Obesity Prevention Interventions In Young Adults

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Preface

Dancing,

With the feet,

With ideas,

With words,

One must also be able to dance with pen

One must learn how to write

Friedrich Nietzsche, Twilight of Idols

Abstract

Background:

Obesity has emerged as a major public health problem across the globe. Unfortunately, all the efforts, to date, to treat obesity have limited success. Despite the increased publicity on health and economic consequences, its prevalence continues to rise, even in countries that were previously battling under-nutrition. The annual weight gain which may lead to obesity if it remains uncontrolled, is small, averaging 0.7-1.0kg/year. Aiming to halt this small weight gain could be a solution towards combating the obesity epidemic and thus reduce its prevalence. One of the critical life stages where weight gain occurs is the transition between adolescence and young adulthood and especially evident in those attending higher education in the US. There is very limited data from the UK on the magnitude of weight gain in this population. This thesis aimed to explore the weight changes occurring during that life-stage, identify factors affecting those weight changes, explore weight gain prevention data and design and test interventions aiming to prevent any weight gain.

Methods:

Several studies were carried out during this PhD programme in order to answer all the research questions. Three systematic reviews were employed to examine 1) weight changes in young adulthood, 2) weight gain prevention studies in young adulthood and 3) the effect of calorie-labelling on calories purchased as an anti-obesity measure. A pilot study was carried out to test and explore methodologies for collecting data from young adults on lifestyle and lifestyle changes. A qualitative study was carried out to supplement the data from the pilot study on the importance of any weight changes for young adults. A prospective cross-sectional study was carried out to examine the weight changes and lifestyle changes occurring during the first year of studies in young adults. An interrupted time-series study was carried out to test the hypothesis that calorie-labelling

might have an effect on preventing weight gain in young adults. A cross-sectional study was carried out to test the effect of calorie-labelling on sales and choices in independent catering facilities where young adults represent a significant proportion of the customers. Lastly, a randomised trial was carried out to test the hypothesis than on-line programmes based on two different behavioural theories could help young adults to avoid any unwanted weight gain.

Results:

The systematic literature review of weight changes in young adults identified 27 studies reporting a mean weight increase of 0.7-3.75kg in those attending higher education. The pilot study examining methodologies and weight changes in young adults attending higher education in the UK found a weight increase between 0.5-5.5kg by 56% of the participants and the best recruitment method to be the on-line method compared to mail or in-person recruitment. The prospective study that looked at weight changes among first-year students attending a large university in the UK found a weight change of 1.8kg in a 9-month period. Baseline weight explained 48% of the variation observed in weight changes. Despite the belief that physical activity or consumption of fruit and vegetables is linked to weight management, neither of these protected against weight gain. The literature review on weight gain prevention studies among young adults, identified twelve studies (five of those conducted in higher education settings). Six of the studies found an effect on preventing weight gain or maintaining weight. No specific techniques were identified to be more effective as the studies that found an effect followed similar techniques with those that did not. The systematic review and meta-analysis on the effect of calorie-labelling on calories chosen/purchased identified seven studies. Overall, there was no effect of calorie-labelling on calories chosen/purchased, however customers noticing the calorie-labels, reduced the calories chosen/purchased by 124.5kcal. Students are generally supportive of the presence of calorie information in a range of products and settings including alcohol products. In the time-interrupted study which was conducted over two years, young adults that were exposed to calorie information did not gain the expected weight observed in young adults in the same setting in the year prior to the implementation of calorie-labelling. The cross-sectional study conducted in an independent catering outlet examined the effect of calorie-labelling on sales of products. Prominent calorie-labelling led to substantial reduction in sales of all labelled products but mostly among those that were high calorie products. The randomised controlled trial led to weight loss among those who were randomised to the intervention groups while those in the control group gained the anticipated weight over a 9-month period.

Conclusion:

Young adults in the UK gain weight when starting higher education. The weight-gain is similar to that observed in young adults in higher education in other countries but higher than the weight gain observed in the general population. Interventions based on different behavioural models were all successful at abolishing this weight-gain. Applying these interventions in a larger scale or making them part of future public health policies could be a significant step towards halting the obesity epidemic.

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To the 33,333 miles

To fellow passengers

To fellow artists

To enemies

To friends

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All the constructive arguments we had

Making me write with **blood**

Only to realise that this blood was **spirit**

The spirit of 'Ubermensch'

Publications arising from this thesis

Full papers

1. Nikolaou CK, Lean MEJ, Hankey CR (2014) Calorie-labelling in catering outlets: acceptability and impacts on food sales. Preventive Medicine
2. Nikolaou CK, Hankey CR, Lean MEJ (2014) Preventing weight-gain with calorie-labelled meals. Obesity.
3. Nikolaou CK, Hankey CR, Lean MEJ (2014) Weight changes in young adults: A mixed method study. Int J Ob.
4. Nikolaou CK, Hankey CR, Lean MEJ (2014) Nudging away at obesity with calorie-labelling. Synthesis of evidence

Full papers submitted

1. Nikolaou CK, Hankey CR Lean MEJ Fuel for weight gain. Nutritional compositions of independent catering facilities and comparison with chain restaurants.
2. Nikolaou CK, Hankey CR, Lean MEJ Accuracy and validation of self-reported weights and heights.
3. Nikolaou CK, Hankey CR, Lean MEJ A randomised trial for weight gain prevention in young adults.

Oral Presentations

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Short communications

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5. Nikolaou CK, Lean MEJ, Hankey CR (2014) Can Calorie Labelling Alter Customer Purchasing Patterns? Obes Rev. 15:(suppl 2)177-205
6. Nikolaou CK, Lean MEJ, Hankey CR (2014) Fuel For Obesity And Thought? Nutritional Composition Of The Evening Meal Offered To University Students In A Catered Hall. Obes Rev. 15:(suppl 2)177-205
7. Nikolaou CK, Lean MEJ, Hankey CR (2013) Calorie labelling of meals in a university catered hall; opinions of students and reported effects on meal choice. Proc Nutr Soc 72, E105
8. Nikolaou CK, Lean MEJ, Hankey CR (2012) Weight and lifestyle changes in first year undergraduate students in rural and urban sites in Scotland. Clinical Nutrition Supplements; 7(1):215
9. Nikolaou CK, Lean MEJ, Hankey CR (2012) Lifestyle changes in first year university students in Scotland and their impact on body weight: A qualitative study Obes Facts 5 (suppl 1) VIII + 280
10. Nikolaou CK, Lean MEJ, Hankey CR (2011) Weight and lifestyle changes in first year students in Scotland. The HEAL pilot study. Obes Rev; 12: S1

Author's Declaration

'I hereby declare that I am the sole author of this thesis, except where the assistance of others has been acknowledged. The planning and design of the studies were completed by myself in collaboration with my supervisors. Recruitment of study participants, delivering of the interventions, data collection, data handling, and data analysis were all conducted by myself. The catering staff posted the calorie-labels on a daily basis in the outlets participating in the studies described in this thesis.

It has not been submitted in any form for another degree or professional qualification.'

Charoula Konstantia Nikolaou

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Abbreviations

WHO	World Health Organisation
ICD	International Classification of Diseases
BMI	Body Mass Index
MRI	Magnetic Reasoning Image
CT	Computed Tomography
WC	Waist circumference
UK	United Kingdom
NHS	National Health Services
ITT	Intention-to-treat analysis
NYC	New York City
FSA	Food Standards Agency
DoH	Department of Health
IT	Information Technology
US	United States
Kg	Kilograms
PA	Physical activity
GD	Goddess Demetra
NTIVC	Not The Ice Cream Van
PI	Principal Investigator

Chapter 1: Introduction

1.1 Definition and Historical Concepts of Obesity

The word ‘obesity’ derives from the Latin word ‘obesitas’, ob + edere and literally, means to ‘overeat’. Obesity, widely considered to be a modern age disease, has its roots back to stone-age. Human obesity is pictured in Stone Age artefacts with the most famous being the ‘Venus of Willendorf’, an 11 cm figurine of an obese female torso found in Austria. In the Stone Age, obesity was a desirable trait as effective storage of energy was crucial for surviving the famine periods.

Obesity is defined by various agencies as a state of adiposity, or as the underlying disease process, which exists before excess adiposity becomes manifest over time:

“Overweight and obesity are defined as abnormal or excessive fat accumulation that presents a risk to health.” (WHO, 2005).

“Obesity is defined as a disease process characterised by excessive body fat accumulation with multiple organ-specific consequences” (SIGN 2010).

Hippocrates-known as the father of medicine-was the first physician to recognise obesity as a disease which can also contribute to the development of other diseases and early death, a concept which is found in the famous Hippocratic aphorisms: `those who are constitutionally very fat are more apt to die quickly than those who are thin' (‘Aphorisms' B44) and when more nourishment is taken than the constitution can stand, disease is caused' (‘Aphorisms’B17; Goold, 1992). Plato also repeatedly emphasised that obesity can lead to corporal diseases (Gorgias' 518C ±D, `Laws' 691C and `The Republic' 557D, Fowler, 1919). While in early human history, and still in some populations exposed to intermittent food shortages, relative excess of body fat and weight confers survival value, chronic and extreme fat accumulation brings costs through metabolic, physical, mental and social ill-health. These secondary pathologies develop over time, and depend on the degree of obesity attained and also on its age of onset and duration (Backholer et al. 2012). The World Health Organisation (WHO) first recognised and included obesity in the International Classification of Diseases (ICD) in 1948 (WHO, 1948). The clinical modification of ICD-10 published in 2007 resulted in the inclusion of morbid data and the allocation to obesity of the code E-66 with subcategories for different classes of obesity (WHO, 2007).

1.2 Assessment of Obesity

As per the definition of obesity, in order to classify an individual as obese, excess fat predisposing to adverse health consequences must be present in the body.

When trying to track and investigate the prevalence of obesity in large populations, valid and accurate field measures of body composition are required. However, it has been questioned how body fat can be accurately measured, and which proxy measure is a better indicator for adverse health consequences (Marshall et al. 1991). The selection of a measure is constrained by time, cost, and reproducibility. Additional considerations must be made, especially for those with excess fat, as it is more difficult to consistently measure obese individuals compared to their lean counterparts, for most anthropometric measures (Heyward, 2001). At the moment, one simple, direct field measure is not available. Instead there are many indirect measures of adiposity, each with their own limitations, and criticisms (Goran, 1998; Marshall et al. 1991).

Commonly used anthropometric measures estimate body size using indices such as height, weight, and circumference measures (Heyward, 2001). Anthropometric measures generally are relatively easy to administer, inexpensive, and require less technical skills and equipment than 'gold standard' methods such as underwater weighing, Magnetic Reasoning Image (MRI) or Computed Tomography (CT) scanning (Heyward, 2001). Anthropometric field measures have to be validated and calibrated against laboratory 'gold standards' measurements and many need modification to use in specific racial groups or age groups. They may not be appropriate in disease status or after periods of major body changes such as weight loss periods. A summary of the most common methods used when assessing obesity with their positives and negatives can be found in **Table 1.1**. It should be taken into account that there is no true method for measuring body composition. The two-compartment methods can be refined to a four-compartment method by adding bone mass and total body water but even this, and the scanning methods are only estimates. Cadaver analysis has been used to 'validate' all of these methods, but it is itself very problematic because of post-mortem changes in hydration.

Table 1.1: Methods for assessing/defining obesity

Method	Definition	Advantages	Disadvantages
BMI	Weight in kilograms divided by square of the height in metres	Correlates with measures of total body fat mass, simple, easy	Cannot diffentiate fat mass from muscle mass, Insensitive to fat distribution
Waist circumference	Measured in centimetres at midpoint between lower border of ribs and upper border of the pelvis, horizontal tape	Better estimate of total body fat than BMI.Also reflects intra-abdominal fat accumulation	Technique needs some training
Skinfold thickness (sum of 4 sites)	Measurement of skinfold thickness with calipers	Estimates total body fat mass similarly to waist circumference	Training needed. Variations between observers. No information on visceral fat distibution

The most widely measure of obesity is the ‘Quetelet’ Index, most widely known as Body Mass Index (BMI) which is the weight in kilograms (kg) divided by the squared height in meters (m). Standard cut-points were adopted for epidemiological classification by WHO (WHO, 2005). Individuals with a BMI≥ 30kg/m^2 are classified as obese, based on life-expectancy data originally but it must be recognised that BMI cannot distinguish between variations in body fat and muscle mass. BMI between 25 and 30kg/m^2 is used to classify ‘overweight’ and BMI over 30 kg/m^2 is used to classify obesity. The main use of BMI is epidemiological and it is not appropriate for clinical assessment. Waist circumference (WC) is a marginally better indicator of total body fat than BMI. It is therefore a better indicator of metabolic disease, and its association with metabolic disease is increased because it also reflects intra-abdominal fat accumulation, the ectopic adipose tissue which is intrinsic to metabolic syndrome. The importance of fat distribution and its link with disease was first observed though anatomical dissection by the physician Joannes Mognani in 1765. He recognized that obesity and visceral fat is linked to metabolic diseases and that position of the fat was crucial (Enzi et al.2003). Recent interest started with the observations of Jean Vague in 1940s and 50s (Vague, 1947, Vague, 1957) and subsequently Bjorntorp and colleagues in Goteborg (Bjorntorp, 1990, Seidell et al.1990), but it was not until the year 1995 that Lean and his colleagues brought attention to the significance of the waist circumference alone, rather than the complex waist/hip ratio which others had explored (Lean et al.1995, Han et al, 1997, Lean et al. 2002) and how it correlates with health and life quality (Han et al 1998). Cut-off points for waist circumference for men and women were developed specifically for health promotion, corresponding broadly with the BMI cut-points. They have subsequently been adopted as part of the diagnostic definition of metabolic syndrome.

In summary, BMI is considered a reasonable marker of fatness or adiposity for epidemiological purposes (WHO, 2006). BMI is a practical, convenient and useful tool for assessment of weight status of groups of people. Its practical advantage is that height and weight are relatively easy and cheap to obtain, and BMI is simple to derive. However, in clinical settings, it can be misleading if applied uncritically to individuals, among whom waist circumference allows better assessment for fatness and health risks.

1.2 Prevalence of Obesity

Traditionally obesity has been a problem of post-industrial countries, but in recent times the prevalence of obesity is rising also in low and middle income countries. The WHO (2006) reported that in 2005, globally, there were about 1.6 billion overweight adults (based on BMI ≥25kg/m^2), with at least 400 million adults considered obese (BMI ≥30kg/m^2). Overweight and obese are starting to become the norm for the world as we have developed a distorted view of normal body weight. Obesity is the most visible yet neglected disease. The United Kingdom (UK) follows a similar trend in obesity, with Scotland having one of the highest rates of obesity in the world, an increase in obesity prevalence of 46% between 1995 and 2003 and a 3-fold increase in prevalence of BMI>40kg/m^2 in the same period (Scottish Health Survey. 2008). The highest growing categories are the highest BMI of >40kg/m^2 or>50kg/m^2 (Grieve et al.2013).

1.3 Co-morbidities of obesity

Obesity is currently considered the major cause of preventable disease. Obesity is associated with higher risk of premature death and disability (WHO, 2006). Co-morbidities of obesity are widely reported across the literature and are summarised in **Table 1.2**.

Table 1.2: Health risks associated with increased BMI

Type 2 diabetes	90% of the cases of type 2 diabetes have a BMI> 23kg/m^2
Hypertension	85% of hypertension is associated with a BMI> 25kg/m^2
Coronary Artery Disease and Stroke	Dyslipidemia develops progressively as BMI increases from 21 kg/m^2
Respiratory Diseases	Neck circumference of >43cm for men and 40.5cm for women is associated with sleep apnea
Cancer	10% of all cancer deaths among non-smokers are associated with obesity
Osteoarthritis	Increasing with increasing BMI
Liver and Gallbladder	Overweight and obesity linked with non-alcoholic fatty liver disease and non-alcoholic steatohepatitis (NASH)

Adapted from Kopelman, 2007

1.4 Aetiology of Obesity

Many cultures, throughout history, have viewed obesity as the result of a character flaw. The fat character in Greek comedy was always a figure of mockery. Out of the 8,000 life-size figures of the Terracotta army of the Chinese Emperor Qin, only one is obese, the entertainer. During the medieval ages, obesity was seen as a sign of wealth. It was assumed that the more you weighed, the higher was the social status. In certain cultures and areas where food is scarce and poverty is prevalent, obesity is still viewed as a symbol of wealth and social status. Obesity is also a sign of power in many cultures. Leaders are expected to be big and fat. The Buddha, from ancient times, has been commonly portrayed as both obese and humorous.

The aetiology of obesity is multi-factorial. There are many complex interactions among and between factors, some yet to be defined. There is a complex interplay of family, community, environment, social demographics, genetics, epigenetics, biology, behaviour, diet and psychology, all intricately interwoven in cause, effects and feedback loops. Global shifts in diet, along with decreased physical activity and increased sedentary activity are seen as the primary attributable factors (WHO, 2006). Obesity has been explained as a natural biological response to a changed environment and that innate body-weight regulatory mechanisms have been overwhelmed by energy-dense diets and sedentary lifestyles (Prentice, 2007 p.89). A different perspective observed from rat animal models suggests that environmental factors and diet are accelerators of obesity, but are not causative (Vickers, 2000). Research teams are considering obesity from numerous perspectives such as prevalence, causation, health consequences and intervention programs from birth to adulthood. Biological, metabolic, behavioural and psychosocial perspectives are used in an effort to identify key factors linked to obesity. Findings are often conflicting due to variation in population groups, measurement methods, population sampling and research designs. Unfortunately evidence is accumulating on the impact of obesity on individual quality of life, increased disease risks, the growing drain on health services, and the mounting associated costs to the individual, community and country. The causes of obesity are complex and dynamic and research aims to identify its determinants and consequences (Hu, 2008e).

Although there are clearly genetic or epigenetic factors which predispose to fat accumulation and obesity, seen in family and twin studies, and from genetics research, these are relatively minor aetiological factors in common obesity, aside from the extremely rare single gene defects. Most of the genes identified as related to weight gain appear to influence appetite and eating behavior, rather than primarily affecting the energy expenditure side of the equation. The recent epidemic of obesity is clearly driven by environmental factors which interact with human psychology and behavioural responses, not by any genetic change.

In seeking to determine pathways to obesity, researchers have used different underlying models, such as the epidemiological triad (Hu, 2008e). This study is based on Social Cognitive Theory (Bandura, 2001) which provides a theoretical framework for understanding, predicting and altering human behaviour, both at an individual and population group level. Briefly, Social Cognitive Theory describes the complex inter-play of individual, environment and behaviour with reciprocal causality (Bandura, 2001; Lindzey, 1978). It suggests that individuals interact, rather than react with their environment throughout their lives (Bandura, 2001) through complex thoughts and actions, beliefs and competencies, and among social influences and structures. These interactions build an individual's attention, memory, modelling and motivation. These life course approaches to investigating obesity, provide for an emphasis on developmental origins of disease, as well as the identification of risk factors at particular life stages (Hu, 2008e).

More recently, research has focused on multi-factorial approaches to identify pathways to obesity, with a heightened call for longitudinal research. In particular, descriptive epidemiology enables an unfolding of patterns and trends over time (Hu, 2008b), particularly in prospective cohort studies. The cohort design is less affected by selection and differential recall bias, provides for periodic collection of data, and is considered the strongest non-randomised study design (Hu, 2008a), although considerations must be made for confounding and reverse causation (Hu, 2008d).

Overall, evidence from prospective cohort studies is considered stronger than analytic epidemiological studies (Hu, 2008a). Physiology, environmental, lifestyle and cultural factors all play important role in the development of obesity. Years of research have been unable to find clear simple causes of the increased prevalence of obesity. One of the major difficulties in obesity research is the problem of causation or consequence. There has been a shift toward interest in epigenetic mechanisms in respect to obesity. There appears to be sub-groups within the population with predisposition to increased adiposity, with evidence of heritability (Silventoinen et al, 2007; Walley et al., 2006), and that this genetic predisposition is strongly interrelated with environmental influences (Silventoinen et al., 2007; Sorensen & Echwald, 2001). These biological mechanisms are being studied in mice showing a genetic tendency for obesity where effects of obesity accumulate over generations (Waterland et al. 2008). Others have shown in rats that fat accumulation is accelerated, but not caused by environmental and behavioural factors (Vickers et al., 2000).

1.4.1 Energy Homeostasis

Hippocrates identified the energy balance equation: 'Aliment fills and exercise empties the body, the result of an exact equipoise between them must be to leave the body in the same state they found it, that is, in perfect health'. Obesity is the result of chronic positive energy balance that leads to excessive fat accumulation.

After Hippocrates laid the basis for understanding energy and weight management within the human body, another two thousand years went by before the general public in Europe, in the early 1600s, began to recognize diet and exercise as means to preserving one's health.

Excess body weight can only accumulate through a positive energy balance. The first law of thermodynamics energy states that energy can neither be created nor destroyed but it can only change form. Therefore even minor changes in energy balance when maintained for a period of time can result in significant changes in body weight. When energy intake equals energy expenditure, body weight remains unchanged. When intake exceeds expenditure body weight increases whereas when expenditure exceeds intake, body weight decreases. A surplus of only 20 calories per day if it is maintained for a year would result in an increase of body weight by almost 1kg (assuming that each kg represents 7,500kcal). If this imbalance was sustained throughout adulthood, it would result in significantly increased body weight. The control of energy intake and expenditure is a complicated procedure. In order to maintain body weight over the years, the two need to match within 0.17% per decade (Weigle, 1994). For that level of precision to be achieved, tight regulation of energy intake and expenditure is necessary.

It is important to recognise that energy intake needs to keep rising in order to present a daily excess above expenditure, because metabolic rate, and the energy cost of daily activities, increase with weight gain.

1.4.2 Diet

The increasing prevalence of obesity may be the result of the cumulative effects of excess daily energy intake (Hu, 2008c; Rennie, Johnson, & Jebb, 2005). However dietary studies have not found secular increases in energy intake (Rennie, Johnson, & Jebb, 2005), nor consistent associations with obesity (Togo, Osler, Sorensen, & Heitmann, 2001). Obtaining accurate information about habitual diets or average nutrient consumptions in populations, particularly populations which are getting fatter, is essentially impossible. Dietary intake assessments are seriously confounded because mis-reporting is usual for most adults (Lara et al.2003) and increasing obesity rates are associated with under-reporting of food intake in this group (Rennie, Johnson, & Jebb, 2005). The evidence generally suggests that a diet high in fruits, vegetables, reduced fat dairy, whole-grains, along with low intakes of red and processed meat, fast food and soft drinks is associated with smaller gains in BMI and waist circumference (Newby et al. 2003). Also, in adult middle aged women, an inverse relationship was shown between increased fruit and vegetable intake and risk of obesity or weight gain (He et al. 2004). It is most important to recognize that population health surveys and cohort studies with follow-up can only identify associations. There may be causal associations but dietary variables are also markers for other behavioural patterns.

1.4.3 Physical Activity

The level of participation in physical activity (PA) is considered to be an important factor in the prevention of obesity (Flynn et al., 2006). PA levels themselves are the result of a complex causal web of influences. Cause and effect with respect to BMI is still debated. Over the years there has been conflicting evidence regarding the relationship between adiposity and physical activity, at least part of which arises from measurement issues. While BMI, and changing BMI or waist circumference can be measured reliably, most studies have used self-reported physical activity levels using a variety of questionnaires. In general these questionnaire methods perform very poorly against measured physical activity (Helmerhorstet al.2012), so substantial bias is introduced. Misreporting of PA and diet are both most pronounced in cross-sectional studies, so conclusions should only be drawn from longitudinal studies. Dragan and Akhtar-Danesh (2007) reported an inverse relationship between physical activity and BMI, that is, with increasing levels of physical activity there is decreasing obesity.

1.4.4 Sedentary behaviour

Traditionally obesity research has focused on physical activity and diet. Recently, however, the role of physical inactivity has been highlighted, especially in the view of the increasing screen time spent by both adults and children. Currently, the lifestyles led in western society are increasingly sedentary. This applies for transport, work, play, entertainment and general living (Struber, 2004). Physical inactivity generally describes sedentary activities such as sitting, screen time and reading, as well as sleep time (Zderic & Hamilton, 2006). It may be an independent risk factor for obesity (Chaput & Tremblay, 2009; Struber, 2004) insulin sensitivity (Alberti, Zimmet, & Shaw, 2006) and metabolic syndrome (Zderic & Hamilton, 2006) and generally chronic disease, disability and premature death (Haskell, Blair, & Hill, 2009). Recent work found that physical inactivity in adolescence was predictive of obesity into young adulthood (Pietiläinen et al., 2008), with sleep time also thought to be important (Chaput & Tremblay, 2009).

1.4.5 Individual obesogenic behavioural factors/ Self-Concept

The term 'obesogenic' is used to describe factors that lead people to becoming overweight or obese. Factors affecting obesity related to the individual include one's innate abilities, knowledge and skills to interact in their environment (Bandura, 2001). Behaviour is influenced by an individual's thoughts and actions, peers, and social structures. 'Self-concept' may play a role in respect to obesity, although study results are mixed (Field, 2008). One's self concept determines how one perceives their ability to perform tasks. Self-concept is a prominent construct in investigations of human behaviour (Hagger & Luszczynska, 2014.), providing an avenue to articulate characteristics of self and their role in specific behaviours.

1.5 Economic cost of obesity

Obesity puts a huge economic burden on societies, not only through increasing costs for health care systems for the treatment of obesity (a very small part) and management of its co-comorbidities (a very large part), but also by affecting employment, production levels and economic development of countries.

From the UK's perspective, modelled projections suggest that indirect costs could be as much as £27 billion by 2015. In Scotland, the total societal cost of obesity and overweight in 2007/08 was estimated to be between £600 million and £1.4 billion, while the cost for the National Health Services (NHS) of Scotland may have been as much as £312 million. The direct costs of obesity to the NHS are likely to be much greater than this because these estimates are largely based on the costs a very few medical consequences of obesity such as Type 2 Diabetes, CHD, colon cancer. Obesity increases healthcare costs for every subspecialty of medical practice, and increases prescriptions in almost every class of prescribed drugs. However, it is not possible to obtain adequate data broken down by age sex, and BMI for most diseases, in order to estimate the attributable costs of obesity.

There is evidence that obesity may cause unemployment and lower wages for those employed. Obese people are less likely to be productive and obese women, more than men, can face workplace discrimination over their appearance. Overweight and obese white women earn 4.5% and 11.9% less, respectively, than normal weight white women (Cawley, 2004). A similar study found that the wages of white women peak at a BMI of 22.5 while wages for black women peak at a BMI of 26.1 kg/m2 (Gregory & Ruhm, 2011). Data from the English Health Survey, reveal a similar pattern (Morris S, 2004). Obese males are 27% less likely to be in paid employment with severely obese are 44% less likely to be paid employment. Obese females are 33% less likely to be in paid employment and severely obese are 55% less likely to be in paid employment.

This might be a particular problem for governments as young adults often take out financial loans to fund their studies which are only to be repaid when an individual is employed and earns above £16,910 per year (http://www.hmrc.gov.uk). The student loans company in Scotland, between 2000 and the end of April 2013, has issued 347,500 loans for Scottish domiciled students with an average amount of £6,480 borrowed per student (www.slc.co.uk). The Scottish government, therefore, has budgeted for an income from loan repayments over the next 40 years of £2.6 billion plus £21.8 billion from income tax.

If the current prevalence of obesity were to remain unchanged at 27.4% in 2010 (SHS, 2010), 95,215 students out of the 347,500 who took out loans will end up obese. Using the data from England on employment of obese people, 30,469 out of the 95,215 obese students will end up to be unemployed. In numbers that means that the government will lose £197.5 million from loan-repayments and £3.05 billion from income tax.

Thus preventing obesity in young adults is economically justified not only through savings from medical expenses for the treatment of obesity and its co-morbidities, but also through the substantial predicted shortfall from the repayment of student loans and losses through income tax as a result of the known effect of obesity on employment.

1.6 Prevention of Obesity

Since ancient times, there have been reports of people wanting to control their tendency to overeat. The Egyptian's method of limiting the food was primitive. They vomited and purged themselves three times every month with a view to preserve their health. Pythagoras recommended, rather than eating too much and then vomiting and fasting, to follow moderation: 'No man, who values his health, ought to trespass on the bounds of moderation either in labour, diet, or concubinage'. The physician Iccus combined exercise and diet to preserve health. Herodicus, one of Hippocrates' teachers, was successful in prolonging his life by regulating diet and exercise. Plutarch also noted in his work that thin people are generally the healthiest: 'We should not therefore indulge our appetites with delicacies or high living, for fear of growing corpulent. The body is a ship which must not be overloaded'. Nowadays, most of the research on obesity concerns developing treatment, with less on preventing its onset. Once obesity establishes, it is very difficult for an individual to return to a normal weight, therefore preventing obesity the next rational step.

1.7 Critical Life course Periods for weight gain and the development of obesity

Pathways to obesity are dynamic and influences change over time. If research can identify periods of particularly frequent, or more rapid weight gain, and the factors implicated at these times, then appropriate and timely prevention measures could be introduced (Hilbert, Rief and Brahler, 2007). Many periods have been proposed as critical for the development of obesity, including infancy, early childhood and adolescence, the transition from adolescence to young adulthood, pregnancy, and middle age (Lawlor & Chaturvedi, 2006).

1.8 Weight gain during emerging adulthood

The time of life when weight gain is most rapid is during the transition from adolescence to adulthood (Lean et al, 2013, Vlassopoulos et al, 2013) which makes this an interesting period to intervene in an attempt to prevent development of obesity. Data from the CARDIA cohort in the US on 5,115 young adults (18-30 years old at baseline) showed that the percentage of participants who were overweight increased in all groups, with the largest weight gain among those in their early to mid-twenties compared to those in their thirties (Lewis et al.1997, Lewis et al.2000). The US National Longitudinal Study of Adolescent Health which assessed 9795 adolescents (13-16 years old at baseline) found a 13% increase in obesity incidence (BMI>30kg/m^2) after 5 years (Gordon-Larson et al. 2004).

Young adulthood is a period when health is usually optimal, with few diseases present. It should be a good time for health promotion and prevention of chronic disease, but the conventional 'medical model' of health promotion, offering information and advice pragmatically at medical contacts reaches few young adults. Young adults belong to an age group with unique characteristics. Extensive demographic changes such as delays in marriage and childbearing and increases in higher education that have occurred the past few decades have created a distinct period of life called 'emerging adulthood' and defined as the age between 18-25 years old (Arnett, 2000). During that time emerging adults try to develop their self-identity by exploring different behaviours and ideas while experiencing significant life changes.

1.8.1 Entrance into higher education as a critical period for weight gain

Entrance into higher education has been proposed as a particularly critical period for weight gain during young adulthood. The weight gain occurring in the first year of university/college, known as the 'Freshman 15' phenomenon refers to the number of pounds that the students were thought to gain during the first year of full time college (Brown, 2008).

Exploring this critical period would possibly allow the design of interventions to prevent weight gain and thereby reduce progression into obesity among susceptible individuals.

A literature review was performed in 2011 using OVID/Medline with the key words Freshman 15, weight gain and young adults, college students/university students. Thirty three studies from USA and one study from UK that had examined the weight gain in students were identified. All studies are in English language and published between 1985 and 2011 (**Table 1.3**). The duration of the studies ranged from one semester (September to December) to sophomore years (2^{nd} year of studies) and the outcome measures ranged from absolute weight change to eating questionnaires, stress questionnaires and body composition in an attempt to explore the aetiology of the weight gain at the same time. There are studies that examined only students of one sex or differences between sexes.

The first study that identified the rapid weight gain occurring in students in the first year of university was published back in 1985. Hovell et al followed 123 college women and 28 community women over a three-year period and found that the college women gained 7.3lbs/month and were 2.6 to 5.2 times more likely to gain 15% or more above the ideal weight compared to community women (Hovell et al.1985). In 1989 the first article referring to the weight gain in students was published in a teenage magazine in USA and the ‘Freshman 15’ term was coined. Since then more than two hundred newspaper or magazine articles on the topic were published (Brown, 2008).

While the first peer-reviewed paper was published in 1985, further studies on the ‘Freshman 15’ phenomenon started being published only in the 2000s. Studies that examined the weight gain in the freshman year found a weight increase ranging from 0.75kg to 3.45kg (Mihalopoulos et al.2008, Provencher et al. 2009, Anderson et al. 2003, Delinsky & Wilson, 2008, Cluskey & Grobe, 2009, Serlahious et al.2007, Pilner & Saunders, 2007, Lowe et al.2006, Yakusheva et al.2010, Kapinos & Yakusheva,2011, Jung et al.2008, Butler et al.2004, Economos et al. 2008, Levitsky et al.2004, Morrow et al.2006). Five studies followed the students into their senior year (second year of studies) and found a weight increase ranging from 2.95kg to 4.1kg (Lloyd-Richardson et al.2009, Racette et al. 2008, Gropper et al.2011, Racette et al. 2005). Some studies looked at the effect of the transition from high school to university and found that weight gain ranged from 1.5kg to 3.0kg (Wengreen & Moncur, 2009, Holm-Demona et al. 2008, Pullman et al. 2009, Edmonds et al.2008). Weight gain was related to increased alcohol intake (Economos et al.2008, Lloyd-Richardson et al.2008), reduced physical activity (Racette et al.2008, Wengreen & Moncur, 2009, Yakusheva et al.2010, Kapinos and Yakusheva, 2011, Racette et al. 2005) and changes in eating habits

(Poddar et al.2009, Racette et al.2008, Wengreen & Moncur, 2009, Hajhosseini et al.2006, Jung et al.2008, Butler et al.2004, Economos et al.2008). Since first year students may still grow in height, some studies examined weight changes by incorporating measures of body composition. Five studies (Hull et al.2007$_a$, Morrow et al.2006, Hull et al.2007$_b$, Poddar et al.2009, Mifsud et al.2000) utilised Dual- Energy X-ray Absorptiometry (DEXA), two studies (Butler et al.2006, Graham & Jones, 2002) utilised skin-fold thickness and three studies (Edmonds et al. 2008, Gropper et al.2009, Hajhosseini et al. 2006) utilised Bioelectrical Impedance (BIA). Misfud et al found an increase of 3.1% of body fat in males over the first semester and an increase of their waist circumference of 2.7cm (Mifsud et al.2009). Increased alcohol intake explained 34% of the changes in WC and % BF (Mifsud et al.2009). In female students body fat increased from 22% to 23.8% and waist circumference by 2.5cm by the end of the sophomore year (Edmonds et al.2008). Gropper et al found a similar increase in the percentage of body fat (1.2+-1.7% in males and 0.7+-1.7% in females) by the end of the first semester (Gropper et al.2009).

All studies have certain limitations in common which may have affected the results. First, the study samples of the studies may be unrepresentative as all were convenience samples. Selection bias occurring from unrepresentative samples are those of the under coverage, no response and voluntary response. Some studies recruited participants from nutrition or psychology courses (Poddar et al.2009, Delinsky & Wilson, 2008, Pilner & Saunders, 2007). Furthermore, there were high attrition rates in most of the studies, with less than half of the participants completing measurements at the end of the study. Another limitation in some studies was the fact that weight and height were self-reported. Heavier people tend to underestimate their weight while over reporting their height (Brunner, 2007, Kuczmarski et al.2001).

Overall, the anecdotal 15 pounds of weight gain is probably an overestimation as a meta-analysis of 24 studies showed that students gain 3.86 +- 1.86lb on average in the first semester (Vella- Zarb & Elgar, 2009). However it should be noted that there is a proportion of students that lose weight since entering higher education and this could bring down the mean weight gain. The scale of weight gain is more apparent when one explores the students that gain weight. Hence, even if the weight gain is less than 15 pounds it is still of concern as the continuous rise could lead to students becoming overweight or obese and especially those that have higher BMI when they enter university (Guo et al.2002, Provencher et al.2009).

To date, only one study looked into this trend in UK students entering higher education. This study showed a significant weight increase (1.53SD2.70kg, p<0.001) over two academic semesters (Serlachious et al. 2007). The participants self-reported their weights and heights through an on-line questionnaires.

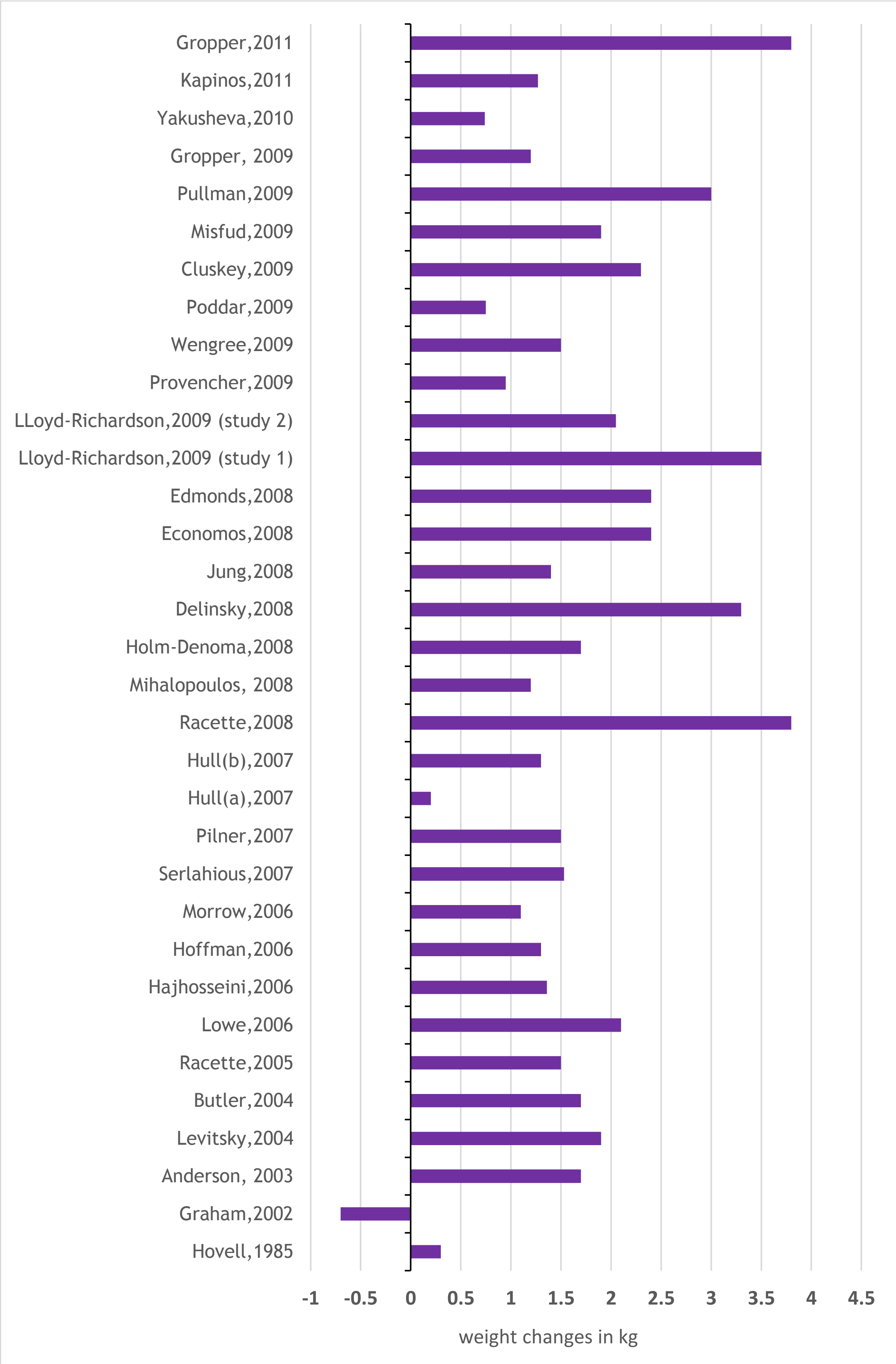
Table 1.3: Studies on weight gain in young adults attending higher education

Author	Year	Sample Size	Country	Outcome Measures	Weight Changes	Limitations
Hovell	1985	123 university women , 28 community women	US university US community	Height, weight, BMI,	0.33kg/month (university women)	Small comparison group, all female
Graham	2002	49 students (39 females, 10 males)	Liberal US college	Height, weight, BMI	-0.7kg	Small sample size, measurements at baseline collected from Health Centre records
Anderson	2003	135 students	US University	Height, weight, BMI	1.7kg/year	Only 46 students had completed measurements at the end of the freshman year
Levitsky	2004	60 students	US University	Height, weight, BMI	1.9kg/year	Small sample size
Butler	2004	54 female students	US University	Height, Weight, BMI,	1.7k/year	Female only, small sample size
Racette	2005	764 students	US University	Height, weight, BMI,	1.5kg/year	Participants recruited over two years(274 enrolled in 1999 and 490 in 200) 290 returned for measurements at the end of sophomore year
Lowe	2006	69 students (all female)	US university	Height, weight, BMI	2.1 kg/year	Small sample size, all female
Hajhosseini	2006	27 students	State US University	Height, weight, BMI,	1.36kg/year	sample size small, mostly female participants
Hoffman	2006	67 students	US University	Height, weight, BMI,	1.3kg/year	Small sample size
Morrow	2006	137 female students	US University	Height, weight, BMI	1.1kg/year	Small sample size, female only, total number of students 25,000.
Serlahious	2007	268 students (100 men and 168women)	UK University	Weight, height, BMI,	1.53kg/year	Self-reported data, small sample size

Pilner	2007	113 students (15 males, 57 females)	Canadian University	Height, weight, BMI,	1.5kg/year	Small sample size, 72 completed both measurements, participants recruited from psychology course
Hull(a)	2007	171 students	US university	Height, weight, BMI,	0.2kg/year	Female students only, small sample size, 48 completed the measurements
Hull(b)	2007	171 female students	US university	Height, weight, BMI,	1.3kg/year	Small sample size,137 completed 2nd measurement, 69 completed the 3rd measurement, all female
Racette	2008	204 students (138 females, 66 males)	Private US University	Height, weight, BMI	3.8kg/year	Participants enrolled over two years (97 students in year 1999 and 107 students in year 2000)
Mihalopoulos	2008	125 students	Private US university	Height, weight, BMI	1.2kg/year	Self-reported data, small sample size, no data on gender
Holm-Denoma	2008	567 students (226 males, 341 females)	US college	Height, weight, BMI	1.7kg/year	Data collected in 1995
Delinsky	2008	149 students (female)	US University	Height, weight, BMI,	3.3kg/year	Participants recruited from psychology course, 337 recruited at baseline
Jung	2008	133 female students	US University	Height, weight, BMI,	1.4kg/year	Female only, 101 students completed all 4 measures
Economos	2008	396 students	US University	Height, weight, BMI,	2.4kg/year	Small sample size
Edmonds	2008	116 female students,	Canadian University	Height, weight, BMI,	2.4kg/year	Female students only, small sample size
Lloyd-Richardson	2009	Study 1: 904 students (494 males, 410 females) Study 2: 382 students (150 males, 232 females)	Study 1: state US University Study 2: private US University	Height, weight, BMI	Study 1: 3.5kg/year Study 2: 2.05kg/year	Participants in study 2 enrolled over two years, 2004 and 2005, Study 1: self-reported height and weight at baseline

Provencher	2009	2753 students	6 Universities Canada	Height, weight, BMI	0.95kg/year	Participants enrolled over two years (1st year 1075 students, 404 males and 671 females, 2nd year 1678 students, 890 males and 935 females), self-reported data, 1,326 students completed study
Wengreen	2009	159 students (102 females, 57 males)	State US University	Height, weight, BMI,	1.5kg/year	Participants with BMI>25 more likely to drop out
Poddar	2009	76 students	US University	Height, weight, BMI	0.75kg/year	Small sample size, students recruited from nutrition course
Cluskey	2009	379 students (227 males, 152 females)	US college	Height, weight, BMI	2.3kg/year	
Mifsud	2009	29 students (16 females, 13 males)	Canadian University	Weight, Height, BMI	1.9 kg /year	Small sample size
Pullman	2009	108 students	US University	Height, weight, BMI	3.0kg/year	Small sample size, all male
Gropper	2009	240 students (156 females, 84 males)	US University	Height, weight, BMI,	1.2kg/year	Small sample size, 214 completed all measurements, 4191 total number of students
Yakusheva	2010	144 students	private US university	Height, weight, BMI,	0.74kg/year	Small sample size, Only females
Kapinos	2011	537 students (344 females and 193 males)	US university	Height, weight, BMI,	1.27kg/year	Self-reported data
Gropper	2011	120 students	US university	Height, weight, BMI,	3.8kg over the two years	

Figure 1.1: Weight changes reported by the studies included in the literature review



1.9 Aims and research questions of this thesis

Aim 1:

To explore and quantify the weight changes in young adults attending higher education in UK.

Research questions:

1. Is weight gain a problem for young adults in higher education in the UK?
2. What is the scale of the problem?
3. Which are the factors influencing weight changes?
4. What do young adults think of these weight changes?

Aim 2:

To design appropriate interventions to prevent unwanted weight gain and the onset of obesity in young adults attending higher education.

Research questions:

1. What is the current evidence for weight gain prevention in this population?
2. Which behavioural models could be used for obesity prevention?
3. Could nudging in the form of calorie-labelling (Thaler & Sunstein, 2008) lead to weight gain prevention?

Aim 3:

To test the effectiveness and the cost-effectiveness of these interventions and assess their impact for public health policy

Research questions:

1. Can weight gain in young adults be prevented through the application of a variety of behavioural models? How much weight was prevented?

1.11 Overview of the thesis

Topics covered in each one of the following chapters are briefly outlined here.

Chapters two and three aimed to answer the first four research question using a combination of methodologies. As a relatively new area of research, both quantitative and qualitative methods were used for exploring young adults' lifestyles and quantifying any weight changes.

Chapter four explored what is the evidence currently behind weight gain prevention in young adults, what conclusions could be drawn, and what techniques were used up to now in those studies and which could be tested or applied within the remit of this thesis.

Chapter five explored the behavioural models used in weight-loss studies and offers an introduction on the behavioural models used in the studies described in the next few chapters.

Chapter six explored the evidence behind the calorie-labelling as an anti-obesity tool. A systematic literature review and a meta-analysis was conducted to determine the effect that calorie-labelling could have on calories chosen and potentially on obesity.

Chapter seven describes the nutritional composition of meals offered to young adults and how these compare with the current recommendation of nutrient intake and with meals provided by popular chain-restaurants. This is part of the study described in chapter 8.

Chapter eight describes an interrupted time series study, carried over two years in a residential student hall to examine the effect that calorie-labels would have on the body weight among those exposed to the labelling. Young adults' and catering staff's on labelling were also explored.

Chapter nine describes a study exploring the effect of calorie-labelling on sales and customers' attitudes and reported use of the labels. The study was carried out in an independent catering outlet that provides services to a big proportion of young adults.

Chapter ten describes a randomized trial aiming at weight gain prevention using two behavioural strategies in the form of modules delivered on-line.

Chapter eleven describes the validation between self-reported and measured anthropometric data used in the studies described in chapters three, four, eight, and nine.

Chapter twelve is the general discussion of this thesis and answers to the aims and research questions along with future research questions stemming from this work.

Table 1.4 Overview and timeline of the studies included in this thesis

Chapter	Description of Studies	Year study was conducted
2	Online pilot study, asking about self-report weight changes and various lifestyle issues, administered at three institutions	2009-2010
2	Online focus group carried out in one institution	2010-2011
3	An online survey of students' heights and weights and lifestyles conducted in Sept 2011 with follow-up April 2012. A validation of self-reported weights and heights is also included.	2011-2012
4	A literature review of weight gain prevention studies	2012-2013
5	A literature review of certain behavioural theories	2012-2013
6	A literature review of calorie labelling studies with a meta-analysis. Students' responses to calorie-labelling included in the analysis. Data collected from the questionnaire described in chapter 3.	2011-2012
7	Analysis of nutritional composition of hall of residence meals and comparison with those in chain restaurants	2011-2012
8	A calorie labelling experiment conducted late in the 2011-12 academic year and throughout the 2012-13 year which also included self-reported and validated heights and weights	2011-2013
9	A study of the effects which labelling sandwiches at university catering outlets had on sales data and including some process evaluation, conducted March-April 2013	2013
10	An RCT of two online weight gain prevention modules for students which also included self-reported and validated heights and weights	2012-2013

11	A validation of self-report heights and weights 2010-2013 including also the data used for validation in chapters 3, 8, and 10.

*The author of this thesis conducted this PhD programme by combining part- and full-time studies.

Chapter 2:

A pilot study exploring weight changes and methodologies

Overview of chapter

This chapter is an introduction to the topic of weight changes in young adulthood in Scotland. The pilot study described in this chapter was designed to capture the weight changes occurring during the first year of studies in different settings, explore the causal factors for any weight changes, and to trial different delivery modes of a questionnaire. A qualitative study was also carried out to gain better insight into this topic.

2.1 Introduction

Obesity prevalence is rising worldwide despite widespread publicity on the adverse health consequences and the development of interventions for treatment (Lobstein & Leach 2007). Particular stages in the life-cycle have been identified when individuals are particularly susceptible to weight gain and may be receptive to advice, guidance, and persuasion to challenge this. Young adults are one population where obesity prevention is justified; the prevalence of obesity in this group is the lowest among the adults in Scotland, 9 and 17% for males and females respectively (SHS, 2011).

Young adults attending higher education appear especially susceptible to weight gain, highlighted by the ‘Freshman 15’ phenomenon in the United States (Crombie et al, 2009), although few studies have examined the causal mechanisms behind these weight changes. Lifestyle changes seem to occur during the transition from secondary education to University education, and could facilitate weight changes (Vella-Zarb & Elgar, 2009). Clarification of the causal factors for weight gain in young adults can assist in the design of effective interventions. Weight gain at commencement and throughout further education in Scotland is under researched, and hence effective interventions non-existent. Investigations are justified in a country with the highest prevalence of adult obesity in Europe (SHS, 2011).

The aim of this mixed methods study in a population of first year undergraduate students in higher education was to: 1) develop and pilot a questionnaire to collect information on lifestyle practices, self-reported body weight and opinions on diet and health, 2) evaluate different approaches to expose students to such a questionnaire to enhance response rates, 3) Identify resources or services that are attractive to students to guide them in establishing lifestyle habits to avoid unwanted weight gain 4) Identification of barriers to and facilitators of healthy lifestyles.

2.2 Methods

A triangulation protocol was used incorporating quantitative methods to estimate the scale of the problem and qualitative methods to explore experiences and perceptions (O'Cathain, Murphy and Nicholl, 2010). Qualitative methods are often useful to explore experiences (Pope and Mays, 1995), and are appropriate in areas such as this, which have yet to be broadly explored.

2.2.1 Participants and setting

For the quantitative part, convenience sampling was used to recruit participants from three educational establishments in the West of Scotland; two Universities and one further education college. The establishments differed in the subjects offered, the level of educational qualifications, age of students and location, two were urban (urban university 1, urban university 2) and one rural (rural FE).

All first year undergraduate students from the three educational establishments were contacted by email, providing information on the study including the information to be collected and a link to the survey. A commercial website (SurveyMonkey) was used deliver the on-line survey, and to enhance response rates a reminder email was sent to all students after two weeks. To evaluate distribution methodologies, in one setting (rural Further Education FE), the questionnaire was delivered in person in addition to online. After an initial email contact, students at the urban university 1 were sent a questionnaire by post with a prepaid return envelope. The study was approved by the University of Glasgow Medical School ethics committee (27/04/2010) (Appendix 1).

For the qualitative part, the study was conducted at the end of the academic year (Summer 2011), after the final exams. The questions used in the focus group were devised based on preliminary results from studies exploring the lifestyle and weight changes in Scottish university students. The questions were reviewed by an independent qualitative research expert.

All first year undergraduate students studying in the University of Glasgow, in the West of Scotland were eligible to participate in the study (n=3,500) and were sent an email informing them about the study, and providing a link to the website where the on-line focus group was hosted together with the password to enter the focus group. The study was approved by the ethics committee of the Medical School of University of Glasgow (7/11/2011) (Appendix 2).

2.2.2 Measurements

Quantitative: A short questionnaire containing 22 items on eating, exercise, lifestyle habits was devised. The questionnaire included multiple response questions along with a one open option response. Students were asked to report any weight change, as a self-determined value. Self-reported weights and heights were reported either in metric or imperial units, and BMI calculated by the researcher (Appendix 7).

Qualitative-Focus group: The focus group was conducted in an on-line environment familiar to the participants. Seven questions exploring lifestyle changes since starting university, based on a pilot study were posed by the moderator on the commercial website platform (Proboards) used to handling an asynchronous, password-protected focus group. The questions were reviewed by an independent qualitative research expert and asked whether the participants had gained any weight during the first year of their studies and the likely causes for any weight or lifestyle changes. The ground-rules for the focus group were posted in the on-line platform, and responses posted were monitored by the moderator to eliminate any inappropriate content. Participants were encouraged to answer the questions freely with as much detail as possible, and to comment respectfully on each other's responses if they wished to do so. The forum was open 24hrs/day for a month to accommodate all participants.

2.3 Analysis

Quantitative analysis-Statistics

Descriptive statistics and ANOVA were performed with the SPSS statistical software (IBM, SPSS statistics, Version 19).

Qualitative analysis-Focus group

Transcripts were extracted directly from the commercial website handling the focus group, and both content and thematic analyses were carried out using ATLAS.ti 5.2 software (Scientific Software Development GMBh, Berlin, Berlin-Brandenburgh, Germany). Content analysis was used to capture quantitative aspects and thematic analysis to capture themes and emergent thematic patterns. This analysis was inductive, not restricted by any a priori theoretical framework. Transcribed data were analysed initially line by line, and codes were assigned. After the initial labelling of data, similarly coded excerpts were grouped. Repeated words/phrases were quantified to identify main themes.

2.4 Results

2.4.1 Response Rates

Final response rates in the three educational establishments were; urban university 1: 30% (19% through e-mail and 11% through postal recruitment), rural FE: 4% (3% through e-mail and 1% through in person recruitment) and urban university 2: 36% (only e-mail recruitment) for each institution respectively. The use of reminder emails to the students increased the response rate in all settings. In the urban university 1 the first email generated a 12% response rate and the reminder a further 7%, for the rural FE the first email generated a 1% response rate and the second a further 2%, and for the urban university 2 the first email generated a 27% response rate and the second a further 9%. No apparent problems were identified with any of the questions in the questionnaire. Cronbach's Alpha for the scale questions was 0.405

2.4.2 Participant characteristics

One hundred and ninety three students participated in the study (69% were females and 18% were overweight or obese at the time of the survey. The mean age of the participants was 20.5 SD 4.2 years old. The majority (n=79, 41%) lived at home with their parents while 68 students (35%) lived in University halls with or without catering, while the smallest proportion (24%) living either with partners or in private flats. Participants from the first institute had higher mean BMI and body weights than those at the others (p=0.003) (Table 2.1) and the majority still lived with their parents. The majority of the participants reported consuming alcohol (88%) and the 30% reported smoking. Close to three quarters of participants (72.5%) reported changing their eating habits since they started higher education, in particular consuming less fruit, fewer vegetables, more snacks and more alcohol.

Table 2.1: Participants' characteristics

	Total n=193	1st Institute (Rural, Further Education) n=27	2nd Institute (Urban, University 1) n=102	3rd Institute (Urban, University 2) n=64
Age (years)	20.5 (4.2)	20.7 (5.7)	20.7 (4.2)	19.8 (1.4)
Height (m)	1.69 (0.09)	1.71 (0.10)	1.7 (0.1)	1.68 (0.09)
Weight (kg)	64.5 (13.3)	74.3 (0.2)	60.7 (8.9)	62.4 (10.5)
BMI (kg/m2)	22.5 (3.9)	25.8 (5.7)	21.2 (2.2)	22.0 (2.6)

Data Mean and SD

2.4.3 Weight changes

Over half of all participants (56%) reported that their weight had increased over their 8 months within higher education while 34% reported a decrease. For those who reported weight gain, this ranged from 0.5-5.5 kg. The reasons participants gave to explain their weight gain were; becoming less active (31%), eating more (29%) and financial constraints (32%).

For those who reported a weight decrease over the last eight months, this was largely intentional, with 39% reporting consciously deciding to lose weight. No data on weight change in this group were collected. For those (10%) who reported remaining weight stable, 40% reported regular self-monitoring their weight and implementing changes in both eating patterns and physical activity (33%).

2.4.3 Services for students

More than a third of the participants reported concern about their current weight and 41% would welcome advice on weight management. Participants from the second institute reported being more concerned about their weight compared to the first and third ($p=0.003$). They reported that joining a gym (55%) or web based information on healthy eating and the calorie content of food (40%) would help in weight control.

2.4.4 Focus Group Results

Of the 31 first year university students who participated in the online focus group, only one reported having made no lifestyle changes since starting higher education. Thirty participants indicated that coming to university has led to significant lifestyle changes. These lifestyle changes mainly involved an increase in alcohol consumption and snacking.

'Yes, definitely. I drink considerably more than I did before starting uni (sic) (although this also coincided with me turning 18) and my diet is very poor in comparison when I was at school.'

'YES, been drinking more and thus acne has gotten quite bad. Been able to exercise more which balances out eating not as healthily as should be.'

‘Yes, I tend to eat only two meals a day when at uni (sic) due to lecture times etc.’

‘Lot more alcohol, lot more exercise, lot more pasta’

‘Yes. In terms of diet, I eat much the same as I used to at home, although my portions are much larger as I always feel really hungry after a full day at uni (sic). As I stay up late at night (12ish, 1am) I usually end up snacking around 11pm too. In terms of exercise, I do less than I used to as I cannot find the time. I don't drink alcohol, so that is the one thing that hasn't changed at all.’

Fourteen participants reported that they gained weight since the beginning of the academic year while eleven reported losing weight at the same time and three managed to maintain their weight. One participant mentioned gaining a significant: amount of weight during the first semester of studies but lost the weight during the second semester through a conscious effort.

‘I have gained a lot of weight since starting uni (sic).’

‘Yes, I have lost a bit of weight during the semesters but when I'm not at uni (sic) I seem to put it back on as I just eat anything and everything because its there and I don't need to pay for it.’

‘Yes, I gained weight, because I don't have a bike in Glasgow’

‘I feel I have put on weight this year - mainly through my own laziness’

Participants reported that they value the services offered by the University however some improvements would help them with dealing with what they identified as barriers to healthy lifestyles (Table 2.3, 2.4, 2.5, 2.6).

Table 2.2: Services that students would like University to offer

Themes	Sub-themes
Economic issues-incentives	Gym membership including at the tuition fees Free membership Food vouchers Free easy recipes Cheaper fruit/healthy food Half-price meals
Better service	Variety of classes Later Gym classes More fun activities
Poor availability	Healthier food on offer Access to healthier food options in University facilities
Education and Health Promotion	Cooking classes Nutrition classes Healthy eating advice and information

'Healthier& fresh food options at the unions at reasonable prices, an online weight tracker? the gym open for longer on Saturday and Sunday, a sports day thing?(just a random idea'

'Give us Wednesday afternoon off, offer a salad bar at the canteen at vet(sic) school'

'I think that maybe there should be something on how to cook as a student for dishes that are both healthy and cheap and also to maybe get the uni(sic) to make us do some sort of sports activities.'

'Some form of subsidised lunches for less well-off students (something like a half-price dinner ticket or perhaps a loyalty card e.g. buy three lunches in the week get a fourth free).'

Main themes

Main themes and sub-themes emerged from the thematic analysis are shown in Tables 3.3, 3.4, 3.5, and 3.6.

Table 2.3: Barriers to healthy eating

Themes	Sub-themes
Young people's attitudes/views	Healthy eating is time consuming and therefore inconvenient Healthy food is expensive
Psychological (internal) factors	Comfort eating (quick fix , treats) Being stressed –tired Lack of motivation
External (environmental) factors	Living in student accommodations Location –easy access to less healthy food
Being busy (lack of time)	Long days at university (lecture schedules) Work and university responsibilities (exams etc)

Table 2.4: Facilitators of healthy eating

Themes	Sub-themes
Control and confidence	Cooking skills Responsibility for shopping Ownership/choice /autonomy
Knowledge	Healthy eating habits Budget (skills –allocate money for healthy food)
Normative beliefs	Peer influence (flatmates as social opportunities / fun) Significant others -partner
Internal/personal factors	Ideal body-image Feeling good/better/satisfaction Preferences (healthy is tasty, pleasing)

Table 2.5: Barriers to Physical Activity

Themes	Sub-themes
Perceived internal/personal barriers	Lack of motivation Lack of energy-tiredness Keeping feet-control weight-appearance Release of stress (coping strategy)
Environmental factor	Availability, accessibility and affordability of facilities Safety
External barriers	Lack of time Work/study commitments Expense (gym too expensive) Weather
Social determinants	Lack of peer/instrumental support

Table 2.6: Facilitators of Physical Activity

Themes	Sub-themes
Personal Factors	Coping with stress Distraction from University work Setting goals/targets
External factor	Variety of classes Weather Low price of gym
Normative behaviours	Peer influence
Social determinants	Friends Joining University sport clubs

Three main themes emerged from the thematic analysis as both barriers to and facilitators of healthy lifestyles.

Theme 1: Budget

Students reported that budget has an impact on eating healthy as ‘healthy food’ cost more and usually ‘unhealthy food’ is on offer e.g. chocolate. Having to deal with a limited budget, be responsible for the shopping of food and cooking often for the first time has been reported as a challenge by the students.

‘I receive the maximum loan (c£500 per month), after rent and bills are paid, this leaves me with around £40 per week (on average, but this isn't always the case as I often spend £80 the first week which leaves me short for the other 3). £40 pw equates to £5.70 per day. It is unfeasible to spend the entire amount on food obviously - hence why my dietary habits are often irregular.’

‘The idea that a healthy mind is a corollary of a healthy body motivates me to eat well. But I am a slave to special offers at the supermarket. I need my money to go far as opposed to having the luxury of choosing the healthy option.’

‘It is pretty cheap to get a pizza or some oven chips.’

Limited budget was reported to be a barrier to exercising too with students reporting that they cannot afford the university’s gym membership or the extra charge for some of the classes available.

‘Only don't take part in exercise classes that cost extra because I can't afford them.’

For some students the limited budget was recognised as a facilitator of eating healthy and exercising.

Theme 2: Peer Influence

Participants reported that their friends’ or partners’ habits have an impact on their habits either in a positive or negative way. This applies both to healthy eating and exercising. Participants reported that having someone to cook with or having someone with healthy lifestyle habits around them, helps with finding the motivation to adopt a healthier lifestyle.

‘I also tend to eat less healthy snacks if my friends or classmates do so.’

'I tend to eat quite healthily but it helps if others around ie flatmates have good eating habits too.'

'Time and a cookbook and a flatmate with a similar taste for food, we cook together and share responsibilities with shopping and kitchen chores. In halls it was the only time I was eating healthy when we were preparing meals together.'

'It is more difficult to motivate oneself(sic)if one doesn't have a friend to work out with.'

Theme 3: Time management and stress

Participants reported that the university coursework along with the lecturing times have an effect on their time management and stress levels which they report both affecting their lifestyle habits. Participants reported that long days of lectures at university along with the lack of breaks between lectures are inhibiting factors to eating healthy or exercising. There were many participants who also reported that having more breaks between lectures would help with eating more sensibly and maybe going to the university gym between lectures.

'Sometimes in between lectures I just want a snack so the easiest thing to do is go to a vending machine or one of the union shops to get a snack which normally ends up to be chocolate.'

'Sometimes the amount of work we get to do makes it hard to participate in physical activity as there are so many lectures to read up on, assignments to had in and so many different subjects to learn stuff for. Also I still live at home and dance at home and a lot of the time I am either late for class or I am unable to go because of uni (sic) work.'

'Not every lecture has a break in between. If I go out after lectures I eat junk food for a quick fix before getting on with my night out.'

'Having set break times during lectures - even if it's only 15mins - would help to stop students eating something quick and easy like chocolate or crisps

rather than something healthier would be helpful. I think that the gym is relatively cheap is great because most students could afford a membership. The only problem is my lectures finish at peak time so it's hard to get on a machine.'

A small proportion reported that being busy helps with planning ahead the day in terms of preparing meals and snacks and exercise as a way to relieve stress and tension at the end of the day.

'I eat more healthily when I am very busy. If I know I am going to have a jam-packed day, then I'll plan ahead and bring food with me, which is normally fairly healthy. Being busy means I am less likely to snack as well.'

'The fact that the gym is such good value for money and that there are lots of exercise classes available so there's something for everyone. It is also such a good destressor.'

2.4 Discussion

This pilot study comprised the development and piloting of a questionnaire and different approaches of delivery. The aim was to engage first year students in higher education to determine their thoughts on health and lifestyle issues within the context of the 'Freshman 15' phenomenon in Scotland.

The best response rates were achieved when using on-line recruitment. On-line recruitment is becoming more popular nowadays as it gives the option to reach all potential participants in a study on an individual basis. One site had particular low response rate compared to the other two. A possible explanation is that this site has students of younger age (accepting students 16-18 years old) that due to the nature of their studies (manual) they don't use the computer a lot for college work and therefore they tend not to check their college email where the link to the study was sent. Mailing the survey to the participants was the second best method of recruitment however it is more costly and time consuming compared to the on-line recruitment. It would also worth noting that when the in-person approach was used to recruit participants those who were visibly overweight or obese refused to participate to the study once informed about the nature of the study. In this study, we approached students studying in Scotland in three different educational establishments. More than half of the students in this study seem to experience some weight gain, although the amount gained was less than their USA counterparts. A previous study from UK found similar results (Serlachious et al. 2007). The second institute approached offers studies on performance arts and in this institute, participants reported to be more concerned about their body weight despite having lower body weight that the third institute ($p<0.001$). This may be an indication that students in the first institute due to the nature of the studies are more body aware.

The aim of this qualitative part of the study was to explore lifestyle changes that first year students in higher education experience, their effect on body weight and barriers to and facilitators of healthy lifestyles. The main themes emerged from the thematic analysis were budget, stress, time management and peer influence. Similar themes emerged from the US students (Greaney et al.2009). Despite participants reporting more barriers to healthy lifestyles than facilitators, it is very encouraging that when they were asked about what the University could offer in terms of services to help them with dealing with these barriers, they recognised the personal responsibility aspect. Students consider important the provision of courses on nutrition and cooking that would help them acquire the knowledge to take on personal responsibility for their lifestyles. The study was carried out at the end of the academic year in order to ensure that the responses represent a “new life style”, long enough to secure meaningful responses. We chose to recruit students electronically and carry out the focus group in a non-traditional on-line environment. On-line focus groups are often criticised for not being able to capture nonverbal and paraverbal cues (Greenbaum, 1997) however this is something that students overcome as with their familiarity with using social media and chat rooms to communicate enriched their text with emoticons, punctuation marks or abbreviations. On-line focus groups encourage more sincere discussions on a topic such as weight and lifestyle that is often considered sensitive. Participants can continue typing their answers without interrupting one another or influencing each other’s answers. This study was carried out at the end of the academic year in a period where some students had already left University for their summer holiday due to a delay in ethical approval. This is a limitation of our study as probably not all students check their university email when away and may have not been informed about the study.

This may also have contributed to the poor response rate. Designing interventions based on students' barriers to and facilitators of healthy lifestyles by working closely with University services could be a potential step towards obesity prevention.

This study has several limitations. We cannot generalise the results to the whole of Scotland or UK as our sample size in this pilot study was small and self-selected although the fact that our study included three different educational establishments that host populations with different characteristics adds some strength to the results. The participants were self-selected and self-reported weight and weight changes. This can potentially be a bias as students that may have experienced higher weight gains or generally have weight problems did not participate due to social desirability bias (Eysenbach & Wyatt, 2002). One of the strengths of using on-line surveys is the fact that online data seem to overcome the social desirability bias and people tend to be more honest as they feel they are not criticised for their answers (Wright, 2005).

With Scotland having one of the highest incidences of obesity worldwide (SHS,2011) it is of particular importance to identify population groups suitable for targeted obesity prevention interventions and to tailor the intervention to the specific population's needs. It is encouraging that a significant proportion of the students would welcome advice on weight management and healthy eating. Young students will form the future workforce and be the future parents hence helping them to establish healthy behaviours and manage their weight is very important and the only hope to halt the obesity epidemic.

To conclude, this study provided us with a useful first insight into the weight changes occurring in young adults in their first year of higher education in Scotland and their lifestyles which seems to be currently a neglected opportunity for obesity prevention.

Chapter 3:

Weight changes in young adults: A prospective study

Overview

After exploring methodologies in the previous chapter and weight changes occurring in the first year students in higher education in Scotland, a cross-sectional study was designed to examine the weight changes and lifestyle changes in first-year students. The questionnaire used in this study was an improved version from the one used in the pilot study described in the previous chapter and on-line recruitment was used as this was proven to be the best method for approaching this group. Weights and heights were self-reported by the participants. Recognising the validity issues concerning self-reported data, those were validated against measured weights and heights held in the database of the university GP surgery.

3.1 Introduction

Obesity prevalence, one of the biggest public health challenges, is rising worldwide despite self-awareness and publicity about its adverse health consequences (Lobstein & Leach 2007). In the UK, 40% of all adults now become obese by the age of 65 (Vlassopoulos et al.2013). Obesity treatments are of limited efficacy so primary prevention of obesity is notionally the best public health strategy, but no cost-effective sustainable model exists. An effective programme would target particular stages in the life-cycle when individuals are particularly susceptible to weight gain and may be receptive to advice. In young adulthood weight gain is more rapid than at later ages, and thus a potential target for obesity prevention. Scotland has one the highest prevalence of obesity in the world, rising to 40% by age 65, but obesity prevalence at age 16-24 is only 9% among males and 17% among females. (SHS, 2011).

Gauging the weight changes in young adults along with potential causal factors can assist in the design of effective interventions which are currently non-existent. A pilot study, conducted in 2010, found that more than half of the young adults participating (56%) gained weight ranging between 0.5-5.5kg in Scotland (Nikolaou et al.2011). The present study aimed to: 1) quantify the weight changes in young adults, 2) explore and Identify lifestyle and dietary factors that may affect weight changes.

3.2 Methods

The study was approved by the ethical committee of the College of Medicine, Veterinary, and Life Sciences (20/11/2010) (Appendix 1,2). The study allowing the validation of weights and heights was approved by the NHS Glasgow and Clyde Ethics Committee (01/2013) (Appendix 5).

3.2.1 Participants and setting

Participants were first year undergraduate students of a large urban University Scotland. First year students were identified by matriculation numbers, and the Information Technology (IT) department of the University provided a mailing list of all undergraduate students attending their first year of study.

Following the pilot study which indicated that electronic recruitment is the best method to approach young adults (Nikolaou et al.2011), all first year students were contacted by email and informed about the study at the start of the academic year (Sept 2011). Brief information on the study and a link to an online questionnaire were included in the body of the email. Full study information sheet was incorporated in the first page of the on-line questionnaire. The act of following the link and completing the questionnaire implied consent to participate to the study. Reminder e-mails were also sent to everyone two days and one week after the initial email. The follow-up email questionnaire was sent following the same protocol at the end of the academic year (April 2012) (**Figure 3.1**).

3.2.2. Measurements

A short questionnaire was devised containing 27 questions, incorporating 23 multiple-choice questions with an option of open answers for some (n=4), on lifestyle habits and self-reported weight and height (Appendix 8,9). Lifestyle questions included eating and physical activity questions, body weight and height. Heights and weights were self-reported in imperial or metric units. Eating-habits variables were; frequency of consumption of vegetables, fruit, ready meals, sugary drinks, and dairy products. Physical-activity questions were; time spent using screen such as computer daily, time spent walking daily, time spent exercising weekly. Sleeping times were calculated using the interval between the sleeping and waking times provided by the participants. Differences between body weights at the start and at the end of the academic year were absolute weight changes.

3.2.3 Validation of self-reported weights and heights

Self-reported weights and heights were validated for sub-sample using measurements made by General Practitioner (GP) trained staff and recorded in young adults' health records.

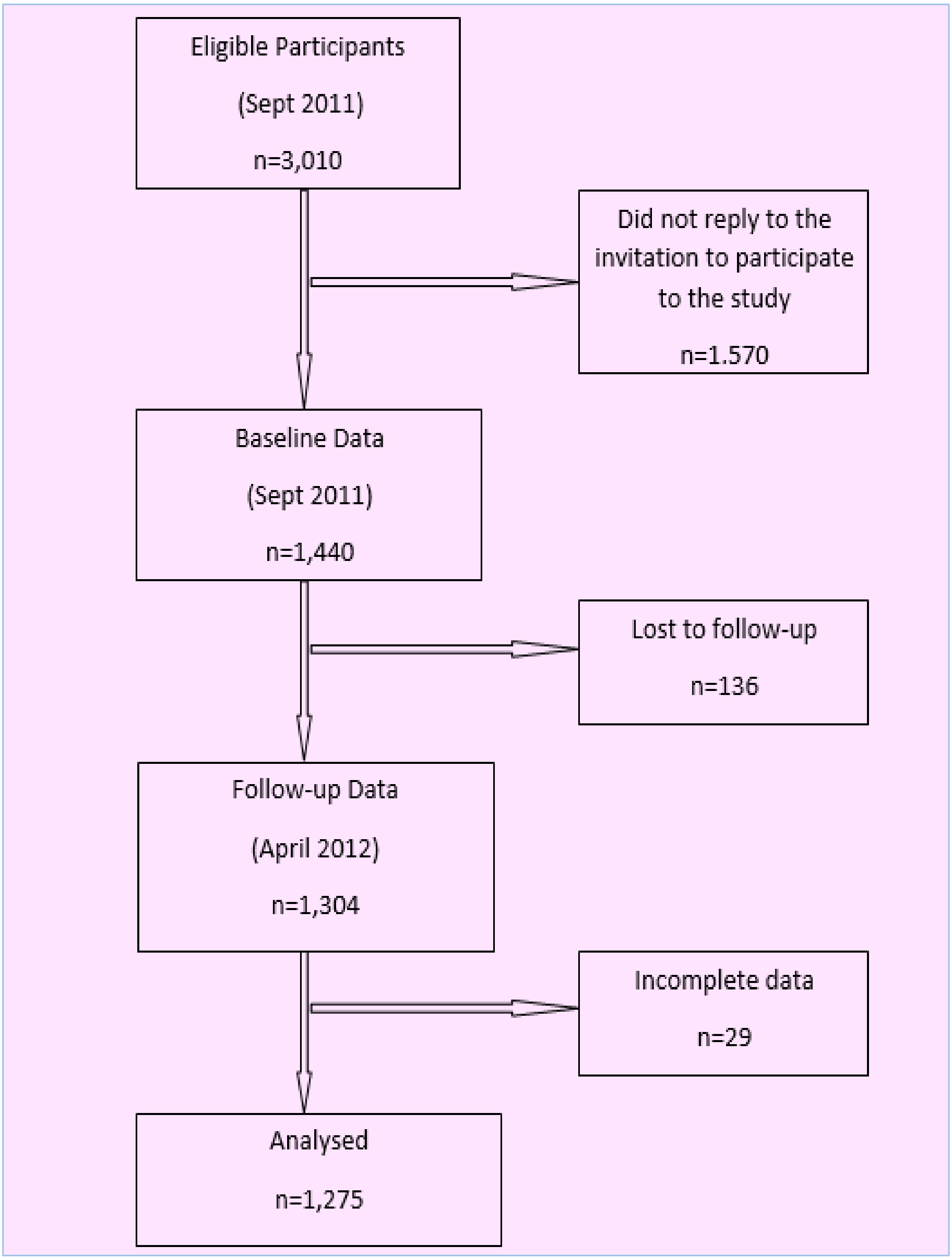
3.3 Statistical Analysis

Data were analysed per protocol, using SPSS 19 (SPSS, Chicago, IL) statistical software. Descriptive statistics were used to describe participants' characteristics and lifestyle habits. Paired t-tests were used to compare baseline and follow-up data. Independent t-tests were used to compare completers and non-completers. Univariate regression modelling was performed to identify predictors of weight changes. Pearson correlation was used to examine the strength of linear relationships between self-reported and measured data. The degree of agreement between self-reported and measured data was also assessed using Bland-Altman plots.

3.5 Results

A total of 1,440 young adults provided baseline data participated in this study, representing 48% of all incoming first year undergraduate students (n=3,010). Completed data, at the end of the academic year, were provided by 1275, 86% follow-up rate (**Figure 3.1**).

Figure 3.1: Study Flowchart



3.5.1 Participant characteristics

Participants' characteristics are shown on **Table 3.1.** Baseline data for completers and non-completers were not different for age (p=0.102), height (p=0.938), and weight (p=0.100).

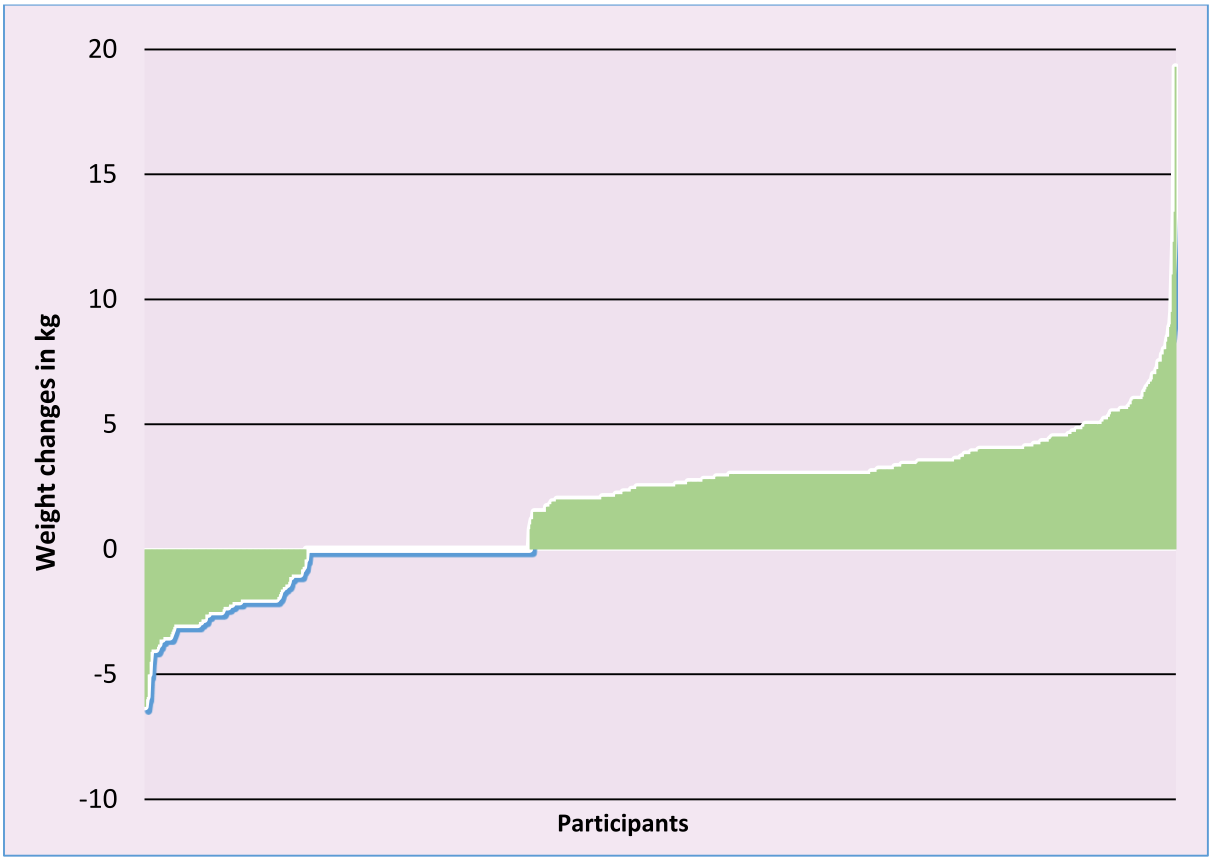
Table 3.1: Participants' Characteristics at baseline and follow-up (after 9-months) and weight changes.

	Baseline	Follow-up	Change	P value
	n=1440	n=1275		
Gender	Female=51%	Female=63%		
Age (Years)	20 (3.8)	20.1 (3.7)		NS
95% CI	19.7-20.8	19.5-20.7		
Height (m)	1.72 (0.10)	1.71 (0.10)		NS
95% CI	1.71-1.72	1.71-1.72		
Weight (kg)	65.8 (14.5)	67.6 (15.2)	1.8 (0.6)	<0.001
95% CI	64.7-66.6	66.7-68.5	1.6-1.9	
BMI (kg/m2)	22.3 (4.6)	22.8 (4.7)	0.5 (0.2)	<0.001
95% CI	22-22.6	22.6-23.1	0.3-0.65	
BMI <18.5 kg/m2 (%)	1	0.5	-0.5	
BMI 18.5-24.9kg/m2 (%)	85	79.5	-5.5	
BMI 25-30kg/m2 (%)	9	14	+5	
BMI >30 kg/m2 (%)	5	6	+1	
Screen time (hrs/day)	3.4 (1.9)	3.3 (1.8)		NS
95% CI	3.3-3.5	3.1-3.4		
Walking time (hrs/day)	1.7 (0.9)	1.65 (0.8)		NS
95% CI	1.6-1.8	1.6-1.8		
Exercise time (hrs/week)	3.3 (0.7)	3.1 (0.2)		NS
95% CI	3.1-3.5	2.9-3.2		
Sleeping time (hrs/day)	8 (1.4)	7.9 (1.6)		NS
95% CI	8-8.1	7.7-8.1		
Smokers (%)	17	17		
Alcohol consumers (%)	78	81		

3.5.2 Weight changes

A mean weight gain of 1.8(SD0.6)kg and an increase of 0.5(SD0.2)kg/m^2 in BMI was observed by the end of the academic year in all participants. Out of the 1275 participants who provided follow-up data, 807 (63%) participants gained weight, 197 (15%) lost weight, and the remaining 271 (22%) maintained their weight (**Figure 3.2**).

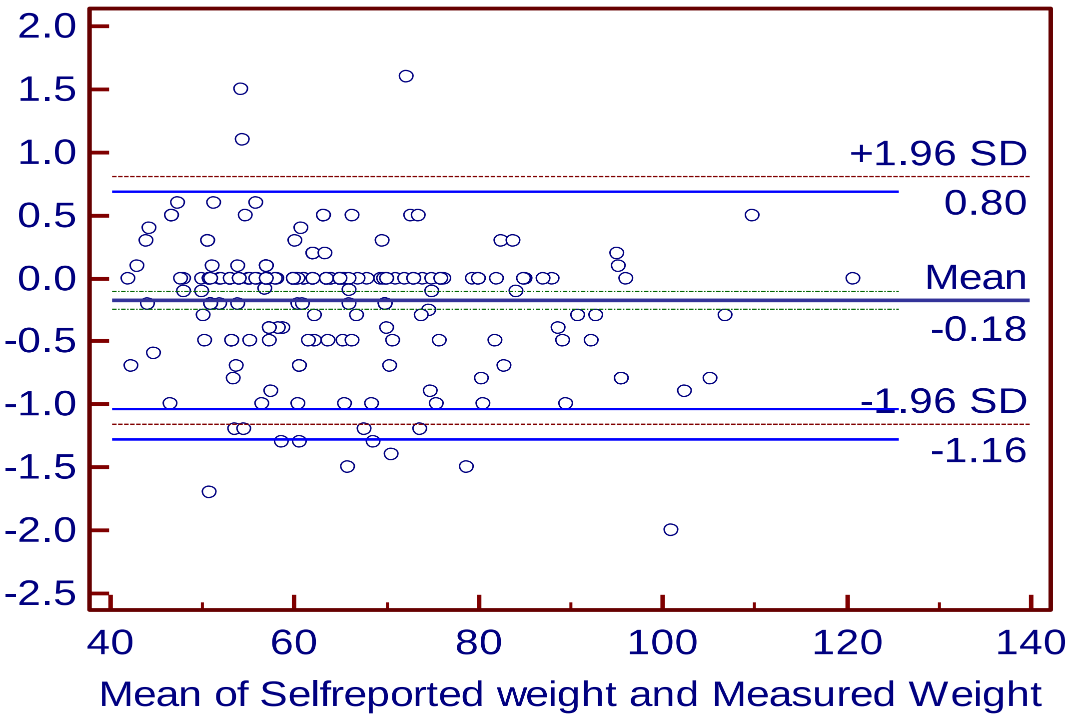
Figure 3.2: Weight changes reported by respondents over the 9-month study period.

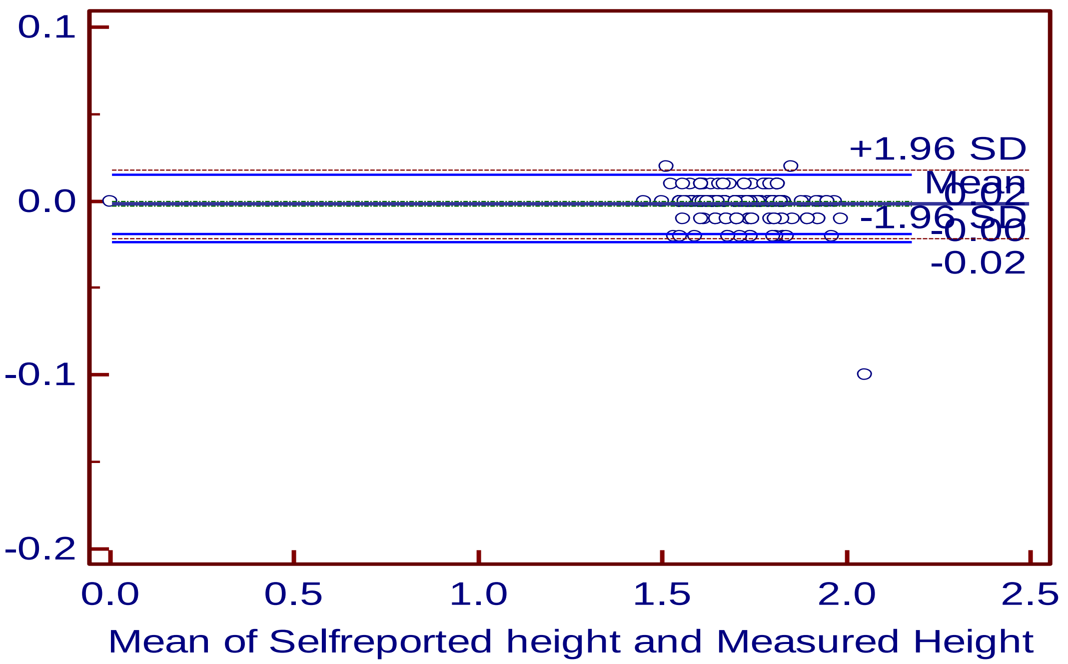


3.5.3 Validation of self-reported weights and heights

Measured weights and heights were available for a sub-sample (n=209) of the participants. Mean (SD) of self-reported weight was 73.9(13.8)kg for men and 60.4(12.6)kg for women while mean (SD) of measured data was 74.1(13.9)kg for men and 60.6(12.7)kg for men leading to underreporting of 0.2kg for both men and women. Mean (SD) of self-reported height was 1.8(0.09)m and 1.66(0.07)m for men and women while measured height was 1.807(0.1)m and 1.66(1)m for men and women, respectively. Self-reported data correlated strongly with the measured weight ($r=0.999$ $p<0.001$) and height ($r=0.998$, $p<0.001$). Bland Altman plots revealed good levels of agreement between self-reported and measured data (Figure 3.3).

Figure 3.3: Bland Altman plots for self-reported and measured weights in kg and heights in metres.





Dark blue line=mean number

Light blue lines=95% level of agreement

3.5.4 Weight Changes predictors

Baseline weight (adjusted for gender and age) explained 42% of variance in weight changes (R^2=0.42, p<0.001). Baseline dairy product consumption was significantly associated, inversely, with weight change (ß=-0.001, p=0.02). The consumption of alcohol was linked with greater weight gain (ß =5.9, p=0.016). Other baseline dietary factors (sugary drinks, fruit and vegetables, snacks), physical activity duration and sleeping time showed no associations.

3.5.5. Dietary habits

At the start of the academic year, under a third (31%, n=446) of subjects reported consuming the recommended 5-day portions of fruit and vegetables. This percentage dropped to 27% (n=344) by the end of the year (p<0.001). Around a 10% (n-=144) reporting eating fruit and vegetables less than once a week and this percentage doubled (20%, n= 255) by the end of the year (p<0.001). Sugary drinks were consumed on a daily basis by 16% at the start and by 13% at the end of the year. Dairy products on the recommended 2-3 30g portions per day was consumed by 49% at the start of the year and by 44% at the end of the year. Ready meals were consumed by 28% at the start of the year and by 22% at the end of the year.

3.5.6. Physical Activity habits

Young adults reported meeting or exceeding the recommended amount of physical activity of 150 minutes /week, both at baseline and follow-up (mean time exercising 3.4 (SD0.8) hrs/week).

3.6 Discussion

This prospective cross-sectional study aimed to quantify the weight changes occurring in young adults, and relate them to lifestyle habits. Over the 9-month period, a mean gain of 1.8 (SD0.6) kg was reported in this study group. The range of reported weight changes was wide, from –6kg to +19.3kg. A meta-analysis conducted in 2008 with US studies found an increase of 1.75kg in weight during the first year of higher education (Vella-Zarb & Elgar, 2009). The mean weight change in this study, was similar to the one observed in a sample of UK young adults attending higher education (Nikolaou et al.2011, Serlachious et al.2007) but was almost double the amount observed in the general population. This mean change was almost double the weight gain of around 1kg/year observed in young adults in by Lewis et al in the CARDIA study which followed young adults for 14 years (Lewis et al.2000).

In the present study, the only self-reported dietary factors at baseline which predicted weight changes were the consumption of dairy products and alcohol. Consumption of alcohol was correlated with higher body weight and BMI both at baseline and at follow-up and with greater weight gain. Alcohol consumption is a particular problem for young adults (Gill, 2002) and was one of the most commonly lifestyle change reported as a consequence of starting university by the students in the focus group. In a recent study, authors found that alcohol can contribute up to 27% and 19% of the recommended calorie intake for men and women, respectively (Shelton & Knott.2014). A protective effect against weight gain from dairy products, including high-fat products, was also reported in 11 of 16 studies included in a recent review (Kratz et al.2012). A multivariate model could also have been used to explore the data but it was decided after professional advice that since no apriory hypothesis was set for any weight changes observed that univariate would be more appropriate.

Despite the heavily promoted message ‘5-a-day’ referring to the minimum number of 80g portions of the fruit and vegetables that people should consume for health protection this was not reported in this study population of educated young adults. Although promoted to prevent heart disease and cancer, the evidence does not support any role for fruit and vegetables preventing weight gain or achieving weight loss. There may be confusion among consumers because the term ‘healthy eating’ has become confused with weight control. Neither fruit nor vegetables, regardless of the amount reported to be consumed, affected weight change in the present study. Self-reported food and drink consumptions are often unreliable, and misreporting is particularly common among the overweight, to the extent that they frequently under-report energy consumptions substantially below what is compatible with their weight, and less than those of thin subjects (Lara et al 2004). That was unlikely to have been a problem in the present study as only 9% of subjects were overweight and 5% obese. Physical activity is well recognised to be preventive against weight gain (Blair, 2009). In the present study, young adults reported amounts of physical activity above the recommendations, but there was no association with weight change. There is a serious limitation in all surveys of this kind, that reported physical activity is almost universally over-reported, and studies using measured physical activity indicate that self-reporting may be biased so strongly that the most inactive report higher activity levels than the more active (Prince et al.2008).

There are differing strengths and limitations of any study design to investigate weight changes, and their causes, particularly in young adults who are notoriously mobile and unpredictable.

The participants were self-selected and they self-reported weight and weight changes. This can potentially be a bias if students who had experienced higher weight gains or were sensitive about weight problems did not participate due to social desirability bias (Eysenbach & Wyatt, 2002). However, one of the strengths of the on-line survey method used is that they can to some extent to overcome social desirability bias, and people tend to be more honest as they feel they are not going to be judged or criticised for their answers (Wright, 2005). We also validated self-reported weights and heights against measured data which revealed a high level of agreement between methods.

Scotland having one of the highest prevalence of obesity worldwide (SHS, 2011), and public awareness is high (Hilton et al.2012). It is encouraging that a large proportion of young adults would welcome advice on weight management and healthful eating. About half of all young adults in UK now move on from school to university or college so the present study population is not a minor, or unusual elite group. The health-behaviours they adopt are nationally important on their short pathway to becoming the future workforce and parents. Characterising better the known susceptibility to weight gain at this age will valuably inform public health measures against the obesity epidemic.

To conclude, this study provided useful insights into the weight changes occurring in young adults and into related lifestyles, to allow the design of interventions for obesity prevention.

Chapter 4:

A literature review of studies aiming at weight gain prevention in young adults

Overview

This chapter aimed to search and review the literature for studies conducted in young adults and aimed to prevent weight gain. Reviewing the literature and appraising it will allow to learn and draw conclusions on the design of effective interventions in the future.

4.1 Introduction

Obesity is a major public health concern as it contributes to ill health and increased medical and societal costs. Weight gain which can potentially lead to obesity is more rapid in young adulthood and especially in those who attend higher education. Preventing weight gain is easier than achieving weight loss thus maintaining the prevalence of healthy weight may be a solution towards halting the obesity epidemic. Very few studies have challenged this weight gain and aimed at preventing it. The aim of this literature review is to summarise the current efforts and evidence behind prevention of weight gain.

4.2 Methods

4.2.1 Search strategy

A snowball strategy was used to identify relevant research studies on weight gain prevention through the databases; PubMed, MEDLINE, and PsychINFO using various combinations of keywords: university, weight, weight gain, obesity, college, young adult, prevention, intervention. No restrictions were made on the date of publication or in the duration and type of the study. The reference lists of each included article and relevant review articles were also reviewed. To be included in the review, interventions had to: 1) have as primary outcome weight gain prevention among adults 2) include young adults (18-35 years old) in the intervention 3) have weight, and/or body mass index (BMI) as primary outcome. Studies were excluded if the intervention was primarily designed to address other outcomes i.e., smoking cessation, eating disorders, mental health, sports nutrition, obesity treatment, weight loss, and examined interventions aimed at families, children, and adolescents.

4.2.2 Rating of studies

Quality of studies was rated using the SIGN (Scottish Intercollegiate Guidelines Network) checklist for rating studies. In addition, the Cochrane collaboration's tool for assessing the risk of bias was used to assess the studies included in this review

(http://ohg.cochrane.org/sites/ohg.cochrane.org/files/uploads/Risk%20of%20bias%20assessment%20tool.pdf).

4.3 Results

The search strategy produced twelve studies describing equal number of interventions which met the inclusion criteria (**Figure 4.1**). All studies were conducted in US except for one which was conducted in Canada with duration ranging from $1^{1/2}$ to 36 months. Studies were carried out in one of the following settings; higher-education institutions, workplaces, and community. All the studies used a combination of strategies, both environmental and individual, aiming at preventing weight gain (**Table 4.1**).

Figure 4.1: PRISMA flow diagram of search strategy

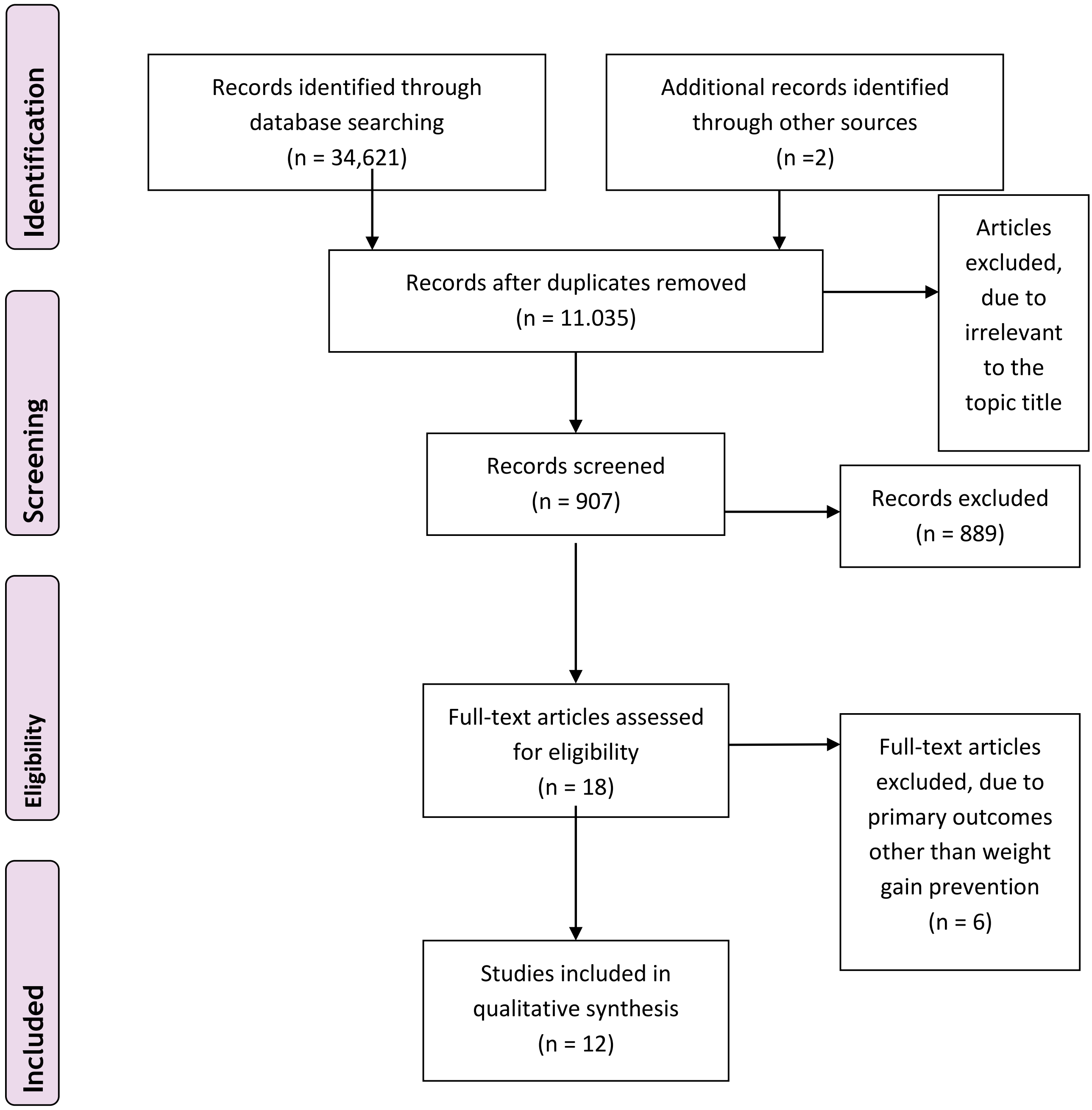


Table 4.1 Characteristics of studies identified through the literature review (C=control, I=intervention), +good, ++really good

Author Year	Study Design	Study Population Location	No of participants	Components of Intervention	Duration	Results	Limitations	Study Quality
Jeffery & French, 1999	RCT 3-arm	Mineapolis citizens and employees of the university of Mineapolis, US	C: 414 (82% female) I1: 198 (78% female) I2: 197 (79% female)	C: No intervention I1: Education and incentive Small changes in diet, focus on weight and exercise via monthly 2-4 pages newsletters. 5 questions in each newsletter that had to be answered and returned via prepaid envelope. $100 raffle once/month for the participants I2: Education only Small changes in diet, focus on weight and exercise via monthly 2-4 pages newsletters. 5 questions in each newsletter that had to be answered and	36 months	No difference in weight gained between groups	More females, self-selected sample, Mean BMI>25kg/m2 at baseline.	+

				returned via prepaid envelope.				
Klem et al, 2001	RCT 3-arm	Pittsburgh US, registered voters and university medical centre	I1: 24 I2:14 I3: 27 (considered as control group) All female	All participants were given dietary and exercise goals and asked to set a healthy weight range determined by their baseline weight. I1: Group intervention, weekly group meetings on behavioural and weight control skills. I2: Correspondence intervention, A lesson/week mailed with completed brief homework assignments. I3: Lifestyle brochure- asked to read a leaflet (considered to be the control group)	2 1/2 months (10 weeks)	I2: Lost significantly more weight than control group (1.9 SD 1.8 kg vs. 0.2 SD 1.3 kg; $p = 0.05$)	Self-selected sample, all female, short study duration	+

Matvienko et al, 2001	RCT	University students US	C: 19 I: 21 All female	C: No intervention I: Lectures to on nutrition, exercise, physiology and laboratory measurements of body composition, serving sizes, food sensory exercises, and food preparation methods	4 months	No change in body weight and BMI in both intervention and control group.	No blinding, small number of participants, all female, self-selected sample, intervention carried out 1997	+
Robbins et al, 2006	Non-Randomized trial, multi-site	Workplace US	C:68,056 (13% female) I: 3,502 (11% female)	C: Usual care I: Completion of personal energy plan workbooks, email on physical activity and healthy eating habits every other week	12 months			+
Levintsky et al 2006	2 independent RCTs	University US	Trial 1: C: 15 I: 11	C: No intervention Trial 1 & 2: Daily self-weighing and values sent by e-mail to research staff.	$2^{1/2}$ months (10 weeks)	Trial 1: C: Weight gain of 3.1 (SD0.51)kg, $p<0.001$	Convenience sample, small sample size, excluded males for convenience, no blinding, participants were informed that the study was about	+

			Trial 2: C: 16 I: 16 All female	Trial 1: Daily emails with the slope of participants' weight change over the past week. Trial 2: Daily emails with the number of calories participants would have to increase/decrease to keep body weight stable.		I: No significant weight change (0.1 SD0.99kg) Trial 2: C: Weight gain of 2(SD 0.65)kg, p=0.01 I: No significant weight change (0.82 SD0.56kg)	preventing weight gain and were given advice to eat 3 meals/day and avoid snacks.	
Hivert et al 2007	RCT	College students Canada	C: 57 (47 female) I: 58 (47 female)	C: No intervention I: Small group sessions focused on increasing knowledge on weight gain, problem solving, goal setting, monitoring strategies, national dietary recommendations, and national	24 months	C: weight gain 0.7(SD 0.6) kg I: Weight loss 0.6 (SD 0.4)kg p=0.004	Self-selected sample, majority females (82%)	++

				recommendations for exercise				
Levine et al 2007	RCT 3-arm	Pittsburgh community US	C: 93 I1: 94 I2:97 All female	C: information only I1: Correspondence I2: Clinic	36 months	Intervention had no effect on weight over the 36 months	Self-selected sample, women only	+
Goetzel et al 2010a	Non-randomised trial, quasi-experimental	Workplace US	C:529 I: 1,902 (30% female)	C: Usual care I: Individualized diet and exercise counselling, Workplace changes to support employees' increased physical activity, improved eating habits, and weight management through	24 months	C: weight gain of 1.3 pounds (p<0.01) I: no weight change	High attrition rate (52.6%). 30% female	+

				environmental prompts and point-of-choice messaging, Key personnel recruited to set worksite health goals and train worksite leaders on health promotion				
Lemon et al 2010	RCT	Workplace US	C: 420 (84% female) I: 386 (78% female)	C: No intervention I: Weekly displays on nutrition and exercise education, weekly e-newsletter on health education, monthly strength training workshops, nutritional information in the cafeteria, new healthy menu options, periodic campaigns and challenges targeting physical activity, healthy eating and weight with group and individual prizes	24 months	No change in BMI from baseline to 24 months between control and intervention (ß=0.276; 95%CI=-0.338,-0.890)	More female participants	+
Gow et al	RCT	1st year students US	C: 40	C: No Intervention	$1^{1/2}$ months (6 weeks)	I3: significantly lower mean BMI than the control group (p =0.05)	Participants recruited from one course, (psychology course).	+

2010	4 arms		I1: 40 I2: 39 I3: 40 74 % female	I1: Internet-only, 6 weekly, 45-minutes sessions on obesity and weight related behaviours I2: Feedback only, weekly self-weighing and feedback in form of graphs of individual change I3: Combination of the two (internet and feedback).		Mean BMIs of I1 and I2 and the control group did not differ.	Participants received research credit for completion and raffle each week.
Gokee-LaRose et al 2010	RCT	Young adults living in Providence, RI or Chapel Hill, NC	I1: 21 I2:23 Female:98%	I1: Small changes group, 8 weekly followed by two monthly meetings. Self-weighing daily I2: Large changes group, 8 weekly followed by two monthly meetings. Self-weighing daily and adherence to specific calorie goal and 50 minutes/day of	4 months (16 weeks)	I1: Weight loss of 1.5 (SD 1.8)kg lost I2: Weight loss of 3.5 (SD 3.1)kg p=0.006	Self-selected sample, small sample size, incentive of $10 and $20 for completing the study

				structured activity for 8 weeks.			
Dennis et al 2012	RCT	Students in university US	I1: 24 Female: 37% I2: 21 Female: 48%	Both groups received 14 online modules and biweekly in-class sessions with an instructor. I1: Social Cognitive Theory based plus self-regulation skills group, focused on outcome expectations I2: Social Cognitive Theory based group, included self-regulation features	3.5 months (14 weeks)	I1: +1.75kg SD0.4kg I2: +0.95SD0.43kg No difference between groups (p=0.18)	39 completed the study, 5 participants received monetary incentives.

I1= Intervention Group 1

I2= Intervention group 2

C: Control group (no intervention)

There are currently six reviews published around this topic but all used different selection criteria to this review. Brown et al included studies that also aimed at weight loss and study populations included those affected by certain diseases (ie type two diabetes, breast cancer, and hypertension), those already obese (BMI<35 kg/m^2) and had a follow-up of at least two years. Wolfenden et al (2010) included studies conducted in the community in children and adolescents. Hebden et al (2011) included studies aiming at prevention of weight gain in young adults (18-35 years old) but excluded all studies that were not RCTs. Gudzune et al (2013) included studies aiming at young adults but also included studies that had as primary outcome a different goal to preventing weight gain (i.e. increase physical activity). Also, studies included had to have, at least, a 12 month follow-up. Hurfless et al (2014) included studies that included other age groups than young adults and also studies that had as primary outcome the prevention of cardiovascular disease, eating disorders, increase of physical activity, prevention of cancer. Included studies had to have, at least, a 12 month follow-up. Laska et al (2012) included studies aiming at weight gain prevention in the transition period to young adulthood thus including some studies with study population adolescents.

The main differences between the reviews published on the topic and this review is that we have excluded studies aiming at weight loss or studies that recruited participants with diseases. The reason for that is that people wanting to lose weight may have different motivations than those who just want to maintain their weight and including those studies would not reflect the true picture of weight prevention efforts. Young adults who have lost weight or trying to lose weight do not represent the general population. Also adults who have been diagnosed with a disease will have different motivations to participate in a study. Obesity prevalence is lower in young adults compared to other age groups. Recognising the difficulty of conducting this type of studies, we did not exclude studies with small duration or studies that have been conducted in other settings other than higher education or worksites. There is a certain degree of overlap between this review and some of the reviews published previously but this review is an attempt to present the efforts of weight gain prevention studies.

4.3.1 Higher education setting

Five studies were conducted in a higher-education setting. Matvienko et al, Levintsky et al, Hivert et al, Gow et al, and Dennis et al were all single-site studies aiming to prevent weight gain. Matvienko et al evaluated a four-month trial of a nutrition course with information on obesity, physiology, and energy metabolism on first-year female college students. There was no change in body weight or BMI between the intervention and the control group but there was a reduction in reported fat intake ($p=0.04$), protein intake ($p=0.03$), and carbohydrate ($p=0.008$) between participants with BMI>24kg/m^2 in the intervention group and those in the control group. Levitsky et al tried a more individualised approach which included daily self-weighing of participants in the intervention groups and values were sent back to the researchers. These values allowed the calculation of linear regression and the slope of the line was e-mailed to participants. All participants in both the control and the intervention group were females. Participants in the control group gained 3.1(SD0.51)kg ($p<0.001$) while weight in those in the intervention group did not change (0.1SD0.99kg). Both, Hivert et al and Gow et al trialled an on-line seminar-type course to combat weight gain in young adults. Hivert et al randomised 115 students in a control or an intervention group (55 students per group gave a power of 90% in order to demonstrate a significant difference of 1.4kg after two years). Those in the intervention group received seminar-type information on obesity, weight, physical activity, diet fortnightly for the first 2 months and the once a month until the end of the study after 24 months from initiation. No information was sent over the summer months. Participants in the control group gained 0.7(SD0.6)kg while those in the intervention group lost 0.7SD0.4kg after 24 months ($p=0.04$). Gow et al in a 6-week and 4-arm randomised trial tested the effect of an online seminar delivered weekly along with weekly self-weighing in scales provided in the gym of the university and values emailed to researchers. Those who received the combination of the intervention had lower BMI than those in the control group ($p=0.05$). Dennis et al recruited students from a US university and tried two on-line courses based on social cognitive theory supplemented by face-to-face lessons delivered by an instructor. One of the groups received in addition instructions on self-regulation. There was no control group in this study. 39 students completed the study which lasted 14 weeks. Participants in both groups gained weight and there was no difference in the weight gained between groups (p=0.18).

4.3.2 Worksite setting

Three studies were conducted in workplaces, including a military base (Robbins et al), a chemical company (Goetzel et al, 2009, 2010a) and hospitals (Lemon et al). All studies were multi-centre studies. Lemon et al recruited individuals while Robbins et al, and Goetzel et al recruited sites. Robbins et al encouraged self-management among those in the intervention group with weekly emails on healthy eating and physical activity habits and personal energy workbooks. Goetzel et al and Lemon et al included an environmental change component in their studies. Goetzel conducted a study in a chemical company which recruited key personnel to train worksite leaders on health promotion, provided point-of-choice information and workplace changes to encourage physical activity and healthy eating. Those were considered as usual care and received by both the control and the intervention group. Those in the intervention group received in addition, individualised diet and exercise counselling. After 24 months those in the control group gained 1.3 pounds in body weight (p=0.01). Lemon et al conducted a study in 6 hospitals, 3 formed the control sites and 3 the intervention sites. Potential participants were identified by human-resources records and a sample size stratified for weight, height, age and gender was drawn. Intervention was not individualised but based on environmental changes of the intervention sites. Changes included; social marketing campaign, nutritional information on food and beverages in the cafeteria, healthy menu options, farmer's market, weekly newsletters, seasonal recipe books, physical activity workshops. After 24 months there was no change in BMI in intention-to-treat analysis (ITT).

4.3.3 Community Setting

Four studies were conducted in community settings in various parts of the US.

Jeffery & French recruited participants to a 36-month, 3-arm randomised controlled trial from the community of Mineapolis. The two intervention arms received information on diet, weight and exercise in the form of a monthly 2-4 pages newsletter along with 5 questions that had to be answered and returned via post. Participants in one of the intervention arms also had the chance to win a $100 prize monthly. The control group received no information. Weight changes after 36 months were not different between groups (p=0.8).

Klem et al recruited women who were registered voters in Pittsburgh and from a large university medical centre. Potential participants were informed of the aim of the study. 102 women in total were randomised into three groups, one had weekly group meetings for 10 weeks, the other one had 10 mailed lessons over 10 weeks and the third which also served as control group received a lifestyle brochure and was not contacted further for the 10-week study duration. Participants in the group-meetings group lost more weight than those in the control group (p=0.05). At 6-month follow-up there was no difference between groups (p=0.70).

Levine et al randomised 284 women into three groups, group one was a clinic offering 15 group meetings over 24-month period, group two was a correspondence group which received 15 lessons by mail over the same period and the third group which served as control group received a booklet on the benefits of weight maintenance at baseline. The intervention had no effect on weight over 24months.

Gokee-LaRose et al tried an individualised intervention by randomising 52 participants into two intervention groups, group one was small-changes group and group two was large changes group. There was no control group in this study. Participants in both groups were asked to attend 8 weekly meetings followed by two monthly meetings and self-weigh daily. In addition the large changes group was asked to adhere to a specific calorie goal and a structured activity of 50 minutes/ day for 8 weeks. After 16 weeks, the large changes group lost more weight compared to the small changes group (3.5kg vs 1.5kg, p=0.006).

4.3.4 Weight changes

Six studies reported significant effect of the intervention on weight with either reporting weight loss or weight maintenance (Klem et al, Levitsky et al, Hivert et al, Goetzel et al, Gow et al, Gokee-LaRose et al) while the remaining six reported no effect of the intervention on body weight. The studies which reported significant effects on weight employed a variety of techniques which were similar to those used by the studies that did not report any effect. Some of the studies (those conducted in work or community settings) included older adults as well within their sample. That might have influenced the results but unfortunately it was not possible to identify the subset of young adults and look at the results based on age group.

4.3.5 Study quality and risk of bias within the studies

Study quality was assessed using the SIGN guidelines (**Table 4.1, Table 4.2**). Only one of the studies was rated as excellent (Hivert et al.2007) as it controlled for all potential sources of bias and included a power calculation a priori. The rest of the studies were rated as acceptable. Five studies were given unclear risk of bias as they reported no information of controlling for potential bias (Jeffery & French, Robbins et al, Levine et al, Goetzel et al, Gokee-LaRose et al) and further two studies controlled for only one risk of bias (Klem et al, Matvienko et al). The fact that so many of the studies did not control for bias or did not report controlling bias may indicate problems with the results or the conclusions drawn from these studies.

Table 4.2: Cochrane Assessment of risk of bias

Author /Year	Sequence generation		Allocation concealment		Incomplete outcome data		Selective outcome reporting	
Jeffery & French,1999	Unclear	No information reported	Unclear	No information reported	Unclear	No information reported	Unclear	No information reported
Klem et al, 2001	Unclear	No information reported	Unclear	No information reported	Low Risk	Number of participants dropping out reported.	Unclear	No information reported
Matvienko et al,2001	Unclear	No information reported	Unclear	No information reported	Low Risk	All participants recruited finished	Unclear	No information reported
Robbins et al,2006	Unclear	No information reported	Unclear	No information reported	Unclear	No information reported	Unclear	No information reported
Levintsky et al, 2006	Unclear	No information reported	Unclear	No information reported	Low risk	No evidence	Low risk	No evidence
Hivert et al, 2007	Low Risk	Software used	Low risk	Two independent researchers	Low risk	Intention-to-treat analysis was performed	Low risk	No evidence

				performed the allocation				
Levine et al, 2007	Unclear	No information reported	Unclear	No information reported	Unclear	No information reported	Unclear	No information reported
Goetzel et al, 2010a	Unclear	No information reported	Unclear	No information reported	Unclear	No information reported	Unclear	No information reported
Lemon et al, 2010	Low risk	Human resources data used to generate list	Low risk	Low risk	Low risk	Reported reasons for drop outs. Intention-to-treat analysis	Low risk	No other bias
Gow et al, 2010	Low risk	Software used	Unclear	No information reported	Low risk	Intention-to-treat analysis was performed	Low risk	No evidence
Gokee-LaRose et al ,2010	Unclear	No information reported	Unclear	No information reported	Unclear	No information reported	Unclear	No information reported
Dennis et al 2012	Unclear	No information reported	Unclear	No information reported	High risk	High drop out	Unclear	No information reported

4.4 Discussion

In this systematic review, we identified 12 studies that assessed change in weight or BMI with a view of preventing weight gain in adults. The studies included in this review tried to halt weight gain by using a combination of strategies and in different settings. Strategies used were mostly strategies that have been previously been tried in weight loss interventions such as health education or self-regulation through cognitive behaviour theories.

Four studies were delivered in higher education settings and some targeted to change the knowledge around nutrition, weight, energy balance in the form of a course while others tried more novel approaches like personalised feedback and self-weighing (Levitsky et al). Although interventions around weight management (mainly weight loss) have always used health education to achieve this, there is evidence that this is not sufficient by itself to change individual behaviour or sustain a behavioural change long-term. The context within weight related decisions and behaviours are made is critical for the success of the intervention. The more personalised trials showed promising results but were only tested on a very small number of subjects (n=11), thus it is difficult to generalise those results and suggest that this approach could be used in public health policy. Further randomised trials need to examine the effect of this personalised approach. Lemon et al approached the weight gain prevention topic by only changing the environmental structure of the settings. Some promising approaches for addressing weight gain prevention may include strategies such as tailored messaging, calorie-labelling in university catering outlets, use of technologies such as internet and social media or finding behaviours other than health that will be motivating in themselves and may promote weight maintenance.

In recent years, there has been a broad array of research focusing on overall population-wide obesity prevention. Although obesity prevention research during young adulthood has been limited, there are important insights that may be drawn from work among other age-groups. Promising avenues for future research include obesity prevention interventions that capitalize on the important influence of social networks and peer influences among young adults, as well as other environmental influences. The integration of technology may be a particularly important strategy among young adults. Furthermore, large-scale population-wide environmental approaches like calorie-labelling for food eaten outside home may be particularly relevant to the young adult age-group, given that individuals of this age are gaining weight rapidly. When designing new interventions, a specific focus on the unique challenges faced by young adults is particularly important. These challenges include the many changes experienced by young adults, such as lifestyle changes and learning the skills needed to manage basic adult responsibilities.

Overall, there is an urgent need to develop and evaluate young adult-focused weight gain prevention strategies, particularly considering that it is likely that interventions developed for other age-groups are not directly transferrable to young adults. Methods used by existing obesity-related interventions may be unsuitable and ineffective for young adults.

This updated literature highlights the limited evidence available on this topic. Although some of the studies have identified some promising strategies for young adult obesity prevention, more large scale studies are needed in order to explore these issues in more depth and draw some conclusions.

Chapter 5:

An Introduction to behavioural theories for designing obesity prevention studies

Overview

This chapter is a brief overview of the behavioural models previously used in weight management studies along with a summary to the theories on which the intervention studies described in the next few chapters are based on.

5.1 Introduction

The annual mean weight gain during young adulthood averages 0.7 kg/year (Lewis et al.2000) with young adults in higher education experiencing higher weight gains but still remaining relatively small ranging from 0.3-1.6kg/year. In theory, weight maintenance and weight gain prevention should be relatively easy to achieve since the weight gain observed requires only an extra 50-100 kcal/day above energy requirements. In reality though, people seldom eat or exercise in a consistent way or monitor their variable food intake and activities on a daily basis. Even if they were to, there are no methods available which can measure accurately enough to detect a 50-100 kcal difference over 24 hours. The wide range of weight gains and weight losses and non-linear patterns of weight change observed in individuals is an indication of the complexity of the issue. The fact that some people start to gain weight later than others indicates that some can control energy balance and thus body weight despite living in an ‘obesogenic’ environment.

There is evidence suggesting that maintaining body weight stable over the course of adulthood, even if the baseline BMI is above the normal range, minimises the risk for developing all components of the metabolic syndrome. A study that followed young adults for 15 years found that those who maintained weight stable had minimal progression of all metabolic syndrome components (Lloyd-Jones et al. 2007).

The problem of overweight and obesity has been addressed by behavioural treatments, more traditional approaches targeting diet and physical activity changes, medication, and surgery. While valuable lessons were learned from weight loss studies and people who were successful at maintaining some weight loss at least for a year, returning to previous behaviours and habits has been the rule (Barte et al.2010). In a recent review of weight management studies three important continuing problems had been identified; 1) long-term adherence to programmes, 2) high cost of interventions, 3) articulate theory-based strategies for different phases of treatment (Peri & Corsica, 2002).

Weight gain prevention studies will need to overcome the same problems and in addition engage with large segments of the population in order to have any meaningful public health effects. Population in weight loss studies are self-selected and usually motivated in a certain way to adhere to programmes while populations that will engage in weight gain prevention programmes will need a completely different approach, especially when this population is of younger age.

The limited studies that were conducted, to date, aiming to prevent weight gain produced limited results. The authors of the first study on weight gain prevention made some recommendation which were drawn from their experience and results on how future studies can be improved (Jeffery et al.2000). Those were; 1) increase frequency contact, 2) maintain motivation, 3) have mechanisms to respond to any observed weight change, 4) prepare tailored and interactive programmes.

The literature on the factors influencing human behaviour is very extensive (Maio et al.2007; Jackson, 2005). Economic theory represents the starting point for modelling many aspects of human behaviour. Behaviours which involve a choice between options with clearly perceived costs and benefits for the decision maker are particularly suited to analysis based on economic theory.

The rate at which people value or devalue outcomes is known as discounting and depends on time preference. The process of devaluing outcomes that occur in the future is known as delay discounting. Time preferences and discounts are related to human behaviours and linked to intertemporal choices and utility. Lately, there has been an increasing level of interest in discounting and health decisions (Rachlin & Green, 1972; Green & Myerson, 2004). This process can be used to explain the observation that individuals will sometimes choose a smaller, more quickly available reward rather than a larger reward available later. This is particularly true for young adults and decisions around health. Young adults have different time preferences and discounts compared to older adults. Several cross-sectional studies tried to explore differences between delayed discounting and age. Green (1994) found that time discounting decreases with increasing age (Green, Fry, & Myerson, 1994). This may indicate that self-control is a feature we develop across the lifespan. Steinberg et al. (2009) found that younger adolescents demonstrated a weaker orientation to the future than did individuals aged >16 years old older.

On the other hand though, the actual amount of lifetime left inevitably decreases over the life span, and the perception that one's remaining lifetime is decreasing may shorten future time perspective in older age (Carstensen, Isaacowitz, & Charles, 1999; Carstensen, 2006). Lang and Carstensen (2002) accordingly found in a sample of 20- to 90- year- old adults that older adults perceived their future time as more limited than younger adults, as measured with Carstensen and Lang's Future Orientation Scale (Carstensen & Lang, 1996). They found that future time perspective was strongly associated with chronological age, sharing more than 50% of the variance with ageFuture orientation may be modified by changes in one's external environment, such as entry into education or occupation as individuals start valuing themselves. . Trommsdorff et al. (1979) in a longitudinal study showed that adolescents who entered the workforce anticipated relatively more events in the occupational domain than before entering and these events were located in the nearer future.

The link between eating patterns or behaviours and discounting has been observed on several studies. Forzano & Logue (1994) and Logue & King (1991) studies both found that most people preferred eating foods/ juice immediately rather than waiting for additional food/juice later. Sharper delay discounting has been related with obesity in women (Weller, Cook, Avsar, & Cox, 2008), and with higher BMI (Zhang & Rashad, 2008; Smith, Bogin, & Bishai, 2005; Borghans & Golsteyn, 2006). Thus, while the current literature is strong that sharper delay discounting is associated with BMI and obesity, there are no studies determining whether the relation also exists for future time perspective. However, in a time-perspective intervention conducted by Hall & Fong (2003) aiming at enhancing long-term thinking on levels of physical activity. The intervention was successful in leading to increased levels of physical activity which might be a first indication that time perspective and delay discounting may be causally associated with health behaviour and could be potentially used in interventions aiming to prevent obesity.

Theories and models regarding human behaviours are drawn from a range of diverse disciplines. A summary of the most popular behavioural models and theories are shown in **Table 5.1.**

Table 5.1 A summary of the most popular models and theories of behaviour grouped by discipline.

	Model or Theory	Author(s)	Year
Economic	Expected Utility Theory	Bernoulli Daniel	1738
Behavioural Economics	Rational Choice	Simon Herbert	1955
	Judgement Heuristics	Tversky and Kaheman	1973
	Prospect Theory	Tversky and Kaheman	1979
	System 1 and 2 Cognition	Stanovich and West	2000
	Nudge	Thaler and Sunstein	2008
Information	Value Action Gap	Blake	1999
	Attention, Interest, Desire, Action	Strong	1925
Attitudes and Beliefs	Theory of Reasoned Action	Fishbein and Ajzen	1975
	Health Belief Model	Rosenstock	1974
	Protection Motivation Theory	Roger	1977
Norms	Norm Activation Theory	Scwartz	1977
	Normative social behaviour	Rimal and Real	2005
	Norm Neutralization Theory	Sykes and Maza	1957
	Stealth	Robinson	2008
Efficacy and Control	Theory of self-efficacy	Bandura	1977
	Theory of planned behaviour	Ajzen and Madden	1986
Habits	Theory of interpersonal behaviour	Triandis	1977
	Change theory	Lewin	1946
	Stealth	Robinson	2008
Self-regulation	Social cognitive theory of self-regulation	Bandura	1991
Change in stages	Transtheoretical model of health behaviour change	Prochaska and Di Clemente	1983

Among all the models presented in table 5.1, three behavioural models were chosen for the studies described in the next few chapters. The literature on the different behaviour models does not allow the drawing of any definite conclusion on the effectiveness. Weight gain prevention studies were not based on any specific theory. Since economic theory is the starting point for exploring human behaviour, the first and latest developed models-the rational and the nudge-with the behavioural economics area were chosen. The recently developed model of stealth was the third one chosen as it is widely used in public health but without any evidence for its impact.

5.2 Theory 1: 'Nudging'

In 2008, Richard Thaler and Cass Sunstein published a book entitled *Nudge: Improving Decisions About Health, Wealth, and Happiness*. In this book, the two authors are trying to explain, by drawing on behavioural economics and social psychology, why people tend to behave in a way that deviates from rationality as defined by classical economics. Indeed, traditional economics holds that humans, as rational beings, make choices to maximise their welfare. Behavioural economics meanwhile relies on cognitive-psychology research to relax those assumptions, teaching instead that humans have bounded rationality and so make biased decisions that sometimes are against their best interest (Stewart, 2005).

Thaler and Sunstein argue that it is acceptable for governments to design environments and contexts, what they call the 'choice architecture'. The 'choice architecture' is the environment in which people make decisions and nudging amy be used in order to make it easier for people to maximise their well-being. However, as people should still be free to make their own decisions without any restriction in options, any change in the choice architecture should be modest (Bonell et al. 2011). As such, a 'nudge' incorporates any aspect of the choice architecture that can potentially alters peoples' behaviour in a predictable way but without forbidding any options or significantly changing economic incentives (Thaler and Sunstein, 2008). Nudges might involve subconscious cues or correcting misapprehensions about social norms.

Table 5. 2: Examples of 'nudging' and regulating actions for the biggest public health models

	Nudging	Regulating
Smoking	Make non-smoking more visible through mass media campaigns communicating that the majority do not smoke and the majority of smokers want to stop Reduce cues for smoking by keeping cigarettes, lighters and ashtrays out of sight	Ban smoking in public places Increase the price of cigarettes
Alcohol	Serve drinks in smaller glasses Make lower alcohol consumption more visible through highlighting in mass media campaigns that the majority does not drink to excess	Regulate pricing through duty or minimum pricing per unit Raise the minimum age for the purchase of alcohol
Diet	Designate sections of supermarket trolleys for fruit and vegetables Make salad rather than chips the default side order	Restrict food advertising in the media directed at children Ban industrially produced trans fatty acids
Physical Activity	Make stairs, not lifts, more prominent and attractive in public buildings Make cycling more visible as a means of transport, e.g. through city bike hire schemes	Increase duty on petrol year on year (fuel price escalator) Enforce car drop-off exclusion zones around schools

The nudge theory is becoming increasingly popular within political systems in countries like the US and the UK as it fits with the 'libertarian paternalism' politics. If successful, nudging may offer an ideal synthesis between the duties first to respect people's autonomy and free will and secondly of beneficence, which at times favours a paternalistic influence. Thaler and Sunstein recognise that it is very rarely that people make rational choices, as they often use heuristics shortcuts in the decision making process. Nudging seems capable of overcoming certain agencies interfering with decision making;

1) ignorance

Information is needed in order to make a decision. Information requires some short of expertise. Nudging does not require knowing or acquiring any information as the desired choice is presented as the default choice.

2) Inertia

Even, in the case of having sufficient information or knowledge on a topic, everyday chores tend to be the steering force towards an 'inertia status'. Once again, by setting the desired choice as a default choice, inertia is overcome.

3) Akrasia

Setting the desired choice as the default choice overcomes people's akrasia when it comes to decision making.

4) Social benefits

Nudging might direct choices towards what is socially beneficial even if that is at the expense of the individual at the time of the decision.

5.3 Theory 2: The rational model

The rational model is based on the assumption that when given all the information human beings will make the best choice for themselves with a view of maximising utility (Simon,1955). It is assumed that there is a linear relationship between information, attitudes and behaviours (Kolmuss & Agyeman 2002). Information can generate the knowledge which forms attitudes, which then lead to certain behaviours. However the relationship between those three is not strong and often, during decision making process, people take shortcuts. This process is known as the 'Value Action gap' (Blake,1999).

Traditionally, weight-loss programmes have been based on the rational model. Researchers assumed that by giving the information of health effects of excessive weight and energy reduction diets, people would generate the knowledge required for changing attitudes and behaviour. In real life settings, though, this was not the case. Health-behaviour change involves a series of episodes of adherence, lapses, relapses, and recovery as the individual faces new behavioural challenges and contexts. Interventions need to plan for these predictable episodes and be long enough to provide individuals with the self-regulatory tools and supports to effectively problem solve and then deal with minor and major setbacks and learn from those experiences. A review on weight loss studies showed that studies lasting more than a year are more successful compared to those with shorter duration (Peri & Corsica,2002).

Generally, the rational model has been unsuccessful for weight loss studies as something did not account for the shortcuts during decision making process and the environment in which decisions are made. Weight-prevention strategies, though, are different in terms of outcomes hence in those the rational model may fit better and be successful, especially by adopting the fourth generation model as described by Bandura which incorporates the provision of information, external reinforcement, adaptive self-regulation skills, and continued support. The idea of weight gain prevention is relatively new and its value is likely to be unknown by population segments. There may be less question about the ability to sustain some simple behaviour changes over time for weight gain prevention, but there may be little motivation to do so if outcome expectancies are neutral or negative or there is dissatisfaction compared to initial unrealistically positive expectancies in weight loss studies. In addition, the new behaviours need to be functionally valuable, particularly if they are to be maintained. That value is likely enhanced if the initial expectations provided to people about outcomes are realistic without much emphasis on the weight per se.

5.4 Theory 3: The stealth model

The ‘stealth’ model is based on the identification and targeting of behaviours that are motivating in themselves and the desired outcome will be the ‘side-effect’ of the intervention rather than the primary outcome. The ‘stealth’ model has been developed the past few years. It first appeared in 2008. Robinson (2010) suggests following new social movements in order to control obesity. There is also evidence that there is a 'transmission' of ideas and behaviours in societies called the 'social contagious' theory. According to Christakis et al (2008) (who developed the notion of social contagious theory) ideas and behaviours spread in networks. Therefore, if we convince large population segments to follow certain social movements that can have a link with healthful lifestyle, the side-effect of that approach could be to control the obesity epidemic. A few examples of the potential movements and effect on individual level behaviour and community/societal changes can be seen in **Table 5.3**.

Table 5.3 Movements, individual behaviours and community or society changes that may lead to changes in physical activity or diet.

Movements/causes	Individual-behaviour change	Community/society changes
Environmental sustainability Climate change		
Preventing global warming and climate change Sustainable agriculture Organic farming Slow food, eating locally	Eat more fresh fruits and vegetables. Eat less meat Eat less processed and packaged foods. Eat less foods transported over long distances	Greater access to fresh fruits and vegetables (farmer's markets, home gardens, community gardens, local supermarkets) Taxes/subsidies to reduce consumer prices of fruits and vegetables. Greenhouse gas cap and trade/water taxes, resulting in increased costs of production for meat and dairy.
Food safety		
Reducing risk of infectious diseases from food (*Escherichia coli*, Bovine Spongiform Encephalopathy) and potentially harmful additives and/or contaminants	Eat less meat Eat less fast food and restaurant food. Eat more organically and locally grown fruits and vegetables	Greater surveillance/inspections of meat and imported foods and food processing, increased food safety requirements, raising costs to consumers
Human rights/social justice		
Improving workers' rights, poor working conditions in fast food industry and suppliers Food justice, increasing access to more healthful foods such as fresh fruits & vegetables in low-income areas; women's rights, families' rights; fair trade; reducing racial/ethnic and gender discrimination from stereotypes in media	Eat less fast food restaurant food. Eat less meat. Eat more fruits and vegetables from farmers' markets, local farmers, following fair trade practices Watch less media to reduce exposure to negative racial/ethnic and gender stereotypes	Increased regulations to protect workers in slaughterhouses, meatpacking, fast food, etc., and resulting increases in consumer prices of meat, fast food. Boycotts of fast food restaurant chains for working conditions of their employees and suppliers. More farmers' markets and CSA providing greater access to fresh fruits and vegetables in low-income areas

Anti-globalization		
Farmers, labour unions, human rights groups, nationalists, etc. resisting corporate and cultural globalization and WTO and World Bank free trade policies	Eat more locally grown/domestically grown food. Eat less fast food and processed foods and beverages from multinational corporations. Eat less imported foods	Trade barriers/tariffs, agricultural subsidies to reduce relative consumer prices of domestically grown produce; policies and public sentiment favouring greater consumption of locally produced food products and less availability and higher costs for highly processed and packaged convenience foods from other countries; boycotts of multinational food chains, imported foods, multinational fast food and beverage companies
Animal protection Reducing inhumane treatment of animals during farming and slaughter	Less beef, pork, poultry, diary, and fish consumption, more vegetarianism	Activist and consumer pressure and legislation to improve treatment of animals during farming and slaughter, resulting in increased production costs and consumer prices of meat and dairy
Anti-consumerism		
Reducing consumer culture and/or the influence of consumer culture	Less purchase and consumption of heavily advertised and marketed fast food and snack foods/ convenience foods Less television watching and other screen media use	Activist and community pressure and legislation to reduce advertising and marketing of foods to children in schools, communities and media. School and community-based programs and campaigns to reduce screen time and other exposures to marketing
Cause-related fundraising		
Raising awareness and funding for charitable causes such as cancer or AIDS research and services	Walk-a-thons, door-to-door fundraising, training and participation in distance and/or endurance races, long distance walks and bike rides, etc.	Greater use of physical activity-related fundraising organized by charities, increasing opportunities for physical activity in local communities. Development of innovative strategies to increase social support and coaching for participation in charitable giving through physical activity-related fundraising events
Patriotism, nationalism		
Supporting one's own national economy and culture	Eat more locally grown/domestically grown food. Eat less fast food and processed foods and beverages from multinational corporations. Eat less imported foods	Trade barriers/tariffs, agricultural subsidies to reduce relative consumer prices of domestically grown produce; policies and public sentiment favouring greater consumption of locally produced food products and less availability and higher costs for highly processed and packaged convenience foods from other countries; boycotts of multinational food chains, imported foods, multinational fast food and beverage companies

*Adapted by Robinson T, 2010

The stealth model has only been used in a very small study, to date, conducted by Hecklerson et al in 2011. He examined the effect of two courses on the awareness of healthful eating habits and any changes in self-reported eating habits of students choosing a course on obesity or a course on health and society.

He found that those who chose the course on society and health improved their eating habits more than those who chose the course on health and obesity.

There are, however, several examples of the use of stealth model in public health but these have not been evaluated, to date. The most common example of stealth model is activities and promotions aiming to increase the physical activity of citizens by organising marathons and encouraging citizens to participate. Participation in such events is encouraged not for any personal benefit but for raising funds for several charity causes. A survey conducted for the Charities Aid Foundation (CAF) showed that almost 5 million Britons run for charities in 2013 (http://www.comres.co.uk/poll/904/charities-aid-foundation-charity-running-survey.htm). Hence, citizens participate in activities for raising funds and the 'side-effect' could be improvements of physical activity levels.

Conclusion

The current evidence behind weight gain prevention is very limited and no definite conclusions can be drawn from the studies conducted to date. Even though, the literature on human behaviour is broad, the studies on weight gain prevention were not based on any theoretical model. The studies described in the next chapters are based on three theories, the nudge, the rational, and the stealth.

Chapter 6:

Nudging with calorie-labelling.

Literature review, meta-analysis

and young adults' views on calorie-labelling

Overview

Calorie-labelling is a form of nudging. This chapter contains a review of the literature on calorie-labelling in catering outlets after the calorie-labelling legislation in the US and its impact on calories purchased along with a meta-analysis. This chapter aimed to gauge young adults' views on calorie-labelling and potential use of it. Exploring young adults' views will help to determine whether calorie-labelling could be used when designing weight gain intervention and also how it could be tailored to the specific needs of the target population.

6.1 Introduction

The prevalence of obesity has been increasing all over the world (WHO, 2013), along with the number of catering outlets available and the number of meals eaten outside home (Defra, 2011). European law requires a list of ingredients on retailed food products not for food provided in catering outlets. Through concern about the obesity epidemic, there are now several examples of legislation to make calorie labelling obligatory. As an early example, the New York City (NYC) Department of Health passed a law requiring calorie contents of foods sold by catering businesses with over 15 outlets to be posted beside the price, in exactly the same font in 2008. The rationale is that providing information on the calorie contents of foods would give people a tool to make informed choices and effectively manage their overall calorie intake. Young adults, and specifically those in higher education, have a particularly susceptibility to weight gain Crombie et al.2009). If this weight gain persists, it may lead to obesity. Calorie-labelling might have a particular value in preventing the weight gain observed in this age group as young adults often rely on meals eaten in catering outlets. This study aimed to review the current literature, conduct a meta-analysis, and determine young adults' views on calorie-labelling and on calories purchased.

6.2 Methods

6.2.1 Search Strategy

A literature review was conducted in 2014 using Pubmed/OVID databases, with key words 'labelling' and 'calories' or 'calorie-labelling' (English and American spellings). Inclusion criteria were: 1) examining the effect of calorie-labelling as an individually identifiable intervention in 'real-life' settings, 2) published between 1990-2014. Studies on children and those of low quality were excluded. Study quality was assessed using the Cochrane risk of bias assessment tool (http://ohg.cochrane.org/sites/ohg.cochrane.org/files/uploads/Risk%20of%20bias%20assessment%20tool.pdf). Two researchers (CKN & MEJL) independently assessed the studies for the inclusion criteria and quality. A meta-analysis used on-line software (http://www.meta-analysis.com/index.php).

6.2.2 Questionnaire

An on-line lifestyle questionnaire on diet and physical activity was sent to all new first-year undergraduate students in a large University in the West of Scotland, a region with a very high prevalence of obesity (SHS, 2012). Three questions on calorie-labelling were included. The study was reviewed and approved by the Medicine, Life Sciences and Veterinary College's Ethics committee of the University of Glasgow (Appendix 1, 2).

Table 6.1: Study characteristics and risk of bias according to Cochrane tool.

Studies Characteristics				**Cochrane Risk of Bias Tool**			
Reference	**Design/Setting/Intervention**	**Primary Outcome Measure Method**	**Results**	**Sequence generation**	**Allocation concealment**	**Incomplete data outcome**	**Selective outcome reporting**
Elbel .2009	Cross-sectional NYC: intervention site Newark: comparator site Calorie Labels added in chain restaurants in the intervention site	Calories purchased before and after the calorie-labelling legislation (1 month interval). from customers' receipts	NYC: 21kcal Newark: 3kcal NS change	Low risk	High risk	High risk	Low risk
Elbel. 2013	Cross-sectional Philadelphia: Intervention site Baltimore: Comparator site Calorie Labels added in chain restaurants	Calories purchased before and after the calorie-labelling legislation (4 months interval). Calories purchased from customers' receipts	Philadelphia:55kcal Baltimore:-52kcal NS change	High risk	Unclear	Low risk	Low risk
Dumanovsky.2011	Cross-sectional NYC Calorie Labels added in chain restaurants	Calories purchased before and after the calorie-labelling legislation (8 months interval). Calories purchased from customers' receipts	18kcal NS change	Low risk	Low risk	Low risk	Low risk

Krieger. 2013	Cross-sectional King County, WA Calorie Labels added in food chains and coffee chains	Calories purchased before and after the calorie-labelling legislation (4-6 & 18 months interval). Calories calculated from customers' receipts	No difference detected at 6 months. After 18 months: -38.1kcal at food chains, NS -22.1 at coffee chains (p=0.002)	Low risk	Low risk	Low risk	Low risk
Finkelstein. 2011	Natural experiment King County, WA Calorie Labels added in chain restaurants	Calories purchased before and after the calorie-labelling legislation (8 & 13months interval). Calories ordered from customers' receipts	No difference detected at 8 or 13 months	High risk	High risk	Low risk	Low risk
Chu. 2009	Quasi-experimental Ohio State University, dining hall Calorie labels added to entrees	Calories purchased- customers' receipts	-12.4kcal (p=0.007)	High risk	Unclear	Low risk	Low risk
Pulos. 2010	Quasi-experimental Pierce County, Washington Calorie labels added to entrees in six restaurants	Calories purchased	- 15 kcal	High risk	Unclear	Low risk	Low risk
Studies Excluded			**Reason for exclusion**				
Harnack. 2008			Study conducted in laboratory setting				
Roberto.2010			Study conducted in laboratory setting				

Hammond.2013	Study conducted in laboratory setting
Balfour.1996	Very poor quality. No statistical analysis
Gerend.2009	Very poor quality.
Downs.2013	Primary outcome other than effect of calorie labels on calories ordered
Vanderlee L & Hammond D. 2013	Other nutrient information were also posted along with calories. Poor quality

Seven studies met the inclusion criteria, and seven were excluded, on the basis of quality or not meeting inclusion criteria (**Table 6.1).** Five studies included some risk of bias in methodology but there were two studies that were low risk thus could be classified as 'high-quality'.

New York City (NYC) legislation: Three studies examined the effect of the NYC legislation for compulsory calorie-labelling in chain restaurants, by collecting customers' receipts and/or questioning customers' views on labelling. None found any effect on calories purchased.

Washington legislation: Two studies assessed the legislation enacted 1st January 2009 which required calorie-labelling for chain restaurants with over 15 outlets and sales over $1 million/year. Calorie-labelling also became compulsory for drive-thru restaurants in Washington from August 2009. Finkelstein et al found no effect neither at eight or thirteen months post-labelling. Krieger et al found no effect at 6 months but a decrease of 22.1kcal at coffee chains (p=0.002) at 18 months post labelling

Entrees at independent catering outlets: Two US studies examined the effect of calorie labelling on entrees only. Chu et al, found a mean decrease of 12.4 kcal per entrée purchased from a university cafeteria (p=0.007). Pulos et al examined the effect of voluntary calorie-labelling in six independent restaurants. This study found reductions ranging from 16.8-55.6kcal in 4 participating restaurants, and no change in the remaining two (Overall mean change -15kcal).

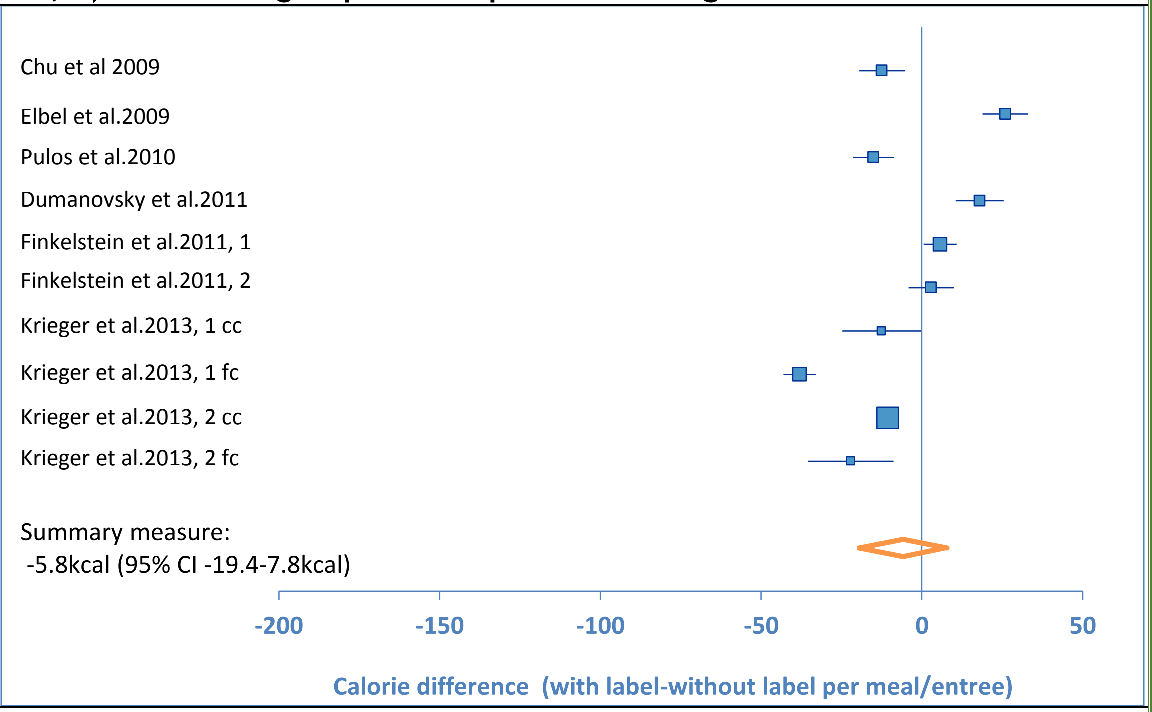
Gender effects: Four studies included analyses based on gender. Dumanovsky et al separated subjects who noticed the calorie-labels according to gender, and found reductions for meals of 94.6kcal for men (p=0.003) and 99kcal for women (p<0.001). Krieger et al found a significant reduction of 65.4 calories for meals purchased by women (p=0.01) but not for men. The two remaining studies found no gender effect.

6.2.2. Meta-Analysis

Data on calorie differences and SD or 95% CI, allowing a meta-analysis, were available for six studies (**Figure 6.1**). The overall effect of calorie-labelling, including both meals and entrees alone, was -5.8kcal (95% CI -19.4-7.8kcal) .The summary measure for two studies which provided separate data on customers who reported noticing the calorie labels (not separated by gender) was -124.5kcal (95% CI -150.7 to -113.8kcal).

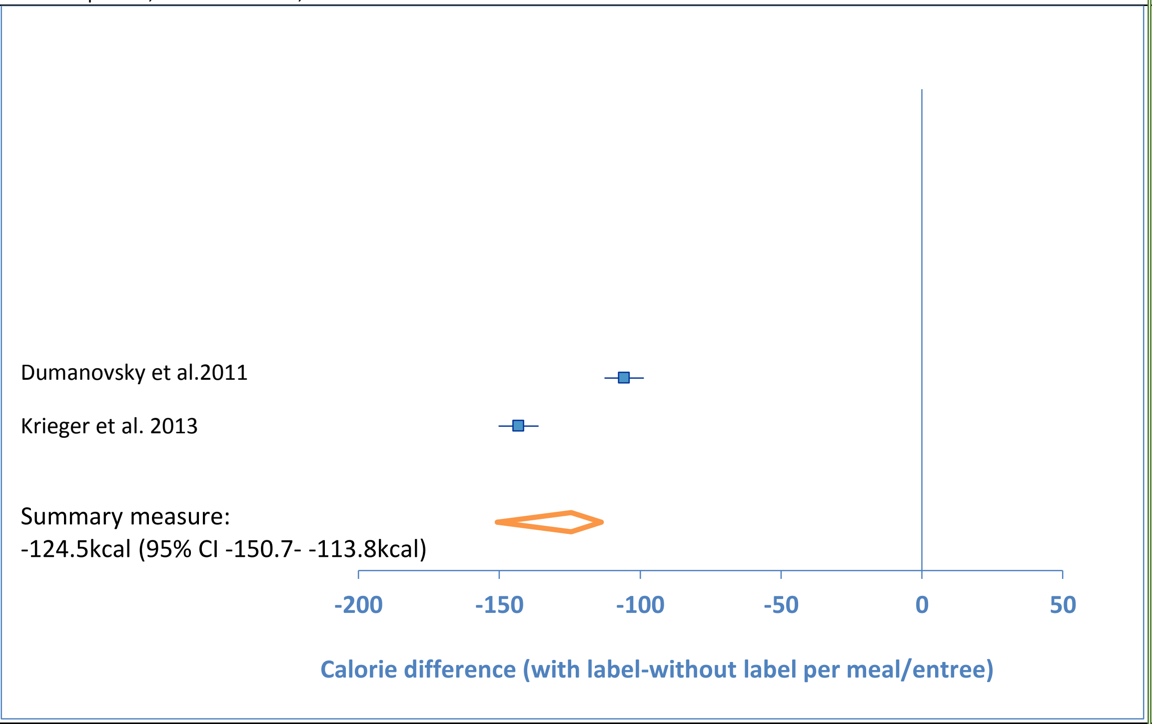
Figure 6.1: Meta-analysis of the differences between calories purchased with and without calorie-labelling, a) for all meals or entrees in the six included studies; b) for the subgroups who reported noticing the calorie-labels.

a)



1=time point 1, after 8 months
2=time point 2, after 13 months
1 cc=time point 1, after 6 months coffee chains
1 fc= time point 1, after 6 months food chains
2 cc= time point 2, after 18 months, coffee chains
2 fc=time point 2, after 18 months, food chains

b



6.2.2 Questionnaire results

Completed questionnaires were returned by 1,440 out of the 3,010 first year students, a response rate of 48%. Participants' characteristics (mean, SD) were; age 20.3 SD 2.9 years, weight 65.9kg SD 14.4, height 1.72m SD 0.01 and BMI=22.3 kg/m^2 SD 4.6.

More females (54%) than males, (36%), reported currently using food labels always or often, when buying food. About a third of female and a quarter of male participants would like to see calorie information at all suggested catering outlets (**Table 6.2**). Half the female participants and a third of males reported that they would like to see calorie information on alcohol. Students (n=213, 15%) mentioned that they recognise that excessive alcohol intake is bad for them and calorie labels might help reinforce that message.

Table 6.2: Nutritional information that first-year students would like to see in various settings

	Female				
	University Canteens n (%)	Fast Food shops n (%)	Take away shops n (%)	Pubs n (%)	Restaurants n (%)
Calories	256 (31)	239 (29)	239 (29)	239 (29)	231 (28)
Fat	198 (24)	206 (25)	198 (24)	165 (20)	165 (20)
Sugar	157 (19)	157 (19)	140 (17)	115 (14)	124 (15)
Salt	157 (19)	165 (20)	157 (19)	124 (15)	124 (15)
No Information	66 (8)	66 (8)	82 (10)	181 (22)	173 (21)
	Male				
	University Canteens n (%)	Fast Food shops n (%)	Take away shops n (%)	Pubs n (%)	Restaurants n (%)
Calories	114 (24)	114 (24)	114 (24)	105 (22)	105 (22)
Fat	110 (23)	124 (26)	119 (25)	96 (20)	91 (19)
Sugar	81 (17)	91 (19)	81 (17)	71 (14)	71 (14)
Salt	81 (17)	94 (20)	88 (18)	75 (15)	78 (16)
No Information	88 (18)	57 (12)	78 (16)	139 (29)	139 (29)

6.3 Discussion

Two reviews were published on calorie-labelling studies in 2008 by Harnack & French (n=6) and 2011 by Swartz et al (n=7), the first concluding that evidence is scarce and more research is needed while the second concluded that calorie-labelling does not have the intended effect on calories purchased. The present literature-review revealed only seven papers with adequate data. Importantly, no study showed any increase in calories purchased. The meta-analysis showed no overall effect on calories purchased, but among those who reported noticing the calorie-labels, the effect was significant, at -125kcal. In theory, saving 125kcal daily through calorie-labelling would result in a saving of 45,260kcal/year, which would avoid a weight gain of about 6kg/year. The average annual weight gain in adults is small, around 0.7kg/year, but obviously greater in those who become obese, so calorie-labelling clearly has capacity as a simple weapon against the obesity epidemic.

The superior effect of calorie-labelling among those noticing the calorie-labels indicates its value for people who want to control their weights, but the lack of effect in others may reflect inappropriate labelling presentation or lack of educational supporting material and guidance. The two studies from independent catering facilities both found significant effects but do not report the labelling format they used: their presentation may have been different from that required by the US calorie-labelling legislation. Given that so many young people would like to avoid weight gain, having very visible calorie-labels is important. From our survey, young adults generally seem in favour of the provision of nutrition-information notion with women appearing more receptive to men, supporting previous evidence (O'Dougherty et al.2006).

Among the studies that assessed the effect of calorie-labelling legislation, there was a large variation in elapsed time between implementation of the legislation and data collection. Krieger et al collected data at two time-points after legislation went in place (6 and 18 months) and found a significant effect only after 18 months, so the timing of studies after the implementation of the law may be important in a setting where the customers vary daily. It may take time for customers' familiarity with calorie-information to affect calories purchased. On the other hand, consumers can be resistant to adopting lifestyle change and become 'blind' to information provided ubiquitously, like the health messages on cigarettes (Rhode et al. 2008). However calorie-information is used by industry voluntarily so clearly has value for marketing. Marketing interventions to change behaviours seem to have effects which increase gradually over time, so long-term observation is necessary along with revision of the public health message around calorie-labelling.

Only one of the studies reported responses from the caterers. Pulos et al who examined the voluntarily effect of labelling reported reformulation of recipes and changes in portion sizes after the initial analysis. Assessing the caterers' responses to calorie-labelling is critical for sustainability. 'Nudging' consumers towards better-informed choices can lead potentially to menu reformulations by working closely with the catering providers.

No studies have assessed the effect of calorie labelling for the UK population or gauged their views on intended use.

Young adults in higher education generally seem positive towards the presence of calorie information and other nutritional information at the point-of-purchase in various settings, but about a third responded positively. Whether that could help them control their body weights would need further research. Female students seem to be more receptive than males to the presence of such nutritional information supporting previous evidence that females, particularly older females, are more responsive to menu labels.

The effectiveness of point-of-purchase calorie-labelling on food choices might be strengthened if the information is combined with other educational materials, and linked to guidance over individual target-setting outcomes.

This review included only studies conducted in real-life settings. Three other studies (Harnack et al.2008; Roberto et al.2010; Hammond et al. 2013) were conducted in closed laboratory settings by randomising participants to groups that received calorie information, no information or other information. The 'laboratory setting' studies cannot represent a realistic environment in which customers make food choices: participants were informed about study aims, which may have influenced results while under observation. Focussing on calorie contents for the purpose of a laboratory study cannot replicate the complexity behind day-to-day real-life food choices, with competing influences from factors such as taste, price, convenience and social relationships (Glanz et al.1998).

Conclusion

Calorie-labelling is a low-cost intervention, which can be easily implemented. Many young adults are receptive to the idea of calorie-labelling in catering outlets and alcoholic drinks. Current evidence supports the notion that it may help against weight-gain and obesity, especially among those noticing calorie-labelling.

Chapter 7:

Nutritional Composition of menu in catered accommodation and comparison with meals available in chain restaurants

Overview

This chapter aims to examine the nutritional composition of the menu offered to young adults in a catered hall and compare it with current guidelines for macronutrients and micronutrients. The analysis of the menu was carried out in order to provide the values for the calorie information used for the calorie-labelling study described in the next chapter. A comparison was also carried out among the meals offered in the student hall, as an example of a small independent catering business, and meals offered by the five biggest chain restaurants.

7.1 Introduction

Weight gain is a particular problem for young adults (Lean et al.2013), including university students (Crombie et al.2009). Catered residences take the pressure off students from preparing and cook their meals, but this convenience comes with uncertain health implications. Menus used in catered halls are not subject to any nutritional controls, in common with most small catering facilities. Food eaten outside home is often higher in calories and of poorer nutritionally quality (Prentice & Jebb. 2003). This is a particular public health concern because young adulthood; once a period of optimal health is now a period where rapid weight gain occurs and poor eating habits can be established (Lewis et al.2000). An awareness of the energy contents of meals may be valuable for interventions to prevent unwanted weight gain and obesity. Chain restaurants have been particularly criticised both for the food they provide and the way they advertise their products especially to children. Chain restaurants account for approximately 25% of the total sales of food eaten outside home, while small independent catering facilities account for the remaining 75%. More importantly, catering facilities in institutions such as universities, hospitals, and schools that usually provide more than one meal/day to service users are not subject to any nutritional control posing a greater risk for the development of obesity and diet-related diseases. Attention has been drawn to the nutritional content of chain-restaurant food, but no studies exist on nutritional provision in settings such as student halls, which provide food on a repeated daily basis.

Poor diet is not only a major contributing factor for chronic diseases, but can also affect the academic performance of students (Florence et al.2008). Attention has been drawn to the nutritional content of chain-restaurant food, but no studies exist on nutritional provision in settings such as student halls which provide food on a repeated daily basis. The present study analysed the menu of evening meals offered to university students in a residence catered hall in Scotland, a country with the worst obesity rates in Europe (Berghofer et al. 2008) and compared them to current dietary recommendations for young people.

7.2 Methods

The catered hall, located in Glasgow University, in Scotland, provides accommodation for approximately 120 students, mostly 1st year. Breakfast and evening meals are included in the accommodation price. The hall is located a 40-minute walk or 10-15 minute bus journey away the main University's campus. The closest retail grocery outlets were a 20 minute-walk away. Very limited cooking facilities are available on-site, so most students rely on meals provided in the hall.

7.2.1 Menu

The menu comprised a five-week cycle, developed by the catering staff, without any nutritional guidance. The main focus of caterers was on low food-costs and wastage. All meals were prepared and cooked on site by in-house catering staff. For meat and fish products, standard portions were purchased (110g per portion of meat and 170g per portion for fish) and cooked. Recipes, including ingredient lists, for all dishes served in the hall, were made available to the researcher for analysis by catering staff. Stock rooms were checked and all commercially prepared ingredients used for cooking or preparations of the meals were recorded.

Evening meals comprised three courses. From a choice of three different main course dishes, students could only choose one, as well as a starter, dessert and a piece of fruit, or two pieces of fruit, or a piece of fruit and a pot of yogurt (125ml). The side dishes (rice, chips, and vegetables) were served using the same utensils to ensure portion-size consistency.

7.2.2 Evening-meal analyses

In view of the numerous possible meal combinations, for this study it was assumed that each student would choose the three-course meal. The meal-options for analysis were created by two formulae: meal-option 1 = starter + main course (from a choice of 3) + side dishes + dessert; meal-option 2 = starter + main course (from a choice of 3) + side dishes + item of fruit. It was assumed for this analysis that when two side dishes were available, students chose half a portion of each, a common practice observed during serving.

7.2.3 Chain restaurants menus

The top five chain restaurants holding the largest share in the UK market were included in this study. Those were, according to the turnover in millions 1) McDonalds (£1,872m) 2) JD Wetherspoons (£1,038m) Greggs (£708m), 4) KFC (£614m) and 5) Costa coffee (£610m). All of these chain-restaurants had nutritional information of the products on sale available on-line and at the point of sale. Nutritional information available on-line included number of calories, amount of fat, saturated fat and salt. Three of these restaurants (McDonalds, Greggs, KFC) have made voluntarily pledges to reduce the calories consumed and started posting calorie information at the point of sale from 1 Jan 2013, under the English Health Department Responsibility Deal (DoH, 2011). The two remaining (JD Wetherspoons and Costa coffee) are not partners in the Responsibility Deal but do provide calorie information of food and drink on sale at the point of sale.

7.3 Data Analysis/Statistics

All possible meal-combinations were compiled using an Access database (Microsoft Office Access, 2013). Nutritional composition of macronutrients and micronutrients of meal choices of the evening meal were determined using nutrient analysis software (WinDiets, Robert Gordon University, 2010). When commercial ingredients used in the preparation of meals were not listed, then that item was added to the database using manufacturer's nutrient values.

After data had been checked for normalcy, mean values ad distributions of macronutrients and micronutrients were calculated and related to UK Dietary Reference Values (DRVs) for macronutrients and Reference Nutrient Intake (RNIs) for micronutrients (DoH.1991). For non-normally distributed data, median and interquartile range was reported. T-test were performed to check for differences in the provision of nutrients between meal-option 1 and meal-option 2 (SPSS 19, Chicago).

One-way ANOVA was used to test for differences between the hall menu and the chain-restaurants' menus for calories, macronutrients, and sodium, using SPSS 21 (SPSS, Chicago).

7.4 Results

A total of 210 combinations for evening meal choices were created from the five-week menu cycle, 105 with a dessert (meal-option 1) and 105 replacing the dessert with one piece of fruit (meal-option 2). Mean values for macronutrients and micronutrient contents are shown on **Table 7.1.**

Table 7.1: Nutritional compositions of evening meal-options, for macronutrients and micronutrients

Nutrient	Meal-option 1		Meal-option 2		DRV/RNI	DRV/RNI
	Median (IQ)	Range	Median (IQ)	Range	Females	Males
Energy (kcal)	1124 (320)	858-1774	925 (293)	594-1431	2000	2500
Fat (g)	52 (25)	17.6-105.5	25 (20)	5.6-78.5	70	95
Saturated Fat (g)	24 (16)	4.7-60.3	9 (7)	0.8-34.9	20	30
Protein (g)	38 (33)	15.8-129.3	30 (21)	15-119	75	94
Carbohydrate (g)	114 (31)	86-188	129 (35)	83-166	90	120
Vitamin A (ug)	558 (2242)	28-3390	634 (2138)	202-3255	600	700
Thiamin (mg)	0.5 (1.9)	0.12-4.33	0.6 (1.2)	0.2-433	0.8	1.1
Riboflavin (mg)	0.5 (0.5)	0.09-3.58	0.5 (0.5)	0.2-3.7	1.1	1.3
Niacin (mg)	9.3 (16)	2.4-105	10 (16)	2-105	14	18
Vitamin B6 (mg)	1 (1.6)	0.39-15	1.9 (1.4)	0.9-15.5	1.2	1.5
Vitamin B12 (ug)	1.5 (1.9)	0-5	1.2 (2.1)	0-5	1.5	1.5
Folate (ug)	87 (73)	30-330	92 (93)	54-359	200	200
Vitamin C (mg)	44 (80)	4.5-237	52 (83)	23.2-256	40	40
Calcium (mg)	190 (146)	37-819	173 (42)	47-849	800	1000
Magnesium (mg)	97 (45)	38-228	103 (45)	31-114	300	300
Sodium (mg)	1058 (848)	141-2972	1079 (957)	49-2987	2,400	2,400
Potassium (mg)	1511 (591)	622-3419	588 (276)	234-1373	3.5	3.5
Iron (g)	6.2 (8)	2.5-59	6.2 (2.7)	3.8-12.2	14.8	8.7
Zn (mg)	3.5 (6)	0.6-149	4.4 (2.9)	2-150	7	9.5
Mn (mg)	0.5 (0.5)	0.3-28.5	1.2 (0.7)	0.7-29	1.4	1.4
Se (ug)	16 (26)	1.1-163.4	16 (23)	3-165	60	70
I (ug)	36 (71)	8-2678	26 (26)	0-2678	150	150

DRV=Dietary Reference Value

RNI=Reference Nutrient Intake

Added sugar not available from the analysis

The median (IQ) nutritional contents of meal-option 1 were 1124(320)kcal, fat 52.0(25)g, saturated fat 24(16)g, protein 38(33)g, carbohydrate 114.0(31)g, vitamin C 44(80)mg, iron 6.2(8)g, calcium 190(146)mg. Proportional energy contents were carbohydrate 39%, protein 14%, fat 39%, sat fat 18%. Mean nutritional contents of meal-option 2 were; 925(293)kcal, fat 25.0(20)g, saturated fat 9.0(7)g, protein 30.0(21)g, carbohydrate 129.0(35)g, vitamin C 52(82)mg, iron 6.2(2.7)g, calcium 173(42)mg. Proportional energy contents for meal-option 2 were carbohydrate 56%, protein 16%, fat 29%, sat fat 10%. The proportion of meal-options which exceeded 50% DRV for energy for young men and women, respectively, were 48% and 90% for meal-option 1, 9% and 18% for meal-option 2. Meal-option 1 provided significantly larger amounts of macronutrients than meal-option 2 ($p<0.001$).

7.4.1 Nutritional adequacy of meal-options.

In general, most meal-options exceeded 30% and many exceeded 50% of recommendations for energy and macronutrients. While most meal-options were adequate for most micronutrients, there were marked short-falls for some, especially iodine and calcium (**Table 7.2**).

Table 7.2: Numbers and proportions of meal-options exceeding 30%, 50% and 100% of daily Dietary Reference Values

	Male			Female		
	>30%	>50%	>100%	>30%	>50%	>100%
Meal-option 1	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Calories	105 (100)	50 (48)	0 (0)	105 (100)	95 (90)	0 (0)
Fat	103 (98)	75 (71)	10 (9)	105 (100)	98 (92)	15 (14)
Sat Fat	88 (84)	68 (65)	20 (18)	105 (100)	88 (84)	75 (71)
Protein	95 (90)	30 (28)	10 (9)	100 (95)	65 (63)	10 (9)
Carbohydrate	105 (100)	105 (100)	40 (38)	105 (100)	105 (100)	100 (95)
Iron	98 (96)	80 (77)	20 (18)	75 (73)	35 (33)	15 (13)
Vitamin C	100 (95)	100 (95)	90 (86)	100 (95)	100 (95)	90 (86)
Iodine	35 (33)	10 (9)	10 (9)	35 (33)	10 (9)	10 (9)
Calcium	15 (13)	5 (5)	0 (0)	10 (9)	5 (5)	0 (0)
Sodium	101 (97)	90 (86)	35 (33)	101 (97)	90 (86)	35 (33)
Meal-option 2						
Calories	90 (86)	10 (9)	0 (0)	100 (95)	20 (18)	0 (0)
Fat	88 (84)	76 (72)	0 (0)	96 (91)	88 (84)	5 (5)
Sat Fat	40 (38)	25 (24)	5 (5)	55 (52)	8 (8)	15 (14)
Protein	90 (86)	20 (18)	5 (5)	103 (98)	35 (33)	5 (5)
Carbohydrate	105 (100)	105 (100)	90 (86)	105 (100)	105 (100)	102 (97)
Iron	105 (100)	100 (98)	10 (9)	80 (78)	40 (38)	0 (0)
Vitamin C	105 (100)	105 (100)	100 (98)	105 (100)	105 (100)	100 (98)
Iodine	20 (18)	10 (9)	5 (5)	20 (18)	10 (9)	5 (5)
Calcium	20 (18)	10 (9)	0 (0)	20 (18)	10 (9)	0 (0)
Sodium	100 (98)	90 (88)	35 (33)	100 (98)	90 (88)	35 (33)

Meal-option 1

Young men: Expressed as % of Guideline Daily Amount (GDA) the mean values of macronutrients for this option were 48% of energy, with 55% of fat, 80% of saturated fat, 45% of protein and 98% of carbohydrate. The number of meal-combinations exceeding 30%, 50% and 100% of the GDAs for macronutrients and micronutrients are shown on **Figure 7.1**. Almost all meals exceeded the 30% recommendation for energy (n=105, 100%), for fat (n=103, 98%), for saturated fat (n=88, 84%), for protein (n=95, 90%), and for carbohydrate (n=105, 100%). The 30% recommendation was only met by 33% (n=35) of the meals for iodine, 13% (n=15) for calcium.

Young women: Expressed as %GDA, this option provided means of 60% of energy, 74% of fat, 120% of saturated fat, 56% of protein, and 130% of carbohydrate of the GDA. The number of meal-combinations exceeding 30%, 50% and 100% of the GDAs for macronutrients and micronutrients are shown on **Table 7.2** and **Figures 7.1,7.2**. All meals exceeded the 30% recommendation for energy (n=105, 100%), for fat (n=105, 100%), for saturated fat (n=105, 100%), and for carbohydrate (n=105, 100%). The 30% recommendation was only met by 33% (n=35) of the meals for iodine, and 10% (n=9) for calcium.

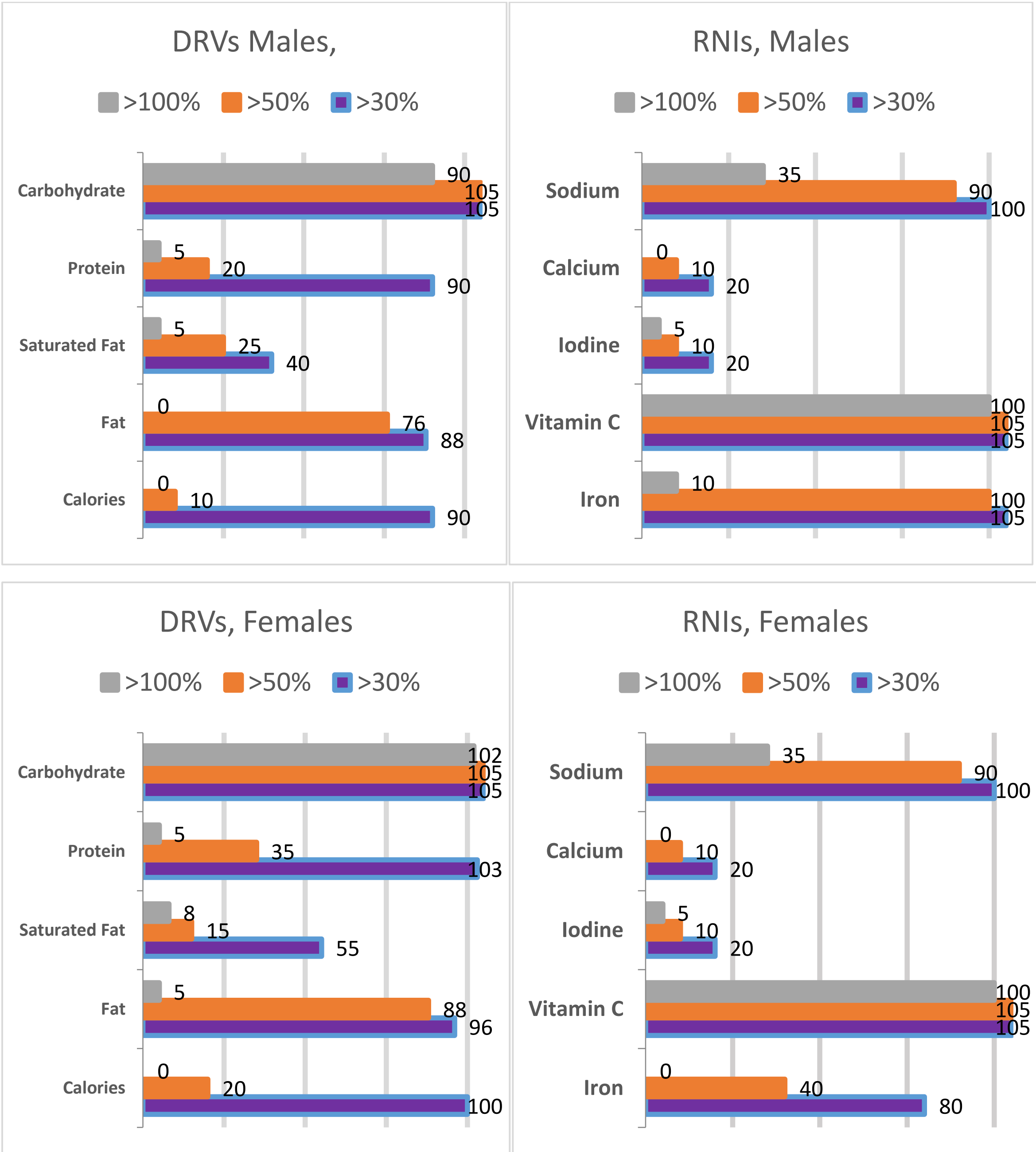
Figure 7.1: Nutrient contents of possible combinations for meal-option 1 which provide >30%, >50%, and >100% of DRVs and RNIs

Meal-option 2

Young men: Expressed as %GDA, this option provided means 36% of energy, 30% of fat, 33% of saturated fat, 37% of protein, and 104% carbohydrate. The number of meal-combinations exceeding 30%, 50% and 100% of the GDAs for macronutrients and micronutrients are shown on **Figure 7.2**. A high proportion of meals exceeded the 30% recommendation for energy (n=90, 86%), for fat (n=88, 84%), for saturated fat (n=40, 38%), for protein (n=90, 86%), and for carbohydrate (n=105, 100%). The 30% recommendation was only met by 20% (n=18) of meals for both iodine and calcium.

Young women: Expressed as %GDA, this option provided means of 45% of energy, 41% of fat, 50% of saturated fat, 47% of protein, and 139% of carbohydrate. The meal-combinations exceeding 30%, 50% and 100% of the GDAs for macronutrients and micronutrients are shown on **Table 7.2** and **Figures 7.1, 7.2**. Most meals exceeded the 30% recommendation for energy (n=100, 95%), for fat (n=96, 91%), for saturated fat (n=55, 52%), for protein (n=103, 98%), and for carbohydrate (n=105, 100%). The 30% recommendation was only met by 20% (n=18) of meals for both iodine and calcium.

Figure 7.2: Nutrient contents of possible combinations for meal-option 2 (including fruit) which provide >30%, >50%, and >100% of DRVs and RNIs



7.4.2 Chain-restaurants Menus

Meal-combinations were created from the items listed using main course food items and a dessert, but not a side dish or a drink, in order to be directly comparable with the meals provided at the hall. In total 1,846 meal-combinations were created for the five chain-restaurants; 1) McDonalds=799, 2) JD Wetherspoons=496, 3) Greggs=180, 4) KFC=143, 5) Costa coffee=228. Mean values, standard deviation, and the range for calories, fat, saturated fat, protein, carbohydrate and sodium are shown in **Table 7.3** (JD Wetherspoons provides only the calorie content of meals and Greggs provides does not provide information on saturated fat).

Table 7.3: Mean nutritional content of meals provided to the five biggest chain-restaurants in the UK for energy and key macronutrients and comparison between hall of residence meal-1 and meal-2.

	Calories (kcal)		Fat (g)		Saturated Fat (g)		Carbohydrate (g)		Protein (g)		Sodium (mg)	
	Mean (SD)	**Range**	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**
McDonalds	820 (289)	292-1240	26.4(16.9)	8.0-67.0	14.5 (9.0)	2.0-27.0	88.9 (29.9)	40.0-137	32.2(12.8)	11.0-49.0	945 (315)	433-1575
JD Wetherspoons*	1,101 (267)	688-1,456	-	-	-	-	-	-	-	-	-	-
Greggs**	885 (181)	630-1,170	45.2 (12.1)	27.0-59.0	-	-	107.3 (13.6)	88.5-116.5	26.7 (4.4)	22.0-31.5	1,221 (276)	788-1,536
KFC	773 (61)	430-1,100	39.8 (9.9)	19-54	11.7 (3.8)	5.5-47	80.9 (15.9)	48-122	24.5 (6.3)	17-37	1,604.3 (363.4)	880-2,300
Costa Coffee	855 (149)	648-1,132	35 (9.1)	18.5-49.0	12 (6.6)	3.0-24.5	105.7 (22.6)	79.8-142.8	26.6 (5.4)	19.9-36	947 (313)	501-1,410
Meal 1	1,193 (268)	858-1,774	52 (22)	17.6-105.5	24.5 (14.4)	4.7-60.3	117 (30)	86-188	42.4 (28.5)	15.8-129.3	1,295 (793)	141-2,972
Meal 2	896 (215)	594-1,431	29 (17)	5.6-78.5	9.9 (8)	0.8-34.9	125 (24)	83-166	35 (22)	15-119	1,281 (753)	49-2,987

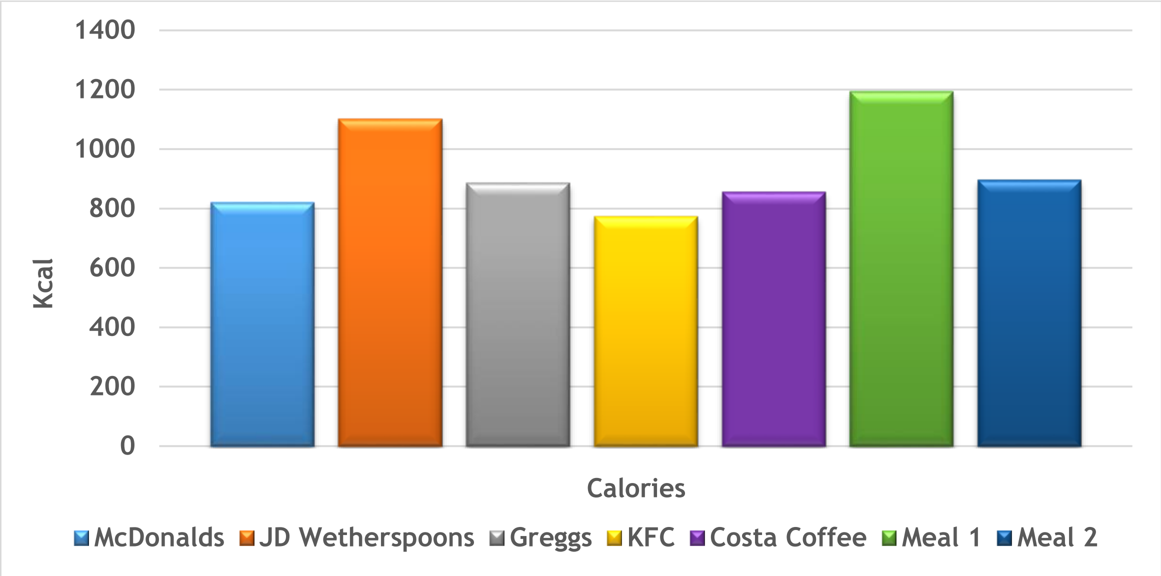
***** JD Wetherspoons only provided information on the calorie content of food items on the menu

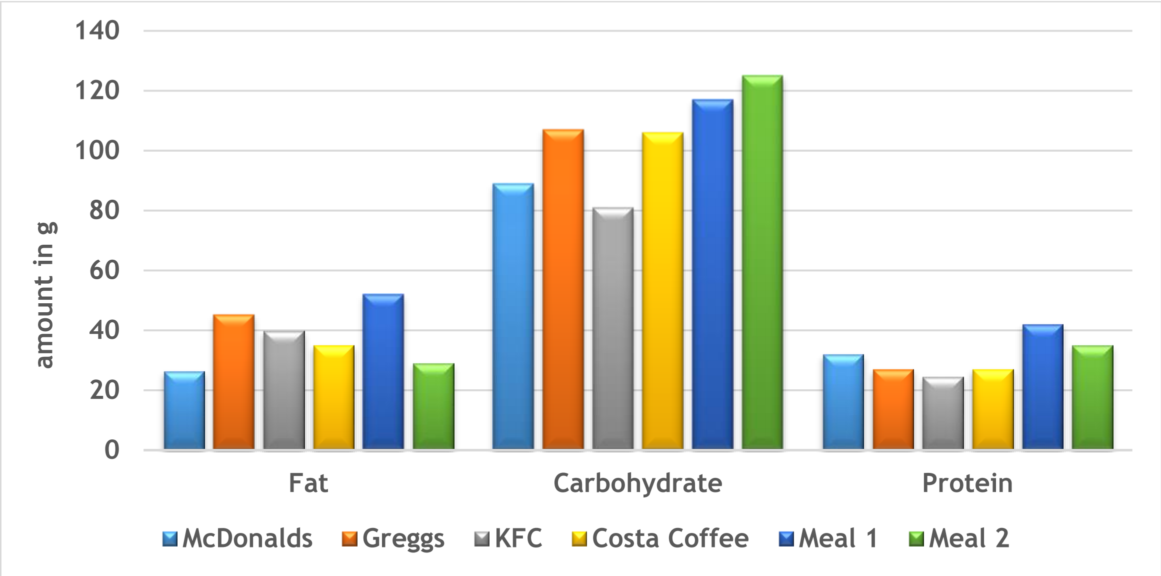
** Greggs did not provide the saturated fat content of food items on salt

7.4.3 Comparison between hall and chain-restaurants menus

Hall and chain restaurants menus were compared for calorie and macronutrient content (**Figure 7.3**). Meal-option 1 was significantly higher in calories than all the meals offered in all of the five-chain restaurants (p=0.015), fat (p= 0.02) and saturated fat (p<0.001). Meal option-2 was not different than the menus in the five chain restaurants.

Figure 7.3: Mean calorie and macronutrient content of the menus in the five biggest UK chain restaurants and the two menu options provided in the hall.





- JD Wetherspoons did not provide information on macronutrients

7.5 Discussion

Guidance from the former UK Food Standards Agency (FSA), now Department of Health, recommends that an evening meal should provide 30% of Guideline Daily Amount (GDA) of energy requirements (FSA,2006), i.e. 600 kcal for women and 750 kcal for men. The three-course evening meals offered to students in this hall greatly exceeded this 30% GDA recommendation, two-fold for energy and up to three-fold for certain macronutrients. For many micronutrients, most meal-options were ample, and indeed exceeded 100% of daily requirements, but low contents were seen for some essential nutrients like iodine and calcium. Table 9.1 includes ranges as well as medians and IQRs, because in some cases many students will regularly choose the highest (or lowest) option, so the extremes of range are important. Students often follow chaotic lifestyles and may commonly skip meals, or need extra energy to sustain sporting activities, in which case providing extra energy at evening meals might be desirable. However, since few students now engage in regular sporting activity and many are prone to rapid unwanted weight gain, routinely providing energy well above average requirements is unwise, at least without some warning. A student choosing the highest calorie three-course option would exceed these recommended amounts for the evening meal by 1630 kcal for women and 1480 kcal for men. Making such high energy choices every day is improbable, but would lead to weight gains of about 6 kg per month, assuming that each kg weight gain requires a surplus intake of 7,000 kcal (Garrow, 1974). Assuming that students had average requirements and over time chose a range of meal-options which provided the average energy content (1193 kcal, about 400kcal above requirement), this excess from evening meals alone would still lead to weight gain would still be about 1.6 kg/ month.

Without nutritional information, it would be difficult for students to guess how the energy or nutrient contents relate to their needs or to recommended values for a meal (Elbel et al.2011). Even trained health professionals, such as dietitians, struggle to estimate nutritional contents of foods accurately (Backstrand et al. 1997) or to identifying when a menu is meeting the requirements for specific macronutrients (Leslie et al.2013). Commercial ready meals are currently nutritionally chaotic (Celnik et al.2012). It has been suggested that to improve health by 'stealth', meals should be designed provide 30% of macronutrients and micronutrients, as a ‘default position’. This can easily be achieved by modifying recipe-ingredients, as shown by modifying traditional pizza recipes to match nutritional guidelines (Combet et al.2013).

When the meals provided in the hall were compared with the menus offered in chain restaurants, they proved to be +8%-+35% higher in calorie content. Large chain-restaurants accounts for only the 25% of food eaten outside home, in the UK. The remaining 75% is consumed in small and independent catering facilities (Defra.2011). Therefore, targeting only large chain restaurants, as in New York, or under the English DoH ‘Responsibility Deal’ to provide calorie information will have only a minor impact on the obesity crisis. A catered student hall is an interesting and important example of smaller independent catering outlets, as it provides meals to students on a daily basis, which may have cumulative effects on health. It is likely that the patterns of nutrient contents will be similar in other commercial outlets. Consumers need better provision, in terms of menu and recipe design, at least to allow nutritionally balanced meals to be chosen by those who want them, and to warn them when energy or nutrient contents are undesirable for long-term health.

Nutritional analyses of meal-options offered to students revealed excessive energy, carbohydrate, fat and saturated fat, and variable micronutrient contents compared to current recommendations. While desirable in certain cases, excess energy content is hard to identify and may promote unwanted weight gain and consumption of nutritionally unbalanced diets.

Chapter 8:

An interrupted time-series pragmatic study

for weight gain prevention with calorie-labelled meals

Overview

The study described in this chapter aimed to examine if calorie-labelling can have halt or minimize the weight gain observed in young adults. The hypothesis of this study was that by providing the calorie-information for meals offered to young adults would nudge them to choose appropriately for balancing their overall calorie intake.

8.1 Introduction

Weight gain, potentially leading to obesity for many, is most rapid in early adulthood (Lean et al 2012). This has been recognised as a particular problem for University students who have observed to gain 15 pounds (c 6kg) in their first year at college, termed the "Freshman 15" phenomenon (Crombie *et al*. 2009). In the current obesity epidemic, and while most interventions to treat obesity have limited efficacy in an obesogenic environment (Huneault *et al*. 2011), obesity-prevention by stalling the otherwise inevitable course of weight gain may be one solution. 'Nudging' people towards less energy-dense and calorific food choices, by modifying structural settings, has been proposed to help people to control their energy intakes (Marteau *et al*. 2011). Calorie labelling in catering outlets aims to alter the 'food-choice architecture', as a simple approach to challenge the processes driving up obesity. It has been implemented in various commercial and geographic settings, such as New York City (Nestle, 2010). Published evaluations of calorie-labelling initiatives, are limited to differences in calories purchased (Elbel et al, 2009, 2011, 2013, Dumanovsky et al.2011). No data have yet been published on the effect on body weights of consumers.

The present study tested the hypothesis that posting the calorie content of meal components provided to residential students, in a non-commercial environment where the catering services provided a choice of meals varying in energy contents could nudge them towards choosing lower calorie meals and help them to control their body weights.

8.2 Methods

The study was approved by the Ethics Committee of the College of Medicine, Veterinary and Life Sciences of the University of Glasgow on 20/11/2010 (Appendix 1,2) and on 13/01/2012 (Appendix 3).

8.2.1 Location and study sample

The study was conducted in a university student hall of residence accommodating a maximum of 120 students, mostly 1st year undergraduates, in the West of Scotland. The hall is located out-with the city centre, a 40 minute walk from the main university campus and a 20 minute walk away from the closest grocery shops. All residents are provided with two meals daily from a 5-week menu-cycle, included in the accommodation charge, breakfast and an evening meal during weekdays and a 'brunch' and an evening meal on weekends. The use of calorie labelling intervention was limited to the evening meals.

8.2.2 Menu and compositional analysis

A three-course evening meal was providing a choice of three different main-course dishes, varying daily, from which students were allowed to choose one. Students could also choose one starter, one dessert and a piece of fruit, or two pieces of fruit, or a piece of fruit and a small pot of yogurt (125ml) (Appendix 14). The options within the 5 week menu-cycle remained unchanged during the entire study.

The menu had been developed over time by the catering staff, without any expert nutritional guidance, reducing food costs and wastage being the main criteria for inclusion of meals. All meals were prepared and cooked on-site by the hall's catering staff. Recipes, including ingredient lists, for all dishes served in the hall, were available for analysis for the researchers, but not provided for students. The energy contents of meal choices on the usual menu were analysed using nutrient analysis software (WinDiets, 2010) according to the Department of Health for England Guidelines (DoH, 2010) for voluntary calorie labelling in catering outlets.

8.2.3 Study timescale and intervention points

The study was conducted during two consecutive academic years (**Figure 8.1**).

Year 1 (2011-2012): calorie labels were posted for the last 5 weeks of the academic year (April 2012), for one five-week menu cycle, in order to pilot the process and to assess its acceptability to residents and staff.

Year 2 (2012-2013): calorie labels were posted for most of the academic year, starting September 2012. They were in place for the first four 5-week menu-cycles, removed in the middle of the academic year (February 2013) for two menu-cycles to assess the impact of their withdrawal, and reinstated in April 2013 for the remaining two menu-cycles. In this final period, additional information on the estimated daily energy requirements of young adults was provided as A4 size posters in the dining room (Appendix 15).

Residents were asked to complete an evaluation questionnaire concerning their opinions on the calorie labels at the end of both academic years, 2011-2012 and 2012-2013 (Appendix 11,12). The questionnaire was developed by the research team. It was delivered on-line and handled on-line by a commercial company. The catering staff emailed all the residents informing them about the chance of participating in the evaluation of the labelling along with a link to the questionnaire incorporated in the body of the email. The questionnaire comprised ten questions, six multiple choice with an option for an open answer and four demographic. All questionnaires were anonymous. The questionnaire was tested during the first year and no problems were identified with any of the questions. At the end of the academic year 2012-2013, one to one informal semi structured interviews were carried out by the principal investigator with the kitchen staff, chefs and those responsible for food preparation and serving to assess the acceptability of labelling to catering providers. All staff were invited to take part in the interviews, and these were recorded in the form of hand written notes, and key points/themes were recorded.

8.2.4 Calorie posting

During four months (September 2012-January 2013), calorie contents per portion for each component of the evening meal were shown each day, in bold text on 5.4 × 9.9 cm laminated cards which also included the university coat of arms, both on the main hall notice board and at the point of meal choice prior to the serving of the meals (Appendix 13, 16, 17).

During three months (April-June 2013) in addition to calorie contents, estimated daily energy requirements were presented for males and females aged 18-34 years old, using the Schofield equation, based on a Physical Activity Level (PAL) of 1.4 and for a range of weights (50-100kg) (Appendix 15). The current recommendation for energy requirements of 2000kcal/day for women and of 2500kcal/day for men is an overestimation for a proportion of young adults. Therefore, we provided energy requirements for males and females, for the specific age group, and for a variety of body weights, in an attempt to make students realise how much energy they need approximately and that the energy requirements can vary based on the current body weight.

8.2.5 Ingredient orders: food purchases and 'disappearance' analysis

All the orders placed with commercial suppliers for meal ingredients were provided by the catering staff for analysis. Data were available for two months for the academic year 2011-2012 (November and December of 2011), when calorie information was not provided, and for the same two months in the academic year 2012-2013 (November and December of 2012), when the calorie information had already been in place for 12 weeks (since September 2012).

8.2.6 Meal choices

Meals were provided as part of the accommodation package and for that reason the catering service did not have a record of individual choices, such as till receipts. During the academic year 2012-2013, the selections of meal-components made by the first 100 students served on selected days, were observed and noted by the principal researcher. The principal researcher attended the evening meal serving on 14 days on each 5-week menu cycle (one cycle with calorie information, one cycle with no calorie information and one cycle with calorie information and daily energy requirements) (42 days in total). The cut-off of 100 students was set because the range of choices was reduced for subsequent students, once the most popular choices had been served. On the days when meal serving was observed and choices recorded, there was no occasion when meal options ran out before the first 100 students had been served.

8.2.7 Student characteristics

Self-reported information on weight, height, and age, were collected at the beginning (September) and end (May) of both academic years, an interval of 9 months, as part of a separate university-wide study. A lifestyle questionnaire consisting of 27 questions (Appendix 8,9) was sent by internal email (SurveyMonkey) to each resident of this hall of residence at the start and at the end of academic years 2011-2012 and 2012-2013. A commercial website was used for handling the questionnaires and responses. Data from residents were identified by student number and residence status.

The self-reported weights and heights were validated for two sub-samples of the students; one against measured data weights and heights, by a trained observer, and for a second against records of measurements recorded by nurses or doctors at General Practice surgeries.

In order to avoid biasing responses to the calorie labelling study, students were not informed that the calorie labelling study and the measurements of heights and weights were related.

8.3 Statistical Analysis

Data were analysed with SPSS 19 (SPSS, Chicago, IL) statistical software. After checking for normalcy of distributions, independent t-tests were performed to check for differences between measurements made in the 2011-2012 and 2012-2013 populations at baseline and paired t-tests were performed to test for changes in weight, height, BMI between the beginning (September) and at the end (May) of each academic year 2011-2012 and 2012-2013.

Relationships between the calorie, the fat and saturated fat content of starters, main courses, and desserts and the number of students choosing them during the three time points of the study were also explored.

One-way ANOVA was performed to determine whether there were any differences between the mean total number of calories, grams of fat and grams of saturated fat in the three time periods for male and female participants.

8.4 Results

8.4.1 Residents' characteristics and body weight changes

Completed information on body weight and height, at both baseline and follow-up was provided by 62 and 84 residents for academic years 2011-2012 and 2012-2013, respectively. Residents' characteristics at baseline and follow-up, for both years are shown in **Table 8.1**. Weight and BMI did not differ at the start of the academic year for the residents of both years. Fewer residents gained weight in the academic year 2012-2013 and the weight gained was less compared to the weight gained during the academic year 2011-2012 ($p=0.002$).

Figure 8.1 Study flowchart

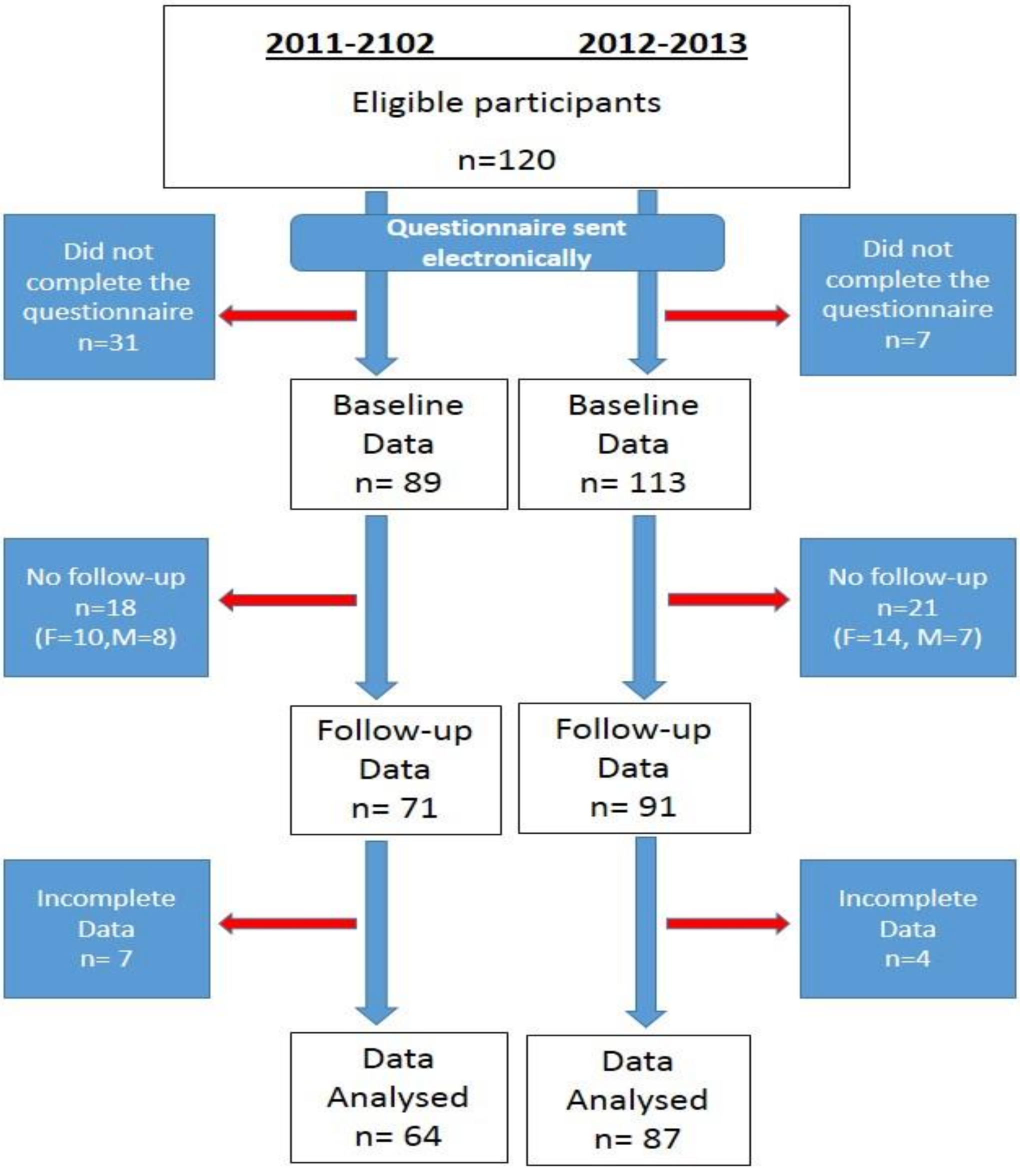


Table 8.1: Participants' characteristics

	September 2011	May 2012	September 2012	May 2013
	(n=62)		(n=84)	
Gender	54% F, 46% M		67% F, 33% M	
Weight (kg)	65.9 (15.5)	69.3 (16.9)	66.1 (12.4)	65.9 (10)
Height (m)	1.73 (0.11)	1.735 (0.11)	1.71 (0.1)	1.71 (0.1)
BMI (kg/m^2)	21.7 (4.1)	22.9 (4.8)	22.6 (4.4)	22.4 (3.1)
Underweight % (n)	17 (11)	8 (5)	9.5 (8)	2 (2)
Normal Weight % (n)	65 (40)	65 (40)	71 (60)	88 (62)
Overweight % (n)	11.5 (7)	19 (12)	12 (10)	8 (7)
Obese % (n)	6 (4)	7 (5)	7 (6)	2 (1)

All data mean and SD

Underweight= BMI<18.5kg/m^2

Normal weight=BMI=18.5-24.9kg/m^2

Overweight=BMI=25-29.9kg/m^2

Obese=BMI>30kg/m^2

Year 1: 2011-2012. A BMI over 25kg/m^2 was recorded in 17% of the residents when coming to University. By the end of the academic year this percentage increased to 26%. Eighty eight percent of residents had gained weight by the end of the academic year, 3.8% managed to maintain their weight and 7.7% lost weight. During the year, 13.5% moved from the normal weight category (BMI=18.5-24.9kg/m^2) to the overweight category (BMI>25kg/m^2). Weight and BMI of the residents both increased significantly ($p<0.001$) during the 9 month academic period.

Year 2: 2012-2013. A BMI over 25kg/m^2 was recorded in 17% of the residents when coming to University. By the end of the academic year, the percentage of the overweight or obese residents decreased to 11%. Weight was gained by 46% of the residents, 36% lost weight and 17.5% remained the same weight by the end of the academic year.

Year 1: 2011-2012 vs Year 2: 2012-2013. All weight changes for both years are shown on table 8.2 and figure 8.2. Mean weight changes over 36 weeks, per protocol, were +3.4(SD2.6)kg (n= 64) in year-1 and -0.15(SD2.4)kg (n=87) in year-2 ($p<0.001$). Weight changes were similar for males and females (both $p<0.001$). Intention-to-treat analysis, imputing mean weight change for subjects with incomplete data, showed +3.4(SD2.5)kg in year-1, and -0.16(SD2.4)kg in year-2 ($p<0.001$). Young adults in year-1 were 10 times more likely to have gained weight that those in year-2 (Odds Ratio=10.5, 95% CI=3.8-28.7, $P<0.0001$).

Table 8.2 Weight changes for study participants for years 2011-2012 & 2012-2013

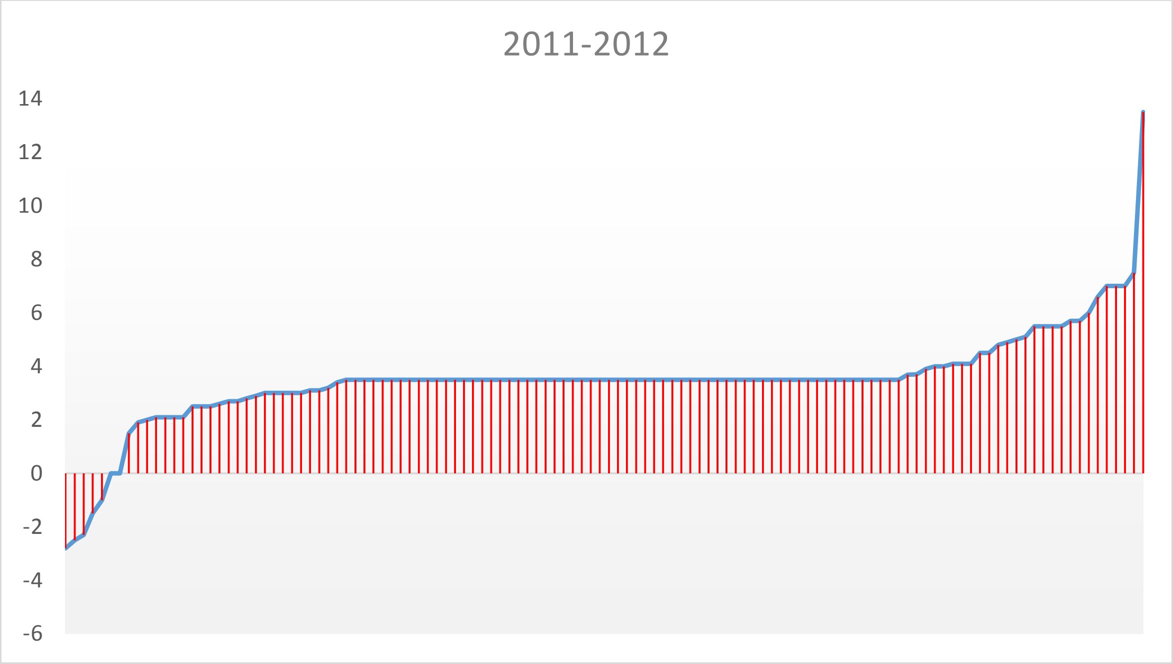
	Baseline Mean(SD)	Follow up Mean(SD)	Change Mean(SD)	P value
2011-2012	n= 64 (F=54%)	n=64 (F=54%)		
Weight (kg)	66.1 (12.9)	69.6 (14.3)	3.4 (2.5)	<0.001
95% CI	62.9-69.4	68.9-73.2	2.8-4.1	
Weight F	61.3 (10.3)	64.5 (11.7)	3.1 (3)	<0.001
95% CI	57.7-64.9	60.0-68.0	2.0-4.1	
Weight M	72.2 (13.3)	76.0 (14.8)	3.8 (1.9)	<0.001
95% CI	67-77	70-81.8	3.1-4.6	
BMI (kg/m^2	22.0 (3.1)	23.0 (3.6)	1.1 (0.9)	<0.001
95% CI	21.1-22.7	22.1-24	0.9-1.4	
BMI F	22.2 (3.1)	23.3 (3.6)	1.0(1)	<0.001
95% CI	21.1-23.3	22.0-24.6	0.7-1.5	
BMI M	21.8 (3)	22.9 (3.5)	1.1 (0.5)	<0.001
95% CI	20.6-23	21.5-24.3	0.9-1.4	
2012-2013	n= 87(F=58%)	n= 87(F=58%)		
Weight (kg)	66.1 (11.6)	66 (12)	-0.16(2.4)	0.585
95% CI	63.6-68.6	63.4-68.5	-0.7-0.3	
Weight F	62.4 (10.9)	62.6 (11.5)	0.2 (2.4)	0.970
95% CI	58.7-66	58.8-66.6	-0.5-1.1	
Weight M	70.5 (12.3)	70.1 (12.8)	-0.4 (2.7)	0.374
95% CI	66.4-74.7	65.7-74.4	-1.3- 0.5	
BMI (kg/m^2)	22.3 (3.2)	22.3 (3.4)	-0.05 (0.8)	0.558
95% CI	21.5-24.4	21.6-23	-0.2-0.1	
BMI F	22.7 (3.6)	22.7 (3.8)	0.08 (0.9)	0.915
95% CI	21.4-23.9	21.4-24	-0.2-0.4	
BMI M	22 (3.2)	21.9 (3.4)	-0.1 (0.9)	0.331
95% CI	20.9-23.1	20.7-23	-0.4- 0.15	

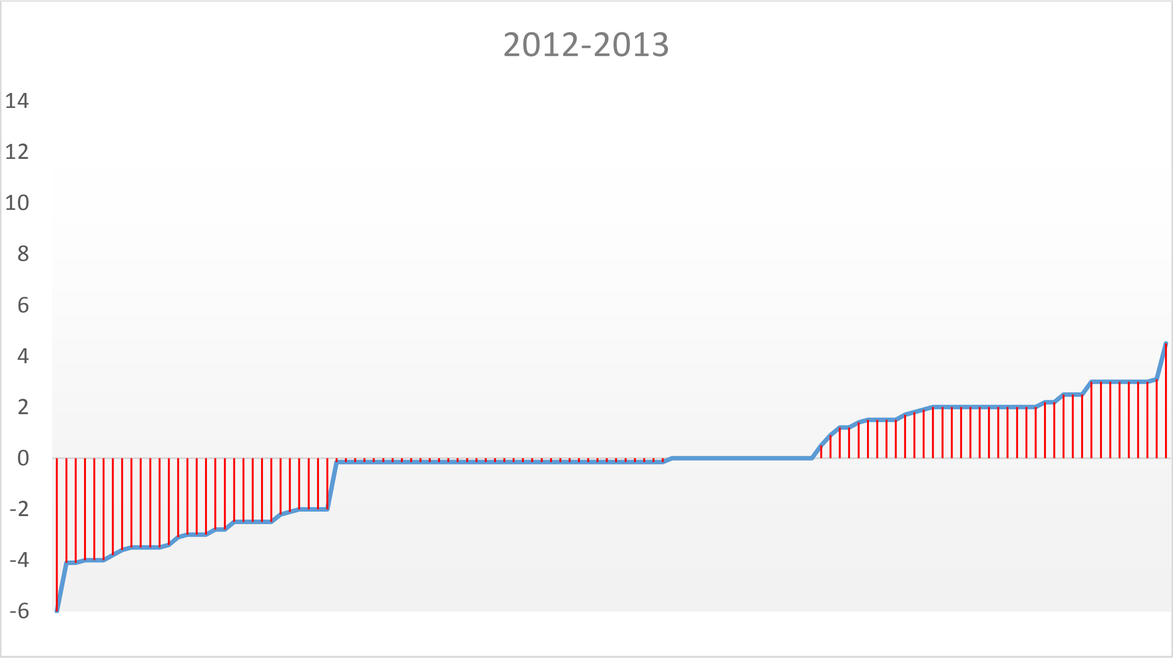
F=Female

M=Male

Weight changes are based on ‘per protocol’ analysis.

Figure 8.2 Weight changes in year 2011-2012 & 2012-2013





8.4.2 Calorie provision in meal options

The ranges of caloric contents of each course were: starters: 18 kcal (tomato soup) – 462 kcal (Pakora with Chilli sauce); main courses: 115 kcal (Bean Stew) -1034 (BBQ Roast Chicken Pizza) kcal; desserts 114 kcal (Mexican Rice Pudding) – 734 kcal (Apple and Maple crumble with custard). In theory, therefore, a student could choose a minimum of 247 kcal and a maximum of 2230 kcal from the three main components at their evening meal (plus any side dishes such as vegetables, rice, potatoes, and chips).

8.4.3 Ingredient orders data: 'food disappearance'

Orders for all main ingredients for meals reduced significantly in the academic year 2012-2013 when the calorie labelling was in place (p=0.002) (Table 10.3) and costs fell by £2,393.73 or £2,470.61 by taking into account inflation of 3.2% for the year 2011 (**Table 8.3**). Total number of calories ordered also fell significantly in the year that calorie labelling was in place, from 9,209,200 to 7,600,320 million calories (**Table 8.3**).

Table 8.3: Orders of main ingredients for 2011-2012 & 2012-2013

Ingredients	Nov-Dec 2011 Number of Units	Number of Calories	Cost (£)	Nov-Dec 2012 Number of Units	Number of calories	Cost (£)
Meat Products	128	2,680,000	2,861.35	87	1,827,000	2,018.46
Vegetables	123	246,000	449.71	109	218,800	391.36
Potatoes	131	491,250	937.61	89	333,750	451.12
Desserts	61	195,200	342.23	50	160,000	255.99
Oils	19	2,052,000	326.46	13	1,404,000	214.66
Fish Products	51	1,020,000	1199.79	51	1,020,000	1107.18
Pasta Products	17	1,774,800	54.26	22	2,296,800	72.04
Other	75	750,000	1194.5	34	340,000	486.69
Total		**9,209,200**	**7,432.55**		**7,600,350**	**5,038.82**

8.4.4 Acceptability of labelling to students and catering staff

Residents were asked to complete an evaluation questionnaire on the value of the calorie labels at the end of both academic years, 2011-2012 and 2012-2013.

Year 1: 2011-2012. Response rate was 52%. 70% (45) of the residents reported to using the calorie labels when making their meal choice and 65% (55) in 2012-2013. Reasons given for using the calorie information were: 1) weight control (35%) and 2) for 'healthier eating' (65%).

Year 2: 2012-2013. Response rate was 73% and 65% (55) of the residents reported to using calorie labels when making their meal choice for 1) weight control (48%), and 2) for 'healthier eating' (52%). In the academic year 2012-2013, when calorie labels had been in place for most of the year, three students complained that a majority of food served was fried. They also questioned the value for money of the catered food. The additional information concerning estimated energy requirements of students appeared to be valued, 78% of the students reported that this information helped them to make better use of the calorie information provided at evening meals.

All members of the catering staff, three cooks and five catering assistants, agreed to be interviewed on their views of the calorie labels. Cooks supervised the preparation of ingredients and the cooking of meals while catering assistants prepared some ingredients for the meals, carried out the serving of the meals and cleaning of the dining hall. Interviews were semi-structured and were not recorded. Two of the three cooks reported that calorie labels made them more aware of the quality of the meals they provide to students. In contrast the third cook was not keen on the calorie labels, predicting they would generate additional work with menu reformulation and finding alternative ways of cooking. All cooks preferred frying food due to time constraints and convenience. All the catering assistants welcomed the calorie labels. They reported them as "eye opening" in terms of the caloric content and as a reflection of the quality of the food served, and, reducing the need for them to inform students the details of each meal option. Catering assistants did express concerns regarding food wastage, as they noticed that more food was wasted than in previous years when the calorie labels were not in place. Staff did not report receiving any negative feedback about the calorie labels from students, but they did receive complaints about the quality of the food and cooking methods due to the high calorific content of some of the food.

8.4. 5 Effect of 1) the provision of calorie information, 2) lack of calorie information, 3) the provision of calorie information and information on energy requirements on meal choices

All correlations between the calorie, the fat, and saturated fat content of starters, main courses, and desserts and the number of students choosing each meal component along with p values can be seen on **Table 8.4.**

Table 8.4: Correlations between calorie, fat, and saturated fat content for starters, main courses, and desserts and the number of students choosing them in the three time periods of the study (1) with calorie labels, (2) without calorie labels and (3) with calorie labels and information on daily energy requirements

	With calorie labels R value (p value)			Without calorie labels R value (p value)			With calorie labels and daily energy requirements R value (p value)		
Starters	**All**	**Female**	**Male**	**All**	**Female**	**Male**	**All**	**Female**	**Male**
Calories	-0.764 (0.004)	-0.618 (0.032)	-0.538 (0.071)	-0.649 (0.023)	-0.379 (0.224)	-0.521 (0.089)	-0.837 (0.001)	-0.681 (0.015)	-0.791 (0.002)
Fat	-0.716 (0.009)	-0.538 (0.071)	-0.544 (0.068)	-0.632 (0.027)	-0.364 (0.245)	-0.505 (0.904)	-0.779 (0.003)	-0.611 (0.035)	-0.762 (0.004)
Saturated Fat	-0.533 (0.74)	-0.535 (0.073	-0.273 (0.390)	-0.322 (0.307)	-0.304 (0.337)	-0.128 (0.692)	-0.621 (0.031)	-0.582 (0.047)	-0.505 (0.094)
Main Courses									
Calories	0.013 (0.937)	-0.295 (0.058)	0.307 (0.048)	0.253 (0.106)	0.044 (0.780	0.361 (0.000)	-0.112 (0.479)	-0.429 (0.005)	0.201 (0.202)
Fat	0.390 (0.805)	-0.265 (0.090)	0.332 (0.032)	0.225 (0.153)	-0.015 (0.925)	0.356 (0.021)	-0.082 (0.606)	-0.373 (0.015)	0.197 (0.210)
Saturated Fat	-0.077 (0.628)	-0.297 (0.056)	0.179 (0.256)	0.069 (0.663)	-0.100 (0.527)	0.230 (0.143)	-0.204 (0.196)	-0.378 (0.014)	0.020 (0.900)
Desserts									
Calories	-0.838 (0.000)	-0.686 (0.007)	-0.590 (0.026)	-0.558 (0.027)	-0.501 (0.068)	-0.484 (0.080)	-0.939 (0.000)	-0.867 (0.000)	-0.819 (0.000)
Fat	-0.551 (0.041)	-0.472 (0.089)	-0.367 (0.196)	-0.278 (0.336)	-0.355 (0.212)	-0.111 (0.706)	-0.684 (0.007)	-0.659 (0.010)	-0.542 (0.045)
Saturated Fat	-0.385 (0.174)	-0.327 (0.254)	-0.259 (0.371)	-0.071 (0.810)	-0.180 (0.538)	0.061 (0.836)	-0.521 (0.050)	-0.506 (0.065)	-0.375 (0.187)

Starters: Inverse associations were found between the calorie content and the number of students choosing each starter for all three time periods in 2012-2013 but the strongest association was in the third period when individual energy requirements were also posted ($r=-0.837, p=0.001$). For female students the inverse association was significant only for the first period ($r=-0.618$, $p=0.032$) and the third study period ($r=-0.681$, $p=0.015$) while for males was only in the third study period ($r=-0.791$, $p=0.002$). Similar inverse associations were found for the fat content and the number of students choosing a starter for all three time periods of the study. Separating the sexes, this inverse association was significant only for the third period for both females ($r=-0.611$, $p=0.035$), and for males ($r=-0.762$, $p=0.004$). For saturated fat content, there was an inverse association which was significant only for the third period when calorie and energy requirements information was posted ($r=-0.621$, $p=0.031$). The inverse association was significant for females in the third period ($r=-0.582$, $p=0.047$).

Main courses: No significant association was found between calorie, fat, and saturated fat content and the number of students choosing a main course in any of the three time periods in 2012-2013. There was a weak positive association for male students for the first period ($r=0.307$, $p=0.048$) and the third period ($r=0.361$, $p<0.001$) for the calorie content and a positive association for the fat content for the first period ($r=0.332$, $p=0.032$) and the third period ($r=0.350$, $p=0.021$). There were positive associations for female students for the third period for the calorie content ($r=-0.429$, $p=0.005$) and for fat content ($r=-0.373$, $p=0.015$) and saturated fat content ($r=-0.378$, $p=0.014$).

Desserts: Inversion associations were found between calorie contents and the number of students choosing each dessert for all three time periods in 2012-2013, but the strongest association was in the third period ($r=-0.939$, $p<0.001$). There was an inverse association between fat content and the number of students choosing a dessert for the period when calorie and energy requirements information was posted ($r=-0.521$, $p=0.05$).

When data were analysed by total number of calories chosen, for the entire meal on the tray for females and males, females choose less calories than males and with the least calories per tray was observed in the third study period (compared to both periods, one and two) which was significant both for females ($p<0.001$) and males ($p=0.01$) (**Table 8.5**, **Figure 8.9**).

Figure 8.9: Mean number of calories by tray and day, chosen by females and males during the three time periods (1) with calorie labels, (2) without calorie labels and (3) with calorie labels and information on daily energy requirements

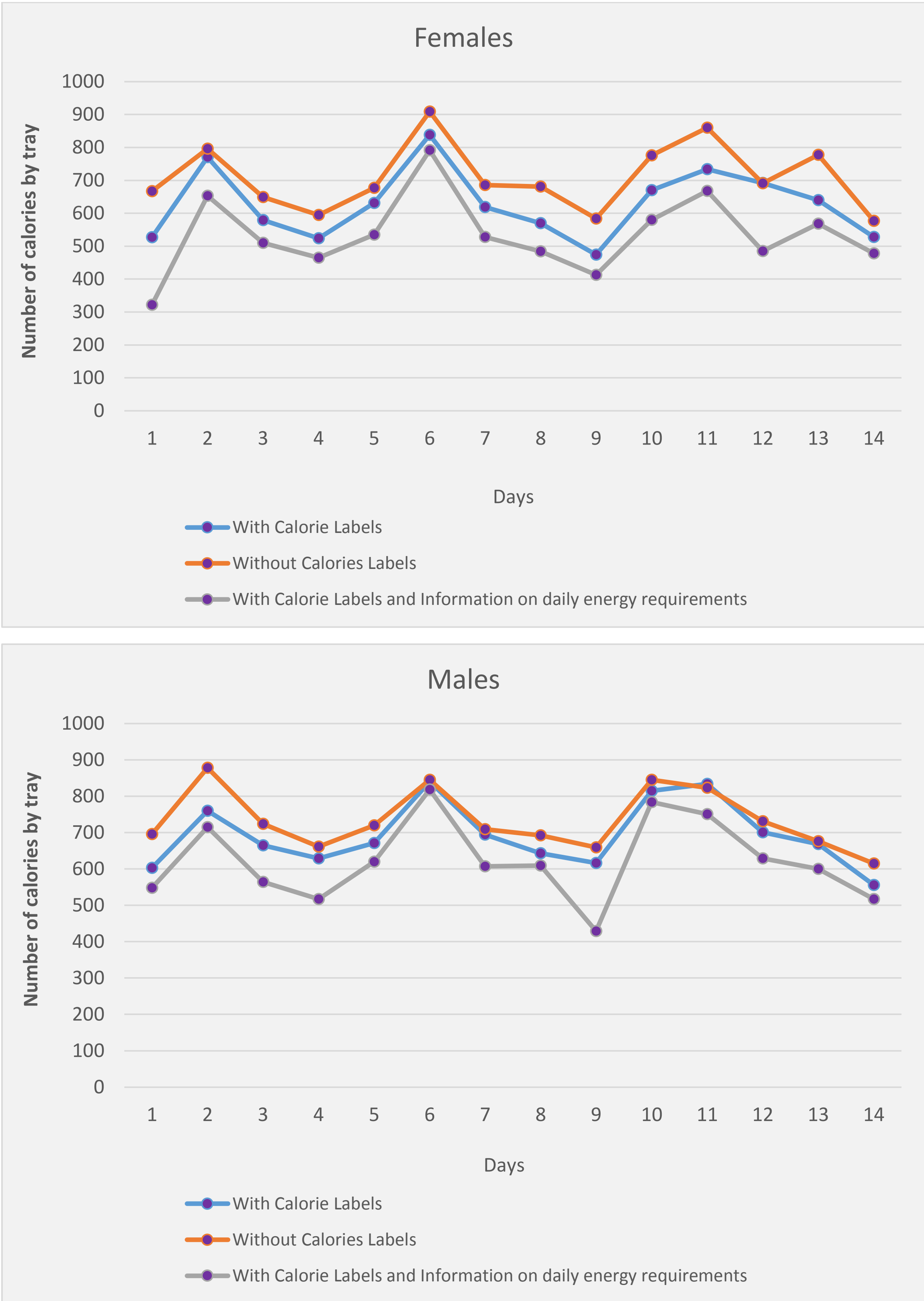


Table 8.5: Total number of calories chosen by participants (including side dishes) during the 14 days of the three study periods (1) with calorie labels, (2) without calorie labels and (3) with calorie labels and information on daily energy requirements

Days	With Calorie Labels	Without Calories Labels	With Calorie Labels and Information on daily energy requirements	With Calorie Labels	Without Calories Labels	With Calorie Labels and Information on daily energy requirements
	Kcal (SD)	Kcal (SD)	kcal (SD)	Kcal (SD)	Kcal (SD)	kcal (SD)
Females				Males		
1	527 (193)	667 (186)	322 (91)	603 (224)	696 (192)	548 (158)
2	770 (187)	796 (166)	653 (145)	760 (194)	878 (245)	715 (181)
3	579 (273)	649 (322)	510 (197)	665 (326)	724 (305)	564 (253)
4	524 (218)	595 (213)	465 (205)	629 (186)	661 (184)	517 (135)
5	631 (201)	677 (229)	535 (100)	671 (197)	720 (224)	620 (182)
6	838 (90)	909 (84)	791 (49)	840 (90)	845 (98)	818 (84)
7	619 (242)	686 (279)	528 (133)	694 (286)	709(293)	607 (250)
8	570 (269)	681 (290)	484 (211)	643 (242)	692 (247)	609 (195)
9	474 (250)	584 (318)	413 (132)	616 (368)	659 (404)	429 (172)
10	670 (280)	776 (268)	580 (186)	815 (329)	845 (338)	784 (332)
11	734 (226)	860 (268)	668 (158)	834 (249)	823 (249)	751 (247)
12	692 (229)	691 (251)	485 (195)	701 (263)	731 (249)	629 (247)
13	640 (216)	777 (311)	568 (156)	668 (242)	676 (243)	600 (150)
14	528 (150)	577 (122)	478 (144)	556 (149)	615 (243)	517 (150)
Average	628** (105)	709** (101)	534** (116)	692* (105)	734* (101)	622*(116)

All data mean and SD

*p<0.05

**p<0.001

8.5 Discussion

Calorie labelling of meals is an example of information transfer, a low cost intervention which might have a modest effect to combat unwanted weight gain for some people. Most previous studies have been carried out in commercial settings and none have examined the relationship between calorie contents of foods bought and body weight change. Although labelling has become mandatory for certain types of outlets in the city of New York since 2009, and WHO recommends it as a potential valuable approach towards obesity, data are inconclusive as to whether purchases or choices can be altered in a way which might help them with controlling weight problems. In England, under the 'Responsibility Deal', a number of large restaurant chains have agreed to support a call to provide voluntarily calorie information on their menus. Small independent restaurants and catering outlets rarely provide nutritional information.

Previous studies on the use of calorie labels and how these affect calories purchased, since the New York policy was put in place, showed mixed results. Some studies showed no differences in calories chosen/purchased between control and intervention groups (Harnack et al., 2008), (Elbel et al.2008) with others showed small calorie reductions (Dumanovsky et al.2011), (Pulos & Leng, 2010). These studies were carried out in commercial settings and the data collected were merely a snapshot of individual consumers' choices with and without the calorie information.

The present study looked at food selections in a student residential catered hall, and followed the residents for two academic years in a location where there was limited choice of alternative food available. Students had no monetary incentives when choosing their meals as the cost of the meals is included in the accommodation charges.

The menu offered at the student hall provided students with a very wide range of calorie options, between 249-2230kcal for the evening meal. Guidance from the former UK Food Standards Agency (FSA), now Department of Health (DoH), recommends that an evening meal should provide 30% of the daily energy requirements (FSA, 2006), i.e. up to 600 kcal for a woman and up to 750 kcal for a man. This setting could allow a student who chose the highest calorie 3-course option to exceed the recommended amount for the evening meal by 1630 kcal for women and 1480 kcal for men. Eating such high energy choices on a daily basis, this excess calorie intake could lead a woman to gain 6.5 kg and a man 5.9 kg in a month. Thus, this labelling intervention offered the students an opportunity to make informed choices and thus regulate their calorie intake, if they wished to do so. The calorie information was generally valued and the students reported using it as intended. The addition of information about individual energy requirements proved valuable addition and nudged students towards lower energy and fat meals.

Providing, information on daily energy requirements based on a range of weights separately for males and females, along with the calorie information on food choices, proved successful at nudging students further away from the high caloric meal options. This information might have helped students to put the calorie information in a context according to their current body weight. Often, consumers may not use calorie information as they may not understand those (Krukowski et al. 2006). Educating the public on daily energy requirements based on current weight and age might not only prove to be a useful tool against the obesity development but also one that should always supplement the calorie information. The current daily energy requirements of 2000 kcal for women and 2500 kcal for men are overestimating the energy requirements for a range of people.

Recognising the difficulty in obtaining self-reported data on food choices, and uncertainty inherent in interpreting it, this study used a triangulation approach, involving independently observed and recorded food choices, and also the data on ingredient purchasing collected routinely by the caterers. Guiding students towards less calorific choices provided an opportunity for caterers to consider improving the nutritional profile of the meals while keeping within the budget. There was a significant decrease in the quantities of the main ingredients ordered for the meals which led to significant savings for the hall’s annual budget.

While these savings are desirable in our setting, this is not the case for commercial settings.

The calorie labels may have not been used by all students when making their meal choice, however, providing the information on such an important part of life like eating can only contribute to the development of the sense of personal responsibility for students and caterers.

The present study collected self-reported data on body weight and height from as many of the residents as possible at the beginning and the end of each year studied. The response rate was higher in the second year when the main calorie-labelling intervention was carried out. During that second year, there was a mean reduction in body weight and BMI which would not be expected on the basis of exactly data on similar student groups but data were unfortunately much less completed during the first year when there was only a brief period of calorie-labelling. Our data showed significantly different weight changes between the two years and significant avoidance of weight gain in the second year which can plausibly be attributed to the calorie-labelling.

The study was carried out in a closed environment and therefore these results may not applicable to commercial settings where decisions on product purchases are made based on other criteria such as price, brand, and convenience. Measuring the food wasted would provide extra strength to the study by collaborating changes in food wastage. However, this was not possible due to a lack of researchers available for this study, and practicalities of waste collection. The main limitation to confidence that calorie labelling prevents weight gain was the poor response rate in the first year.

Students experience a range of lifestyle changes which may contribute to weight gain. Calorie-labelling appears to have highlighted both to food providers and students, as consumers, the wide range of caloric intakes offered within the 5-week menu. Prompts from the labels energy content were sufficient to prompt changes in food choice and changes to menus with some cost benefits. This study has generated valuable evidence for a ‘nudging’ effect helping students to avoid weight gain, at a critical life period where there is a well-recognised problem.

Chapter 9:

Effect of calorie-labelling on sales and customers' reported use of calorie labels?

Overview

This chapter aimed to examine the effect of the voluntary calorie-labelling in catering outlets on total sales and reported use of the calorie-labels from customers. Most of the literature, up to now, has focused on the effect of calorie-labelling on chain restaurants however most of the catering establishments belong to independent caterers. This study was conducted in independent catering establishments located within a large university in order to capture customers of younger age which was the primary target group of this study.

9.1 Introduction

The relentless increase in obesity has been related to the 'obesogenic' environment (Huneault et al, 2011) which provides unlimited, heavily-promoted energy-dense foods and limited physical activity opportunities. Eating out, previously a special occasion, is now a part of everyday life. In the UK, on average, 26% of a person's weekly budget is spent on food eaten outside home (Defra, 2011). There is wide variability but many people eat catered meals most days. This now presents a health problem because catered meals are not subject even to the minimal requirements for provision of nutritional information. Most meals eaten outside home do not need to provide information about ingredients or calorie and nutrient contents but is higher in fat, protein, and calories (Prentice & Jebb, 2003), and lower in carbohydrates (Defra, 2012). Small catering facilities in particular often provide meals with excess calories (Urban et al, 2013).

To try to assist consumers, calorie labelling in catering outlets has been implemented in various commercial and geographic settings, such as the New York City (Dumanovsky et al. 2011) and in the UK at restaurants and take-away the majority of which are national chains. Calorie labelling was suggested as a public health attempt to challenge the processes driving up obesity by altering the 'food-choice architecture' (Marteaux et al. 2011). It was hoped that providing information of the energy content of those meals may help people to make informed food choices and nudge them towards controlling their calorie intake and body weight.

University students and staff often rely on University catering outlets for their meals. The present study examined the effect of posting calorie content of chilled food at the point of purchase within commercially-run catering outlets, located within a large urban university site.

9.2 Methods

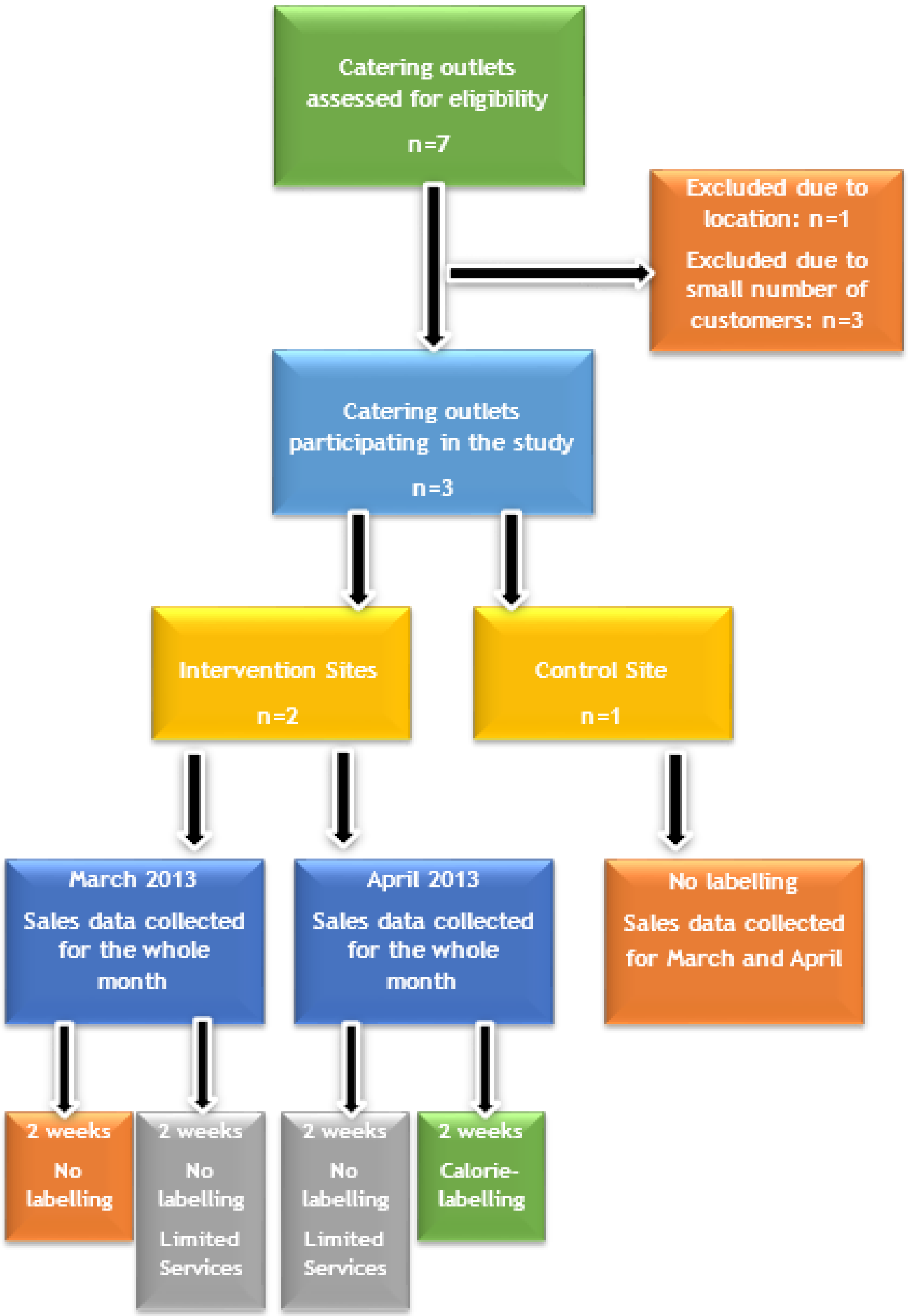
The study was approved by the Ethics committee of Medical School of Glasgow University (07/01/2012) (Appendix 3).

9.2.1 Location/Sample

The study was carried out in catering outlets within a large university, with an inner-city location, such that the catering facilities are in direct competition with other local commercial outlets. Three catering outlets on the campus all serving similar mixes of students and staff were identified as potential sites for the study. All three outlets were open for the same time daily, and the same items were offered for sale. Two sites located close together, received calorie labelling, while a third was used as a control site where no calorie information was posted during the study period. Calorie labelling was limited to chilled food (sandwiches, wraps and two salads). In the catering outlets there was also hot food on offer which was not labelled to time constraints. The month of April was chosen as the month of intervention and March as the comparator month as after consultation with the catering director, those two months were identical in terms of season and amount of holiday days. Also during those two months few visitors were expected: there were no graduations or public events (**Figure 9.1**).

All these factors could influence sales and bias the pattern of sales across the labelled food ranges due to different likes/dislikes and monetary incentives of non-university customers visiting the catering outlets.

Figure 9.1 Study Flowchart



9.2.2 Consumers' evaluation and use of the calorie labels

A short evaluation questionnaire on customers' understanding, views and use of the labels was devised (Appendix 18). The questionnaire included nine questions; whether the labels were used, reasons for use and respondents' demographic information. Open questions to elicit the opinions of respondents on labelling and other catering issues were included. The questionnaire was distributed using a site wide email to reach all university students and staff and it was sent on behalf of the hospitality services' email address. To maximise responses, paper copies of the questionnaire and boxes for the return of completed questionnaires were also offered to customers at the two catering outlets where labels were in use.

9.2.3 Nutritional information

Nutritional information for all calorie labelled foods were provided to researchers by the catering staff. Items were analysed nutritionally using food composition tables available for all ingredients, with an Excel programme. The UK traffic light guidelines were used to categorise the items to high, medium, low groups for fat, saturated fat, sugars, and salt contents (FSA,2007), (Appendix 21). The nutritional information became available on-line in the hospitality services' website a few weeks before the study was initiated, however unlike other news from the hospitality services, the fact that the nutritional information became available on-line was not circulated with the University news email.

9.2.4 Calorie posting

Calorie labels were displayed prominently beside all the chilled food available in the two intervention catering outlets for two weeks in April 2013. The laminated 5.4 × 9.9 cm labels provided the product name and calorie content in bold text, and also included the university coat of arms (Appendix19,20). The size of the labels was significantly bigger than any other labels on or around the products. The calorie labels were placed in the chilled cabinets where items to be labelled were displayed, in front of each item. The calorie labels were placed in front of the items every morning by the catering staff to allow space for restocking the chilled cabinets with the chilled food items.

9.2.5 Sandwiches sales

Data on sales for all the sandwiches for the months March and April 2013 were obtained from the catering staff for the catering outlets participating in the study through their receipt and sales system. Sales data collected for the four weeks prior to the posting of the calorie labelling showed the patterns of consumers' choices. For the four weeks when calorie labels were displayed, sales data reflected the effect of the presence of the calorie labels on customers' choices. No seasonal variations or differences in the number of students in the campus were expected for the time that sales data were collected.

9.3 Data Analysis/Statistics

Data were analysed with SPSS 19 (SPSS, Chicago, IL) statistical software. Data were reported descriptively.

Chi-square Goodness of Fit test was used to test for differences between sales in the intervention and in the control site for total sales, for the high/low fat items, for the high/low calorie items, and for the high/low price items. P values were considered to be statistically significant at $p<0.05$.

9.4 Results

9.4.1 Participants' Characteristics

1,166 students and 646 members of staff completed the evaluation questionnaire. Participants' general characteristics are shown in Table 9.1. Members of staff differed from the student body, as anticipated. BMI was calculated by the weight and height that participants self-reported. At the time of the survey, 43% of the staff, (mean age 42 years) and 24.4% of the students (mean age 24 years) had a BMI $>25kg/m^2$. This is in accordance with the age specific prevalence of overweight and obesity found in the general Scottish population (SHS, 2012). About two thirds of the participants were female, and staff were heavier than the students.

Table 9.1: Characteristics of the study participants

Characteristic	Staff (n=646)	Students (n=1166)
Gender	Female 68%, Male 32%	Female 75%, Male 25%
Age (years)	42.4±10.7	24.2±6.9
Height (cm)	1.69±0.09	1.7±0.09
Weight (kg)	71.9±16.4	67.5±15.9
BMI(kg/m^2) ¶	25.1±5.7	23.2±5.1

Plus-Minus values are means ±SD.

¶ BMI is the weight in kilograms divided by the square of the height in meters

9.4.2 Calorie Label Use

More than half (56%) of all respondents reported using the calorie labels and that the information had influenced and modified their food purchases. Most of those who reported using the calorie labels (97%) said that they had changed their choices to a lower calorie option.

There were differences in the use of the labels between genders, among both students and staff, with more females reporting using the calorie labels than males. More female students of normal weight used the labels than the overweight/obese male and female students (Table 9.2) (Figure 9.3, 9.4).

Table 9.2: The self-reported use of the calorie labels by weight status, gender, and occupation.

Use of Labels	Yes % (n)	No % (n)
Staff Male	**39 (80)**	**61 (123)**
Normal Weight◊	59 (42)	62 (93)
Overweight/Obese*	41 (38)	38 (30)
Underweight¥	0 (0)	0 (0)
Staff Female	**65 (279)**	**35 (151)**
Normal Weight◊	62.5 (165)	38 (58)
Overweight/Obese*	37 (99)	62 (93)
Underweight¥	0.5 (1)	0 (0)
Student Male	**41 (121)**	**59 (177)**
Normal Weight◊	68 (75)	76 (134)
Overweight/Obese*	22 (24)	24 (43)
Underweight¥	10 (10)	0 (0)
Student Female	**61 (527)**	**39 (332)**
Normal Weight◊	76.5 (384)	79 (263)
Overweight/Obese*	22.5 (113)	20 (65)
Underweight¥	1 (6)	1(4)

◊Normal weight: BMI=18.5-24.9 kg/m^2

***Overweight/Obese: BMI=25->30 kg/m^2**

¥Underweight: <18.5 kg/m^2

BMI is the weight in kilograms divided by the square of the height in meters (weight and height were self-reported by participants)

Figure 9.2: Self-reported use of the calorie labels by occupation, and gender and whether calorie-labelling led to a higher or lower calorie option.

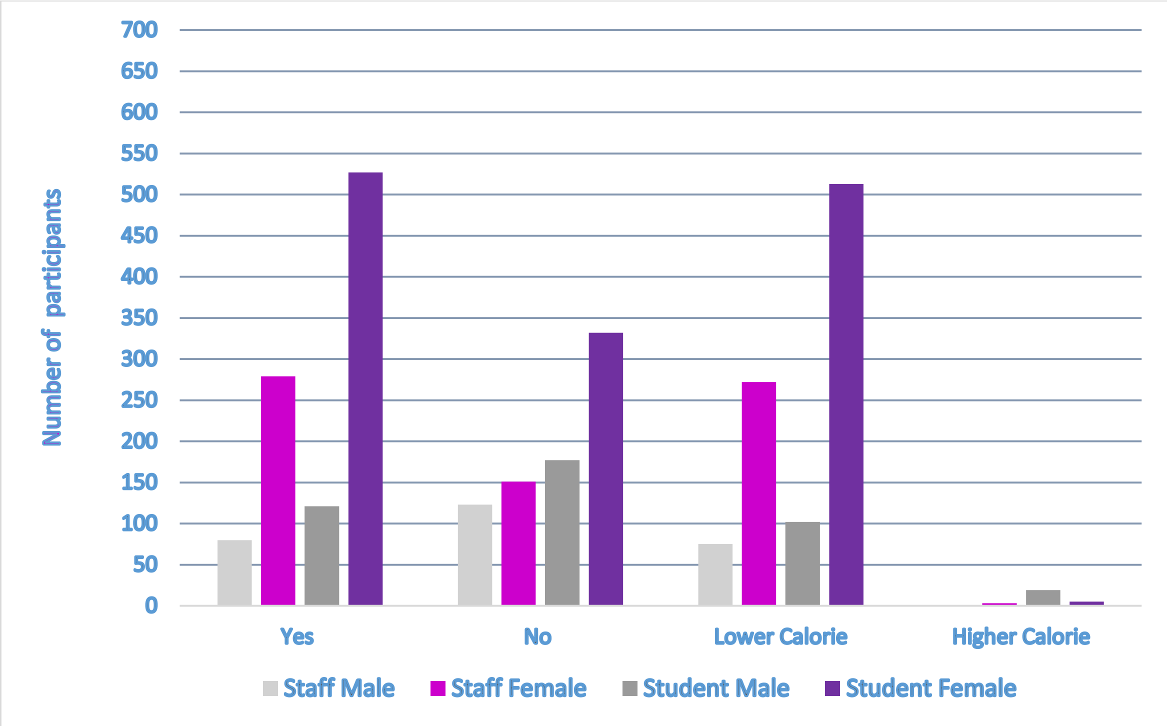
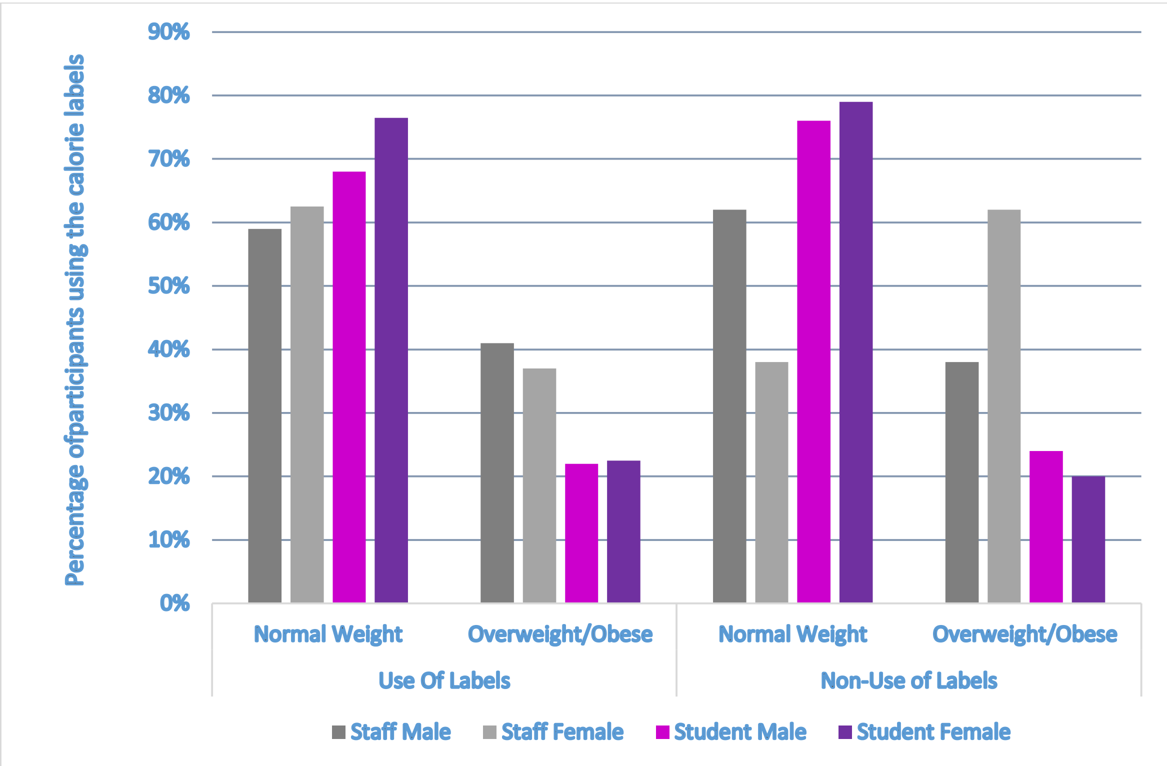


Figure 9.3: Self-reported use of the calorie labels by weight, gender, and occupation group



9.4.3 Customers' views on and reasons for the use of the calorie labels

Different reasons were given by female and male staff and students. Female students reported being interested in the calorie content to assist in maintaining a 'normal' weight and to 'eat healthily'. Male students reported not using the calorie labels, as they were more interested in the protein contents of meals which they believed to be related to fitness and training. Those who reported being physically active indicated using the calorie information to choose higher calorie options to ensure they consumed sufficient calories to allow them to carry out their exercise regimes. Female members of staff reported using calorie labels because they were already aware of what they ate and had some knowledge of calories from following calorie-controlled diets. Calorie labels were welcomed with very positive comments by the majority of customers and reported that they would like to see the information permanently in the catering outlets. There were very few comments from customers who suffer or suffered in the past from eating disorders who said that the calorie labels might provoke the disease activity.

9.4.4 Nutritional Profile of the Sandwiches

The sandwiches on sale were grouped, by the caterers, into five categories; 'plain', 'simple', 'classic', 'special', and 'healthy'. These were caterers' descriptors'/terms assigned without any reference to the nutritional composition of each item (Table 9.3). Amongst the sandwiches on sale, ten items contained less than 400 kcal per item while six items contained more than 400 kcal per item. According to FSA traffic light guidelines all items were high or medium in salt content, and all but three items, high or medium in fat.

Table 9.3: Nutritional profile of the sandwiches by caterers' descriptors' terms

Sandwich Selection	Nutritional Composition				
	Calories (Kcal)	Fat (g)	Saturated Fat (g)	Sugars (g)	Salt (g)
'Plain'	319.0	15.0	6.2	3.0	2.1
'Classic'	343.8	13.7	3.2	3.7	1.4
'Simple'	344.4	10.1	3.9	1.2	0.9
'Healthy'	464.0	18.6	4.6	7.9	2.2
'Special'	384.6	14.3	5.3	3.4	2.1

9.4.5 Sales Data

Sales numbers by sandwich, price and nutritional range for the intervention sites and control site for the two months along with percentage of change can be seen in Table 9.4, Figure 9.3,9.4. Differences between the observed and the expected numbers of sales for all the different categories are shown on Figure 9.5. Expected sales were calculated based on the observed sales in the control site. All changes in sales in all categories were significant with a p value of less than 0.001. Sales of unlabelled hot foods did not change across the study period, in either intervention or control outlets.

Table 9.4: Sandwich sales numbers at intervention sites and at control site before and during the calorie labelling by caterers' descriptors' terms for sandwich ranges and high/low calories, fat, and price.

	Calorie Content kcal (kcal/£)¶	Number of items sold Intervention Sites			Number of items sold Control Site			*P value*[1]
		Before	After	% change	Before	After	% Change	
'Plain'	318 (199/£)	1234	887	-28	728	748	+2	
'Classic'	345 (229/£)	1668	1252	-25	1088	1007	-7	
'Simple'	344 (246/£)	476	373	-22	330	354	+7	
'Healthy'	464 (165/£)	281	313	+11	273	289	+5	
'Special'	384 (137/£)	1048	832	-21	905	847	+6	
Total	371 (195/£)	4407	3657	-17	3324	3245	-2	
Low Calorie®	296 (144/£)	3028	2488	-18	1829	1990	+8	
High Calorie®	479 (239/£)	1669	1169	-30	1362	1316	-3	
'Healthy' Low calorie/Fat	368 (131/£)	147	221	+50	116	136	+17	**<0.001**
'Healthy' High calorie/Fat	560 (200/£)	134	92	-31	126	105	-17	
'Special' Low calorie/fat	263 (94/£)	112	63	-56	298	233	-22	
'Special' High calorie/fat	544 (194/£)	176	212	+20	112	126	+12	
Low Fat*	317 (159/£)	3693	2861	-23	2260	2349	+4	
High Fat*	506 (253/£)	1004	796	-21	931	957	+3	
Low Price¥	336(224/£)	3378	2512	-26	2146	2109	-2	
High Price¥	411(147/£)	1329	1145	-14	1178	1136	-4	
Unlabelled hot food		14,271	17,481	+19	109	139	+22	NS

¶ Amount of calories that can be purchased with one pound.

[1] *P values* derived from chi-square goodness of fit test for comparison of the total sales between the time periods before and during the calorie labelling

*Low fat are all the items providing ≤10grams of fat/100gr. High fat are all the items providing ≥10grams of fat/100gr

¥Low Price are all the items that cost <£2. High Price are all items that cost >£2

®Low calorie are all the items ≤400kcal/item. High calorie are all the items ≥400kcal/item

Figure 9.4: Sandwich sales before and during the labelling period by sandwich range in the intervention and in the control site

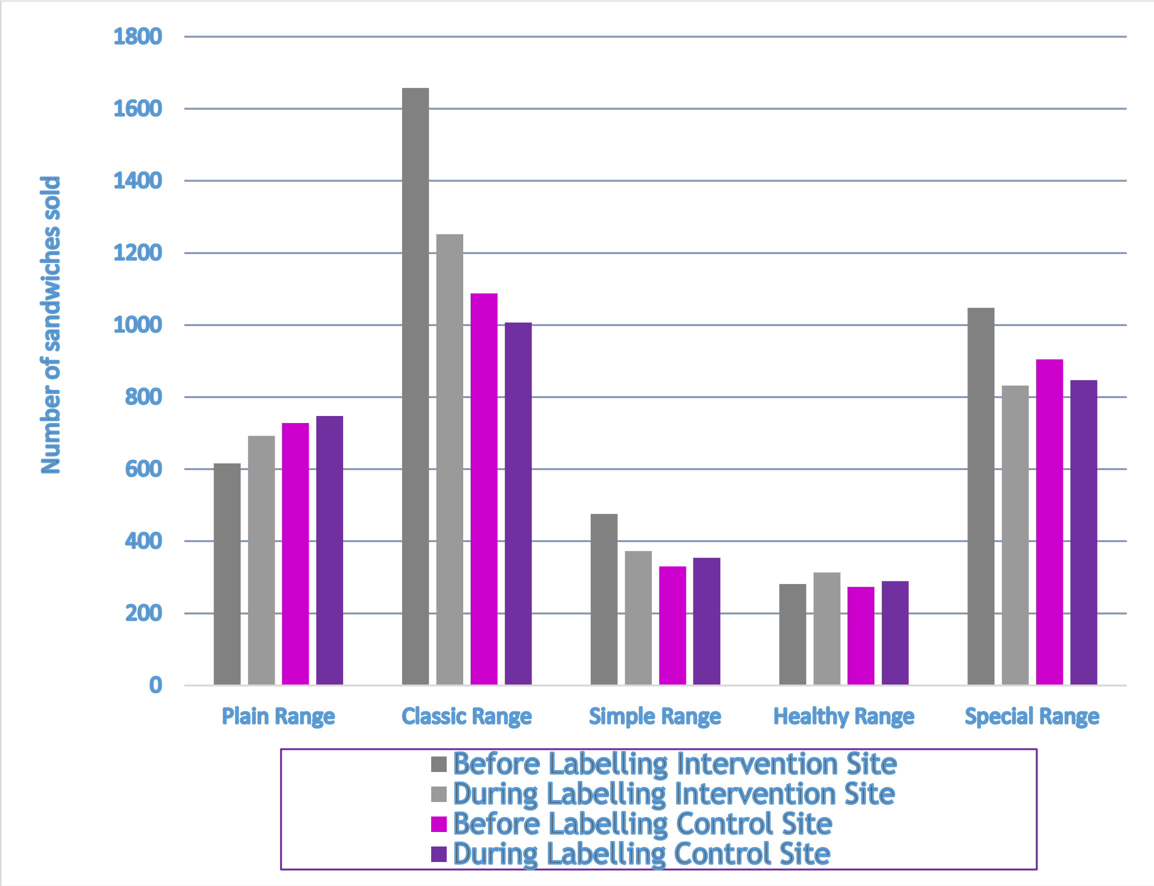


Figure 9.5: Sandwich sales before and during the calorie labelling by low/high calorie range, by low/high price, and by low/high fat content in the intervention and in the control site

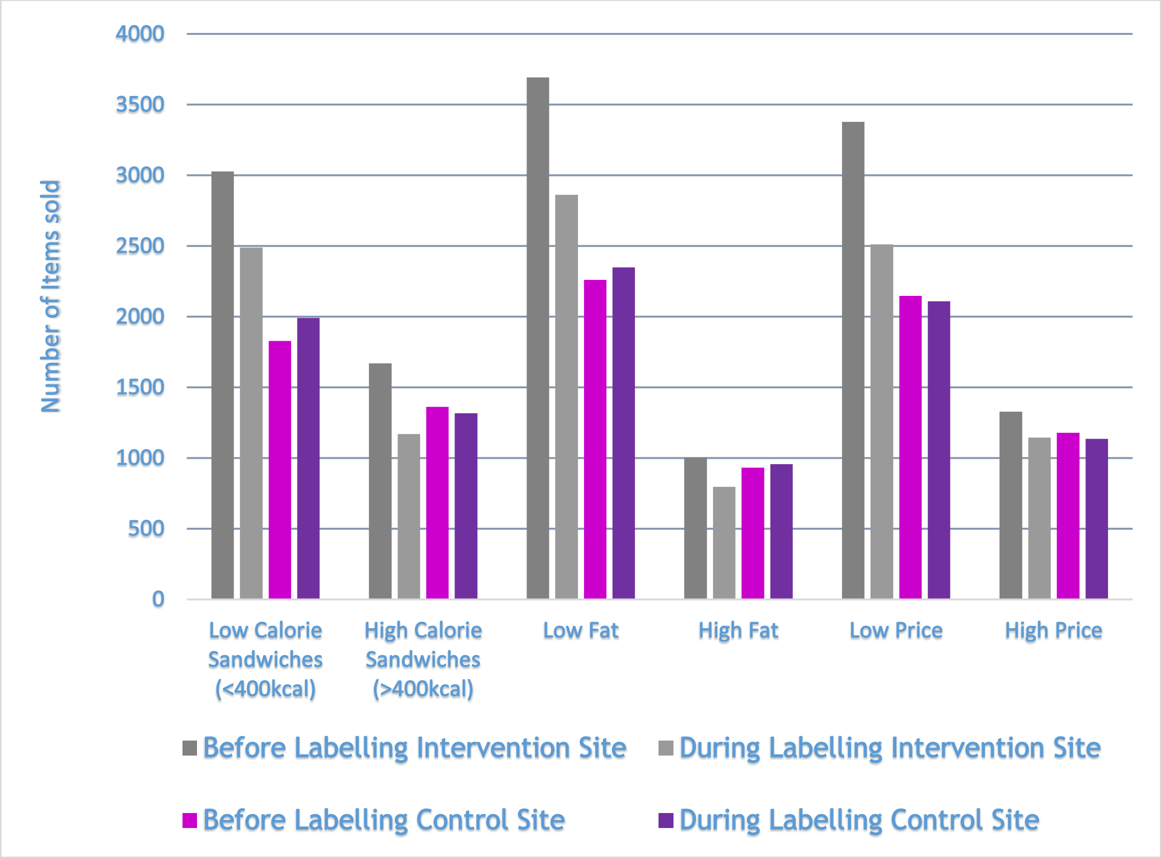
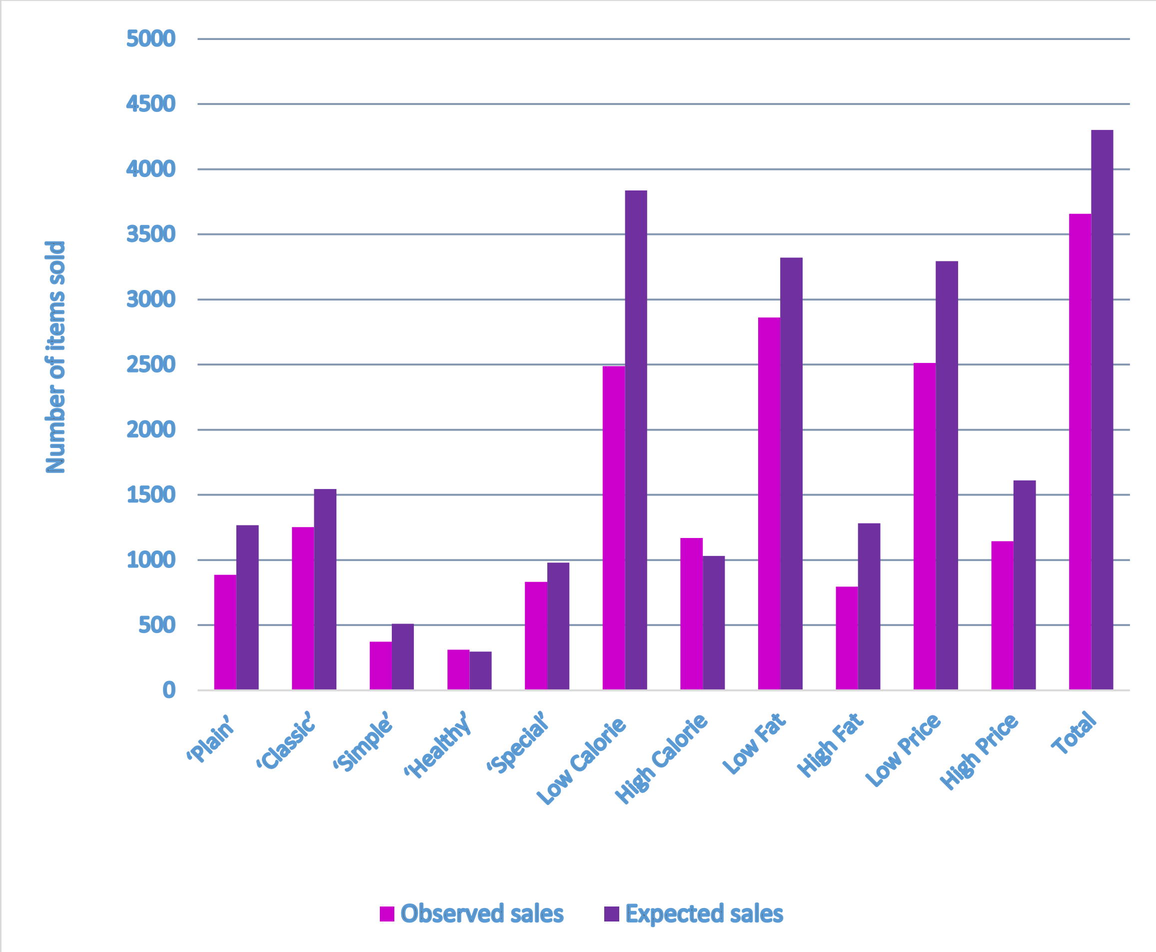


Figure 9.6: Observed sales and expected sales in the intervention outlets based on the observed sales in the control outlet by ranges, calories, fat, and price



Total sales of all labelled items reduced significantly in the intervention sites, compared to the control site (-30%). A drop in sales was seen for all the sandwich ranges except for the 'healthy' one, was between -30% and -21% in the intervention sites, changes in sales for the ranges were between -7% and 8%, which was within the month to month variation in sales expected by the caterers.

The sales for the 'healthy' range increased overall by 11% in the intervention site, while in the control site they increased by 5%. Within the 'healthy' range the sales of the high calorie/fat option decreased by 17% while the sales of the low calorie/fat option increased by 50%.

Within the ‘special’ range, sales for the highest calorie option increased by 21% while sales for the lower calorie option decreased by 50%. Reduction in sales for the low fat and the high fat items were similar (-21% and -23%). Highest priced items’ (>£2) sales decreased less than the low priced items’ (<£2) (-14% vs -26%). The ‘healthy’ range which was the only range where sales increased during the labelling period. It also provided on of the lowest calorific value for money, 165kcal/£.

9.5 Discussion

Calorie labelling has been suggested as an approach to combat the obesity epidemic (Nestle, 2011) but there has been strong opposition by catering stakeholders such as the restaurant association. Currently, only firms with more than 15 catering outlets are obliged to provide the calorie content of their products along with the price. This approach fits in with the UK’s government public health policy on obesity and with ‘libertarian paternalism’ politics, as it encourages personal responsibility and may nudge people towards less calorific choices, without restricting free choice and will. Under the 2011 Responsibility Deal in the UK, 48 companies have committed to provide calorie information on their products (DoH,2013) but this is not a widely visible practice, and none of these companies has yet produced evidence for effectiveness. Studies conducted in the USA have shown mixed and inconclusive results. Some studies found no differences in calories chosen/purchased between control and intervention groups (Harnack et al., 2008), (Elbel et al.2008) while others showed small calorie reductions (Dumanovsky et al.2011), (Pulos & Leng, 2010). No study to date has looked at the effect of the calorie labels on body weight, or the use of calorie labels in relation to consumers’ body weight status.

In the present study, we attempted to discover how posting calorie information, prominently, at the point of purchase would be received by customers, and caterers, and how it would affect their choices. Agreements were in place for a medium-term study, over a 2-week period of exposure to calorie labels, to establish whether the overall approach might be acceptable for longer term or even permanent calorie labelling. The present study employed much more prominent calorie labels than are used on foods elsewhere. They could not be missed, and were widely discussed. The results revealed an overwhelmingly positive response from customers and strong support from the caterers. There were several significant changes in choices, with an overall tendency towards choosing the lower-calorie options, and with a reduction in total sales. We can only report responses over a 2-week period, so must accept that novelty could have generated some results, which might be modified over a longer period.

Prior to the present study, the catering service of the university was becoming more aware of consumer interest in calorific contents and quality of their products. They recently started to provide nutritional information of the sandwiches on their webpage, but not at the point of purchase. Consumers (student and staff) were not informed in any official way e.g. University wide email or announcements in the catering outlets, about the availability of the nutritional information on-line. We can assume, therefore, that the availability of this information would not have influenced sales prior to the labelling period. Posting calorie information by the sandwiches at the point of purchase resulted in significant reductions in the sales of all items, both high- and low- calorie in the intervention sites compared to the control site with the only exception being the 'Healthy' range. There are many possible explanations for this result. It may indicate that some consumers thought twice about purchasing any food at all, especially later on the day when choices were limited. They may have preferred ignorance, and chose hot food selections which were not labelled. When items were analysed by catering category, there more easily explicable changes within the 'Healthy' range. Sales for highest calorie item belonging in the 'Healthy' range fell significantly while the sales of lowest calorie 'Healthy' range item increased. Previous research has shown that consumers are influenced by health claims on products, known as the 'halo effect' (Chandon & Wansink, 2007), (Williams, 2007). Consumers already interested in a 'healthy' option appear to have been more likely to opt for the lower calorie item when presented with the calorie values. A possible 'halo effect' was also evident in the 'Special' range category, where displaying calorie information had the opposite effect such that the sales increased for the highest calorie item. The word 'Special' may have attracted those consumers who are interested in foods providing greater calorie content.

The 'Healthy' range and the 'Special' range represented the most highly-priced items among the sandwich ranges studied here, but prices of items within these two ranges are the same. Price is one of the most significant factors when it comes to food choice (Defra, 2012). There has been some debate on whether the calorie labels might have the opposite effect and nudge customers towards the more calorific products which would provide better calorie value for money (Alisson, 2008). In our setting this was not the case, as within the overall decrease in sales, there was an increase in the items which provided less calories for money (165 kcal/£) compared to the items which provided more calories for money (199-246kcal/£).

Even though the study was carried out in a real-life setting, results may not be fully applicable to other settings. The customers studied were mostly female and of high educational attainment. A study that looked at the use of calorie labels in a low income population found that only 27% of study participants were interested in the calorie information, and there was no change in the calories purchased (Elbel et al.2009).

Providing information contributes to decision-making, but people interpret and use this information in different ways. Consumers may not understand calorie information sufficiently for informed decision-making (Krukowski et al.2006). In our study, providing calorie information proved to be of use mostly for females of normal body weight.

To conclude with, providing information on the calorie content of meals bought out of home and in small, independent catering outlets was welcomed by both caterers and consumers. Calorie labels were most used by normal weight female students; for those already overweight or obese, more public health strategies need to be devised.

Chapter 10:

A randomised controlled study

for weight gain prevention in young adults

Overview

This chapter describes a randomised controlled trial study designed for testing the efficacy of two contrasting behavioural models for the prevention of weight gain in a population of young adults.

10.1 Introduction

Obesity is a major public health concern, generating disease in most organ systems, and massive medical and societal costs, but its treatment has been of limited efficacy regardless of the approach used (Bestwick et al. 2013). Obesity prevention appears a preferable public health approach, but no reliable sustainable solution has yet been developed. Weight gain, potentially leading to obesity, is most rapid in the transitional period spanning adolescence and young adulthood (Lewis et al 2000, Lean et al 2013, Vlassopoulos et al 2013), and especially noted in those who attend higher education (Crombie et al, 2009, Nikolaou et al. 2011, Nikolaou et al. 2012). Despite this, few studies have challenged weight gain in young adults, as a preventive strategy against obesity.

In theory, weight maintenance and weight gain prevention should be relatively easy to achieve since the average weight gain observed requires only an extra 50-100 kcal/day above estimated energy requirements. In reality though, people seldom eat or exercise in a consistent way or monitor their variable food intake and activities on a daily basis. The literature on the factors influencing human behaviour is very extensive (Maio et al.2007, Jackson, 2005) and behavioural models have been used widely in a range of disciplines to date as a way of changing behaviour. The problem of overweight and obesity has been addressed by behavioural treatments, more traditional approaches targeting diet and physical activity changes, medication, and surgery. While valuable lessons were learned from weight loss studies and people who were successful at maintaining some weight loss at least for a year, relapse into previous behaviours and habits has been the rule rather than the exception (Barte et al.2010). The use of behavioural models for the prevention of weight gain is under-researched.

The present study examined the effectiveness of two behavioural models aiming at preventing weight gain and encouraging healthier lifestyles among young adults in higher education, using the on-line environment for their delivery.

10.2 Methods

The study was approved by the ethical committee of the College of Medicine, Veterinary, and Life Sciences (20/11/2010) (Appendix 4). The study allowing the validation of weights and heights was approved by the NHS Glasgow and Clyde Ethics Committee (01/2013) (Appendix 5).

10.2.1 Participants

Eligible participants for this study were all undergraduate students registered in a large urban university. None was excluded from participating. University email addresses and registration numbers were provided for the randomisation process.

10.2.2. Design

This study used a three-group parallel randomized controlled trial design. Two intervention groups received different interventions, based on two separate behavioural models, one addressing issues around weight control and the other addressing political, environmental and social issues around the food industry. Both were designed to lead interested participants towards more healthful diets and lifestyles, one overtly, the other covertly. The control group was not contacted at all and received no information about the study.

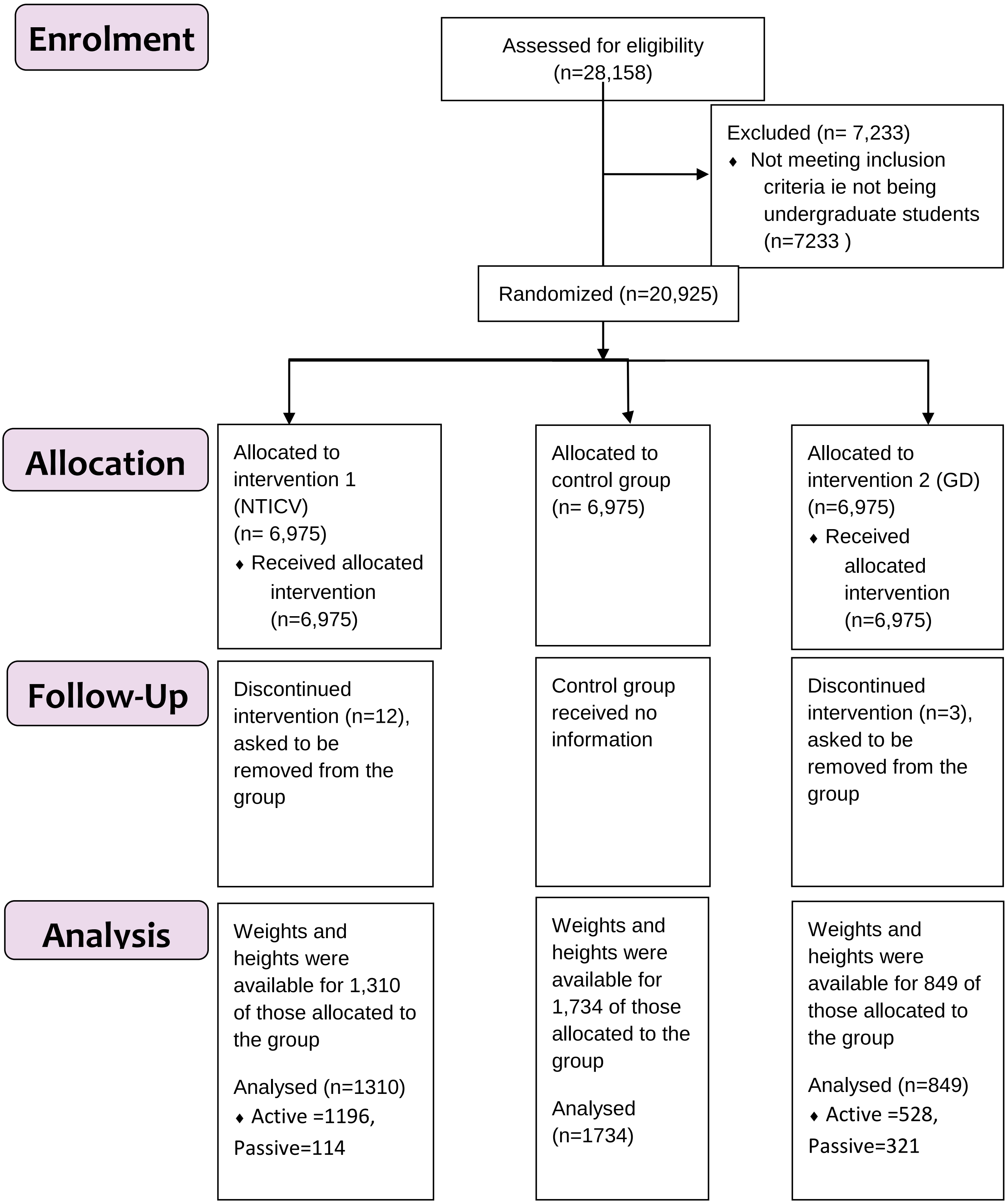
The primary outcome measure was weight change over a period of 9 months, between the beginning and end of an academic year, to test the hypothesis that intervening with young adults will help them minimise or abolish the weight gain usually observed at this stage of life. To reduce risk of bias to recruitment which might have resulted from early emphasis on personal bodyweight, self-reported body weight and height data were collected through a separate on-line questionnaire, which was part of a different university-wide study. Recognising the potential for bias in self-reported data, these data were validated against measured data in a subsample.

It was recognised that this on-line approach would likely attract only a minority of students, and probably those already interested in the topics of the programmes. However, in order to further avoid confounding the study and to retain a 'realistic' design so that results might be directly applicable to other real-life settings, participants in the intervention arms were not informed about the true aim of this study, ie to assess weight changes in the intervention groups compared to controls. Young adults were told that the University was trialling some new courses as part of the University wide services and participation was voluntarily. No financial incentives or academic incentives were offered for participation. Publicity around the courses was kept to minimal in order not to influence those in the control group or those assigned in the courses.

10.2.3 Randomization

Randomization to treatment groups or control group was conducted a priory with the use of statistical software (SPSS 19, Chicago) by the two independent researchers. Each eligible participant was represented as a 6-digit number. A table was stratified based on this 6-digit number for each of the 20,975 eligible participants. Sample size was estimated posteriori using data from a study which was conducted in a population of young adults attending the same university the year before and which looked at weight changes during a 9-month period. In that study, which was conducted by the same research team, per protocol analysis results showed a mean increase in weight of 1.8kg, over the 9-month period. Power calculations (SPSS 19, Chicago, Sample Power) indicated that there would be 85% power to detect a 1.8kg difference with a minimum of 290 total participants at the end of intervention period, in each group. As the study involved all students in order to retain the realistic design, all students were randomized and this gave a total of 6,275 participants to each group (Figure 10.1). The far greater number of participants randomised in each group than that required to detect an effect controlled for a potential high attrition rate and secured a smaller effect size.

Figure 10.1: Consort Flow Diagram



10.2.4 Behavioural models

A wide range of potential models have been proposed to explain, and potentially generate, behavioural changes in relation to weight control (Abraham et al.2007). A recent large systematic review and meta-analysis (Webb et al.2010) of web-based behaviour-change interventions aimed to identify why some interventions worked and some did not. The review included approximately 85 studies covering more than 45,000 participants. The authors applied a newly developed taxonomy of behaviour-change techniques to interventions in the included studies. From this analysis, they were able to conclude that more extensive use of theory (particularly the Theory of Planned Behaviour) and certain behaviour-change techniques (eg, stress management, goal setting, and action planning) were associated with larger effect sizes. For the present study two simple, contracting models were used.

Treatment 1 'NOT THE ICE CREAM VAN' (NTICV). This treatment followed the 'rational model' (Simon, 1952). The rational model is based on the assumption that human beings, when provided with all the information, will make the best choice for themselves with a view of maximising utility, or usefulness. It assumes a linear relationship between information, attitudes and behaviours (Kolmuss & Agyeman, 2002).

Traditionally, many weight-loss programmes have been based on the rational model. Researchers assumed that by giving the information of health effects of excessive weight and energy reduction diets, people would generate the knowledge required for changing attitudes and behaviour. In real life settings, though, this was not the case. Health-behaviour change involves a series of episodes of adherence, lapses, relapses, and recovery as the individual faces new behavioural challenges and contexts. (Michie et al.2011).

Generally, the rational model has been unsuccessful for weight loss studies, as it did not account for the shortcuts during decision making process, or the environment in which decisions are made. Weight-prevention strategies, though, are different to weight-loss strategies in terms of outcomes by not focusing on any weight change per-se. So the rational model may fit better, especially by adopting the 'fourth generation model' as described by Bandura, which incorporates the provision of information, external reinforcement, adaptive self-regulation skills, and continued support (Bandura et al.2007)).

Treatment 2 'Goddess Demetra' (GD). This treatment is based on the 'stealth' model, which first appeared in 2008 (Robinson.2008). The stealth model is based on the identification and targeting of behaviours that are motivating in themselves and the desired outcome will be the 'side-effect' of the intervention rather than the primary outcome. Robinson suggested preventing obesity through promoting certain social movements that could have a link with a healthful lifestyle There is also evidence that there is a 'transmission' of ideas and behaviours in societies called the 'social contagious' theory. According to Christakis who developed the notion of social contagion theory, ideas and behaviours spread in networks (Christakis et al.2007).

10.2.5 Materials and Modes of Delivery

Materials for the two intervention groups were developed and tailored to the specific age group and time of the year when the programmes were delivered. Materials for the intervention were delivered using Moodle, a software package already used by students. Moodle is used as a platform for delivering internet-based university courses, where students access lecture notes, upload essays and provide feedback.

Materials were posted weekly for a total 19 weeks, with three-week breaks in continuity during Christmas and Easter holiday periods. A weekly email was sent to the intervention groups to inform them that new materials were uploaded, the topic of the week and a reminder of the password for joining the group. An anonymised forum was available for participants to comment on the materials and exchange ideas and opinions. Materials were presented in different forms such as word, power-point, including graphics and photographs and figures in order to make them more interesting, interactive and eye-catching. Simple marketing techniques were applied to maximise impact (Evans, 2006).

Treatment 1 NTICV: The topics presented on each week during the 19-week period are shown in Figure 2a, Appendices 27-36. Some of the information presented in the materials were adapted from resources developed by organisations such as Food Standards Agency, British Heart Foundation etc and others were developed from scratch by the research team.

Treatment 2: GD: The topics presented are shown in Figure 2b, Appendices 37-53. Materials were developed to present information on food and agriculture sustainability, food politics, science-based reports and social dimensions of food and eating were uploaded.

Figure 10.2a: Timetable for Treatment- 1

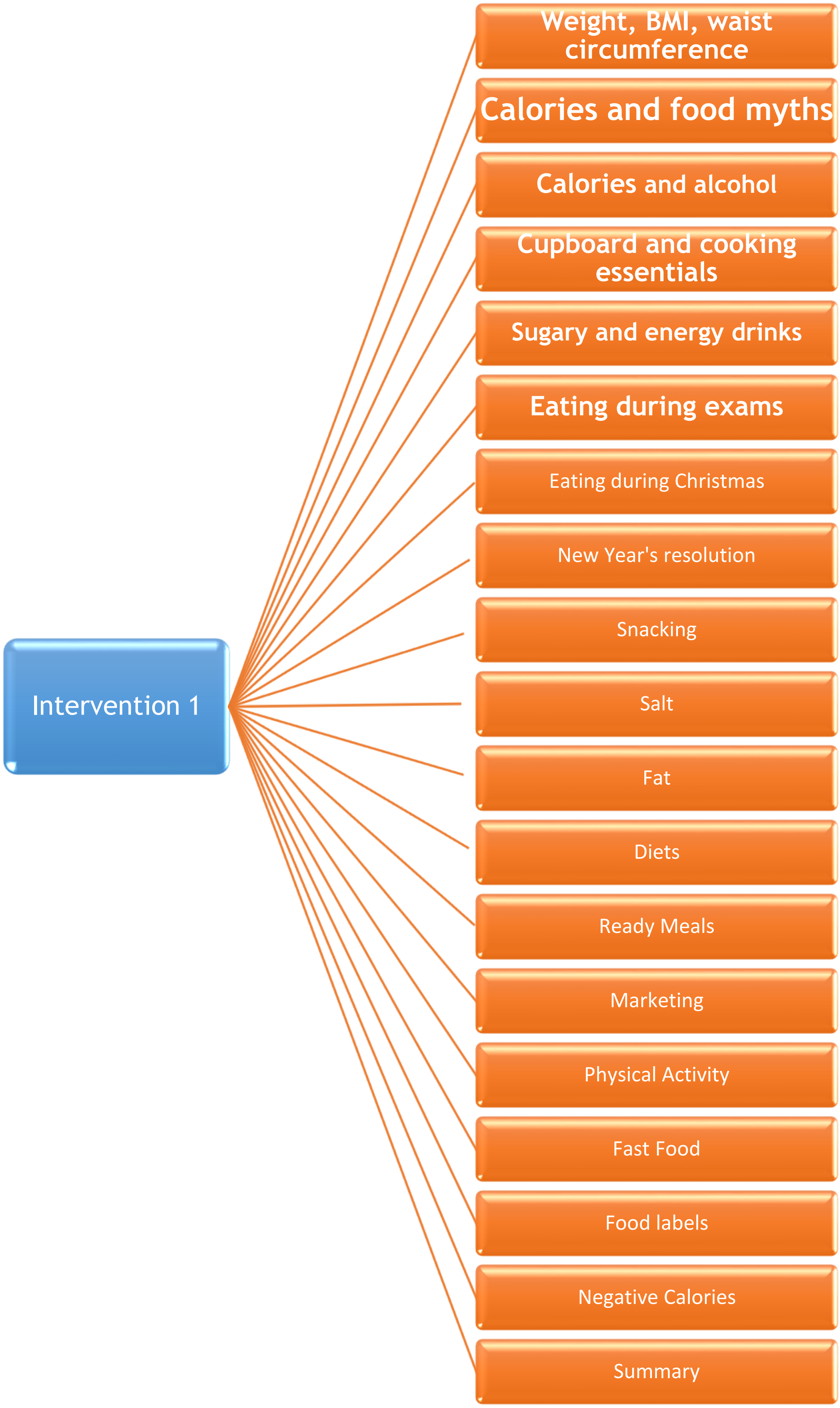
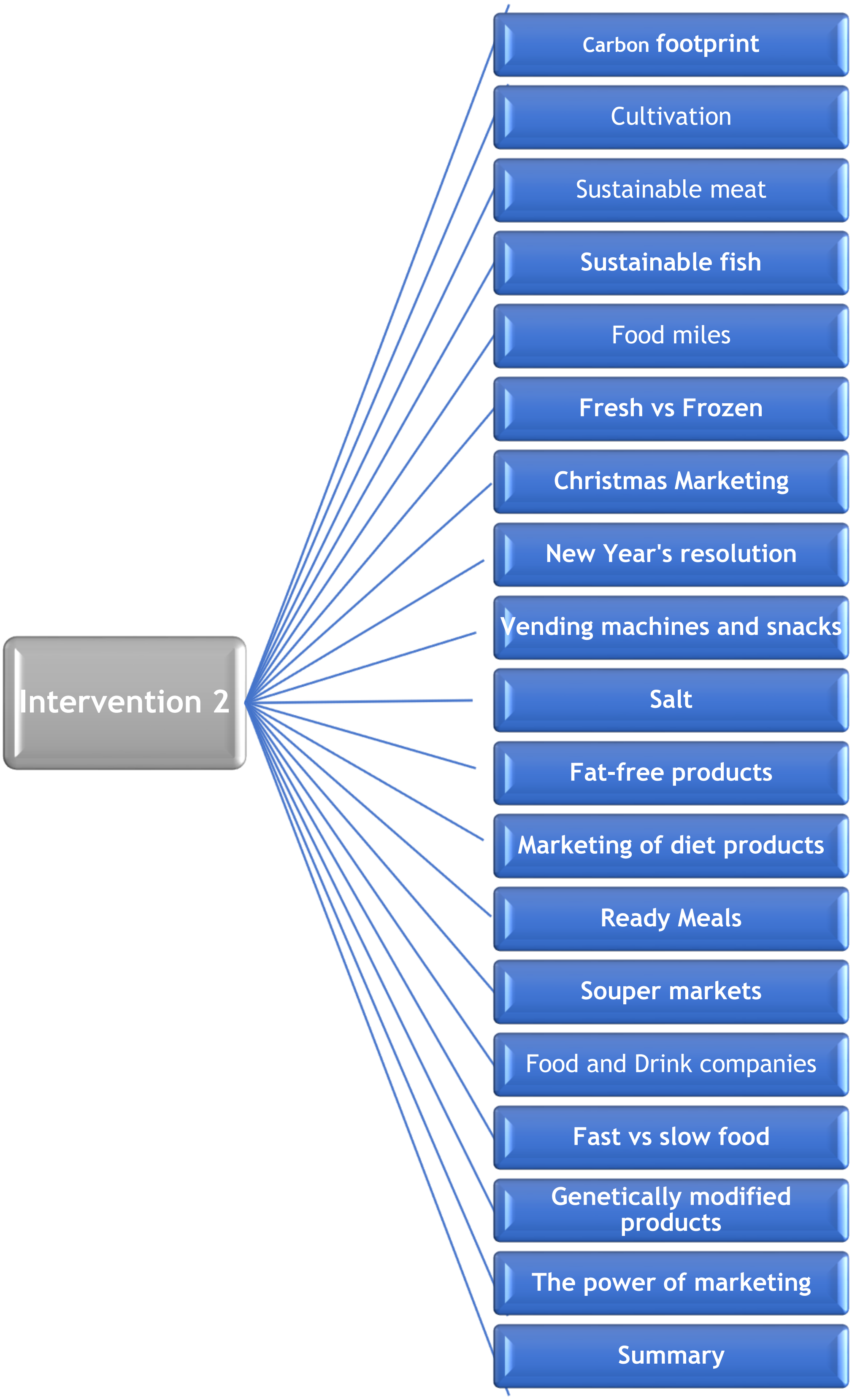


Figure 10.2b: Timetable for Treatment-2



Control group: This group received no information.

10.2.6 Validation of self-reported weights and heights

Self-reported weights and heights which allowed the calculation of weight changes were validated for two sub-samples of the participants against objectively measured heights and weights held in the health records of young adults and against measured data by a trained researcher

10.2.7 Use of Online Resources

Moodle offers a platform which allows recording each participant's 'log in' times, dates and materials accessed and time spent on each material. These data will allow an independent assessment of the use of the materials developed for the treatment groups.

10.2.8 Evaluation of treatments

At the end of the 9-month period, participants who were randomised to one of the treatment groups were sent a short questionnaire. The questionnaire was specific for each group and was devised to collect the views of both those who subscribed to the group and those who did not. The questionnaire was anonymous and included questions on use of the materials, reasons for logging in or not and awareness before and after the module has been delivered.

10.3 Results

Those subjects randomised to intervention groups who subscribed to the groups and accessed the Moodle sites are defined as 'active' participants. Those who received the weekly emails but did not subscribe, and were not actively seeking to be removed from the mailing lists, are defined as 'passive' participants. By the end of the study, 1,412 young adults (23% response rate) had subscribed to the NTICV group and 625 young adults (11% response rate) to the GD group, as 'active participants'. The numbers who asked to be removed from the mailing lists were twelve and three respectively, leaving 4,851 'passive participants' for NTICV and 5,647 for GD.

10.3.1 Weight changes

Data were available on weights at baseline and at 9-month follow-up were available for 1,310 (1,196 active participants and 114 passive participants) for NTICV, 849 (528 active participants and 321 passive participants) for GD and 1,734 in the control group (Table 10.1, Figure 10.3). Participants' characteristics are shown in Table 1. Weight changes over the 9-months period are shown in Table 10.2. Mean overall weight changes were: Control +2.1kg (95%CI 1.3, 2.8kg) $p<0.001$; 'NTICV' -1.1kg (95%CI -1.8, -0.4kg), and 'GD' -1.5kg (95%CI -1.7, - 0.9). Weights changes were significant in all groups and for both men and women ($p<0.001$).

For actively-engaged participants, defined as those logging in the webpage of the programmes, weight changes were: NTICV (n=1,196) -1.4kg (95%CI -2.1, -0.7kg) p=0.002, and GD -1.8kg (95%CI -1.9, -1.2kg) p=<0.001. Weight-changes remained significant when analysed separately for men and women. Among passive participants, who were randomised to the intervention groups and received the weekly emails without subscribing to the online platform, there was no weight change over the 9-month period: NTICV: -0.2kg (95%CI -0.4, 0.1kg), p=0.634, GD: -0.1kg (95%CI -0.2, 0.3kg) p=0.586.

Odds ratio for weight gain for the compared to the control group was; NTICV=27 (95% CI 21.7- 33.6) $p<0.0001$, GD=43.8 (95% CI 31.0- 62.0) $p<0.0001$.

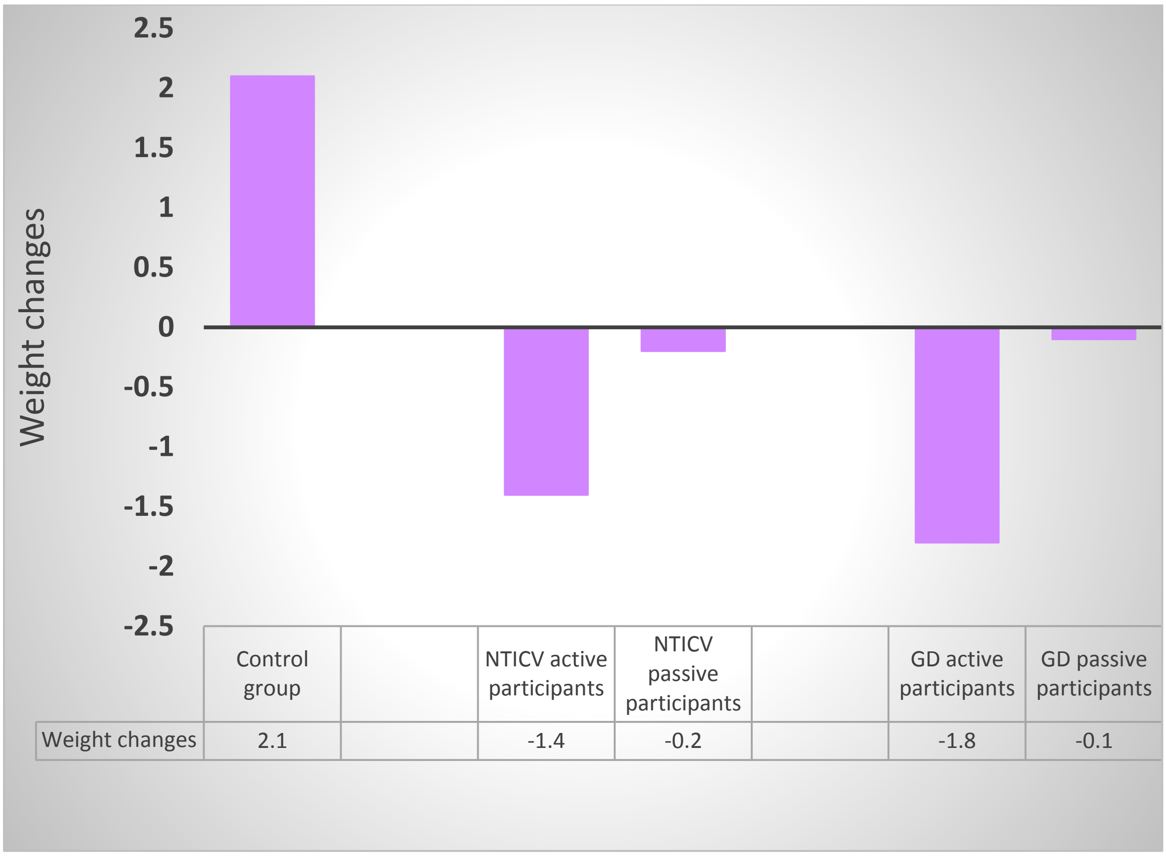
Relative risk for weight gain compared to the control group was; NTICV=0.13 (95% CI 0.11-0.15) $p<0.0001$, GD=0.07 (95% CI 0.05-0.1) $p<0.0001$.

Table 10.1: Participant characteristics at baseline and follow up, and weight changes in the 9-month period, and treatment group

	Control group				NTICV				GD			
	Baseline	**Follow-up**	**Change**	**P value**	**Baseline**	**Follow-up**	**Change**	**P value**	**Baseline**	**Follow-up**	**Change**	**P value**
Weight												
All	65.3 (13.5)	67.4 (14.7)	+2.1	<0.001	65.8 (12.9)	64.7 (11.7)	-1.1(1.3)	0.02	68.5 (15.7)	67.0 (15.2)	-1.5(1.1)	<0.001
Active	-	-	-	-	67.3 (13.0)	65.9 (13.2)	-1.4 (1.8)	<0.001	67.2 (14.9)	65.4 (14.3)	-1.8 (1.6)	<0.001
Passive	-	-	-	-	65.2 (13.1)	65.0 (13.0)	-0.2 (0.8)	0.585	67.6 (14.3)	67.5 (14.2)	-0.1 (0.9)	0.635
BMI												
All	22.3 (4.6)	22.6 (4.9)	+0.3	<0.001	22.4 (4.2)	22.2 (3.9)	-0.2(0.4)	0.03	22.7 (5.4)	22.5 (5.0)	-0.2 (0.5)	0.024
Active	-	-	-	-	22.3 (3.5)	21.8 (3.2)	-0.5 (0.6)	0.02	22.9 (3.2)	22.4 (3.2)	-0.5 (0.4)	0.03
Passive	-	-	-	-	22.2 (3.1)	22.2 (3.0)	-0.1 (0.3)	0.754	22.7 (3.1)	22.6 (2.9)	-0.1 (0.3)	0.843

* Differences between all groups were tested with ANOVA
* All data mean and standard deviation

Figure 10.3: Weight changes reported in a 9-month study period among participants in the; control group, NTICV active and passive participants, and GD active and passive participants.



10.3.2 Use of Materials

The use of the Moodle platform/week of the intervention can be seen in Figure 10.4. The activity in both interventions fell from the start to the end by approximately 50% for the NTICV and by a third for the GD.

NTICV: 1,412 young adults subscribed to the group. In the 9-month period that the group was active, there were 5,410 viewings of individual materials and 10,470 log-ins, in total. The average number of log-ins per active participant was 7.2. Of these, 305 logged in only once, 638 2-5 times, 220 6-10 times and 248 11 times or times, up to an individual maximum of 106 log-ins.

GD: 625 young adults subscribed to the group. In the 9-month period that the group was active, there were 1,233 viewings of individual materials and 5,863 log-ins, in total. The average number of log-ins per active participant was 5.4. Of these, 169 logged in only once, 343 2-5 times, 65 6-10 times and 47 11 or more times, up to an individual maximum of 50 log-ins.

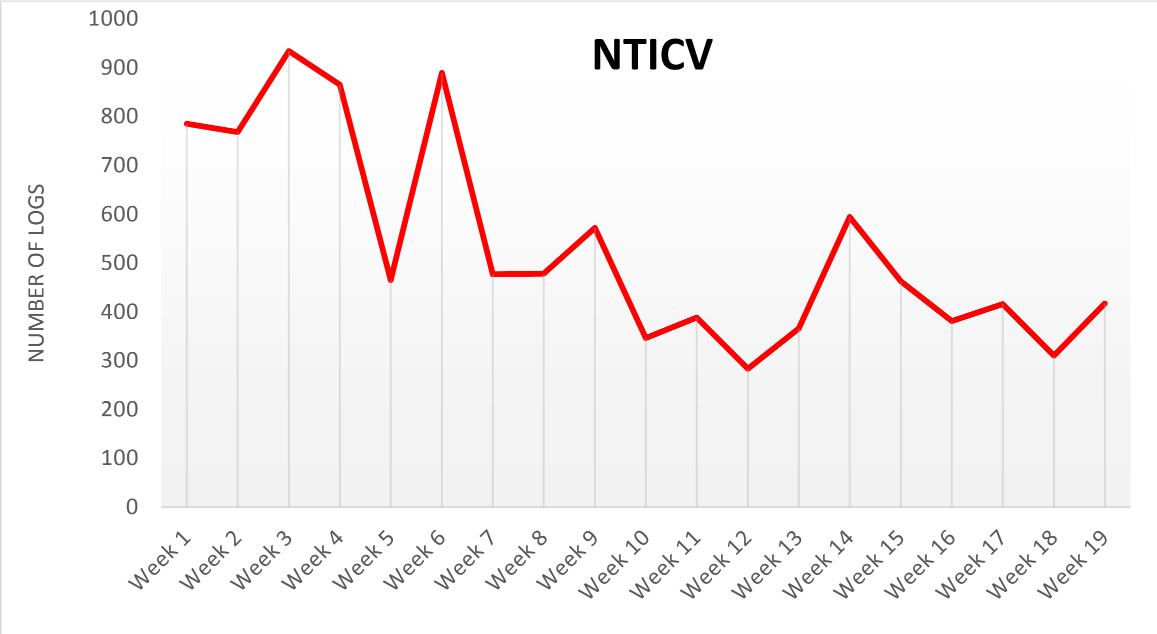
10.3.3 Material Use and weight changes

Weight changes in the active participants of the two interventions were correlated with the number of logs. Individual weight changes and logs for the two groups are shown in figure 10.5.

There was an inverse significant correlation (-0.217, p=0.01) of weight change and logs for the NTICV group and no significant correlation for the GD group. There was a significant positive correlation between those logging in between 6-10 times and weight loss, in the GD group (0.906, p=0.01).

When data were analysed by those who gained, maintained, or lost weight during the 9-month study period in participating in both groups, there was an increase in the number of logs by weight loss (Figure 10.5). However, when data were analysed by quartile of logs, in the NTICV participants there was a peak in weight loss for those who logged between 6-10 times while for the GD, there was a decline in the weight loss achieved with an increase in the logs (Figure 10.5, 10.6).

Figure 10.4: Weekly activity in logs for the duration of the study for the two interventions



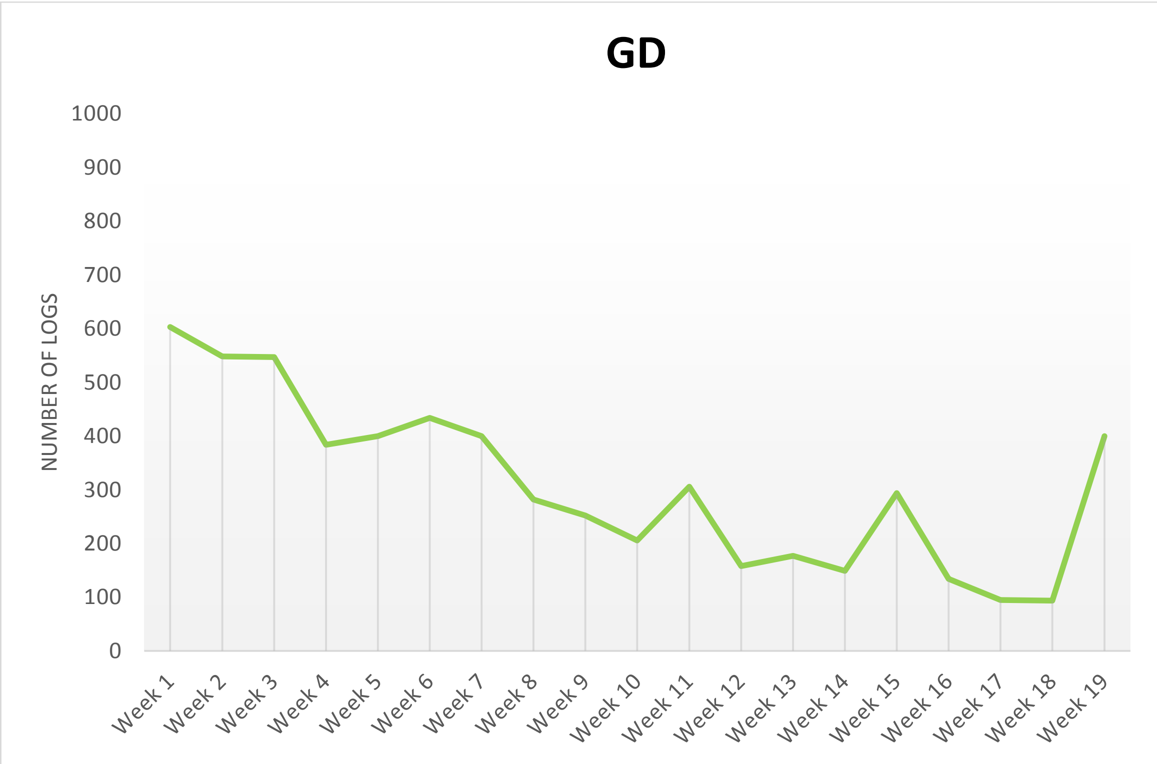
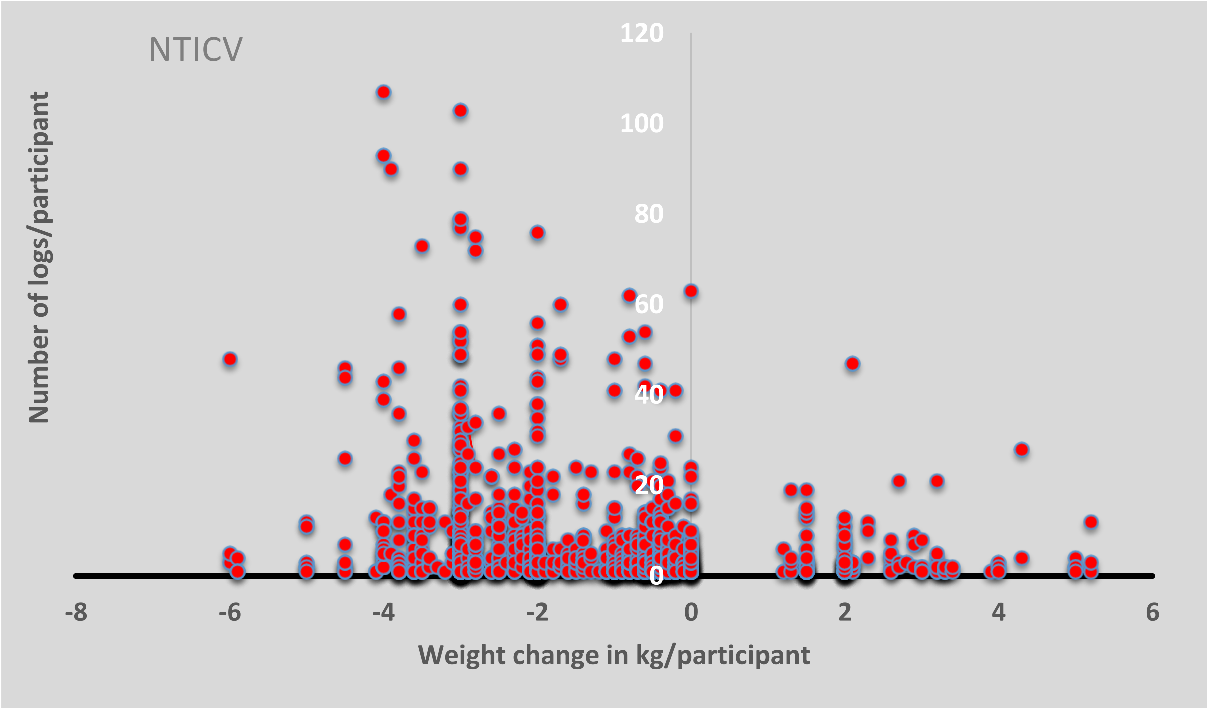


Figure 10.5: Individual weight changes and logs for the two intervention groups



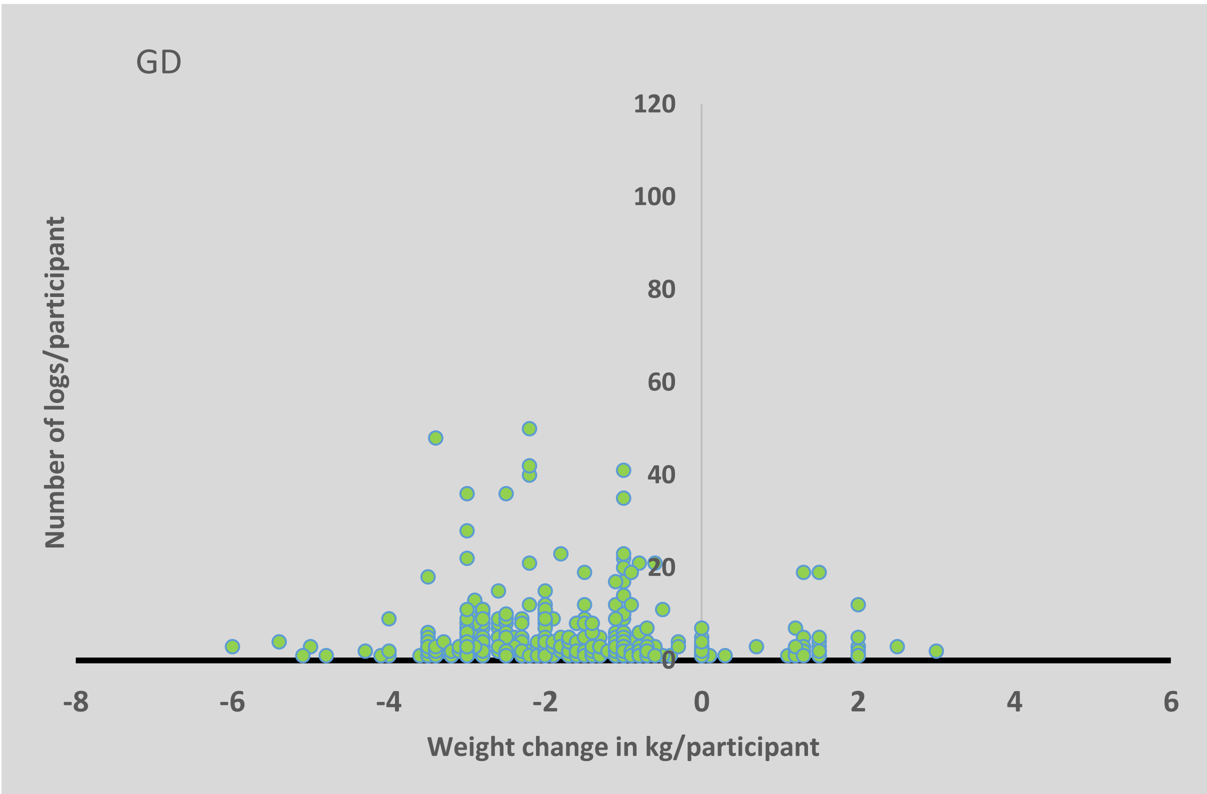
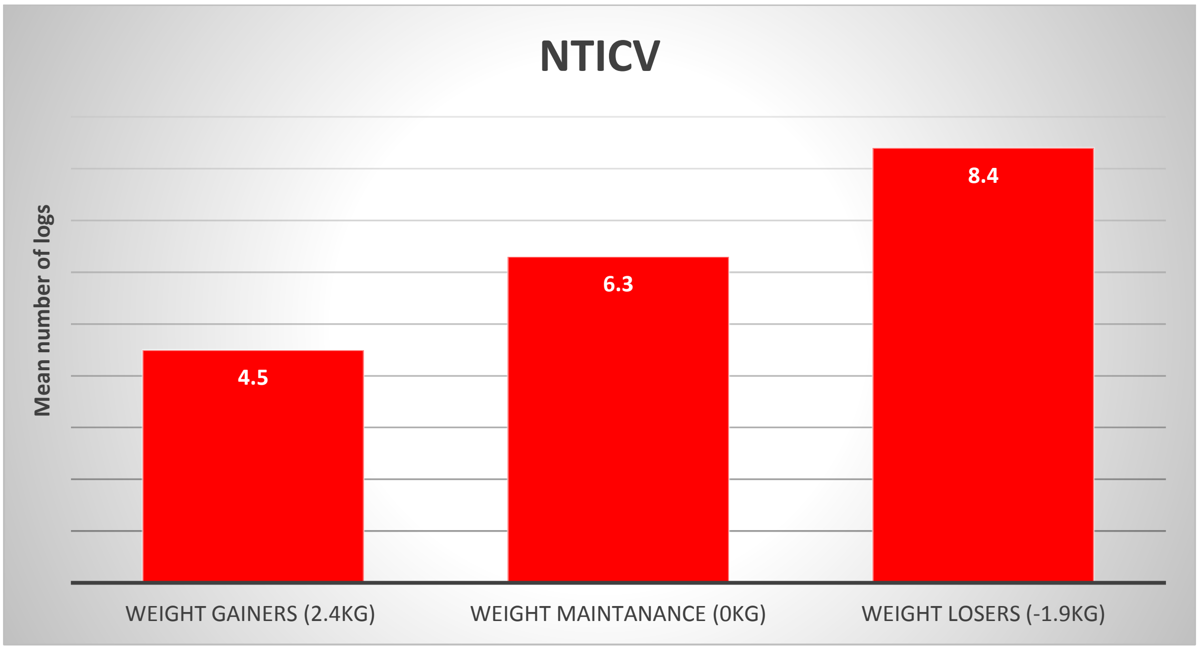


Figure 10.6: Mean number of logs among weight gainers, maintainers and losers in the NCITV and GD intervention groups.



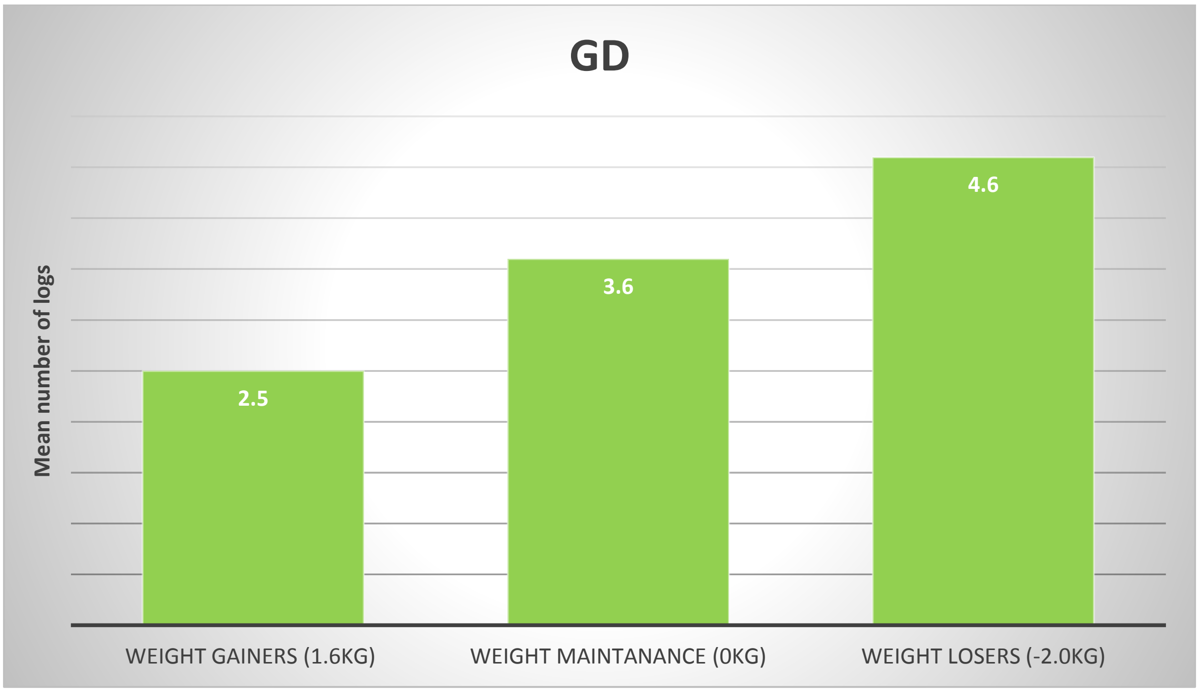
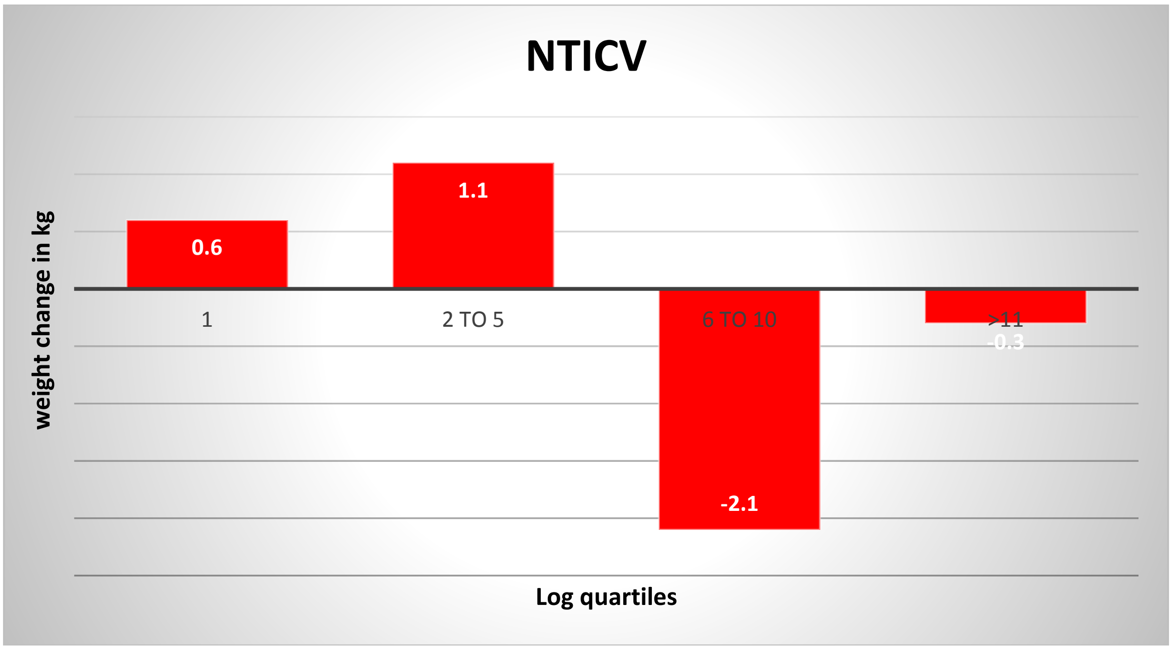
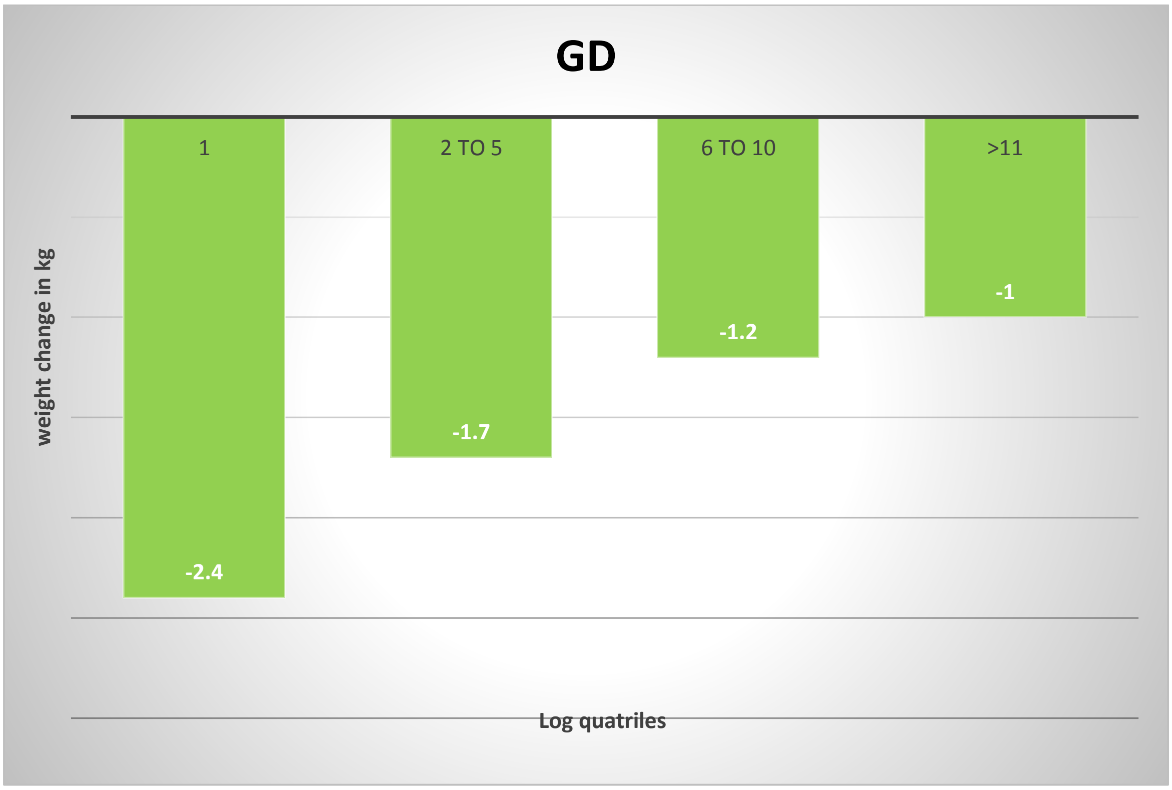


Figure 10.7: Logs in quartiles and mean weight change per quartile for the participants in NTICV and GD.





10.4 Discussion

The present study aimed to prevent the onset of weight gain or minimise the weight gain observed in young adulthood, using a novel on-line approach. Participants in both intervention groups lost weight while those in the control group gained weight. The weight gain observed in those in the control group was similar to that observed in previous studies among young adults in the UK (Serlahious et al, 2009, Nikolaou et al, 2010, Nikolaou et al, 2014). Both intervention programmes were associated with significantly different weight changes compared to the control group. They both appeared to abolish the increase in body weight usually seen among young adults in UK, with similar effect sizes. It is unlikely that any single on-line programme would suit the needs and interests of all young adults, and in a real-life setting outside the confines of a randomised trial, supporting advertising through social media etc could encourage greater engagement with programmes directed towards weight-control. The subjects in this large study were not given a choice of programmes, so the results might be considered conservative.

A recent review on interventions for weight gain prevention in young adults identified some promising areas targeting mostly behaviours and knowledge around nutrition and/or physical activity although the results were of limited efficacy and studies were conducted in self-selected populations (Laska et al, 2012). Designing effective interventions for this specific age group is extremely challenging, with many competing elements aiming to attract young adults. The feasibility and efficacy of Internet interventions have been demonstrated across a wide range of physical and mental health conditions, including smoking cessation, chronic pain management, and cardiac rehabilitation (Bennett & Glasgow, 2009). Internet interventions are currently underutilized given the high percentage of Internet access especially among a young adult population.

Five studies have previously been conducted in a higher-education settings with the aim of preventing weight gain. Matvienko et al evaluated a four-month nutrition course with information on obesity, physiology, and energy metabolism in first-year female college students. There was no change in body weight or BMI between the intervention and the control group but there was a reduction in reported fat intake (p=0.04), protein intake (p=0.03), and carbohydrate (p=0.008) between heavier participants, with BMI>24kg/m^2, in the intervention group compared to controls. Levitsky et al tried a more individualised approach which included daily self-weighing of participants in the intervention groups with values sent back to the researchers. These values allowed the calculation of linear regression of energy requirements and weight changes and the slope of the line was e-mailed to participants. All participants in both the control and the intervention group were females. Participants in the control group gained 3.1(SD 0.51)kg (p<0.001) while the weight in those in the intervention group did not change 0.1 (SD 0.99kg). Both, Hivert et al, Gow et al and Dennis et al trialled an on-line seminar-type course to combat weight gain in young adults. Hivert et al randomised 115 students into control or an intervention groups (55 students per group gave a power of 90% to demonstrate a significant difference of 1.4kg after two years). Those in the intervention group received seminar-type information on obesity, weight, physical activity, diet fortnightly for the first 2 months and then monthly (except over the summer months) until the end of the study, 24 months after initiation. Participants in the control group gained 0.7(SD 0.6)kg while those in the intervention group lost 0.7 (SD 0.4)kg (p=0.04). Gow et al in a 6-week and 4-arm randomised trial tested the effect of an online seminar delivered weekly along with weekly self-weighing in scales provided in the gym of the university and values emailed to researchers. Those who received the combination of the intervention had lower BMI than those in the control group (p=0.05). Dennis et al recruited students from a US university and tried two on-line courses based on social cognitive theory supplemented by face-to-face lessons delivered by an instructor. One of the groups received in addition instructions on self-regulation. There was no control group in this study. 39 students completed the study which lasted 14 weeks. Participants in both groups gained weight and there was no difference in the weight gained between groups (p=0.18).

A major weakness of all the studies conducted previously was that participants were informed of the study aims, and that would have attracted more committed individuals, willing to report weight change. Our study was therefore unusual in attempting to replicate a more ‘realistic’ setting by randomising all eligible young adults, and in collecting weights and heights in completely separate study, independently from the intervention programmes. We also validated the self-reported data against weights and heights collected independently, openly in one sub-sample and covertly in another, from measurements made at a health centre.

For most individuals, preventing weight gain requires only small shifts in daily energy intake or expenditure (50-100kcal), a great deal less than that required to achieve appreciable weight loss of around 600kcal/day (Lean et al 2006). Our results suggest that engaging online with young adults can help them make such a change in energy balance, sustainably to prevent weight gain over 9 months. That was seen not only in those who actively participated and joined the intervention groups, but also in those who merely received the weekly emails. Receipt of a weekly email appeared to act as a 'nudge' towards controlling energy intake/expenditure.

There were differences between the uptakes of the two programmes (revealing that there may be a need for a combination of interventions or promotional techniques and education. People engage in a different way with science (Boylon et al. 2010) and respond differently to public health messages. The intervention based on the rational model, directed specifically and overtly towards preventing weight gain, was more popular (23% vs 11% response rate) The intervention based on the GD stealth model was overall less popular and the greatest uptake was amongst older students. This could be because older students have a better sense of ethical issues and politics around food and environment. There were also differences in the uptake of the two programmes in terms of gender distributions with NTICV being more popular to females (65% females) while the GD was more popular to males (64% males).

A stealth model has only ever previously been used in one very small study, with 104 student participants, conducted by Heckleret al in 2010. This quasi-experimental, non-RCT study examined the effect of two relatively demanding face-to-face courses, one on obesity and health (which proved the more popular with 79 participants) and the other on health and society (29 participants). A food frequency questionnaire was administered at the start and at the end of both courses to assess any changes in eating habits of students choosing a course. The subjects' weights were not recorded. Those who chose the course on society and health improved their eating habits more than those participating in the course on obesity and health (Heckler et al, 2010)

Strengths and weaknesses

This study was large in terms of the eligible participant base, and targeted young adults, a hard-to-reach and relatively under-researched and neglected group known to be at a life-stage with rapid weight gain. Effective interventions to prevent weight gain among young adults could have massive public health value, so the results, albeit in only one site, are important. On-line interventions can only reach individuals who are familiar with the technology. Although that is now a large majority of young adults, some individuals at risk would be missed by this type of approach if extended outside a university setting, probably more in poorer educational and social circumstances. University students used to represent a highly educated elite sector, but that is no longer the case in obesity-prone European and North American countries: half of all young adults now attend universities in UK. Inevitably, self-selection defines response rates and characteristics of non-responders may be different. For the present study the response rates were 23% and 11%, respectively. For NTICV, a response rate of 23%, might be considered low, but probably represents a substantial proportion of those who are currently overweight, or perceive that they are at risk of weight gain at programme would be of less interest to those who do not believe they have a weight programme. Similarly, it is possible that those who elected to participate actively with the GD 'stealth' intervention could also represent a section of young adults with unusual attitudes or physical characteristics. It was important therefore to see that the control group had baseline weights and BMIs very similar to those in the two intervention groups, and that the active participants had BMI similar to the passive participants. For those with specific concerns and interests, there are of course many other competing sources of information and guidance available on-line, both on weight control and on the politics of food. It was a strength of the present study that the two interventions were supported by a clear statement that they came from University Services, and that there were no commercial involvements or sponsorship.

There are several reasons why this study can be considered conservative in its effect size. Promotion of the intervention programmes, which would be usual in real life, was avoided in order not to interfere with the control group. However the programmes proved popular and even 13 months after the end of the intervention, with no advertisement or promotion, both intervention groups remained active and going through the weekly topics. Using local promotion eg through social media could further enhance the effect of this intervention when out of the RCT setting.

To conclude, two online interventions based on the rational and stealth behavioural models both proved successful in preventing the expected weight gain observed in young adults. The use of an online platform is a simple and low-cost way of reaching large segments of a targeted population for weight-gain prevention and requires only basic programming skills from the researchers. The programmes developed were cheap to deliver, and could easily be replicated and adapted for non-student young adult population.

Chapter 11:

Accuracy and validation of self-reported weights and heights

Overview

The study described in this study aimed at examining whether the self-reported anthropometric data correlate with the measured data collected independently from the studies described in the previous studies. Misreporting of anthropometric data is a common issue in studies and self-reported data are often critisised for being inaccurate.

11.1 Introduction

On-line research is becoming increasingly popular in collecting epidemiological data and deliver health related interventions. On-line research is more cost effective when compared to face-to-face interaction, as it allows contacting large numbers of people concurrently and with minimal cost. On-line data collection and delivery of programs is also convenient with materials accessible at any time online, allowing for participation at times that are more suitable or outside regular hours and for those at remote places.

Epidemiological studies which require information on weights and heights from participants are always prone to bias, either through self-selection and desirability bias when they collect measured weights and heights or through misreporting bias when they collect self-reported weights and heights. Data for any study need to be accurate and representative in order for appropriate conclusions to be drawn. Discrepancies between measured and self-reported anthropometric data can lead to a misclassification of weight status and can thus affect results and conclusions.

Previous research indicates that a variety of factors including gender, age, and body mass index (BMI) can affect the accuracy of paper-based and interview-based self-reported anthropometric data with a tendency for height to be overestimated and weight to be underestimated (Gropper et al.2008). This leads to a subsequent misclassification of BMI category as a result of misreported anthropometric data, which is significant given that BMI is the most commonly used indicator of weight status classification of individuals. Self-reported data are subject to influence by factors including social desirability and mode of data collection, leading to estimation bias of anthropometric data (Larson, 2000). Mail surveys are associated with more accurate reporting of anthropometric data because participants are not as likely to be affected by the social pressures associated with data collection via interview. Similar to mail surveys, the anonymity of on-line data collection may result in more accurate self-reported data compared to face-to-face and telephone interviews.

On-line research is used more often in studies but very few studies have attempted to validate online self-reported height, weight, and BMI data, especially in a young-adult population. The aim of this study is to validate self-reported height, weight, and calculated BMI data via an online survey compared to objectively measured data.

11.2 Methods

This study is was approved by the MVLS (Medical, Veterinary and Life Sciences) Ethics committee for the first part of the study and the second part from the local ethics committee of NHS Glasgow and Clyde.

11.2.1 Participants/Measurements

Young adults, studying in a big urban university in the west of Scotland, were recruited to participate in a lifestyle changes study. Participants were recruited through an email which was distributed through the university wide email system. The survey included lifestyle questions such as dietary and physical activity habits. Respondents were asked to self-report their current height and weight. The survey was handled by a commercial website, SurveyMonkey. Other demographic information were also collected including gender, age, and date of birth. Body Mass Index (BMI) was calculated from online self-reported height and weight.

Self-reported weights and heights were validated against two different sets of measured data.

Set 1: Within one month of completing the survey, measurements of weights and heights were measured by the principal researcher, a trained dietitian, by visiting subjects to their place of residence (students visited by the researcher in various student accommodations and asked for permission to provide measured weights and heights). Height was measured by a portable stadiometer to 0.1 cm. Weight was measured using a digital set of scales (SECA) without shoes and heavy clothing to 0.1kg.

Set 2: Health records of students kept in the GP practice of the university were searched retrospectively and matched with the self-reported data. Weights and heights recorded in the health records were measured by nursing staff of the surgery and recorded into students' records. According to the NHS guidelines regarding patients' data, once the data are anonymised, they are not considered as personal data. The GP staff identified the registered students. Names, DoB were matched with the students who were already in our database. After matching all personal details were removed and each participant was allocated a number.

11.3 Statistical Analysis

Statistics were performed using SPPS 21 (SPSS, Chicago).

Pearson correlation was used to examine the strength of linear relationships between self-reported and measured data. To further investigate the relationship between variables, a multivariate general model using age, gender, and BMI was used. The degree of agreement between self-reported and measured data was also assessed using Bland-Altman plots. Respondents were grouped and analysed by gender, BMI category, and ethnicity to determine differences between self-reported and measured data both within groups and across groups.

11.4 Results

A total of 5,505 young adults participated in the study over two consecutive years and provided self-reported weights and heights while the records of 5,105 young adults were retrieved from the GP practice. For a total of 1446 (26%) of young adults, measured data of weight and height were available; 1,278 from the health records and 168 from the principal researcher (**Figure 11.1**). Participants' characteristics are shown in **Table 11.1** along with differences between self-reported and measured data. As overweight (BMI=25-30kg/m^2) was classified 13% (n=187) of the participants and as obese (BMI>30kg/m2) 5% (n=77) of the participants according to the self-reported data. Measured data revealed a misclassification for BMI category for 15 participants for the overweight category and for 2 participants for the obese category. This misclassification did not contribute to any significant changes in the proportion of overweight or obese participants (14% n=202 overweight, 5.4% n=79 obese).

Figure 11.1: Number of available measured and self-reported data

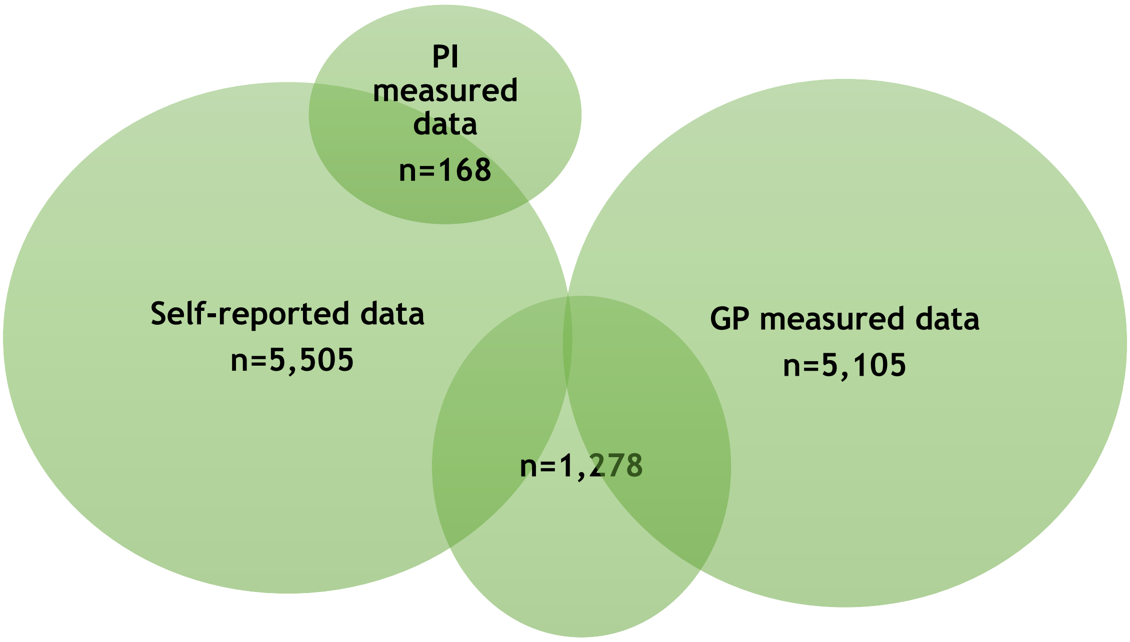


Table 11.1: Self-reported and measured data from health records and from principal researcher

	Self-reported Weight	Measured weight	Difference	P value	Self-reported Height	Measured Height	Difference	P value	Self-reported BMI	Measured BMI	Difference	P value
	Mean(SD)	Mean(SD)	Mean(SD)		Mean (SD)	Mean (SD)	Mean(SD)		Mean(SD)	Mean(SD)	Mean(SD)	
Self-reported vs health records measured data												
All (n=1278) Age=18.8(8.3)	67.1(16.7)	67.5(16.7)	-0.4(0.5)	<0.001	1.71(0.01)	1.72(0.01)	-	NS	22.5(4.6)	22.6(4.6)	-0.1(0.2)	<0.001
Male (n=478) Age= 18.7 (8.7)	75.7(16.3)	76.1(16.3)	-0.37(0.6)	<0.001	1.8(0.08)	1.81(0.08)	- 0.01(0.009)	NS	23.3(4.4)	23.4(4.4)	-0.08(0.3)	<0.001
Female (n=800) Age=18.8 (8.3)	61.8(14.2)	62.2(14.2)	-0.36(0.4)	<0.001	1.67(0.07)	1.67(0.08)	0.003(0.04)	NS	22.0(4.8)	22.1(4.5)	-1.4(0.2)	<0.001
Self-reported vs PI measured data												
All (n=168) Age: 19.6 (2.2)	66.9(17.7)	67.5(17.6)	-0.5(0.6)	<0.001	1.71(0.8)	1.71(0.09)	0.002(0.07)	NS	22.7(5.0)	22.9(5.0)	-0.2(0.2)	<0.001
Male (n=68) Age=19.2(1.5)	67.3(16.1)	67.9(16.0)	-0.5(0.6)	<0.001	1.72(0.08)	1.72(0.09)	0.009(0.07)	NS	22.6(4.7)	22.8(4.7)	-0.2(0.3)	<0.001
Female (n=96) Age=19.8 (2.5)	66.6(18.8)	67.1(18.7)	-0.5(0.6)	<0.001	1.7 (0.08)	1.7(0.08)	- 0.003(0.06)	NS	22.8(5.2)	22.9(5.1)	-0.17(0.2)	<0.001

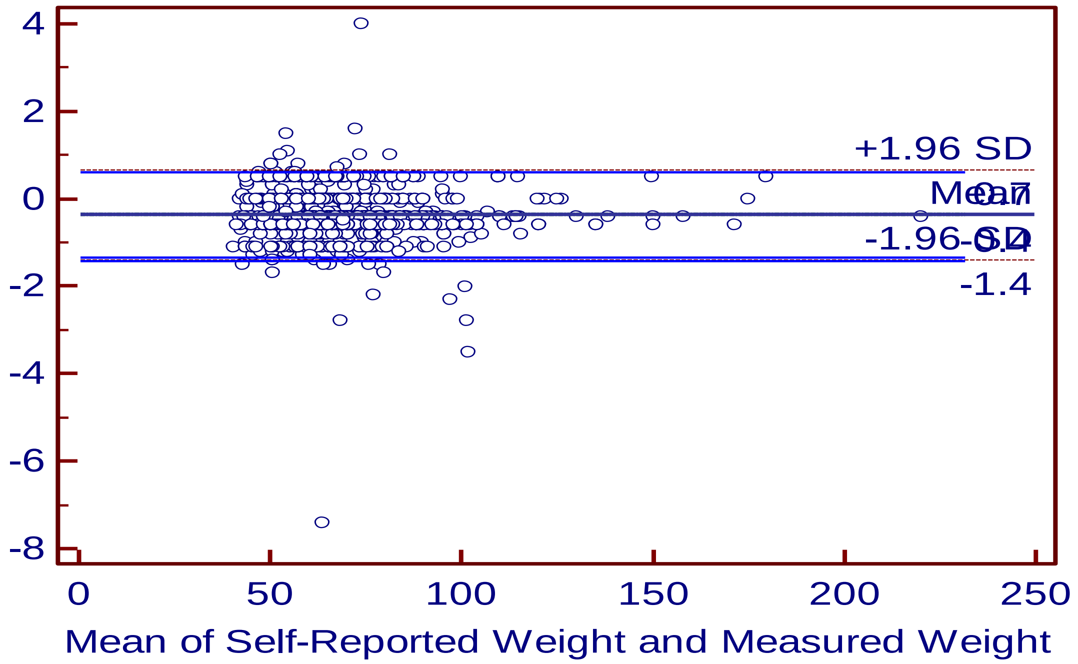
11.4.1 Self-reported vs measured data from health records

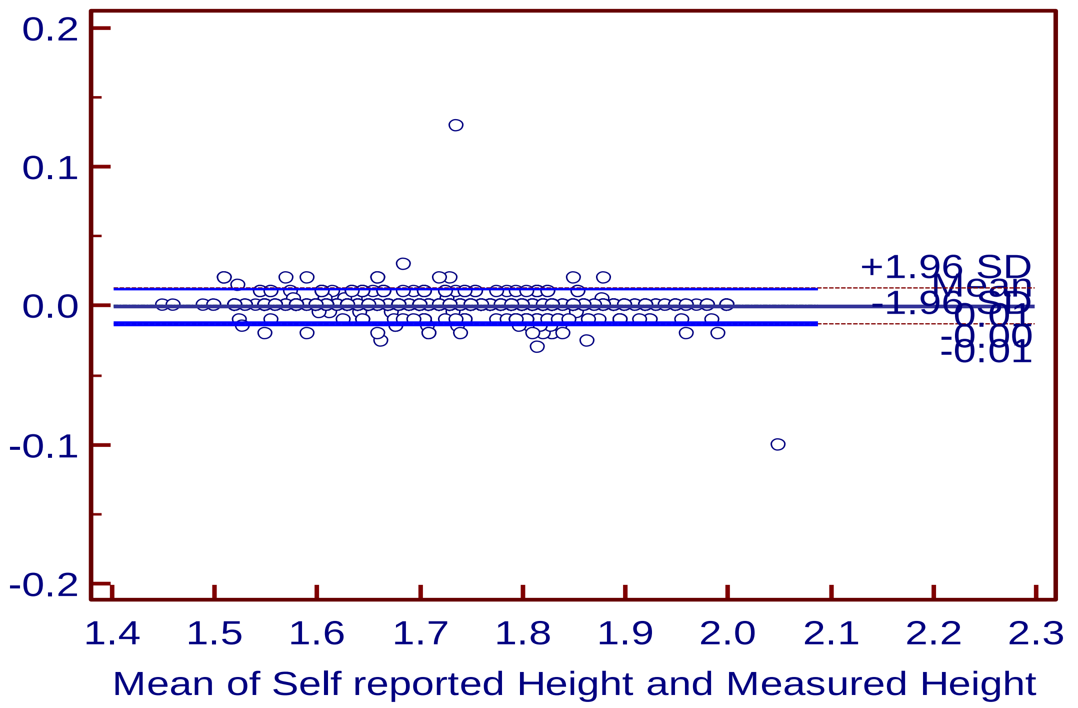
Mean (SD) self-reported weight was 67.1(16.7)kg while measured was 67.5(16.7)kg significantly lower than measured weight; mean difference – 0.4(0.5)kg, $p<0.001$. Mean (SD) self-reported and measured height was 1.72(SD0.01), no difference. As a result of the discrepancy between self-reported and measured weight, BMI calculated from self-reported weight was significantly lower than measured BMI -0.1(0.2)kg/m^2,p <0.001).

Bland Altman plots for the average versus mean difference in self-reported and actual measurements showed that the limits of agreement were narrow for the variables of height, and weight (Figure 11.2). All values fell within the limits of agreement, two standard deviations for height indicating a very good level of agreement, while for weight and BMI the majority of values fell within the limits of agreement.

Self-reported height and weight and calculated BMI correlated highly with the measured data (height: r=0.980, weight: r=0.999, BMI: p=0.999; p<0.001) (Figure 11.3, 11.4).

Figure 11.2: Bland Altman plots for agreement between self-reported and measured weights (in kg) and height (in m) by GP practice staff

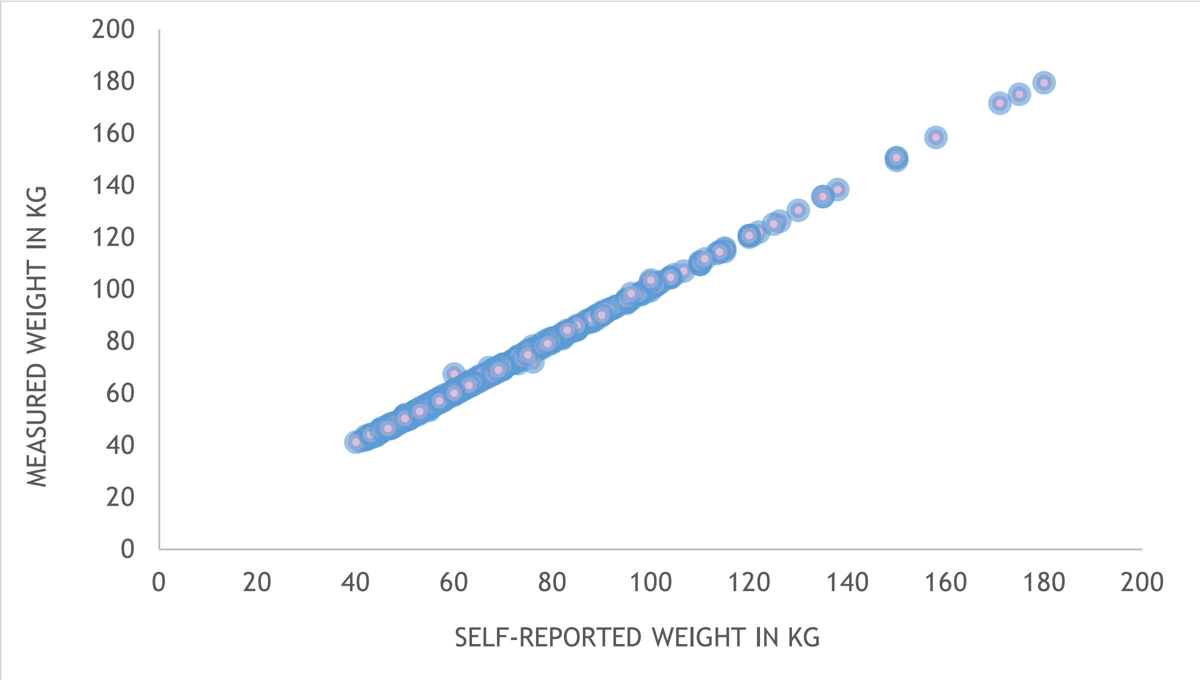




Dark blue line=mean number

Light blue lines=95% level of agreement

Figure 11.3: Correlation of self-reported weights and heights against measured weights (in kg) and heights (in m) by clinic staff.



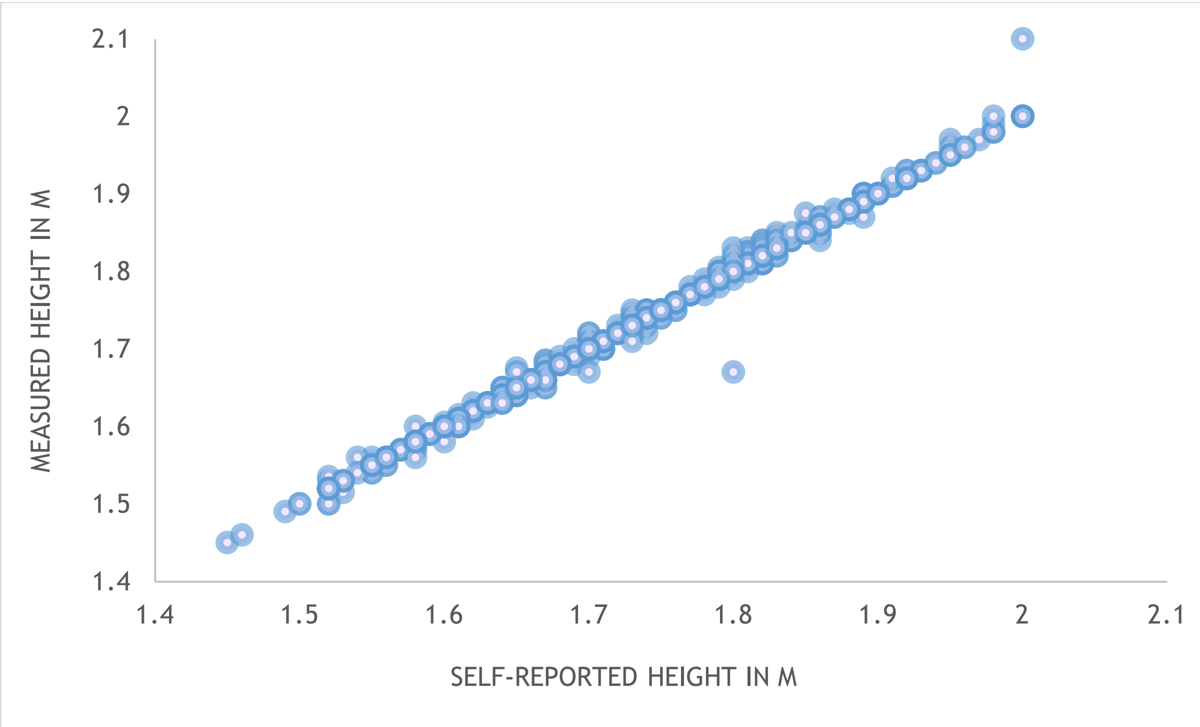
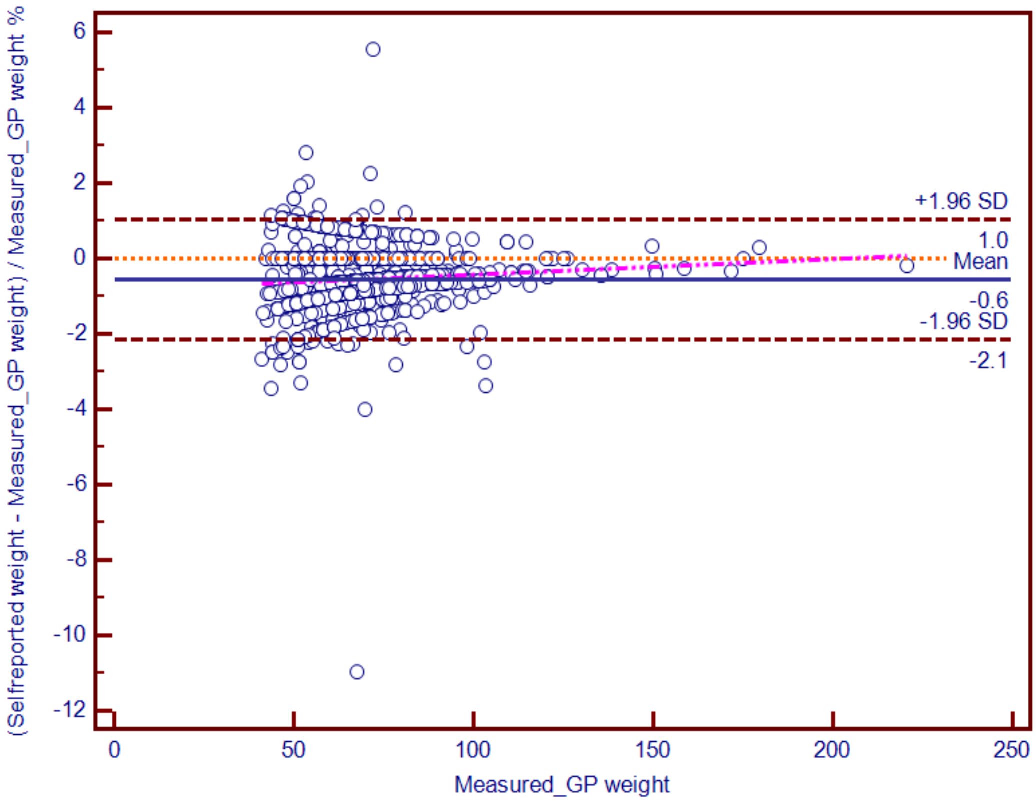
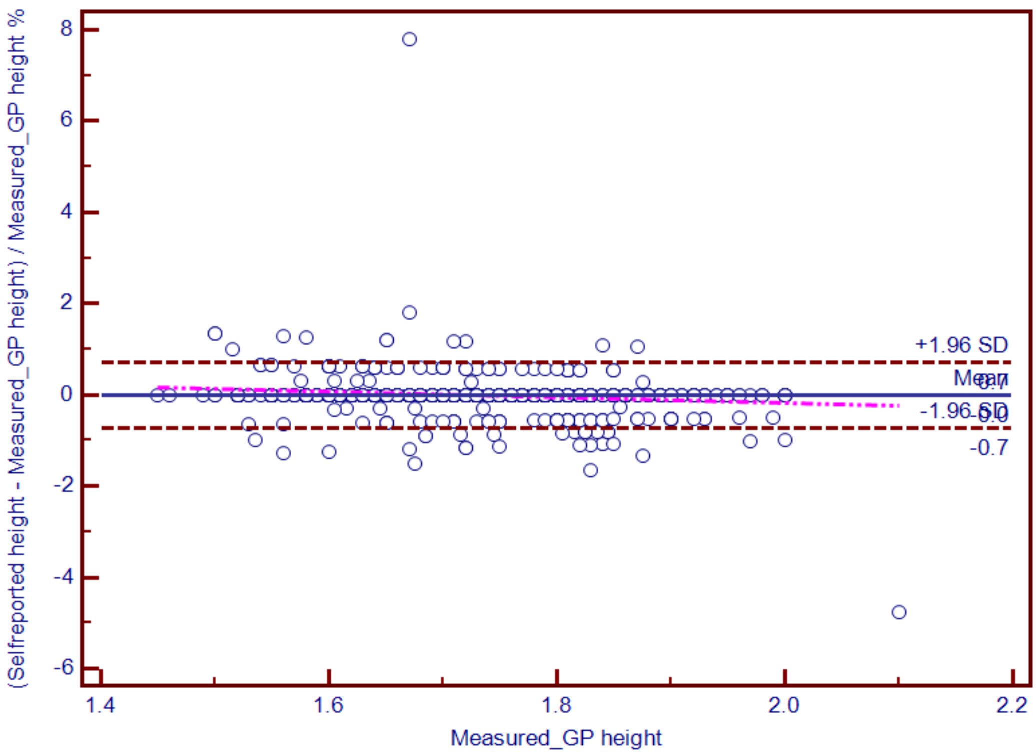


Figure 11.4: % of error against golden measurements ie measured weight and height by clinic staff.





Weight remained significantly misreported for all groups when grouped by BMI, gender and ethnicity. When grouped by BMI category, self-reported and measured weight differed significantly in both healthy weight participants and overweight/obese participants ($p<0.001$). Self-reported weight was significantly underreported by both females and males ($p=0.02$). There were no differences between self-reported and measured height for both males ($p=0.839$) and females ($p=0.664$) or BMI category (p=0,547). When grouped by ethnicity, male individuals of Scottish origin were found to significantly underreport height ($p=0.03$). When controlling for variables including gender, age, and BMI, the relationship between self-reported and measured data for each outcome measure remained highly significant ($p<0.001$).

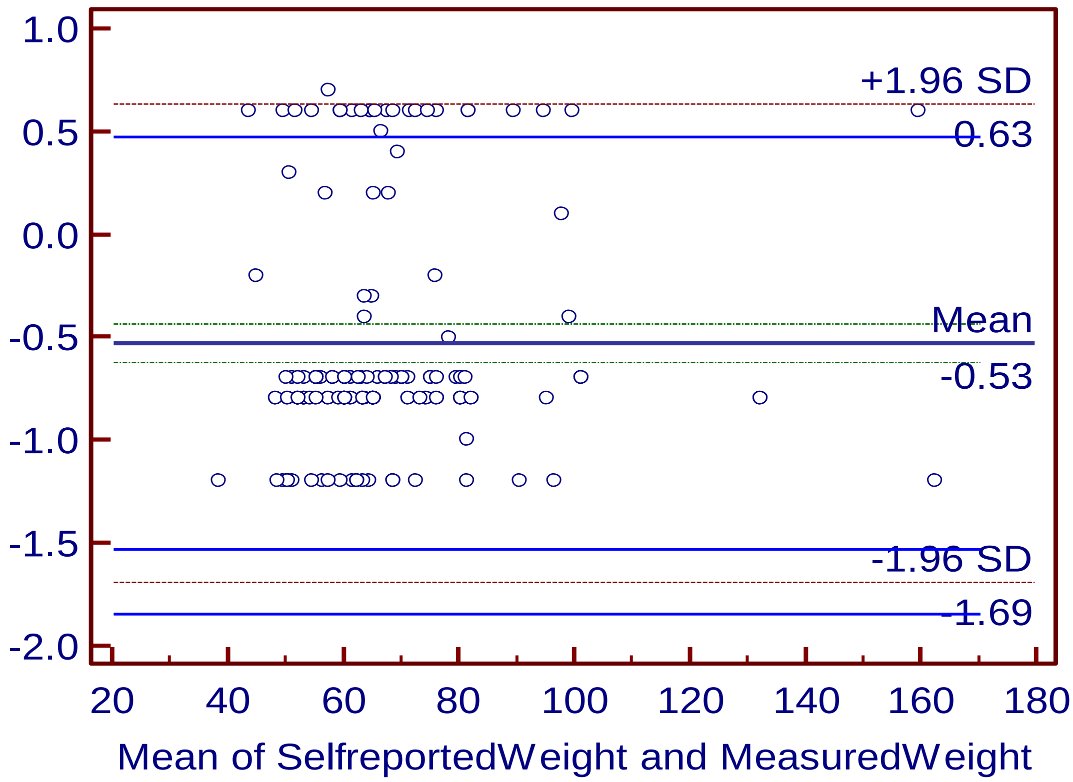
11.4.2 Self-reported data vs measured data from the researcher

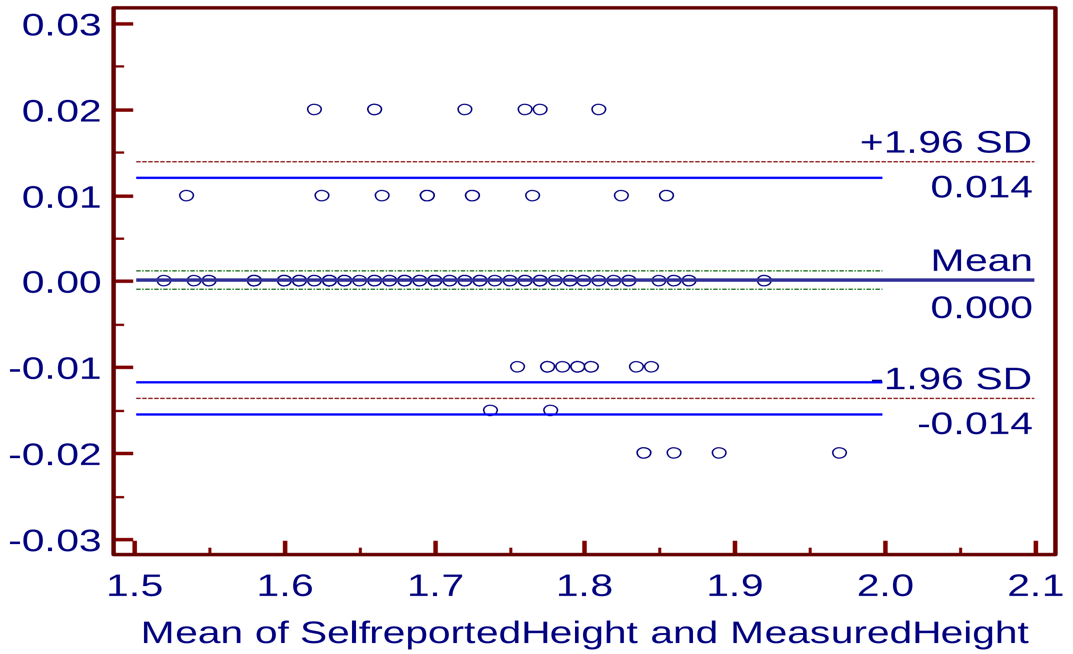
Mean (SD) self-reported weight was 66.9(17.7)kg while measured was 67.5(16.7)kg significantly lower than measured weight; mean difference – 0.5(0.6)kg, $p<0.001$. Mean (SD) self-reported was 1.71(SD0.09) and measured height was 1.71(SD0.07), no difference. As a result of the discrepancy between self-reported and measured weight, BMI calculated from self-reported height and weight was significantly lower than measured BMI (–0.2(0.2)kg/m^2,p <0.001).

Bland Altman plots for the average versus mean difference in self-reported and actual measurements showed that the limits of agreement were narrow for each variable of height, weight (**Figure 11.5**). All values fell within the limits of agreement, two standard deviations for height indicating a very good level of agreement, while for weight and BMI the majority of values fell within the limits of agreement.

Self-reported height and weight (**Figure 11.6, 11.7)** and calculated BMI were highly correlated with the corresponding measured data (height: $r=0.980$, weight: $r=0.999$, BMI: $p=0.999$; $p<0.001$).

Figure 11.5: Bland Altman plots for agreement between self-reported and measured weights (in kg) and height (in m) by PI

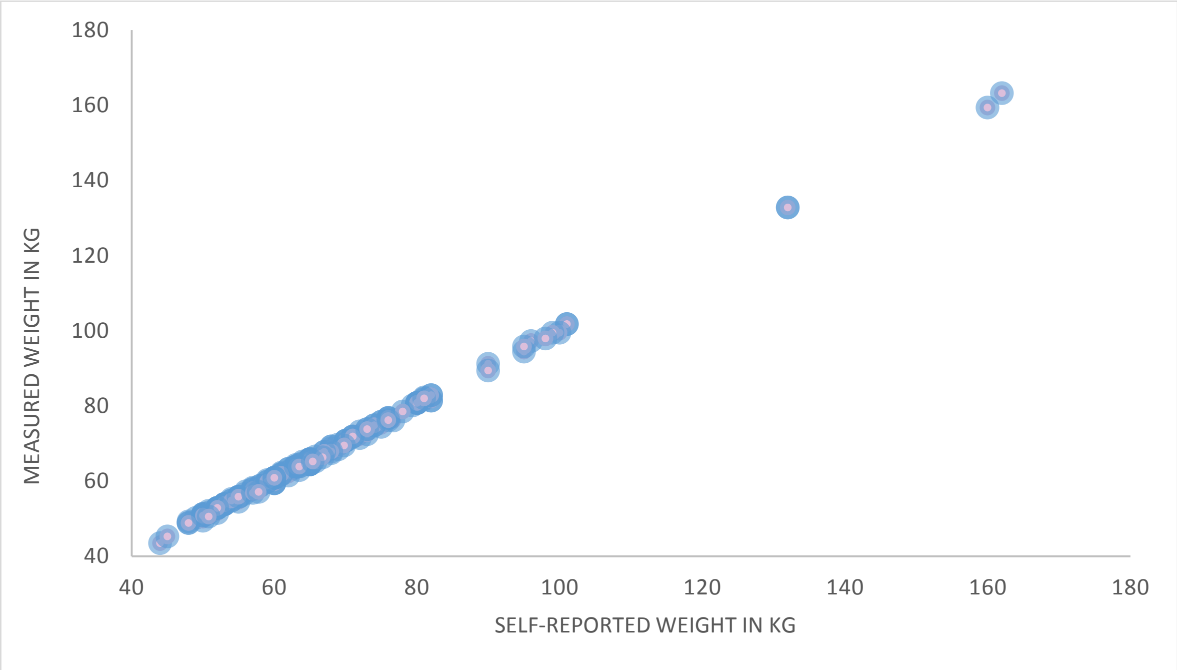




Dark blue line=mean number

Light blue lines=95% level of agreement

Figure 11.6: Correlation of self-reported weights and heights against measured weight (in kg) and height (in m) by PI.



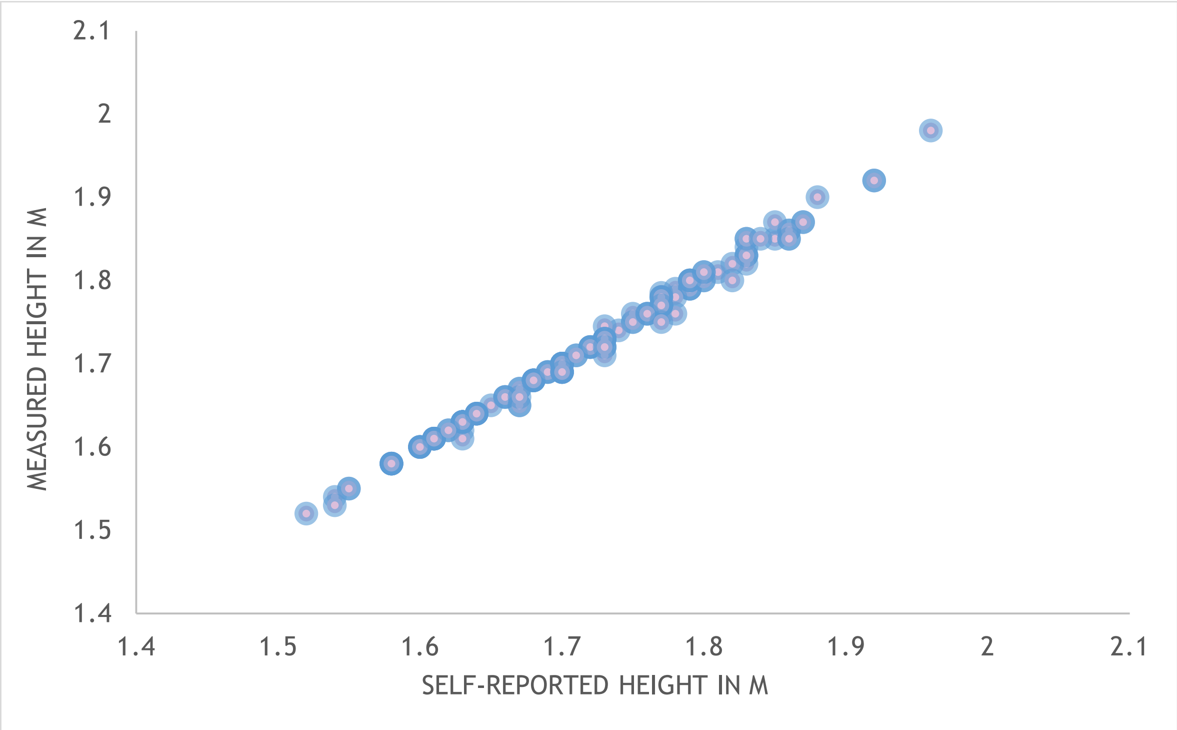
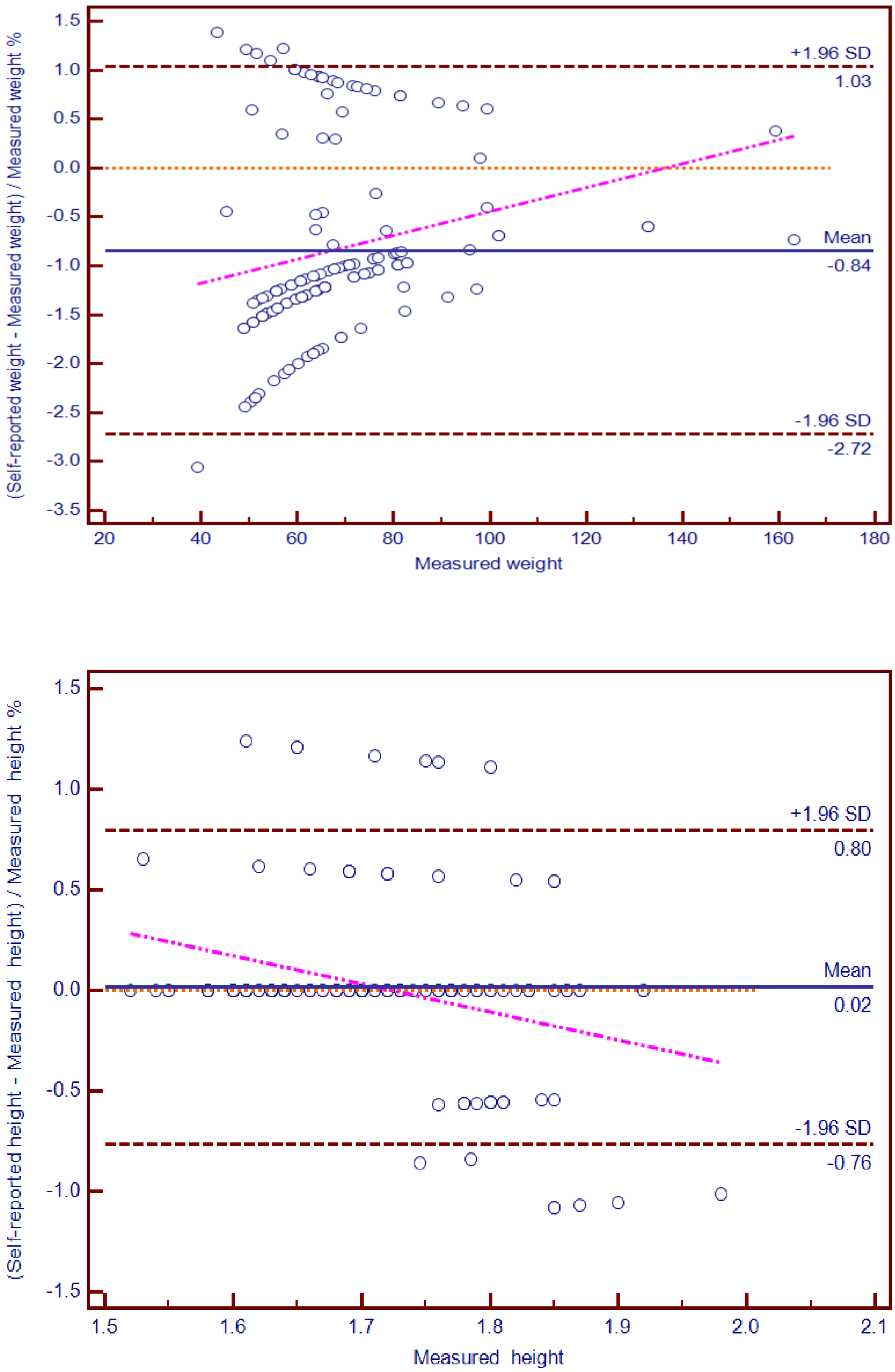


Figure 11.7: % of error against golden measurements ie measured weight and height by PI



Self-reported height and weight and calculated BMI correlated highly with the measured data (height: r=0.997, weight: r=0.999, BMI: p=0.999; p<0.001).

Weight remained significantly misreported. For BMI category, self-reported and measured weight differed significantly in both healthy weight participants and overweight/obese participants (p=0.03). Self-reported weight was significantly underreported by both females and males (p=0.02). Height remained the same for self-reported and measured methods for all groups when grouped by BMI and gender. When grouped by ethnicity, male individuals of Scottish origin were found to significantly underreport height (p=0.02).

11.5 Discussion

This study aimed to evaluate the accuracy of online self-reported height and weight in a young adult population. Weight was significantly underreported by self-reported data compared to objectively measured data. There was no difference in height. As a consequence of the differences in self-reported and measured weight, self-reported BMI was significantly underestimated by participants. This underestimation of BMI changed the BMI category classification for 17 participants.

Measured and self-reported height, weight, and BMI were all strongly positively correlated with good levels of agreement. Our results are in agreement with a study in a population of Australian young adults where they also underreported weight but not height (Browning et al.2011). A few studies explored the accuracy of on-line self-reported weights and heights (Lassale et al.2013, Bonn et al. 2013, Pursey et al. 2014). The discrepancies between self-reported and measured weight in the current study were smaller than those reported by those three previous on-line studies validating weight. Pursey et al in a study of young adults in Australia found an underreporting of weight by 0.5kg (Pursey et al.2014). Bonn et al found an underreporting of 1.2kg but this study involved older adults,as well, up to 65 years old. Lassale et al found an underreporting of 0.49kg. No difference was found for height except for Scottish male, that self-reported height was misreported by 0.01m similar to that found by Bolton-Smith et al in Scottish adults with the exception that in our study this was found only for males but not for females.

The strength of the current study is the fact that the self-reported data were validated against objectively measured data which were collected independently of the primary study. This allowed for controlling for self-selection bias of measurements by more motivated volunteers than the general population. The records were searched retrospectively and participants were not aware that the heights and weights they provided would be compared with those measured when registering at the general practice. The time between the self-reporting data was also short (1-2 weeks). Even though, we cannot exclude the possibility that weight might have changed during this time period and participants might have reported the weight they were given when registering but at least it is an indication that young adults are being honest when reporting on-line anthropometric data and not prone to misreporting due to recollection issues. The second set of data which was also collected by approaching a sample of young adults randomly, controlled for the confounding factor of volunteering for measured data.

The time elapsed between self-report and measurement could potentially be enough time for weight to have changed. This is particularly important in our study participants whose weight has been shown to fluctuate rapidly during university life. This time might explain why the measured data from the principal researcher had greater differences compared to the measured data extracted from health records as greater time elapsed between those two. In addition, it might be possible that the use of different measuring equipment by participants compared to the calibrated equipment used by the principal researcher or GP's measuring equipment could have introduced measurement bias. However, we would expect to see greater differences between self-reported and measured data than the results obtained if differences were due to measurement error.

To conclude with, there was a good agreement between self-reported and measured data, and these were strongly positively correlated. When grouped by BMI category and demographic data, self-reported weight remained significantly underreported by individuals. These findings suggest that online self-reported height and weight can be a valid method of collecting anthropometric data and calculating BMI.

Chapter 12:

General Discussion

In the second half of the 20^{th} century, the science of public health has seen a shift towards non-communicable diseases and social determinants of health. With the great advances towards controlling infectious diseases, currently the main causes of mortality and morbidity are chronic diseases such as cancer, cardiovascular diseases, and obesity. Today the focus has shifted in line with the epidemiological transition, so there is increasing emphasis on social determinants of health rather than on infectious agents. Obesity is, without any doubt, one of the biggest public health problems affecting our world. In an attempt to control the ever increasing obesity prevalence, there has been a lot of research around childhood obesity with following the notion that prevention should start at a very early age. However, most obese adults were not obese as children. Most weight leading to the onset of obesity is gained during adulthood. Also, interventions targeting children are of very limited efficacy maybe because of the fact that the primary stakeholders, ie the children, cannot make decisions for themselves.

Young adults is a highly neglected population but ideal for any type of intervention. Young adults are still in the process of establishing habits and most of the times for the first time away from parental influences. Young adulthood was considered to be a period of optimal health thus it was never an age where research was targeted at. The main aim of the art of public health is to promote good health among the population by preventing disease. In line with that, this PhD programme aimed to explore the determinants of weight gain in young adults with a view of preventing weight gain and thus the onset of obesity.

13.1 Research Questions posed, and answers from the present PhD programme.

1) Is weight gain a problem for young adults in higher education in the UK?

Weight gain in young adults has been described in the US in both community and educational settings. The literature from other countries, though, is limited with only a few studies examining the weight changes in this population from England and none from Scotland, a country with one of the highest prevalence of obesity in the world. Data from the Scottish National Health Survey, indicate that the lowest prevalence of obesity is in young adults (16-24 years old) but increases sharply at the next age band. Hence, exploring when this weight gain occurs and the reasons behind that, it might be a first step towards solving the obesity epidemic. Young adults leaving secondary school, either start working or continue studying in higher education settings (colleges or universities). In the UK and North America, the percentage of young adults continuing to higher education is approximately 50% of all young adults hence targeting higher education establishments is a good place to capture a significant proportion of young adults. Results in the studies described in chapters two and three indicated that young adults attending higher education in the UK experience significant weight changes. Over half of all participants (56%) reported that their weight had increased over their 8 months within higher education while 34% reported a decrease. For the study described in chapter three, out of the 1275 participants who provided follow-up data, 807 (63%) participants gained weight, 197 (15%) lost weight, and the remaining 271 (22%) maintained their weight. This study is the first one with such a high follow-up rate. The best follow-up rate achieved in previous studies on the same topic was 50% of the baseline population participating in the study. The exceptionally high follow-up rate in this study could be probably attributed to the engagement achieved with young adults and using on-line methods at right times. Defining the right time and day of the week to email information on a study to young adults could be an important step towards improving the outcome of not just observational studies but intervention studies.

2) What is the scale of the problem?

Data from the US, indicate that the average weight gain in a year is approximately 0.7-1.0kg. However, for those attending higher education, the weight gain is higher and on average 1.7kg. Defining the scale of the problem is crucial is order to define the level of intervention. During this PhD programme, data was collected on weight changes from young adult population. In more detail, in the study described in chapter two, for those who reported weight gain, this ranged from 0.5- 5.5 kg. In the prospective study in chapter three, a mean weight gain of 1.8(SD2.6)kg and an increase of 0.5(SD0.3)kg/m^2 in BMI was observed by the end of the academic year in all participants. The weight gain observed in the population in our studies is more than that observed in similar studies studying students in the US or non-students in the US.

3) What are the factors influencing weight changes?

Weight changes result when there is an imbalance between energy intake and energy expenditure. Maintaining a healthy weight is an important component of a healthy individual but weight status and weight changes are influenced by a number of factors. The reasons participants gave to explain their weight gain were; becoming less active (31%), eating more (29%) and financial constraints (32%). Baseline weight were both positively associated with greater weight gain at follow-up. Neither physical activity times nor sleeping times predicted weight changes.

Dietary factors predictive of weight changes were: consumption of alcohol and of dairy products. The consumption of alcohol was linked with greater weight gain ($f=5.9$, $p=0.016$). Frequency of dairy product consumption was associated with less weight gain with 1-2 portions/day causing less weight gain compared to higher or lower consumption.

4) What do young adults think of these changes?

It is important to take into account the individual needs and interests of potential stakeholders when designing any intervention or policy. This will determine the kind of relationships you establish with them. Young adults, in this case, are the main stakeholders when designing this intervention and thus should be consulted first. Exploring their views on weight changes and the importance was critical for effective intervention design. Young adults participating in our studies (the majority of them being normal weight) recognised that weight gain was an issue and would like to get help in order to manage that. It is also very encouraging that when they were asked about what the University could offer in terms of services to help them with dealing with these barriers, they recognised the personal responsibility aspect. Young adults consider important the provision of courses on nutrition and cooking that would help them acquire the knowledge to take on personal responsibility for their lifestyles.

5) What is the current evidence for weight gain prevention in this population?

Most of the efforts, thus far, focused on the treatment of obesity rather than on its prevention. The complexity around the obesity epidemic and the myriad reasons involved in the development of obesity make the development of interventions and policies extremely difficult. In the literature review, described in chapter four, the search strategy produced twelve studies describing equal number of interventions which met the inclusion criteria. All studies were conducted in the US except for one which was conducted in Canada with duration ranging from $1^{1/2}$ to 36 months. Studies were carried out in one of the following settings; higher-education institutions, workplaces, and community. All the studies used a combination of strategies, both environmental and individual, aiming at preventing weight gain. In this systematic review, we identified 12 studies that assessed change in weight or BMI with a view of preventing weight gain in adults. The studies included in this review tried to halt weight gain by using a combination of strategies and in different settings. Strategies used were mostly strategies that have been previously been tried in weight loss interventions such as health education or self-regulation through cognitive behaviour theories.

This updated literature highlights the limited evidence available on this topic. Although some of the studies have identified some promising strategies for young adult obesity prevention, more large scale studies are needed in order to explore these issues in more depth and draw some conclusions.

6) Which behavioural models could be used for obesity prevention?

The review of behavioural models and theories reveals the complexity around human behaviour which arises from diverse psychological factors, and from social, societal and contextual influences. Building on standard economic assumptions, social-psychological theory shows people's motivations to be wider than self-interest, and to be varying over time, and in different contexts. Most importantly, theory reveals behaviour to be both more and less rational, sometimes strongly influenced by emotions, or habits and routines. The diversity of factors at play in social-psychological models explains why changing behaviours has proven so challenging for policy makers. Interventions must address a number of factors at once, and be flexible to different audiences and contexts.

Behavioural models can help in the task of identifying which factors are the most significant in determining behaviours. However, behavioural models do not specify how to bring about behaviour change; as well as understanding behaviour, we need to understand change. The review of theories of change suggests some intervention techniques which may prove effective for particular behaviours, but more fundamentally, it shows how best to approach the task of behaviour change. These models of change suggest that interventions should be sustained over time, and be differentiated across audience groups.

The two bodies of theory should be seen as working together, with behavioural models embedded within intervention processes shaped by theories of change. As frameworks such as social marketing show, underpinning the intervention process should be a thorough understanding of the target behaviour, and the variation in that behaviour among the audience groups in question. Behavioural models are essential to developing this understanding; however, both bodies of theory agree that these models should not be adopted and imposed uncritically through interventions. Behavioural models work best when applied in the context in which they were developed; even the most flexible models work better for some behaviours than others. Models should not be regarded as solutions to policy problems, but as tools to be used in the process of developing interventions with the audience groups in question.

7) **Can weight gain in young adults be prevented through the application of a variety of behavioural models? Did any of the interventions (calorie-labelling, two online courses based on the rationale or stealth model) achieved weight gain prevention, how much weight was prevented and which behavioural model was the most effective?**

In theory, all behavioural models could be applied for the prevention of weight gain. Cronbach in 1975 said that all models are "*…concepts that will help people use their heads*". Models are best used critically, in devising the strategy for behaviour change interventions. The interventions themselves should then be developed based on past experience of what works, and be worked out on the ground, through research and piloting with the target groups in question. The theories ultimately suggest that behaviour change is best pursued as a craft not a science.

In this PhD programme, three behavioural models were tested for their efficacy and effectiveness for the prevention of the weight gain observed in young adults. Those were the following: 1) The model based on the 'nugde' theory by Thaler and Sunstein, 2) The 'rationale' model by Simon and 3) the 'stealth' model described by Robinson. The studies described in chapters eight and nine used the nudge theory while the study described in chapter ten used the rational and the stealth model and conducted a comparison among those two and a control group.

In the studies described in the chapters eight and ten, all the three bahavioural models were tested for their success in reducing the weight gain observed in young adults. All the models tested were successful in controlling weight gain in a normal weight population of young adults. Even the rationale model, which has previously been unsuccessful in weight loss trials, in our study was successful. It may be the case that rationale model might be effective for preventing disease rather than treating it. When one has reached the obese category, the small changes encouraged by the rational model are not sufficient to bring about weight changes big enough to make a difference or be sustained over time. Interestingly, the most successful behavioural model in preventing weight gain was the stealth model which did not encourage actively weight control practices but encouraged social movements.

13.2 How this PhD programme extends the literature on Obesity prevention, and can inform practice and policy

This PhD programme extended significantly the literature on obesity prevention. By following pragmatic design studies, provided evidence that unwanted weight gain can be prevented through the application of simple and low-cost behavioural models in the context of real-life settings and with the use of modern technologies for delivery. This delivery mode can ensure sustainability as it is of very low cost and can also reach large segments of the targeted population concurrently.

Devising public health policies has always been challenging as in order for any public health benefits to become evident, time is needed. Therefore, most of the times, public health policy makers need to act even with limited evidence available.

As well as grounding interventions in a thorough understanding of behaviour and change, policy makers also need to consider the consequences of any intervention, not only in terms of the intended consequences but also around the ethics on intervening, equity and unintended consequences.

There is little evidence that any of these equity and related issues arise from using models and theory to design interventions. No model of behaviour is inherently fairer than another. The ethical opposition to any intervention targeting behaviour change, especially in the case of prevention, is that it is not the government's role in a liberal and democratic society to be intervening in individual behaviour. There is an advanced relationship, based on an open market, between government, policy makers and citizens. The philosophical theory of 'libertarian paternalism' has been suggested and used when designing policies as an attempt to bridge the tension inherent in behavioural change policy which entails encouraging people to take responsibility without telling them what to do (Lewis, 2007). Individuals are informed and empowered to exercise genuine choice without any limitations to the available.

However, encouraging personal responsibility in a given direction is difficult when individuals are pursing divergent courses. In an example from the Foresight project on tackling obesity, the government could be seen to have little right to prevent people from making unhealthy food choices, but conversely they also have little right to make others meet the increased healthcare costs of those who are obese (JP Morgan in Foresight 2007b). Similarly it is hard to help people to help themselves if they do not appreciate the appropriateness of the behaviour change being encouraged.

As with all behavioural models, there are both negatives and positives around their use and these may be not appropriate for everybody. That is the reason why most of the times we need a combination of models in order to engage most of the population towards the intended action.

'Nudge'

'Nudging' has great potential of helping to solve some of the greatest public health problems in our days and at a very low cost which is also quite important for stretched economies. Highlighting the 'right choice' without restricting choice is appealing for those who are undecided or for those who are not interested in having extra information. However, critics of nudge and libertarian paternalism argue that attempts to change people's lifestyle choice are potentially patronising and condescending and embody excessive state interference.

Thaler and Sunstein, however, note that there is no such thing as neutral design. Some organisation or agent must provide starting points of one kind or another. Indeed, ‘once you know that every design element has the potential to influence choice, then you either close your eyes and hope for the best, or you take what you know and design programmes that are helpful’ (Stewart, 2005).

People engaging in a certain type of activity eg not adhere to taking prescribed medication, smoking, drinking or carrying excessive weight, pose avoidable harms and costs for individuals or for the communities in which they live and nudge techniques are justifiable in this context (Oliver and Brown, 2010).

Another criticism of this approach has focussed on whether designing cues to prompt desirable behaviour can translate into sustainable public policy. Bonell et al expressed a concern that to date, few nudging interventions have been evaluated for their effectiveness in changing behaviour in general populations and none has been evaluated for its ability to achieve sustained change of the kind needed to improve health in the long term (Bonell et al., 2011).

Moreover, effective nudging may require legislation, either to implement healthy nudges such as displaying fruit at checkout or to prevent unhealthy nudges from industry such as food advertising aimed at children. Without regulation to limit the potent effects of unhealthy nudges in existing environments nudging towards healthier behaviour may struggle to have an impact on the scale and distribution of behaviour change needed to improve population health to the level required to reduce the burden of chronic disease in the UK and beyond. (Marteau et al., 2011).

For example, a voluntary agreement between food manufacturers and the Food Standards Agency in the UK resulted in a 0.9g per person decrease in daily salt consumption, which compares poorly to the reductions of 5g per person in Finland and Japan as a result of enacting relevant legislation (Marteau et al., 2011).

This PhD programme provides the first evidence that ‘nudging’ in the form of calorie-labelling can be effective in preventing weight gain but as explained above a supplementary legislation may be necessary for any long term effects to be sustainable.

'Rationale model'

This model, inherently, does not carry any risks in the sense that it is providing individuals with all the information and the intended action. However, there are issues with equity when information is not adapted to the targeted population. No one should be disadvantaged from achieving his full potential because of social position or other socially determined circumstances. In this PhD programme, we developed a tool based on the rationale model which was effective in preventing weight gain in the targeted population. However this tool will need to be modified and adapted if it is going to be used with different population segments.

'Stealth Model'

This model has the risk of 'tricking' people into following a social movement with a view of achieving something different to the initial related to food and weight. It is very appealing model and particularly in young adults. This PhD programme provides the first evidence from a randomised study that encouraging social movements and ethical issues around food may have particular usefulness for the prevention of weight gain and especially in males who are usually under-represented in studies targeting behaviours around weight. Participation may be even more motivating to young people because they are actively forming their own self-identity, collective-identity, and social-identity, and also perceive they will be impacted greater personally by problems such as climate change, globalization, energy insecurity, and most other social causes. This is beneficial because their behaviours at an earlier age are likely to produce a greater impact over their lifetimes and, as early adopters, young people are an appropriate group to trigger broader diffusion of new attitudes, norms, and participation throughout their communities, families, peer groups, community organizations, and workplaces. In the randomised trial described in chapter ten, the uptake of this group was lower than the group which used the rationale model approach which may indicate that this type of approach needs further enhancement by social marketing and citizenship lessons.

14.4 New Research Questions which have been raised during the current PhD programme to be addressed in future research or to be answered by further analysis of data collected during this PhD programme

Questions to be answered by further analysis of data collected during this PhD programme

1) What is the effect of calorie-labelling on the amount of macronutrients and micronutrients in the meals chosen by those using the calorie-labels?
2) Which behavioural model was most cost-effective in preventing weight-gain?
3) What is the best way of engaging young people with on-line methods?
4) Are there any other lifestyle factors influencing weight gain and that should be included in future interventions and policies?

Questions to be answered by future research

1) Should calorie-labelling become mandatory? Would nudging be more effective with some form of legislation?
2) Could social marketing enhance the effects of both interventions aiming at weight gain prevention?
3) What is the appropriate form of calorie-labelling?
4) Should calorie-labelling be modified or supplemented with additional educational materials in order to be used by low socio-economic groups?

Research and Personal skills developed through this PhD programme

My genuine curiosity and dissatisfaction with superficial explanations were the main reasons for starting this PhD five years ago. Being oblivious to what the process of a PhD really entails, I started with only two arrows in my quiver, enthusiasm and positive attitude.

Skills, personal and professional experiences built up during any PhD are mostly acquired through practice. Now, after five years, I managed to enrich my quiver with plenty more well-honed arrows. The nature of the studies described in this thesis mostly made me develop my creativeness and resourcefulness when having to tackle the myriads unexpected events during the research design, data collection, database formatting, analysis, and writing-up. I developed my research competence in an implicit manner, through constant engagement with my topic, by working through materials again and again, by engaging in intense discussions and by being challenged in my research approach. I had to find my way to move from a descriptive approach to an analytical one; being able to work with theories, developing rigour in a topic area, building up expertise, getting people from a wide range of backgrounds to think differently about a topic and develop and back up an argument. My personal effectiveness was also further developed by self-discipline, motivation and thoroughness.

Appendices

Appendix 1: Ethical Approval for pilot study described in chapter 2

University of Glasgow | Faculty of Medicine

Ms Charoula-Konstantia Nikolaou
Life Course
Nutrition and Health
4th Floor Walton Building
Glasgow Royal Infirmary
84 Castle Street
Glasgow G4 0SF

27 April 2011

Dear Ms Nikolaou

Medical Faculty Ethics Committee

Project Title: Weight and lifestyle changes in first year college students in Scotland: The HEAL YOUNG ADULTS observational study

Project No.: FM08009

The Faculty Ethics Committee has reviewed the amendments to your application and has agreed that there is no objection on ethical grounds to the proposed study now that the requested revisions have been incorporated. They are happy therefore to approve the project, subject to the following conditions:

- The research should be carried out only on the sites, and/or with the groups defined in the application.
- Any proposed changes in the protocol should be submitted for reassessment, except when it is necessary to change the protocol to eliminate hazard to the subjects or where the change involves only the administrative aspects of the project. The Ethics Committee should be informed of any such changes.
- If the study does not start within three years of the date of this letter, the project should be resubmitted.
- You should submit a short end of study report to the Ethics Committee within 3 months of completion.

Yours sincerely

pp

Dr David Shaw
Faculty Ethics Officer

Dr D Shaw
Lecturer in Ethics & Ethics Officer

School of Medicine, University of Glasgow, 378 Sauchiehall Street, Glasgow, G2 3JZ

Tel: 0141 211 9755
E-mail: david.shaw@glasgow.ac.uk

Appendix 2: Extension of ethical approval

University of Glasgow | College of Medical, Veterinary & Life Sciences

Ms Charoula-Konstantia Nikolaou
Human Nutrition Section
Centre for Population and Health Sciences
4th Floor Walton Building
Glasgow Royal Infirmary
84 Castle Street
Glasgow G4 0SF

30 August 2012

Dear Ms Nikolaou

MVLS College Ethics Committee
*Project Title: **Weight and lifestyle changes in first year university students in Scotland: The HEAL YOUNG ADULTS observational study** Project No: **FM 07309***

The College Ethics Committee has reviewed your application for an extension and has agreed that there is no objection on ethical grounds to the proposal to extend the project until 31st October 2013. The Committee is also willing to agree to your request to extend your recruitment to include all undergraduate students rather than just those in first year. These approvals are subject to the following conditions:

- You must inform the Clerk of Senate about your expansion in student recruitment.
- The research should be carried out only on the sites, and/or with the groups defined in the application.
- Any proposed changes in the protocol should be submitted for reassessment, except when it is necessary to change the protocol to eliminate hazard to the subjects or where the change involves only the administrative aspects of the project. The Ethics Committee should be informed of any such changes.
- If the study does not start within three years of the date of this letter, the project should be resubmitted.
- You should submit a short end of study report to the Ethics Committee within 3 months of completion.

Yours sincerely

Professor William Martin
College Ethics Officer

Appendix 3: Ethical Approval for studies described in chapters 7,8,9,10

University of Glasgow | College of Medical, Veterinary & Life Sciences

Dear Dr Catherine Hankey,

MVLS College Ethics Committee

Project Title: 1. The effect of food labelling in a catered hall of residence on the dietary composition of students food intakes and on the calories they consumed. 2. The effect of food labelling in a University's catering outlets on users' meal choices and calo
Project No: 2011033

The College Ethics Committee has reviewed your application and has agreed that there is no objection on ethical grounds to the proposed study. They are happy therefore to approve the project, subject to the following conditions

- The research should be carried out only on the sites, and/or with the groups defined in the application.
- Any proposed changes in the protocol should be submitted for reassessment, except when it is necessary to change the protocol to eliminate hazard to the subjects or where the change involves only the administrative aspects of the project. The Ethics Committee should be informed of any such changes.
- If the study does not start within three years of the date of this letter, the project should be resubmitted.
- You should submit a short end of study report to the Ethics Committee within 3 months of completion.

Yours sincerely

Dorothy McKeegan

Dr Dorothy McKeegan
College Ethics Officer

Appendix 4: Extension for ethical Approval for studies described in chapter 10

University of Glasgow | College of Medical, Veterinary & Life Sciences

Dear Dr Catherine Hankey,

MVLS College Ethics Committee

Project Title: Prevention of overweight and obesity in full time undergraduate students: A randomised-controlled trial.
Project No: 2012069

The College Ethics Committee has reviewed your application and has agreed that there is no objection on ethical grounds to the proposed study. They are happy therefore to approve the project, subject to the following conditions

- The research should be carried out only on the sites, and/or with the groups defined in the application.
- Any proposed changes in the protocol should be submitted for reassessment, except when it is necessary to change the protocol to eliminate hazard to the subjects or where the change involves only the administrative aspects of the project. The Ethics Committee should be informed of any such changes.
- If the study does not start within three years of the date of this letter, the project should be resubmitted.
- You should submit a short end of study report to the Ethics Committee within 3 months of completion.

Yours sincerely

Professor William Martin
College Ethics Officer

Appendix 5: Ethical approval allowing validation of weight and heights of participants in the studies described in chapters 3, 9, 10,11

WoSRES

West of Scotland Research Ethics Service

West of Scotland REC 4
Ground Floor, Tennent Building
Western Infirmary
38 Church Street
Glasgow
G11 6NT
www.nhsggc.org.uk

Date 14 May 2012
Direct line 0141-211-1722
Fax 0141-211-1847
e-mail evelyn.jackson@ggc.scot.nhs.uk

Miss Charoula-Konstantia Nikolaou
PhD Student
University of Glasgow
4th floor, Walton Building
Glasgow Royal Infirmary
84 Castle Street
Glasgow
G4 0SF

Dear Miss Nikolaou

Study title:	**Prevalence of obesity in full time first year undergraduate university students in Scotland and weight changes during the first year of full time higher education**
REC reference:	**12/WS/0118**
Protocol number:	**1**

The Research Ethics Committee reviewed the above application at the meeting held on 4 May 2012.

Ethical opinion

The Committee thank you for attending the meeting but noted that it would have been helpful if the Chief Investigator, Dr Catherine Hankey had attended the meeting in order to answer the Committee's questions. The following was discussed:

1. It is answered in QA27-5 of the IRAS REC application form that prior consent has been obtained for access to identifiable personal information. The Committee asked if the local GP Practices have already agreed to take part in the study. You explained that you have only made preliminary contact with the University of Glasgow, GP Practice and that they have a database which holds information regarding height and weight of new patients who have registered with the Practice. No contact has been made with the local GP Practices and you were not aware if they also hold this information.

2. The Committee asked what value initial weight and height information would have if there were no follow-up information collected or available. You explained that this would still be of value as you would be able to compare it to previously collected data.

3. The Committee were concerned about the study methodology, noting that with the exception of the Glasgow University GP Practice, no approach had been made to other GP Practices to test the feasibility of the project and whether this data is available/accessible. The Committee were also unclear about the value of a crosssectional assessment of this data extracted from an assortment of GP Practices.

The members of the Committee present gave a favourable ethical opinion of the above research on the basis described in the application form, protocol and supporting documentation, subject to the conditions specified below.

Ethical review of research sites

NHS Sites

The favourable opinion applies to all NHS sites taking part in the study, subject to management permission being obtained from the NHS/HSC R&D office prior to the start of the study (see "Conditions of the favourable opinion" below).

Conditions of the favourable opinion

The favourable opinion is subject to the following conditions being met prior to the start of the study.

Management permission or approval must be obtained from each host organisation prior to the start of the study at the site concerned.

Management permission ("R&D approval") should be sought from all NHS organisations involved in the study in accordance with NHS research governance arrangements.

Guidance on applying for NHS permission for research is available in the Integrated Research Application System or at http://www.rdforum.nhs.uk.

Where a NHS organisation's role in the study is limited to identifying and referring potential participants to research sites ("participant identification centre"), guidance should be sought from the R&D office on the information it requires to give permission for this activity.

For non-NHS sites, site management permission should be obtained in accordance with the procedures of the relevant host organisation.

Sponsors are not required to notify the Committee of approvals from host organisations

<u>The Committee gave this study a favourable opinion, with the strict understanding that the study is conducted only with the GP Practice based at Glasgow University.</u> This will give you access to 4000 potential participants, based on the information given by you regarding the number of first year students who register with the practice. Also you must <u>not</u> be the person who will access students' medical records.

This decision is based on the Committee's concerns regarding the feasibility and methodology of the study involving various GP Practices in the area.

Given the above, the title of the study should be changed to reflect the amended study, i.e. remove "in Scotland" from the title.

It is responsibility of the sponsor to ensure that all the conditions are complied with before the start of the study or its initiation at a particular site (as applicable).

You should notify the REC in writing once all conditions have been met (except for site approvals from host organisations) and provide copies of any revised documentation with updated version numbers. Confirmation should also be provided to host organisations together with relevant documentation

Approved documents

The documents reviewed and approved at the meeting were:

Document	Version	Date
REC application	-	27 March 2012
Protocol	1	27 March 2012
Investigator CV	1	27 March 2012
Other: Confirmation of Insurance	-	04 August 2011
Other: Confirmation of Insurance	-	02 August 2011

Membership of the Committee

The members of the Ethics Committee who were present at the meeting are listed on the attached sheet.

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

After ethical review

<u>Reporting requirements</u>

The attached document "After ethical review – guidance for researchers" gives detailed guidance on reporting requirements for studies with a favourable opinion, including:

- Notifying substantial amendments
- Adding new sites and investigators
- Notification of serious breaches of the protocol
- Progress and safety reports
- Notifying the end of the study

The NRES website also provides guidance on these topics, which is updated in the light of changes in reporting requirements or procedures.

<u>Feedback</u>

You are invited to give your view of the service that you have received from the National Research Ethics Service and the application procedure. If you wish to make your views known please use the feedback form available on the website.

Further information is available at National Research Ethics Service website > After Review

12/WS/0118	**Please quote this number on all correspondence**

With the Committee's best wishes for the success of this project.

Yours sincerely

Evelyn Jackson

for Dr Brian Neilly
Chair

Enclosures: List of names and professions of members who were present at the meeting "After ethical review – guidance for researchers"

Appendix 6: Extension for ethical approval allowing validation of weight and heights of participants in the studies described in chapters 3, 9,10,11.

University of Glasgow

School of Medicine

Dr JB Neilly,

Chair West of Scotland REC 4,

Western Infirmary,

38 Church Street,

Glasgow,

G11 6NT.

25/07/2013

Dear Dr Neilly,

Rec. reference: 12/WS/0118

Study title: Prevalence of obesity in full time year undergraduate university students and weight changes during the first year of full time higher education

Permission was granted for this study on 14/05/2012 to Charoula Nikolaou and as one of her supervisors I am writing to request an extension to the study duration.

The completion date of this study was the 31/05/2013 however due to a delay in initiating the data collection, the study is still ongoing. Therefore, we would like to request an extension of 6 months for this study to allow completion of the data collection.

Thank you for your help in this matter.

Yours sincerely,

Cathie Hankey

Catherine Hankey PhD RD

Senior Lecturer in Human Nutrition

School of Medicine – Human Nutrition

Postal Address: Human Nutrition, 4th Floor, Walton Building,
Glasgow Royal Infirmary, 84 Castle Street, Glasgow G4 0SF
Tel: +44 (0)141 211 4686; Fax: +44(0)141 211 4844
E-mail: Mike.Lean@glasgow.ac.uk AND Maureen.McNee@glasgow.ac.uk

Appendix 7: Questionnaire used in the study described in chapter 2

GLASGOW UNIVERSITY

1. The HEAL Questionnaire

Thank you for taking part in this study.

Please read the following information.

WHY HAVE I BEEN CONTACTED AND WHAT IS THE PURPOSE OF THE STUDY?
You have been contacted to take part in this study as you are a first year student.This study is trying to find out what, if any lifestyle and body weight changes occur in students's first year of full time study here in Scotland.

WHAT WILL IT INVOLVE?
There are some questions which will take approximately 10 minutes to complete. If you would like to take part in this study please complete the questionnaire. IF you complete the questionnaire you will be able to enter your name in a prize draw for Amazon Vouchers.

DO I HAVE TO TAKE PART?
There is no obligation to take part.

CONFIDENTIALITY
All information in the questionnaire is completely anonymous and you will not be asked for your name or contact details. Responses will be stored securely with no identifying information. If you would like to enter the prize draw you will be asked to give your email address after completing the questionnaire. This email address will be stored separately from your questionnaire responses.

CAN I WITHDRAW FROM THE STUDY AFTER I HAVE STARTED TO COMPLETE THE QUESTIONNAIRE?
You can withdraw from the study at anytime by simply closing the browser window. Closing the browser window will delete your questionnaire data.

WHAT WILL HAPPEN TO THE RESULTS?
Anonymous summary results may be written up for publication or shared with other researchers.

WHO SHOULD I CONTACT IF I NEED ANY FURTHER INFORMATION OR WHAT TO MAKE COMMENTS OR COMPLAINTS ABOUT THE STUDY?
You can contact Charoula-Konstantia Nikolaou (c.nikolaou.1@research.gla.ac.uk).

Thank you very much for taking time to participate!

2. The HEAL Questionnaire

1. How tall are you?

2. What is your weight?

3. What is your date of birth?

4. What is your gender?

5. What course are you attending?

GLASGOW UNIVERSITY

3. The HEAL Questionnaire

1. Do you live:

- At home with parents
- In self-catering university/college accomodation
- In catered university/college accomodation
- In other accomodation
- Alone
- With a partner

2. Do you think your eating habits have changed since you started your present course?

- Yes
- No
- Stayed the same (go to question 4)
- Don't know

3. If yes, in what way?

	More	Less
Fruit		
Vegetables		
Ready Meals		
Snacks		
Alcoholic Drinks		

Other (please specify)

4. What is the average number of people with whom you usually eat your main meals?

Breakfast

Lunch

Dinner

5. Since you started your course, has your weight:

- Increased (go to question 6)
- Decreased (go to question 8)
- Stayed the same (go to question 9)
- Don't know

GLASGOW UNIVERSITY

6. If your weight has increased could it be explained by any of the following? (Please tick all that apply)

- ☐ Becoming less active
- ☐ Eating more
- ☐ Financial limitations
- ☐ Not aware of making conscious changes

Other (please specify)

7. If your weight has increased, do you think the increase is:

- ○ 1-4 pounds (0.5 kilos-2 kilos)
- ○ 4-8 pounds (2 kilos-3.5 kilos)
- ○ 8-12 pounds (3.5 kilos-5.5 kilos)
- ○ more than 12 pounds (more than 5.5. kilos)

8. If your weight has decreased could it be explained by any of the following? (Please tick all that apply)

- ☐ A conscious decision to lose weight
- ☐ Becoming more physically active in order to control weight
- ☐ Unintentional changes in eating habits such as skipping meals
- ☐ Stress
- ☐ Financial limitations
- ☐ Not aware of any lifestyle changes

Other (please specify)

9. If your weight has remained the same could it be explained by any of the following? (Please tick all that apply)

- ☐ No change in eating habits or physical activity
- ☐ Regular monitoring of your weight
- ☐ Increase in food intake along with an increase in physical activity
- ☐ Decrease in food intake along with a decrease in physical activity
- ☐ Not aware of making any changes

Other (please specify)

GLASGOW UNIVERSITY

10. How do you feel about your current weight?

- Happy
- Concerned
- Not Concerned

11. Would you like advice that would help you limit/control weight gain or improve your diet and physical activity?

- Yes
- No
- Don't Know

12. If yes which of the following would you find helpful?
(Please tick all that apply)

- Attending a healthy eating education programme
- Join jogging/running club/gym
- Leaflets on healthy eating
- Attending a cooking class
- Web based information on healthy eating and calories
- Texts with calorie requirements to maintain your weight
- Guide to eating out and weight control

Other (please specify)

13. Would you be willing to participate in a study to examine the effect of some of the above on your diet and physical activity?

- Yes
- No

14. Would you be more likely to participate if you were given a small financial incentive?

- Yes
- No

4. The HEAL Questionnaire

1. Do you smoke at all?

- Yes
- No

GLASGOW UNIVERSITY

Thank you for completing our questionnaire!

Good luck with your studies!

6. The HEAL Questionnaire

1. If you would like to participate in the prize draw for the Amazon Vouchers, please enter your name below.

Appendix 8: Questionnaire used in the study described in chapter 3

THE GLASGOW UNIVERSITY 1

1. The HEAL questionnaire

Thank you for taking part in this study.

Please read the following information.

WHY HAVE I BEEN CONTACTED AND WHAT IS THE PURPOSE OF THE STUDY?
You have been contacted to take part in this study as you are a first year student. This study is trying to find out what, if any lifestyle and body weight changes occur in students' first year of full time study here in Scotland.

WHAT WILL IT INVOLVE?
There are some questions which will take approximately 10 minutes to complete. If you would like to take part in this study please complete the questionnaire. You will be asked to complete the same questionnaire on one more occasion-at the end of the academic year. Those who will complete the questionnaire both times will enter a prize draw for Amazon Vouchers, as a thank you.

DO I HAVE TO TAKE PART?
There is no obligation to take part.

CONFIDENTIALITY
Responses will be stored securely with no identifying information.

CAN I WITHDRAW FROM THE STUDY AFTER I HAVE STARTED TO COMPLETE THE QUESTIONNAIRE?
You can withdraw from the study at anytime by simply closing the browser window. Closing the browser window will delete your questionnaire data. If you decide to withdraw from the study after you have completed the questionnaire or any of the follow-up measurements you are free to do so with no explanation.

WHAT WILL HAPPEN TO THE RESULTS?
Anonymous summary results may be written up for publication or shared with other researchers.

WHO SHOULD I CONTACT IF I NEED ANY FURTHER INFORMATION OR WHAT TO RAISE ANY ISSUES ABOUT THE STUDY?
You can contact Charoula-Konstantia Nikolaou (c.nikolaou.1@research.gla.ac.uk).

Thank you very much for taking time to participate!

2. The HEAL questionnaire

1. Do you live:

- At home with parents
- In self-catering university/college accomodation
- In catered university/college accomodation
- In other accomodation
- Alone
- With a partner

THE GLASGOW UNIVERSITY 1

2. How often do you eat the following meals?

	Never	Seldom	Sometimes	Usually	Always
Breakfast					
Lunch					
Dinner					
Supper					

3. What is the average number of people with whom you usually eat your main meals?

Breakfast

Lunch

Dinner

4. How often do you have snacks?

- Never
- Occasionally
- A few times per week
- One to two times per week
- One to two times per day
- Two to three times per day
- More than 4 times per day

Other (please specify)

5. What types of food do you normally snack on?

- Crisps, crackers, nuts
- Cakes, muffins, cookies
- Fast food (e.g.pizza, burger)
- Confectionary (e.g. chocolate, sweets)

Other (please specify)

6. Are you more inclined to snack in any of the following situations?

- Studying
- Partying
- Bored
- Emotional

Other (please specify)

THE GLASGOW UNIVERSITY 1

7. How often do you eat vegetables (1 serving= 1/2 cup cooked/1 cup raw)

- Once per week or less
- 2 to 6 times per week
- Once per day
- 2 to 3 times per day
- More than 4 times per day

Other (please specify)

8. How often do you eat whole or canned fruit (1 serving= 1 piece or 1/2 cup canned)?

- Once per week or less
- 2 to 6 times per week
- Once per day
- 2 to 3 times per day
- More than 4 times per day

Other (please specify)

9. How often do you drink sugared beverages e.g carbonated drinks, juices (1 serving= 1 glass of 240ml)

- Never
- Occasionally
- A few times per week
- One to two times per day
- Two to three times per day
- More than 4 times per day

Other (please specify)

THE GLASGOW UNIVERSITY 1

10. How often do you consume dairy products like milk, yogurt, cheese (1 glass of milk = 1 serving, 1 pot of yogurt = 1 serving, 30gr of cheese= 1 serving)

- Never
- Occasionally
- A few times per week
- One to two times per day
- Two to three times per day
- More than 4 times per day

Other (please specify)

11. How often do you eat ready meals (ready to eat, fast food, microwave meals)?

- Never
- Occasionally
- A few times per week
- One to two times per day
- Two to three times per day
- More than 4 times per day

Other (please specify)

12. How often do you buy food at the following locations?

	Never	Occasionally	A few times per week	1 to 2 times per week	2 to 3 times per day	More than 4 times per day
University canteens						
Fast food shops e.g. McDonalds, KFC etc						
Take-away shops e.g. chip-shops, sandwich shops, Indian, chinese, pizza etc						
Pubs						
Restaurants						

Other (please specify)

THE GLASGOW UNIVERSITY 1

13. How frequently do you use food labels when buying food?

- ☐ Always
- ☐ Often
- ☐ Occasionally
- ☐ Rarely
- ☐ Never

Other (please specify)

14. Would you like to see any nutritional information in the following food outlets?

	Calories	Fat	Sugar	Salt	No information
University Canteens	☐	☐	☐	☐	☐
Fast food shops e.g. McDonalds, KFC etc	☐	☐	☐	☐	☐
Take away shops e.g. Chip shops, sandwich shops, Indian, chinese, pizza etc	☐	☐	☐	☐	☐
Pubs	☐	☐	☐	☐	☐
Restaurants	☐	☐	☐	☐	☐

Other (please specify)

15. How do you feel about your current weight?

- ○ Happy
- ○ Concerned
- ○ Not Concerned
- ○ Don't know

16. Would you like you to improve your eating habits and eat more healthily?

- ○ Yes
- ○ No
- ○ Don't know

THE GLASGOW UNIVERSITY 1

17. Which of the following would you find helpful?
(Please tick all that apply)

- [ ] Attending a healthy eating education programme
- [ ] Join jogging/running club/gym
- [ ] Leaflets on healthy eating
- [ ] Attending a cooking class
- [ ] Web based information on healthy eating and calories
- [ ] Texts with calorie requirements to maintain your weight
- [ ] Guide to eating out and weight control

Other (please specify)

3. The HEAL questionnaire

1. Do you smoke at all?

- Yes
- No

2. How much time on an average day do you spend watching TV or another type of screen such as computer?

3. How much time on an average day do you spend walking to classes, shopping, leisure?

4. How much time on an average week do you spend exercising (e.g. aerobics, tennis, swimming, jogging etc)

5. What is the average time you go to bed on weekdays and on weekends?

Weekdays

Weekends

6. What is the average time you get out of bed on weekdays and on weekends?

Weekdays

Weekends

7. Do you drink alcohol?

- Yes
- No

THE GLASGOW UNIVERSITY 1

8. How much do you drink per week?

Beer/Cider

Wine

Spirits

Other

9. Would you like to see calorie information on alcohol?

- Yes
- No
- Not sure

Other (please specify)

4. Some questions about you

1. Gender

- Male
- Female

2. Please estimate your height

3. Please estimate your current weight

4. CONTACT DETAILS

Name

E-mail address

5. Nationality

6. Date of Birth (DD/MM/YYYY)

7. Course you are studying

Appendix 9: Questionnaire used in the study described in chapter 3

THE GLASGOW UNIVERSITY

1. The HEAL questionnaire

Thank you for taking part in this study.

Please read the following information.

WHY HAVE I BEEN CONTACTED AND WHAT IS THE PURPOSE OF THE STUDY?
You have been contacted to take part in this study as you are a first year student. This study is trying to find out what, if any lifestyle and body weight changes occur in students' first year of full time study here in Scotland.

WHAT WILL IT INVOLVE?
There are some questions which will take approximately 10 minutes to complete. If you would like to take part in this study please complete the questionnaire. You will be asked to complete the same questionnaire on one more occasion-at the end of the academic year. Those who will complete the questionnaire both times will enter a prize draw for Amazon Vouchers, as a thank you.

DO I HAVE TO TAKE PART?
There is no obligation to take part.

CONFIDENTIALITY
Responses will be stored securely with no identifying information.

CAN I WITHDRAW FROM THE STUDY AFTER I HAVE STARTED TO COMPLETE THE QUESTIONNAIRE?
You can withdraw from the study at anytime by simply closing the browser window. Closing the browser window will delete your questionnaire data. If you decide to withdraw from the study after you have completed the questionnaire or any of the follow-up measurements you are free to do so with no explanation.

WHAT WILL HAPPEN TO THE RESULTS?
Anonymous summary results may be written up for publication or shared with other researchers.

WHO SHOULD I CONTACT IF I NEED ANY FURTHER INFORMATION OR WHAT TO RAISE ANY ISSUES ABOUT THE STUDY?
You can contact Charoula-Konstantia Nikolaou (c.nikolaou.1@research.gla.ac.uk).

Thank you very much for taking time to participate!

2. The HEAL questionnaire

1. Do you live:

- ○ At home with parents
- ○ In self-catering university/college accomodation
- ○ In catered university/college accomodation
- ○ In other accomodation
- ○ Alone
- ○ With a partner

Page 1

THE GLASGOW UNIVERSITY

2. How often do you eat the following meals?

	Never	Seldom	Sometimes	Usually	Always
Breakfast					
Lunch					
Dinner					
Supper					

3. What is the average number of people with whom you usually eat your main meals?

Breakfast

Lunch

Dinner

4. How often do you have snacks?

- Never
- Occasionally
- A few times per week
- One to two times per week
- One to two times per day
- Two to three times per day
- More than 4 times per day

Other (please specify)

5. What types of food do you normally snack on?

- Crisps, crackers, nuts
- Cakes, muffins, cookies
- Fast food (e.g.pizza, burger)
- Confectionary (e.g. chocolate, sweets)

Other (please specify)

6. Are you more inclined to snack in any of the following situations?

- Studying
- Partying
- Bored
- Emotional

Other (please specify)

THE GLASGOW UNIVERSITY

7. How often do you eat vegetables (1 serving= 1/2 cup cooked/1 cup raw)

- Once per week or less
- 2 to 6 times per week
- Once per day
- 2 to 3 times per day
- More than 4 times per day

Other (please specify)

8. How often do you eat whole or canned fruit (1 serving= 1 piece or 1/2 cup canned)?

- Once per week or less
- 2 to 6 times per week
- Once per day
- 2 to 3 times per day
- More than 4 times per day

Other (please specify)

9. How often do you drink sugared beverages e.g carbonated drinks, juices (1 serving= 1 glass of 240ml)

- Never
- Occasionally
- A few times per week
- One to two times per day
- Two to three times per day
- More than 4 times per day

Other (please specify)

THE GLASGOW UNIVERSITY

10. How often do you consume dairy products like milk, yogurt, cheese (1 glass of milk = 1 serving, 1 pot of yogurt = 1 serving, 30gr of cheese= 1 serving)

- Never
- Occasionally
- A few times per week
- One to two times per week
- Two to three times per day
- More than 4 times per day

Other (please specify)

11. How often do you eat ready meals (ready to eat, fast food, microwave meals)?

- Never
- Occasionally
- A few times per week
- One to two times per day
- Two to three times per day
- More than 4 times per day

Other (please specify)

12. How often do you buy food at the following locations?

	Never	Occasionally	A few times per week	1 to 2 times per week	2 to 3 times per day	More than 4 times per day
University canteens						
Fast food shops e.g. McDonalds, KFC etc						
Take-away shops e.g. chip-shops, sandwich shops, Indian, chinese, pizza etc						
Pubs						
Restaurants						

Other (please specify)

THE GLASGOW UNIVERSITY

13. How frequently do you use food labels when buying food?

- Always
- Often
- Occasionally
- Rarely
- Never

Other (please specify)

14. Would you like to see any nutritional information in the following food outlets?

	Calories	Fat	Sugar	Salt	No information
University Canteens					
Fast food shops e.g. McDonalds, KFC etc					
Take away shops e.g. Chip shops, sandwich shops, Indian, chinese, pizza etc					
Pubs					
Restaurants					

Other (please specify)

15. How do you feel about your current weight?

- Happy
- Concerned
- Not Concerned
- Don't know

16. Would you like you to improve your eating habits and eat more healthily?

- Yes
- No
- Don't know

THE GLASGOW UNIVERSITY

17. Which of the following would you find helpful? (Please tick all that apply)

- Attending a healthy eating education programme
- Join jogging/running club/gym
- Leaflets on healthy eating
- Attending a cooking class
- Web based information on healthy eating and calories
- Texts with calorie requirements to maintain your weight
- Guide to eating out and weight control

Other (please specify)

3. The HEAL questionnaire

1. Do you smoke at all?

- Yes
- No

2. How much time on an average day do you spend watching TV or another type of screen such as computer?

3. How much time on an average day do you spend walking to classes, shopping, leisure?

4. How much time on an average week do you spend exercising (e.g. aerobics, tennis, swimming, jogging etc)

5. What is the average time you go to bed on weekdays and on weekends?

Weekdays

Weekends

6. What is the average time you get out of bed on weekdays and on weekends?

Weekdays

Weekends

7. Do you drink alcohol?

- Yes
- No

THE GLASGOW UNIVERSITY

8. How much do you drink per week?

Beer/Cider

Wine

Spirits

Other

9. Would you like to see calorie information on alcohol?

- Yes
- No
- Not sure

Other (please specify)

4. Some questions about you

1. Gender

- Male
- Female

2. Please estimate your height

3. Please estimate your current weight

4. CONTACT DETAILS

Name

E-mail address

5. Nationality

6. Date of Birth (DD/MM/YYYY)

7. Course you are studying

Appendix 10: Questionnaire used in the study described in chapter 3, follow-up

THE GLASGOW UNIVERSITY FOLLOW-UP

1. The HEAL questionnaire

Thank you for taking part in this study.

Please read the following information.

WHY HAVE I BEEN CONTACTED AND WHAT IS THE PURPOSE OF THE STUDY?
You have been contacted to take part in this study as you are a first year student. This study is trying to find out what, if any lifestyle and body weight changes occur in students' first year of full time study here in Scotland.

WHAT WILL IT INVOLVE?
There are some questions which will take approximately 10 minutes to complete. This is the follow-up questionnaire. The first questionnaire was distributed in October 2011. Those who will have completed the questionnaire both times will enter a prize draw for Amazon Vouchers, as a thank you.

DO I HAVE TO TAKE PART?
There is no obligation to take part.

CONFIDENTIALITY
Responses will be stored securely with no identifying information.

CAN I WITHDRAW FROM THE STUDY AFTER I HAVE STARTED TO COMPLETE THE QUESTIONNAIRE?
You can withdraw from the study at anytime by simply closing the browser window. Closing the browser window will delete your questionnaire data. If you decide to withdraw from the study after you have completed the questionnaire or any of the follow-up measurements you are free to do so with no explanation.

WHAT WILL HAPPEN TO THE RESULTS?
Anonymous summary results may be written up for publication or shared with other researchers.

WHO SHOULD I CONTACT IF I NEED ANY FURTHER INFORMATION OR WHAT TO RAISE ANY ISSUES ABOUT THE STUDY?
You can contact Charoula-Konstantia Nikolaou (c.nikolaou.1@research.gla.ac.uk).

Thank you very much for taking time to participate!

2. The HEAL questionnaire

1. Do you live:

- At home with parents
- In self-catering university/college accomodation
- In catered university/college accomodation
- In other accomodation
- Alone
- With a partner

THE GLASGOW UNIVERSITY FOLLOW-UP

2. How often do you eat the following meals?

	Never	Seldom	Sometimes	Usually	Always
Breakfast					
Lunch					
Dinner					
Supper					

3. What is the average number of people with whom you usually eat your main meals?

Breakfast

Lunch

Dinner

4. How often do you have snacks?

- Never
- Occasionally
- A few times per week
- One to two times per week
- One to two times per day
- Two to three times per day
- More than 4 times per day

Other (please specify)

5. What types of food do you normally snack on?

- Crisps, crackers, nuts
- Cakes, muffins, cookies
- Fast food (e.g.pizza, burger)
- Confectionery (e.g. chocolate, sweets)

Other (please specify)

6. Are you more inclined to snack in any of the following situations?

- Studying
- Partying
- Bored
- Emotional

Other (please specify)

THE GLASGOW UNIVERSITY FOLLOW-UP

7. How often do you eat vegetables (1 serving= 1/2 cup cooked/1 cup raw)

- Once per week or less
- 2 to 6 times per week
- Once per day
- 2 to 3 times per day
- More than 4 times per day

Other (please specify)

8. How often do you eat whole or canned fruit (1 serving= 1 piece or 1/2 cup canned)?

- Once per week or less
- 2 to 6 times per week
- Once per day
- 2 to 3 times per day
- More than 4 times per day

Other (please specify)

9. How often do you drink sugared beverages e.g carbonated drinks, juices (1 serving= 1 glass of 240ml)

- Never
- Occasionally
- A few times per week
- One to two times per day
- Two to three times per day
- More than 4 times per day

Other (please specify)

THE GLASGOW UNIVERSITY FOLLOW-UP

10. How often do you consume dairy products like milk, yogurt, cheese (1 glass of milk = 1 serving, 1 pot of yogurt = 1 serving, 30gr of cheese= 1 serving)

- Never
- Occasionally
- A few times per week
- One to two times per week
- Two to three times per day
- More than 4 times per day

Other (please specify)

11. How often do you eat ready meals (ready to eat, fast food, microwave meals)?

- Never
- Occasionally
- A few times per week
- One to two times per day
- Two to three times per day
- More than 4 times per day

Other (please specify)

12. How often do you buy food at the following locations?

	Never	Occasionally	A few times per week	1 to 2 times per week	2 to 3 times per day	More than 4 times per day
University canteens						
Fast food shops e.g. McDonalds, KFC etc						
Take-away shops e.g. chip-shops, sandwich shops, Indian, chinese, pizza etc						
Pubs						
Restaurants						

Other (please specify)

THE GLASGOW UNIVERSITY FOLLOW-UP

13. How frequently do you use food labels when buying food?

- Always
- Often
- Occasionally
- Rarely
- Never

Other (please specify)

14. Would you like to see any nutritional information in the following food outlets?

	Calories	Fat	Sugar	Salt	No Information
University Canteens					
Fast food shops e.g. McDonalds, KFC etc					
Take away shops e.g. Chip shops, sandwich shops, Indian, chinese, pizza etc					
Pubs					
Restaurants					

Other (please specify)

15. How do you feel about your current weight?

- Happy
- Concerned
- Not Concerned
- Don't know

16. Since starting university have you made any changes to try to control your weight?

- Food & Diet
- Physical Activity

Other (please specify)

17. Would you like you to improve your eating habits and eat more healthily?

- Yes
- No
- Don't know

THE GLASGOW UNIVERSITY FOLLOW-UP

18. Which of the following would you find helpful?
(Please tick all that apply)

- ☐ Attending a healthy eating education programme
- ☐ Join jogging/running club/gym
- ☐ Leaflets on healthy eating
- ☐ Attending a cooking class
- ☐ Web based information on healthy eating and calories
- ☐ Texts with calorie requirements to maintain your weight
- ☐ Guide to eating out and weight control

Other (please specify)

3. The HEAL questionnaire

1. Do you smoke at all?

- Yes
- No

2. How much time on an average day do you spend watching TV or another type of screen such as computer?

3. How much time on an average day do you spend walking to classes, shopping, leisure?

4. How much time on an average week do you spend exercising (e.g. aerobics, tennis, swimming, jogging etc)

5. What is the average time you go to bed on weekdays and on weekends?

Weekdays

Weekends

6. What is the average time you get out of bed on weekdays and on weekends?

Weekdays

Weekends

7. Do you drink alcohol?

- Yes
- No

THE GLASGOW UNIVERSITY FOLLOW-UP

8. How much do you drink per week?

Beer/Cider

Wine

Spirits

Other

9. Would you like to see calorie information on alcohol?

- Yes
- No
- Not sure

Other (please specify)

4. Some questions about you

1. Gender

- Male
- Female

2. Please estimate your height

3. Please estimate your current weight

4. When was the last time you weighed yourself?

- 0-3 months ago
- 3-6 months ago
- 6-12 months ago
- Other (please specify)

5. CONTACT DETAILS

Name

E-mail address

6. Nationality

THE GLASGOW UNIVERSITY FOLLOW-UP

7. Date of Birth (DD/MM/YYYY)

8. Course you are studying

Appendix 11: Questionnaire used in the study described in chapter 8, year 2011-2012

Wolfson Hall

University of Glasgow

University of Glasgow

1. Did you notice the posting of the calories by the meals you were offered in the hall?

- Yes
- No

Other (please specify)

2. Did you use the calorie information when you chose your meals?

- Yes
- No

Other (please specify)

3. What is the reason for using the calorie information?

- To control your weight
- To eat healthier

Other (please specify)

4. Would you like the calorie information to be available on-line?

- Yes
- No
- Don't know

Wolfson Hall

5. Would you like more nutritional information to be available by the meals (e.g. protein, fat, fibre content)?

- Yes
- No
- Don't know

Other (please specify)

6. Gender

- Male
- Female

7. Age

8. Please estimate your current weight

9. Please estimate your current height

10. Any other comments

Appendix 12: Questionnaire used in the study described in chapter 8, year 2012-2013

Wolfson Hall

University of Glasgow

University of Glasgow

1. Did you notice the posting of the calories by the meals you were offered in the hall?

- Yes
- No

2. Did you use the calorie information when you chose your meals?

- Yes
- No

3. What is the reason for using the calorie information?

- To control your weight
- To eat healthier

Other (please specify)

4. Did you usually choose

- A higher calorie option
- A lower calorie option

Other (please specify)

5. Would information on your daily energy requirements help you to use the calorie information better?

- Yes
- No

Other (please specify)

Page 1

Wolfson Hall

6. Would you like more nutritional information to be available by the meals (e.g. protein, fat, fibre content)?

- Yes
- No
- Don't know

Other (please specify)

7. Gender

- Male
- Female

8. Age

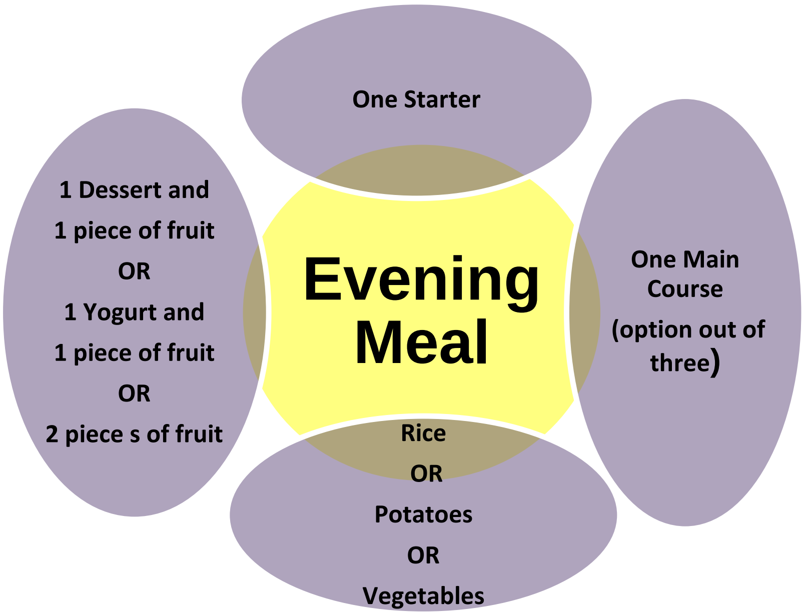
9. Please estimate your current weight

10. Please estimate your current height

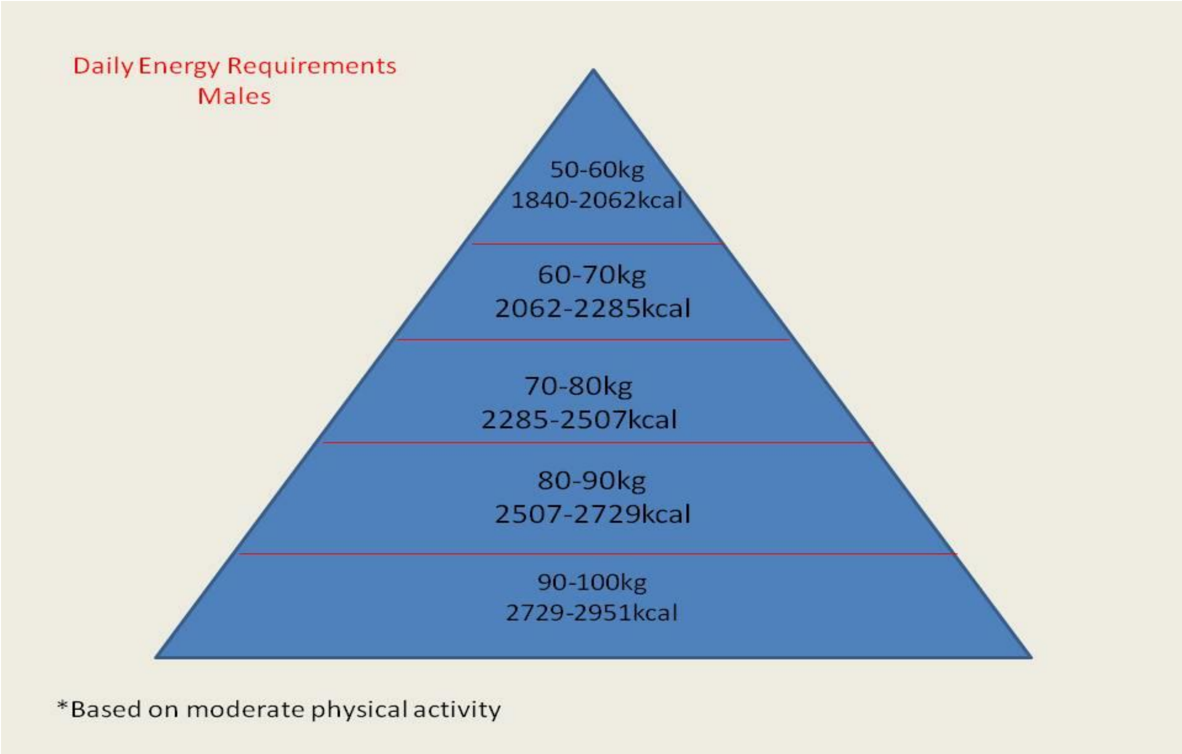
11. Any other comments to help?

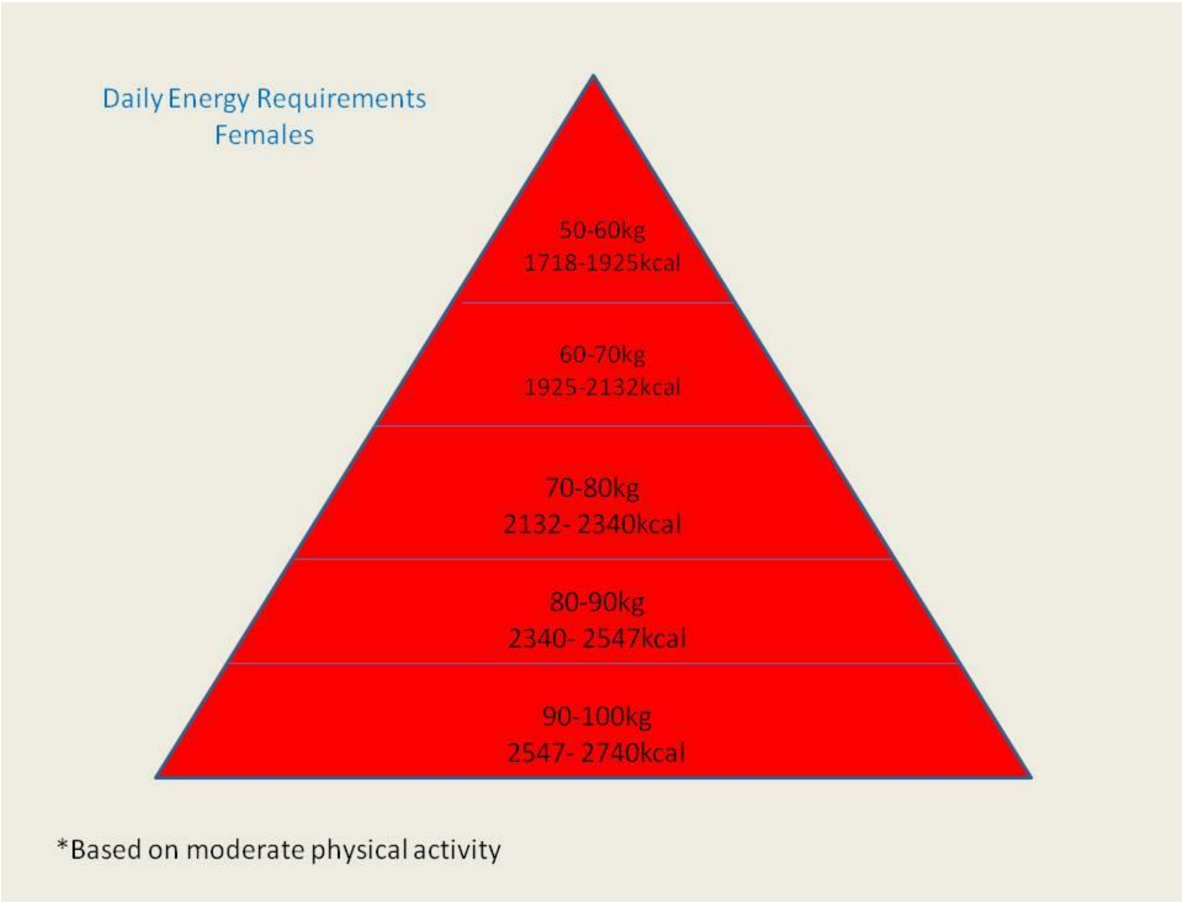
Appendix 13: Calorie label sample for study in chapter 8

Appendix 14: Meal option for students for study in chapter 8



Appendix 15: Daily energy posters for students for study described in chapter 8





Appendix 16: Photographs of the study described in chapter 8

Appendix 17: Photographs of the study described in chapter 8

Appendix 18: Questionnaire used in the study described in chapter 9

**University of Glasgow
**

3 minutes of your time PLEASE! This would be most appreciated! Any information you provide will be anonymous and is required for an ongoing PhD project. Please give honest answers!

University of Glasgow

1. Are you

- Student
- Member of staff
- Visitor

2. Are you

- Male
- Female

3. Did the calorie information influence your choice of food?

- Yes
- No

4. If yes, did you choose

- A lower calorie option
- A higher calorie option

5. Was your choice because

- You are overweight
- You are underweight
- You have a normal weight but want to avoid weight gain

Other (please specify)

6. What is your age?

7. What is your current weight (stones / pounds / kg)?

8. What is your height (feet / metres)?

9. Any other comments/suggestions to help you or help other people

Appendix 19: Calorie label sample used in the study described in chapter 9

Appendix 20: Photograph of the site in the study described in chapter 9

Appendix 21: Sample of the nutritional information provided on-line for the sandwiches by the caterers in the study described in chapter 9

Ayrshire gammon,brie,chutney bap

Ingredients

Bap White Floured 5" (95g)

HAM SLICED SMOKED 100%

CHEESE BRIE DOULCE

Chutney Tomato

MARGARINE SUMMER COUNTY SPREAD

Calories	Fat	Saturates	Sugars	Salt
543.8	27.9g	12.7g	6.1g	3.3g
27%	40%	64%	7%	55%

Appendix 22: Questionnaire used in the study described in chapter 10, baseline

THE GLASGOW UNIVERSITY 2012

1. The HEAL questionnaire

Thank you for taking part in this study.

Please read the following information.

WHY HAVE I BEEN CONTACTED AND WHAT IS THE PURPOSE OF THE STUDY?
You have been contacted to take part in this study as you are an undergraduate student. This study is trying to find out what, if any lifestyle and body weight changes occur in students in full time study here in Scotland.

WHAT WILL IT INVOLVE?
There are some questions which will take approximately 5 minutes to complete. The same questionnaire will be sent out for completion on January 2013 and April 2013. Those who will complete the questionnaire at all three times will enter a prize draw for Amazon Vouchers, as a thank you.

DO I HAVE TO TAKE PART?
There is no obligation to take part.

CONFIDENTIALITY
Responses will be stored securely with no identifying information.

CAN I WITHDRAW FROM THE STUDY AFTER I HAVE STARTED TO COMPLETE THE QUESTIONNAIRE?
You can withdraw from the study at anytime by simply closing the browser window. Closing the browser window will delete your questionnaire data. If you decide to withdraw from the study after you have completed the questionnaire or any of the follow-up measurements you are free to do so with no explanation.

WHAT WILL HAPPEN TO THE RESULTS?
Anonymous summary results may be written up for publication or shared with other researchers.

WHO SHOULD I CONTACT IF I NEED ANY FURTHER INFORMATION OR WHAT TO RAISE ANY ISSUES ABOUT THE STUDY?
You can contact Charoula-Konstantia Nikolaou (c.nikolaou.1@research.gla.ac.uk).

Thank you very much for taking time to participate!

2. The HEAL questionnaire

1. Do you live:

- ○ At home with parents
- ○ In self-catering university accommodation
- ○ In catered university accommodation
- ○ In other accommodation
- ○ With a partner

THE GLASGOW UNIVERSITY 2012

2. How often do you eat the following meals?

	Never	Seldom	Sometimes	Usually	Always
Breakfast					
Lunch					
Dinner					
Supper					

3. How often do you have snacks (between meals)?

- Never
- Occasionally
- A few times per week
- One to two times per week
- One to two times per day
- Two to three times per day
- More than 4 times per day

Other (please specify)

4. What types of food do you normally snack on (between meals)?

- Crisps, crackers, nuts
- Cakes, muffins, cookies
- Fast food (e.g.pizza, burger)
- Confectionary (e.g. chocolate, sweets)
- Fruit

Other (please specify)

5. How often do you eat vegetables (1 serving= 1/2 cup cooked/1 cup raw)

- One serving per week or less
- 2 to 6 servings per week
- One serving per day
- 2 to 3 servings per day
- More than 4 servings per day

Other (please specify)

THE GLASGOW UNIVERSITY 2012

6. How often do you eat whole or canned fruit (1 serving= 1 piece or 1/2 cup canned)?

- One serving per week or less
- 2 to 6 servings per week
- One serving per day
- 2 to 3 servings per day
- More than 4 servings per day

Other (please specify)

7. How often do you drink sugared beverages e.g carbonated drinks, juices (1 serving= 1 glass of 240ml)

- Never
- Occasionally
- A few times per week
- One to two times per day
- Two to three times per day
- More than 4 times per day

Other (please specify)

8. How often do you eat dairy products like milk, yogurt, cheese (1 glass of milk = 1 serving, 1 pot of yogurt = 1 serving, 30gr of cheese= 1 serving)

- Never
- Occasionally
- A few times per week
- One to two times per week
- Two to three times per day
- More than 4 times per day

Other (please specify)

THE GLASGOW UNIVERSITY 2012

9. How often do you eat ready meals (ready to eat, fast food, microwave meals)?

- Never
- Occasionally
- A few times per week
- One to two times per day
- Two to three times per day
- More than 4 times per day

Other (please specify)

3. The HEAL questionnaire

1. Do you smoke at all?

- Used to smoke but stopped
- Never smoked
- Current smoker

2. How much time on an average day do you spend:

	Hour	Minutes
Watching TV or another type of screen such as computer?		
Walking to classes, shopping, leisure?		

3. How much time on an average week do you spend exercising (e.g. aerobics, tennis, swimming, jogging etc)

Hours

Minutes

4. What is the average time you go to bed on weekdays and on weekends?

	Hour	Minutes
Weekdays		
Weekends		

5. What is the average time you get out of bed on weekdays and on weekends?

	Hour	Minutes
Weekdays		
Weekends		

THE GLASGOW UNIVERSITY 2012

6. Do you drink alcohol?

- Yes
- No

4. Some questions about you

1. Gender

- Male
- Female

2. Please estimate your height

3. Please estimate your current weight

4. When was the last time you weighed yourself?

- 0-3 months ago
- 3-6 months ago
- 6-12 months ago
- Other (please specify)

5. How do you feel about your current weight?

- Happy
- Concerned
- Not Concerned
- Don't know

6. What size jeans do you wear?

7. CONTACT DETAILS

Matriculation number

Name

E-mail address

THE GLASGOW UNIVERSITY 2012

8. Nationality

9. Date of Birth (DD/MM/YYYY)

10. Course you are studying

Appendix 23: Questionnaire used in the study described in chapter 10, follow-up

2013

1. The HEAL questionnaire

Thank you for taking part in this study.

Please read the following information.

WHY HAVE I BEEN CONTACTED AND WHAT IS THE PURPOSE OF THE STUDY?
You have been contacted to take part in this study as you are an undergraduate student. This study is trying to find out what, if any lifestyle and body weight changes occur in students in full time study here in Scotland.

WHAT WILL IT INVOLVE?
There are some questions which will take approximately 5 minutes to complete. The same questionnaire will be sent out for completion on January 2013 and April 2013. Those who will complete the questionnaire at all three times will enter a prize draw for Amazon Vouchers, as a thank you.

DO I HAVE TO TAKE PART?
There is no obligation to take part.

CONFIDENTIALITY
Responses will be stored securely with no identifying information.

CAN I WITHDRAW FROM THE STUDY AFTER I HAVE STARTED TO COMPLETE THE QUESTIONNAIRE?
You can withdraw from the study at anytime by simply closing the browser window. Closing the browser window will delete your questionnaire data. If you decide to withdraw from the study after you have completed the questionnaire or any of the follow-up measurements you are free to do so with no explanation.

WHAT WILL HAPPEN TO THE RESULTS?
Anonymous summary results may be written up for publication or shared with other researchers.

WHO SHOULD I CONTACT IF I NEED ANY FURTHER INFORMATION OR WHAT TO RAISE ANY ISSUES ABOUT THE STUDY?
You can contact Charoula-Konstantia Nikolaou (c.nikolaou.1@research.gla.ac.uk).

Thank you very much for taking time to participate!

2. The HEAL questionnaire

1. Do you live:

- At home with parents
- In self-catering university accommodation
- In catered university accommodation
- In other accommodation
- With a partner

2013

2. How often do you eat the following meals?

	Never	Seldom	Sometimes	Usually	Always
Breakfast	○	○	○	○	○
Lunch	○	○	○	○	○
Dinner	○	○	○	○	○
Supper	○	○	○	○	○

3. How often do you have snacks (between meals)?

- ○ Never
- ○ Occasionally
- ○ A few times per week
- ○ One to two times per week
- ○ One to two times per day
- ○ Two to three times per day
- ○ More than 4 times per day

Other (please specify)

4. What types of food do you normally snack on (between meals)?

- ○ Crisps, crackers, nuts
- ○ Cakes, muffins, cookies
- ○ Fast food (e.g.pizza, burger)
- ○ Confectionery (e.g. chocolate, sweets)
- ○ Fruit

Other (please specify)

5. How often do you eat vegetables (1 serving= 1/2 cup cooked/1 cup raw)

- ○ One serving per week or less
- ○ 2 to 6 servings per week
- ○ One serving per day
- ○ 2 to 3 servings per day
- ○ More than 4 servings per day

Other (please specify)

2013

6. How often do you eat whole or canned fruit (1 serving= 1 piece or 1/2 cup canned)?

- One serving per week or less
- 2 to 6 servings per week
- One serving per day
- 2 to 3 servings per day
- More than 4 servings per day

Other (please specify)

7. How often do you drink sugared beverages e.g carbonated drinks, juices (1 serving= 1 glass of 240ml)

- Never
- Occasionally
- A few times per week
- One to two times per day
- Two to three times per day
- More than 4 times per day

Other (please specify)

8. How often do you eat dairy products like milk, yogurt, cheese (1 glass of milk = 1 serving, 1 pot of yogurt = 1 serving, 30gr of cheese= 1 serving)

- Never
- Occasionally
- A few times per week
- One to two times per week
- Two to three times per day
- More than 4 times per day

Other (please specify)

2013

9. How often do you eat ready meals (ready to eat, fast food, microwave meals)?

- Never
- Occasionally
- A few times per week
- One to two times per week
- Two to three times per day
- More than 4 times per day

Other (please specify)

3. The HEAL questionnaire

1. Do you smoke at all?

- Used to smoke but stopped
- Never smoked
- Current smoker

2. How much time on an average day do you spend:

	Hour	Minutes
Watching TV or another type of screen such as computer?		
Walking to classes, shopping, leisure?		

3. How much time on an average week do you spend exercising (e.g. aerobics, tennis, swimming, jogging etc)

Hours

Minutes

4. What is the average time you go to bed on weekdays and on weekends?

	Hour	Minutes
Weekdays		
Weekends		

5. What is the average time you get out of bed on weekdays and on weekends?

	Hour	Minutes
Weekdays		
Weekends		

2013

6. Do you drink alcohol?

- Yes
- No

4. Some questions about you

1. Gender

- Male
- Female

2. Please estimate your height

3. Please estimate your current weight

4. When was the last time you weighed yourself?

- 0-3 months ago
- 3-6 months ago
- 6-12 months ago
- Other (please specify)

5. How do you feel about your current weight?

- Happy
- Concerned
- Not Concerned
- Don't know

6. Did your weight change during the academic year?

- Increased
- Decreased
- Stayed the same

Other (please specify)

2013

7. Since starting University have you made any changes to control your weight?

- [ ] Food & Diet
- [ ] Exercise

Other (please specify)

8. What size jeans do you wear?

9. CONTACT DETAILS

Matriculation number

Name

E-mail address

10. Nationality

11. Date of Birth (DD/MM/YYYY)

12. Course you are studying

Appendix 24: Questionnaire used in the evaluation of the study described in chapter 10

FEEDBACK QUESTIONNAIRE "Goddess Demetra"

1. Have you ever logged on to the "Goddess Demetra" project?

- Yes
- No

2. Was there any particular reason that you never logged on to Moodle for the "Goddess Demetra" project?

3. What is your age?

4. What year of studies are you in?

- 1st year
- 2nd year
- 3rd year
- 4th year
- 5th year

5. What is your current weight in kg?

6. What is your height in cm?

7. What is your Nationality?

- UK
- European Union/EEA
- International

8. What is your gender?

- Female
- Male

FEEDBACK QUESTIONNAIRE "Goddess Demetra"

9. On the whole, how satisfied are you with the life you lead?

- very satisfied
- fairly satisfied
- not very satisfied
- not at all satisfied

10. How relevant to your own concerns and interests was "Goddess Demetra"? (1=Not at all, 7=Very relevant)

	1	2	3	4	5	6	7
o							

11. Was the overall project covered adequately? (1=Not at all, 7=Great extent)

	1	2	3	4	5	6	7
-							

12. How relevant to your self did you find each of the topics?

- Earth & Food
- The cost of cultivating our land
- Meat Production
- Sustainable Fish
- Food Miles
- Is fresh the best?
- Festive Excess
- New Years' Resolution
- Snacks & the vending machines Business
- Salt
- Fat
- ready Meals
- Supermarkets
- Food & drink Companies
- Marketing Power

FEEDBACK QUESTIONNAIRE "Goddess Demetra"

13. On reflection, where would you place your understanding of the following topics at the beginning of the course and now?

	At the beginning of the course	At the end of the course
Importance of environmental sustainability		
Importance of animal rights		
Importance of eating a healthful diet		
Importance of staying physically fit		
Importance of social justice		
Importance of food ethics		

14. On reflection, how many servings a day of the following were you consuming at the beginning of the year and now?

	At the beginning of the course	At the end of the course
Vegetables		
Fruit		
Sweets/Confectionary		
Ready meals		
Snacks		
Fizzy Drinks		
Fast Food		

15. Did your weight change in the course of the year?

- Increased
- Decreased
- Stayed the same
- Don't know

Other (please specify)

FEEDBACK QUESTIONNAIRE "Goddess Demetra"

16. Did this project help you to avoid unwanted weight gain?

	Not at all	Very Little	Somehow	A lot
-	○	○	○	○

17. Would you like the "Goddess Demetra" to be available in another format?

- ☐ Face to face
- ☐ Leaflets
- ☐ Podcast
- ☐ Youtube

Other (please specify)

18. We are interested to know how you accessed the "Goddess Demetra"?

- ☐ Personal Computer (laptop, desktop)
- ☐ Tablet
- ☐ Smart phone
- ☐ Public computer (library etc)

Other (please specify)

19. Did you ever share the information with someone else?

- ○ Yes
- ○ No

20. Have you ever copied and send these materials to others (eg friends, relatives, colleagues)?

- ○ Yes
- ○ No

Other (please specify)

21. How can we improve the "Goddess Demetra"?

22. What is your age?

FEEDBACK QUESTIONNAIRE "Goddess Demetra"

23. What year of studies are you in?

- 1st year
- 2nd year
- 3rd year
- 4th year
- 5th year

24. What is your current weight in kg?

25. What is your height in cm?

26. What is your Nationality?

- UK
- European Union/EEA
- International

27. What is your gender?

- Female
- Male

28. On the whole, how satisfied are you with the life you lead?

- very satisfied
- fairly satisfied
- not very satisfied
- not at all satisfied

Thank you for your time!

Appendix 26: Questionnaire used in the evaluation of the study described in chapter 10

FEEDBACK QUESTIONNAIRE "NTICV"

1. Have you ever logged on to Moodle for the "Not the Ice Cream Van" project?

- Yes
- No

1. Was there any particular reason why you never logged on to Moodle for the "Not the Ice Cream Van"?

2. What is your age?

3. What year of studies are you in?

- 1st year
- 2nd year
- 3rd year
- 4th year
- 5th year

4. What is your current weight in kg?

5. What is your height in cm?

6. What is your Nationality?

- UK
- European Union/EEA
- International

7. What is your gender?

- Female
- Male

Page 1

FEEDBACK QUESTIONNAIRE "NTICV"

8. On the whole, how satisfied are you with the life you lead?

- very satisfied
- fairly satisfied
- not very satisfied
- not at all satisfied

1. How relevant to your own concerns and interests was the "Not the Ice Cream Van" project? (1=Not at all, 7=Very relevant)

	1	2	3	4	5	6	7
-							

2. Was the overall project covered adequately? (1=Not at all, 7= Great extent)

	1	2	3	4	5	6	7
-							

3. How relevant to your self did you find each of the topics?

- Weight & BMI
- Eat Well
- Alcohol
- Cupboard and Fridge Essentials
- Fizzy drinks
- Exam & Stress
- Christmas foods & calories
- Detox
- Snacks
- Salt
- Fat & Fat free foods
- Diets
- Ready Meals
- Supermarkets
- Physical Activity
- Fast Food
- Food Labels
- Negative Calorie Foods

FEEDBACK QUESTIONNAIRE "NTICV"

4. On reflection, how many servings a day of the following were you consuming at the beginning of the year and now?

	At the beginning of the course	At the end of the course
Vegetables		
Sweets/Confectionery		
Ready meals		
Snacks		
Fruit		
Fizzy Drinks		
Fast Food		

5. On reflection, where would you place your understanding of the following topics at the beginning of the project and now?

	At the beginning of the course	At the end of the course
Importance of environmental sustainability		
Importance of animal rights		
Importance of eating a healthful diet		
Importance of staying physically fit		
Importance of social justice		
Importance of food ethics		

6. Did your weight change in the course of the year?

- Increased
- Decreased
- Stayed the same
- Don't know

Other (please specify)

7. Did this project help you avoid unwanted weight gain?

	Not at all	Very Little	Somehow	A lot
-				

FEEDBACK QUESTIONNAIRE "NTICV"

8. Would you like the "Not the Ice Cream Van" to be available in another format?

- Face to face
- Leaflets
- Podcast
- Youtube

Other (please specify)

9. We are interested to know how you accessed the "Not the Ice Cream Van"?

- Personal Computer (laptop, desktop)
- Tablet
- Smart phone
- Public computer (library etc)

Other (please specify)

10. Did you ever shared the information with someone else?

- Yes
- No

11. Have you ever copied and send these materials to others (eg friends, relatives, colleagues)?

- Yes
- No

Other (please specify)

12. How can we improve the "Not the Ice Cream Van" ?

13. What is your age?

FEEDBACK QUESTIONNAIRE "NTICV"

14. What year of studies are you in?

- 1st year
- 2nd year
- 3rd year
- 4th year
- 5th year

15. What is your current weight in kg?

16. What is your height in cm?

17. What is your Nationality?

- UK
- European Union/EEA
- International

18. What is your gender?

- Female
- Male

19. On the whole, how satisfied are you with the life you lead?

- very satisfied
- fairly satisfied
- not very satisfied
- not at all satisfied

Thank you for your time!

Appendix 27: Materials used in the study described in chapter 10

Topic outline

We are concerned that many students gain weight during their University years, on average gaining 6 to 10 pounds (3-5kg), according to surveys.

If you become **a weight-gainer**, it can only be for **three fundamental reasons**

You eat more calories AND/OR You drink more AND/OR You do less

Some people are more prone to weight gain than others but It's not all down to genetics or bad luck! **Everyone can avoid weight gain if they know how.**

It can be very difficult to make the right decisions all the time but don't worry!

Ice-cream (often 250-300kcal) is not the only problem, but it is an obvious example. We've commissioned the **'Not the Ice Cream Van'** full of good things to **help you** avoid unwanted weight gain, and great tips every week throughout the year!

Appendix 28: Materials used in the study described in chapter 10

It's no secret that the **amount of calories** you eat and drink **has a direct impact on your weight**:

Consume the same number of calories that your body burns up over time, and your weight stays stable.

Consume more than your body uses up, your weight goes up.

Consume less than your body uses, your weight goes down.

Just 100 calories/day extra means one kilo difference.

Each kilo represents about 7000 calories. So gaining 5kg=35000 calories over a year requires about 100 calories extra per day- That is not much-not enough to see as you eat it.

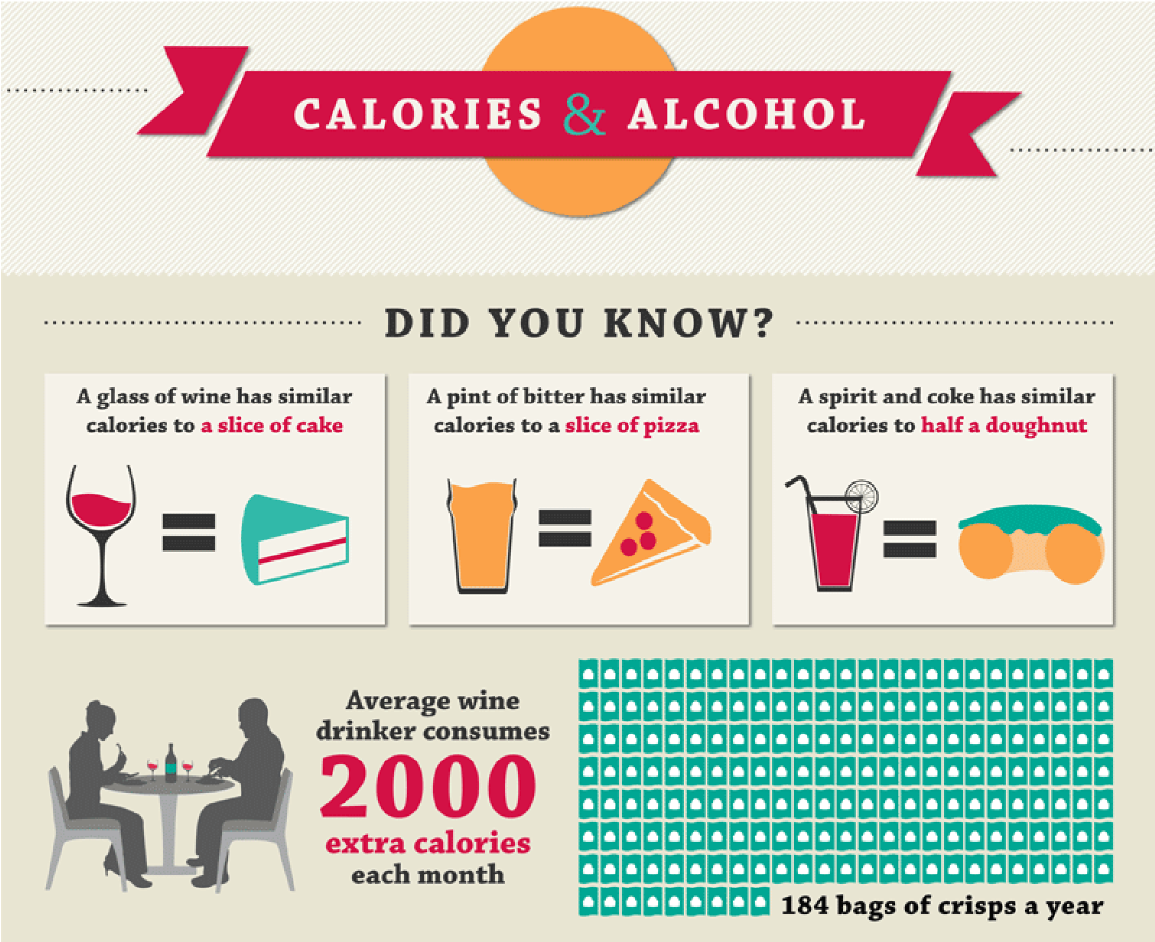
What about the type of calories? Does it matter whether they come from specific nutrients—fat, protein, or carbohydrate? Specific foods—whole grains or potato chips? Specific diets—the Mediterranean diet or the "Twinkie" diet? And what about when or where people consume their calories: Does eating breakfast make it easier to control weight? Does eating at fast-food restaurants make it harder?

Plenty of research shows which food and diet patterns protect against heart disease, stroke, diabetes, and other chronic conditions. The good news is that many of the foods that help prevent disease also seem to help with weight control—foods like whole grains, vegetables, fruits, and nuts. And many of the foods that increase disease risk—chief among them, saturated fat—are also factors in weight gain.

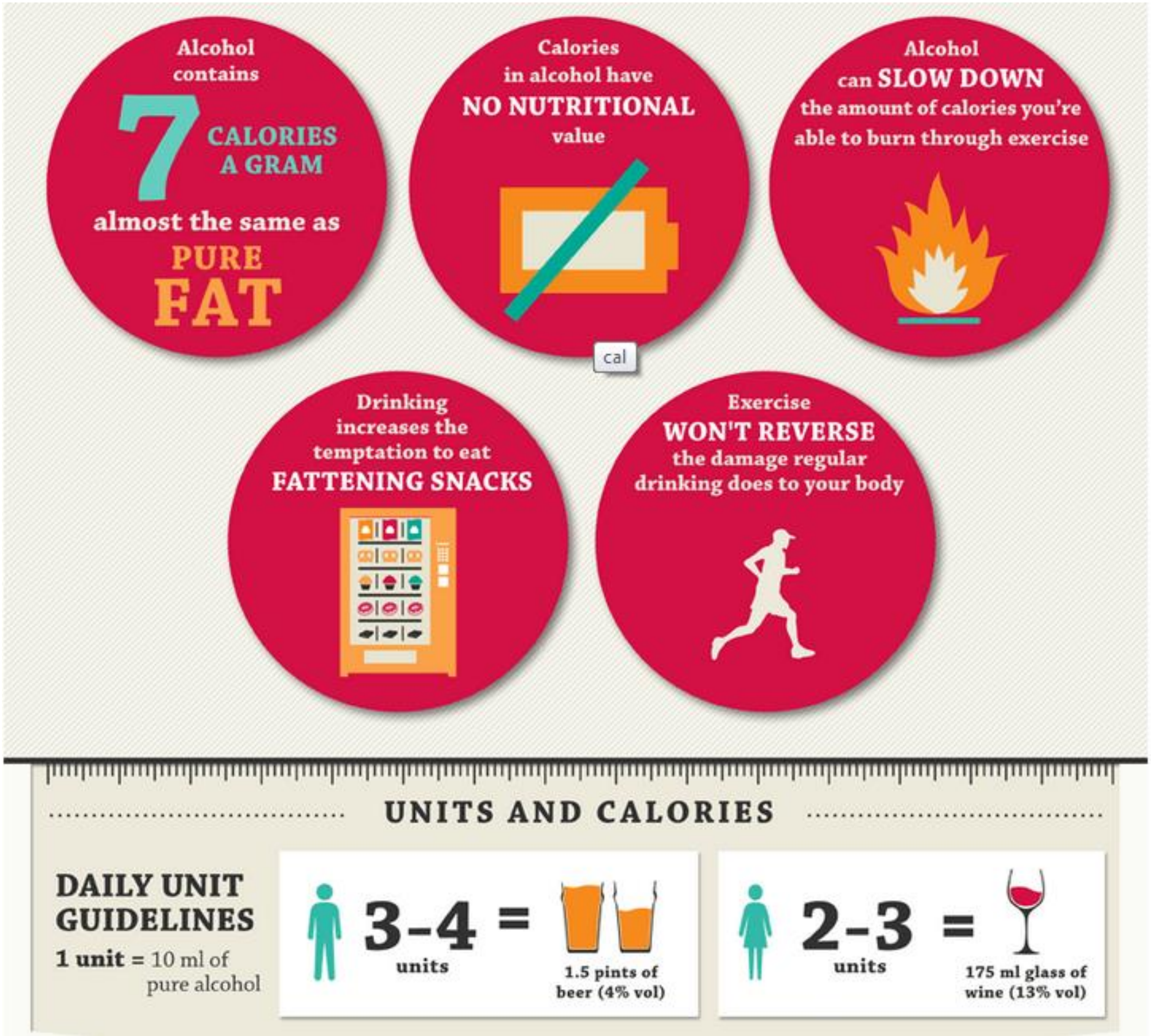
Conventional wisdom says that since a calorie is a calorie, regardless of its source, the best advice for weight control is simply to eat less and exercise more. Yet emerging research suggests that some foods and eating patterns may make it easier to keep calories in check, while others may make people more likely to overeat.

Where do you stand weight wise?

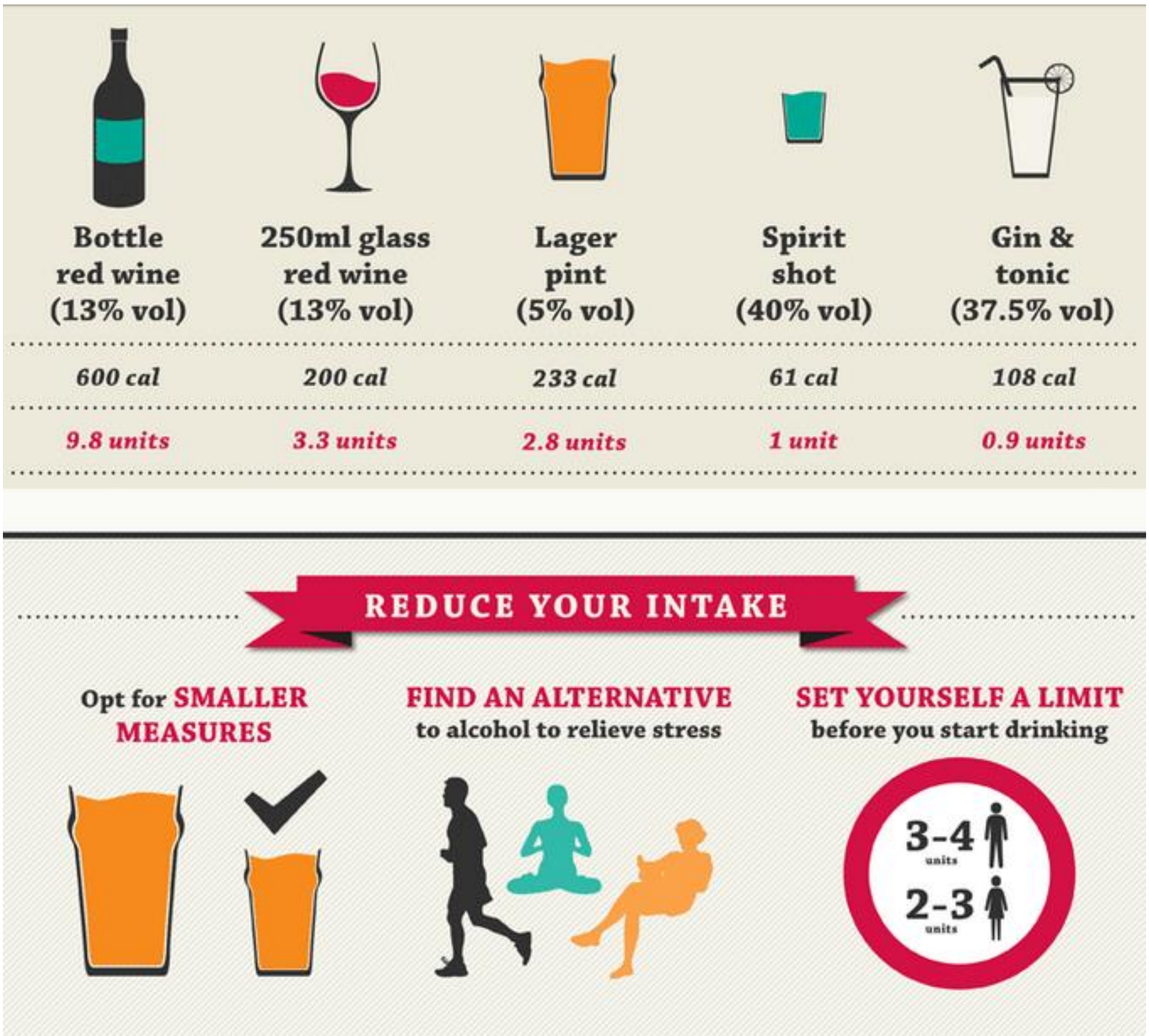
Appendix 29: Materials used in the study described in chapter 10



Appendix 30: Materials used in the study described in chapter 10



Appendix 31: Materials used in the study described in chapter 10



Appendix 32: Materials used in the study described in chapter 10

Vending machines full of sugary fatty salty snacks are OUT OF ORDER.

If you feel you need snacks between lectures, or studying in the library, stay away from the vending machines. You can print out a sheet with the words **OUT OF ORDER**, very large, and stick it on the vending machine (don't do any damage)

Identify external cues to snacking

If we can see food, it's human nature to want to eat it. Keep snacks hidden away so you're not tempted. Avoid, or cover up, advertisements for snacks. (as long as no criminal damage is done!)

Say "No thank you" politely

Don't give in to pressure to eat extra. Practice in front of a mirror!

Only ever eat with a knife, fork or spoon

Top tip!. Just don't eat with your fingers, if you want to avoid extra calories.

Use small packets and small bowls

If you are still going to eat them, don't eat straight out of a big packet of nibbles (it makes us eat up to ¼ more without even realising it). Instead, put nibbly things in a small bowl.

Watch-out for TV or computer snacking

Eating distractedly e.g. in front of a screen, makes us eat more without noticing or even enjoying it. Food deserves more respect. Eat off a table.

Start your day with a good breakfast

If you have a proper breakfast in the morning - say porridge - you will not need to snack before lunch.

Plan in advance

If you know you are going to miss a meal, take a sensible snack, rather than buying whatever is available. A 300 kcal sandwich is fine, but you can't get one everywhere, and home-made is cheaper.

Appendix 33: Materials used in the study described in chapter 10

The UK has become a nation of foodies, with increasingly sophisticated tastes and an appetite for world cuisines.

The UK eats the most ready meals in Europe.

Pizza, pasta, oven chips are all quickly re-heated and with no mess.

Supermarkets and convenience stores display a dazzling range – the more exotic the better. One quarter of chilled meals is Indian, and nearly one in five is Chinese'. Only 18% of sales are for traditional British food.

Why do ready meals seduce us?

Convenience certainly; people commonly say they are too busy; they don't have enough time to cook.

Some people would say that the main problem is that the average British person has no talent for cooking; our passion for ready meals is all a disguise of our basic incompetence and confusion in the kitchen.

Some people would also say that ready meals might help them with losing weight.

Appendix 34: Materials used in the study described in chapter 10

Appendix 35: Materials used in the study described in chapter 10

Appendix 36: Materials used in the study described in chapter 10

Appendix 37: Materials used in the study described in chapter 10

Topic outline

"**Toxic**" - a word often used to describe the 21st century 'food environment'. Most food itself is usually safe to eat, but it is very easy to choose an unhealthful balance, or unethically produced foods which compomise human values and earth sustainability.

What makes up our 21st food environment is vast and varied, ranging from EU agricultural and communication policy, and industry decisions for the global market, to very local issues like catering contracts and permits for chip vans.

Who is making the decisions that ultimately define what you eat?

Does that matter to you?

Are you an ethical consumer?

The **Greek Goddess Demetra (http://en.wikipedia.org/wiki/Demeter)** is here to help you discover the secrets behind food policies, agriculture, politics of food.

That's her chariot, flying above Athens en route to Glasgow!

Appendix 38: Materials used in the study described in chapter 10

It is said that in Scotland, there are more sheep than people.

There are indeed, 1 million more sheep than people in Scotland.

But why does Scotland need all these sheep?

Appendix 39: Materials used in the study described in chapter 10

Once upon a time, Christmas was a mid-winter celebration, to call for longer days again.

Families got together, exchanged (cheap) token gifts, and hair was let down during a period with limited light, food and fun.

Santa was dressed in green, to symbolise the green fuse of life. Stockings contained a walnut and a tangerine, Christmas cake or pudding contained beans as tokens of dormant life ('Favours', in cakes, from *fava*, latin for a bean)

Now, all is red and sparkling. **We have come to believe that without spending, meaningless- gift-giving, excessive drinking and eating, it's not Christmas.**

Supermarkets launched Christmas campaigns in November in attempts to target our emotions and make us buy more...**using marketing lines which people are comfortable with because they resonate with folk-sayings:**

"A little of what you fancy will do you no harm"
"All things are all right in moderation"
"Temptation is there for a good reason"
"Time to cast caution to the wind"
"Just this once..."

Coca-Cola has one of the most successful Christmas campaigns, worldwide.

It is not Christmas until the Coca Cola advert starts!

Coca-Cola launched this campaign back in 1930s to increase winter sales when weather was cold.

No joke, the fat, jolly guy with the red suit and cap and rosy cheeks - is the spawn of an advertising campaign by Coca-Cola.

Before then, and still in some less Coca-Colanised countries like Sweden Santa is dressed in Green.

Coca Cola if not solely responsible was heavily instrumental in switching Green Santa to RED. People should have seen RED and STOPPED.

Appendix 40: Materials used in the study described in chapter 10

We've all gone through the annual panic to stock up with food and fuel for Christmas (hopefully successfully) and realised that the world is not ending and Christmas is not all about spending.

Did you resist Santa's demand that you over consume and to buy more and more food and everything?

Food is a good example of marketing encouraging over consumption.

Many people **DID** resist and supermarkets are now faced with left-over foods.

What do you think supermarkets do with all the unsold Christmas puddings and Christmas-themed chocolates?

Appendix 41: Materials used in the study described in chapter 10

There are some interesting snack-tricks.

Commercial snacks often can contain a lot of salt, which makes you thirsty. Thirsty people then take in extra calories from sugary drinks or alcohol..... No mystery then that Pepsico now owns Walkers crisps!

Commercial snacks encourage addictive eating or grazing patterns. You may recognize how their marketing promotes external 'cues' to snacking, like meeting friends, having coffee, finishing lectures.

Coca-cola.....?

Kellogg's, world's biggest cereal-maker recently announced that its recent acquisition of the snack 'Pringles' was enough to boost its net income and sales by 15%. Kellogg's appetite for salty snacks is helping fatten its profits!

Appendix 42: Materials used in the study described in chapter 10

Vending machines provide an easy option to grab a snack and increase both intended and impulse purchases.

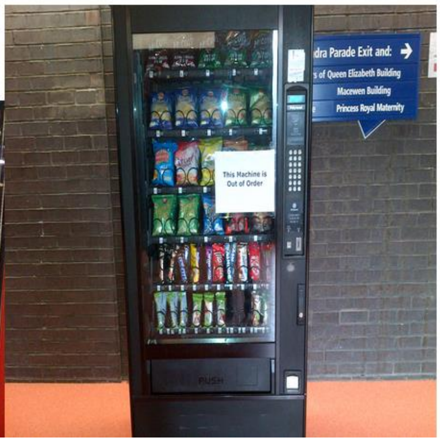
Companies **make huge profits**from selling largely unnecessary snacks in vending machines. They may offer snacks that are minor variations of known brand names, the remains of failed product launches that no one should ever eat.

In order to have a long 'shelf-life' snacks in vending machines are dehydrated, and high in fat and sugar. Ingredients are often of low quality and of unknown origin. Only two days ago during a routine check, horse-meat was found in beef-burgers!

Snacks in vending machines are more expensive, and seldom lead to a healthful nutritionally balanced diet.

Next time, you pass by a vending machine, pass it by! Ask yourself whether you really want what you are offered to contribute to the big food companies' extra profits.

Better still, print **OUT OF ORDER** on a pile of A4 sheets, and stick them across vending machines (but don't damage the machine). That way you will be helping other people with weight problems.



Appendix 43: Materials used in the study described in chapter 10

Supermarkets:

Can better afford to open their stores for more hours than small local shops

Dominate the supply chain and squeeze suppliers on prices in order to be able to offer "bargains" to their customers

Use their massive profit margins to permit under-pricing of popular products as 'loss-leaders' to attract more custom

Thus commonly force small independent businesses to close

All this comes at a cost.

The recent "horse meat" scandal is a good example of this practice. Suppliers were under pressure to provide ever-cheaper meals to supermarkets. It became increasingly difficult for them to survive or make a profit. So some decided to slip in cheap horse meat at a price of only 2 Euros per kg, compared to the 6-8 Euros per kg for beef. Others slipped pig and turkey – presumably cuts that could not be sold as pork or turkey.

Everybody seemed happy for a while as customers were ignorant and deceived.

Suppliers managed to reduce the production cost and make good profits.

Supermarkets increased their profit margin too.

Appendix 44: Materials used in the study described in chapter 10

When a ready meal might have more than fifty ingredients that means that potentially there are 50 chances for something to go wrong.

Can any food testing system, however robust, possibly check the source, safety and quality of 50 plus ingredients in thousands of food products with 100 per cent confidence?

The EU only recommends, and does not insist, that companies be able to trace the movement of batches of ingredients within their factories.

The recent scandal about the DNA-identified horse material in beef products is the proof that sometimes things can go seriously wrong.

The beef lasagne by Findus at the special price of £1.29 would seem like a good bargain. However at this price, consumers got horse lasagne instead of beef.

Is there something wrong with eating horse?

In principle no, but the DNA-identified horse material may be meat or other bits of horse. And because it is put in to make extra money illegally it might easily come from old, diseased horses. And perhaps they have put in other dead animals too? Nobody has yet checked for camel, or dog, or rat... The profit margin is so low that even major supermarket suppliers have turned a blind eye to fraud and illegal practices.

The "horse meat" scandal is a big fraud of around 300,000 Euros at the expense of consumers' health.

Appendix 45: Materials used in the study described in chapter 10

The Olympic Games began over 2,700 years ago in Olympia, in southwest Greece. The Games were part of a religious festival. The Greek Olympics, thought to have begun in 776 BC, inspired the modern Olympic Games (begun in 1896) The Games were held in honour of Zeus, king of the gods, and were staged every four years at Olympia, a valley near a city called Elis. People from all over the Greek world came to watch and take part. Olympic Games were a symbol of peace and a sense of fair play. The athletes' award was a olive wreath.

A few months ago, London hosted the Olympic Games.

The Games should have encouraged physical activity, promoted healthy living, and inspired the next generation to exercise.

However, marring this healthy vision has been the choice of junk food and drink giants—McDonald's, Coca-Cola, and Cadbury's—as major sponsors of the event.

Should soda and fast-food companies be sponsoring the Olympics?

Is this the message we want sent to kids?

The UK's Academy of Medical Royal Colleges has said that the presence of McDonald's and Coca-Cola at the 2012 Games sends out the wrong message to children.

Appendix 46: Materials used in the study described in chapter 10

Who has never eaten at a fast food restaurant?

For convenience, pleasure or forced by circumstances, everyone has eaten at a fast food restaurant. But how many have even heard of a Slow Food Restaurant?

Fast food is a modern term given to food or meals that can be served very quickly.
But fast food existed since antiquity. Romans had stalls called popinas where they sold bread soaked in wine and vegetables. All through the Middle Ages, cities like London and Paris supported stalls selling pies, flans, pastries, pancakes and precooked meats. The Forfar Bridie, Cornish Pasty, and pizza all started life as portable fast foods.

Nowadays, when we refer to a fast food meal, we mostly mean burgers&fries, pizzas, fish suppers - and chips.

So what is wrong with Fast Food?
Fast foods are for people on the move, where eating is crammed in between other activities. For hurried, distracted, consumers the concepts of food quality are different from those of conventional meals.
The pursuit of low prices with high profits have resulted in many fast foods being made from very cheap materials, but modern marketing methods have portrayed them as desirable.

There are therefore nutritional issues. Western commercial fast food is commonly calorie-dense, heavily flavoured with salt and sugar, and lacking important nutrients). But there are shining examples of nutritionally excellent fast foods - the Japanese sushi was originally sold in railway stations for workers on the move. It still is, and it provides very good nutrition at a low price.

Commercial Fast Food chains like McDonalds, KFC, Pizza Hut are considered "bad globalisation" as a threat against national and local cultural values. And they drain local economies, often driving local food companies out of business.

The Slow Food movement was set up by Carlo Petrini, in protest against a McDonald's opening in Rome's Piazza di Spagna. Such local efforts against Fast Foods are celebrated but few. Jose Bove, defending French foods and French catering, famously dismantled a new McDonalds in France. Recently, Prada won a case to get a McDonalds restaurant evicted from Milan's famous Galleria Vittorio Emanuele II. The citizens a small city of Greece managed to close down a new McDonalds restaurant by simply not going there. Fast foods outlet commonly ignore planning regulations by erecting enormous and grotesque advertising signs: the people of Forfar complained to the planning authorities, and their new McDonalds was obliged to reduce its huge M sign.

Appendix 47: Materials used in the study described in chapter 10

The Slow Food movement celebrates local and cultural values in foods and food preparation. It promote enjoying carefully and individually prepared food in a relaxed way. Eating becomes real pleasure.

Fast Food restaurants give little back to the local community. Ingredients are supplied centrally, not grown locally. Staff are often temporary and poorly paid. Their profits disappear to fat cats overseas. By insisting on a very narrow range of ingredients and high-volume food sources, the nutritional profiles of Fast Food meals are restricted. They fail to provide well for the nutrient needs of humans, and long-term health is impaired. This week a massive European study has confirmed what nutritional scientists have been saying for decades: eating processed meat products has a major effect to increase cancers, diabetes and heart disease

Slow Food support local food producers and local economies by using regional varieties, and seasonal perishable ingredients which are not supported by supermarkets. Their wider variety of foods and ingredients naturally leads to a better nutritional profile, satisfying more of the nutrient needs of humans, and thus they promote better long-term health for consumers.

The choice is yours: Fast or Slow Food?

Appendix 48: Materials used in the study described in chapter 10

Marketing is an integral part of food promotion.

It is the chain of activities that brings food from "farm gate to plate" and aims to increase sales.

The food industry spends millions to attract customers through various marketing techniques which are indeed very successful.

About a month ago, an outlet of the famous Krispy Krème doughnut opened in Edinburgh. It was the first store of the chain to open in Scotland.

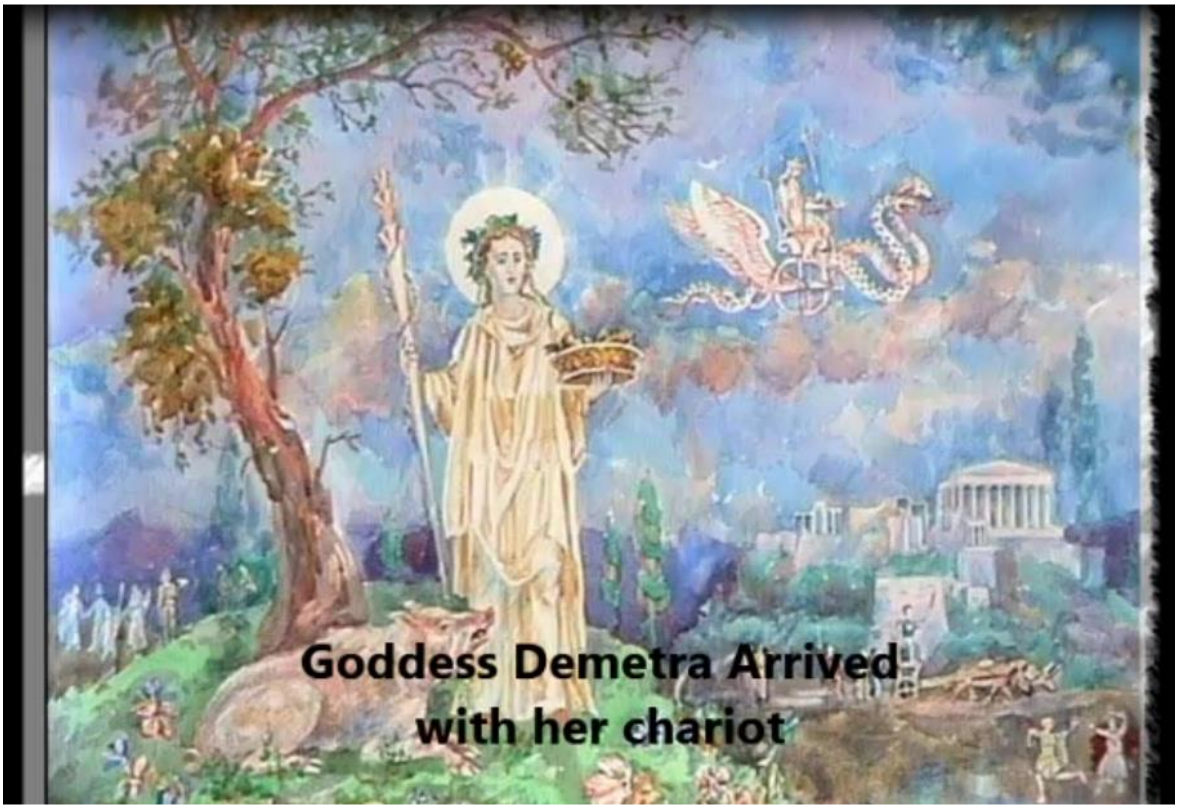
The opening of the store caused a traffic chaos and people camped outside the store overnight to get a box of doughnuts.

Would you wait in a queue for up to 7 hours in order to get a doughnut?

What is so special about these doughnuts? They look great, don't they?

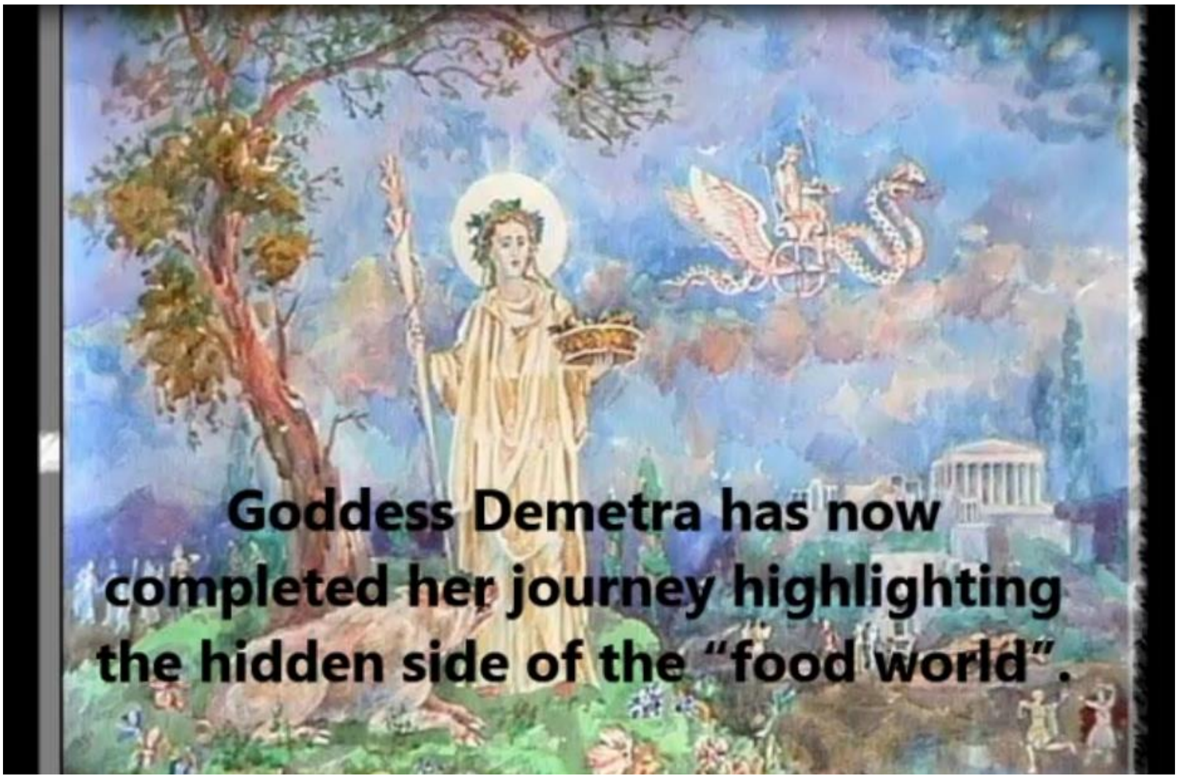
Appendix 49: Materials used in the study described in chapter 10

Appendix 50: Materials used in the study described in chapter 10



Appendix 51: Materials used in the study described in chapter 10

Appendix 52: Materials used in the study described in chapter 10



Appendix 53: Materials used in the study described in chapter 10

Appendix 54:

Weight and lifestyle changes in first year students in Scotland: the heal pilot study

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Introduction: The 'Freshman15' phenomenon (15 pounds weight-gain in first-year undergraduates) has been described in US (Crombie *et al*.2009) but data from elsewhere are limited. We aimed to (i) evaluate methodologies (ii) document reported weight/lifestyle changes in first-year full-time students' in Scotland.

Methods: A questionnaire was devised, covering weight-changes, eating and lifestyle habits. In three higher-education institutions. All the students, towards the end of first undergraduate year, were emailed the online questionnaire. Students were also handed questionnaires personally, and in one institute posted a prepaid envelope for questionnaire return.

Results: Final response rates were: 30.3% (19.1% through email and 11.2% through post recruitment), 4.2% (2.9% through email and 1.3% through in person recruitment) and 36% (only email recruitment) for each institution. A total of 219 students participated, mean age-21.4 SD-6.6 years, BMI-22.5 SD-3.9 kg/m^2. Most (71.7%) reported adverse changes in eating habits: more snacks, ready-meals and alcohol and less fruit and vegetables. Weight increases over 9 months of first-year were reported by 28.1%: 0.5–2 kg (12.1%), 2–3.5 kg (10%), 3–5.5 kg (3%), > 5 kg (3%). Many (37%) would welcome advice on improving diet and physical activity and weight-control.

Conclusion: The highest response rates were achieved when email recruitment was used in all three institutions. Entering higher education commonly involves poor diet and rapid weight-gain, but a valuable proportion of students appear potentially receptive to initiatives for healthy lifestyles and to prevent weight gain.

Reference: Crombie *et al.* Nutr Rev. 2009;67:83–94

Conflict of interest: None disclosed.
Funding: No funding.

Nikolaou CK, Lean MEJ, Hankey CR (2011) Weight and lifestyle changes in first year students in Scotland. The HEAL pilot study. Obes Rev; 12: S1

Appendix 55:

WEIGHT AND LIFESTYLE CHANGES IN FIRST-YEAR UNDERGRADUATE STUDENTS IN RURAL AND URBAN SITES IN SCOTLAND

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Rationale: Weight gain in first-year undergraduate students has been documented in USA (Crombie et al. 2009). This study aimed to (i) explore if Scottish students experience similar changes, (ii) compare students attending rural and urban university sites.

Methods: A 29-item questionnaire on lifestyle habits and weight was devised. Participants were recruited in person in the rural, and through email in the urban site. Weights and heights were measured in the rural and self-reported in the urban site. A subset of the rural-site participants self-reported weights and heights and a subset of the urban site participants had weights and heights measured to assess bias between methods.

Results: 69 urban students (median age: 18.9 years) and 72 rural students (median age: 18.4 years) provided data at both the start and end of their first academic year. There was no detected change in mean self-reported urban site weights (baseline: 65.5 SD 10.9 kg, end: 66.0 SD 11.2 kg, $p = 0.94$) or BMI (baseline: 22.6 SD 3.3 kg/m^2, end: 22.7 SD 3.8 kg/m^2, $p = 0.40$) but an increase in measured rural site weights (baseline: 66.3 SD 13.0 kg, end: 68.0 SD 14.2 kg, $p < 0.0001$) and BMI (baseline: 23.0 SD 4.0 kg/m^2, end: 24.0 SD 4.8 kg/m^2, $p < 0.0001$). For 24 students assessed by both methods, there was a strong correlation between self-reported and measured weight ($r = 0.996$, $p < 0.0001$) and height ($r = 0.996$, $p < 0.0001$). Bland–Altman analysis indicated a strong level of agreement between methods in both sites.

Conclusion: First year undergraduate Scottish students experience some weight increase using measured data in a rural site, but self-reported data did not reveal any difference in an urban site. The apparent disparity is not the result of bias between methods. Specific weight-gain prevention strategies may be justified in these settings.

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Disclosure of Interest: None Declared.

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Appendix 56:

Calorie labelling of meals in a university catered hall; opinions of students and reported effects on meal choice

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Weight gain in young adulthood often persists across the life-course, favouring the development of obesity and overweight. Calorie labelling in catering outlets has been used in various commercial and geographic settings, such as New York City, in an attempt to tackle the obesity epidemic. Providing information on calorific values on prepared meals at the point of choice may guide students to consume fewer calories and assist in preventing unintentional weight gain. The aim of this study was to explore whether labelling meals can influence students' meal choices and calorie consumption for meals served at an institutional catering setting. The energy content of the usual menu of a catered student hall of residence where 2 meals daily were provided on weekdays, and 1 breakfast/lunch on weekend days was analysed using with nutritional analysis software (WinDiets, 2010) according to Department of Health Guidelines[1]. Calorie-range for each course was; starters 18–462 kcal, main course 206–952 kcal and for desserts 169–682 kcal. Calorie-range for a three-course meal was 393–2096 kcal. Calories for each menu choice for evening meals provided were posted daily at the point of service throughout the 5 week menu cycle. After the 5 week period students resident in the hall were emailed an evaluation questionnaire seeking their views on and use of calorie posting. Responses were collected anonymously on a commercial website. 42 students completed the evaluation questionnaire at the end of the calorie posting period, a response rate of 35%. Mean age of the participants was 19.7 SD 2.2 years old, mean self-reported body weight 67 SD 11.8 kg, mean self-reported height 172.5 SD 9.9 cm and mean BMI 22.4 SD 3 kg/m^2. All participants reported noticing the calorie labels by the meals and 71% of them reported using the labels when choosing their meals. Participants reported the calorie values were of value to allow them to eat healthier and control their body weight. A majority (52%) of participants would welcome additional nutritional information such as macronutrient content, such as protein and fat values. Within this study design it was not possible to measure any change in calorie content of meals chosen and consumed by the students. Regularly eating out or consuming prepared meals is part of everyday life. Students appeared to value calorific information and further studies to estimate an effect on meal choice are justified.

1. Department of Health (2011) http://www.wp.dh.gov.uk/responsibilitydeal/files/2012/01/Technical-Guidance-on-Voluntary-Calorie-Labelling-for-Catering-Businesses.pdf (accessed 10/01/2013).

Nikolaou CK, Lean MEJ, Hankey CR (2013) Calorie labelling of meals in a university catered hall; opinions of students and reported effects on meal choice. Proc Nutr Soc 72, E105

Appendix 57:

Sleep duration and BMI in young adults

Charoula-Konstantia Nikolaou

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Background

Epidemiological evidence suggests a link between shorter sleep duration and obesity (Marshall et al, 2008). We examined this association in university students, who are susceptible to weight gain and whose lifestyle patterns vary widely.

Methods

A cross-sectional survey was conducted in 2012/2013 among the 18,170 students attending a Scottish university. Self-reported data on sleep duration on weekdays and weekends, weight and height were collected using an on-line questionnaire of 25 questions. Linear regression (SPSS 19) was used to investigate associations between sleep duration and BMI.

Results

5,226 students (62% female, 38% male) participated by returning the questionnaire. The response rate was 28.8%. Mean age of participants was 21.7 (SD2.8) years, weight 66.7 (SD16) kg, BMI 22.5 (SD4.8) kg/m2, sleeping times weekdays:8.2 (SD1.4) hours, weekends: 9 (SD3.8) hours. Using all subjects, there was no association between sleeping times and BMI even after adjusting for age and gender. However, among participants with BMI over 25 kg/m2 (593 = overweight, 223 = obese), there was a significant association between sleeping time, BMI, and body weight. BMI was greater by 0.09 kg/m2 ($p = 0.03$), and weight by 0.3 kg ($p = 0.02$), for each decrement of 14 minutes in sleeping time.

Conclusions

Young adults do not report a consistent association between reported sleeping time and BMI, but there is some suggestion of a weak inverse association among those who are overweight and obese.

Key messages

- There is a weak inverse association between sleeping times and BMI for those who are overweight or obese.
- Strategies to prevent the onset of obesity in young adults may benefit from including sleep in their agenda.

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