong relationship between nutritional knowledge, healthy eating, and the family environment (Chapter 5 section 5.2.3.1) in that healthy eating is dependent on the nutritional practice of both parents and siblings. However, much of the nutritional knowledge from parents was incorrect and this study identified that adolescent nutritional knowledge was poor. A factor to consider that could influence adolescent nutritional knowledge and health was that adolescents wanted to be educated with positive eating messages in place of negative messages. They wanted a week of workshops presented by experts. This could potentially enhance their knowledge and theoretically override the often incorrect nutritional advice from their parents. If education was from experts these experts could also hopefully lessen adolescents stereotyping eating by gender and reduce the pressure on adolescents to conform to norms.

Themes from the focus groups identified that the environment influenced adolescent food choice at school. The school environment (Chapter 5 section 5.4.1) comprised of the length of the queue, the pressure of exams on females' eating behaviour, and food on the go in the form of sustainable take away containers. In some cases, the length of the queues resulted in pupils not eating at lunchbreak, as they chose socialisation rather than eating. Females in the sixth form selected food to take away to allow them to study for their exams. There appears to be an issue between a lack of space in the dining area which results in queues and yet pupils (except for sixth formers) cannot take food away from the dining area. If pupils could take food away or be provided with additional space to consume their food, this could potentially reduce the queue and allow more adolescents to eat at lunchtime.

Adolescent food choices at school are often reported as automatic and they select food based on habit, appearance and often the first food they see. Using choice architecture allows individual choice within controlled parameters. There needs to be collaboration between the school and the caterer. If the caterers were to create healthy food choices in sustainable take away containers, in sufficient quantity, and position them at the front of the queue, and if this arrangement was in conjunction with the schools allocating additional space to eat take away foods, this could

potentially nudge adolescent food choice behaviour, reduce the queues, encourage more adolescents to eat at school and allow greater time to socialise.

The quantitative results from all four schools indicated that adolescents self-reported that friends do not affect their food choices and therefore should not be a factor to consider (Chapter 4 section 4.4 Table 4.6). However, the influence friends asserted on food choices from the qualitative results differed between what they self-reported and what they say (Chapter 5 section 5.3.2.1). Initially the effect of friends on food choices was adamantly denied. However, in practice, females indicated that they select similar categories of food to enable them to socialise. They also emphasised that if their friends implied that they like a food this gives them the courage to try that food because they have similar tastes. Males highlighted food envy when they saw others consuming their food.

In conclusion, the sensory aspects of taste, flavour and seasoning are the predominant factors that influence adolescent food choices which is related to home and culture. Adolescents demonised unhealthy food but described these foods as tasty, cheap, and filling. When food is polarised into healthy or unhealthy this can be a barrier to selecting healthier food choices. The school environment is synonymous with long queues yet by placing healthy food to take out nearer to the front of the queues and providing an additional area to consume take away foods, schools have the potential to reduce the queue and at the same time increase healthier food choices. Despite adamantly denying that friends have any effect on their food choices, females in particular display group ordering behaviour to socialise with their friends. The social environmental influences within the physical environment of a school can be seen as important factors in influencing adolescent food choices. It can be stated that the individual influences, social influences, and the effect of the physical environment from Story et al`s., (2002) conceptual model all influence adolescent eating behaviour.

7.5 Research Questions

Research Question 1 - How effective is the experimental food label at influencing adolescents' food choice behaviour in a secondary school restaurant?

As outlined in Chapter 4 section 4.1, the results from the quantitative data indicated that the experimental FL in the design of a nutritional food score, when applied to food served at four secondary schools in the Greater London area, did not guide adolescents to healthier food choices.

There could be several reasons why the experimental FL did not influence adolescents' food choices. From the food choice questionnaire, pupils were asked to tick one answer on a 5-point Likert scale if they `noticed` the food score on a scale from 1, indicating `I did not notice the food score` to a score of 5, indicating `I did notice the food score`. Results (Chapter 4 section 4.2 Table 4.4) indicated that

the average score from all four schools of noticing the food score and scoring this at score five was 16.8%. Those that scored this as score one - did not notice the food score - averaged at 46.65%.

On the same scale in the questionnaire, adolescents were asked if the food score affected their food choices (Chapter 4 section 4.3 Table 4.5). In School Two, Three and Four there was a non-significant association between pupils' gender and pupils reporting that the food score had a perceived effect on their food choices. In School One there was a significant association between the food score and the effect on food choices whereby more males identified that the food score affected their food choices than females.

Results from the focus group indicated that most pupils did not receive the post card in the awareness phase and, as a result, they did not understand the food score (Chapter 5 section 5.2.1.1). Despite posters being displayed in the dining areas most pupils stated that they did not see them. The pupils that did receive the postcard or did see the posters and did notice the food score were investigated across the entire data set and appeared to have a better understanding towards health and dietary information.

When asked about the design of the food score some pupils perceived the food score as calories which highlights adolescents` lack of knowledge of calories. It was reported as being inconsistently positioned and they wanted to see bigger signs (Chapter 5 section 5.2.1.2). There was more interest if the score could be used in conjunction with an App, but phones are not allowed in schools. However, retrospectively, when the food score was explained to them more pupils stated that it could influence their food choices.

In summary, the experimental FL was not effective in influencing adolescents' food choice behaviour in a secondary school restaurant. This could have been because the awareness phase was not successfully implemented.

> RQ2 - What factors have the greatest influence on adolescent food choice and do these factors differ between genders?

From the questionnaire, the quantitative data (Chapter 4 section 4.5) revealed that in School One, males rated the factor of food being high in protein as being significantly more important than females. Females rated low in fat, controls my weight, and keeps me healthy significantly more highly than males.

In School Two, males rated high in vitamins and minerals, high in fibre, high in protein, low in fat and controls my weight significantly more than females. Females did not significantly rate any factor higher than males.

In School Three, females rated high in vitamins and minerals, is nutritious, is low in calories, is low in fat and keeps me healthy significantly more highly than males. Males did not significantly rate any factor higher than females.

In School Four, males rated high in protein, is what I usually eat and looks nice significantly more highly than females. Females did not rate any factor more highly than males.

In conclusion from the quantitative data there were no commonalities between genders and specific factors in any of the four schools, and, therefore, results are not conclusive.

From the qualitative data there appeared to be stereotyping of gender and eating but this was not in accordance with the results from the questionnaire. The data from the focus groups (Chapter 5 section 5.2.4.2) suggested that females associate males with protein, sport, weight and building muscle, whilst one male felt pressured to conform to this body image, but this was not identified across all schools. The data from the focus groups identified that males reported that females are more concerned with weight, yet this was not indicated from the quantitative data as only females from School Three rated 'is low in calories' and 'is low in fat' as important, but males in School Two identified with both factors as well as with 'controls my weight' (Chapter 4 section 4.5). Thus, the results can not verify that any of these factors influence adolescents' food choice or that they consistently differ between genders.

From the focus groups, the factors that influence adolescent food choice which differed by gender were taste (Chapter 5 section 5.3.1.1), appearance (Chapter 5 section 5.3.1.3), feel-good foods, (Chapter 5 section 5.3.3.2) and the influence of friends (Chapter 5 section 5.3.2.1). Females favour the taste of sugar and identify these foods as feel-good foods. Males preferred main meals and protein-based foods, and associate heavy food, curry, and fried foods as feel-good foods. Females preferred food to be neat and appearance was important to them - they disliked messy food and males liked food to be colourful. Females will select the same category of foods as each other, to allow them to socialise.

In conclusion the results from the quantitative data did not verify that any of the twenty-one factors differ in importance between genders. From the qualitative data there are differences in gender in the factors of taste, appearance, feel good foods, and the influence of friends.

7.6 Research Hypotheses

1. To test hypothesis one: `an experimental food label applied to food served in secondary schools in Greater London will influence adolescents to select healthier food choices`.

The descriptive statistics indicated that there was no consistent difference in the mean scores from pre-intervention baseline, post-intervention phase one or post-intervention phase two (Chapter 4 section 4.1). The inferential tests confirmed that there was no significant difference between the weeks in any school. Thus, the thesis can reject the alternative hypothesis. From the quantitative data results, it can be evidenced that the experimental FL was not effective in influencing dietary behaviour.

2. To test hypothesis two: `females are more likely than males to both notice the food score and to self-report that the food score affects their food choices'.

As outlined in Chapter 4 section 4.2, the results from the quantitative questionnaire indicated that in all four schools there was a non-significant association between participants' gender and participants reporting noticing the food score. As outlined in Chapter 4 section 4.3, in School One there was a significant association between the food score and the effect on food choices whereby, overall, more males identified that the food score affected their food choices more than females. In School Two, Three and Four there was a non-significant association between pupils' gender and pupils reporting that the food score had a perceived effect on their food choices.

In conclusion, there was a non-significant association between gender and noticing the food score from all four schools. In School One more male adolescents identified that the food score affected their food choices than females but in the other three schools there was a non-significant association between pupils' gender and pupils reporting that the food score had a perceived effect on their food choices. Thus, the thesis can reject this complex hypothesis.

3. To test hypothesis three: `adolescents will report that their food choices are more influenced by their peers than the sensory aspects of food`.

How adolescents reported their food choices was assessed by two measures; the first was the similarity to foods chosen by friends, and the second was the sensory properties of food. Sensory properties were measured as a mean score of four factors; tastes good, smells nice, has a pleasant texture, and looks nice (Chapter 4 section 4.4).

The results indicated that in all four schools the median score for the importance of friends was lower than the median score for the importance of sensory properties. Not only was there no significant difference between these factors, but the medians also indicate a trend in the opposite direction to that which was predicted. The hypothesis that `adolescents will report that their food choices are more influenced by their peers than the sensory aspects of food` has been rejected for all schools and the null accepted.

4. To test hypothesis four: `there will be a significant association between adolescent gender and the importance placed on health when making food choices`.

Health and Nutrition included the following factors contains vitamins and minerals, is nutritious, is high in fibre, is high in protein, is low in calories, is low in fat, helps me control my weight, keeps me healthy and includes lots of fruit and vegetables (Chapter 4 section 4.5).

The commonalities from each school between the genders and specific factors were not conclusive. The thesis can reject the hypothesis `there will be a significant association between adolescent gender and the importance placed on health when making food choices` and the null accepted.

In summary, the experimental FL in the form of a food score was not effective in influencing adolescents to select healthier food choices in a live school setting in Greater London. There was no gender difference in noticing the food score in all four schools, although males in School One identified that the food score affected their food choices more than females. The awareness phase was not successful in communicating how the food score worked, resulting in a lack of understanding as to the purpose of the experimental FL in the form of a food score.

The quantitative data identified that the factors adolescents deemed the most important in their food choice behaviour were taste, hunger and keeps me healthy. The qualitative data identified that taste differed between genders with females reporting a liking for sweet foods. Males preferred main courses and meat. Story et al`s., (2002) conceptual model identified taste and sensory perceptions of food as an important individual influence in adolescent food choices. This study found that adolescents want food to have flavour and seasoning which they identify with their culture, family, and familiar food choices. How food is cooked at home set a precedence for the expectation of how a food should taste at school, suggesting that food preferences are influenced by social environmental influences.

Both genders described foods that they would select when they are hungry as main courses, pasta, and jacket potato which are nutrient dense healthy foods, yet the literature indicates that adolescents do not associate healthy food with food that satiates them. Adolescents criticised junk food and selected the factor of keeps me healthy in the top three factors that influenced their food choice behaviour. However, there is disparity between the individual influences of self-efficacy and actual behaviour in the physical environment of a school setting.

Despite the denial of any social influence of friends impacting individual food choices, females did acknowledge that categories of food can be considered as a factor that influenced their food choices to allow more time to socialise. Thus, the individual influence is swayed by both the social and physical environmental influence. The restraints of the physical influence result in queues at break

time that has an impact on adolescent food choices. The focus should be on the provision of main meals, but the caterers need to position healthy food choices closer to the front of the queue and present the food choices attractively in sustainable take away containers, and the schools need to designate additional space to consume take away food. Using choice architecture allows adolescents individual choice within controlled parameters.

7.7 Strength and Limitation of the Study

This section will address the strengths and limitations of the study. The strengths of this study were that this research used an experimental FL design in the form of a nutrient food score that has not been used before. A single score allows adolescents to visually assess multiple foods for a quick easy comparison regarding the nutrient value of each food item in a school restaurant setting. This food score was applied in four operational school restaurants to measure adolescents' real life food choices. Studies that have evaluated the effect of a food score from NuVal were undertaken in a retail environment with adults. This study explored whether the food score influenced adolescents to select healthier food choices alongside explaining the reasons for either the success or failure of the food score impacting on their behaviour.

The food score design can be replicated to test the effect of the design in different settings. The process of scoring the food used standardised recipe cards, (Figure 7), diet plan 7 (Appendix Q), and an algorithm designed for the Food Standards Agency (Table 3.12). Through using a pragmatic and a positivist approach the study was able to generate quantifiable data that measured the effect of the FL. When combined with the interpretivist approach this study allowed the quantitative data of the mean scores from the food score to be reported alongside adolescents' thoughts regarding the food score and its influence on their food choices.

A further strength was the use of the adapted validated food choice questionnaire (Table 3.23) from Steptoe et al., (1995) and Ooi et al., (2015). Ooi et al`s., (2015) questionnaire was specifically designed to measure adolescents' food choices. The results produced measurable data regarding which factors adolescents reported as influencing their food choices the most. Through the interpretivist approach adolescents were able to expand on how they interpret these factors. The deductive approach tested verifiable evidence whilst the interpretive approach identified patterns in food choice behaviour. Overall, the current study combined quantitative and qualitative research in a manner that previous literature has not. The research verified the literature regarding specific factors that affect adolescent food choices and put forward new factors for consideration for future policy.

Ethical issues were fully complied with throughout this study. The schools took responsibility for gaining parental consent for the participants to attend the focus groups. Participants had total anonymity, no names were used, and they could leave the focus group discussion at any time and their contribution to the qualitative data would be removed. There was a balanced representation between males and females and all participants contributed to the discussion. Transcripts were typed verbatim and by using NVivo and open coding it was possible to organise and examine different themes from an expansive data set.

There were several limitations of the study. It was not possible for me as the researcher to select the schools and I had to rely on the contract caterers to provide them. This resulted in considerable distances between the locations. Three schools who were operated by one of the contractors commenced the experiment at the same time on the 5th of October, School Four commenced 20th of November (Appendix N). I was in full time employment and due to the distance between the schools I had to rely on the client, tutors, and the caterer to deliver the awareness phase, (Chapter 3 section 3.25), position the posters (Illustration 3.1), and position the food score (Illustration 3.2 and 3.3). The awareness phase was not successful, and most adolescents did not understand the food score which may be the reason that the food score did not influence adolescent food choices. Not being able to amalgamate the data across all schools was an unavoidable limitation.

Although Ooi et al's (2015) food choice questionnaire was designed for adolescents it had to be adapted for the school environment (Table 3.23). Initially the questionnaire was going to be completed online in IT lessons which could have resulted in a greater response rate. This proved challenging for schools to logistically get all pupils to the IT rooms to complete the questionnaire. Nevertheless, despite this limitation the response rate was considered reasonable for a study of this kind.

In summary, the novel design measured real food choices in a live school setting and used both quantitative and qualitative methods which has not been done before. The algorithm for the FL can be replicated and the study used a validated food choice questionnaire. The main limitation was thought to be due to the unsuccessful awareness phase, resulting in a lack of understanding of the experimental FL. The methodological recommendation for future research is to ensure that adolescents are educated regarding the intervention.

7.8 Recommendations for future policy

The evidence of the factors that policy should consider are taste and the connotation of healthy eating, queues, the position and presentation of the food and education.

This study identified that adolescents focus on taste and flavour, keeps me full and keeps me healthy as their top factors affecting food choices. Some studies imply that adolescents understand healthy eating whilst others disagree but advocate that by adolescents polarising healthy food into good and bad categories this can be a barrier to healthy eating. From this study, the terminally of 'healthy food' was described as synonymous with being tasteless and expensive.

This study identified that adolescents preferred the main meals which were described as tasty and filling. `Keeps me full` was an important factor adolescents consider in their food choices at school. Both genders associated foods that are tasty and filling with main meals and carbohydrate food choices. This is a significant finding for policy makers, especially if school food is an adolescent's primary meal of the day. At school the main meal choices, jacket potatoes, vegetarian pizza and pasta scored some of the highest food scores, illustrating the nutritional density of these food choices. It is well documented that hunger affects learning (The Felix project, ND). Policy makers could consider marketing these foods as `hunger busters` which can be of benefit to the individuals learning and physical development. In addition, it can be of benefit for the school in higher educational attainment and for the profit of the caterer.

Adolescents in all schools complained about the length of the queues. Due to their experience of the queuing system, adolescents' food choices were compromised. In some cases, they elect not to eat which can impact on individuals' learning and results in hunger. Dependent upon the school and space available, schools could designate additional space to eat at lunchtime. This space could be in the form of standing or sitting space to consume take away food options. To ease the problem of limited space and reduce queues, caterers could position and present healthy food choices near to the start of the queue in sustainable take away containers. As food choices at school are often selected due to their presentation or as adolescents select the first food they see, this can potentially influence food choices, allowing individuality of choice within a controlled environment. This could also influence females' selection of categories of food to enable them to socialise. Evidence from the literature revealed that adolescents' understanding of nutritional information on FLs is low and that adolescents` knowledge on nutrition is poor. Given the growing evidence on adolescent obesity the emphasis on policy should include `health` as a subject in its entirety. Currently, nutrition is embedded within food technology which covers a broad span of topics. Findings from this study indicated that adolescents want positive health messages, and these messages must be capable of being applied and considered in relation to longer term health. The use of media to engage this generation is essential to their learning and engagement. Ultimately FLs do not impact on food choice behaviour unless adolescents are educated in how to read them and how to make healthy food choices.

7.9 Areas for future research to consider

A number of recommendations for further research have been derived from this study. Three areas are identified in this section. The first relates to possible extensions of the current study by additional analyses of the data. The second is a recommendation as to how the focus of further research could be shifted in the light of the literature review and findings from this study, and the third emphasises the importance of education and the concomitant technology.

Inevitably, in a project of this nature, choices had to be made as to the focus of the study and the use of data that addressed the research questions and the objectives. Indeed, more quantitative data were collected than were included in the analysis. This research concentrated on the influence of an experimental FL on adolescents' food choices at school and the factors adolescents rank as important in their eating behaviour. The study recorded actual food sales in four live operational settings. In three of the schools the main meal was in the top two sales items. School Three had low main meal sales. School Four increased the price of the main meal after the baseline sales were recorded which resulted in the highest sales from the lite bite menu which consisted of more snack food. Therefore, future research could explore these food choices, with an extension of questioning in focus groups, in order to evaluate how much price affects food choices in a school setting.

Second, the questionnaire included a section on nutritional knowledge (adapted from Parmenter and Wardle 1999) (Appendix W and X). The literature suggests that nutritional knowledge increases with age, and an investigation of this conclusion could shed light as to whether different approaches to FL would be suitable, depending on the age of the pupils. The literature also suggests that females have greater nutritional knowledge than males and such a study could help to verify or dispute this. More specifically, an in-depth research study along these lines could identify if either gender has more knowledge of specific food categories. The literature and data from the focus groups suggests that males identify with protein and females with lower fat food choices, and it would be of interest to explore this further. The results could have a bearing on the kind of education about nutrition that is made available to enhance improvements in food choice behaviour.

Third, and linked to the above point, active education is recognised as a key area to consider for future research. The adolescents in this study are generation Alpha who were born into a digital world. Future research could focus on producing an App which pupils can access, and not one that is dependent on policies regarding the use of mobile phones in school. Adolescents could scan and record their food choices at school to produce a weekly average food score. This App needs to be incorporated into their education curriculum that contain positive weekly messages, which could be

reinforced through multiple interactive games. This could probably identify more precisely if adolescent food choice behaviour can be influenced by a food score.

7.10 Overall conclusions and contribution to knowledge

In conclusion, the food score did not influence adolescents to select healthier food choices in selected secondary schools in Greater London. It is believed that the main factor contributing to this was the unsuccessful awareness phase; most pupils did not receive their post cards; they did not understand the food score and they did not notice the posters. The minority of pupils who indicated that they did receive a post card, or see the food score, or see the posters, were shown across the data set to have more interest in health and healthy eating. There were no gender differences with regards to noticing the FL. However, more males identified that the food score affected their food choices than females. Education integrated with technology is required for future research in this area.

Taste was the most important factor that influenced adolescent food choices, but this terminology was incorrectly used and the terms `flavour' or 'food preferences' were more correct. The study identified that females preferred sweet food and carbohydrate-based foods and males preferred main meals and protein foods. When adolescents described foods that made them feel good these same gender differences were noted. One contribution to knowledge from this research is that adolescents like flavour, seasoning, and familiar foods; they dislike bland food, and relate `flavour` to culture and food consumed at home. The sensory aspects of appearance also revealed a contribution to knowledge whereby females wanted food to look neat and not messy, and males wanted food to be colourful. Both genders favoured the colourful presentation of sliced fruit in bags or sustainable pots, but caterers need to make enough to satisfy demand, ensure that these food choices are available at all break times and position them in a prominent place.

The positioning of food in a school environment differs to that of a retail environment. School is a time pressured environment and pupils rely on their food choices predominantly through an automatic, non-cognitive process. Adolescent food choices can be influenced by the position of the food, familiarity of the food, or by selecting the first food that looks good. Therefore, by re-positioning healthy and well-presented food choices near to the front of the queue, this could challenge such behaviour and lead to healthier eating.

By understanding adolescent behaviour and changing the environment, this can assist in shaping healthier food choices. The effect of friends on females' food choices was identified. Females will select categories of foods in order that they can socialise. Caterers need to identify what these

categories are, present them neatly and position them to nudge food choices towards the healthier options.

Unhealthy food was demonised, but was associated with being cheaper, more satiating, and tastier than healthy food, therefore adolescents confess that they will still consume it. However, adolescents liked the main meals which were identified in both the sales data and the focus groups. Main meals were described as `filling', and hunger was a factor adolescents prioritised in their decision making. Therefore, the application to knowledge is to maximise this finding and market the main meals, accordingly, ensure that meals have flavour, and that sufficient meals are produced at an affordable price.

Time, space, and queues were identified as barriers as to why adolescents do not eat school food. To change this, the caterer needs to produce enough nutritious main meals with options for the meal to be served in sustainable take away containers. The school should apportion additional space in which to consume these food choices. This would lead to a reduction in the length of the queue, giving adolescents more time to socialise while still consuming nutritious food choices.

Chapter 8: Reference list

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