



PEXPO 2021

CAN-TEENS MAKE BETTER FOOD CHOICES?

Project Booklet

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<https://scienceproject21.wixsite.com/canteens>

Overview:



“My project aims to encourage adolescent students to make healthier food choices when consuming food from their school canteen using a ‘traffic-light’ system”

Acknowledgements:

I would like to thank and acknowledge the guidance and support from many throughout the project...

Firstly, a sincere thank you to the entire PE Xpo community, your encouragement last year really motivated me to further my studies in the area of nutrition this year.

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Abstract:

Introduction:

The essence of my research is the overall lack of nutritional knowledge and the poor nutritional choices made by teens in their school canteens. Adolescents are currently not meeting the recommended guidelines for numerous nutrients and vitamins and according to a study by Rastogi S, et al. 2018, is exacerbated by the skipping of meals particularly school meals. According to this study 72% of adolescent school-goers between the ages of thirteen and fifteen skipped one or more meals on a daily basis. Only 18% of those surveyed knew that a lack of iron could cause anaemia whilst the other 82% seemed to believe that a lack of iron and other essential vitamins and nutrients would not cause them any harm in the future. Lack of knowledge in regard to nutritional requirements overall and RDA levels of salt, sugar, fat and saturates for teens resulted in those surveyed either skipping meals or making poorer choices in school canteens.

Low consumption of essential vitamins and nutrients during adolescence is linked to a number of potential long-term health deficiencies including bone health deficiencies, weight control, cardiovascular disease and colorectal cancer. Whilst also being a key cause of the development of anorexia, bulimia, insomnia, lethargy and poor concentration levels (WHO, 2002). National survey data shows adolescents' intakes of saturated fatty acids, salt and non-milk extrinsic sugars (added sugars) are above recommended levels (British Nutrition Foundation 2015). Hence, education on this topic is essential for adolescents in order to prevent many long-term health effects.

One of the issues with school canteen meals is that sometimes the most 'common' choices are the ones with the least nutritional value (Colby College, 2018). The high levels of salt, sugar and fat can unfortunately make these nutritionally poor options taste better which is why they are often chosen. Overall, there has been very little research done to date with regards to school canteen meals and those existing are predominantly observational studies rather than providing solutions. In addition, no studies have been completed on adolescent's knowledge of RDA. Education of adolescents in nutritional knowledge is hit and miss at best. The culmination of the lack of knowledge and education, the lack of food choices, poor food choices, and the lack of a clear concise system whereby nutritionally knowledgeable choices can be made is creating the perfect storm for the future health of adolescents. *"The consumption of essential vitamins and nutrients amongst adolescents is declining steadily and will continue to do so if this problem is not adequately addressed"* (British Nutrition Foundation, 2015).

Therefore, the examination of school canteen meals, the education of adolescents on nutritional knowledge relevant to their age group with a particular focus on RDA for salt, fats, sugar and saturates and the introduction of a clear, concise and easy to read food traffic-light system in school canteens is crucial to tackling these issues.

Experimental Methods:

1. I interviewed 10 female and 10 male adolescents at random in my school and asked them questions about their current food choices in relation to the school canteen.
2. Due to the result obtained in the interviews, I realised that the students were looking for more choice in meals and so, I introduced two additional choices.
3. I kept track of all orders in my school canteen for a week and analysed these results using SPSS to see which of the meals were the most popular.
4. I carried out my first online survey amongst 150 male and 150 female adolescents (n=300) from the age range of 12 to 18 in my school. I got them to rank which meals they thought were the healthiest and which they thought were the least healthy. I also asked them further questions such as what their likelihood was to choose each of the meals.
5. I analysed the quantities of fat, sugars, saturates and salt in each canteen meal and designed my food traffic-light system.

6. I then introduced my food traffic-light system and kept track of the orders for a week. I analysed these results using SPSS to see how big of an influence the food traffic-light system had.
7. I then designed an 'Importance of School Meals' website (including nutritional information and my food traffic-light system) to further educate students on adolescent nutrition.
8. I then re-surveyed the same 150 male and 150 female adolescents (n=300) and analysed these results using SPSS to see how the food traffic-light system had also influenced how healthy and unhealthy they now thought that the meals were.
9. Due to the fact that the 'Chicken Fillet Roll' was still being purchased even though it was an unhealthy option, I worked with my Home Economics teacher in order to make a healthier version. I demonstrated making this to a class and asked them their thoughts on it. Feedback was positive and therefore, I plan on introducing this into the school canteen with the help of the canteen staff in late January.
10. I conducted an interview to obtain as much real-life information as possible. This interview was with BiteBack 2030 member Nika Strukelj. Here I found out more information about their ideas on school meals and food traffic-light systems.
11. I drew a conclusion on my study.

Results:

IBM SPSS Statistics 26 Software was used to analyse all data obtained. Sample size n=300. I kept track of orders on meals twice in my school canteen, once prior to introducing my food traffic-light system and once afterwards. Furthermore, I carried out a survey twice amongst my target group (n=300), both before and after my experimental methods. I then compared my results. This ensured that my experimental methods were beneficial and that they educated my target group on how nutritionally beneficial each meal in the school canteen is and what quantities of sugar, salt, fat and saturates they need to be consuming daily prior to taking the second survey. Full results can be viewed in (5.0 Results), but here is a summary:

After tracking the orders on both occasions, it was clear that the 'Chicken Fillet Roll', the least healthy meal had become much less popular with now only 19.3% purchasing it rather than the previous 72%. Additionally, 'Beef Stew', the healthiest meal became much more popular as now 53.3% were purchasing it rather than the previous 8%.

Nutritional knowledge also increased. One example is how prior to my experimental methods only 34.7% knew that 6g of salt was the correct RDA whereas after my experimental methods 81.3% knew this figure.

Discussion:

This study has revealed that adolescents have a poor knowledge of nutrition and its implications for long term health. It has also revealed that students are unable to easily identify which foods are more nutritionally beneficial in their school canteens. Increasing nutritional knowledge in adolescents and providing them with a clear, concise method of making healthy choices has the potential to reduce obesity and other medical issues caused by poor nutrition. This study has highlighted the need for an information campaign on good nutrition and the urgent need for the introduction of a food traffic-light system in school canteens.

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Introduction:

1.1 TEENS Nutrition:

The road to good health in adulthood is paved with the decisions made during the teenage years. And as teen girls and boys continue to grow, there are daily nutrients and habits they'll need to keep them happy and healthy.

“In transition from the childhood to the teen years, nutritional needs increase with the rapid physical growth that occurs during those years,” says APHA member Nicole Larson, PhD, MPH, RDN, a National Institutes of Health-funded researcher and senior research associate at the University of Minnesota’s School of Public Health. *“So, there’s an increase in energy demands, but it’s also important to think about increases in nutrient demands.”* (Larson N, American Public Health Association 2016)

Nutrients, by definition, are substances that provide nourishment essential for the maintenance of life and growth. Growth and development are rapid during adolescent years, and demand for most nutrients is relatively high. At this stage, a number of physiological, physical and behavioural changes occur. Adolescents require an increased amount of nutrients for these physical changes. They should eat a healthy, varied diet as described in the Eatwell Guide; a healthy diet is important for growth, maintaining a healthy weight and preventing chronic diseases as they get older.

Whilst the demand for most nutrients is similar to other age groups, there are some nutrients that adolescents need more of to meet the period of increased growth, for example calcium. Requirements for many other vitamins and minerals are higher compared to the needs of younger children (see nutrient requirements below). This demand differs between boys and girls: for example, boys need more protein than girls as they are generally larger and have a greater body mass (British Nutrition Foundation 2015). In general, however according to John Muir Health teens should eat a varied diet including:

- Fruits and vegetables every day. Teens should eat 2 cups of fruit and 2 ½ cups of vegetables every day (for a 2,500-calorie diet).
- Calcium-rich foods. The rapid increase in bone mass in young people means that they require more calcium during their teenage years and if this is not provided, future bone health may be compromised. At ages 11-18 years, the reference nutrient intake for boys is 1000 mg per day and for girls the figure is 800 mg per day.
- Protein to build muscles and organs. Teens should eat around 50g of protein per day on average. However, if teens are small or large for their age, or very active, their needs are different.
- Whole grains for energy. Teens should get 170g of grains every day.
- Iron-rich foods. Boys double their lean body mass between the ages of 10 and 17 and thus need iron to support their growth. Girls need iron for growth too, and to replace blood they lose through menstruation. The reference nutrient intake for girls (11-18 years old) is 14.8 mg of iron each day, while for boys of the same age the figure is 11.3 mg of iron daily.
- Limiting fat. Teens should limit their fat intake to 25 to 35 percent of their total calories every day and they should choose unsaturated fats over saturated fats whenever possible (Figure 1.1)

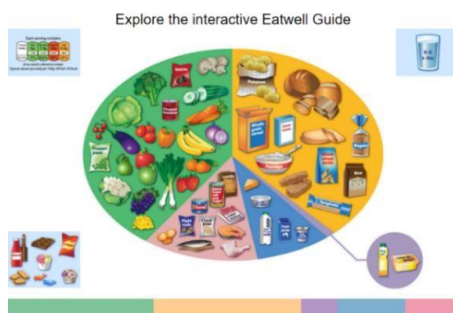


Figure 1.1 – Wheel illustrates how much should be eaten from each food group in order to achieve a healthy, balanced diet. (The National Health Service – The Eatwell Guide)

However, although essential nutrients and vitamins are vital for adolescents, many adolescents still do not have balanced diets. According to a study by the *University of Oklahoma Health Sciences Centre in 2013*, 80% of adolescents had unhealthy diets and this number is steadily increasing. I believe that my first survey and tracking of

orders will illustrate a similar result.

As more independent choices are made, consumption of low-nutrient energy-dense (LNED) foods may increase, with a consequent excess intake of added sugar and fat, and inadequate intake of micronutrients such as calcium, iron, zinc, and vitamins A and C. The changes that occur during adolescence may contribute to the development of a number of nutrition-related problems that may have lasting effects throughout the lifespan (Banna et al. 2016)

Adolescents need a healthy, varied diet, incorporating all the major food groups. As well as having some more noticeable benefits in the short-term, such as improved energy levels, in the long term, a healthy, balanced diet can help reduce the risk of chronic diseases such as heart disease, type 2 diabetes and osteoporosis. The most recent report of the *National Diet and Nutrition Survey (NDNS)* rolling programme Years 1-4 was published in 2014. Several areas of concern for this age group were highlighted:

- The RDA for the average adolescent for salt is 6g, sugar is 25g, fat 60-80g and saturates 25g.
- Both boys and girls exceeded the recommendation that only 11% of food energy should come from non-milk extrinsic sugars (NMES) (referred to as added or free sugars), consuming on average about 15.6% of food energy from NMES.
- Average intakes of total fat were 34% of food energy, just below the benchmark of 35%.
- But average intakes of saturated fatty acids were at 12.5% of dietary energy, higher than the recommendations of 11%.
- Adolescents aren't getting enough dietary fibre. New recommendations for fibre intakes suggest that 11-16-year-olds should have 25g fibre/day and 16-18-year-olds 30g/day, but current intakes are around 15g/day. Some adolescents had low intakes of nutrients such as calcium and iron, with more girls having vitamin and mineral intakes below the LRNI compared to boys. Intakes below the LRNI are likely to be inadequate and may lead to nutrient deficiencies.
- Low intakes of vitamin A, zinc and iodine are also of concern in some adolescents. Additionally, for some girls aged 11-18 years, low intakes of folate are of concern.
- Daily sodium intakes, estimated from sodium excreted in urine over 24-hours, were higher than the RNI. The estimated mean intake of sodium was 2.8 g/day in boys aged 11-18 years and an average of 2.5 g/day in girls aged 11-18 years. These figures are equivalent to 7.1 g/day and 6.2 g/day of salt, respectively. It is recommended that children 11 years or over should not consume more than 6 g of salt per day. These levels, together with salt added during cooking and at the table, are likely to exceed the current recommendation. Persistently high levels of salt in the diet can contribute to high blood pressure, which is a risk factor for heart disease in later life.

1.2 Sources of Essential Nutrients:

<u>Nutrient:</u>	<u>Sources:</u>
Complex carbohydrate & fibre	wholemeal bread, wholegrain cereals, baked beans, pasta, potatoes, peas, other starchy vegetables
Protein	lean meat, chicken, fish, cheese, milk, eggs, bread, nuts, legumes
Fat	oils, butter, margarine, cream, meat, cheese, pastry, biscuits, nuts
Preformed Vitamin A	butter, margarine, cream, cheese, eggs, meat
Beta-carotene (converts to vitamin A)	carrots, spinach, pumpkin, broccoli, tomatoes, apricots, rockmelon
Vitamin D	fatty/canned fish, butter, margarine, cream, cheese, eggs
Vitamin E	polyunsaturated oils, polyunsaturated margarine, nuts, olive oil, fatty fish and small amounts in wholegrain cereals and green vegetables
Vitamin K	green vegetables, cheese, butter, pork, eggs
Thiamin	wholegrain cereals, pork, bread, nuts, peas
Riboflavin	milk, meat, eggs, cheese, wholegrain, cereals, nuts, mushrooms
Niacin	fish, meat, peanuts, wholegrain cereals, nuts, mushrooms
Pantothenic acid	eggs, wholegrain cereals, peanuts, fish, meat, vegetables
Vitamin B6	wholegrain cereals, meat, fish, peanuts, bananas
Folic acid	green vegetables, wholegrain cereals, wholemeal bread, nuts
Vitamin B12	meat, fish, eggs, cheese, milk, oysters
Biotin	eggs, cheese, milk, fish, wholegrain cereals
Vitamin C	oranges, tomatoes, potatoes, broccoli, cabbage, brussels sprouts, strawberries
Calcium	cheese, milk, yoghurt, canned fish, nuts, sesame seeds (tahini), dried fruit
Phosphorus	meat, fish, poultry, eggs, milk, cheese, nuts, cereals, bread
Iron	meat, poultry, wholegrain cereals, wholemeal bread, eggs
Sodium	table salt, meat, milk, cheese, seafood, spinach, celery
Potassium	potatoes, bananas, oranges, apricots, other fruit and vegetables, meat, fish, nuts
Iodine	sea foods, milk and cereals and vegetables from areas with high iodine content in the soil, iodised table salt
Zinc	oysters, meat, fish, poultry, eggs, wholegrain cereals, peanuts

Table 1.1 – *Illustrates the best sources of essential vitamins and nutrients (Professor Mark Wahlqvist of The Nutrition Society 2002)*

Nutrition is a vital factor for healthy development and growth in adolescents especially as their bodies are going through a period of rapid growth and development leading to an increased demand for energy and nutrients.

Teens need a variety of nutrients, such as iron, calcium, folic acid and protein, which can be found in lean meats, whole grains, low-fat dairy foods, fruits and vegetables, according to *The U.S. Department of Agriculture's Center for Nutrition Policy and Promotion 2000*.

1.2 Factors Affecting Food Choices:

According to *The European Food Information Council 2006*, the key driver for eating is of course hunger but what we choose to eat is not determined solely by physiological or nutritional needs. Some of the other factors that influence food choice include:

- Biological determinants such as hunger, appetite, and taste
- Economic determinants such as cost, income, availability
- Physical determinants such as access, education, skills (e.g. cooking) and time
- Social determinants such as family, peers and meal patterns
- Psychological determinants such as mood.
- Attitudes, beliefs and knowledge about food

Food choice factors also vary according to life stage and the power of one factor will vary from one individual or group of people to the next.

1.3.1 Biological Determinants of Food Choice:

Hunger and satiety:

Humans need energy and nutrients in order to survive and will respond to the feelings of hunger and satiety.

The macro-nutrients i.e. carbohydrates, proteins and fats generate satiety signals of varying strength. The balance of evidence suggests that fat has the lowest satiating power, carbohydrates have an intermediate effect and protein has been found to be the most satiating.

The energy density of diets has been shown to exert potent effects on satiety; low energy density diets generate greater satiety than high energy density diets. The high energy density of high-fat and/or high-sugar foods can also lead to 'passive overconsumption', where excess energy is ingested unintentionally and without the consumption of additional bulk. (Stubbs RJ, et al. 1996).

Palatability:

Food is not solely regarded as a source of nourishment but is often consumed for the pleasure value it imparts.

The influence of palatability on appetite and food intake in humans has been investigated in several studies. There is an increase in food intake as palatability increases, but the effect of palatability on appetite in the period following consumption is unclear. Increasing food variety can also increase food and energy intake and in the short term alter energy balance (Sorensen LB, et al. 2003).

Sensory Aspects:

'Taste' is consistently reported as a major influence on food behaviour. In reality 'taste' is the sum of all sensory stimulation that is produced by the ingestion of a food. This includes not only taste per se but also smell, appearance and texture of food. These sensory aspects are thought to influence, in particular, spontaneous food choice (See Table 1.2).

From an early age, taste and familiarity influence behaviour towards food. A liking for sweetness and a dislike for bitterness are considered innate human traits, present from birth (Steiner JE 1977). Taste preferences and food aversions develop through experiences and are influenced by our attitudes, beliefs and expectations (Clarke JE 1998).

Sensory Characteristic	Sensory Property		
Taste	1. Sweet	4. Bitter	7. Capsaicin
	2. Sour	5. Umami	8. Hot
	3. Salty	6. Astringent	
Flavor	1. Citrus-Fruit	9. Fermented-Beverage	17. Vegetable-Cooked
	2. Non-Citrus-Fruit	10. Compound-Beverage	18. Fruit-Cooked
	3. Fresh-Vegetable	11. Mammal-Meat	19. Smoky-Emphyreumatic
	4. Dried-Vegetable	12. Fish-Meat	20. Broiled, fried-Emphyreumatic
	5. Aromatic-Spice	13. Fowl-Meat	21. Roasted, toasted, baked-Emphyreumatic
	6. Lachrymatory-Spice	14. Vegetable-Fat	22. Fermented-Stench
	7. Hot-Spice	15. Animal-Fat	23. Oxidized-Stench
	8. Unfermented-Beverage	16. Broth-Cooked	
Texture	1. Brittleness	3. Gumminess	5. Oiliness
	2. Chewiness	4. Creaminess	6. Viscosity

Table 1.2 - Illustrates the different sensory characteristics and their sensory properties (Angskun T 2014)

1.3.2 Economic and Physical Determinants of Food Choice:

Cost and Accessibility:

The cost of food is a primary determinant of food choice. Whether cost is prohibitive depends fundamentally on a person's income and socio-economic status. Low-income groups have a greater tendency to consume unbalanced diets and in particular have low intakes of fruit and vegetables (De Irala-Estevéz J, et al. 2000)

Education and Knowledge:

Studies indicate that the level of education can influence dietary behaviour during adulthood (Kearney M, et al. 2000). In contrast, nutrition knowledge and good dietary habits are not strongly correlated. This is because knowledge about health does not lead to direct action when individuals are unsure how to apply their knowledge. Furthermore, information disseminated on nutrition comes from a variety of sources and is viewed as conflicting or is mistrusted, which discourages motivation to change (De Almeida MDV, et al. 1997). Thus, it is important to convey accurate and consistent messages through various media, on food packages and of course via health professionals. Furthermore, according to the *Healthy Eating Advisory Service 2016*, traffic-light food labelling systems have been successful in encouraging healthier dietary habits amongst all age categories.

1.3.3 Social Determinants of Food Choice:

Influence of Social Class:

What people eat is formed and constrained by circumstances that are essentially social and cultural. Population studies, including a study by Hupkens CL et al. in 1997, show there are clear differences in social classes with regard to food and nutrient intakes. Poor diets can result in under- (micronutrients deficiency) and over-nutrition (energy over consumption resulting in overweight and obesity); problems that face different sectors of society, requiring different levels of expertise and methods of intervention.

Social Context:

Social influences on food intake refer to the impact that one or more persons have on the eating behaviour of others, either direct (buying food) or indirect (learn from peer's behaviour), either conscious (transfer of beliefs) or subconscious. Even when eating alone, food choice is influenced by social factors because attitudes and habits develop through the interaction with others. However, quantifying the social influences on food intake is difficult because the influences that people have on the eating behaviour of others are not limited to one type and people are not necessarily aware of the social influences that are exerted on their eating behaviour (Feunekes GIJ, et al. 1998).

Social support can have a beneficial effect on food choices and healthful dietary change (Devine CM, et al. 2003) Social support from within the household and from co-workers was positively associated with improvements in fruit and vegetable consumption (Sorensen G, et al. 1998) and with the preparative stage of improving eating habits, respectively. Social support may enhance health promotion through fostering a sense of group belonging and helping people to be more competent and self-efficacious (Berkman LF 1995).

The family is widely recognised as being significant in food decisions. Research shows the shaping of food choices taking place in the home. Because family and friends can be a source of encouragement in making and sustaining

dietary change, adopting dietary strategies which are acceptable to them may benefit the individual whilst also having an effect on the eating habits of others (Anderson AS, et al. 1998).

Social Setting:

Although the majority of food is eaten in the home, an increasing proportion is eaten outside the home, e.g. in schools, at work and in restaurants. The venue in which food is eaten can affect food choice, particularly in terms of what foods are on offer. The availability of healthy food at home and 'away from home' increases the consumption of such foods. However, access to healthy food options is limited in many work/school environments. This is particularly true for those with irregular hours or with particular requirements, e.g. vegetarian (Faugier J, et al. 2001). With the majority of adult women and men in employment, the influence of work on health behaviours such as food choices is an important area of investigation (Devine CM, et al. 2003).

The physical environment also plays a part in influencing behaviour, with the school environment being of particular importance. School food environments and practices affect dietary behaviours of US public school children (Journal of the American Dietetic Association Journal 2009).

School food and physical activity (PA) environments and cultures can impact the eating and physical activity behaviours, as well as BMI, of students¹. Adolescents are aware of the discrepancy between health education advice, and school-wide food practices and it contributes to their confusion about nutrition and health (Birch et al. 2009)

Schools are providing many of the foods that contribute to high sugar and fat intakes among Irish adolescents. This appears to be at odds with their responsibility for child welfare and national dietary recommendations for young people. This study highlights the ad-hoc nature of food provision to school-going adolescents in the ROI and the need for a national nutrition policy for secondary schools (Irish Universities Nutrition Alliance, The National Teens' Food Survey 2005)

At the societal level are media influences; several recent studies in diverse adolescent populations have demonstrated associations between excessive television and computer use and undesirable eating behaviours that may contribute to overweight and obesity (Shi L et al.)

1.3.4 Meal Patterns:

People have many different eating occasions daily, the motivations for which will differ from one occasion to the next. Most studies investigate the factors that influence habitual food choice, but it may be useful to investigate what influences food choice at different eating occasions.

The effects of snacking on health have been debated widely. Evidence shows that snacking can have effects on energy and nutrient intakes but not necessarily on body mass index (Hampl JS et al.).

Helping young adults to choose healthy snack choices poses a challenge to many health professionals. In the home, rather than forbidding unhealthy snacks, a more positive approach may be the introduction of healthy snack options over time. See Graph 1.1 for information on snack intakes amongst children. Moreover, healthy food choices outside the home also need to be made more readily available.

1.3.5 Psychological Factors:

Mood:

Hippocrates was the first to suggest the healing power of food, however, it was not until the middle ages that food was considered a tool to modify temperament and mood. Today it is recognised that food influences our mood, and that mood has a strong influence over our choice of food.

Interestingly, it appears that the influence of food on mood is related in part to attitudes towards particular foods. The ambivalent relationship with food – wanting to enjoy it but conscious of weight gain is a struggle experienced by many. Dieters, people with high restraint and some women report feeling guilty because of not eating what they think they should (Dewberry et al. 1994). Moreover, attempts to restrict intake of certain foods can increase the desire for these particular foods, leading to what are described as food cravings.

Thus, mood and stress can influence food choice behaviour and possibly short- and long-term responses to dietary intervention.

1.3.6 Attitudes, Beliefs and Knowledge About Food:

Diet habits established during the adolescent years often continue to adulthood, so a good foundation is key to a healthy life. Poor-quality diets in the developmental years can lead to chronic obesity and other health problems (Birch et al. 2009)

Suggestions for helping adolescents to eat a healthier diet include making healthy food taste and look better, limiting the availability of unhealthy options, making healthy food more available and convenient, teaching children good eating habits at an early age, and changing social norms to make it "cool" to eat healthfully (Neumark-Sztainer et al. 1999)

As part of the development of interventions to address nutritional issues in adolescent populations, it is necessary to understand contextual factors that influence eating habits. Adolescence is a period of susceptibility to several influences on diet. Story et al. presents a theoretical framework to understand influences on behaviour, which includes four levels: individual (intrapersonal), social environmental (interpersonal), physical environmental (community settings), and macrosystem (societal) (Story M et al. 2002)

Individual influences include food preferences, found to be a strong predictor of food choices and knowledge of why and how to eat healthily, which may or may not translate into healthful behaviour. At the interpersonal level, peers play a large role in determining habits as does family (Birch LL et al. 1998)

Interest in alternative lifestyles and diets, including vegetarianism, is a growing phenomenon in adolescence. Furthermore, at this age, both males and females have a heightened sensitivity about their appearance and often experience pressure to conform to a cultural ideal, resulting in body dissatisfaction and experimentation with various weight loss methods (Larsen B et al. 2018). Adolescents may adopt eating patterns, such as vegetarianism, to establish an identity, express values, and assert control over their lives (Dahl RE 2004).

While there is a range of health benefits associated with a vegetarian diet, there are potential risks as well. If vegetarian diets are not well-planned, there may be an increased potential for specific nutrient deficiencies. In addition to potential nutrient deficiencies, there is concern about the consistent pattern associating vegetarianism and disordered eating behaviours in adolescents (Marsh K et al. 2011)

According to Flinders University in Australia 2014, fitness bloggers are now overtaking celebrities as role models for teenage girls.

A study of 13-17-year-old girls found that their main role models were women who ran online 'fitspo' pages which involve offering diet and fitness advice. The majority of these bloggers have no formal training in either fitness or nutrition. The research also found that many of the girls interviewed felt 'bad' about their body as a result of these blogs.

Eating disorder organisations have also noted a marked rise in cases of orthorexia - defined as a fixation on righteous eating - among teenagers and young women.

1.3 Problems Associated with Deficiencies of Essential Nutrients and the Effects of Unhealthy Diets

1.3.1 Problems Associated with Deficiencies of Essential Nutrients:

<u>Nutrient:</u>	<u>Examples Of What Nutrient Deficiency Can Cause:</u>
Complex carbohydrate & fibre	heart disease, type 2 diabetes, diverticular disease, bowel problems, colon cancer, breast cancer
Protein	loss of muscle mass, anaemia, hair, skin and nail problems, mood changes, weakness and fatigue
Fat	a too low-fat diet can cause hormonal issues including loss of menstrual cycle, issues concentrating, feeling hungry, mental fatigue, dry skin, hair and eyes.
Preformed Vitamin A	inflamed skin, night blindness, infertility, delayed growth, respiratory infections
Beta-carotene (converts to vitamin A)	night blindness, dry skin, decreased resistance to infections
Vitamin D	bone pain, fatigue, muscle weakness, mood changes such as depression
Vitamin E	nerve and muscle damage, muscle weakness and vision problems, weakened immune system
Vitamin K	excessive bleeding, skin bruises easily
Thiamin	loss of appetite, fatigue, reduced reflexes, mood changes
Riboflavin	skin disorders, hair loss, reproductive problems
Niacin	rash, headache, fatigue, depression, memory loss
Pantothenic acid	extreme tiredness, stomach pain, vomiting, loss of appetite, irritability, sleeping problems
Vitamin B6	impaired immune function, tiredness, nerve pain, skin rashes, mood changes
Folic acid	mouth sores, fatigue, tongue swelling, depression
Vitamin B12	sore tongue, pins and needles, disturbed vision, lack of energy, palpitations
Biotin	rashes, thin hair, hair loss
Vitamin C	(scurvy) anaemia, bleeding, pain in limbs, ulceration of the gums and loss of teeth
Calcium	osteoporosis, osteopenia, rickets, tooth decay
Phosphorus	loss of appetite, anxiety, bone pain, stiff joints, decreased growth and children
Iron	anaemia, tiredness, shortness of breath
Sodium	vomiting, muscle twitches, seizures
Potassium	fatigue, muscle cramps, breathing difficulties, heart palpitations
Iodine	goiter, hypothyroidism, developmental delays
Zinc	hair loss, loss of appetite, impaired immune function

Table 1.3 – Illustrates the different effects of nutrient deficiencies (Harvard School of Public Health 2018)

A well-rounded diet based on the USDA guidelines should deliver sufficient amounts of all the essential vitamins and minerals. Adolescents tend to most often fall short of their daily quotas of [calcium](#), [iron](#), [zinc](#), and vitamin D which can lead to various health deficiencies in later life (American Academy of Pediatrics 2019).

According to the *British Nutrition Foundation 2018 National Survey* adolescents tend not to have nutritionally insufficient diets for a variety of reasons. Furthermore, adolescents' intakes of saturated fatty acids, salt and non-milk extrinsic sugars (added sugars) are well above recommended levels.

The *National Diet and Nutrition Survey (NDNS)* in 2014 revealed that more than half of girls aged between 11 and 18 lack magnesium, threatening their immune systems; one in five lack vitamin B2, risking fatigue and anaemia; and that in 45% of girls, iron levels are too low. Furthermore, a large proportion of teenagers (especially girls) also have low intakes of other vitamins and minerals (in particular vitamin A, iron, calcium, zinc and iodine).

1.3.2 The Effects of Unhealthy Diets:

Although it is important for adolescents to obtain sufficient energy and nutrients for their growth and development, some eat more than they need and as a result become overweight or obese, especially if they are inactive.

National surveys indicate that overweight and obesity is prevalent in British adolescents. For example, in 2013 in England, 34% of boys and 39% of girls aged 13-15 years were overweight or obese (British Nutrition Foundation 2018)

Whilst growing taller, younger teenagers will need help maintaining their existing weight in the short-term, which will improve their BMI over time. This is often described as 'growing into their weight'. Older adolescents that are overweight or obese and are no longer growing taller will need to lose weight to improve their BMI. In the short-term, it may be helpful to prevent further weight gain in these adolescents as they make healthier lifestyle changes that will improve their weight in the long-term.

In contrast, cases of eating disorders such as anorexia nervosa have been shown to peak between the ages of 15-19 years in teenage girls. Some teenagers try to control their weight by unsuitable methods such as smoking, skipping meals or cutting out perceived fattening foods (e.g. red meat and dairy products) from their diets.

A restricted diet especially one that excludes whole food groups, can lead to nutrient deficiencies and problems in later life. Teenagers with weight problems may need specialist advice from appropriately trained health professionals to ensure that their dietary pattern remains adequate to support growth and development (British Nutrition Foundation 2018)

According to a recent poll by the London School of Economics and Political Science, Ireland has the second highest rate of anorexia in Europe with a staggering three in every 200 teenagers and young girls aged 15-34 affected by the disease, while over a third of girls (35.9%) admitted to worrying about their weight.

Encouraging a healthy lifestyle is of prime importance during adolescent years. Therefore, maintenance of good habits throughout adolescence is likely to benefit health throughout adulthood and into old age.

1.4 The Importance of the School Canteen in the Diets of TEENS

The school canteen is a great place to promote an enjoyment of healthy eating. For students who use the canteen regularly, the food purchased makes a significant contribution to their total food intake and nutrition; therefore, it makes sense to ensure the best food possible is available to enhance their ability to learn and take in the information presented to them in class.

For students who don't use the canteen regularly, the canteen still plays an important educational and modelling role for healthy eating habits (The Australian Department of Health 2013).

School food and physical activity (PA) environments and cultures can impact the eating and physical activity behaviours, as well as BMI, of students (Rutgers University 2020)

According to a study by the School of Health & Human Performance, Dublin City University in 2015 adolescents are aware of the discrepancy between health education advice, and school-wide food practices and it contributes to their confusion about nutrition and health. This study also showed that schools are providing many of the foods that

contribute to high sugar and fat intakes among Irish adolescents. This study highlights the ad-hoc nature of food provision to school-going adolescents in the ROI and the need for a national nutrition policy for secondary schools.

Children need to have a healthy diet that provides adequate energy and nutrients and which is balanced and varied in all the Food Pyramid groups. A well-nourished child is a child that is healthier and better equipped to learn and develop at school; therefore, the acquiring of food in schools needs to assure a healthy diet for children.

The increasing prevalence of overweight and obesity in Irish children is a major public health issue. Overweight and obesity can have multiple negative consequences for physical and emotional health both acutely and in the long-term, while also impeding social wellbeing. As children from low-income households are more vulnerable to inadequate nutrition, the DEIS school setting is a primary target for these Nutrition Standards (Nutrition Standards for School Meals)

Adherence to the Nutrition Standards for Schools Meals should be central to the development of a national nutrition policy for secondary schools along with a traffic labelling system empowering teen with nutritional knowledge and choice.

1.5 The Benefit of Food Traffic-Light Systems

The three traffic-light colours can be broken down as follows:

A red light indicates the food is high in something we should be trying to cut down on. It's fine to have these occasionally, or as a treat, but try to limit them.

An amber light means the food isn't high or low in the nutrient, meaning that it is an acceptable food item to eat quite regularly. There may be an even healthier option in the shop, so keep looking!

A green light indicates that the food is low in fat, sugar or salt. The more green lights, the healthier the choice and the more likely the food is to be a good option for everyday eating. If you want to make the healthy choice when you are shopping, go for more greens and ambers, and fewer reds.

(See Figure 1.2)

Many foods will have a mixture of red, amber and green. It's best to try to go for the product with more greens and ambers and less reds for a healthy diet!

Currently in the EU and Ireland having a nutrition declaration on pre-packaged foods is compulsory. This generally involves having a GDA type label on the back of the package.

However, the food traffic-light system is voluntary so many manufacturer's do not use it. The GDA labelling system which is mainly used in Ireland has been found to be confusing and mis-leading according to the CEO of the Irish Heart Foundation Michael O'Shea. Michael goes on to explain that the GDA system proclaimed to be consumer-friendly is in fact based on adult nutritional requirements and serves to deceive parents into thinking that products are healthier than they actually are (Irish Health 2010)

The Irish Heart Foundation in conjunction with heart foundations and consumer organizations across Europe believes that there is a wealth of scientific evidence to show that front of pack labels combining traffic-light colours; the words high, medium and low; percentage guideline daily amounts; and the levels of nutrients per portion of product best supports consumers to make healthy food choices (Irish Health 2010)

According to research undertaken by Red C and published by the IHF, the NYCI and the Irish Cancer Society on 400 Irish shoppers found that four out of five claimed that the words high, medium and low, combined with the colours red, amber and green helped them to determine the nutritional content of a product (Irish Health 2010). In fact, those using this labelling system were more likely to correctly identify the level of key nutrients in the majority of products tested compared to shoppers using the current GDA label that is widely used in Ireland.

Deirdre Clune MEP says that according to a UCC study, people being overweight costs the country over €1.1 billion per year. Studies from Growing up Ireland also found that a quarter of thirteen-year olds are overweight and 19% of children are overweight at age nine.

She goes on to state *"It is my view that traffic-light labelling system should be implemented in all major food retailers here in Ireland, including newsagents."*

The topic of Food Labelling is currently very topical. A fledgling campaign group led by teenagers is currently calling for a traffic-light-style front of pack labelling to be made mandatory in the UK.

The Bite Back 2030 campaign said progress on improving child health was stalling and that the move would bring the UK in line with other countries. These include Israel, who have introduced new laws making warning labels compulsory on packaged products high in fat, salt and sugar. Elsewhere, Canada also plans to introduce mandatory warning labels, while Chile introduced them in 2016.

Bite Back 2030 was set up in 2019 to create an “unstoppable movement” of young people to campaign for healthier eating. Its aim is to half childhood obesity by 2030. It was co-founded by chef Jamie Oliver.

On Saturday, 25 January 2020 the Bite Back 2030 Youth Board launched the #DontHideWhatsInside campaign to demand more honest food labels.

The traffic-light labelling system which has been shown to be the preferred method of giving nutritional information by health experts and indeed the more easily understood system as has been depicted through scientific studies and research is a system which would greatly benefit teenagers in making nutritionally beneficial choices in their school canteens (Nutrition Insight 2020).

Overall, introducing a food traffic-light system into school canteens would not only help adolescents to make better food choices but it would also encourage food providers to develop their healthy food options.

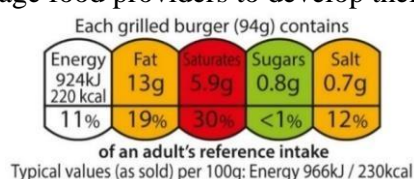


Figure 1.2 – Easy to understand food traffic-light system illustrating whether the quantities of fat, saturates, sugars and salt are healthy or not (Food Standards Agency)

2.0 Case Study:

2.1 Background Information:

As a part of my research, I decided to conduct multiple interviews in order to obtain as much information about people’s views on issues regarding school canteen meals. I interviewed 10 students at random from my school that used the school canteen daily, 5 males and 5 females. After doing research, I also decided it would be a good idea to interview BiteBack 2030 member Nika Strukelj in order to find out what her and her youth group were doing in order to tackle issues surrounding school canteens and what her opinions were on the importance of school canteen meals.

2.2 Interviews with TEENS

1) Do you think there’s a good choice of meals in the school canteen?

“No, since there are only two meals in the school canteen there definitely isn’t much choice”

“Definitely not, I get so bored of having the exact same meals every day!”

“No, it would be nice to have more options so that we could have a bigger selection”

“Honestly, not at all! I think that the current options are getting very boring”

“Not at all, and I don’t even like the savoury minced beef so I have to have a chicken fillet roll everyday”

“I definitely think that having only two meals in the school canteen gets really boring, its annoying to have to choose from only two meals each day.”

“Having only two options definitely isn’t enough because people get sick of them after a while”

“No way, I hate having only two options available to me”

“No, the meals choices we have are very limited”

“No, I would prefer if we had three-four options rather than just two”

2) Have you any meal suggestions for the school canteen?

“Something healthier, maybe something like chicken curry?”

“I’d love if we had different kinds of rolls, possibly regular chicken or ham, served with salad or something like that”

“Certainly, some healthier options, I’m not picky so anything really just so that we could have more choice”

“I would love something like stew or chili con carne. I feel like they would be healthier than the chicken fillet roll and maybe even the savoury minced beef”

“I’d like more chicken meals. Chicken curry would be great!”

“I think it might be nice to have chicken curry as well as just the ‘Savoury Minced Beef’ and the ‘Chicken Fillet Roll’. I also think that the ‘Chicken Fillet Roll’ is way too big. I can never finish it!”

“I’d love maybe 2 more healthy options in the canteen maybe like shepherd’s pie or something. Then, I feel like if any options started to become less popular, they could be removed and replaced with something else”

“Maybe something like meatballs and pasta, spaghetti bolognese or chicken curry, I feel like these would be popular”

“Stew, chili con carne, chicken curry, lasagna, salad or anything along those lines. I feel like these would be popular”

“A healthy vegetarian option would be great.”

3) Do you feel you have enough information on how much salt, sugar, fat and saturates you should have per day?

“Honestly, I haven’t a clue as to what I should be consuming with regards to salt, sugar, fat and saturates I feel like more information on this would definitely be beneficial”

“Sort of, but only because I do Home Economics, I feel like students that don’t take this subject have very little knowledge in this area and should be better educated”

“No, I know I probably eat too much sugar but I’m not sure.”

“Off the top of my head I don’t have a clue!”

“I don’t know but I probably should!”

“Yes, as I am diabetic so it’s important to have this information.”

“No, I don’t know.”

“I don’t know but it probably doesn’t matter that much at our age.”

“I don’t consume any of them so I should be ok?”

“I kind of know as we were learning about it in Science.”

4) Have you ever heard of a food traffic-light system?

“Yes, we learned a bit about it in Home Economics.”

“When something is green it is good and red/ orange it is bad?”

“No, I’ve never heard of it.”

“Is it the label on the front of some packets?”

“Yes, I’ve heard of it. More green is good and too much red is bad?”

“Yes, it’s on the front of some packets but not on others. It helps us to make good choices.”

“Yes, it helps people to eat healthier.”

“It tells us how much salt, sugar and other things are in a product”

“I have no idea what it is?”

“I have seen them in lots of shops, they tell us whether something is good, bad or in between nutritionally”

5) Do you think that showing how much fat, saturates, sugar, and salt would influence what items you would purchase in the canteen?

“Yes, I would try to choose lower fat and sugar.”

“Yes, it would definitely influence my choice.”

“Yes, I think it would make me think twice about what I’d purchase”

“Yes, maybe but I’m not a fan of the canteen food.”

“Definitely as I like to make healthier choices where possible.”

“Yes, it would definitely make me think more about what I buy”

“No, I don’t think it would.”

“Yes, if there were more choices.”

“No, I’d just buy whatever tasted the nicest.”

“Yes, as too much fat, salt and sugar is bad.”

2.3 Interview with BiteBack 2030 member Nika Strukelj

1) Do you believe that school meals are important and why?

Yes, I think that school meals are very important as they play a major role in the diets of teenagers internationally. Teenagers spend a huge portion of their days in schools so, I believe that healthy school meals are essential and need to be provided in all school canteens. In England 1.4 million children are eligible for free school meals. As obesity rates are higher in children from deprived backgrounds, it is even more crucial that these children have access to a decent, nutritious meal, all year round.

2) What initiatives have you taken to improve school meals/meals in general?

School Food Matters is a great organization who we collaborate with - we've campaigned together on extending the provision of free school meals over the holidays. In May 2020, our Youth Board Co-Chair Christina launched a petition to extend provision over the holidays. Since then, we've had four campaign wins, with the government extending access to free school meal provision over Easter, May half-term, and finally summer, when Marcus Rashford got involved. And in November 2020, the Government announced measures to provide meals to young people on free school meals over the holidays to the end of 2021! Members of our group have also featured on BBC6 and BBC News at Ten, The Mirror, the Daily Mail, Channel 5 News, Sunday Times, London News Online, ITV London, Radio 2 Jeremy Vine and also Good Morning Britain, to name a few. I am now working at the Jamie Oliver Group and working to fix the food system.

3) Do you think that children/teens need more education on food choices?

Yes, children/teens definitely need more education on food choices in order for them to be able to make better choices, but I also believe that adults in charge of providing school meals need to take action and make these meals healthier and provide more information for the children/teens.

4) Do you think food labelling is worthwhile in educating children/teens on their food choices?

Yes, I do think that food labelling is worthwhile but in a more simplistic fashion. Children and teens need to be able to see at first glance whether or not something is healthy for them or not and I think that your idea of a food traffic-light system in school canteens would certainly be beneficial in making this work.

5) What initiatives have you taken to lobby for food labels to be put on food?

On Saturday, 25 January, the Bite Back 2030 Youth Board launched the #DontHideWhatsInside campaign to demand more honest food labels. Right now, companies are bending the truth about what's inside their products. It's a tactic they use to sell us more or make us think something is healthy when it's not. As young consumers, don't we have a right to simple, understandable information on what we eat and drink?

We just want products to show us what they're really made of! They should have colour-coded traffic-light labels on the front of their packs. And they should be honest and clear about portion sizes.

6) What's your favourite school meal recipe?

Honestly, anything that I know is nutritionally beneficial! I love all of our 'Cook with Jack' recipes. He has a series of healthy, tasty and affordable lunch recipes all from all from a £15 weekly shopping list that's in line with the value of free school meals provision, with the majority of the recipes within the School Food Standards.

7) Any final words?

At Bite Back 2030 we want healthy food to be an option for all of us wherever we live. Our vision is a world where all young people have equal access to good food and good health, including those from disadvantaged backgrounds. We want to help get kids cooking in the kitchen by teaching them fun and easy to follow recipes with our brilliant chef Jack and to have healthy, free school meals available to them in all school canteens.

3.0 Aims of the Project

The Main Aims of This Project Were:

- To investigate the current attitudes and nutritional knowledge of adolescents towards school canteen meals
- To introduce a food traffic-light system in my school canteen and to evaluate whether or not it is beneficial in making healthier food choices
- To design a website to educate adolescents on how to make healthier food choices

4.0 Hypothesis

1. Nutritional knowledge will be low amongst the target group (n=300)?
2. The 'Chicken Fillet Roll' will be the least healthy meal but still the most popular?
3. The introduction of the food traffic-light system in the school canteen will influence adolescents to purchase healthier choices?
4. Showcasing the website will make the target group (n=300) more nutritionally aware?

5.0 Methodologies:

5.1 Ethical Considerations

All ethical concerns were considered prior to beginning this research study. All participants parents/guardians and the school principal received an explanatory letter explaining outlining the purpose of this study. Parents of all students under 18 had to sign the form and return it to the school. Students over 18 did not need to do this in line with GDPR regulation. Participation was voluntary for all students. All surveys were anonymous.

5.2 Experimental Methods

5.0.1 Introducing Additional Meals

Reasoning:

After completing interviews with ten students, it was clear that each of the students was looking for more choice in regard to what was currently available in the school canteen. Prior to my study, there were only two options available in the canteen, 'Chicken Fillet Rolls' and 'Savoury Minced Beef'. However, after doing these interviews, it was evident that students felt that the current options provided only little choice and because St. Brogans College is a DEIS school many students rely on these meals as the main part of their daily diets.

Choosing and Introducing the Additional Meals:

After much research, I decided to introduce two additional healthier meals to the school canteen, 'Chicken Curry' with rice and 'Beef Stew' with rice. I worked with my Home Economics teacher to make sure that these meals were as nutritionally beneficial as possible. We selected healthy ingredients and tried to adhere to the RDA levels of salt, sugar, fat and saturates. I tested my meals and asked a few students their thoughts on them and how likely they would be to purchase them, based on taste alone. Due to mostly positive feedback, these meals were then introduced into my school canteen with the help of the canteen staff.

5.0.2 Tracking Purchases

Participants:

In order to keep this study equal both prior to and after introducing the food traffic-light system, I kept track of the first 300 purchases of the meals on both occasions. Participants ages ranged from 12-18 and genders were mixed.

Procedure:

Participants chose the meals honestly as they were not aware that meals were being tracked, however participants remained anonymous. Keeping the tracking unknown, ensured that this study was accurate and fair. On the first occasion, students selected one of the four meals at random without viewing the food traffic-light system or having viewed the website. However, after the introduction of the food traffic-light system and viewing the website participants were more educated on their nutritional and RDA require what to choose and this showed in the results. See Results 5.1.

5.0.3 Surveys

Participants:

Three hundred participants took part in this survey (n=300). These participants included both genders (150 female, 150 male). All participants adolescents aged between 12 and 18. This same survey see Appendix 2.0 was carried out twice on the same three hundred participants, one prior to the introduction of the food traffic-light system and viewing our website and one after the introduction of the food traffic-light system and viewing our website. Participants completed this survey anonymously and voluntarily. See Appendix 2.0.

Design and Analysis:

The survey was composed of nineteen multiple choice and personal response questions (See Appendix 2.0). Questions offered participants a wide range of responses for each question and captured new thoughts from the respondents. The personal response questions welcomed additional opinions and ideas from the participants. Topics included in the survey were: Do you eat meals from the school canteen? Which of the following meals do you think is the healthiest/least healthy? Do you know how much fat, saturates, sugars and salt is the RDA for someone of your age on average? On a scale of 1-5 how likely are you to choose _____ for your lunch? Describe, as best you can, what you think a 'food traffic-light system' is. Do you have any suggestions for meals that you would like to have in the school canteen? The data collected from the survey was analysed using IBM SPSS Statistics 26 Software. These results were analysed into tables, pie charts and bar charts.

Materials:

A self-administrated online-based questionnaire (See Appendix 2.0) was provided to participants who volunteered to take part in the study. It was created using Microsoft Forms. The questionnaire was composed of nineteen questions and designed specifically for this study. Participants responded to sixteen of the survey questions with fixed answers. Three of the questions were open-ended.

Procedure:

Participants were required to be between the age range of 12 and 18 and 150 females and 150 males were selected. Participation was voluntary, anonymous and confidential. Participants were selected at random from 1st – 6th year classes in St. Brogans College. These various selection methods ensured a wide representative sample was present. Prior to the second survey participants were able to see the food traffic-light system in the school canteen prior to purchasing their meal and were given the opportunity to view my website. It took approximately 5 minutes to complete the survey. All participants were treated the same and received the same amount of knowledge on healthy eating intake prior to the second survey. Each participant was thanked for their time on completion of the survey. See Results 5.2.

5.0.4 The Food Traffic-Light System

Analysing:

It was crucial that my food traffic-light system reflected accurate RDA levels for adolescents. This posed a challenge and required substantial research on my part to get it correct. Firstly, it was necessary to establish correct RDA levels for adolescents on salt, sugar, fat and saturates. This was done through extensive research. Next it was necessary to analyse each school canteen meal by examining the ingredients. This was completed by obtaining the recipes for each school meal and establishing how much salt, sugar, fat, saturates, energy (kj) and energy (kcal) were in each individual ingredient using the packaging labels. Finally, I developed my food traffic-light system using Nutritics Analysis Software (<https://www.nutritics.com/p/home>). This involved analysing each canteen meal by inputting the information obtained above. This was done using the following steps:

1. By inputting the full nutritional information (Per 100g) of each ingredient used in a particular meal into different sections called 'New Food'. I also had to place the food in a category e.g. meat, vegetable, etc.
2. By creating the recipe. This can be done on the Nutritics by combing multiple ingredients into one section called 'New Recipe.'
3. By inputting the quantities of each ingredient used in the meal. This was essential so that the meals final serving size on the label matched what was served in the canteen.
4. By transporting this into the label maker
5. By selecting 'Nutrition' and then 'Traffic-Light System'
6. By inputting the allergens of the meal
7. By inputting the RDA's for the person/people that it was designed for
8. By repeating these steps to create 4 separate food traffic-light systems

This resulted in the development of a bespoke food traffic-light system for my school canteen.

Design:

The food traffic-light systems were compiled into 5 separate sections; salt, sugar, fat, saturates and calories. The salt, sugar, fat and saturates were displayed in either red, amber or green depending on how nutritionally beneficial they were for adolescents. The calorie content was also displayed but in white in order to follow EU labelling guidelines and to keep the food traffic-light system similar to the ones displayed on certain products. Each food traffic-light system was displayed on a board in my school canteen. There was a clear order of which meals were the healthiest, 1 = healthiest, 4 = least healthy:

1. Beef Stew
2. Chicken Curry
3. Savoury Minced Beef
4. Chicken Fillet Roll

Introducing:

The food traffic-light system was introduced into my school canteen after my first round of surveys were complete. The food traffic-light system played a major role in educating the target group (n=300) before the second round of surveying and on influencing the purchases made by students in the school.

Beef Stew:

CONTAINS				
Each 170g portion contains:				
ENERGY	FAT	SATFATS	SUGARS	SALT
219kcal 927kJ	3.2g	1.4g	0.7g	0.52g
11%	5%	7%	1%	9%



Savoury Minced Beef:

CONTAINS				
Each 140g portion contains:				
ENERGY	FAT	SATFATS	SUGARS	SALT
146kcal 614kJ	4.7g	1.9g	2g	0.91g
7%	7%	10%	2%	15%

GLUTEN

Chicken Curry:

CONTAINS				
Each 200g portion contains:				
ENERGY	FAT	SATFATS	SUGARS	SALT
255kcal 1077kJ	5.2g	0.2g	1.8g	0.87g
13%	7%	1%	2%	15%

Chicken Fillet Roll:

CONTAINS				
Each 240g portion contains:				
ENERGY	FAT	SATFATS	SUGARS	SALT
651kcal 2733kJ	24g	12g	14g	2.7g
33%	34%	60%	16%	45%

WHEAT MILK

Figures 1.3-1.7 – Image illustrating my food traffic-light system sign displayed in the canteen surrounded by the meals individual food traffic-light systems

5.0.5 Importance of School Meals Website

Constructing the Website:

This website was designed using Wix Website Creator (<https://www.wix.com/>). Information showcased was chosen based on its relevance to adolescents and each page was designed in a way that made it easy to navigate through the information. This website was presented to my target group (n=300) prior to the second survey to insure they were well educated prior to taking this survey. Website link: <https://scienceproject21.wixsite.com/canteens>

Format of the Website:

This website can be viewed on various electronic devices including smartphones and laptops. The website consists of multiple pages. These include: Home, About My Project, Nutritional Information and Contact. The website also includes a chat centre. See clips from my website below.

Purpose of the Website:

The purpose of this website is to spread awareness to adolescents on the importance of school canteen meals, to illustrate the nutritional guidelines for adolescents and to showcase my food traffic-light system. My target group (n=300) were shown this website prior to the second survey in order to see if the nutritional information provided made an impact on the results.



Figure 1.8 – Image from my 'Importance of School Meals' Website

5.0.6 Improving the Chicken Fillet Roll

Reasoning:

After the introduction of the food traffic-light system, there was a substantial drop in the number of students purchasing the ‘Chicken Fillet Roll’. However, a significant 19.3% were still purchasing this poor nutritional option. I decided that due to its ongoing popularity it might be best to try to develop a ‘Healthier Chicken Fillet Roll,’ without compromising the taste.

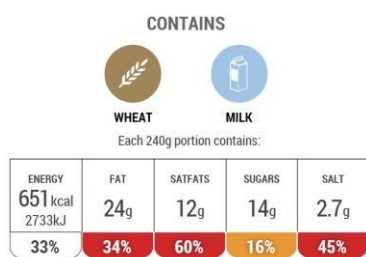
Designing:

The improved ‘Chicken Fillet Roll’ was designed after much research. I decided on which ingredients to use based on how healthy they were. The new ingredients were: low-fat wraps, chicken fillets, egg, wholemeal breadcrumbs and lettuce. This made the ‘Chicken Fillet Roll’ much healthier (See Figures 1.8-1.11)

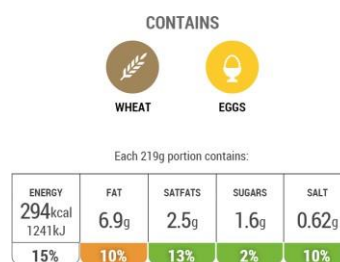
Introducing:

I demonstrated how I made my ‘Healthier Chicken Fillet Roll’ to a class and asked their opinions on the improved version. I also provided them with the recipe for it (See Appendix 3.0). Feedback was very positive as they thought that the taste hadn’t been compromised. In fact, they stated that they would be more likely to purchase it as they knew it was healthier than the regular ‘Chicken Fillet Roll’. Therefore, I intend to introduce it into my school canteen as a part of my further studies. I also developed a food traffic-light system for it using Nutritics Analysis Software in order to make a better comparison between the improved ‘Chicken Fillet Roll’ and the old one. See Figures 1.8-1.11.

Before:



After:



Figures 1.9-1.12 – Images illustrating the original ‘Chicken Fillet Roll’ versus the new healthier option

5.2 Limitations of the Study

The study was limited by the student’s ability to answer all the survey questions truthfully. I ensured students were aware that the survey answers were all anonymous which encouraged students as much as possible to answer the questions truthfully. Furthermore, due to COVID-19 restrictions I could only introduce my food traffic-light system in St. Brogans College rather than in multiple schools.

6.0 Results:

I tracked meal orders twice for a day, once prior to the introduction of my food traffic-light system and showcasing my website and once afterwards. I tracked the first 300 meals on both occasions as I believed this to be a significant sample size.

Furthermore, I carried out my 19-question survey (Appendix 2.0) twice on my target group of three-hundred adolescents aged between 12 and 18. Once, prior to the introduction of my food traffic-light system and showcasing my website and once after our experimental methods. Due to the fact that all participants were the same on both occasions the, the result of question 6.2.1, 6.2.18 and 6.2.19 was not obtained in the second surveying. Here are the results;

6.1 Tracking Orders Results:

Before food traffic-light system was introduced

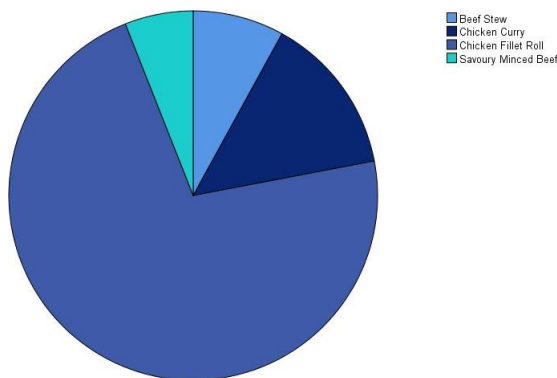


Chart 1.1, Table 1.4 – Chart and table illustrating the purchase of meals prior to the introduction of my food traffic-light system

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Beef Stew	24	8.0	8.0	8.0
	Chicken Curry	42	14.0	14.0	22.0
	Chicken Fillet Roll	216	72.0	72.0	94.0
	Savoury Minced Beef	18	6.0	6.0	100.0
	Total	300	100.0	100.0	

After food traffic-light system was introduced

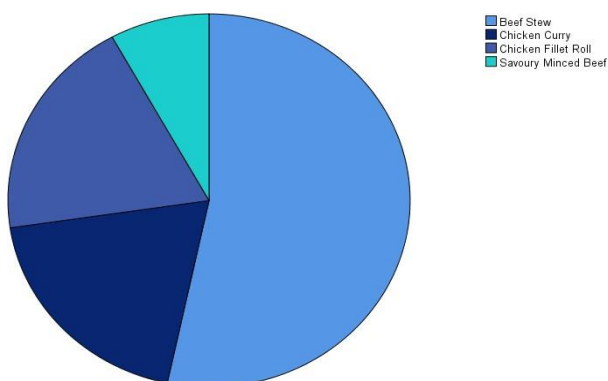


Chart 1.2, Table 1.5 – Chart and table illustrating the purchase of meals after the introduction of my food traffic-light system

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Beef Stew	160	53.3	53.3	53.3
	Chicken Curry	58	19.3	19.3	72.7
	Chicken Fillet Roll	58	19.3	19.3	92.0
	Savoury Minced Beef	24	8.0	8.0	100.0
	Total	300	100.0	100.0	

The above results from tracking the orders illustrate how much of an impact my food traffic-light system made on my target group (n=300). Prior to my experimental methods only 8% were purchasing 'Beef Stew', the healthiest meal. In contrast, after my experimental methods, 53.3% were purchasing 'Beef Stew' which really illustrates the positive impact of the food traffic-light system. Additionally, the 'Chicken Fillet Roll', the least healthy meal became much less popular with now only 19.3% purchasing it compared to the previous 72%. Overall, these results really illustrate the importance and benefits of having food traffic-light systems in schools.

6.2 Survey Results:

6.2.1 Question 1:

Do you have a dietary preference/need?

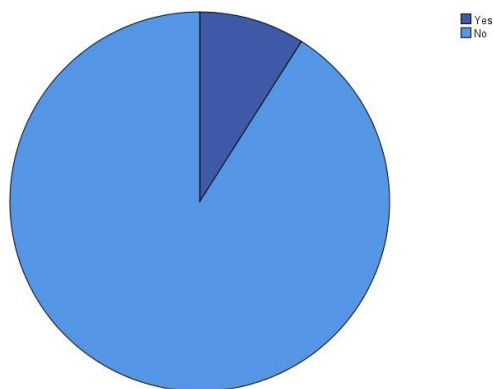


Chart 1.3, Table 1.6 – Chart and table illustrating the target group's (n=300) response to question 1 on both occasions of surveying

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	27	9.0	9.0	9.0
	No	273	91.0	91.0	100.0
Total		300	100.0	100.0	

6.2.2 Question 2:

Do you eat meals from the school canteen?

Before experimental methods:

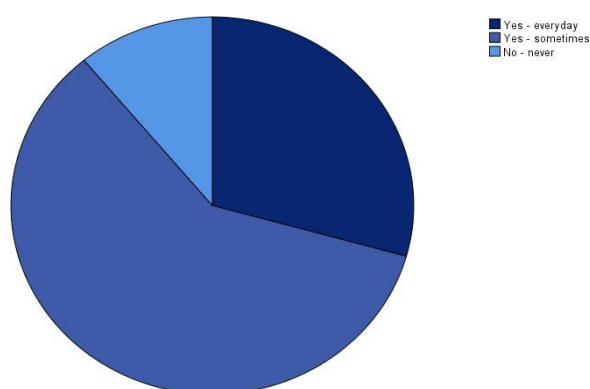


Chart 1.4, Table 1.7 – Chart and table illustrating the target group's (n=300) responses to question 2 in the first survey

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes - everyday	88	29.3	29.3	29.3
	Yes - sometimes	179	59.7	59.7	89.0
	No - never	33	11.0	11.0	100.0
Total		300	100.0	100.0	

After experimental methods:

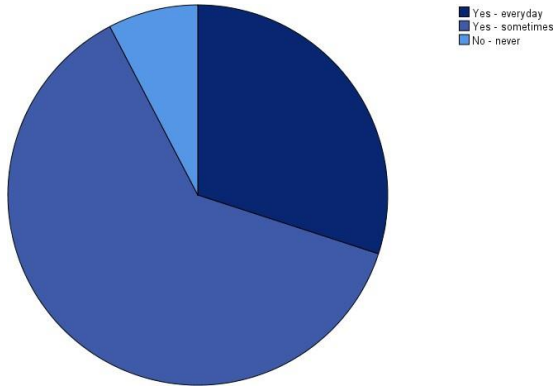


Chart 1.5, Table 1.8 – Chart and table illustrating target group’s (n=300) responses to question 2 in the second survey

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Yes - everyday	90	30.0	30.0	30.0
Yes - sometimes	187	62.3	62.3	92.3
No - never	23	7.7	7.7	100.0
Total	300	100.0	100.0	

The above results show how because of the introduction of two additional healthy meals and the food traffic-light system convinced some of my target group (n=300) to start eating meals from the school canteen. Prior to my experimental methods, 89% ate meals from the school canteen sometimes or everyday. However, after my experimental methods this rose to 92.3% showing me that because of these additional two meals, people were more likely to buy meals from the school canteen.

6.2.3 Question 3:

If you answered no to this question, why not?

Before experimental methods:

Common Answers:

“I have allergies”

“I’m a very picky eater and there are limited options”

“I’m not hungry at lunchtime”

“I think the meals are unhealthy”

“I bring my own lunch everyday”

After experimental methods:

Common Answers:

“I have allergies”

“I bring my own lunch everyday”

“I’m not hungry at lunchtime”

The above results show how because of the introduction of two additional healthy meals and the food traffic-light system, people stopped believing that all of the meals were unhealthy and that because of the additional two meals being introduced, “picky eaters” were now more likely to eat meals from the school canteen.

6.2.4 Question 4:

Do you know which meals are the healthiest and which are the least healthy in regard to the school canteen?

Before experimental methods:

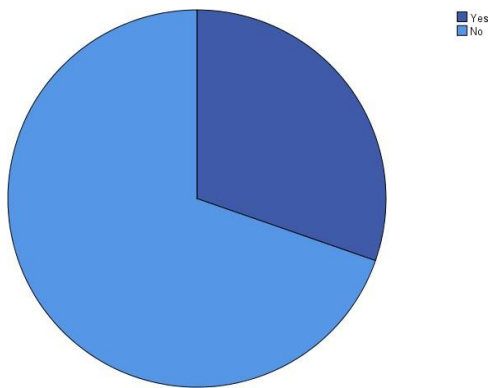


Chart 1.6, Table 1.9 – Chart and table illustrating the target group's (n=300) responses to question 4 in the first survey

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	91	30.3	30.3	30.3
	No	209	69.7	69.7	100.0
	Total	300	100.0	100.0	

Results post experimental methods:

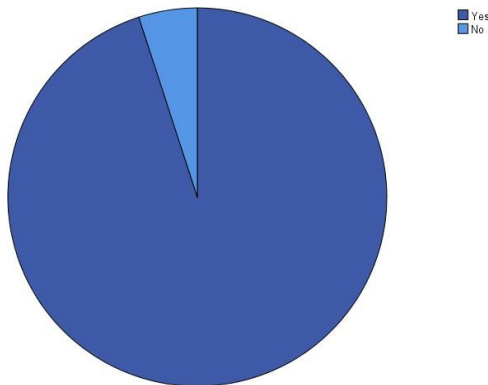


Chart 1.7, Table 2.0 – Chart and table illustrating the target group's (n=300) responses to question 4 in the second survey

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	285	95.0	95.0	95.0
	No	15	5.0	5.0	100.0
	Total	300	100.0	100.0	

The above results show how my experimental methods had a positive effect on the target groups' confidence in believing that they knew which meals were healthiest and which were the least healthy. Prior to the introduction of my food traffic-light system and showcasing my website only 30.3% of my target group (n=300) believed that they knew which meals were the healthiest and which were the least healthy in regards to the school canteen. However, after my experimental methods 95% believed that they knew which meals were the healthiest and which were the least healthy.

6.2.5 Question 5:

Select which of the following you think is the healthiest:

Before experimental methods:

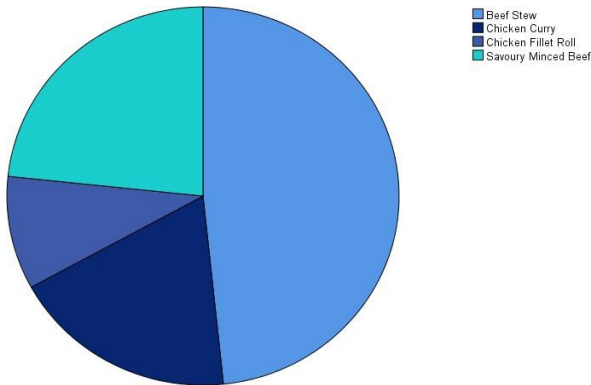


Chart 1.8, Table 2.1 – Chart and table illustrating the target group's (n=300) responses to question 5 in the first survey

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Beef Stew	145	48.3	48.3	48.3
	Chicken Curry	56	18.7	18.7	67.0
	Chicken Fillet Roll	29	9.7	9.7	76.7
	Savoury Minced Beef	70	23.3	23.3	100.0
	Total	300	100.0	100.0	

After experimental methods:

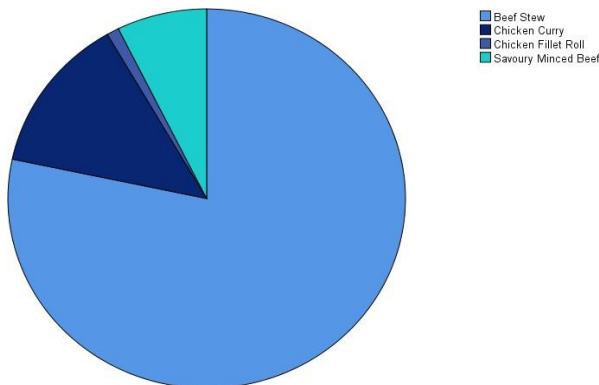


Chart 1.9, Table 2.2 – Chart and table illustrating the target group's (n=300) responses to question 5 in the second survey

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Beef Stew	235	78.3	78.3	78.3
	Chicken Curry	40	13.3	13.3	91.7
	Chicken Fillet Roll	3	1.0	1.0	92.7
	Savoury Minced Beef	22	7.3	7.3	100.0
	Total	300	100.0	100.0	

My food traffic-light system significantly increased the knowledge of my target group (n=300) with regards to which meals were healthiest and which were least healthy with regards to the school canteen meals. Prior to my experimental methods 48.3% were correct and said that 'Beef Stew' was the healthiest meal. However, when surveyed for a second time, this percentage increased to 78.3% illustrating the positive influence of the food traffic-light system.

6.2.6 Question 6:

Select which of the following you think is the second healthiest:

Before experimental methods:

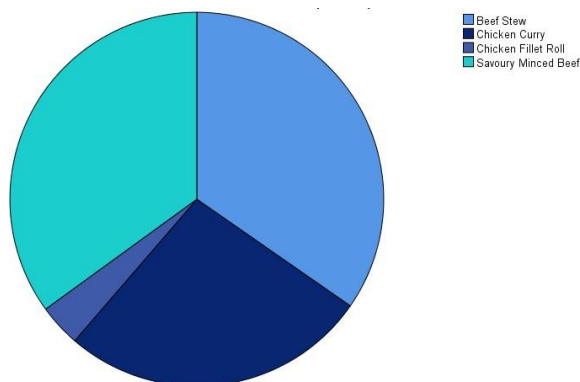


Chart 2.0, Table 2.3 – Chart and table illustrating the target group’s (n=300) responses to question 6 in the first survey

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Beef Stew	104	34.7	34.7	34.7
	Chicken Curry	80	26.7	26.7	61.3
	Chicken Fillet Roll	11	3.7	3.7	65.0
	Savoury Minced Beef	105	35.0	35.0	100.0
	Total	300	100.0	100.0	

After experimental methods:

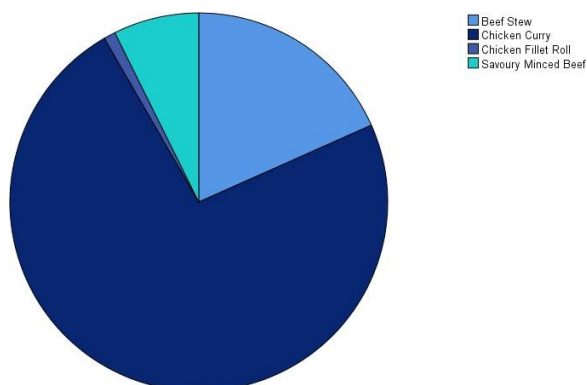


Chart 2.1, Table 2.4 – Chart and table illustrating the target group’s (n=300) responses to question 6 in the second survey

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Beef Stew	55	18.3	18.3	18.3
	Chicken Curry	220	73.3	73.3	91.7
	Chicken Fillet Roll	3	1.0	1.0	92.7
	Savoury Minced Beef	22	7.3	7.3	100.0
	Total	300	100.0	100.0	

As seen in “6.2.5 Question 5”, my food traffic-light system significantly increased the knowledge of my target group (n=300) with regards to which meals were healthiest and which were least healthy with regards to the school canteen meals. Prior to my experimental methods, only 26.7% were correct and said that ‘Chicken Curry’ was the second healthiest meal available in the school canteen. However, after my experimental methods, this increased to 73.3% illustrating the positive influence of the food traffic-light system.

6.2.7 Question 7:

Select which of the following you think is the third healthiest:

Before experimental methods:

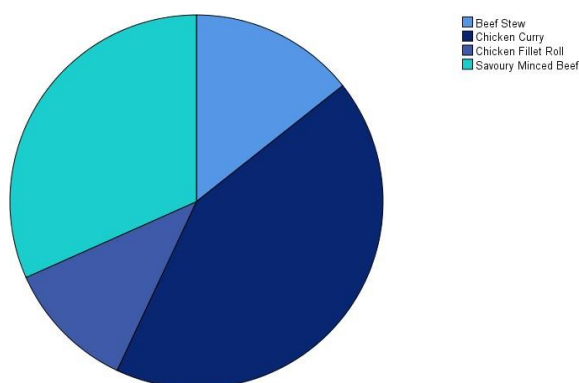


Chart 2.2, Table 2.5 – Chart and table illustrating the target group’s (n=300) responses to question 7 in the first survey

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Beef Stew	43	14.3	14.3	14.3
	Chicken Curry	128	42.7	42.7	57.0
	Chicken Fillet Roll	34	11.3	11.3	68.3
	Savoury Minced Beef	95	31.7	31.7	100.0
	Total	300	100.0	100.0	

After experimental methods:

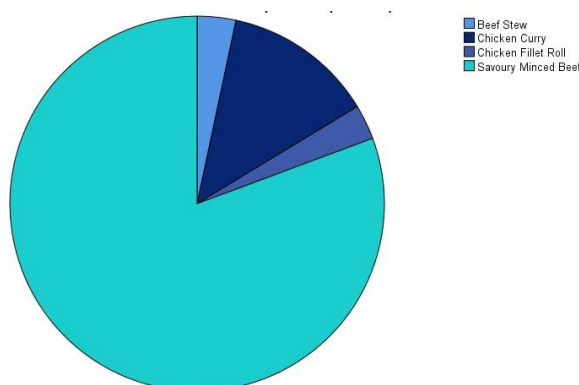


Chart 2.3, Table 2.6 – Chart and table illustrating the target group’s (n=300) responses to question 7 in the second survey

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Beef Stew	10	3.3	3.3	3.3
	Chicken Curry	39	13.0	13.0	16.3
	Chicken Fillet Roll	9	3.0	3.0	19.3
	Savoury Minced Beef	242	80.7	80.7	100.0
	Total	300	100.0	100.0	

As seen in “6.2.5 Question 5” and “6.2.6 Question 6”, my food traffic-light system significantly increased the knowledge of my target group (n-300) with regards to which meals were healthiest and which were least healthy with regards to the school canteen meals. Prior to my experimental methods, only 31.7% were correct and said that ‘Savoury Minced Beef’ was the third healthiest meal available in the school canteen. However, after my experimental methods, this increased to 80.7% illustrating the positive influence of the food traffic-light system.

6.2.8 Question 8:

Select which of the following you think is the least healthy:

Before experimental methods:

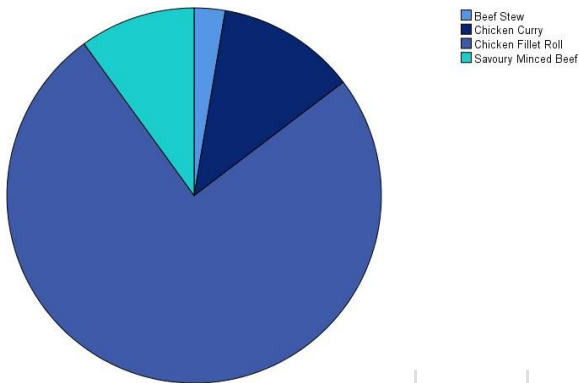


Chart 2.4, Table 2.7 – Chart and table illustrating the target group’s (n=300) responses to question 8 in the first survey

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Beef Stew	8	2.7	2.7	2.7
	Chicken Curry	36	12.0	12.0	14.7
	Chicken Fillet Roll	226	75.3	75.3	90.0
	Savoury Minced Beef	30	10.0	10.0	100.0
	Total	300	100.0	100.0	

After experimental methods:

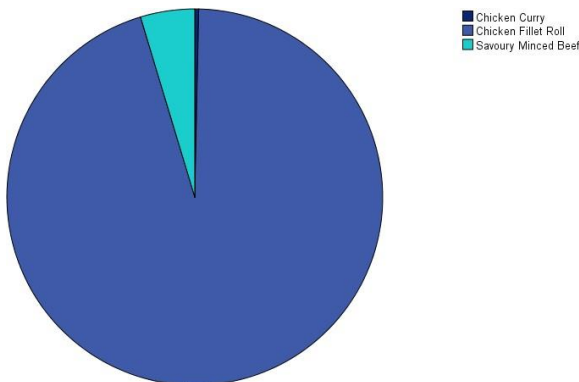


Chart 2.5, Table 2.8 – Chart and table illustrating the target group’s (n=300) responses to question 8 in the second survey

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Chicken Curry	1	.3	.3	.3
	Chicken Fillet Roll	285	95.0	95.0	95.3
	Savoury Minced Beef	14	4.7	4.7	100.0
	Total	300	100.0	100.0	

As seen in “6.2.5 Question 5”, “6.2.6 Question 6” and “6.1.7 Question 7”, my food traffic-light system significantly increased the knowledge of my target group (n=300) with regards to which meals were healthiest and which were least healthy with regards to the school canteen meals. Prior to my experimental methods, 75.3% were correct and said that the ‘Chicken Fillet Roll’ was the least healthy meal available in the school canteen. However, after my experimental methods, this increased to 95% illustrating the positive influence of the food traffic-light system.

6.2.9 Question 9:

Do you know how many grams of fat, saturates, sugars and salt are the RDA for someone of your age on average?

Before experimental methods:

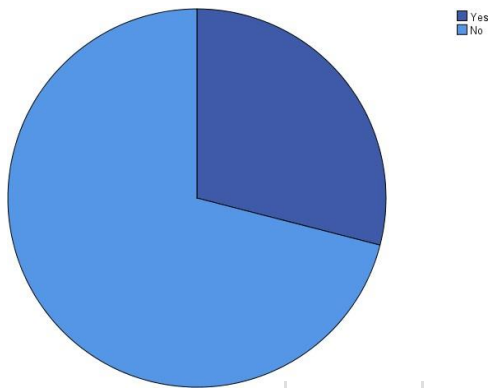


Chart 2.6, Table 2.9 – Chart and table illustrating the target group’s (n=300) responses to question 9 in the first survey

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	87	29.0	29.0	29.0
	No	213	71.0	71.0	100.0
Total		300	100.0	100.0	

After experimental methods:

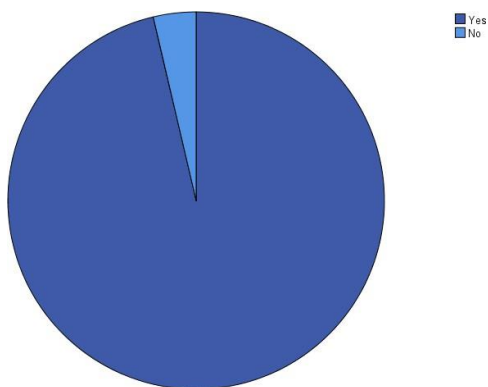


Chart 2.7, Table 3.0 – Chart and table illustrating the target group’s (n=300) responses to question 9 in the second survey

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	289	96.3	96.3	96.3
	No	11	3.7	3.7	100.0
Total		300	100.0	100.0	

The above results show how my experimental methods had a positive effect on the target groups’ confidence in believing that they knew how many grams of fat, saturates, sugars and salt is the RDA. Prior to showcasing my website only 29% of my target group (n=300) believed that they knew how many grams of fat, saturates, sugar and salt is the RDA. However, after my experimental methods 96.3% believed that they knew how many grams of fat, saturates, sugars and salt is the RDA illustrating the positive influence of my informative website.

6.2.10 Question 10:

How many grams of daily SUGAR do you think you think is recommended for someone of your age on average?

Before experimental methods:

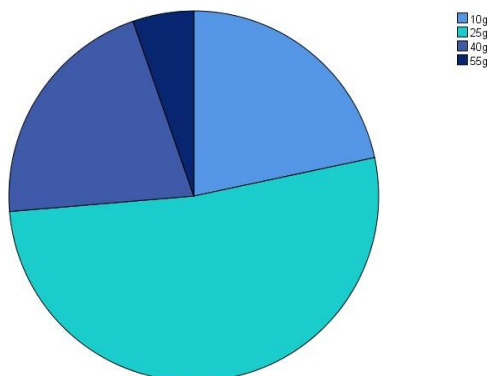


Chart 2.8, Table 3.1 – Chart and table illustrating the target group's (n=300) responses to question 10 in the first survey

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 10g	65	21.7	21.7	21.7
25g	156	52.0	52.0	73.7
40g	63	21.0	21.0	94.7
55g	16	5.3	5.3	100.0
Total	300	100.0	100.0	

After experimental methods:

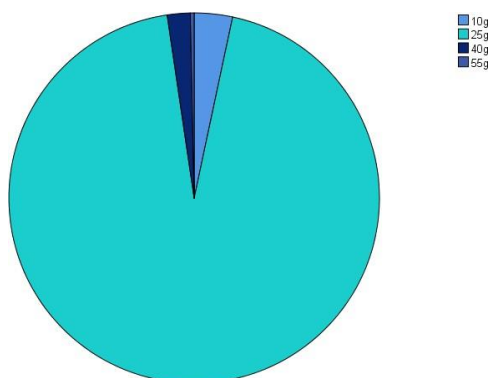


Chart 2.9, Table 3.2 – Chart and table illustrating the target group's (n=300) responses to question 10 in the second survey

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 10g	10	3.3	3.3	3.3
25g	283	94.3	94.3	97.7
40g	6	2.0	2.0	99.7
55g	1	.3	.3	100.0
Total	300	100.0	100.0	

My informative website significantly increased the knowledge of my target group (n=300) with regards to what the RDA for adolescents was for sugar, salt, fat and saturates. Prior to my experimental methods, only 52% were correct and said that 25g was the average RDA of sugar for an adolescent. However, after my experimental methods, this increased to 94.3% illustrating the positive influence of my informative website.

6.2.11 Question 11:

How many grams of daily SALT do you think is recommended for someone of your age on average?

Before experimental methods:

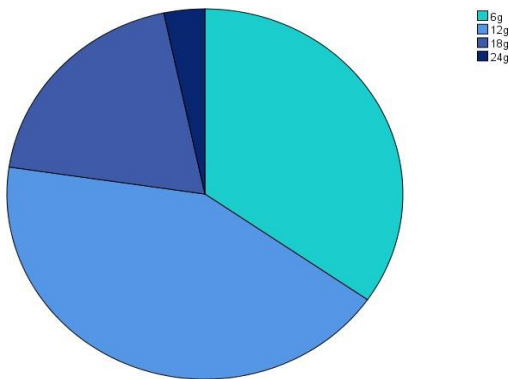


Chart 3.0, Table 3.3 – Chart and table illustrating the target group’s (n=300) responses to question 11 in the first survey

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	6g	104	34.7	34.7	34.7
	12g	128	42.7	42.7	77.4
	18g	58	19.3	19.3	96.3
	24g	10	3.3	3.3	100.0
	Total	300	100.0	100.0	

After experimental methods:

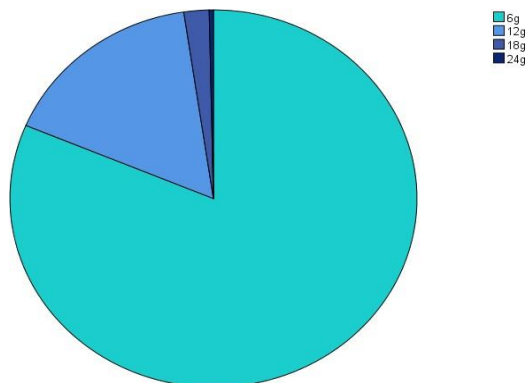


Chart 3.1, Table 3.4 – Chart and table illustrating the target group’s (n=300) responses to question 11 in the second survey

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	6g	244	81.3	81.3	81.3
	12g	49	16.3	16.3	97.6
	18g	6	2.0	2.0	99.6
	24g	1	.3	.3	100.0
	Total	300	100.0	100.0	

As seen in ‘6.2.10 Question 10’, my informative website significantly increased the knowledge of my target group (n=300) with regards to what the RDA for adolescents was for sugar, salt, fat and saturates. Prior to my experimental methods, only 34.7% were correct and said that 6g was the average RDA of salt for an adolescent. However, after my experimental methods, this increased to 81.3% illustrating the positive influence of my informative website.

6.2.12 Question 12

How many grams of daily FAT do you think is recommended for someone of your age on average?

Before experimental methods:

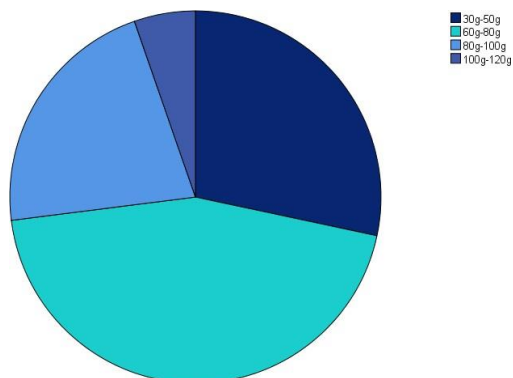


Chart 3.2, Table 3.5 – Chart and table illustrating the target group’s (n=300) responses to question 12 in the first survey

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	30g-50g	85	28.3	28.3	28.3
	60g-80g	134	44.7	44.7	73.0
	80g-100g	65	21.7	21.7	94.7
	100g-120g	16	5.3	5.3	100.0
	Total	300	100.0	100.0	

After experimental methods:

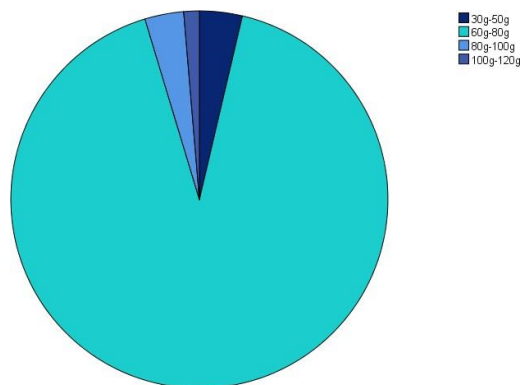


Chart 3.3, Table 3.6 – Chart and table illustrating the target group’s (n=300) responses to question 12 in the second survey

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	30g-50g	11	3.7	3.7	3.7
	60g-80g	275	91.7	91.7	95.4
	80g-100g	10	3.3	3.3	98.7
	100g-120g	4	1.3	1.3	100.0
	Total	300	100.0	100.0	

As seen in ‘6.2.10 Question 10’ and ‘6.2.11 Question 11’, my informative website significantly increased the knowledge of my target group (n=300) with regards to what the RDA for adolescents was for sugar, salt, fat and saturates. Prior to my experimental methods, only 44.7% were correct and said that 60g-80g was the average RDA of fat for an adolescent. However, after my experimental methods, this increased to 91.7% illustrating the positive influence of my informative website.

6.2.13 Question 13

How many grams of daily SATURATES do you think is recommended for someone of your age on average?

Before experimental methods:

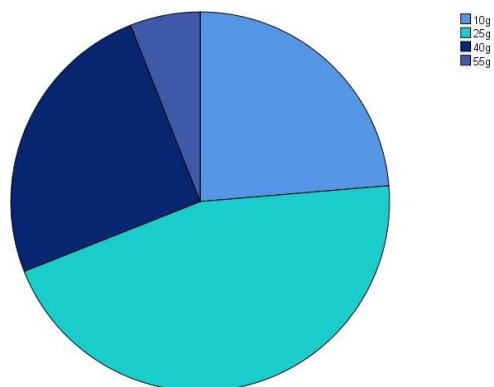


Chart 3.4, Table 3.7 – Chart and table illustrating the target group’s (n=300) responses to question 13 in the first survey

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	10g	71	23.7	23.7	23.7
	25g	136	45.3	45.3	69.0
	40g	75	25.0	25.0	94.0
	55g	18	6.0	6.0	100.0
	Total	300	100.0	100.0	

After experimental methods:

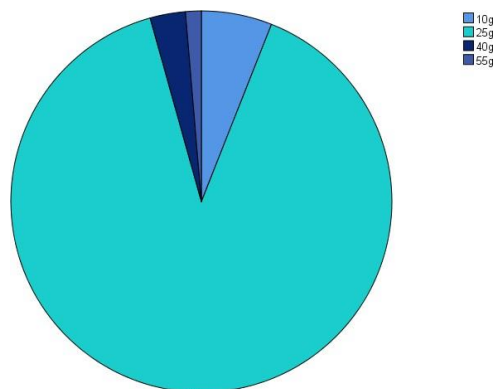


Chart 3.5, Table 3.8 – Chart and table illustrating the target group’s (n=300) responses to question 13 in the second survey

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	10g	18	6.0	6.0	6.0
	25g	269	89.7	89.7	95.7
	40g	9	3.0	3.0	98.7
	55g	4	1.3	1.3	100.0
	Total	300	100.0	100.0	

As seen in ‘6.2.10 Question 10’, ‘6.2.11 Question 11’ and ‘6.2.12 Question 12’, my informative website significantly increased the knowledge of my target group (n=300) with regards to what the RDA for adolescents was for sugar, salt, fat and saturates. Prior to my experimental methods, only 45.3% were correct and said that 25g was the average RDA of fat for an adolescent. However, after my experimental methods, this increased to 89.7% illustrating the positive influence of my informative website.

6.2.14 Question 14

On a scale of 1-5 how likely are you to choose A CHICKEN FILLET ROLL for your lunch?

Before experimental methods:

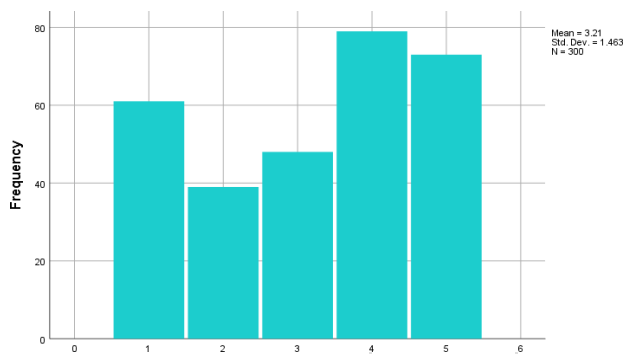


Chart 3.6, Table 3.9 – Chart and table illustrating the target group’s (n=300) responses to question 14 in the first survey

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	61	20.3	20.3	20.3
	2	39	13.0	13.0	33.3
	3	48	16.0	16.0	49.3
	4	79	26.3	26.3	75.7
	5	73	24.3	24.3	100.0
	Total	300	100.0	100.0	

After experimental methods:

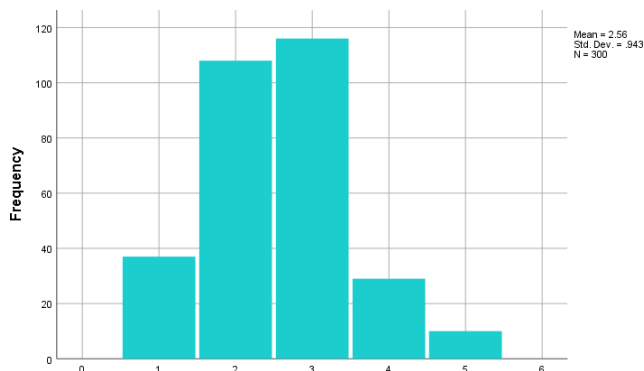


Chart 3.7, Table 4.0 – Chart and table illustrating the target group’s (n=300) responses to question 14 in the second survey

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	37	12.3	12.3	12.3
	2	108	36.0	36.0	48.3
	3	116	38.7	38.7	87.0
	4	29	9.7	9.7	96.7
	5	10	3.3	3.3	100.0
	Total	300	100.0	100.0	

The above results show how the introduction of my food traffic-light system influenced the adolescent’s likelihood of choosing particular meals. Prior to the introduction of my food traffic-light system, 24.3% rated their likelihood of choosing the ‘Chicken Fillet Roll’, the least healthy meal for lunch as 5 on a scale of 1-5. However, after the introduction of my food traffic-light system only 3.3% rated their likelihood of choosing the ‘Chicken Fillet Roll’ for lunch as 5 on a scale of 1-5. In the first survey, the mean likelihood of choosing the ‘Chicken Fillet Roll’ for lunch on a scale of 1-5 was 3.21 but this decreased to 2.56 in the second survey showing that the food traffic-light system was a positive influence.

6.2.15 Question 15

On a scale of 1-5 how likely are you to choose SAVOURY MINCED BEEF for your lunch?

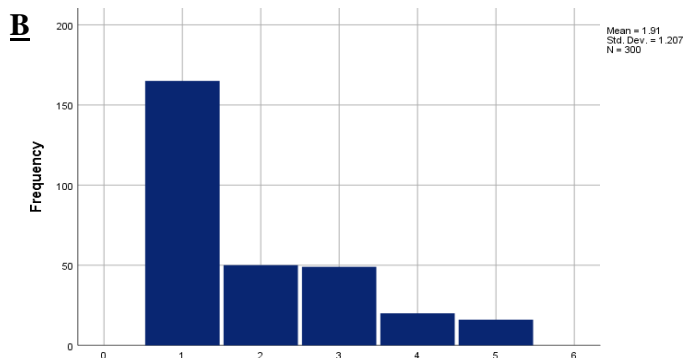


Chart 3.8, Table 4.1 – Chart and table illustrating the target group's (n=300) responses to question 15 in the first survey

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	165	55.0	55.0	55.0
	2	50	16.7	16.7	71.7
	3	49	16.3	16.3	88.0
	4	20	6.7	6.7	94.7
	5	16	5.3	5.3	100.0
	Total	300	100.0	100.0	

After experimental methods:

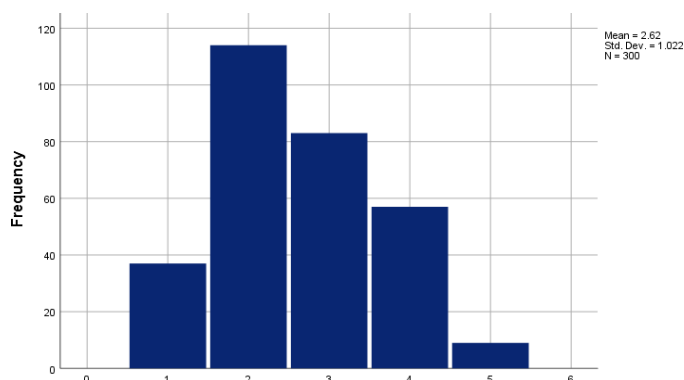


Chart 3.9, Table 4.2 – Chart and table illustrating the target group's (n=300) responses to question 15 in the second survey

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	37	12.3	12.3	12.3
	2	114	38.0	38.0	50.3
	3	83	27.7	27.7	78.0
	4	57	19.0	19.0	97.0
	5	9	3.0	3.0	100.0
	Total	300	100.0	100.0	

As seen in '6.2.14 Question 14' the above results show how the introduction of my food traffic-light system influenced the adolescent's likelihood of choosing particular meals. Prior to the introduction of my food traffic-light system, the mean likelihood of choosing the 'Savoury Minced Beef', the third healthiest meal for lunch on a scale of 1-5 was 1.91 but this increased to 2.26 in the second survey showing that although the 'Savoury Minced Beef' wasn't the healthiest of meals people were more likely to buy it now, after the introduction of the food traffic-light system therefore indicating the positive influence of the food traffic-light system.

6.2.16 Question 16

On a scale of 1-5 how likely are you to choose CHICKEN CURRY for your lunch?

Before experimental methods:

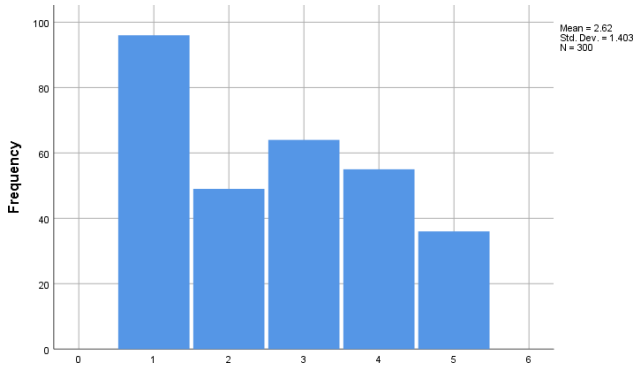


Chart 4.0, Table 4.3 – Chart and table illustrating the target group’s (n=300) responses to question 16 in the first survey

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	96	32.0	32.0	32.0
	2	49	16.3	16.3	48.3
	3	64	21.3	21.3	69.7
	4	55	18.3	18.3	88.0
	5	36	12.0	12.0	100.0
	Total	300	100.0	100.0	

After experimental methods:

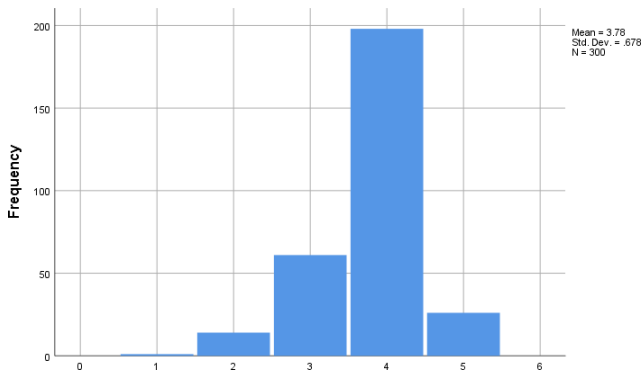


Chart 4.1, Table 4.4 – Chart and table illustrating the target group’s (n=300) responses to question 16 in the second survey

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	.3	.3	.3
	2	14	4.7	4.7	5.0
	3	61	20.3	20.3	25.3
	4	198	66.0	66.0	91.3
	5	26	8.7	8.7	100.0
	Total	300	100.0	100.0	

As seen in ‘6.2.14 Question 14’ and ‘6.2.15 Question 15’ the above results show how the introduction of my food traffic-light system influenced the adolescent’s likelihood of choosing particular meals. Prior to the introduction of my food traffic-light system, the mean likelihood of choosing the ‘Chicken Curry’, the second healthiest meal for lunch on a scale of 1-5 was 2.62 but this increased to 3.78 in the second survey showing that the food traffic-light system was a positive influence.

6.2.17 Question 17

On a scale of 1-5 how likely are you to choose BEEF STEW for your lunch?

Before experimental methods:

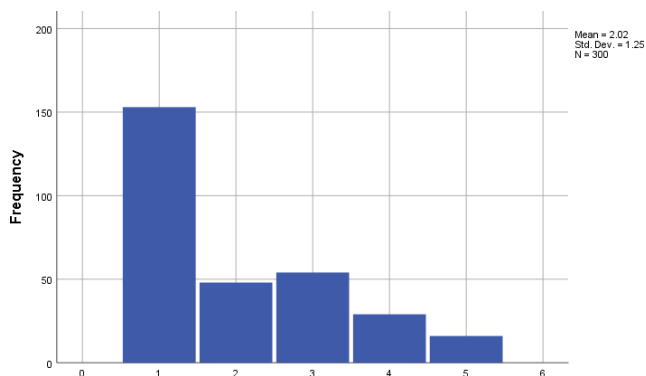


Chart 4.2, Table 4.5 – Chart and table illustrating the target group’s (n=300) responses to question 17 in the first survey

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	153	51.0	51.0	51.0
	2	48	16.0	16.0	67.0
	3	54	18.0	18.0	85.0
	4	29	9.7	9.7	94.7
	5	16	5.3	5.3	100.0
	Total	300	100.0	100.0	

After experimental methods:

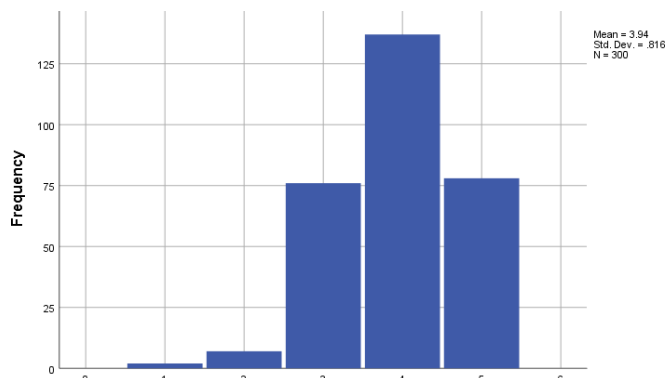


Chart 4.3, Table 4.6 – Chart and table illustrating the target group’s (n=300) responses to question 17 in the second survey

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	2	.7	.7	.7
	2	7	2.3	2.3	3.0
	3	76	25.3	25.3	28.3
	4	137	45.7	45.7	74.0
	5	78	26.0	26.0	100.0
	Total	300	100.0	100.0	

As seen in ‘6.2.14 Question 14’, ‘6.2.15 Question 15’ and ‘6.2.16 Question 16’, the above results show how the introduction of my food traffic-light system influenced the adolescent’s likelihood of choosing particular meals. Prior to the introduction of my food traffic-light system only 5.3% rated their likelihood of choosing the ‘Beef Stew’, the healthiest meal for lunch as 5 on a scale of 1-5 and only 9.7% rated their likelihood of choosing the ‘Beef Stew’ for lunch as 4 on a scale of 1-4. However, after the introduction of my food traffic-light system 26% rated their likelihood of choosing the ‘Beef Stew’ for lunch as 5 on a scale of 1-5 and 45.7% rated their likelihood of choosing ‘Beef Stew’

for lunch as 4 on a scale of 1-4. In the first survey, the mean likelihood of choosing the 'Beef Stew' for lunch on a scale of 1-5 was only 2.02 but this significantly increased to 3.94 in the second survey showing that the food traffic-light system was a positive influence. This mean of 3.94 is higher than all other mean values obtained in both surveyings.

6.2.18 Question 18

Describe, as best you can, what you think a 'food food traffic-light system' is:

Sample Answers:

"Distinguishing between good and bad food to intake using the colours red, orange and green. There are different categories: salt, sugar, saturates and fat"

"Red means that there is a very high quantity of something e.g., salt in a product, amber means that there isn't a high or low quantity of something in a product and green means there is a healthy amount of something in a product"

"It shows how nutritionally beneficial products are using the colours red, orange and green"

"It is on the front of some food packaging and briefly outlines the amount of sugar, salt, fat etc. in a serving using the colours of a traffic-light"

"Indicator of whether the food is healthy (green) or not (orange/red) based on RDAs and amounts of sugars, salt, etc. in foods"

"I don't know"

"I'm unsure, maybe it's to do with transporting foods?"

Prior to introducing my food traffic-light system, I ensured that all of the target group (n=300) understood what a food food traffic-light system was. Therefore, I included the above question in my first survey in order to find out if people understood what it was and most people had a brief understanding. However, since some people were unsure, I explained what it was on my website.

6.2.19 Question 19

Do you have any suggestions for meals that you would like to have in the school canteen?

Common Answers:

"Stir fry"

"Salads"

"Vegetarian/vegan options"

"Carbonara"

"Bacon and Cabbage"

"Lasagne"

"Chilli con carne "

"Bolognese"

"Cottage pie"

"Pasta bake"

"Noodles"

In my first survey I asked the above question in order to find out what the target group (n=300) wanted to see available in the canteen. As a part of my future studies, I hope to introduce some healthy versions of these into the school canteen.

7.0 Discussion

The main aim of this project was to investigate the attitudes and nutritional knowledge of adolescents towards school canteen meals and whether a food traffic-light system is beneficial in making better choices. My initial research involved surveying the target group to find out their current nutritional knowledge (n=300). I also tracked the meals in my school canteen. The students had a choice of four meals, the two meals I developed along with the two original choices (one of which had a high level of salt, fat and saturates). The survey revealed that nutritional knowledge and food choices were poor in the target group (n=300). A significant percentage of students did not understand the importance of good nutrition in adolescence and furthermore were unable to identify the correct RDA for salt, sugar, fat and saturates. In addition, tracking the meals showed that a majority of the target group were unable to identify which meals were healthier. Many opted for the nutritionally poor 'Chicken Fillet Roll.'

This study found that adolescents did not understand the implications of skipping meals or of choosing LNE (low nutrition energy dense) foods. Prior to my experimental methods 11% of students never ate meals from the school canteen. Additionally, prior to my experimental methods 72% of the target group chose the nutritionally poor 'Chicken Fillet Roll' and only 8% were purchasing the 'Beef Stew' which is the healthiest of the four meals. This confirms what was found in a previous study by (Colby College, 2018) is that regularly in school canteens the most 'common' choices are the ones with the least nutritional value. Additionally, a study by Rastogi et al. (2018), found that adolescents are currently not meeting the recommended guidelines for numerous nutrients which is further exacerbated by the skipping of meals particularly school meals. According to this study 72% of adolescent school-goers between the ages of thirteen and fifteen skipped one or more meals on a daily basis. The most concerning study of all is perhaps a study conducted by The Nutrition Society, (2015) which shows that schools are providing many of the foods that contribute to high sugar and fat intakes among Irish adolescents.

Furthermore, this study found that adolescents have poor knowledge of nutrition and are unable to identify what a healthy meal should consist of. Prior to my experimental methods only 48.3% could identify the healthiest meal in the canteen. In addition, only 34.7% could correctly identify what the RDA for salt was for an adolescent and only 44.7% could correctly identify what the RDA for fat was for an adolescent. 'The consumption of essential vitamins and nutrients amongst adolescents is declining steadily and will continue to do so if this problem is not adequately' (British Nutrition Foundation (2015). According to a study by Rastogi S, et al. (2018), 82% of adolescents believed that a lack of iron and other essential vitamins and nutrients would not cause them any harm in the future.

Worryingly, low consumption of essential vitamins and nutrients during adolescence is linked to a number of potential long-term health deficiencies including bone health deficiencies, weight control, cardiovascular disease and colorectal cancer. Whilst also being a key cause of the development of anorexia, bulimia, insomnia, lethargy and poor concentration levels (WHO, 2002).

The lack of information leading to poor canteen choices as highlighted by this and previous studies shows the importance and indeed urgency of educating adolescents in the area of nutrition and particularly in enabling them to make informed choices in regard to food eaten in their school canteens. This prompted further study as part of this project on the specific nutritional requirements for adolescents as is outlined earlier in this document. Additionally, an interview with BiteBack 2030 member Nika Strukelj, a UK organisation run by teens and supported by Jamie Oliver about their current campaign in pushing for a food traffic-light system for UK teens proved very informative. A clear and concise website was developed to provide information to adolescents on making good food choice decisions. The main experimental method trialed was the introduction of a food traffic-light system outlining the RDA's for adolescents of salt, sugar, fat and saturates. The canteen food was analysed by deciphering nutritional information from the back of each ingredient packet. This information was then further analysed using Nutritics Analysis Software to develop a clear and concise food traffic-light system. The food traffic-light system developed as part of this project took complex nutritional information and changed this into correct RDA amounts for adolescents which was then displayed on a traffic-light board which was designed, printed and displayed. Adolescents could identify with one glance which foods were more nutritionally beneficially and which weren't on the premise that more red is bad and more green/orange is good. Furthermore, I believe that the introduction of a food traffic-light system in all secondary school canteens would not only help adolescents to make better food choices but it would also encourage food providers to develop their healthy food options.

A similar food traffic-light system though generally geared to adult RDA's can be found on the front of some pre-

packaged products. However, this is done on a voluntary basis and is not currently mandatory in the EU. The Irish Heart Foundation in conjunction with heart foundations and consumer organizations across Europe believes that there is a wealth of scientific evidence to show that front of pack labels combining traffic-light colours; the words high, medium and low; percentage guideline daily amounts; and the levels of nutrients per portion of product best supports consumers to make healthy food choices (Irish Times 2010). This supports my findings when I completed a second day of meal tracking and a second survey (n=300) after completing the experimental methods. The second day of meal tracking found that the number of adolescents now choosing the 'Chicken Fillet Roll' fell to 19.3% rather than the previous 72% and the number choosing the healthiest option which was the 'Beef Stew' rose to 53.3% from the previous 8%. The second survey found that for example the number of adolescents able to identify the correct RDA for salt rose from 34.7% to 81.3% and the number able to identify the RDA for fat went from 44.7% to 91.7%. Another example was how 78.3% were now able to identify 'Beef Stew' as the healthiest meal in the school canteen rather than the previous only 48.3%. Furthermore, now 92.3% eat meals sometimes or everyday from the school canteen rather than the previous 89%. This shows that the experimental methods had a positive effect on the food choices of adolescents in the school canteen and their overall nutritional knowledge.

8.0 Conclusion and Potential for Future Studies:

This project was an investigation into the lack of nutritional knowledge and poor nutritional choices made by teens in their school canteens. My initial examination of the canteen food revealed that choice was limited. I worked with the canteen staff to add two further healthy choices to the school canteen menu.

My initial research which involved surveying the target group (n=300) revealed that nutritional knowledge and food choices were poor. A significant percentage of students did not understand the importance of good nutrition in adolescence and furthermore were unable to identify the correct RDA for salt, sugar, fat and saturates. In addition, a majority of the target group were unable to identify which meals were healthier. Many still opted for the nutritionally poor 'Chicken Fillet Roll'.

My project was successful in informing and educating the target group in relation to nutritional requirements during adolescence as well as allowing them to make an informed decision about what they were consuming particularly in relation to salt, sugar, fat and saturates. This was achieved through an information campaign which involved the nutritional analysis of the canteen options and the development of a food traffic-light system based on the information obtained. This was implemented through designing and printing a large board containing the food traffic-light system and displaying it prominently in the canteen. In addition, I worked with canteen staff and my Home Economics teacher to provide further nutritional knowledge on the canteen foods on a separate board. All information was clear and concise which was essential as adolescents needed to be able to establish at first glance what the healthier options were. The information campaign was aided through the development of a website informing the students about the correct nutritional requirements for their age group along with an explanation of the food traffic-light system.

On completion of the information/education section of my project I surveyed the target group (n=300) once more and established that not only had my target group's nutritional knowledge increased overall but the food traffic-light system was very successful in helping students quickly and easily choose foods which were nutritional beneficial. In addition, students were now less likely to skip meals.

Overall, my hypothesis has been proven as correct. Nutritional knowledge amongst the target group was initially very low but now the target group have been well informed on the importance of adequate nutrition in terms of choice and of not skipping meals. Furthermore, the 'Chicken Fillet Roll' was the most popular meal initially but this has changed substantially because of my food traffic-light system. Thus, it is evident that my experimental methods have had a huge impact on the target group. My study has spread awareness on, and increased nutritional knowledge of the target group in terms of our school canteen food. Therefore, I believe that the introduction of a food traffic-light system combined with an educational programme in all secondary schools is essential in order for adolescents to make better food choices before it is too late.

Potential for Future Studies:

On completing my study, I found that though the study had been hugely successful a small but significant group of students were still choosing the low nutrition 'Chicken Fillet Roll' from the canteen menu. I worked with my Home Economics teacher to develop a healthier option to the 'Chicken Fillet Roll'. Having developed and taste tested it I am hoping to introduce this to the school canteen shortly.

As studies have shown the school canteen is crucial in providing nutritional meals to adolescents. However more work and studies are needed in terms of how the meals are developed in successfully providing adolescents with appropriate nutrition. This should also include vegetarian and vegan meals.

In addition, as this and previous studies have shown the food traffic-light system is successful in informing not just to adolescents but people in general in a quick and clear manner about their daily RDA in relation to salt, sugar, fat and saturates. It is the preferred choice of health professionals in tackling the obesity epidemic. Further studies should be completed on using the food traffic-light system in different settings such as restaurants and colleges as well as introducing it into all secondary school canteens because it is clear that food traffic-light systems help people to make better food choices.

Finally, whilst conducting my study I found that the traffic light system encouraged the students to push for more and healthier options. It would be worth conducting further studies here to see if the introduction of the food traffic-light system would ultimately result in better and healthier meals being provided.

Bibliography (A-Z):

American Academy of Paediatricians (2019), *A Teenager's Nutrition Needs*, Available from: <https://www.healthychildren.org/English/ages-stages/teen/nutrition/Pages/A-Teenagers-Nutritional-Needs.aspx> [accessed: 29th September 2020]

Anderson AS, Cox DN, McKellar S, Reynolds J, Lean ME, Mela DJ (1998), *Take Five, a nutrition education intervention to increase fruit and vegetable intakes: impact on attitudes towards dietary change*, British Journal of Nutrition 1998 Aug; 80:133-140, Available from: <https://pubmed.ncbi.nlm.nih.gov/9828754/> [accessed: 7th December 2020]

Angskun T, Angskun J (2014), *Food sensory properties for an ontology design*, Available from: https://www.researchgate.net/figure/Food-sensory-properties-for-an-ontology-design_tbl1_292598243 [accessed: 1st November 2020]

Banna JC, Buchthal OV, Delormier T, Creed-Kanashiro HM, Penny ME (2016), *Influences on eating: a qualitative study of adolescents in a periurban area in Lima, Peru*, BMC Public Health 2016 Jan; 16:40, Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4714484/> [accessed 10th November 2020]

Berkman LF (1995), *The role of social relations in health promotion*, Psychosomatic Medicine May-Jun 1995; 57(3):245-254, Available from: <https://pubmed.ncbi.nlm.nih.gov/7652125/> [accessed: 7th December 2020]

Dr. Birch L, Savage JS, Ventura A (2009), *Influences on the Development of Children's Eating Behaviours: From Infancy to Adolescence*, Canadian Journal of Dietetic Practice 2009 May; 68(1): s1-s56, Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2678872/> [accessed: 29th October 2020]

Birch LL, Fisher JO (1998), *Development of eating behaviours among children and adolescents*, Paediatrics 1998 Mar; 101(3 Pt 2):539-49, Available from: <https://pubmed.ncbi.nlm.nih.gov/12224660/> [accessed: 3rd December 2020]

BiteBack 2030 (2020), *About Us: BiteBack exists for a healthier generation*, Available from: <https://biteback2030.com/about-us> [accessed: 14th September 2020]

- Briefel RR, Cabill C, Crepinsek MK, Wilson A (2009), *School Food Environments and Practices Affect Dietary Behaviours of US Public School Children*, Journal of American Dietetics Association 2009 Feb; 109(2 Suppl): S91-107, Available from: https://www.researchgate.net/publication/51435604_School_Food_Environments_and_Practices_Affect_Dietary_Behaviors_of_US_Public_School_Children [accessed: 29th October 2020]
- British Nutrition Foundation (2015-2018), *Nutrition throughout life: teenagers*, Available from: <https://www.nutrition.org.uk/nutritionscience/life/teenagers.html?showall=1> [accessed: 15th September 2020]
- Clarke JE (1998), *Taste and flavour: their importance in food choice and acceptance*, Proceedings of the Nutrition Society 1998 Nov; 57:639-643, Available from: <https://pdfs.semanticscholar.org/fed9/af6b3c92217b2c9ce4679857f6a42f1a8ca7.pdf> pp.1-2 [accessed: 2nd December 2020]
- Dahl RE (2004), *Adolescent brain development: a period of vulnerabilities and opportunities. Keynote address*, Annals of the New York Academy of Sciences 2004 June; 1021: 1-22, Available from: <https://pubmed.ncbi.nlm.nih.gov/15251869/> [accessed: 30th November 2020]
- De Almeida M, Graça P, Lappalainen R, Giachetti I, Kafatos A, Remaut-De Winter A, Kearney JM (1997), *Sources used and trusted by nationally-representative adults in the European Union for information on healthy eating*, European Journal of Clinical Nutrition 1997 Jun; 51:S8-15, Available from: <https://pubmed.ncbi.nlm.nih.gov/9222719/> [accessed: 3rd December 2020]
- De Irala-Estévez J, Groth M, Johansson L, Oltersdorf U, Prättälä R, Martínez-González MA (2000), *A systematic review of socioeconomic differences in food habits in Europe: consumption of fruit and vegetables*, European Journal of Clinical Nutrition 2000 Sep; 54:706-714, Available from: <https://pubmed.ncbi.nlm.nih.gov/11002383/> [accessed: 30th October 2020]
- Deidre Clune MEP (2012), *Vending machines and tuck shops should be banned in schools*, Fine Gael, Available from: <https://www.finegaele.ie/vending-machines-and-tuck-shops-should-be-banned-in-schools/> [accessed: 11th November 2020]
- Devine CM, Connors MM, Sobal J, Bisogni CA (2003), *Sandwiching it in: spillover of work onto food choices and family roles in low- and moderate-income urban households*, Social Science and Medicine 2003 Feb; 56:617-630, Available from: <https://pubmed.ncbi.nlm.nih.gov/12570978/> [accessed: 4th December 2020]
- Dewberry C, Ussher JM (1994), *Restraint and perception of body weight among British adults*, Journal of Social Psychology 1994; 134(5):609-619, Available from: <https://psycnet.apa.org/record/1995-21228-001> [accessed: 1st December 2020]
- Faugier J, Lancaster J, Pickles D, Dobson K (2001), *Barriers to healthy eating in the nursing profession: Part 2*, Nursing Standard 2001 May-Jun; 15(37):33-35, Available from: <https://pubmed.ncbi.nlm.nih.gov/12205763/> [accessed: 28th October 2020]
- Feunekes GI, De Graaf C, Meyboom S, Van Staveren WA (1998), *Food choice and fat intake of adolescents and adults: associations of intakes within social networks*, Preventive Medicine 1998 Sep-Oct; 27:645-656, Available from: <https://pubmed.ncbi.nlm.nih.gov/9808794/> [accessed 2nd December 2020]
- Flinders University Australia (2014), *Social media puts body-conscious girls off sport*, Medical Xpress, Available from: <https://medicalxpress.com/news/2014-10-social-media-body-conscious-girls-sport.html> [accessed: 21st October]

- Food Standards Agency (2020), *Check the label*, Available from: <https://www.food.gov.uk/safety-hygiene/check-the-label#:~:text=The%20traffic%20light%20labelling%20system,kilojoules%20in%20that%20particular%20product> [accessed: 5th December 2020]
- Hampel JS, Heaton CLB, Taylor CA (2003), *Snacking patterns influence energy and nutrient intakes but not body mass index*, *Journal of Human Nutrition and Dietetics* 2003 Feb; 16(1):3-11, Available from: <https://pubmed.ncbi.nlm.nih.gov/12581404/> [accessed: 8th December 2020]
- Harvard School of Public Health (2020), *The Nutrition Source*, Available from: <https://www.hsph.harvard.edu/nutritionsource/> [accessed: 5th September 2020]
- Healthy Eating Advisory Service (2016), *Healthy choices guidelines: Traffic light systems*, Available from: <https://heas.health.vic.gov.au/healthy-choices/guidelines/traffic-light-system> [accessed: 2nd December 2020]
- Hupkens CL, Knibbe RA, Drop MJ (1997), *Social class differences in women's fat and fibre consumption: a cross-national study*, *The Department of Medical Sociology Netherlands* 1997 Apr; 28(2):131-149, Available from: <https://europepmc.org/article/med/9158848> [accessed 3rd December 2020]
- Irish Universities Nutrition Alliance (2005), *The National Teens' Food Survey*, Available from: <https://irp-cdn.multiscreensite.com/46a7ad27/files/uploaded/The%20National%20Teens%27%20Food%20Survey%20%282005-2006%29.pdf> pp. 8-16 [accessed: 4th December 2020]
- John Muir Health, *Nutrition for teens*, Available from: <https://www.johnmuirhealth.com/health-education/health-wellness/childrens-health/nutrition-teens.html> [accessed: 24th October 2020]
- Kearney M, Kearney J, Dunne A, Gibney M (2000), *Sociodemographic determinants of perceived influences on food choice in a nationally representative sample of Irish adults*, *Public Health Nutrition* 2000 Jun; 3(2):219-226, Available from: <https://pubmed.ncbi.nlm.nih.gov/10948389/> [accessed: 3rd December 2020]
- Larsen B, Luna B (2018), *Adolescence as a neurobiological critical period for the development of higher-order cognition*, *Neurosci Biobehav Rev.* 2018 Nov; 94: 179-195, Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6526538/> [accessed: 8th December 2020]
- Larson N (2016), *Teen nutrition: making healthy food choices easy*, McGill N, American Public Health Association: *The Nation's Health* 2016 Jan; 45 (10) 36, Available from: <https://www.thenationshealth.org/content/45/10/36> [accessed: 24th October 2020]
- Reuters Health - Lehman S (2016), *Kids who skip lunch meals are missing out on essential nutrients*, Available from: <https://www.reuters.com/article/us-health-kids-lunch-idUSKCN0WA2HY> [accessed: 19th September 2020]
- London School of Economics and Political Science (2014), *The Rise of the Instagram Health Blogger*, *The Irish Independent*, Available from: <https://www.independent.ie/life/health-wellbeing/healthy-eating/the-rise-of-the-instagram-health-blogger-30726665.html#:~:text=According%20to%20a%20recent%20poll,to%20worrying%20about%20their%20weight> [accessed: 3rd December 2020]
- Marsh K, Zeuschner C, Saunders A (2011), *Health implications of a vegetarian diet: A review*, *American Journal of Lifestyle Medicine* 2011 Nov, Available from: <https://journals.sagepub.com/doi/abs/10.1177/1559827611425762> pp. 250-267 [accessed: 24th October 2020]
- National Diet and Nutrition Survey (2014), *Summary of key findings from the NDNS report of years 7 and 8 (combined)*, Public Health England, Available from: <https://www.nutrition.org.uk/nutritioninthenews/new-reports/ndnsyears7and8.html> [accessed: 15th October 2020]

National Health Service (2020), *The Eatwell Guide*, Available from: <https://www.nhs.uk/live-well/eat-well/the-eatwell-guide/> [accessed: 5th November 2020]

Neumark-Sztainer et al. (1999), *Factors influencing food choices of adolescents: findings from focus-group discussions with adolescents*, *Journal of the American Medical Directors Association* 1999 Aug; 99(8):929-37, Available from: <https://pubmed.ncbi.nlm.nih.gov/10450307/> [accessed: 3rd December 2020]

Nutrition Insight (2020), *UK teenagers demand compulsory front-of-pack labelling as they “bite back” to accelerate health*, Available from: <https://www.nutritioninsight.com/news/uk-teenagers-demand-compulsory-front-of-pack-labeling-as-they-bite-back-to-accelerate-health.html> [accessed: 14th September 2020]

Nutrition Standards for School Meals (2020), *Safefood - Nutrition standards for school meals*, The Department of Health, Ireland, Available from: <https://assets.gov.ie/15978/6ade4b9f4810445e8c6516b3a33d330b.pdf> pp.15-19 [accessed: 6th September 2020]

O’Shea M (2010), *Traffic light labels better for Irish shoppers*, Condon D, Irish Health, Available from: <http://www.irishhealth.com/article.html?id=18222> [accessed: 30th September 2020]

Rastogi S, Mathur P, Khanna A (2018), *Gaps in nutrition knowledge and barriers to eating healthy among low-income, school-going adolescent girls in Delhi*, *Journal of Public Health: From Theory to Practice* 2018 Sep; 27:629-636, Available from: <https://doi.org/10.1007/s10389-018-0985-6> pp.1-8 [accessed: 10th September 2020]

Rutgers University (2020), *Healthier school food and physical activity environments matter for childhood obesity*, *Science Daily*, Available from: <https://www.sciencedaily.com/releases/2020/07/200708133021.htm> [accessed: 11th December 2020]

School Health & Human Performance, Dublin City University (2015), *Are schools promoting low-nutrient, energy-dense (LNED) foods? Results from student-led research of foods sold in six secondary schools*, Available from: https://www.researchgate.net/publication/283910361_Are_schools_promoting_low-nutrient_energy-dense_LNED_foods_Results_from_student-led_research_of_foods_sold_in_six_secondary_schools [accessed: 31st October 2020]

Shi L, Mao Y (2010), *Excessive recreational computer use and food consumption behaviour among adolescents*, *Ital J Pediatr* 2010 Aug; 36:52, Available from: <https://pubmed.ncbi.nlm.nih.gov/20687951/> [accessed: 8th December 2020]

Smead S (2018), *Global food, health and society*, Colby College, Available from: <http://web.colby.edu/st297-global18/2018/10/29/americas-fast-food-obsession/> [accessed: 4th October 2020]

Sorensen G, Hunt MK, Cohen N, Stoddard A, Stein E, Phillips J, Baker F, Combe C, Hebert J, Palombo R (1998), *Worksite and family education for dietary change: The Treatwell 5-A-Day program*, *Health Education Research* 1998 Dec; 13(4):577-591, Available from: <https://pubmed.ncbi.nlm.nih.gov/10345908/> [accessed: 3rd December 2020]

Sorensen LB, Moller P, Flint A, Martens M, Raben A (2003), *Effect of sensory perception of foods on appetite and food intake: a review of studies on humans*, *International Journal of Obesity and Related Metabolic Disorders* 2003 Oct; 27:1152-1166, Available from: <https://pubmed.ncbi.nlm.nih.gov/14513063/> [accessed 24th October 2020]

Steiner JE (1977), *Facial expressions of the neonate infant indicating the hedonics of food-related chemical stimuli*. In: *Weiffenbach J. ed. Taste and development: The Genesis of Sweet Preference* (DHEW Publication No. NIH 77-1068), Washington DC: US Gover, Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2784884/> [accessed: 24th October 2020]

Story M, Neumark-Sztainer D, French S (2002), *Individual and environmental influences on adolescent eating behaviours*. Journal of the American Dietetics Association 2002 Mar;102(3 Suppl): S40–51, Available from: <https://pubmed.ncbi.nlm.nih.gov/11902388/> [accessed: 3rd December 2020]

Stubbs RJ, Van Wyk MC, Johnstone AM, Harbron CG (1996), *Breakfasts high in protein, fat or carbohydrate: effect on within-day appetite and energy balance*, European Journal of Clinical Nutrition 1996 Jul; 50:409-417, Available from: <https://pubmed.ncbi.nlm.nih.gov/8862476/> [accessed: 25th October 2020]

The Australian Department of Health (2013), *Role of the School Canteen in contributing to a health promoting school*, Available from: <https://www1.health.gov.au/internet/publications/publishing.nsf/Content/canteen-mgr-tr1~role-school-canteen> [accessed: 4th December 2020]

The Eatwell Guide (2016), *The Eatwell Guide: helping you to eat a balanced diet*, Public Health England, Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/742750/Eatwell_Guide_booklet_2018v4.pdf pp. 3-12 [accessed: 22nd October 2020]

The European Food Information Council (2006), *The factors the influence our food choices*, Available from: <https://www.eufic.org/en/healthy-living/article/the-determinants-of-food-choice> [accessed: 31st October]

U.S. Department of Agriculture's Center for Nutrition Policy and Promotion (2000), *Nutrition and your health: dietary guidelines for Americans*, Available from: <https://health.gov/sites/default/files/2020-01/DGA2000.pdf> pp.19 [accessed: 24th October 2020]

University of Oklahoma Health Sciences Centre (2013), *80% of teens have a bad diet*, United Press International: Health News, Available from: https://www.upi.com/Health_News/2013/04/07/80-percent-of-US-teens-have-a-bad-diet/13101365358161/ [accessed: 14th November 2020]

Wahlqvist M, The Nutrition Society (2002), *Best sources of essential nutrients*, The Healthy Eating Club, Available from: <http://apjcn.nhri.org.tw/server/info/articles/nutrients/food-source.htm> [accessed: 25th October]

World Health Organisation (2002), *Diet, nutrition and the prevention of chronic disease*, Available from: https://apps.who.int/iris/bitstream/handle/10665/42665/WHO_TRS_916.pdf;jsessionid=A5C50BEAD4AC307C8EC04B4E0F12BEA9?sequence=1 pp. 34-38 [accessed: 24th October 2020]

Appendices:

1.0 Permission E-Mail



Dear parents/guardians,

I am a second-year student from St. Brogan's College Bandon and have been recently registered to compete in the PeXpo Competition 2021. My project is called 'CAN-TEENS Make Better Food Choices' and aims to investigate the current attitudes and nutritional knowledge of adolescents towards canteen meals, and whether a food traffic-light system is beneficial in making better choices.

We are therefore writing to you to invite your child to take part in the study with your consent. The key points we would like to emphasize are the following:

- The project will require the students to complete two surveys.
- Canteen meal purchases will be tracked anonymously on two occasions.
- The research will be conducted during school hours.
- Anonymity and confidentiality will be protected at all times.
- All information gathered will be stored securely and will be used only for the purpose of this project.

Students are under no obligation to participate in this study and they have a right to withdraw from participation at any time. If you are happy for your child to take part in this study, please respond to this e-mail with your name, your child's name and what year they are currently in.

Kind Regards,
Caoimhe Walsh

For Further Information Please E-Mail:

sbc19.caoimhe.walsh@sbc.ie

2.0 Survey Questions

CAN-TEENS Make Better Food Choices? Survey
BT/STE Project By Caoimhe Walsh

Hi Caoimhe, when you submit this form, the owner will be able to see your name and email address.

Required

1. Do you have a dietary need/preference? (e.g. vegan, lactose intolerant) *

Yes
 No

2. Do you eat meals from the school canteen? *

Yes - everyday
 Yes - sometimes
 No - never

3. If you answered no to the above question, why not? (if you answered yes, skip this question)

Enter your answer

4. Do you know which meals are the healthiest and which are the least healthy in regard to the school canteen? *

Yes
 No

5. Select which of the following you think is the healthiest? *

Chicken Fillet Roll
 Chicken Curry
 Beef Stew
 Savoury Minced Beef

6. Select which of the following you think is the second healthiest? *

Chicken Fillet Roll
 Chicken Curry
 Beef Stew
 Savoury Minced Beef

7. Select which of the following you think is the third healthiest? *

Chicken Fillet Roll
 Chicken Curry
 Beef Stew
 Savoury Minced Beef

8. Select which of the following you think is the least healthy? *

Chicken Fillet Roll
 Chicken Curry
 Beef Stew
 Savoury Minced Beef

9. Do you know how much fat, saturates, sugars and salt is the RDA for someone of your age on average? *

Yes
 No

10. How many grams of daily SUGAR do you think you think is recommended for someone of your age on average? *

10g
 25g
 40g
 55g

11. How many grams of daily SALT do you think is recommended for someone of your age on average? *

6g
 12g
 18g
 24g

12. How many grams of daily FAT do you think is recommended for someone of your age on average? *

30g-50g
 60g-80g
 80g-100g
 100g-120g

13. How many grams of daily SATURATES do you think is recommended for someone of your age on average? *

10g
 25g
 40g
 55g

14. On a scale of 1-5 how likely are you to choose A CHICKEN FILLET ROLL for your lunch? *

☆☆☆☆☆

15. On a scale of 1-5 how likely are you to choose SAVOURY MINCED BEEF for your lunch? *

☆☆☆☆☆

16. On a scale of 1-5 how likely are you to choose CHICKEN CURRY for your lunch? *

☆☆☆☆☆

17. On a scale of 1-5 how likely are you to choose BEEF STEW for your lunch? *

☆☆☆☆☆

18. Describe, as best you can, what you think a 'food traffic-light system' is *

Enter your answer

19. Do you have any suggestions for meals that you would like to have in the school canteen? *

Enter your answer

3.0 Chicken Fillet Wrap Recipe

Chicken Fillet Wrap

Here is my recipe for a healthier version of the 'Chicken Fillet Roll' that I wish to add to my school canteen in the future as a part of my future research for my 'BT Young Scientist 2021' project 'CAN-TEENS Make Better Food Choices?' I have found that this recipe makes a much healthier version of the current 'Chicken Fillet Roll' and that people believe that the taste has not been compromised.



Ingredients (Makes 4 Wraps):

4 Chicken Breast Fillets
125g Breadcrumbs
50g Plain Flour
3 Fresh Eggs
4 Wraps
Mixed Lettuce Leaves

Method:

- Preheat the oven to 190C/375F/Gas 5. Line two trays with greaseproof paper
- Place the breadcrumbs and plain flour on two separate plates. Place the eggs in a shallow bowl and beat well
- Cut the chicken into strips. Dip the strips into pieces into the plain flour, then in the beaten egg and finally coat in the breadcrumbs. Shake off the excess and lay the chicken goujons onto the lined trays.
- Bake in the oven for 30 minutes. Turn halfway
- Remove from the oven when completely cooked through and golden-brown all over.
- Serve in a wrap with lettuce leaves

