The Potential Role of Personalised Nutrition for Patients in Irish Public Hospitals

A Thesis Presented as Part Fulfilment for the Award of Master of Science in Food Business Management and Technology

By

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For Research Carried Out Under the Guidance of

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DECLARATION

I hereby certify that the material, which I now submit for assessment on the programme of study leading to the award of Master of Science in Food Business Management and Technology, is entirely my own work and has not been taken from the work of others save to the extent that such work has been cited and acknowledged within the text of my own work. No portion of work contained in this thesis has been submitted in support of an application for another degree or qualification to this or any other institution.

Signed: _____**Caoimhe Reid**_____ Date: ___**25Apr2022**_____

Caoimhe Reid

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ABSTRACT

This research project was conducted with the view to achieving three aims. These aims were to gain a better understanding of the public's perception of how important nutrition is to health, to obtain information on people's opinions of the Irish public health system, and to show that there is the potential to harness targeted nutrition to benefit hospital patients. A survey was conducted which collect pertinent information and opinions from 423 participants. The Pearson chi-square test of independence and the Kruskal-Wallis H test were used for statistical analysis of the data collected.

The majority of survey participants agreed that their diet impacts their physical and psychological health, with a more significant p-value obtained when comparing age categories against belief that food impacts psychological health (p-value of 0.001). When asked to rate the food received during a hospital stay in the past five years, 38.2% of respondents rated the food as being of fair quality whilst 40.6% of respondents rated the variety of food choice to be poor. The consensus amongst respondents (72.3%) was that there is room for improvement in public hospitals in Ireland, with 91.7% of people agreeing that diet individualisation would benefit hospital patients. This shows that there is the potential to better target nutrition to individual patients.

This study achieved its aims of better understanding the opinions of the public regarding nutrition, particularly regarding the situation in public hospitals in Ireland, and of showing that there is the potential to harness the power of food to benefit the individual patient.

List of Abbreviations

≥	Greater than or Equal to
<	Less Than
ANOVA	Analysis of Variance
BMI	Body Mass Index
BSc	Bachelor of Science
CYP450	Cytochrome P450
df	Degrees of Freedom
EPA	Environmental Protection Agency
FODMAP	Fermentable Oligosaccharides, Disaccharides, Monosaccharides and Polyol
H	Kruskal-Wallis H Test Value
HIQA	Health Information & Quality Authority
HSE	Health Service Executive
IBS	Irritable Bowel Syndrome
ICU	Intensive Care Unit
IHD	Ischaemic Heart Disease
LDL	Low Density Lipoprotein
N	Number of People
N/A	Not Applicable
P	P-Value
PCOS	Polycystic Ovary Syndrome
PEG	Percutaneous Endoscopic Gastrostomy
PN	Parenteral Nutrition
RCT	Randomised Control Trial
WHO	World Health Organisation
χ^2	Chi-Square Value

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Chapter 1

Introduction

1. INTRODUCTION

This research project answers the question as to whether personalised nutrition would be of benefit to patients in public hospitals within Ireland. The aims of this work were to gain an insight into the public's opinion of the importance of nutrition, their perception of the food service within public hospitals in Ireland and to show there is potential to harness targeted nutrition for the benefit hospital patients. The benefits in mind include quicker recovery, protection from malnutrition and better overall health during their stay and onwards after discharge. Public hospitals within Ireland were the focus of this research as this is the first line service for the majority of people in the country and therefore would likely have the most impact on the country's health. Information was also readily available to the public in the forms of audit reports and surveys which were conducted by the Health Service Executive (HSE), the Health Information and Quality Authority (HIQA) and the Department of Health. Private hospitals were outside the scope of this research as many operate independently of one another using different protocols, hence the information obtained could not be used for a like-for-like comparison. Being private businesses there would also be little information readily available to the public. The introduction will give an overview of the thesis aims, objectives, layout and literature explored as part of this research.

1.1. Thesis Outline

This thesis consists of:

- An introduction to the background of the research question
- An outline of the methodological approach to the research
- The results of the study
- A discussion of the results
- The conclusion drawn from the research and recommended work for the future

1.2. Thesis Structure

The introduction to the thesis will first discuss the basic nutritional requirements of the body, followed by an insight into some of the most popular diet trends being followed today, including those that are followed for medicinal purposes. The difference between the role of a dietician and a nutritionist is explained and the part played by a dietician in

a patient's care is explored. Next, the range of impacts that a poor diet can have on the body and mind is described as well as how the diet can be personalised to the individual. Finally, an overview is provided of the results of previous feedback surveys carried out in public hospitals within Ireland. Following on from the introduction, the methodology section outlines how the study was designed. As a survey was used to gather data for this research study, the methodology also outlines the criteria that was used to include and exclude survey participants, how it was distributed to potential respondents and the way in which the questionnaire was laid out. This section will also discuss methods used for analysis of the data. The results obtained from the survey are collated and displayed in the results section, with them being analysed and interpreted in the discussion section. Finally, concluding remarks are made regarding the outcome of the research study and areas of interest for future exploration are recommended.

1.3. Rationale for Conducting Research

Overcrowded Accident and Emergency departments, a lack of beds and extremely long waiting lists is the reality of the public health system in Ireland. The Covid-19 pandemic which hit Ireland in March 2020 exacerbated this issue and put more strain on the already struggling system. With very little known as to what methods were useful to prevent infection with this virus, or which medications could effectively clear the infection, people turned to food (Henchion, McCarthy and McCarthy, 2021), to boost their immune systems. This approach could have merit in relation to hospital patients. By bolstering their nutritional status it is possible that they will be better able to withstand treatment, have a shorter hospital stay and be set up for success when they are discharged and return home. Not only would this be a positive outcome for the patient and their family, it would also reduce the burden on the healthcare system and the Irish taxpayers. It must be remembered that not everyone can or should be treated the same way when it comes to diet. There is huge variety within the population in relation to preferences, allergies, religious requirements, eating abilities and medical conditions (Nelson, 2021), which should be a primary consideration when designing hospital menus.

The survey conducted as part of this research was performed to gain an understanding of people's attitudes towards and opinions of nutrition and how it relates to health, as well as the public hospital system in Ireland and whether they believe there is room for improvement. The research aims to prove that there is potential for nutrition to be

harnessed as a means for fighting sickness and maintaining health, and that it should be tailored to the needs of the individual.

1.4. Diet & Nutrition

The term, “Diet”, can often have negative connotations as it has long been associated with depriving the body of nice things with the goal of losing weight. During this project however, the term diet will be used in a emotionless way to refer to the type of food that a person routinely eats. The World Health Organisation (WHO) are amongst the many bodies to put forward dietary recommendations in the early 2000’s with the aim of preventing diet-related chronic diseases, advice which has prevailed to this day. Recommendations suggest dividing energy consumption via the three macronutrients in the range of 10 – 15% protein, 15 – 30% fat and 55 – 75% carbohydrate as shown in Figure 1.1 (World Health Organization., 2003). Trace amounts of a long list of micronutrients and vitamins are also needed to keep the body functioning at its best (Health Service Executive, 2021c). Whilst only small amounts of these substances are required, lack thereof can have serious consequences, as seen in the case of iron deficiency, which is leading cause of disease globally (Pasricha et al., 2021).

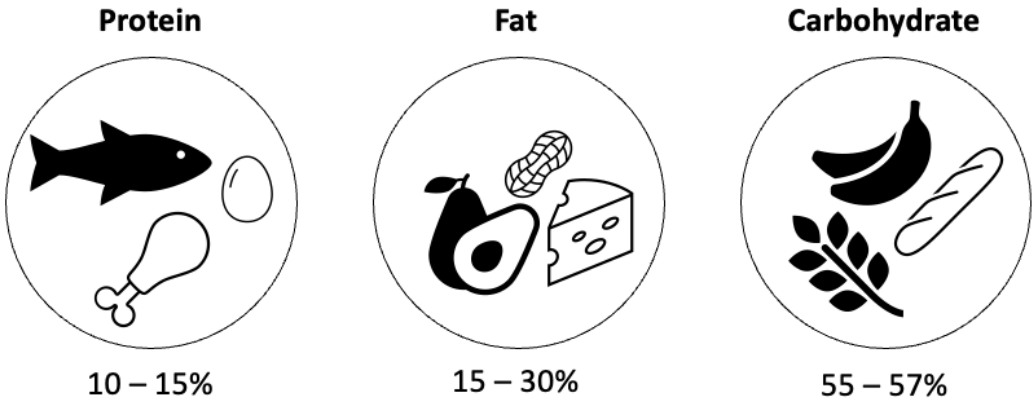


Figure 1.1: Recommended macronutrient consumption

Following the recommendations mentioned sounds like a simple task, however in 2017 it was discovered that 11 million people worldwide died from ailments associated with their diet (Afshin et al., 2019), whilst in Europe 2.8 million people die yearly from diet related disease (United Nations, 2022). Therefore it would appear that a shift is required to tip the scales back towards balance when it comes to eating habits, whether that is done at a governmental, familial or individual level.

1.4.1. Diet Trends

Dietary preferences vary depending on geography, culture, economic status, religion, social circles and numerous other factors. For centuries, religious dietary rules have steered food consumption for millions of people around the world. For example, many Hindus refrain from eating meat, fish and eggs as they believe all living beings are equal, and Jews only consume kosher food which means avoiding items such as pork and shellfish (Chouraqui et al., 2021). Muslims only consuming food that is Halal, meaning it is lawful according to the Quran, hence they abstain from eating meat or consuming alcohol. Religious holidays such as Lent and Ramadan in the Catholic and Muslim calendars require abstinence and fasting over certain periods of time, showing that there is huge variety throughout the world in the food people choose to consume.

Vegetarianism is the practice of not eating any type of meat or fish (Oxford Dictionary, 2022b). The origins of the vegetarian diet are deep routed from thousands of years ago. In 3200 before Christ (BC), the ancient Egyptians were said to abstain from meat to facilitate reincarnation (Touzeau et al., 2014), however some people call the 6th century BC Greek philosopher, Pythagoras, the Father of Ethical Vegetarianism (Leitzmann, 2014). According to Bord Bia an estimated 8% of the Irish adult population follows a vegetarian diet (Bord Bia, 2021). Another 2% of people go a step further to follow a vegan diet, which involves avoiding all animal related products in order to avoid any exploitation and cruelty (Oxford Dictionary, 2022a). Individuals follow these plant based diets for a plethora of reasons such as concern for animal welfare, to relieve pressure on the environment, for personal health reasons or for economic purposes, to name but a few (Rosenfeld and Burrow, 2017). In Ireland, 16% of people have chosen to be a flexitarian, a diet half-way between carnivore and omnivore in which the diner eats meat only on an occasional basis (Forestell, 2018; Bord Bia, 2021). Data published by Bord Bia Thinking house, outlined in Figure 1.2, shows that a higher percentage of vegans have chosen that lifestyle due to concern for animal welfare (75%) and the environment (60%), than either vegetarians (66%; 42%) or flexitarians (36%; 32%) (Bord Bia Thinking House, 2021).

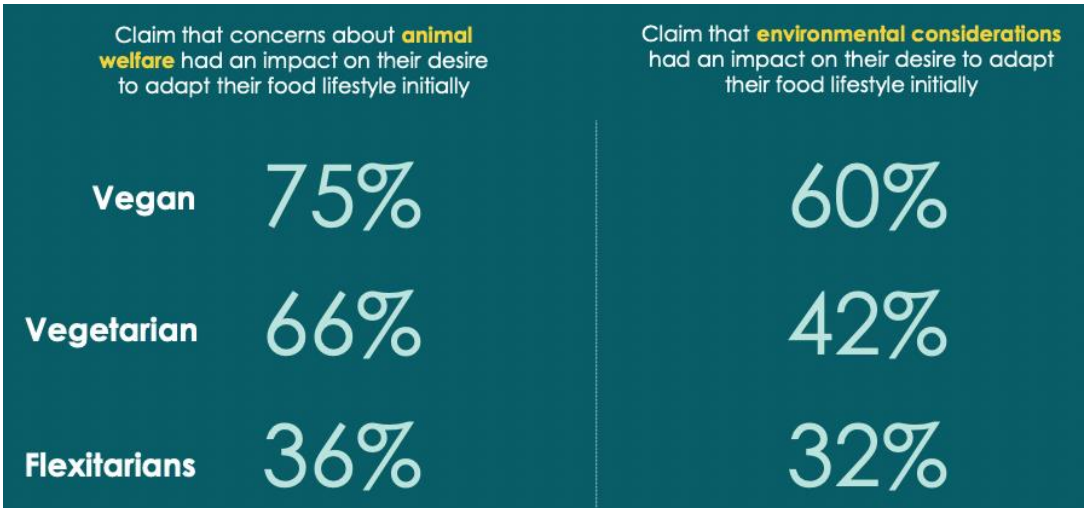


Figure 1.2: Motivation for following particular diets
(Taken from Bord Bia Thinking House, 2021)

1.4.2. Diets for Medical Conditions

Not everyone following a diet does so by choice. Some people have specific dietary conditions which require a strict dietary regime in order to keep well. Irritable bowel syndrome (IBS) is a group of conditions, including Chron's disease and ulcerative colitis, in which the intestine becomes inflamed. There is an estimated 40,000 people in Ireland living with IBS (Chron's & Colitis Ireland, 2020). Symptoms, which are usually episodic and very severe, include abdominal pain, erratic bowel habits and malabsorption of nutrients (Patel and Shackelford, 2021). Diet has been proven to be an exacerbating factor, particular those high in fermentable oligosaccharides, disaccharides, monosaccharides and polyol (FODMAP) (Singh et al., 2019), hence many people eliminate these types in order to avoid their condition flaring up.

Polycystic ovary syndrome (PCOS) is another condition which can be managed in part via the diet. The HSE estimates that one in five women of child bearing age are affected by the endocrine condition in which there is an over production of the sex hormones, androgens, resulting in the formation of multiple cysts on the ovaries (Shaaban et al., 2019; Health Service Executive, 2021b). Metabolic abnormalities such as insulin resistance has also been implicated in PCOS, linking in with diabetes. Diabetes is a condition in which the regulation of a person's blood sugar does not work correctly due to a lack of, or an unresponsiveness, to the hormone insulin, which facilitates the transport of glucose from the blood into the cells of the body (Sapra and Bhandari, 2022). Diet is a key factor in the management of diabetes as eating a balanced diet, little and often, can help to avoid any high or low spikes in blood sugar.

1.4.3. Roles of Dieticians and Nutritionists

Often the terms “dietician” and “nutritionist” are used interchangeably, however they are discrete roles performed by people with different educational backgrounds, as outlined in Figure 1.3. In Ireland a dietician is qualified to work with both healthy and ill people in healthcare facilities and private practice (Irish Nutrition and Dietetic Institute, 2021a). If trained in Ireland they will likely have received a Bachelor of Science (BSc) in Human Nutrition and Dietetics, often with further third level education. The HSE hires qualified dieticians only for the purpose of providing nutritional advice to patients. A trained nutritionist is a separate profession in which the person will likely have studied a BSc in Public Health Nutrition or an equivalent course. Nutritionists are skilled in the provision of information regarding food and healthy eating patterns. Frequently they work in public health, governmental and educational roles. There is no law or register regulating the nutritionist profession therefore it is possible for anyone to proclaim themselves as a nutritionist without having completed any training. In contrast, since 2005 all dieticians must be registered with CORU, the body responsible for regulating health and social care professionals (Government of Ireland, 2021).

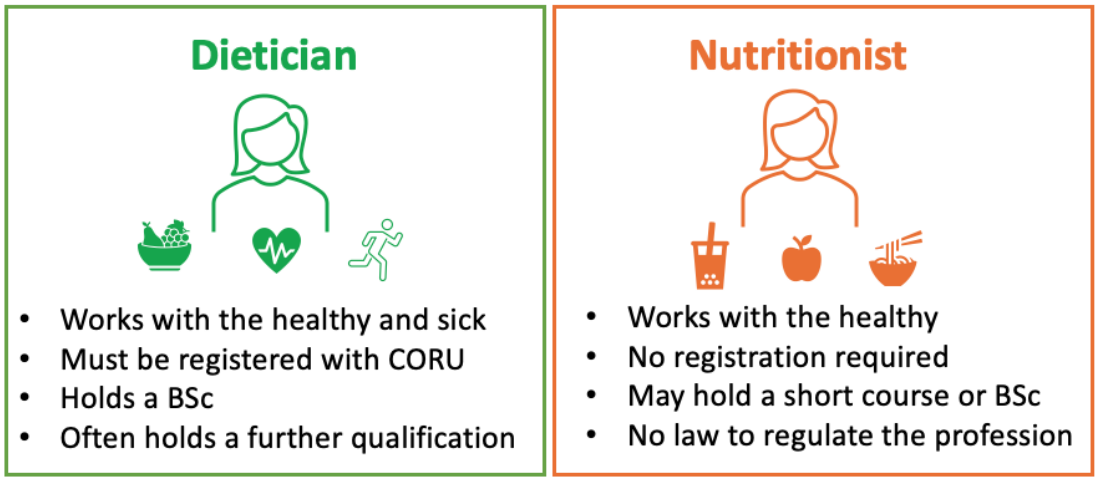


Figure 1.3: Differences between a dietician and nutritionist

1.4.4. Dietician Consultations

A hospital patient who is deemed in need of the nutritional support and education will be referred via a letter written by the medical team to a dietician. In the hospital setting the dietician is responsible for the nutritional care of their patients however they may also facilitate consultations on an out-patient basis (Health Service Executive, 2022). Dieticians work in concert with the patient's multi-disciplinary team to assess the patient, create a plan to improve future nutritional status and in extreme cases, organise urgent nutritional support intravenously or via a tube. A recommended diet plan could be thought of as a prescription from the doctor to purchase on-script medication, with the cashier at the supermarket playing the role of the pharmacist. Not only do they provide meal plans, they also educate patient so they have the skills to plan for their own future, particularly those managing diabetes, hypercholesterolemia, gastrointestinal disorders and cancer (Irish Nutrition and Dietetic Institute, 2021b). Whilst it is an excellent free service to make use of, the waiting lists for an appointment to see a dietician are extremely long. As of April 2022, the number of adults waiting for consultations stands at 1,923 for diabetes mellitus, 16,396 for gastro-enterology and 33,816 for cardiology specialties (The National Treatment Purchase Fund, 2022). Whilst only a subsection of these people may require the help of a dietician, it is clear that the system is saturated with patients resulting in long waiting lists to obtain an appointment.

1.4.5. Physical Impact of Poor Diet

Food consumed has a direct impact on human health and wellbeing. It supplies energy for basal metabolic processes as well as thought, speech, movement and growth. Energy requirement levels increase throughout childhood until the age of 20, where energy demand plateaus, until the age of 60 after which time requirements decrease (Pontzer et al., 2021). This decreased energy demand can be attributed to a decline in physical activity and tissue specific metabolism, as well as an increased percentage body fat which occurs naturally with age (Macek et al., 2020). The amount of energy provided by food consumption and expended by movement along with the other processes mentioned should be finely balanced in order to maintain a healthy

individual, as represented by Figure 1.4 (a). An imbalance in energy in either direction can cause overnutrition (b) or undernutrition (c), both of which pose their own issues.

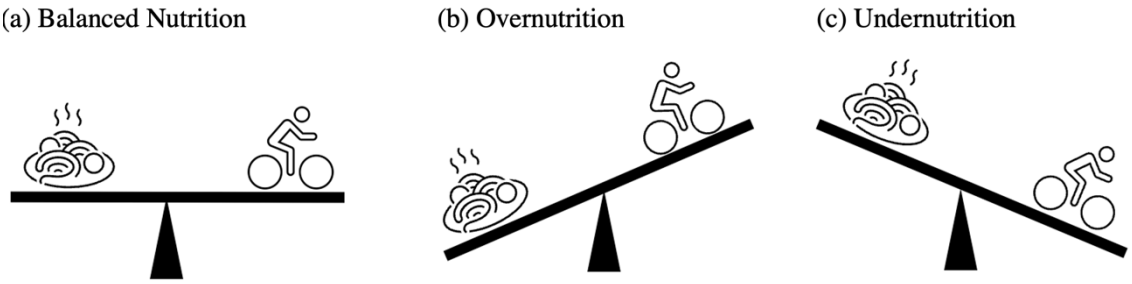


Figure 1.4: Balance between energy consumed and expended

Not only does being under- or overweight cause health issues, but so does an imbalance in the amount of nutrients consumed. Although dietary carbohydrates, fatty acids and cholesterol play essential roles in the human body such as providing energy, being a components of cell wall and acting as a hormone precursor respectively, their presence in excess is undesirable. Low density lipoproteins (LDL) are cholesterol rich lipoproteins who's physiological function is to provide cholesterol to peripheral tissue. However, LDLs are implicated in the deposition of plaque which leads to atherosclerosis in a person's arteries (Ference et al., 2017). A poor diet has been proven to affect blood pressure, causing hypertension which can be relieved by loss of weight, increase in fibre consumption and a reduction in the intake of sodium chloride and alcohol (Appel, 2017). Dai *et al*. conducted a study using data obtained in the 2017 Global Burden of Disease study in order to approximate the amount of ischaemic heart disease (IHD) deaths that could be attributed to modifiable risk factors (Dai et al., 2022). Figure 1.5 graphically represents the data obtained in the study regarding potentially modifiable risk factors associated with deaths attributed to IHD. Age, sex and genetics are non-modifiable risk factors, however the authors identified eleven risk factors that could be modified in order to prevent morbidity and mortality from IHD. In both females and males, dietary risk was the number one modifiable cause (68.1% and 69.7%), followed closely by high systolic blood pressure (55.5% and 53.1%) and high LDL cholesterol (43.0% and 40.5%).

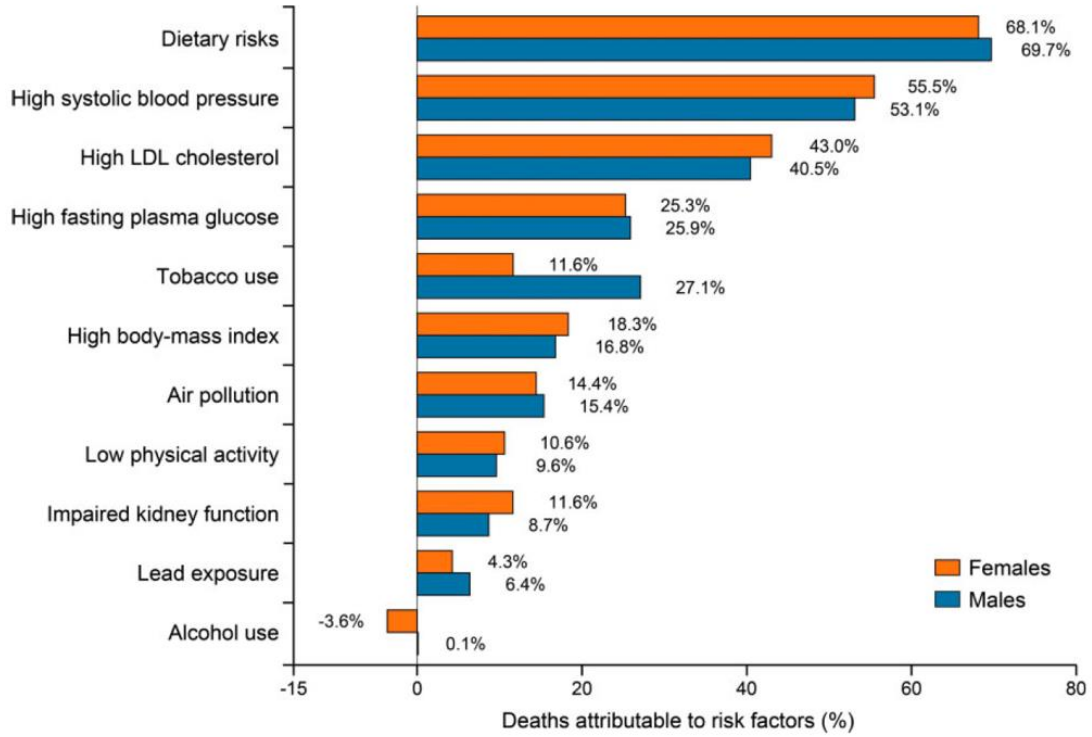


Figure 1.5: Percent of Deaths Attributed to Modifiable Risk Factors
(Taken from Dai et al., 2022)

The quantity and type of food consumed by an individual can lead to weight gain, potentially resulting in an obesity classification if a body mass index (BMI) score of ≥30 kg/m^2 is calculated. In 2020, Schnurr *et al.* published data to show that an obese person is eight times more likely to develop type II diabetes than their counterpart in the normal weight category, who lives a similar lifestyle and with genetic risk patterns (Schnurr et al., 2020).

1.4.6. Psychological Impact of Poor Diet

Food is the body's main source of energy, therefore the quality of the fuel provided has a profound impact on all aspects of health (Elizabeth et al., 2020). It helps to determine how you look and feel physically but plenty of evidence is available to show that food plays a role in mood and mental health. A Greek study showed that diets high in sugar and saturated fats exacerbated anxiety in older individuals (Masana et al., 2019), whilst a Dutch study showed that diets high in non-refined grains and vegetables were associated with lower levels of depression and anxiety (Gibson-Smith et al., 2020).

There are more than 100 trillion microbes in the human gut. This large population, referred to as the microbiome, consists of bacteria, viruses, archaea, eukaryotes and fungi, which participate in a symbiotic relationship with the host (Malard et al., 2021). Mainly consisting of anaerobic bacteria, the microbiome plays a role in the digestion of food, absorption of nutrients and maintenance of intestinal health via the production of short chain fatty acids (Grochowska, Wojnar and Radkowski, 2018). Diversity of microbes plays a role in prevention of disease (Manor et al., 2020) and has even been shown to influence personality traits (Kim et al., 2018). The diversity of bacterial species in the gut is determined by numerous factors including the person's method of delivery at birth, whether they were breastfed, their diet as they grow up, medication intake and environmental hygiene Figure 1.6.

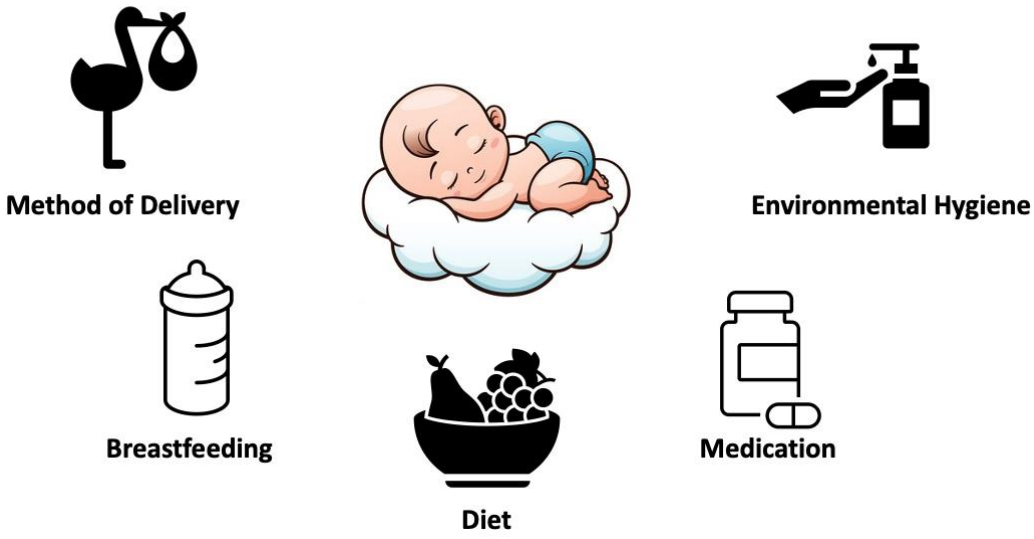


Figure 1.6: Factors Influencing the microbiome

Balance between bacterial species is important for gut homeostasis, but it can be tipped off kilter with a radical change in diet or when spoiled food is eaten. The bad bacteria are able to outgrow the commensal bacteria resulting in the secretion of toxins and increased recruitment of immune cells (Huang, 2021). These cells secrete signally proteins called cytokines, which promote inflammation of the gut and loss of tight junctions between epithelial cells (Calarge, Devaraj and Shulman, 2019). This results in a leaky gut allowing commensal bacteria to migrate into the blood. Whilst they are harmless in the gut, their presence in the blood stream is a warning sign for the body, which activates a signalling cascade to recruit immune cells to fight the infection (Pont et al., 2020). Gut endothelial cells are capable of secreting various neurotransmitters and hormones which communicate to the brain via the hypothalamic-pituitary-adrenal

axis and the vagus nerve (Cryan et al., 2019). These communication channels support the idea that diet influences the gut, which in turn sends signals to the brain, which will determine a person's mental state (Wilmes et al., 2021).

1.5. Personalised Nutrition

As with many skills and habits, dietary practices are learned as a child from what is taught by a person's elders and by mimicking those around them (Ragelienė and Grønhøj, 2020). As such, people often eat similarly to their tribe out of tradition, convenience or requirement. However, nuisances exist such as preferences, allergies and portions required, that set people apart as individuals. Everyone personalises their own meals even if they do not realise it, by adding seasoning and condiments to suit their liking. But it is possible to target specific diets towards particular cohorts of people, with the aim of improving their all-round health.

1.5.1. Personalisation by Genome and Proteome

Genomic and proteomic heterogeneity is the reason that everyone in the world does not look exactly the same. If the world's population looks different on the outside, it stands to reason that they are different on the inside. Cytochrome P450 (CYP450) is a family of enzymes produced predominantly in the liver and the gut, which are involved in the breakdown and metabolism of steroids, fatty acids and exogenous substances such as drugs (Manikandan and Nagini, 2017). Variations exist in specific CYP450 enzymes that allow for faster or slower metabolism of specific compounds, for example variations in CYP1A2 dictate the rate at which individuals are able to metabolise caffeine (Faber, Jetter and Fuhr, 2005). Studies performed in mouse models have shown that enzymatic variation in the CYP450 enzyme family can enhance the progression of fatty liver disease, highlighting the link between chronic disease and genetic variation (Liu et al., 2017). Pharmacogenetic testing is routinely carried out in the clinical setting to assess the impact of CYP450 enzymatic variation on drug metabolism to determine medication dosage (Forster, Duis and Butler, 2021), therefore the same method could be applied to diet recommendations.

1.5.2. Personalisation by Microbiome

As previously discussed in Section 1.4.6, the diet and environment has an extensive impact on the microbiome. Diversity of microbial species within the microbiome can

protect against certain infections and diseases. An Israeli group of researchers conducted an 11 week research study using mice, which was able to prove that glucose intolerance induced by artificial sweeteners could be protected against by certain microbial characteristics of the microbiome (Suez et al., 2014). Microbial species present in the microbiome can be tested for by obtaining a stool sample on which to perform deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) testing, and by culturing the sample using petri dishes and specific growth conditions which can help to better direct the investigation (Allaband et al., 2019). Caution is still urged to use multiple tests in combination with one another to increase test specificity and sensitivity, and whilst these methods aid in the collection of information, much work has yet to be down to determine the best way to interpret and apply it for nutritional advice.

1.6. Sickness and Nutrition

Loss of appetite along with fatigue and muscle aches are common symptoms suffered during an infection. Immune cells at the site of infection generate pro-inflammatory proteins called cytokines, which act as signals to an abundance of areas within the body in order to coordinate a response to the infection. Whilst aiding in the fight against infection, the cytokines and the cascade that they initiate result in the generation of the symptoms of sickness (Paulsen et al., 2017). A persistent lack of appetite causes muscle atrophy, and in cases of wasting due to chronic disease related malnutrition, will progress to extreme wasting known as cachexia (Cederholm et al., 2017).

1.6.1. Nutritional Support in Critically Ill Patients

The generation of an immune response is metabolically expensive, hence the lack of appetite could be considered counterproductive (Hosomi and Kunisawa, 2020). However, the phenomenon of appetite suppression is seen across a vast range of animal species, suggesting that it is an evolutionary trait that has been conserved as a survival advantage (de Voe, 2014; Povey et al., 2014). A number of randomised control trials (RCTs) that investigated early nutritional support in critically ill patients showed no benefit was observed (Allingstrup et al., 2017). Figure 1.7 shows results from two other RCTs which concluded that delaying the administration of parenteral nutrition (PN) by one week in the intensive care unit (ICU) resulted in a shorter duration of mechanical ventilation and an earlier discharge from hospital in both adults and children (Casaer

et al., 2011; Fivez et al., 2016).

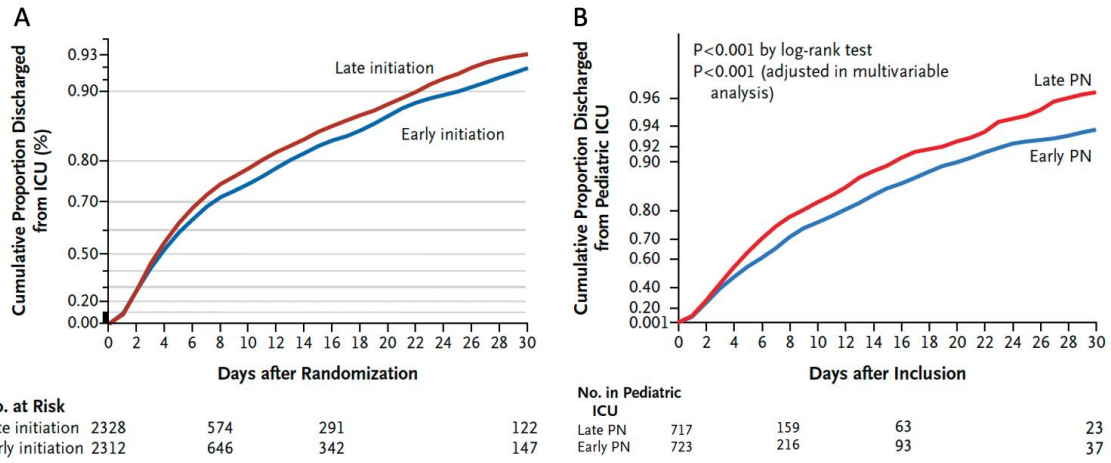


Figure 1.7: The cumulative proportion of adults (A) and children (B) discharged from ICU categorised by early and late PN feeding
(Adapted from Casaer et al. and 2011; Fivez et al., 2016)

The mechanism behind this is suggested to be autophagy related. Autophagy is the body's way of removing dangerous or unwanted material in a controlled manner, without initiating an unnecessary immune response. By holding off on parenteral feeding, this allows time for critically ill patients to fight the infection and remove infected cells and debris by autophagy (Russell, Yuan and Guan, 2014), followed by nutritional support at a later time. However, more research is required in order to fully understand the underlying mechanism.

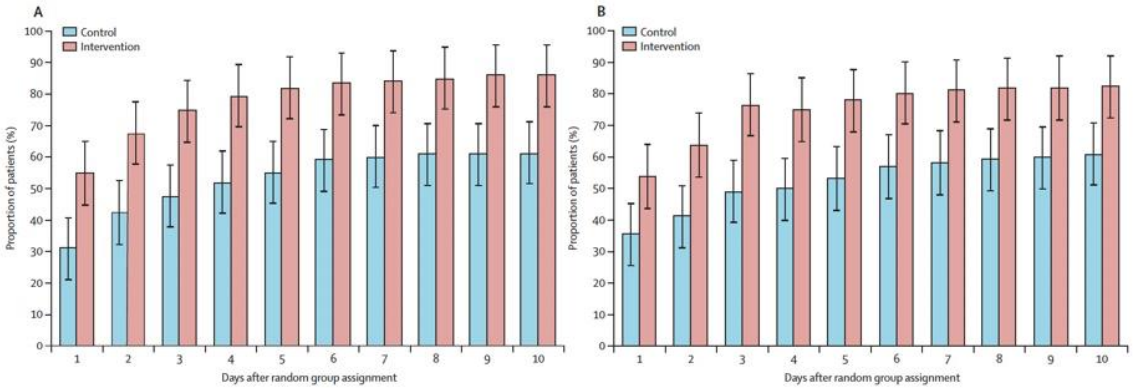
1.6.2. Nutritional Support in Mildly Ill Patients

A RCT was conducted by Scheutz *et al.* in eight Swiss hospitals to investigate the impact of individualised nutritional support for mildly ill inpatients, as opposed to those who are critically ill, who are at risk of malnutrition (Schuetz et al., 2019). Patients in the study were randomly divided in to two groups. The control group (1013 people) was fed the normal hospital food diet, whilst the intervention group (1015 people) had an individualised nutrition plan developed for them by a registered dietician. The tailored diet plan took patient preferences into account, involved fortification of food with additional nutrients and supplied snacks in between meals. Figure 1.8 represents the proportion of patients reaching caloric and protein requirements over a ten day period in the control and the intervention groups. Patients in the intervention group reached their caloric and protein goals in 79% and 76% of cases respectively, which is

markedly higher than the 54% and 55% of participants reaching their caloric and protein goals in the control group.

Figure 1.8: The proportion of patients reaching caloric (A) and protein (B) requirements during the initial 10 days after random assignment into groups
(Adapted from Schuetz et al., 2019)

Although no significant difference was observed in the length of hospital stay between



the two groups, patients following a personalised nutrition plan had a lower risk of all-cause mortality within 30 days of treatment. The Barthel Index is used to measure ability to perform activities of daily life and was applied to this study. The intervention group had a score of 88 in comparison to 85 in the control group, which was significantly higher (p-value = 0.006), indicating better ability to perform tasks associated with daily living for the intervention group. This research suggests that individualisation of nutrition plans are of benefit to mildly sick inpatients during a hospital stay. However, the adverse effects seen in immediate nutritional support for critically ill patients demonstrated by Casaer *et al.* and Fivez *at al* as discussed above, would suggest that patient status and timing should be considered by healthcare professionals when planning patient care (Casaer et al., 2011; Fivez et al., 2016).

1.7. Nutritional Situation in Irish Public Hospitals

Of the 86 hospitals within Ireland (Statista, 2021), 48 of them are public hospitals run by the HSE, whilst the remaining 38 are run privately or voluntarily (IBIS World, 2021). There are six hospital groups into which each of the public hospitals in Ireland can be divided as represented by Figure 1.9. Information regarding the nutritional situation in the majority of these public infirmaries has been obtained by conducting surveys and inspections. The National Inpatient Experience Survey was open to feedback from those over the age of 16 who spent more than 24 hours in one of 40 acute public hospitals around the country (The National Inpatient Experience Survey, 2019). HIQA conducted a study comprising a self-questionnaire for 42 public acute hospitals, with 13 hospitals being subject to an unannounced follow-up inspection (Health Information and Quality Authority, 2016).

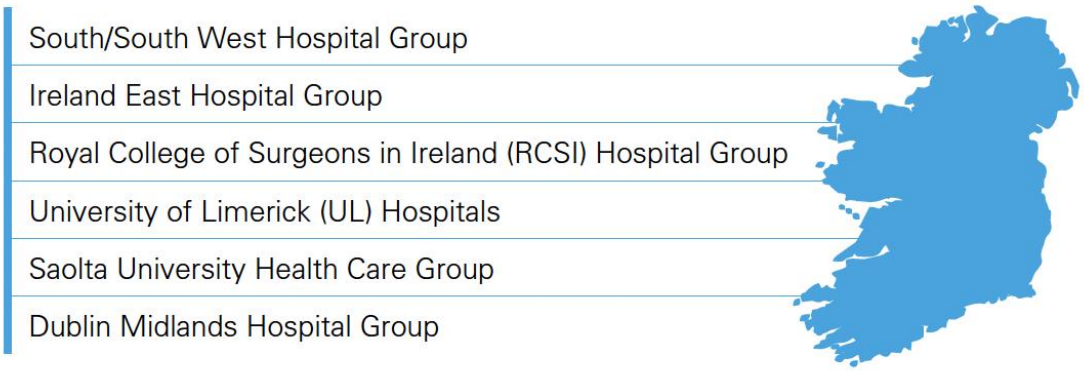


Figure 1.9: Six Irish Public Hospital Groups
(Taken from The National Inpatient Experience Survey, 2019)

A secondary analysis of a randomised control trial performed by Griffin *et al.* concluded that every third person over the age of 65 presenting to a public hospital in Ireland is classed as being malnourished, or at a high risk of becoming malnourished (Griffin et al., 2020). Another significant finding for the analysis was that despite their BMI classifying them as being obese (BMI $\geq$ 30 kg/m^2), 13% of those in the trial were found to be at risk for malnutrition. This serves as a reminder that malnutrition can manifest in forms other than low BMI, including an inadequate supply of micronutrients and the overconsumption of food (World Health Organisation, 2021). A diagnosis of malnourishment can have negative consequences on patient well-being, increasing morbidity and mortality (Volkert et al., 2019). Malnourishment is more prevalent in those who are already vulnerable such as oncology patients (Gebremedhin et al., 2021), geriatrics, those suffering with gastrointestinal issues or undergoing surgery

(Kamperidis et al., 2020). The probability of a malnourished individual attending a healthcare facility again within 30 days of originally being discharged is 30 times that of a well-nourished person (Griffin et al., 2020).

1.7.1. Patient Screening Programme

In 2009 the Department of Health and Children mandated that everyone admitted to hospital should be screened within 24 hours in order to assess their risk of malnutrition (Department of Health and Children, 2009). In reality, the HIQA study published in 2016 documented that half of the hospitals surveyed had implemented a protocol for screening in more than 75% of their wards and 9 of the 21 hospitals had no procedure in place at all (Health Information and Quality Authority, 2016) (Table 1.1).

Percentage of hospital wards	Number of hospitals
0% of wards	9
1–25% of wards	8
26–50% of wards	3
51–75% of wards	1
76–100% of wards	21

Table 1.1: The Proportion of Malnutrition Screening in Irish Public Hospitals
(Taken from Health Information and Quality Authority, 2016)

There are a variety of validated screening tools recommended for use in a healthcare setting such as the Malnutrition Universal Screening Tool or the Mini Nutritional Assessment-Short Form which is a condensed and more rapid alternative for use in the older population (Oifig Náisiúnta um Shábháilteacht Othar, 2020). These questionnaires are comprised of a number of steps involving anthropometric measurements and speaking to the patient regarding their eating habits and any unintended weight loss. The results will produce an overall score which will instruct the healthcare professional performing the test as to whether the person is well nourished, in need of monitoring or if they require immediate action (British Association for Parenteral and Enteral Nutrition, 2011).

The HIQA study involved an unannounced inspection of 13 of the surveyed hospitals. The auditors observed that the process and consistency of screening across and within institutions varied widely (Health Information and Quality Authority, 2016). 4 hospitals had zero to minimal screening in place, whilst the remaining 9 screened between 25% to 82% of those admitted, as outlined in Table 1.2. Whilst screening in some hospitals was quite high, patient records showed that only 39% assessments were performed within 24 hours of admission. When inspectors inquired as to why the risk assessment was not being carried out, staff revealed that nutrition and hydration were not deemed to be a priority and patients being identified as vulnerable to malnutrition would place an additional burden on the already stretched dietetics service.

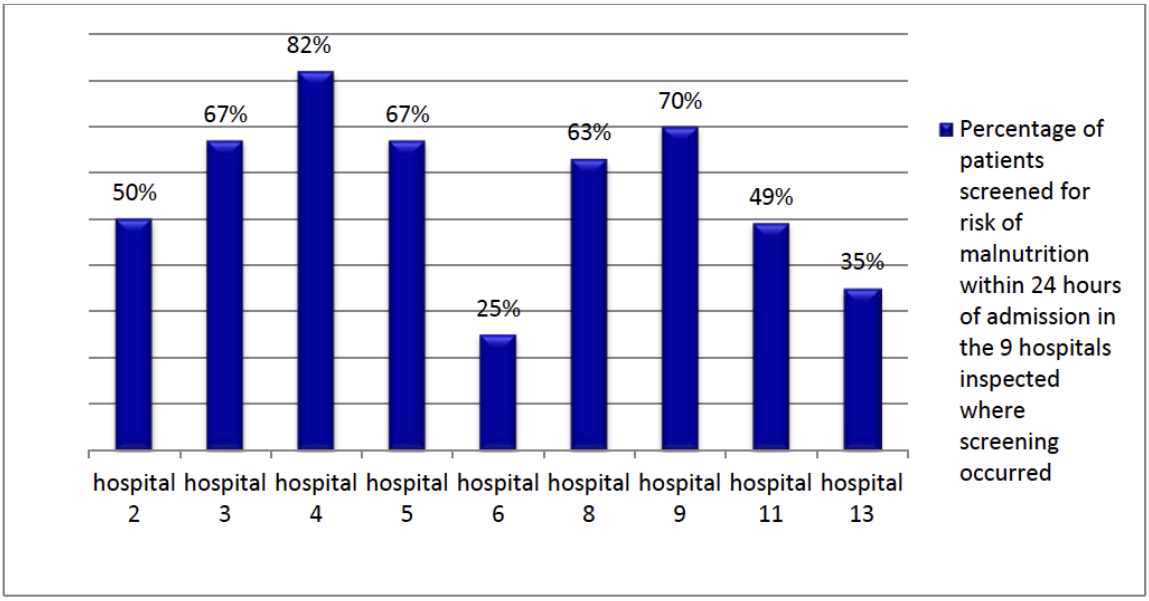


Table 1.2: The Breakdown of Patients Screened for Malnutrition in the nine Hospitals Inspected by HIQA that Performed Screening
(Taken from Health Information and Quality Authority, 2016)

The survey and inspection highlights the fact that the nutritional status of patients are not being assessed and monitored as is recommended. Protocols are not in place in the majority of hospitals and where they are implemented, they are not being carried out by all staff members, or in a timely manner. It is clear also that many healthcare workers are not convinced that nutrition and hydration support would be of benefit to their patients and hence they do not engage with the screening process. It would be a worthwhile exercise for management to educate staff on the ways in which nutrition can benefit patients in the long run as if they understand the reason behind a procedure, they are more likely to support it. They could also involve staff in the brainstorm

process to discuss the best way to implement successful nutrition screening, as research shows that employees who feel involved in the decision making process are more likely to engage with their work and report higher job satisfaction (Landry, 2020). Employee buy-in and support from management would be crucial to ensuring the success of this initiative. There was also a belief that increased screening would result in an increased number of patients being identified as needing a referral to a dietician, putting increased strain on a system which would not have the resources to meet the demand (Health Information and Quality Authority, 2016).

1.7.2. The Food Service

A variety of food preparation methods were used across the acute public hospitals that were surveyed by HIQA, with 33 of the 42 hospitals reporting that their food was cooked fresh in their own kitchens and served immediately whilst 3 outsourced the meals to an external company. 16 institutions cooked and chilled the food, whilst 3 reported cooking and freezing the food until required at meal times. 1 hospital served convenience foods to sustain their patients and in some cases a combination of cooking methods were used, as depicted in Table 1.3 (Health Information and Quality Authority, 2016).

Food production systems used	Number of hospitals*
Cook-fresh	33
Cook-freeze	3
Cook-chill	16
Convenience foods	1

*Nine hospitals reported using two food production systems, while one hospital said it used three systems.

Table 1.3: Methods Used for the Preparation of Food in the 42 Hospitals as Part of the HIQA Study
(Taken from Health Information and Quality Authority, 2016)

Each hospital served three meals per day at a variety of times. Patient feedback noted that breakfast being served from 7:15am – 8:30am was too early in the day and they would prefer a later meal time (Health Information and Quality Authority, 2016). The main meal was served between 11:30am – 1:00pm with an afternoon supper distributed between 4:00pm – 5:30pm. This meant that 90% of the hospitals were in breach of the

Department of Health and Children's guidelines of at least four hours between meals (Department of Health and Children, 2009), with some extreme cases leaving only 2 hours and 30 minutes between feeding times. The knock on effect of this short interval meant that many patients were not hungry enough to eat their next meal, but were then subjected to a 16 hour overnight fast with the exception of a small snack.

The Green Healthcare programme, funded by the Environmental Protection Agency (EPA) in conjunction with the HSE , was implemented in 2009 to identify potential areas for improvement regarding waste and sustainability within the Irish healthcare system (Green Healthcare, 2020b). Studies conducted by the Green Healthcare Programme revealed that on average, 0.73kg of food waste is generated per bed each day, costing €2.50 when taking into account purchase cost, storage, preparation and disposal (Green Healthcare, 2020a). Over a one year period this amounts to 3,600 tonnes of food waste, costing the healthcare system €7.2 million ((a), Figure 1.10). Only 51% of the food prepared in these institutions is actually consumed by the patient with 22% of the waste arising from plate waste and the remaining 27% stemming from food that was unserved never reaching the patient at all, as seen in part (b) of Figure 1.10 (Green Healthcare, 2020b).

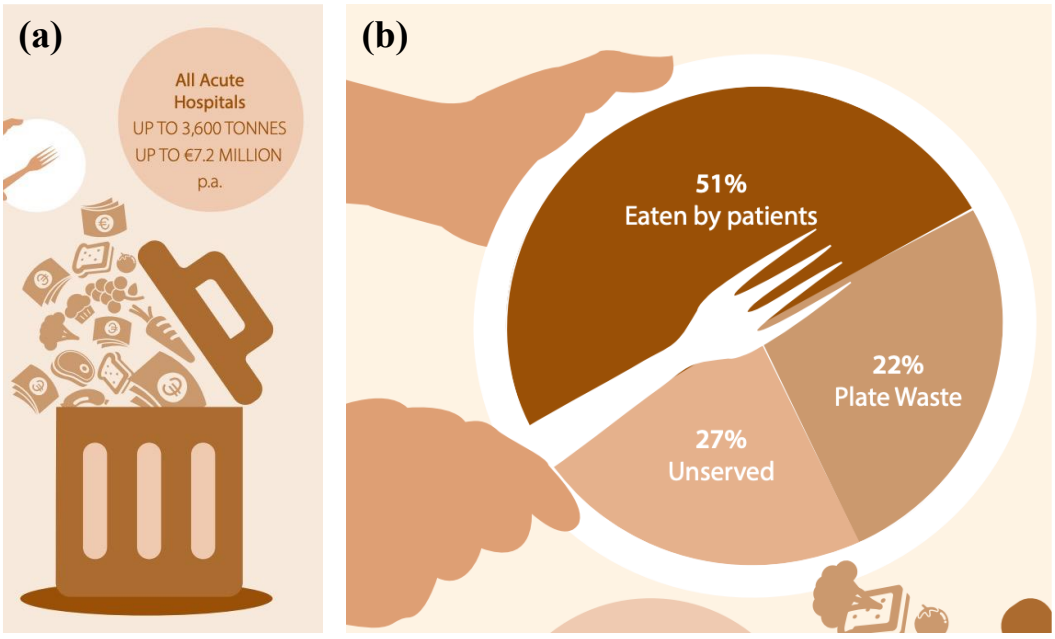


Figure 1.10: Yearly Food Waste in Irish Acute Public Hospitals
(a) Weight and value of waste. (b) Breakdown of food by destination
(Adapted from Green Healthcare, 2020)

By adjusting the meal times and intervals between each, the likelihood of patients being hungry is increased. This would result in increased nutrient intake for the patient setting

them on a successful trajectory, whilst also reducing the amount of waste generated to save energy and money.

1.7.3. Satisfaction Surveys

The results of the National Inpatient Survey showed that 3,214 of the 12,343 people who completed the questionnaire (28%) rated the food served to them as poor or fair (The National Inpatient Experience Survey, 2019). The overall rating calculated was 6.6 out of 10 (Figure 1.11), which was the lowest rating recorded for the "Care on the Ward" section, representing an opportunity for improvement in the future. Replacement meals were offered in 6.8 out of 10 cases where a patient missed a meal leaving room for improvement for the 3.2 cases where patients went unfed. One respondent commented as to being offered a salad after undergoing tests as it was all that was available, and was not given any other option.

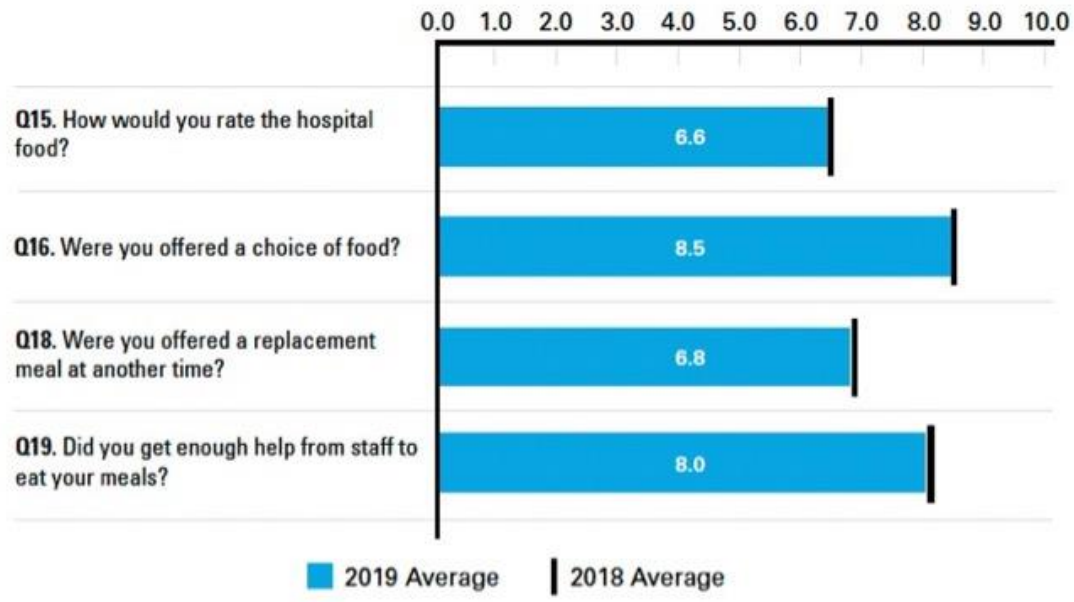


Figure 1.11: Feedback from Patients Surveyed Regarding Meals
(Adapted from The National Inpatient Experience Survey, 2019)

Regarding the ability to select a meal from the menu, a high score of 8.5 out of 10 was obtained however this also highlights the fact that 1,851 respondents were not given any option at all, and had to eat what was given to them. This may be acceptable in certain situation where the diner is not a picky eater but it would certainly be an issue for someone with specific food preferences, allergies or requirements. These people may have been forced to skip their meals putting them at a disadvantage when it comes

to maintaining body composition and a healthy nutritional standing. Some additional survey feedback is displayed in Figure 1.12.

Figure 1.12: Feedback from the National Inpatient Survey
(Taken from The National Inpatient Experience Survey, 2019)

Chapter 2

Methodology

2. METHODOLOGY

The aim of this thesis is to explore the potential role of personalised nutrition within public hospitals in Ireland. This section details the methods used to design and distribute a survey to collect data regarding people's attitudes and opinions of various questions and statements related to the thesis aim. It also outlines what methods were used to organise and interpret the data obtained from the survey.

2.1. Study Design

A combination of quota sampling and snowball sampling was used to obtain data. According to worldpopulationreview.com at the time of access (20Jan2022), the population of Ireland was 5,009,499, with people over the age of 18 accounting for 3,763,440 (World Population Review, 2022). Using a 95% confidence interval and 5% margin of error, the survey was calculated to need a sample size of 385 in order to give power to the study. This was calculated using equation (1) (Yamane, 1967).

$$\boldsymbol{Sample\ Size} = \frac{\boldsymbol{Z\ Score^2\ x\ Standard\ Deviation\ x\ (1 - Standard\ Deviation)}}{\boldsymbol{Margin\ of\ Error^2}} \qquad (1)$$

The study sample size calculation is represented by equation (2).

Where:

Z Score = 1.96 (95% Confidence Interval)

Standard Deviation = 0.5

Margin of Error = 0.05 (or 5%)

$$\frac{(1.96^2\ x\ 0.5\ x\ (1-0.5))}{0.05^2} \qquad (2)$$

$$\frac{0.9604}{0.0025}$$

$$Sample\ Size = 385$$

The survey was divided into six separate sections consisting of 18 questions altogether. Table 2.1 gives an overview of the number of sections in the survey, the topics covered and the number of question in each section. The Participant Information Sheet (Appendix A), Participant Consent Question (Appendix B) and Survey Questions (Appendix C) are available in the Appendices section.

Section	Topics Covered	No. of Questions
Participant Information	• Information on the study, the researcher and supervisor, data handling procedures and approximate completion time was provided to the participant. • Contact details of the researcher and project supervisor were provided in the event that the participant would like more information, or access to a copy of the participant information or the ethics approval letter.	N/A[1]
Participant Consent	• Statement confirming the participant is at least 18 years of age, has read and understood the information provided and is taking part in the study voluntarily.	1[2]
1	• Age • Food-Health Link • Dietary Requirements • Personalised Diet	7[3]
2	• Hospital Meals Consumed in Previous 5 Years	3[3]
3	• Importance of Food Served in Hospital • Opinion of Potential Improvements for Patient Nutrition in Irish Public Healthcare • Opinion of Diet Individualisation • Factors Hindering Meal Personalisation for Patients	6[3]
4	• Additional Comments or Feedback	1[3]

Table 2.1: Survey Layout Overview

[1] Refer to Appendix A
[2] Refer to Appendix B
[3] Refer to Appendix C

The survey was created using a combination of literature regarding validated questionnaires (Tsang, Royse and Terkawi, 2017; Aithal and Aithal, 2020), the author's own theoretical knowledge and feedback from the project supervisor. The questions were designed to gain an understanding of the public's beliefs regarding the association of food and health, past hospital meal experiences where applicable, opinion whether the heath service could be improved and if so, ideas for how. The questions were asked in such a way that would allow data obtained to be analysed and conclusions to be drawn in relation to the research question.

Although the survey consisted of 18 questions, some questions branched depending on the answer to the previous question, hence not all respondents will have completed every question. Some questions had multiple parts to them such as a choice to what extent the participants agreed with several statements. Other questions were requests for the respondent to elaborate on a previous answer although doing so was optional.

2.2. Survey Requirements

The survey was opt-in and required the respondent to read the research project information and confirm that they agreed to the criteria as stated. If they did not confirm to give consent they were brought to the "Thank You" page were not allowed to proceed in order to complete the survey. There was no requirement to have ever been in hospital in order to complete the questionnaire, as opinions and perceptions are valuable information to be obtained.

2.3. Survey Distribution

The survey was created using Microsoft Forms and was publicised via LinkedIn, Facebook and Instagram. Connections, friends and followers respectively were encouraged to share the survey amongst their own connections without sending the access link to anyone directly, in order to increase the number of responses via snowball sampling.

2.4. Inclusion Criteria

Anyone aged 18 years or older from the general population was welcome to participate in this study. Fully completed questionnaires by people of any gender, nationality and socioeconomic background were considered valid and included in the data interpretation. Age was the only information collected about the participants therefore

people from various demographics were included in the study, once aged 18 or older. There was no requirement to have spent time in hospital in order to take part in the survey. Participants had the option to skip questions referring to hospital food feedback in the case that this was not applicable to them. Their opinions on personalised nutrition and its potential benefits were valid and welcomed in order to get a sense of the public's perceptions on this topic.

This inclusion criteria was selected due to the fact that attitudes and opinions of the public are of interest to the researchers, as much as past experiences in hospital settings. Therefore having spent time in hospital and consuming a meal was not a pre-requisite for participating in the survey.

2.5. Exclusion Criteria

Anyone less than 18 years of age was excluded from taking part in this study. As per Appendix B – Participant Consent, respondents who would not agree to having read the participant information sheet (Appendix A) and confirm they were taking part in the survey voluntarily were excluded. Also, those who were unwilling to allow their data be shared with the researcher and project supervisor were excluded from the study. Regarding the questions pertaining to having spent time in an Irish public hospital and consuming a meal, participants were asked to only include experiences within the last 5 years. Experiences more than 5 years ago were excluded as they may no longer be representative of the current landscape within the public health system.

2.6. Statistical Analysis

The method of statistical analysis was chosen based on the appropriateness of the data for the test. The data obtained from the questionnaire was of ordinal and nominal levels of measurement and was not assumed to fit a normal distribution (Grant, James and Li, 2021). Therefore the use of non-parametric tests was most suitable. Chi-square test of independence was chosen for the analysis of data containing two variables of the nominal level of measurement. Kruskal-Wallis H test was used for the analysis of ordinal data obtained by Likert-style questions as part of the survey, due to the fact that much of the data was skewed and contained zeros which would be in violation of assumption 6 of the chi-square test (Section 2.6.1).

Additional tests were investigated and deemed unsuitable for interpretation of the data set for various reasons. The Fisher's Exact T Test is most appropriate for 2x2 contingency tables which would have been unsuitable as a larger matrix is required for this study. Rows and columns are also assumed to be fixed rather than the random distribution used as part of the chi-square test (Ludbrook, 2008). The Mann-Whitney U test is suitable for analysing one independent variable with two levels (Hart, 2001), whereas the Kruskal-Wallis H test would be more suitable for interpreting independent variables of three or more levels which is required for this study (Hoffman, 2019).

2.6.1. Pearson Chi-Square Test for Independence

The Pearson chi-square test for independence (χ^2) was used to compare the distribution of nominal data obtained in one group with the distribution of nominal data in another, to determine whether the variables were independent from one another. The advantages and disadvantages of using this test were evaluated in relation to various others, as mentioned in the previous paragraph, and the Pearson chi-squared test was deemed to be most suitable for analysis of this data. Certain assumptions had to be satisfied to ensure that the test was suitable for interpretation of the data set. These assumptions are as follows (Kim, 2017):

1. The data used are counts or frequencies rather than percentages.
2. The two sets of data used are mutually exclusive.
3. Each subject contributes only on unit of data to the test.
4. The sample groups are independent of one another.
5. Two variable are used, both of the ordinal or nominal levels of measurement.
6. The expected value of cells should be ≥5 in at least 80% of cells, with no cells having an expected value of <1.

Degrees of freedom (df) for the chi-square test for independence were defined as (rows – 1) × (columns – 1). The level of statistical significance was set at $P < 0.05$ (where P is P-value, *N* is number of people). Statistical analyses were completed in SAS's JMP (version 16.2.0). Some of the data obtained as part of this study were in violation of assumption 6, particularly those obtained as part of the Likert style questions. For this reason it was decided that the Kruskal-Wallis H test would be more suitable for the analysis and interpretation of questions required the respondent to rank their answers (Hoffman, 2019). However, the chi-square test was still appropriate for the categorical style questions and was therefore used as a method of analysis for these questions.

2.6.2. Kruskal-Wallis H Test

Kruskal-Wallis H test, also referred to as the on-way ANOVA (analysis of variance) on ranks, is a rank-based nonparametric test which was used to determine if there was a statistically significant relationship present in the data obtained by the Likert style survey questions. As an extension of the Mann-Whitney U test, the Kruskal-Wallis H test has the ability to compare independent variables with three or more levels (Kruskal and Wallis, 1952). The letter H is used to represent the value obtained from this test. The data characteristics must meet the following four assumptions for the test to be valid (McDonald, 2014):

1. The two variables are of the ordinal or continuous levels of measurement.
2. The independent variables consist of two or more categorical groups that are independent from one another.
3. The sample groups are independent of one another.
4. All groups have the same shape distribution.

P values < 0.05 were deemed statistically significant. IBM's SPSS (version 26) was used for this statistical analysis.

2.6.3. Descriptive Statistics

Descriptive statistics was used to outline the measure of frequency of the data, the mode which is the answer which appears most frequently and the proportion of certain group's answers in comparison to one another. Graphs created using Microsoft Excel (Version 16.60) were used for the analysis of this data.

2.7. Validity Rules

Survey responses were deemed valid if the respondent selected, "Yes", to Question 1, Appendix B – Participant Consent. Of the 18 survey questions, 11 were compulsory to answer. Four of the optional answers were free-text boxes for the respondents to add

additional information if they so wished. The remaining three questions were branches of compulsory questions which meant that the requirement for respondents to complete them was based off their response to the previous questions. Question 14 asked participants to select three of eight options. The choices of anyone who selected more than three options will be branded as invalid as they were in breach of the question parameters, and subsequently disregarded. The answers of individuals who selected less than three options will be included in the data analysis due to the fact that they may have only found merit in one or two of the possibilities outlined.

Chapter 3

Results

3. RESULTS

A survey consisting of 18 questions was launched on 18 February 2022 and accepted responses for 30 days, closing on 20 March 2022. In that time, 424 responses were recorded. A summary table outlining the statistical tests used to analyse specific results is outlined in Appendix D.

3.1. Participant Consent

The answer to Question 1 on the survey (Appendix B – Participant Consent) confirmed whether the respondent was allowed to continue to answer the survey to completion. The question asked respondents to confirm that they are aged 18 or above, that they have read the project information and are taking part in the survey voluntarily, and that they agree to their information being shared with the researcher and project supervisor. All "No" responses were directed straight to a "Thank you" page and did not allow the person to continue to answer questions. Table 3.1 outlines the responses.

Answer to Question 1 Participant Consent	Number of Responses
Yes	423
No	1

Table 3.1: Confirmation of Participant Consent

One "No" response was recorded. This person would not have been allowed to progress on to the question section. Hence, all of the information displayed in the remainder of this section come from the 423 valid responses obtained.

3.2. Survey Section 1 – Fundamental Information and Opinions

Section 1 of the survey asked respondents to provide a variety of information regarding their age, opinions on the connection between food and health, dietary requirements and past experiences, if any, of personalised diet plans (Appendix C – Survey Questions).

3.2.1. Respondent Age Stratification

Respondents were asked to select the age category that applied to them from the following options; 18 – 30, 31 – 45, 46 – 60 and 61+ (Appendix C, Question 2). Table 3.2 represents the breakdown of ages amongst those who answered the questionnaire. The largest cohort represented was the 18 – 30 age category at 40% (168 people), followed by 29% in the 46 – 60 age group (125 people), 19% in the 31 – 45 category (79 people), with the minority of people (51) representing those aged 61 and older.

Age Category	No. of Responses	% of Total
18 – 30	168	40
31 – 45	79	19
46 – 60	125	29
61+	51	12
Total	423	

Table 3.2: Age Categories of Survey Respondents

Figure 3.1 is a graphical representation of the spread of responses across the four age categories.

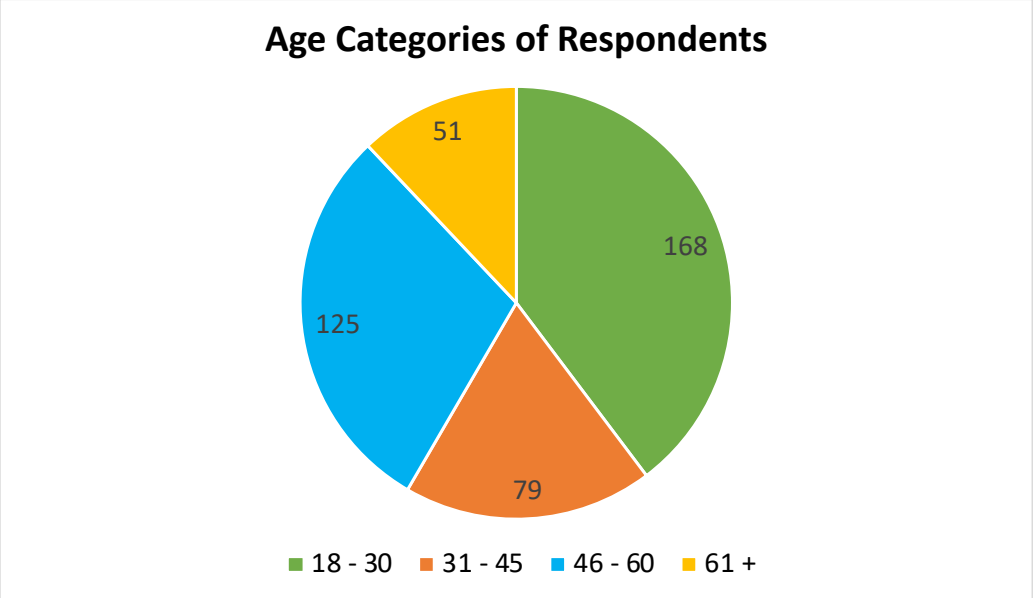


Figure 3.1: Age Categories of Respondents
This figure shows the distribution of respondents across four age categories, with the majority of those surveyed (39%) falling into the 18 – 30 bracket.

3.2.2. Opinions on the Relationship Between Food and Health

Respondents were given a series of phrases to which they had to select whether they strongly agreed, agreed, felt neutrally, disagreed or strongly disagreed with the (Question 3, Appendix C). Comparison of responses to various statements are analysed below. In addition, the Pearson chi-square analysis of independence was performed on each statement to assess the relationship between the replies and each age category. These results are outlined in Table 3.7.

The responses obtained to the phrase, "I believe there is a link between food and health" are displayed in Table 3.3 and Figure 3.2. When comparing the breakdown of responses by age categories, the Kruskal-Wallis H test was used as the data would have been in breach of assumption 6 of the chi-square test of independence (Section 2.6.1). The Kruskal-Wallis returned a p-value of 0.525 which was greater than the alpha value of 0.05. The "Strongly Agree" category was selected 351 times which made it the most popular response in every age category, and hence the overall most popular selection (83.0%). The 46 – 60 age group was the most supportive of this answer with 88.8% (111 of 125) respondents selecting it.

I Believe there is a Link Between Food and Health						
Age Group	**Measure**	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
18 – 30	Count	142	23	1	0	2
	% of Total	*33.6*	*5.4*	*0.2*	*0.0*	*0.5*
	% of Age	84.5	13.7	0.6	0.0	1.2
31 – 45	Count	66	9	0	0	4
	% of Total	*15.6*	*2.1*	*0.0*	*0.0*	*0.9*
	% of Age	83.5	11.4	0.0	0.0	5.1
46 – 60	Count	111	14	0	0	0
	% of Total	*26.2*	*3.3*	*0.0*	*0.0*	*0.0*
	% of Age	88.8	11.2	0.0	0.0	0.0
61+	Count	32	18	0	0	1
	% of Total	*7.6*	*4.3*	*0.0*	*0.0*	*0.2*
	% of Age	62.7	35.3	0.0	0.0	0.0
Total	Count	351	64	1	0	7
	% Total	*83.0*	*15.1*	*0.2*	*0.0*	*1.7*

Table 3.3: Those who believe there is a link between food and health

The 61+ age category was the least supportive of this answer at 62.7% (32 of 55). "Agree" was the next most popular selection with 64 responses (15.1% of the voting population). One person felt neutrally about the statement (0.2% of the population) whilst no one disagreed. Seven people of the 423 respondents strongly disagreed with the statement comprising 1.7% of those surveyed, four of which were aged 31 – 45.

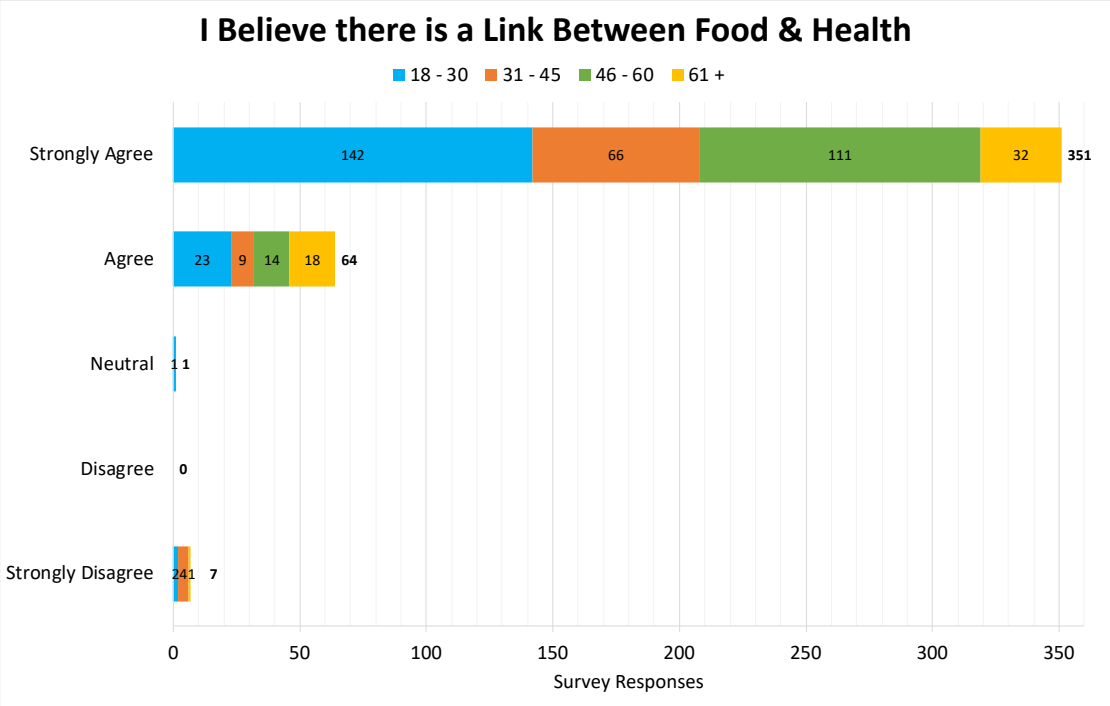


Figure 3.2: Opinions on the link between food and health

3.2.3. Impact of Food on Physical and Psychological Health by Age

The next two statements regarded the extent to which respondents agreed that food impacts their physical (Table 3.4) and psychological (Table 3.5) wellbeing. Their responses are displayed graphically in and Figure 3.3. The Kruskal-Wallis H test was performed on this data. Responses for "Strongly Agree" and "Agree" were grouped together and named "(Strongly) Agree". The same was done with the responses that disagreed but neutral responses were unaltered. Grouping was done for stronger analysis and to ensure the analysis fully captures the concept being assessed (Rickards, Magee and Artino, 2012). P-values of 0.819 and 0.001 were obtained when assessing whether age group and opinion of food impacting physical and psychological health were statistically significant respectively (Table 3.7).

			The Food I Eat Impacts the way I Feel Physically				
	Age Group	**Measure**	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Age Group	**18 – 30**	Count	93	67	5	0	3
		% of Total	*22.0*	*15.8*	*1.2*	*0.0*	*0.7*
		% of Age	55.4	39.9	3.0	0.0	1.8
	31 – 45	Count	52	24	2	0	1
		% of Total	*12.3*	*5.7*	*0.5*	*0.0*	*0.2*
		% of Age	65.8	30.4	2.5	0.0	1.3
	46 – 60	Count	67	52	2	0	4
		% of Total	*15.8*	*12.3*	*0.5*	*0.0*	*0.9*
		% of Age	53.6	41.6	1.6	0.0	3.2
	61+	Count	21	29	1	0	0
		% of Total	*5.0*	*6.9*	*0.2*	*0.0*	*0.0*
		% of Age	41.2	56.9	2.0	0.0	0.0
	Total	Count	233	172	10	0	8
		% Total	*55.1*	*40.7*	*2.3*	*0.0*	*1.9*

Table 3.4: Opinions of food impacting physical health

In both cases, the majority of participants opted to strongly agreed with the statements, "The food I eat impacts the way I feel physically" and "psychologically", at a rate of 55.1% (233 people) and 44.7% (189 people) respectively. Overall, 95.7% of people (405 of 423) either strongly agreed or agreed with the food they eat impacting their physical health. Ten people (2.3%) had a neutral opinion, no one disagreed and eight people (1.9%) of respondents disagreed strongly with their diet impacting their physical health. Of those ten people, three were 18 – 30 years of age, one was 31 – 45, four were 46 – 60. Proportionally, the 31 – 45 year old age group were most in favour of this statement as 65.8% (52 people) strongly agreed with it, although they only contributed 12.3% of the total number of people that selected this, due to the fact that they were the second smallest age cohort. In the case of diet affecting psychological wellbeing, 376 people (88.9%) strongly agreed or agreed, whilst 36 people (8.5 %) had a neutral opinion of this statement, and 11 people (2.6%) (strongly) disagreed. The four people who strongly disagreed were evenly divided between the 18 – 30 and the 31 – 45 group constituting 1.2% and 2.5% of their respective age brackets.

The Food I Eat Impacts the way I Feel Psychologically						
Age Group	**Measure**	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
18 – 30	Count	79	76	8	3	2
	% of Total	*18.7*	*18.0*	*1.9*	*0.7*	*0.5*
	% of Age	47.0	45.2	4.8	1.8	1.2
31 – 45	Count	42	29	6	0	2
	% of Total	*9.9*	*6.9*	*1.4*	*0.0*	*0.5*
	% of Age	53.2	36.7	7.6	0.0	2.5
46 – 60	Count	54	59	10	2	0
	% of Total	*12.8*	*13.9*	*2.4*	*0.5*	*0.0*
	% of Age	43.2	47.2	8.0	1.6	0.0
61+	Count	14	23	12	2	0
	% of Total	*3.3*	*5.4*	*2.8*	*0.5*	*0.0*
	% of Age	27.5	45.1	23.5	3.9	0.0
Total	Count	189	187	36	7	4
	%	*44.7*	*44.2*	*8.5*	*1.7*	*0.9*

Table 3.5: The Food I Eat Impacts the Way I Feel Psychologically

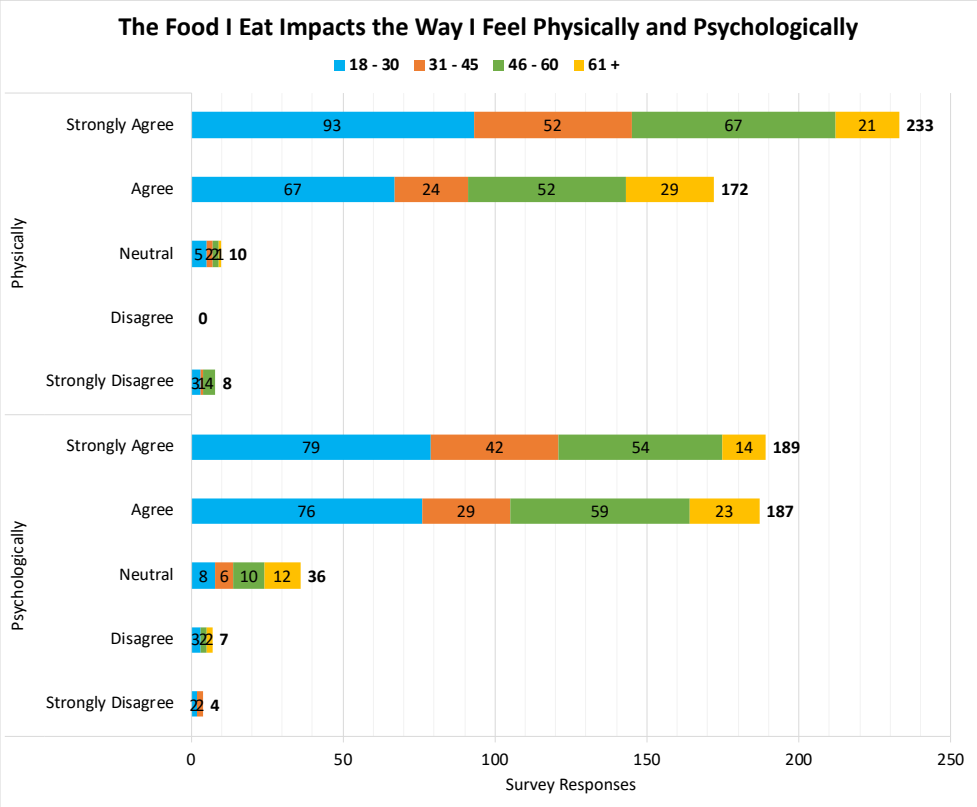


Figure 3.3: The impact of food on physical and psychological health

3.2.4. Comparison of Opinions - Physical and Psychological Impacts

The relationship between people opinions regarding food and physical versus mental health was assessed. The contingency table in Table 3.6 displays the count and percentage of opinions of one statement in relation to the other. The majority of respondents (363; 85.8%) selected the positive response to both statements. In contrast, only one person constituting 0.2% of the population surveyed felt negatively towards both statements. The Kruskal-Wallis p-value was 0.028.

		The Food I Eat has an Impact on How I Feel Physically			
The Food I Eat has an Impact on How I Feel Psychologically	**Count** ***Total %***	**(Strongly) Agree**	**Neutral**	**(Strongly) Disagree**	**Total**
	(Strongly) Agree	363 *85.8*	6 *1.4*	7 *1.7*	376 *88.9*
	Neutral	33 *7.8*	3 *0.7*	0 *0.0*	36 *8.5*
	(Strongly) Disagree	9 *2.1*	1 *0.2*	1 *0.2*	11 *2.6**
	Total	405 *95.7*	10 *2.4**	8 *1.9*	423
	H	N = 423, df = 2, H = 7.174, p = 0.028			

*Value is 0.1% higher than the sum of its parts due to rounding

Table 3.6: Relationship between opinions regarding the impact of food on physical and psychological wellbeing

	Age Group								[1] χ^2 (df)	H(df)	p
	18 – 30		31 – 45		46 – 60		61+				
	N	*%*	*N*	*%*	*N*	*%*	*N*	*%*			
I believe there is a link between food and health										1.289 (2)	0.525
(Strongly) Agree	165	39.0	75	17.7	125	29.6	50	11.8			
Neutral	1	0.2	0	0.0	0	0.0	0	0.0			
(Strongly) Disagree	2	0.5	4	1.0	0	0.0	1	0.2			
I would be happy to eat the same diet as everyone else									5.020 (6)		0.541
(Strongly) Agree	24	5.7	8	1.9	14	3.3	5	1.2			
Neutral	29	6.9	15	3.6	20	4.7	4	1.0			
(Strongly) Disagree	115	27.2	56	13.2	91	21.5	42	9.9			
The food I eat has an impact on how I feel physically										0.929 (3)	0.819
(Strongly) Agree	160	37.8	76	18.0	119	28.1	50	11.8			
Neutral	5	1.2	2	0.5	2	0.5	1	0.2			
(Strongly) Disagree	3	0.7	1	0.2	4	1.0	0	0.0			

[1] χ^2 = chi-square value, **df** = degrees of freedom, **H** = Kruskal-Wallis value, **p** = p-value

	Age Group								[1] χ^2 (df)	H(df)	p
	18 – 30		31 – 45		46 – 60		61+				
	N	*%*	*N*	*%*	*N*	*%*	*N*	*%*			
The food I eat has an impact on how I feel psychologically										15.428 (3)	.001
(Strongly) Agree	155	36.6	71	16.8	113	26.7	37	8.8			
Neutral	8	1.9	6	1.4	10	2.4	12	2.8			
(Strongly) Disagree	5	1.2	2	0.5	2	0.5	2	0.5			
I modify my diet when I am sick										0.293 (3)	0.961
(Strongly) Agree	146	34.5	68	16.1	109	25.8	43	10.2			
Neutral	16	3.8	8	1.9	12	2.8	6	1.4			
(Strongly) Disagree	6	1.4	3	0.7	4	1.0	2	0.5			
A food plan made specifically for me would be the same as one made for someone living down the road										1.372 (2)	0.712
(Strongly) Agree	8	1.9	4	1.0	3	0.7	4	1.0			
Neutral	153	36.2	68	16.1	111	26.2	45	10.6			
(Strongly) Disagree	7	1.7	7	1.65	11	2.6	2	0.5			

Table 3.7: Statistical analysis of responses obtained to survey question 3 analysed by age category

[1] χ^2 = chi-square value, **df** = degrees of freedom, **H** = Kruskal-Wallis value, **p** = p-value, ***N*** = Number of people

3.2.5. Diet Modification During Illness

Another statement associated with Question 3 of the survey (Appendix C) was regarding the modification of the diet during illness, or when feeling unwell. Table 3.8 and Figure 3.4 display the participant's attitude towards this statement. When testing the relationship between age and statement opinion, a Kruskal-Wallis H test p-value of 0.961 was obtained which is greater than the alpha value of 0.05 (Table 3.7).

I Modify my Diet When I am (Feeling) Sick						
Age Categories	**Measure**	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
18 – 30	Count	42	104	16	6	0.0
	% of Total	*9.9*	*24.6*	*3.8*	*1.4*	*0.0*
	% of Age	25.0	61.9	9.5	3.6	0.0
31 – 45	Count	22	46	8	3	0
	% of Total	*5.2*	*10.9*	*1.9*	*0.7*	*0.0*
	% of Age	27.8	58.2	10.1	3.8	0.0
46 – 60	Count	50	59	12	4	0
	% of Total	*11.8*	*13.9*	*2.8*	*0.9*	*0.0*
	% of Age	40.0	47.2	9.6	3.2	0.0
61+	Count	16	27	6	2	0
	% of Total	*3.8*	*6.4*	*1.4*	*0.5*	*0.0*
	% of Age	31.4	52.9	11.8	3.9	0.0
Total	Count	130	236	42	15	0
	% Total	*30.7*	*55.8*	*9.9*	*3.5*	*0.0*

Table 3.8: Response to the statement "I modify my diet when I am (feeling) sick"

Overall there was a positive response with 86.5% (366 people) strongly agreeing or agreeing that they do indeed change their eating pattern when under the weather. The 46 – 60 year old age group was most in favour of this with 87.2% (109 of 125 people) of those in the category voting positively. Overall 3.5% (15 people) replied "Disagree", whilst no-one selected "Strongly Disagree". Neutrality accounted for 9.9% (42) of the 423 replies. The Kruskal-Wallis H test was performed to test whether there was any

statistical significance between age group and opinions of diet modification during illness. and age cohort, producing a p-value of 0.967.

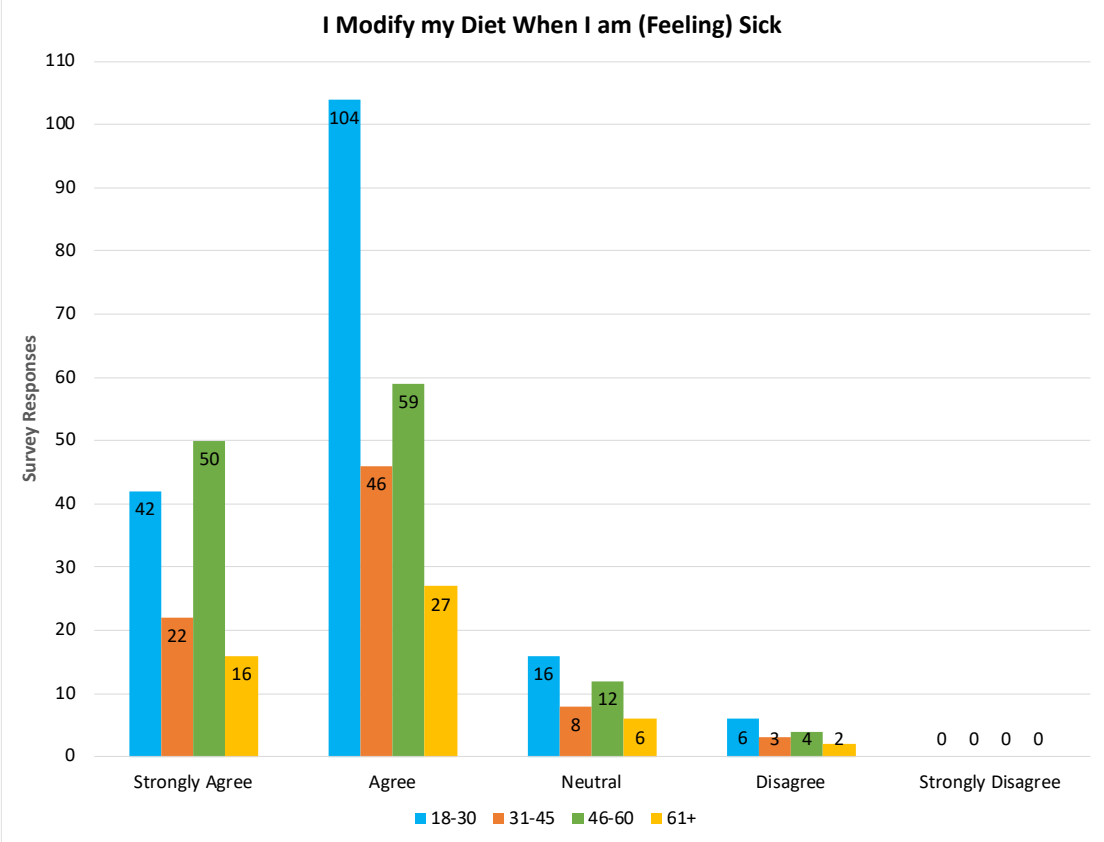


Figure 3.4: Opinions of diet modification during illness

3.2.6. Individualisation of Food Plans

The final two statements in Question 3 which participants had to react to was regarding whether they would be happy to eat the exact same diet as someone else, and if they thought a food plan made for them would be the same as for somebody else. Responses were stratified by age category and can be visualised in Figure 3.5. Chi-square analysis was performed to discover if there was a relationship between age categories and the statement regarding consumption of the same diet as the rest of the population, producing a p-value of 0.541. The Kruskal-Wallis H test was used to assess age and the phrase, “A food plan made specifically for me would be the same as one made for someone living down the road”, produced a p-value of 0.0.712 (Table 3.7). The majority of respondents had a negative reaction to both statements, in that they disagreed or strongly disagreed with each.

	Age Group	Measure	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
A Food Plan for me Would be the Same as for Others	**18 – 30**	Count	1	7	7	74	79
		% of Total	*0.2*	*1.7*	*1.7*	*17.5*	*18.7*
		% of Age	0.6	4.2	4.2	44.0	47.0
	31 – 45	Count	2	2	7	37	31
		% of Total	*0.5*	*0.5*	*1.7*	*8.7*	*7.3*
		% of Age	2.5	2.5	8.9	46.8	39.2
	46 – 60	Count	1	2	11	48	63
		% of Total	*0.2*	*0.5*	*2.6*	*11.3*	*14.9*
		% of Age	0.8	1.6	8.8	38.4	50.4
	61+	Count	1	3	2	23	22
		% of Total	*0.2*	*0.7*	*0.5*	*5.4*	*5.2*
		% of Age	2.0	5.9	3.9	45.1	43.1
	Total	Count	5	14	27	182	195
		% Total	*1.2**	*3.3***	*6.4***	*43.0**	*46.1*

*Value is 0.1% higher than the sum of its parts due to rounding
**Value is 0.1% lower than the sum of its parts due to rounding

Table 3.9: Opinions of diet plan individuality and similarity

Of the 423 people who registered their opinion, 182 (43.0%) disagreed that a food plan made for them would be the same as for someone else, whilst 195 people (46.1%) feel even more strongly against this phrase (Table 3.9). However 19 people (4.5%) agreed or strongly agreed that a food plan made to suit their specific needs would in fact be the same as for a stranger. Over half (50.4%) of those in the 46 – 60 age group strongly disagreed with the phrase, making them the most opposed cohort, however the data was spread across all age groups and all responses with each receiving at least one vote, showing a wide range of opinions.

Table 3.10 displays the results obtained regarding the statement, “I would be happy to eat the same diet as everyone else”. Eight people are absolutely certain that they would be content to eat the same diet as everyone else (1.9%), whilst 43 others (10.2%) are quite certain.

	Age Group	Measure	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I am Happy to Eat the Same Diet as Others	**18 – 30**	Count	4	20	29	75	40
		% of Total	*0.9*	*4.7*	*6.9*	*17.7*	*9.5*
		% of Age	2.4	11.9	17.3	44.6	23.8
	31 – 45	Count	2	6	15	38	18
		% of Total	*0.5*	*1.4*	*3.5*	*9.0*	*4.3*
		% of Age	2.5	7.6	19.0	48.1	22.8
	46 – 60	Count	2	12	20	53	38
		% of Total	*0.5*	*2.8*	*4.7*	*12.5*	*9.0*
		% of Age	1.6	9.6	16.0	42.4	30.4
	61+	Count	0	5	4	29	13
		% of Total	*0.0*	*1.2*	*0.9*	*6.9*	*3.1*
		% of Age	0.0	9.8	7.8	56.9	25.5
	Total	Count	8	43	68	195	109
		% Total	*1.9*	*10.2*	*16.1*	*46.1*	*25.8*

Table 3.10: Happiness of participants to eat the same diet as everyone else

Feeling neutrally about the individuality of their diet, 68 people which is 16.1% of the population, have no preference either way. Just shy of half of those surveyed, 46.1% (195 people) of the population, would disagree that they would be happy to eat the same food as everyone else, whilst 25.8 % (109 people) strongly disagreed with the statement. The respondents aged 61 years or older were the most opposed to the idea with 82.4% (42) of the cohort disagreeing or strongly disagreeing that they could eat their meals to match the rest of the population, with no one strongly agreeing.

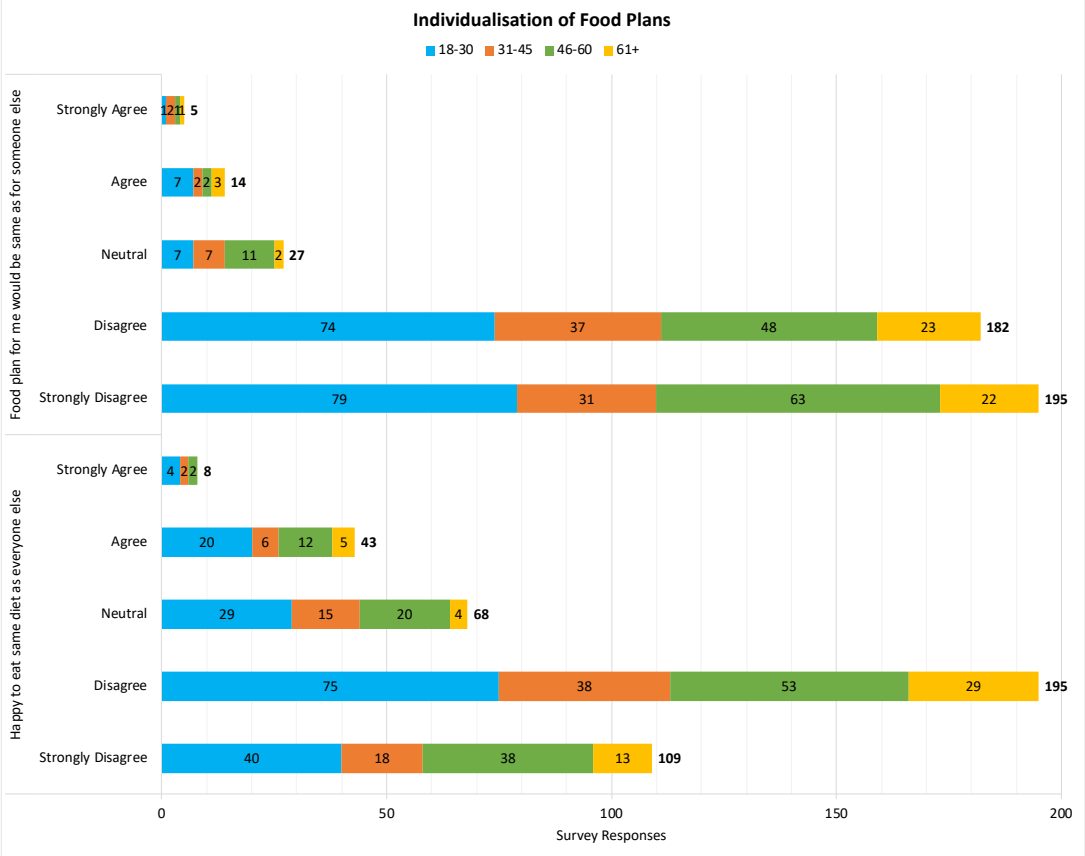


Figure 3.5: Attitude towards individualised diets

When analysing the responses to both statements in relation to one another, a Kruskal-Wallis H test returned a p-value of <0.001 (Table 3.11).

		I Would be Happy to Eat the Same Diet as Everyone Else			
A Food Plan Made for Me Would be the Same as for	**Count** ***Total %***	**(Strongly) Agree**	**Neutral**	**(Strongly) Disagree**	**Total**
	(Strongly) Agree	5 *1.2*	6 *1.4*	8 *1.9*	19 *4.5*
	Neutral	8 *1.9*	7 *1.7*	12 *2.8*	27 *6.4*
	(Strongly) Disagree	38 *9.0*	55 *13.0*	284 *67.1*	377 *89.1*
	Total	51 *12.1*	68 *16.1*	304 *71.9**	423
	H	*N* = 423, df = 2, H = 21.625, p = <0.001			

*Value is 0.1% higher than the sum of its parts due to rounding

Table 3.11: Relationship between happiness to eat same diet as everyone else and belief that personalised food plan would be the same as everyone else's

3.2.7. Dietary Requirements

Participants were to select any applicable dietary requirements from option list provided (Question 4, Appendix C). 449 responses were recorded as this question allowed the selection of multiple answers. 65.7% of respondents (278) reported having no special dietary requirements, as per Table 3.12 and Figure 3.6.

	Do you have any special dietary requirements?		
	No. of Responses	**% of Total Respondents**	**% of Total Dietary Requirements**
Allergies	33	7.8	19.3
Intolerances	66	15.6	38.6
Religious Requirements	5	1.2	2.9
Vegetarian	30	7.1	17.5
Vegan	5	1.2	2.9
Difficulties Chewing /	3	0.7	1.8
Other	29	6.9	17.0
None	278	65.7	

Table 3.12: Breakdown of the special dietary requirements selected by participants

The remaining 145 respondents reported having some form of special requirement, with 26 people having more than one, totalling 171 requirements. Of those people, 33 (19.3%) suffered with dietary allergies, 66 (38.6%) had an intolerance and 30 people (17.2%) followed a vegetarian diet. The dietary requirements in the minorities were those relating to religious beliefs (5 people; 2.9%), people following a vegan diet (5 people; 2.9%), and those with chewing or swallowing difficulties (3 people; 1.7%). For the 30 people who selected "Other" and for anyone who had more information to add, Question 5 of the survey (Appendix C) asked participants to elaborate further on any specific dietary requirements they had. Figure 3.7 below visually displays the information gathered.

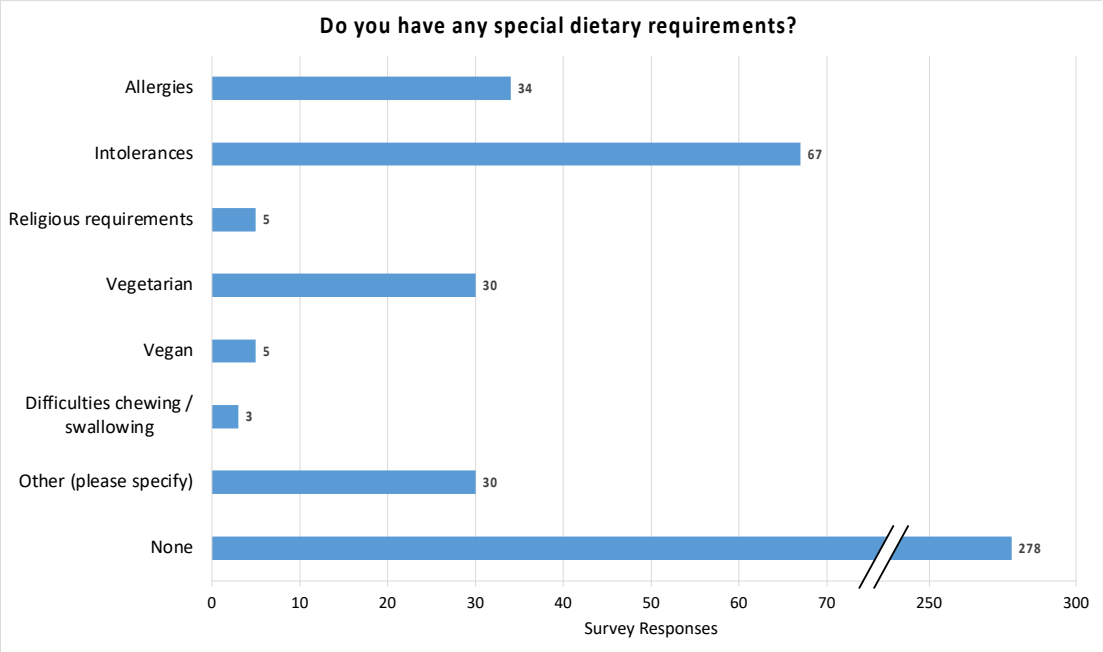


Figure 3.6: Special dietary requirements of the survey respondents

Five people suffered with IBS and three additional people noted that they follow a FODMAP diet. Various people reported suffering with bloating, particularly after consuming onions (5), garlic (3) and chickpeas (2). Six people disclosed that they were pescatarian and three that they were flexitarian, adding strength to the 30 vegetarians and five vegans, who have removed meat from their diet.

Figure 3.7: Additional information regarding respondent's dietary requirements

Multiple participants divulged that they have altered their diet in order to manage a medical condition such as endometriosis, PCOS, acid reflux, bloating and stress. One person consumes a liquid diet via a percutaneous endoscopic gastrostomy feeding

(PEG) tube as they are unable to consume food orally due to oesophageal cancer. Two people avoid bread as there is a risk it will get stuck in their oesophagus causing them to choke. Two people consume Halal food and one does not consume beef, as part of their religion. Two others do not eat pork, however it was not specified if this was for religious reasons. Allergies were reported to nuts (10), seafood (5), kiwi (3), eggs (2), coffee (2), celery, pepper, pineapple and orange.

3.2.8. Professional Advice – Personalised Meal Plans

Question 6 asked participants if they had ever visited a professional to discuss personalising their diet to suit any requirements they had. Table 3.13 and Figure 3.8 below shows that 81 of the 423 people surveyed (19.1%) had in fact sought professional advice regarding their diet.

Have You Been to a Dietician / Nutritionist to Discuss a Personalised Diet?			
Response	**Number of Responses**		**% of Respondents**
No	342		80.9
Yes	81		19.1
Of Which Yes			
Age Group	**Number of**	**% of Respondents**	**% of Age**
18 – 30	30	37.0	17.9
31 – 45	23	28.4	29.1
46 – 60	18	22.2	14.4
61+	10	12.3	19.6

Table 3.13: Breakdown of participants who have visited a dietician or nutritionist for personalised dietary advice

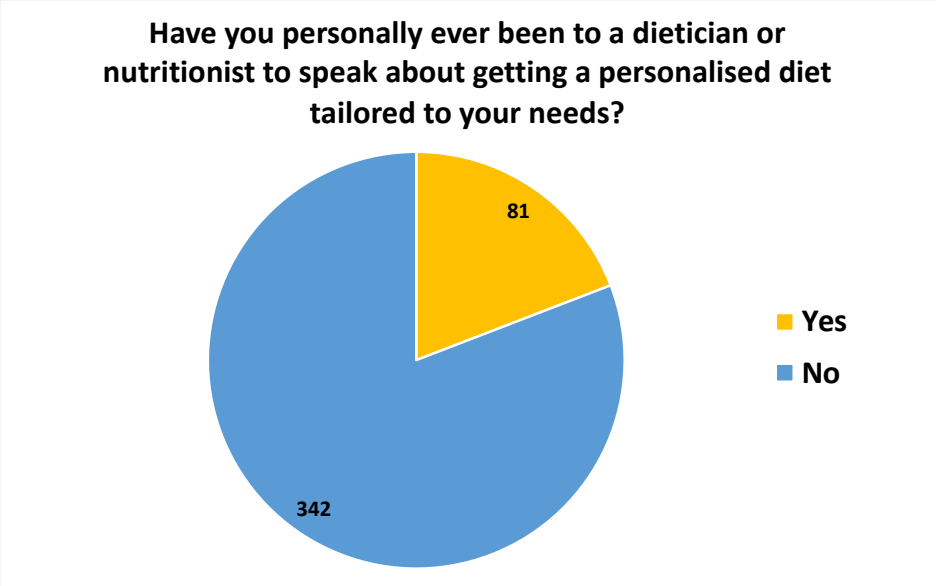


Figure 3.8: Participants who have visited a dietician or nutritionist to discuss personalisation of meals

These 81 people were stratified by age and the results are displayed graphically in Figure 3.9. The age group with the largest number of member that had been to a professional for nutritional advice were those in the youngest age category (30 people), and the number declined with increasing age to 23 in the 31 – 45 age group, 18 in the 46 – 60 age group and 10 people in the eldest cohort (Table 3.13). However, proportionally to age group size, the 31 – 45 age group had the largest number of people visit a dietician (29.1%)

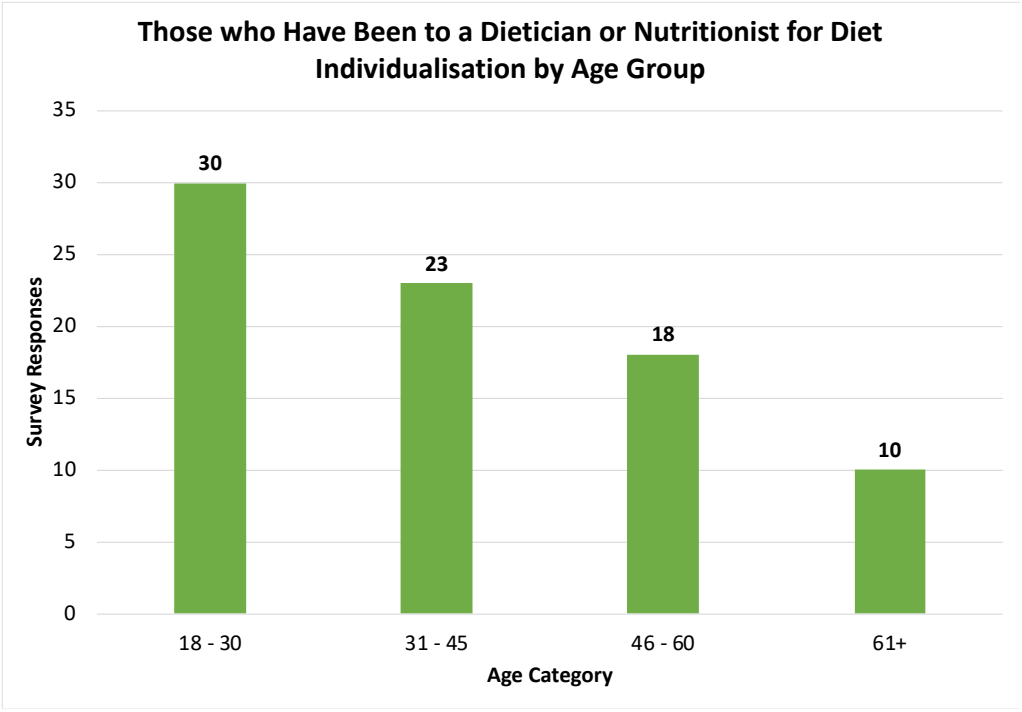


Figure 3.9: Ages of those who have sought professional dietary advice

The Pearson chi-square test of independence was performed to test the null hypothesis that age and past visits to a professional for dietary advice are independent of one another. A chi-square value of 0.00695 was obtained, as outlined in Table **3.14**.

		Have You Attended a Dietician or Nutritionist in the Past to Discuss a Diet Tailored to Your Needs?		
Age Group	**Count** *Total %*	**Yes**	**No**	**Total**
	18 – 30	30 *7.1*	138 *32.6*	168 *39.7*
	31 – 45	23 *5.4*	56 *13.2*	79 *18.7**
	46 – 60	18 *4.3*	107 *25.3*	125 *29.6*
	61+	10 *2.4*	41 *9.7*	51 *12.1*
	Total	81 *19.2*	342 *80.9**	423
	χ^2	N = 423, df = 3, χ^2 = 7.076, p = 0.00695		

*Value is 0.1% higher than the sum of its parts due to rounding

Table 3.14: Relationship between age and those who attended a dietician or nutritionist in the past

Question 7 asked anyone who answered, "Yes", to the preceding question, what outcome following a personalised diet had for them (Figure 3.10 and Table 3.15).

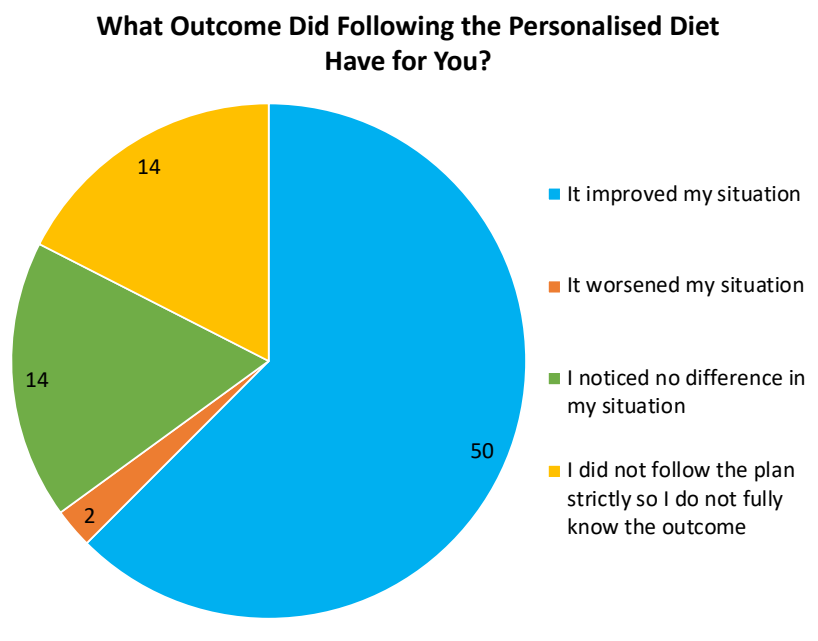


Figure 3.10: Results reported by those who tried a personalised diet

This answer was a branch from the previous one and for that reason it was not compulsory to answer. One of the 81 people failed to complete the answer hence the results are interpreted from the remaining 80 people who did complete the question. Obeying an individualised diet was a success for 50 of the 80 people (62.5%) who followed it. Only two of the 80 people (2.5%) found that the regime worsened their situation, whilst 14 people (17.5%) felt they diet had no impact and 14 people (17.5%) admitted that they did not follow the plan strictly enough to make a judgement for or against the efficacy of the plan. Proportionally to the numbers in each age group, those aged 46 – 60 had the most success with this method as 82.4% (14 people) of those in that age category said their situation improved once they followed the diet.

What Outcome did the Personalised Diet Have for You?					
Age Group	**Measure**	**Improved My Situation**	**Worsened My Situation**	**Noticed No Difference**	**Did Not Follow the Plan**
18 – 30	Count	17	1	8	4
	% of Total	*21.3*	*1.3*	*10.0*	*5.0*
	% of Age	56.7	3.3	26.7	13.3
31 – 45	Count	15	1	3	4
	% of Total	*18.8*	*1.3*	*3.8*	*5.0*
	% of Age	65.2	4.3	13.0	17.4
46 – 60	Count	14	0	1	2
	% of Total	*17.5*	*0.0*	*1.3*	*2.5*
	% of Age	82.4	0.0	5.9	11.8
61+	Count	4	0	2	4
	% of Total	*5.0*	*0.0*	*2.5*	*5.0*
	% of Age	40.0	0.0	20.0	40.0
Total	Count	50	2	14	14
	% Total	*62.5**	*2.5**	*17.5**	*17.5*

*Value is 0.1% lower than the sum of its parts due to rounding

Table 3.15: Impact of personalised diet on participant's situation

Question 8 asks survey respondents if they would considering trying a personalised diet in future, or trying it again for those who had already attempted it. Results displayed in Figure 3.11 and Table 3.16 show that 276 respondents (65.2%) would be willing to try a personalised diet for the first, or a subsequent time. Of those willing, 218 (79.0%) were people who would be undertaking this experiment for the first time.

Would You be Interested in Trying a Personalised Diet (Again)?				
Age Group	**Measure**	**Yes**	**No**	**I Am Already Following One**
18 – 30	Count	113	49	6
	% of Total	*26.7*	*11.6*	*1.4*
	% of Age	67.3	29.2	3.6
31 – 45	Count	58	18	3
	% of Total	*13.7*	*4.3*	*0.7*
	% of Age	73.4	22.8	3.8
46 – 60	Count	81	35	9
	% of Total	*19.1*	*8.3*	*2.1*
	% of Age	64.8	28.0	7.2
61+	Count	24	22	5
	% of Total	*5.7*	*5.2*	*1.2*
	% of Age	47.1	43.1	9.8
Total	Count	276	124	23
	% Total	*65.2*	*29.3**	*5.4*

*Value is 0.1% lower than the sum of its parts due to rounding

Table 3.16: Willingness to try a personalised diet divided by age group

Those who were not willing to try it constituted 29.3% (124 people) of the population questioned, 11 of which had previously attempted it. Twenty-three people (5.4%) were already following an individualised diet at the time of data collection. The 31 – 45 age category were the cohort with the most members willing to try the diet at 73.4% which represents 58 people. Each of the four age categories were represented in the 23-strong group who are already following their own individualised meal plan.

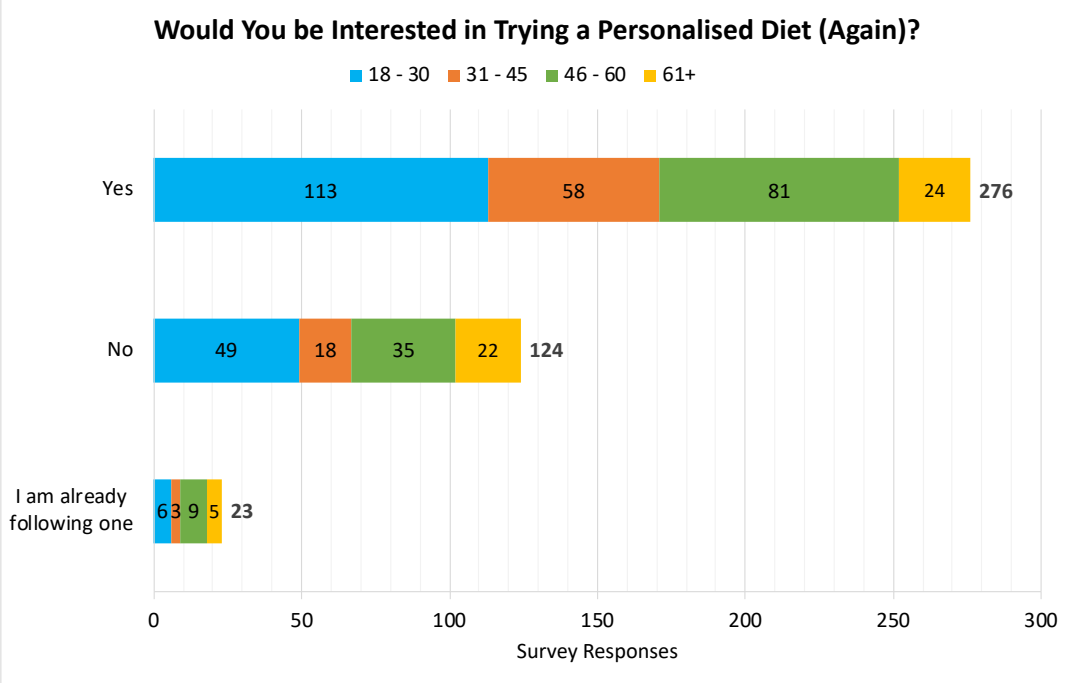


Figure 3.11:Willingness of participants to try a personalised diet (again)

The chi-square test was carried out to determine if the null hypothesis held true that those who have tried a personalised diet in the past and those who are willing to try one in future are independent of one another. A p-value of <0.0001 was obtained as per the contingency table, Table 3.17.

	Would You Be Interested in Trying a Personalised Diet (Again)?				
Have You Ever Been to a Dietician to Discuss a Personalised Diet?	**Count** *Total %*	**Yes**	**No**	**I Am Already Following a Personalised Diet**	**Total**
	Yes	58 *13.7*	11 *2.6*	12 *2.8*	81 *19.2**
	No	218 *51.5*	113 *26.7*	11 *2.6*	342 *80.9***
	Total	276 *65.3**	124 *29.3*	23 *5.4*	423
	χ^2	N = 423, df = 2, χ^2 = 25.284, p = <0.0001			

*Value is 0.1% higher than the sum of its parts due to rounding
**Value is 0.1% lower than the sum of its parts due to rounding

Table 3.17: Relationship between those who have tried a personalised diet in the past and those who would in future

3.3. Survey Section 2 – Hospital Meal Experience in Past Five Years

This section of the survey requested information regarding any hospital visits on the part of the respondent, or someone for whom they were a guardian or carer, in the preceding five years. They were asked to choose the most applicable option of responses based on any meals that they consumed during their stay (Appendix C).

3.3.1. Dined in Hospital Within Five Years

Question 9 confirmed whether the participant, or someone for whom they were responsible, had consumed a meal in an Irish public hospital in the past five years. The feedback from this question is outlined in Table 3.18 and Figure 3.12 below.

Consumed a Meal in an Irish Public Hospital in the Past Five Years		
Response	**Number of Responses**	**% of Respondents**
Yes	217	51.3
No	206	48.7

Table 3.18: Number of participants who consumed a meal in an Irish public hospital in the past five years

Slightly over half of the respondents (51.3%) answered yes to this question, meaning 217 people had themselves, or cared for someone who had, eaten food in a public hospital within Ireland in the last five years.

Figure 3.12: Number of people who consumed, or were responsible for someone who consumed, a meal in an Irish public hospital in the past five years

3.3.2. Review of Hospital Food

Question 10 then asked them to rate the quality of the food, the variety of meal choices and the suitability of options to their specific dietary requirements, if applicable, from the options, "Excellent", "Good", "Fair", "Poor", "Very Poor" or "Not Applicable" (N/A). Results are displayed in Figure 3.13 and the individual tables below. As this question was a branch of the previous, it was not obligatory to answer, resulting in some people failing to complete certain sections.

Table 3.19 captures the results when respondents were asked to select how they rated the quality of the food they received during their stay in hospital. The most common answer obtained was that the food was, "Fair", totalling 83 of the 217 people who answered (38.2%). The next most popular opinion was that the food served was poor (57 people; 26.3%). The positive responses combined tallied to 20.8% of the votes (45 people). All 217 people who answered, "Yes", to Question 9 completed this task.

			How Would You Rank this Meal?					
	Age Group	**Measure**	**Excellent**	**Good**	**Fair**	**Poor**	**Very Poor**	**N/A**
Quality of Food	**18 – 30**	Count	1	10	27	16	6	0
		% of Total	*0.5*	*4.6*	*12.4*	*7.4*	*2.8*	*0.0*
		% of Age	1.7	16.7	45.0	26.7	10.0	0.0
	31 – 45	Count	4	9	24	11	5	0
		% of Total	*1.8*	*4.1*	*11.1*	*5.1*	*2.3*	*0.0*
		% of Age	7.5	17.0	45.3	20.8	9.4	0.0
	46 – 60	Count	1	13	23	22	15	1
		% of Total	*0.5*	*6.0*	*10.6*	*10.1*	*6.9*	*0.5*
		% of Age	1.3	17.3	30.7	29.3	20.0	1.3
	61+	Count	2	5	9	8	5	0
		% of Total	*0.9*	*2.3*	*4.1*	*3.7*	*2.3*	*0.0*
		% of Age	6.9	17.2	31.0	27.6	17.2	0.0
	Total	Count	8	37	83	57	31	1
		% Total	*3.7*	*17.1**	*38.2*	*26.3*	*14.3*	*0.5*

*Value is 0.1% higher than the sum of its parts due to rounding
**Value is 0.1% lower than the sum of its parts due to rounding

Table 3.19: Quality of food served during respondent's hospital stay

Next, opinions of the variety of meals made available were explored. When asked to rate their opinion of the variety of meals they were offered, 202 people completed the

exercise, with 15 people failing to answer. Table 3.20 shows that the most common response was that people found there to be poor variety of meal choices during their hospital admission, with 40.6% of respondents (82 people) selecting this choice. Only two people out of the 202 that answered this questions (1.0%) found the variety of meal options to be excellent, whilst a further 34 people (16.8%) were of the opinion that it was very good. Three people (1.5%) deemed the question, "N/A".

			How Would You Rank this Meal?					
	Age Group	**Measure**	**Excellent**	**Good**	**Fair**	**Poor**	**Very Poor**	**N/A**
Variety of Meal Choices	**18 – 30**	Count	0	8	18	26	5	1
		% of Total	*0.0*	*4.0*	*8.9*	*12.9*	*2.5*	*0.5*
		% of Age	0.0	13.8	31.0	44.8	8.6	1.7
	31 – 45	Count	2	9	12	19	5	1
		% of Total	*1.0*	*4.5*	*5.9*	*9.4*	*2.5*	*0.5*
		% of Age	4.2	18.8	25.0	39.6	10.4	2.1
	46 – 60	Count	0	11	31	27	9	1
		% of Total	*0.0*	*5.4*	*10.4*	*13.4*	*4.5*	*0.5*
		% of Age	0.0	15.9	30.4	39.1	13.0	1.4
	61+	Count	0	6	8	10	3	0
		% of Total	*0.0*	*3.0*	*4.0*	*5.0*	*1.5*	*0.0*
		% of Age	0.0	22.2	29.6	37.0	11.1	0.0
	Total	Count	2	34	59	82	22	3
		% Total	*1.0*	*16.8**	*29.2*	*40.6**	*10.9**	*1.5*

*Value is 0.1% lower than the sum of its parts due to rounding

Table 3.20: Varity of meal choice during respondent's hospital stay

The third statement to be investigates as part of Question 10 is whether the meal choices were suitable to any specific dietary requirements the patients had (Table 3.21). Of the 217 respondents eligible, 187 gave their opinions on this matter and 30 failed to answer. The N/A category was selected 54 times (28.9%), meaning that the number of people for whom this question was applicable is 133. Overall the most popular answer was, "Poor", having been chosen by 59 people constituting 31.6%, with the 46 – 60 age group feeling most strongly about this proportionally, with 40.7% of the group agreeing that the suitability for dietary requirements was poor (24 people). Positive feedback was given by 35 people (13.4%) who thought the choice for their special requirements was good, and a further 6 people (3.2%) thought it was excellent.

		How Would You Rank this Meal?						
	Age Group	**Measure**	**Excellent**	**Good**	**Fair**	**Poor**	**Very Poor**	**N/A**
Suitability to Specific Dietary Requirements	**18 – 30**	Count	2	4	12	15	2	22
		% of Total	*1.1*	*2.1*	*6.4*	*8.0*	*1.1*	*11.8*
		% of Age	3.5	7.0	21.1	26.3	3.5	38.6
	31 – 45	Count	3	5	6	13	3	16
		% of Total	*1.6*	*2.7*	*3.2*	*7.0*	*1.6*	*8.6*
		% of Age	6.5	10.9	13.0	28.3	6.5	34.8
	46 – 60	Count	0	10	10	24	5	10
		% of Total	*0.0*	*5.3*	*5.3*	*12.8*	*2.7*	*5.3*
		% of Age	0.0	16.9	16.9	40.7	8.5	16.9
	61+	Count	1	6	1	7	4	6
		% of Total	*0.5*	*3.2*	*0.5*	*3.7*	*2.1*	*3.2*
		% of Age	4.0	24.0	4.0	28.0	16.0	24.0
	Total	Count	6	25	29	59	14	54
		% Total	*3.2*	*13.4**	*15.5**	*31.6**	*7.5*	*28.9*

*Value is 0.1% higher than the sum of its parts due to rounding
**Value is 0.1% lower than the sum of its parts due to rounding

Table 3.21: Suitability of food offered for dietary requirements during respondent's hospital stay

Figure 3.13 visually displays the spread of data across the range of options broken down by age group. Each age category is represented across almost all options with the exception of "Excellent" in the latter two statements, and the N/A option regarding variety of meal choice.

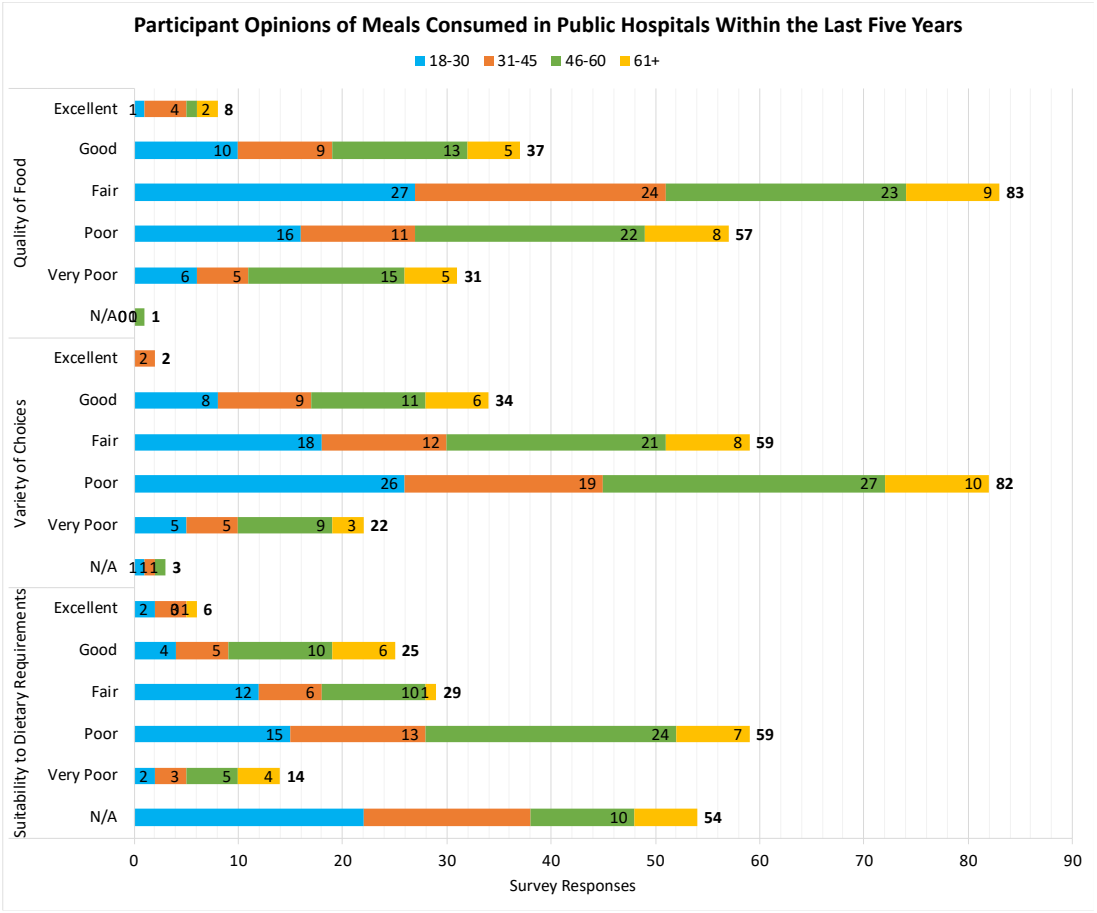


Figure 3.13: Opinions of food consumed during hospital admission during the past five years

For more accurate analysis using the Pearson chi-square test, the options were grouped together as, “(Very) Good”, which is a combination of excellent and good, “Fair”, and “(Very) Poor”, which is a combination of poor and very poor. The N/A option was excluded from the analysis as it could potentially skew the data. When the chi-square test of independence was performed to assess the relationship between each of the three statements, each test returned a p-value of <0.0001 (Table 3.22).

	Quality of Food						χ^2 (df)	p
	(Very) Good		Fair		(Very) Poor			
	N	*%*	*N*	*%*	*N*	*%*		
Variety of Meal Choice							110.081 (4)	<0.0001
(Very) Good	28	14.1	7	3.5	1	1.0		
Fair	11	5.5	36	18.1	12	6.0		
(Very) Poor	5	2.5	33	16.6	66	33.2		
Suitability of Food to Dietary Requirements							63.901 (4)	<0.0001
(Very) Good	19	14.3	9	6.8	3	2.3		
Fair	6	4.5	19	14.3	4	3.0		
(Very) Poor	5	3.8	18	13.5	50	37.6		
	Variety of Meal Choice							
Suitability of Food to Dietary Requirements							65.001 (4)	<0.0001
(Very) Good	19	14.7	2	1.6	1	0.8		
Fair	5	3.9	12	9.3	17	13.2		
(Very) Poor	6	4.7	14	10.9	53	41.1		

Table 3.22: Chi-Square Results – Relationship between quality, variety and suitability of meals served in Irish public hospitals

3.3.3. Comments Regarding Hospital Food

Question 11 asked for additional feedback on the answers given in the previous questions and 133 of the 217 people (61.3%) chose to elaborate. The word cloud shown in Figure **3.14** depicts a snapshot of the information provided. The phrase, "limited choice", was mentioned 22 times and the term, "tasteless", was mentioned 20 times. Over a dozen people reported the food being cold or visually unappealing. Feedback was given that there was not enough fibre in the meals to prevent constipation, and the other end of the spectrum heard other people suffering from diarrhoea. One woman said that the meals were not energy dense enough for her to sustain breast feeding and had to have family members bring her additional snacks when they visited. Many people mentioned their needs were not taken into account and requests for specific foods were ignored. Some participants recounted known diabetics and coeliac disease suffers being served biscuits and gluten containing foods respectively. Another anecdote features a respondent's husband who was fed battered fish and chips following a procedure to implant a stent into an occluded artery. The overall consensus was that there was limited choice on the menu with the standard being poor and presentation unappealing.

Figure 3.14: More information regarding the meals consumed by participants during a hospital stay in the last five years

Contrastingly, eight other people were of the opinion that the food was of a good standard, with two saying the portions were good sizes, and three others saying they had plenty of choice including salads, fruit and vegetables. One person said they thought the presentation was nice whilst another said that they were very happy with their experience. The staff received compliments on multiple occasions and high praise was bestowed upon the food served at the maternity hospitals with the new mothers recounting plenty of meals of the healthy variety to choose from.

3.4. Survey Section 3 – Opinions and Suggestions for More Supportive Hospital Nutrition in Future

Section 3 of the survey focuses on participant's opinions of and ideas for the future, regarding improvement of the food service within the public healthcare sector. It also gains information on what respondents think could be the main challenges hindering this process.

3.4.1. Future Ideas for Hospital Food

The first question of this section asks their opinion of the importance of food served to them or someone they care about during a hospital stay (Question 12). The answers collected are tabulated in Table 3.23 and graphically represented in Figure 3.15.

If you or a close family member / friend / colleague were in hospital, would the food served be an important factor in your opinion?					
Age Group	**Measure**	**Yes - It will speed up recovery**	**Yes - But only because tasty food is a comfort when you are sick**	**No - I do not think it makes a difference**	**It does not matter as medical care is more important**
18 – 30	Count	109	44	6	9
	% of Total	*25.8*	*10.4*	*1.4*	*2.1*
	% of Age	64.9	26.2	3.6	5.4
31 – 45	Count	56	17	4	2
	% of Total	*13.2*	*4.0*	*0.9*	*0.5*
	% of Age	70.9	21.5	5.1	2.5
46 – 60	Count	97	24	2	2
	% of Total	*22.9*	*5.7*	*0.5*	*0.5*
	% of Age	77.6	19.2	1.6	1.6
61+	Count	34	14	1	2
	% of Total	*8.0*	*3.3*	*0.2*	*0.5*
	% of Age	66.7	27.5	2.0	3.9
Total	Count	296	99	13	15
	% Total	*70.0**	*23.4*	*3.1**	*3.5***

*Value is 0.1% higher than the sum of its parts due to rounding
**Value is 0.1% lower than the sum of its parts due to rounding

Table 3.23: Opinion of the Importance or Insignificance of food to the participants during a hospital stay

The consensus, according to 93.4% of respondents (395) was that food is important. The reason for its importance has divided the population, with 70.0% (296 people) feeling it has the ability to speed up the rate of recovery, whilst 23.4% (99 people) attribute its importance to the fact that tasty food provides a comfort to the patient during their stay. Those who think food is unimportant (6.7%; 28 people) feel that the source of sustenance is makes no difference (3.1%; 13 people), and that the standard of food is irrelevant as the quality of medical care is more important (3.5%; 15 people).

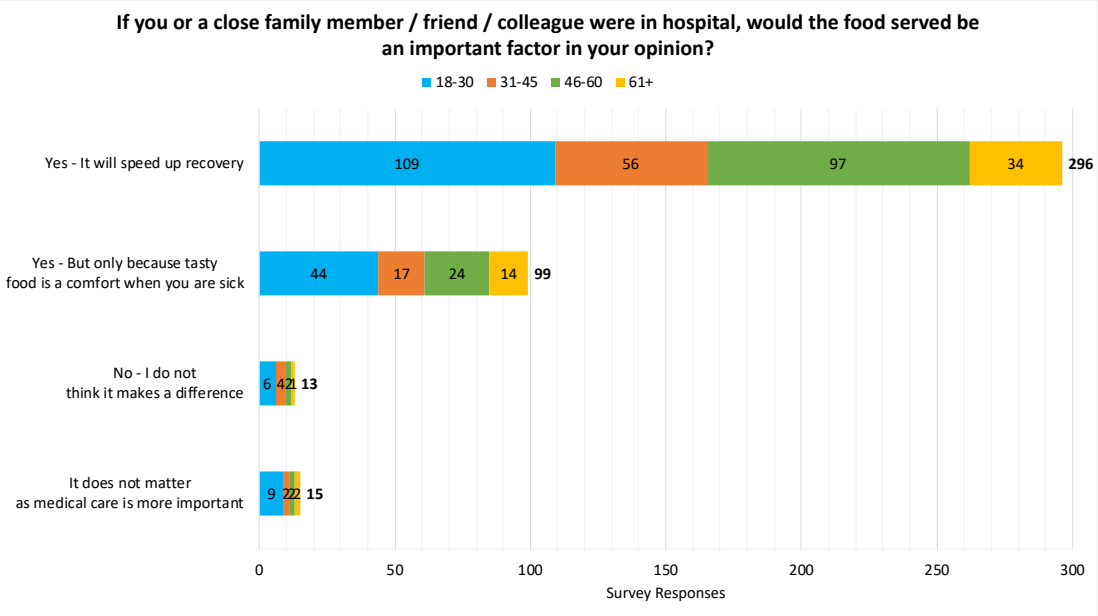


Figure 3.15: Significance of food during a hospital stay in the opinion of the survey participants

The 18 – 30 year olds were the cohort with the most votes for food being unimportant, registering 9.0% of the votes from their age category (15 people). The 46 – 60 age group had four votes for this, totalling 3.6% making them the age category with the smallest proportion to support this. Conversely, they were the age group to most strongly support the statement that food is important (96.8%; 121 people), and the age group to feel most strongly that this is due to the fact that it will speed up patient recovery (70.9%; 97 people). The relationship between the answers to this question and a later question regarding the benefit of personalised meals in a hospital setting (Question 16) will be investigated in Section 3.4.4, Table 3.27. For ease of analysis and to satisfy assumption 6 of the chi-square test of independence (Section 2.6.1), answers were grouped into two answers, “Yes” and “No”.

3.4.2. Potential for Future Improvements

Question 13 asks participants whether they believe that there is potential to improve the food served in public hospitals. Table 3.24 and Figure 3.16 display the answered provided by the population surveyed.

Do you think that there is room for improvement regarding the food served in Irish public hospitals?				
Age Group	**Measure**	**Yes**	**No**	**I Would Not Know Enough to Answer**
18 – 30	Count	100	0	68
	% of Total	*23.6*	*0.0*	*16.1*
	% of Age	59.5	0.0	40.5
31 – 45	Count	63	0	16
	% of Total	*14.9*	*0.0*	*3.8*
	% of Age	79.7	0.0	20.3
46 – 60	Count	103	1	21
	% of Total	*24.3*	*0.2*	*5.0*
	% of Age	82.4	0.8	16.8
61+	Count	40	2	9
	% of Total	*9.5*	*0.5*	*2.1*
	% of Age	78.4	3.9	17.6
Total	Count	306	3	114
	%	*72.3*	*0.7*	*27.0*

Table 3.24: Breakdowns of those who believe there is room for improvement in the food served in public hospitals in Ireland

The majority of people (306; 72.3%) responded that they thought there was room for improvement in the standard of food served in hospital, whilst only three people (0.7%) of those surveyed said they did not believe they system could be improved upon. Of the three people who voted "No", one was in the age 46 – 60 cohort and two were in the 61+ group. Just over one quarter of the population (27.0%; 114 people) regarded themselves as not knowing enough about the situation to be able to answer one way or the other. The number of those who felt they did not know enough information was

highest in the youngest age group (40.5% of the age category) and lowest in the 61+ age group (17.6%) of the age category.

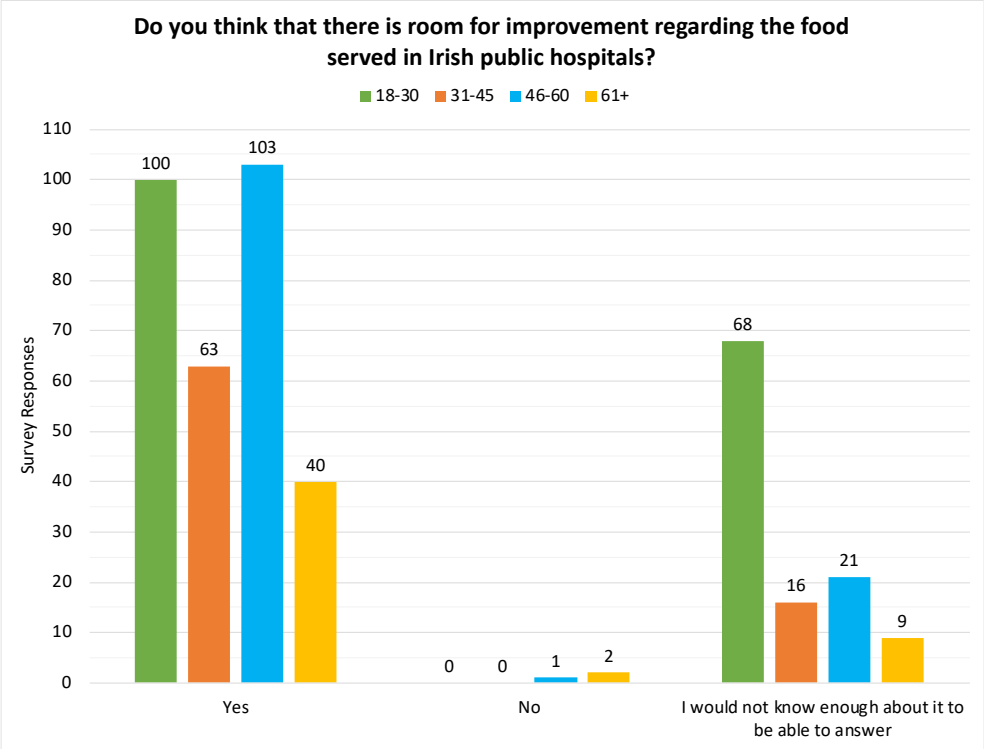


Figure 3.16: Opinions on whether there is room for improvement regarding hospital meals

3.4.3. Ideas to Improve the Future Situation

Question 14 gave the participants eight ideas which could be beneficial in bringing about change in the nutrition space within hospitals. They were asked to select three which they thought would be of the most value. The answers selected by 29 participants have been deemed invalid as per the validity rules outlined in section 2.7 of the methodology, due to the fact that they selected more than three options. An additional 55 people selected less than three options, one of which shall not be counted as the individual selected, "Other", and then commented that they had never been in a hospital in Ireland before. Hence, the answers of the 54 people who selected less than three will be included in the data analysis. Overall 1,072 opinions were registered from the 393 valid responses and the results are tabulated in Table 3.25 and the spread of data is displayed in Figure 3.17. The most popular option from the eight with 256 of the 1072 responses (23.9%) was the implementation of questionnaires to elucidate any allergies, intolerances or special requirements the patient may have. The next most popular was for hospitals to provide wider food choices (216 responses; 20.1%), followed by a free

consultation with a dietician to discuss a food plan individualised for the patient (181 responses; 16.%).

Option	No. of Responses	% of Total
Patient screening for malnutrition within 24 hours of admission	128	11.9
Questionnaires for the patient regarding preferences, allergies and requirements	256	23.9
Wider choice of food	216	20.1
More flexible meal times	116	10.8
Additional snacks provided by the hospital	76	7.1
Laboratory testing for nutrient deficiency	87	8.1
Free consultation with dietician to make personalised food plan	181	16.9
Other	12	1.1
Total	1072	*

*Total is 99.9% due to rounding

Table 3.25: Votes for each idea to improve nutrition in the future

The least popular option amongst the respondents was the provision of additional snacks at the expensive of the hospitals, with only 76 responses constituting 7.1% of the overall votes.

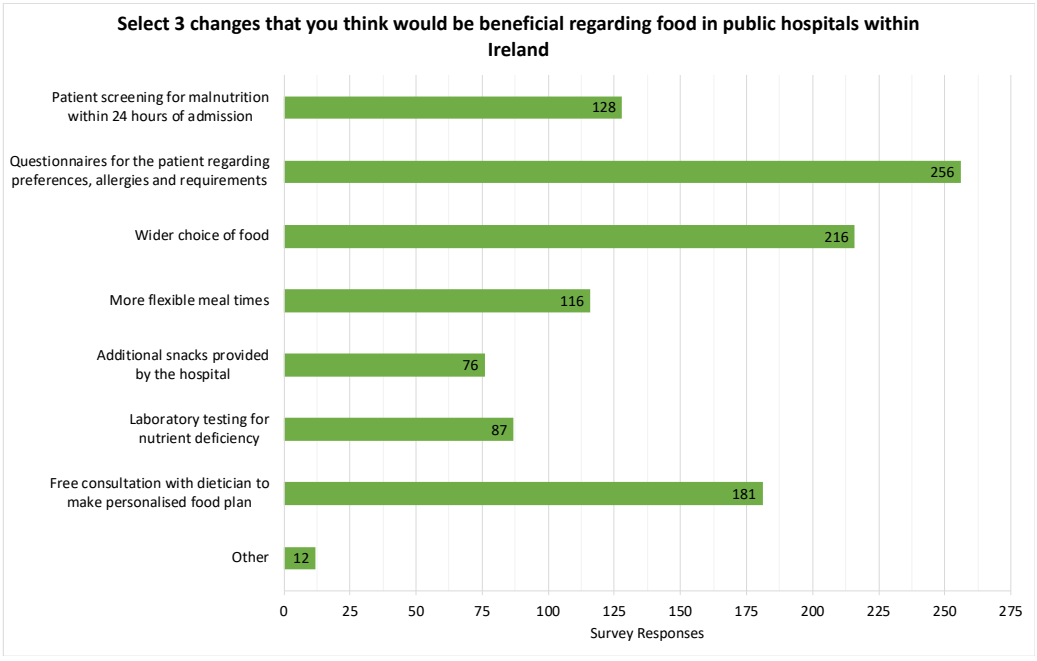


Figure 3.17: Responses to the ideas which could benefit hospital nutrition in future

Question 15 allowed respondents a chance to comment on any of the options and outline ideas of their own which could improve the overall nutritional situation for inpatients. A wide variety of feedback was given by 153 of the 393 people whose answered were deemed valid. Many people felt that the potential options outlined in Question 14 were idealistic and unrealistic for the Irish healthcare system due to cost, time and resources. Others were of the opinion that malnutrition testing and referrals to dieticians are already taking place. Better patient education was a common theme amongst the feedback, suggesting that patients have the opportunity to speak with someone, or attend a short informative seminar, to equip them with the tools to understand and manage their own nutrition. Additional feedback obtained from this question are visually represented in Figure **3.18** below.

Figure 3.18: Feedback and ideas regarding potential future changes

Multiple people suggested that the hospital curate a range of recovery meals, specific to people recovering from specific conditions. For example, a meal plan for people suffering with gastrointestinal issues, cardiac complaints and a specific post-operative diet due to the fact that the bodies of these people are all undergoing different trauma. The provision of more fresh fruit and vegetables was a common theme amongst answers, with one person suggesting fresh smoothies with added vitamins, especially for oncology patients. There was the suggestion of multiple small kitchens to cater for a smaller number of patients, located proximally to the wards, as opposed to one large remote kitchen. This would allow for more attention to be paid to the specific patients' needs whilst minimising the likelihood that meals would go cold in transit.

One person pointed out that nurses of the past would have served and collected all of the meals and therefore would have been aware if a patient was not eating. With the new systems on wards today they have very little visibility of this and patient's eating habits go unnoticed. Their idea to rectify this was to have a dedicated team to assist people during the meal times, particularly those with eating difficulties, and to monitor patients' food consumption. They would act as an early warning system to identify if someone was not eating well. More flexible meal timing was raised multiple times particularly in relation to a patient who fasts for 24 hours in advance of a test and when the test is completed have missed their meal, hence could go 36 hours or more without food. Another respondent was vehemently opposed to the "cruel" act of waking patients early in the morning to feed them their breakfast because of the strict meal scheduling.

3.4.4. Opinion of Individualised Diet

Question 16 asked participants if they thought inpatients would benefit from having their food individualised to suit them rather than being fed the same meal as everyone else. Yes, there is a benefit to this, was the most popular answer amongst 91.7% of the group (388 people), as displayed in Table 3.26 and Figure 3.19. The 46 – 60 year olds had the highest percentage voting "Yes" of any age group at 93.6% (117 people). Those who voted "No", not seeing any benefit to meal personalisation, constituted 8.3% of the population (35 people). People aged 18 – 30 who voted "No" made up 3.3% of the overall population, with the 31 – 45 year olds being the group to be most against the idea proportionally with 11.4% of the age group feeling this way.

Do you think it would be beneficial to hospital patients if their diets were individualised rather than everyone being fed similar meals?			
Age Group	**Measure**	**Yes**	**No**
18 – 30	Count	154	14
	% of Total	*36.4*	*3.3*
	% of Age	91.7	8.3
31 – 45	Count	70	9
	% of Total	*16.5*	*2.1*
	% of Age	88.6	11.4
46 – 60	Count	117	8
	% of Total	*27.7*	*1.9*
	% of Age	93.6	6.4
61+	Count	47	4
	% of Total	*11.1*	*0.9*
	% of Age	92.2	7.8
Total	Count	388	35
	%	*91.7*	*8.3**

*Value is 0.1% higher than the sum of its parts due to rounding

Table 3.26: Participant opinion of potential for individualised patient diets

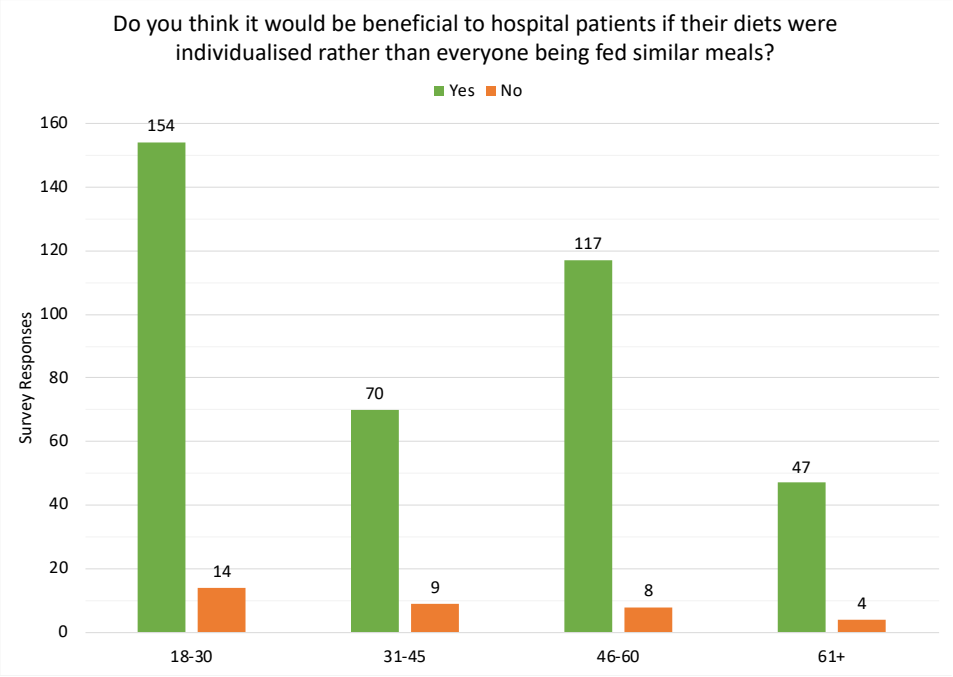


Figure 3.19: Opinion of individualised diet for hospital patients

The relationship between people's opinion of this topic and how they felt regarding the food served to them or a family member during a hospital stay was assessed by

the chi-square test of independence. A p-value of 0.0009 was obtained as shown in the contingency table in Table 3.27.

		If you or a close family member / friend / colleague were in hospital, would the food served be an important factor in your opinion?		
Do you think it would be beneficial to hospital patients if their diets were individualised?	**Count** ***Total %***	**Yes**	**No**	**Total**
	Yes	21 *5.0*	367 *86.8*	388 *91.7**
	No	7 *1.7*	28 *6.6*	35 *8.3*
	Total	28 *6.6**	395 *93.4*	423
	χ^2	N = 423, df = 1, χ^2 = 11.052, p = 0.0009		

*Value is 0.1% lower than the sum of its parts due to rounding

Table 3.27: Relationship between importance of food hospital food for family member and opinion of the benefit of personalised meals

3.4.5. Opinion of Individualised Diet

Question 17 gave the participants a number of statements and asked them to select to what extent they agreed with the fact that each statement hinders the ability of the public hospitals to serve personalised meals for patients. The results obtained are outlined in Table 3.28 and Figure 3.20. Across each of the five statements the most popular answer was, “Agree”, meaning that the majority of people agreed that the topic stated hindered public hospitals from serving personalised meals to patients. Combining the answers for “Strongly Agree” and “Agree”, the responses to budget for food ingredients and budget for resourcing hindering progress totalled 339 (80.2%) and 343 (81.1%) respectively. Those that disagreed regarding budget for ingredients or resources made up 10.2% (43 people) and 6.2% (26 people) each. The availability of staffing was seen as a stumbling block by 77.3% of the population (327 people) who (strongly) agreed, whilst 11.88% (strongly) disagreed with this statement impacting meal personalisation negatively.

Statement	Measure	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

Budget for Food Ingredients	Count	142	197	41	29	14
	% of Total	*33.6*	*46.6*	*9.7*	*6.9*	*3.3*
Budget for Resources	Count	121	222	54	19	7
	% of Total	*28.6*	*52.5*	*12.8*	*4.5*	*1.7*
Availability of Staff	Count	121	206	46	41	9
	% of Total	*28.6*	*48.7*	*10.9*	*9.7*	*2.1*
The Ability to Organise and Schedule Resources	Count	97	221	63	34	8
	% of Total	*22.9*	*52.2*	*14.9*	*8.0*	*1.9*
The HSE not Believing Personalised Nutrition is of Value	Count	75	151	119	63	15
	% of Total	*17.7*	*35.7*	*28.1*	*14.9*	*3.5*

Table 3.28: The extent to which each statement hinders meal individualisation

Almost a sixth of the population (63 people; 14.9%) felt neutrally about whether the ability to organise and schedule resources was a contributing factor to the provision of personalised meals whereas 75.1% (318) felt that it did and 9.9% (42) felt that it did not. The final statement saw the largest spread of data with slightly more than half of the respondents (226; 53.4%) thinking the a lack of belief of the value of personalised nutrition was the reason for it not being a reality. With contrasting opinions, 78 people (18.4%) do not believe this to be the case, whilst 119 people (28.1%) have no opinion either way.

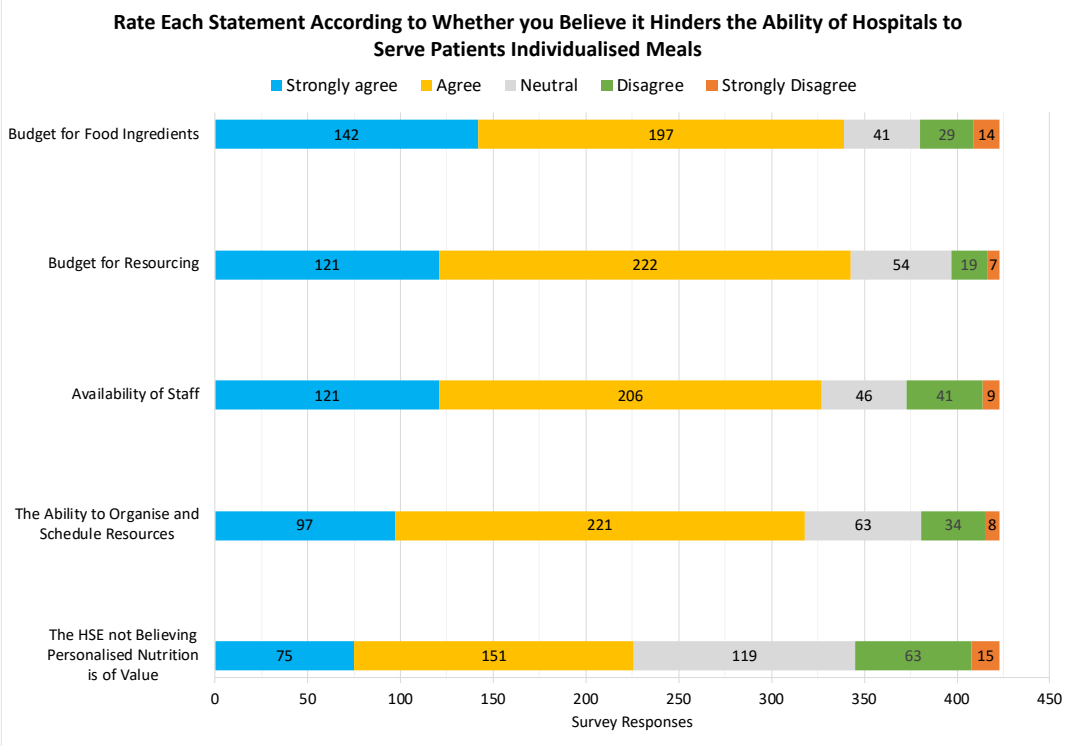


Figure 3.20: Hinderances to the provision of personalised meals

3.5. Survey Section 4 – Additional Comments

The final question, Question 18, gave the respondents the opportunity to elaborate on anything that was touched on in the questionnaire or to add anything that they felt strongly about. Eighty-seven people chose to add more information, some of which is represented in Figure **3.21**. A number of people made comment that they through personalisation was a step too far, that it was, costly, unrealistic and logistically not feasible. Many felt the budget available to the health service was too low to accommodate a project such as this, even though the HSE likely knows the potential the idea holds. Some commenters feel that whilst the system is stretched the resources to implement new initiatives is there, however they believe that the power of technology needs to be harnessed and different departments needs to communicate better with one another.

Figure 3.21: Additional comments

Multiple people mentioned that there is a lack of innovation and desire within the system to become a leading global healthcare provider. One person maintained that the standard of anaesthesiology in Ireland is amongst the best in the world, partly due to innovative partnerships with universities. Complimentary to this, a second person suggested inviting trainee chefs to do a placement in the hospital kitchens to inject some new life into the menu, whilst also giving the apprentices experience of an alternative career path. This could be done in partnership with a university or culinary arts school, similar to the link with university hospitals which take in medical and nursing students.

Another strong theme amongst the comments was that not enough pride and love is put into the preparation and presentation of the dishes, which can be sensed by the patients. It was said that food could be a therapy for the sick and vulnerable to boost their mental and physical state by providing comfort in a foreign environment. Many comments were received regarding nutrition not being recognised as a modifiable factor in someone's health and there not being enough credence given to the fact that nutritional status can be a protective measure against future illness. To enhance the social side of hospital stays it was suggested that inpatients who were mobile enough could go to a dining area to eat at a table with others if they wished, to create some sense of community and break the monotony of being in bed most of the day. Suggestions to facilitate more dietician visits were plentiful, however it was also noted that care must be taken so as not to inadvertently create problems in the area of eating disorders.

Chapter 4

Discussion

4. DISCUSSION

This research investigates the potential role of personalised nutrition in Irish public hospitals, with the aim of reducing patient morbidity and mortality, as well as expediting recovery. A survey was conducted to gain an understanding of the public's perceptions and opinions on the connection between food and health, what their perceptions are of the food service within public hospitals and whether they anticipate personalisation having a positive impact on the situation. Whilst surveys have been conducted by HIQA and the HSE to collect feedback from patients, this research is unique in that it is being conducted by a third party with no association with any healthcare or governmental bodies involved in the running of the system. This has allowed the collection of novel information and opinions from the people who the health service is designed to cater for, with the intention of highlighting opportunities to better target nutrition towards the individual.

Question 1 – Participant consent

A total of 423 valid responses were recorded for the survey, which is greater than the 385 required to give power to the study, as outlined by equation (2) in the Study Design, Section 2.1. Therefore, conclusions drawn from the data obtained has a very low probability of having occurred by chance and is therefore likely to be a significant finding.

Question 2 – Which age group applies to you?

The majority of respondents (168 of 423) fell into the 18 – 30 years of age category, and in contrast the smallest age group was the 61+, containing 51 respondents (Section 3.2.1, Table 3.2). It would be prudent to bear in mind that the opinions and life experiences of those from the younger cohort is likely to differ from their older counterparts. Being more than twice as old, those in the 61+ category are more likely to have spent time in a hospital or to have conversed with family & friends who have been admitted to hospital. They are also more likely to be invested in the inner workings of healthcare facilities and insurance policies, as it is probable that they use them more frequently than the younger generations. People of different ages certainly require varying levels of care and hence may expect different standards based on their needs. With the wide variety of social media platforms available today, there is a huge array of information at our fingertips. This is a way in which many people become aware of recipes, workouts, and diet trends, making today's population more knowledgeable than ever, depending on the reliability of their information source. Social media influencers are omnipresent with an opinion and advice

on every topic from gardening to farming, cleaning to cooking, make-up application to interior design and everything in between. These people are extremely talented at convincing the world that they are the foremost expert in their field of study, which may be true, but in many cases, they do not have any qualification to support their teachings. Often there is no harm in this, but it can be dangerous when people follow advice regarding diets and exercise regimes that are completely inappropriate for that individual. There is immense pressure on people of all ages in society to conform to certain stereotypes. Constantly being bombarded with masses of contradictory information on how to assimilate to society can take a toll on people's health, therefore it is important as an individual to find information from reliable sources and to realise that what is suitable for one person may not be applicable to them. The same sentiment is true for hospital patients. If they would not treat themselves as a clone in their own homes, they should not be treated that way in hospital. Patients are cared for medicinally based on their ailment, hence the same should be true for their diet as food can be a medicine in itself. Patient X who hates pasta would not have their leg amputated because Patient Y had gangrene, so it stands to reason that they should not have to eat lasagne like everybody else on the ward.

Younger people in particular have a vested interest in how society's actions are impacting the Earth, as they will be the ones to suffer the consequences if it continues to be neglected. More emphasis than ever is being put on sustainable agriculture and food traceability to minimise the air-miles and deleterious effects associated with food, with all generations of farmers and food producers responding to the emerging trend. People are more conscious of how their meat sources were raised and whether the crops they are consume were treated with pesticides, hence large cohorts are now choosing to eat vegetarian and buy organic if they can afford it. Hospital patients have little control over the produce they eat during their stay, therefore the hospital should advocate for them by providing additional support via their diet.

Many of the graphs in the Results Section displaying responses were displayed by age category to assess whether there was an answer pattern based on age. The results will be discussed further in this section to show to what extent respondents believe in the importance of nutrition and what their perceptions are of hospital food in Ireland.

Question 3 – Please read the following statements and select to what extent you agree with each.

I believe there is a link between food and health: As per the null hypothesis, age cohort and belief that there is a link between food and health are independent entities. The Kruskal-Wallis p-value obtained was 0.525 which is greater than the alpha value of 0.05 (Section 3.2.2, Table 3.7), hence this meant that there was not a statistically significant difference in the relationship between the different age groups and their opinions on the link between food and health. The overwhelming majority of people (83.0%) stated that they strongly agreed that there was a relationship between food and health, as opposed to the 1.7% of people who felt strongly that there is no relationship. The 46 – 60 age cohort were the only category in which everyone stated that they strongly agreed or agreed. This could be suggestive of the fact that they are at the age where they are conscious of how their actions will impact their health in later years and have found the statement to be true. Similarly, all bar one of those in the 61+ age category strongly agreed or agreed, supporting the idea that they, or someone they know of a similar age, may have suffered some type of health scare and are conscious of preserving their vitality. No one selected "Disagree", yet seven people selected "Strongly Disagree", suggesting that those who consider health and food to be mutually exclusive have strong feelings on the matter. It can be concluded that those surveyed feel nutrition is important for health.

The food I eat has an impact on how I feel physically / psychologically: Whilst most of the survey participants strongly agreed or agreed that food has an impact on how they feel physically and psychologically, there was more of a spread in comparison to the previous question simply linking diet and health. The p-value comparing age and thoughts on physical health was not significant, but the p-value obtained in relation to age and opinion of psychological health being impacted by food was statistically significant. Therefore, it can be concluded that participant age has an impact on their opinion of food impacting mental health. When comparing responses to opinions of physical and psychosocial a statistically significant p-value was obtained. This means that the way in which people answered were significantly related to one another.

Specifying physical and mental health seemed to have prompted people to select answers more towards the "Strongly Disagree" end of the scale. It also prompted more people to select that they had neutral feelings, with ten times the number of people selecting "Neutral" for food impacting them physically, and 36 times more feeling neutral for psychological health being impacted by their diet. Overall, 6.9% less people (29) agreed that food had an influence on their psychological status. Proportionally, the 31 – 45-year-old group strongly agreed the most with both statements than any other group, whilst the

61+ age group strongly agreed the least. The 46 – 60 age category made up half of the "Strongly Disagree" responses for the statement regarding psychological health. This contrasts with the statement regarding a general link between diet and health in which the cohort all agreed or agreed strongly. However, no one from this group strongly disagreed that food impacts their psychological health, therefore it could be possible that they believe food impacts their mental state but not how their bodies feel. Of the seven people who said that they strongly disagreed that food and health are linked, six people selected a positive response for food impacting their physical or psychological health. These responses were at odds with one another, however it could be possible these people do not consider their physical and psychological feelings to play a role in the status of their overall health. There is novelty in this work by taking into consideration the mental health of the patient in addition to the physical health. Whilst Ireland has come a long with in speaking openly about the impacts of mental health, there is more work to be done in normalising people seeking help for psychiatric issues. This study acknowledges psychological health as being a way of measuring wellbeing, which was not done in any of the reports conducted by the healthcare bodies.

I modify my diet when I am (feeling) sick: From the results obtained, the consensus is that diet is a factor that is modified during illness either by necessity or design. The Kruskal-Wallis H test gave a p-value of 0.0967 which was not statistically significant. Hence it can be concluded that the age group and diet modification habit during illness are not reliant on one another. In addition to almost 10% of respondents feeling neutrally about this, there was 25.1% (106) more people agreeing with the phrase rather than strongly agreeing, whilst 15 people disagreed and nobody strongly disagreed. It is possible that appetite during sickness varies across the population hence the more measured responses to this question than previous ones. It is also possible that respondents were envisaging different sicknesses when answering this question. For example, a fever, a cold, and a broken leg will all leave the victim with varying levels of desire and ability to eat. Future work on this topic could explore this niche in further detail, asking more targeted questions which would probe specific illnesses to better understand voter's opinions and past experiences.

A food plan made specifically for me would be the same as one made for someone living down the road: The chi-square test analysing age groups and respondents' opinions of a food plan for them being the same as for someone down the road produced a statistically insignificant p-value. Without enough statistical evidence to reject the null

hypothesis it must be assumed that the variables are independent of one another. The Kruskal-Wallis test was used to analyse age group and respondents' willingness to eat the same diet as everyone else and was not found to be statistically significant either. Most respondents were not in agreement that a food plan made specifically for them would be the same as for other, showing that those people do believe that some type of difference exist between one another and the diet that is preferred and required. Nineteen people (strongly) agreed that they would be supplied with the same food plan as a stranger. This finding could infer several things. It could mean that they do not believe that people's diets vary much from one another, or that they feel the person to create the proposal would lack the ingenuity to draw up something original. They may think that the professionals whose job it is to understand the inner workings of the human body and recommend dietary advice to those in need are frauds, unable to tell the colon from the clavicle, prescribing recipes they read in the latest issue of Bon Appétit. Or it could simply imply that they believe all humans need the same basic ingredients to survive and thrive. Future studies would need to request more specific feedback to accurately interpret these findings.

I would be happy to eat the same diet as everyone else: When given the statement that they would be happy to eat the same diet as everyone else, 71.9% disagreed or strongly disagreed. Although humans are said to be creatures of habit, it seems clear from this result that humans are also individuals with their own sense of what they want. This implies that people are aware that their tastes and appetites are distinct from that of their neighbour, and they may even have certain allergies to foods which will need to be avoided, a topic which will be discussed more in subsequent sections. The p-value obtained from the Kruskal-Wallis H test (< 0.001) comparing happiness to eat the same diet as someone else and a food plan for them being the same as a stranger, was significantly significant. This means that there was enough statistical evidence to say that responses to both statements were significantly related. Thus, these results give valuable information regarding there being the potential to target meals towards individuals in the future.

Question 4 and Question 5 – Do you have any special dietary requirements? Please elaborate.

Intolerances were the most common type of condition disclosed in this section of the questionnaire at 38.6% of dietary requirements. Gluten intolerance was common amongst

the participants (17) along with five people who were confirmed to have coeliac disease, an autoimmune condition in which the body makes antibodies that attack the intestine when a sufferer ingests gluten. The HSE stated that the prevalence of coeliac disease in Ireland is about 1 in every 100 people (Health Service Executive, 2021a), with many cases going undiagnosed or being misdiagnosed as IBS. Admittedly, gluten intolerance is not the same thing as Coeliac disease, however some people with bloating and digestive issues may have never been tested to rule out presence of the disease. Hence, with 5.2% of the 423 people surveyed reporting symptoms of intestinal discomfort due to the consumption of gluten, this number is consistent with the prevalence reported by the HSE.

Allergies were the next most common occurrence at 19.3% of the dietary requirements reported (33). The allergies were various and included nuts, fruit, vegetables, seafood, and coffee. Several people also reported bloating after consumption of onions, garlic, and chickpeas, and for that reason they avoid eating them. Five people follow a specific diet due to their religious beliefs. Historically Ireland was a Catholic state and the 2016 census confirmed that 78.3% of the population still identify as Roman Catholic (Central Statistics Office, 2017). However, only 9.8% of the population identified as having no religion, meaning that the remaining 11.9% of people in Ireland in 2016, which was 566,662 people, must have been part of a different religion. In the period since the 2016 census was conducted, there has been mass movement of people around the world with refugees fleeing war in countries such as Syria and Ukraine, and with people leaving the UK due to Brexit. A number of these people have come to settle in Ireland; therefore, it is likely that there is an even higher percentage of people living here who are part of a religion other than Catholicism. The survey conducted as part of this study received responses from five people (1.2%) who tailor their diet due to their religious beliefs. Whilst this may seem like a small number, that is five individuals who would go hungry if served a meal in hospital that they were prohibited from eating. With Ireland becoming a progressively multicultural country, it is important for health care centres to take this situation into consideration when planning and executing meal plans for their guests.

These findings alone are evidence that many people in the population have specific requirements and would not be able to consume the same food as everyone else. The consequences of serving each of the questionnaire respondents the same meal would vary from irritating to potentially life threatening. Refraining from eating may be sustainable for a short period, but long-term this would certainly lead to weakness and progress into malnourishment. This information confirms that there is the potential to personalise

patient's diets to stop any potential worsening of their illness and potentially to heal them quicker. This conclusion sets this study apart from any conducted previously which simply attained feedback without making any suggestions regarding diet differentiation.

Question 6 – Have you personally ever been to a dietician or nutritionist to speak about getting a personalised diet tailored to your needs?

Seeking dietary advice from a professional is quite a common occurrence amongst the population with almost one fifth of respondents (19.1%) having done so in the past. This result shows that the desire is there for a more targeted approach to good nutrition to feel and look better. It is unknown as to why the remaining four fifths of the population have not employed this service but could be due to no requirement for it, not knowing it was an option, not being able to afford it, or simply not believing that it is a worthwhile endeavour. Future work done in this area could certainly explore this in more detail and find out the reasons behind this.

Considering the age profile of those who have attended a professional, the 18 – 30 age group are leading the way representing 37.0% of respondents. This poses the question as to why they are the ones that are most concerned about seeking professional advice on this topic. It is possible they understand that good nutrition is of benefit to their physical and mental status, or they could be under the influence of current social media trends. It is possible that as they are the most junior of all respondents, they have not yet had the time and life experience to work out which foods nourish their bodies, a skill which their older counterparts have already mastered. This could be a plausible explanation were it not for the fact that proportionally (29.1% of age group), those aged 31 – 45 were the people who attended a professional the most. This could be because these people likely have the most disposable income of any of the age groups. Being mature enough to have spent sufficient time building their career to have earned a substantial wage and being young enough not to have a family to support based on the increasing age at which people are having children today, this age group may well be in a position to spend money on obtaining the advice of a dietary expert.

The Pearson chi-square test to assess the relationship between age and those who sought professional dietary advice, returned a p-value of 0.07. This was not statistically significant enough to reject the null hypothesis, hence the two variables are deemed independent of one another. However, the p-value was quite close to the alpha value of 0.05, which could be explained by the stepwise decrease in numbers employing a profession with the increase in age. More work could certainly be conducted in future to

better understand the reason for this based on age group and lifestyle, however, even to discover that a fifth of people are willing to ask for help with their nutrition shows that people understand it is important.

Question 7 – What outcome did following the personalised diet have for you?

Of those who tried a personalised diet in the past, 62.5% said their situation improved (Section 3.2.7, Table 3.15), proving that a targeted approach to nutrition does have merit. It was not specified in what capacity these people visited a dietician, whether they were referred by a physician or if they sought the advice of their own accord. If this success was found during these people's daily lives with external temptation and without constant oversight by medical staff, then it can certainly be extrapolated that this method has potential to work in a hospital setting where additional healthcare staff supports are on hand. Fourteen people (17.5%) admitted that they did not strictly follow the plan created for them and were not able to make an informed decision whether it would have benefitted them or not. Compliance could be a stumbling block to the successful implementation of individualised nutritional plans, particularly in the home environment with no one to keep them accountable.

It can be difficult to follow a food plan as it takes time and foresight to prepare the meals. In a healthcare facility it would be easier to implement and enforce specific diets for specific patients as it is possible to monitor and control most of the food that patients consume. Even by supporting patients with targeted nutrition during their hospital stay, the healthcare system is setting them up for a better chance of regaining full health when they are discharged. Supplying the patients with a meal plan for when they return home would be useful however it is likely compliance will drop when patients return to their familiar home environment. It is also very important for the dietician to educate the person as to why they should be eating specific amounts of certain macro- and micro-nutrients. If the person understands the reason behind something they are told to do, they will become more invested and more likely to succeed. It is possible that the 14 respondents who did not follow the plan laid down for them did not fully understand what they should be doing or were not in a bad enough situation to warrant really investing their time and energy into making a change in their habits.

Two respondents reported a negative outcome from this exercise, whilst fourteen people reported noticing no difference in themselves, totalling 20% overall. Similarly, these people may not have fully understood exactly what was being asked of them or the plan laid out was not suitable for them in the first place. It would be interesting to find out

more information as to whether they had any discussions with their dietary professional regarding their dissatisfaction, or whether they tried multiple approaches. This could an avenue to be further explored in future research. Whilst some insight was gained into the number of people adopting a personalised meal plan, there is still work to be done to fully understand why it worked for some people and not everyone.

Question 8 – Would you be interested in trying a personalised diet (again)?

Overall, there was a strong open-mindedness amongst the survey cohort as 65.2% of participants (276 people) said they were willing to try a personalised diet. Over one fifth of those people (58) had previously attempted to follow an individualised meal plan, meaning that their willingness to try it again could be seen as a testimony of their positive experience, or their belief that the method holds potential. The chi-square test of independence was carried out to assess the relationship between those who had tried a personalised diet in the past and those who were willing to do so in future or had continued to follow the diet (Section 3.2.7, Table 3.17). A p-value of <0.0001 was obtained, meaning that there was enough statistical evidence to reject the null hypothesis. Therefore, it can be concluded that there is a dependent relationship between those who previously experienced a personalised nutritional plan, and those who would be willing to try one in the future. As the majority of people who tried the diet in the past said it improved their situation, and 65.2% of people overall said they would be willing to try one in future, it can be inferred that the relationship between the two is a positive one.

This is useful feedback from their personal experiences and demonstrates that there would be a benefit to implementing this in healthcare settings for support of undernourished and malnourished patients. On the other hand, 11 people who previously tried the personalised diet were not willing to try it again, even though only one of those people reported that the protocol worsened their situation. It would be worth-while in future focusing more on the past experiences of people who have attempted to follow a targeted diet, in order to understand what worked well for them and what could be improved either on the side of the dietary professional or facilitating better compliance on the side of the respondent. The 31 – 45-year-olds were the age group with the most participants willing to take part in the diet, which is the same group with the most members having tried a personalised diet in the past. The rationale behind this could be because they are young and willing to invest the time, money and energy in themselves to reach their maximum potential while they still can, whilst concurrently setting themselves up for a smooth aging process. This question helped to gain a better understanding of the public's opinion of the importance

of food, and the positive feedback from this question supports the idea that there is potential to utilised targeted nutrition in daily life and by extension, to hospital patients, further supporting the aims of this study.

Question 9 – In the last 5 years, have you, or someone for whom you are a guardian/carer, been a patient in a Public Hospital within Ireland and been served a meal?

Just over half of the people who took the survey (217; 51.3%) said that they, or someone for whom they were responsible, had spent time in a public hospital within Ireland in the last five years and had consumed a meal. If this is extrapolated for the entire population of Ireland which is approximately 5.04 million people (Worldometer, 2022), 2.6 million people would have spent time, or cared for someone who spent time in hospital and consumed a meal. This is a very large number of people to have had contact time with one organisation, namely, the HSE. This would have been an excellent opportunity for the HSE to have forged a positive relationship with patients during their stay and set them on the right track to recovery. The public health system is the only option for many people as it is quite expensive to purchase private health insurance, therefore it is extremely likely that everyone will have at least one public hospital experience during their lifetimes. Not alone should the HSE be striving for excellent medicinal standards in their facilities, they should be paying attention to other aspects including cleanliness, staff to patient ratio, accessibility and very importantly, nutrition and hydration. As this research study has been attempting to emphasise, health is holistic and requires many pieces of the puzzle to fit coherently. With the sheer number of people who engage with the health service on a regular basis, there is huge potential to further harness the power of nutrition to target individuals who are at risk of malnourishment.

Question 10 – How would you rank this meal regarding, quality of food, variety of meal choices, suitability to specific dietary requirements.

An assessment of the food quality showed that most respondents rated the food as being "Fair", followed by "Poor" (Section 3.3.1, Table 3.19). The chi-square test of independence returned p-values of < 0.0001 when each of the three statements were compared against one another. This value is statistically significant and means that there is sufficient statistical power to be able to reject the null hypothesis. Therefore, it can be concluded that food quality, variety and suitability of meals served in public hospitals within the past five years in Ireland are all related to one another.

In the greater scheme of things, the HSE is a business which provides a healthcare service to the taxpayers of this country. Receiving customer feedback such as that provided in the questionnaire is not the situation any business should be striving towards. If they were reviews for a coffee shop on Trip Advisor, tourists would walk straight past it to the tearoom around the corner. With 45 people testifying that the food they received was on the positive end of the scale and 88 people saying they received a meal that was on the positive end of the scale, there seems to be a discrepancy between opinions. It is likely that the people who completed the survey consumed their meals in a variety of healthcare facilities in any number of places throughout the country. As the catering facilities are location-specific and the staff likely work in only one location, there will certainly be a variability in the quality of food served. It must also be remembered that the phrasing of this question allows people to recount experiences for a person for whom they were a carer or guardian. Whilst they may have been acting in a supportive and administrative capacity for the patient, it would be unlikely that they went to such extremes as to taste their food. Therefore, the information supplied by the survey participant in this case is second hand and may not have been a completely true reflection of the standard of food in that hospital. This could be avoided in future by asking respondents to answer whilst reflecting on their own personal hospital meal experiences only.

The variety of meal choices were again ranked towards the negative end of the scale at 51.5% versus 17.8% of the population that ranked it positively (Section 3.3.2, Table 3.20). Ireland is world renowned for its excellent quality of crops, dairy, fish, and grass-fed beef, so it is astonishing that the food quality in hospitals could obtain such poor reviews. It also seems that hospitals could benefit from implementing more variety on their menus, or from allowing the patients to pick and choose different options from what is available. Some more creative dishes and ways of serving the dishes could go a long way towards filling the variety gap that seems to be present. For invalids with an anyway adventurous palate, the banality of these meals would no doubt quickly impact their mood and appetite within a short space of time.

The final statement of question 10 asked for feedback on the suitability of the meal options for any specific dietary requirements they had (Section 3.3.2, Table 3.21). Of those with certain demands, 39.1% of them negatively rated the suitability of the menu, whilst 16.6% rated it positively. With such a wide array of potential dietary requirements it must be difficult to cater for every eventuality. However, there are several basic meals which could be prepared with individual components that could be substituted depending

on any specific allergies or intolerances. Questions 4 and 5 focused on the main dietary requirements experienced by the respondents, with many of them not only being foods to be avoided, but actual diets to be followed. Many people reported following specific diets due to IBS, Diabetes and PCOS, conditions which they certainly would like to keep under control to avoid any exacerbations which may make their medical situation even worse. It would be worth diving into more detail on this specific issue in any future research, to find out more specifically how the meals were unsuitable to their needs and what changes need to be implemented in the future to avoid this from happening again. One aim of this study was to gain a better understanding of how the public health service is perceived by people within Ireland, and the results to this question have certainly outlined their opinions of the quality, variety and suitability of hospital food serviced within the system.

Question 11 – Please elaborate on your two previous answers.

Participants were very generous with their feedback to this question. For the majority of those who elaborated on their experiences, the standard was well below par. Harrowing stories were recounted such as a parent whose adult child with Down Syndrome and Coeliac disease was constantly served dishes containing gluten. As the patient could not communicate their own needs it was the responsibility of the family to check every meal to ensure it did not contain gluten. Coping with a loved one in hospital is a tough enough experience without adding the anxiety of having to censor every meal they consume. This situation would put unnecessary pressure on the health of both the patient and their family, when they should be able to rest easy in the knowledge that the hospital has the case under control. One point made was that the food seemed cheap and only there to fill a need. This person commented that food should be seen as a supplement to help people to get better, but they have never seen this be the case in any hospital they have visited. This point is very poignant as it encapsulates the essence of this research study. The negative feedback overall shows that there absolutely is room for improvement in the area of nutrition within the hospital system in Ireland and the appetite is clearly there from the patient perspective.

Question 12 – If you or a close family member / friend / colleague were in hospital, would the food served be an important factor?

From the results it can be postulated that food served to the participant, or their close circle would matter to them, supporting the aims of this research project to show that there is potential to harness the power of nutrition for health (Section 3.4.1, Figure 3.15). Although almost one quarter of the population believes that food is important due to

comfort alone, this is still a step in the right direction to gain momentum towards the understanding the substances consumed have an impact on the body. Proportionally to the size of the population, the youngest age group have the highest number of people with the opinion that food consumed would be unimportant to them. This result is slightly surprising, particularly when reminded of the fact that >95% of the 18 – 30-year-olds (strongly) agreed with the statements regarding food impacting their physical and psychological health (Section 3.2.2, Figure 3.3). Question 12 is posing a very similar question but in the context of a hospital setting, which may possibly shroud the fact that fundamentally the respondent is being asked if food impacts the body and the psyche. Therefore, the results to this question support the study's aim to gain an insight into the public's opinion of the importance of nutrition.

Question 13 – Do you think that there is room for improvement regarding the food served in Irish public hospitals?

The population surveyed believes there is room for the hospital food service to be improved as 72.3% were for and only 0.7% were against. The age category that was least sure of this was the 18 – 30 cohort with two fifths of them admitting they had not got enough knowledge of the topic to make an informed decision. As the youngest of the age groups, it stands to reason that these people are the least likely to have been in hospital themselves or had older relatives in need of visiting. They have the least life experience and exposure to information regarding the situation. It is also logical that the three people to vote against there being potential to improve on the food service are in the eldest two age cohorts. These people may be more likely to not to kick up a fuss and to accept the standards of the current situation, in contrast to the younger generations who are prone to expecting high standards, particularly when they are cognisant of the high rates of tax they pay which contributes to funding the hospital system.

The percentage of young people selecting that they do not know enough about the situation to be able to answer is more than double that of any other age category, with the oldest age group being the lowest to select this answer. The older the person, the more likely they have first-hand or anecdotal evidence from their friends. In order to incite any change in this situation in the future, the younger people need to be educated on this issue and find a way to become invested in creating change for the better. This survey question supports the aims of this study in that the population agrees there is room improvement, however it also highlights the amount of work that needs to be done to shed light on the matter.

Question 14 and Question 15 – Select three changes that you think would be beneficial regarding food in public hospitals within Ireland. Please elaborate.

The most popular three changes as voted by survey respondents were the questionnaire, a wider choice of food and screening for malnutrition within 24 hours, in that order. Patient education is a very important topic, as it lets them know what to expect from their condition and aids in their own self-care particularly when they are discharged and return home. Numerous respondents spoke about consultations with a dietician for an individual food plan, but they also went a step further to suggest really educating patients on how to eat well to suit their own bodies. From a young age our ideas of what we should eat and how often are ingrained in us from observing what happens in our own homes. Unless someone has purposely studied a course in nutrition, is an athlete competing at a high level or has a particular penchant for reading literature on food, then it is extremely unlikely that a member of the public will know the intricacies of a well-balanced diet. Some people naturally eat food that keep their bodies balanced without knowing the science behind it, but others require help with this. This is where some basic education in the hospital setting would come in. Rather than giving the patient a leaflet that they will not read, some people suggested a conversation with the dietician or even a short, interactive seminar would be better. Whilst not everyone will be interested in this, some key points will stick with others and help them to live a healthier life when they return home.

The fourth most popular option was to use patient screening within 24 hours of admission to identify anyone who may be at risk of malnutrition, with some people adding comments that this already happens in hospitals. The screening of patients within a day of admission was mandated by the Department of Health and Children in 2009 (Department of Health and Children, 2009), However, the HIQA study from 2016 (Health Information and Quality Authority, 2016) revealed that in the majority of hospitals this was not actually being carried out, as discussed in introductory section 1.7.1. One reason given for this was that more screening would result in the identification of more at-risk individuals, causing an increased demand for dietetic services which they did not believe could cope. For any substantial positive changes to occur there must be an investment made to hire more staff trained to council patients regarding their diet and there needs to be an investment in the education of hospital staff in the importance of the screening tool as an aid to save lives. The fact that survey participants thought screening would be a good idea for the future shows that many of them were unaware that this should currently be

happening. It is evident that there is room for this to be implemented across the board, giving credence to the aim of this study which is to show that individualisation of patient nutrition holds merit.

Multiple, smaller kitchens located close to the wards could be worthwhile investigating. Certainly, it would be a large investment of money in capital expenditure and staffing for each individual kitchen, but it would give each team the scope to target the dishes to people on the specific wards they are catering for. With less pressure on the number of meals to be created it would facilitate more attention to detail making the meals more aesthetically pleasing and hence more appetising to the customer. The close proximity would reduce the likelihood of food being cold and would allow the ward more flexibility to request staggered mealtimes for those who may be absent due to medical testing. Flexibility of mealtimes was a common talking point of question 15. Numerous people expressed dissatisfaction with the strict set dining time saying that it was not conducive to people's home schedules and could add strain to an already disorientated elderly person. The point was raised that waking patients before 8 o'clock in the morning to serve them a meal they likely will not even be able to stomach is a cruel practice, done to suit the staff schedule rather than the patient's healthcare regime. Sleep is also an extremely important contributing factor to the maintenance of health and to disturb that sleep unnecessarily is a crime, particularly as some patients use sleep as an escape from the banality of another day on the hospital ward.

The flexibility to be able to choose the time, within reason, at which you receive your breakfast could have the potential to positively impact patient's physical wellbeing and their overall morale for the day. A final important point made was regarding patients following a meal schedule for religious reasons. For example, a Muslim observing Ramadan would need to eat one hour before sunrise and again after sunset, not eating or drinking during the daylight hours. If these mealtimes were not facilitated for that person, then they would likely go hungry from their entire stay in hospital.

The comments and feedback provided valuable information that supports the aims of this research to get an insight into what people think of nutrition and the situation in public hospitals. It also proves that the respondents find that personalised nutrition would be more suitable for many individuals.

Question 16 – Do you think it would be beneficial to hospital patients if their diets were individualised rather than everyone being fed similar meals?

The consensus amongst the group was that there is potential benefit for hospital patients by implementing personalised meals for them, with 8.3% in disagreement. The chi-square test of independent to assess whether there is a relationship between the respondent's opinion of these benefits, and their perception of the importance of food for themselves or a loved-one during a stint in hospital, returned statistically significant p-value of 0.0009. There is enough significance to be able to reject the null hypothesis, therefore the two variables are dependent on one another.

Question 17 – Please rank each option according to whether you believe it hinders the ability of public hospitals within Ireland to serve patients food based on their individual requirements / preferences.

In the eyes of four fifths of the questionnaire respondents, the budget allotted to the public healthcare system for food and resourcing are two factors which hinder the ability of the hospitals to create patient personalised meals. Availability of staff was also seen to be a stumbling block to attaining stratified nutrition by approximately three quarters of respondents, with almost the same amount of people agreeing that the ability to adequately manage and organise resources was an issue. However more people felt neutrally about this topic, possibly due to the fact that it would be difficult for a lay person to have any insight into the systems that hospitals use for this type of scheduling.

The statement with the least clear-cut opinions was regarding the suggestion that the HSE does not believe personalised nutrition is of value, and that is one of the inhibitory factors to personalised meals. "Agree" was the most popular answer for over half of the population but more people disagreed with this than any of the previous four statements. Over a quarter of the people were reluctant to take a side. In a way, this result is a positive sign for the Irish health system in that almost one fifth of the public believes that they believe in innovative approaches to healthcare, being personalised nutrition in this case. However, from a different perspective, more than half of those surveyed feel that they do not believe in this holistic approach healing people. The responses to the five statements gave a unique insight into how the public perceive the healthcare situation within the country, giving strength to the wealth of information gained to prove that the aims of this project have been attained.

Question 18 – Do you have any additional comments?

This request for open ended feedback was a very useful tool to better understand the public's opinions on the importance of nutrition and their perception of public hospital food in Ireland. This helped to satisfy two of the three goals of this research study. The common agreement was that personalisation to the specific individual was a step too far. Respondents agreed that a targeted approach to nutrition certainly held potential and that not enough attention was paid to what patients were consuming, but attempting to create a whole menu for each particular patient was not possible given the time and resources available. In reality personalisation would be very difficult, however a balance could be struck where patients are stratified into groups based on their needs, and catered for as smaller cohorts.

Many ideas were put forward which hold merit, even if they are slightly unrealistic. Facilitating a dining room area for patients to sit together around a table would certainly allow patients the chance to socialise and boost their morale, however this may be inappropriate given that hospitals are excellent environments for opportunistic pathogens to spread between hosts. Inviting trainee chefs to complete work placement in the hospital kitchens would be a wonderful way to create innovative new menus that would boost patient satisfaction and health. Much planning and administration would be required to implement this programme, but with some investment of time and money, it would be beneficial not only to the patients but to the trainee chefs too.

A valid point was raised in the feedback regarding eating disorders. Whilst one participant expressed surprise that hospitalisation due to eating disorders was not explored, concern was raised by another that strict advice by dieticians could create an unhealth relationship with food for the patient. This topic is important and complex, with those managing an eating disorder having a more complex relationship with food than others, hence it would not be appropriate to group their eating habits with those of the general population. As these people would be even more vulnerable to malnutrition and the risks associated with it, future investigation into this would be very beneficial to all.

The feedback provided to this question was a novel and invaluable insight into how highly respondents regarded nutrition, what they thought of hospital food served to the people of Ireland and what they thought could be done in the future to improve patient prognosis via nutrition.

Overall a large body of information was obtained from the questionnaire responses. This facilitated a better understanding of the public's opinion of how important nutrition is for

health and wellbeing. It was also an original way of discovering the population's perceptions of the food that is served to patients in public hospitals within Ireland. Finally, the data obtained during this research study not alone showed that there is a need to better target meals served in hospitals, but that the public believes that there is potential to implement this to improve the quality of life for hospital patients. Therefore the three aims of the study were attained via a new approach to researching this topic.

Chapter 5

Conclusion and Future Work

5. CONCLUSION AND FUTURE WORK

This research study obtained a large amount of information from the literature published in the past and from the responses and feedback generously provided by the survey participants. Conclusions which can be drawn from this research and future work that could be carried out in the future are outlined below.

5.1. Conclusion

This research was conducted in order to answer the question as to whether there is potential to use personalised nutrition within Irish public hospitals. The literature research carried out and assessment of the survey results show that there absolutely is a desire and potential to target hospital patients via specific nutritional plans, rather than treating everybody the same. Whilst the project originally suggested that the nutrition be personalised to each individual patient, following much research and assessing participant feedback, it can be concluded that targeting a menu to every individual would not be possible. However, the researcher would still advise that each patient should be assessed for malnutrition, screened for allergies and given the opportunity to make the staff aware of any cultural preferences and religious requirements upon admission to hospital. The current situation in public hospitals in Ireland is by no means perfect, leaving a lot of room for improvement in the future.

Unlike any work that has been carried out in Ireland in the past, this study was able to gain a unique insight into the opinions and past experiences of the public relating to how they feel food impacts their physical and mental health. Information collecting exercises conducted by public health organisations do not often focus closely on food in relation to mental health. Although knowledge of the gut-brain axis is more widespread today than ever before, it is not a common topic of conversation in the media as people may still think it is taboo to speak about. This study shows that many people in the population acknowledge that the food they consume has an impact on their psychological health. This research put emphasis on how health should be thought of holistically and not only based on physical stature.

Unlike others, this study suggests that targeting meals towards specific individuals with particular needs can facilitate a more rapid recovery, foster a better experience during their hospital stay and maintain their health when they leave, so they do not return. Feedback from the survey participants showed that they were not satisfied with the current hospital situation and that they were would like to see change brought about

using the method of individualising food for specific patients. The quality and number of suggestions provided for future ideas was a testament to how much thought the respondents had put into answering, and how much they genuinely care about this topic, as it is something that affects everyone.

This project showed that the public realise that nutrition is an important factor in maintaining health. It also demonstrated that the majority of people are not satisfied with the standard of food served in public hospitals or the attention to detail for induvial patients. It was proven that there is the potential to target nutrition to specific patients based on their wants and needs. In conclusion, the study achieved its aims, and although it may not be possible to create a personalised menu for every single patient, there is certainly the potential to target food toward cohorts with similar characteristics.

5.2. Future Work

With the intention of minimising the amount of identifying information collected, respondents were not asked to identify their gender. In hind sight, interesting conclusions could have been made by comparing answers based on gender as well as age group. This information may identify sex-specific issues that may not otherwise be considered. It would be recommended that future surveys on this topic take this into consideration during the questionnaire design stage.

Whilst the required number of responses was obtained in order to ensure the study had sufficient power, there was a disparity in the number of respondents from each of the four age categories. Although the number of respondents from each group could be compared using proportions, in future it would be prudent to have a specific quota of people required for each cohort for more accurate comparison of results.

Participant feedback commented on the lack of consideration for those hospitalised due to an eating condition. Whilst this was deemed to be out of the scope of this project, it is certainly an area with a lot of potential, as this cohort of people would likely require much more specific nutritional planning than someone in hospital requiring surgical intervention. A more specific review of the literature could be carried out in relation to eating disorders, with a more targeted approach to survey question design.

The researcher felt that religious dietary requirements is an interesting area to which enough attention was not paid. With a wide variety of traditions and requirements across

religious groups, it would be worthwhile spending more time researching and obtaining feedback on gaps in the resources in the hospital environment.

Some of the survey questions obtained large amounts of neutral responses which is not very informative. If the survey were to be repeated it would be advisable to remove the "Neutral" response so that participants would have to decide how they felt one way or another. It was noted that some of the questions were slightly ambiguous and open to interpretation. For example, the statement in Question 3 regarding modification of diet during sickness received a wide spread of responses suggesting that people were likely thinking of varying types of sickness. This introduced variability culminating in less accurate results. It would be recommended that future questions are made as specific as possible to minimise the amount of misinterpretation possible on the part of the respondent and the researcher. Accuracy could also be increased such as in Question 10 which allowed the participant to answer on behalf of the person for whom they were responsible. Second hand information is vulnerable to errors and misinterpretation by the survey participant. In future this could be tackled by asking participants to only recount their own personal experiences.

Chapter 6

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Chapter 7

Appendices

7. APPENDICES

Appendix A – Participant Information Sheet

Dear Participant,

My name is Caoimhe Reid and I am studying a Masters in Food Business Management and Technology in TU Dublin. As part of my studies I am required to complete a research project and the topic I have chosen is, "The Potential Role for Personalised Nutrition in Irish Public Hospitals". I would be extremely grateful if you were in a position to take part in a survey which will take approximately fifteen - twenty minutes. The survey will consist of yes/no, multiple choice and ranking questions. Some questions will allow you to enter additional information if you wish. Some questions will refer to you, or a close family member/friend/colleague of yours, eating a meal in a hospital within the last five years.

Involvement in this study is completely voluntary. All information will be fully confidential and will not be shared with any other third party, except my project supervisor, Mrs. Olga Sazenova, MSc. No identifying personal information will be requested as part of this survey and all answers to the questions will remain anonymous. Your data will be used only for this study and will be stored on my password protected TU Dublin OneDrive account. One year post the completion of the Masters programme, all raw data will be destroyed.

If you would like to participate in this study, please read the participant consent information on the next page and tick that you confirm to take part. A copy of this participant information sheet and a copy of the ethics approval letter can be made available to you by sending a request via email to my email address in the below paragraph.

If you would like further information about this research, please do not hesitate to contact me by email at X00181151@mytudublin.ie. Furthermore, you can also contact my supervisor at olga.sazenova@tudublin.ie

Thank you for taking the time to read this information. I would be grateful if you would consider participating in this study.

Kind Regards,
Caoimhe Reid

Appendix B – Participant Consent

Please provide an answer to this statement.

* Required

Question 1

I confirm that I am 18 years of age or older. I have read and understood the information regarding this research project and I fully understand that I am taking part in this study voluntarily. I agree that the information I provide may be shared with the researcher (Caoimhe Reid) and the project supervisor (Mrs. Olga Sazenova, MSc). *

○ Yes

○ No

Appendix C – Survey Questions

Question Section 1

* Required

Question 2

Which age group applies to you? *

	18 – 30	31 - 45	46 – 60	61 +
Your Age Group	◯	◯	◯	◯

Question 3

Please read the following statements and select to what extent you agree with each on a scale from **Strongly Disagree** to **Strongly Agree** *

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I believe there is a link between food and health	◯	◯	◯	◯	◯
I would be happy to eat the same diet as everyone else	◯	◯	◯	◯	◯
The food I eat has an impact on how I feel **physically**	◯	◯	◯	◯	◯
The food I eat has an impact on how I feel **psychologically**	◯	◯	◯	◯	◯
I modify my diet when I am (feeling) sick	◯	◯	◯	◯	◯
A food plan made specifically for **me**, would be the same as one made for someone living down the road	◯	◯	◯	◯	◯

Question 4
Do you have any special dietary requirements? Tick all that apply. *

- [ ] Allergies
- [ ] Intolerances
- [ ] Religious requirements
- [ ] Vegetarian
- [ ] Vegan
- [ ] Difficulties chewing / swallowing
- [ ] Other (please specify)
- [ ] None

Question 5

Please elaborate on your answer to Question 4 above.

Question 6

Have you personally ever been to a dietician or nutritionist to speak about getting a personalised diet tailored to your needs?*

- ○ Yes
- ○ No

Question 7

What outcome did following the personalised diet have for you?

- ◯ It improved my situation
- ◯ It worsened my situation
- ◯ I noticed no difference in my situation
- ◯ I did not follow the plan strictly so I do not fully know the outcome

Question 8

Would you be interested in trying a personalised diet (again)? *

- ◯ Yes
- ◯ No
- ◯ I am already following a personalised diet

Question Section 2

Question 9

In the last **5 years**, have you, or someone for whom you are a guardian/carer, been a patient in a Public Hospital **within Ireland** and been served a meal? *

○ Yes

○ No

Question 10

From memory, how would you rank this meal from **Very Poor** to **Excellent**?

	Very Poor	Poor	Fair	Good	Excellent	N/A
Quality of Food	○	○	○	○	○	○
Variety of Meal Choices	○	○	○	○	○	○
Suitability to specific Dietary Requirements (if applicable)	○	○	○	○	○	○

Question 11

Please elaborate on your two previous answers if possible.

Question Section 3

Question 12

If you or a close family member / friend / colleague were in hospital, would the food served be an important factor in your opinion?*

- ○ Yes - It will speed up recovery
- ○ Yes - But only because tasty food is a comfort when you are sick
- ○ No - I do not think it makes a difference
- ○ It does not matter as medical care is more important

Question 13

Do you think that there is room for improvement regarding the food served in Irish public hospitals? *

- ○ Yes
- ○ No
- ○ I would not know enough about it to be able to answer

Question 14

Select 3 changes that you think would be beneficial regarding food in public hospitals within Ireland.

- ☐ Patient screening for malnutrition within 24 hours of admission
- ☐ Questionnaires for the patient regarding preferences, allergies and requirements
- ☐ Wider choice of food
- ☐ More flexible meal times
- ☐ Additional snacks provided by the hospital
- ☐ Laboratory testing for nutrient deficiency
- ☐ Free consultation with dietician to make personalised food plan
- ☐ Other

Question 15

Please elaborate on the above if possible. Please add additional ideas if you have any.

Question 16

Do you think it would be beneficial to hospital patients if their diets were individualised rather than everyone being fed similar meals? *

○ Yes

○ No

Question 17

Please rank each option according to whether you believe it hinders the ability of public hospitals within Ireland to serve patients food based on their individual requirements / preferences. *

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Budget for Food Ingredients	○	○	○	○	○
Budget for Resourcing	○	○	○	○	○
Availability of Staff	○	○	○	○	○
The ability to Organise and Schedule	○	○	○	○	○
Resources	○	○	○	○	○
The HSE not Believing Personalised Nutrition is of Value	○	○	○	○	○

Question Section 4

Question 18

Do you have any additional comments about anything touched on in the previous questions, or anything you would like to add?

Appendix D – Summary of Statistical Tests Used

Variable 1	Variable 2	Test	p-Value
Age Group	I believe there is a link between food and health	Kruskal-Wallis H test	0.525
	I would be happy to eat the same diet as everyone else	Pearson Chi-square	0.541
	The food I eat has an impact on how I feel physically	Kruskal-Wallis H test	0.819
	The food I eat has an impact on how I feel psychologically	Kruskal-Wallis H test	0.001
	I modify my diet when I am (feeling) sick	Kruskal-Wallis H test	0.961
	A food plan made specifically for me would be the same as one made for someone living down the road	Kruskal-Wallis H test	0.712
	Have you attended a dietician or nutritionist in the past to discuss a diet tailored to your needs?	Chi-square	0.00695
The food I eat has an impact on how I feel psychologically	The food I eat has an impact on how I feel physically	Kruskal-Wallis H test	0.028
Have you attended a dietician or nutritionist in the past to discuss a diet tailored to your needs?	Would you be interested in trying a personalised diet (again)?	Chi-square	<0.0001
Variety of choice of hospital food	Quality of hospital food	Chi-square	<0.0001

Variable 1	Variable 2	Test	p-Value
Suitability of hospital food to dietary requirements		Chi-square	<0.0001
	Variety of choice of hospital food	Chi-square	<0.0001
Do you think it would be beneficial to hospital patients if their diets were individualised?	If you or a close family member / friend / colleague were in hospital, would the food served be an important factor in your opinion?	Chi-square	0.0009