THE IMPACT OF CALORIE LABELING ON CALORIE CONSUMPTION IN EUROPE AND THE CARIBBEAN

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MAY 2, 2022

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Master Thesis Behavioural Economics

Acknowledgements

I would like to thank the following people for their support, without whose help this work would never have been possible.

Foremost, I express my sincere gratitude to my research supervisor, Prof. Dr. Kirsten Rohde for her mentorship towards the completion of this thesis. Her advice and guidance elevated this thesis to a more professional level.

I would also like to thank the respondents for participating in my online experiment. Without their participation and input, my master thesis would not have been possible.

Lastly, I am indebted to my father, my mother, my girlfriend, my brother and his girlfriend for providing me with unfailing support, continuous encouragement and who helped me balance it all. This accomplishment would not have been possible without them.

Abstract

Obesity is a global public health issue with millions of sufferers and the rates continue to grow. Obesity and diseases associated with this condition kill millions of people all over the world every year and has also financial and social consequences. Developing regions within the Caribbean have a higher rate of obesity than the developed regions within Europe. Various methods to counteract the growth of obesity have been tested with a variety of effects on calorie intake. This study investigated whether calorie labeling and calorie labeling along with additional dietary information could decrease calorie intake and have an influence on being overweight or obese. Testing the effectiveness of calorie labeling was achieved using Food Choice Scenarios in which subjects had to make a meal choice in a given situation. Furthermore, the effectiveness of calorie labeling and calorie labeling with additional dietary information between different regions was also tested. Subjects were divided into three groups: The control group in which no method of calorie reduction was implemented on food, Treatment group 1 in which calorie labeling was implemented on the Food Choice Scenarios and Treatment group 2 in which calorie labeling with additional dietary information was implemented on the Food Choice Scenarios. Analysis from the survey data indicated that there was no difference in the number of calories consumed in the experiment between Europeans and Caribbean people (H1). Moreover, the data also showed that there was no difference for certain food choice aspects such as taste, healthiness of a meal, packaging or convenience. Lastly the research found no evidence that neither of the treatments had any effect on the number of calories consumed (H2 and H3).

Keywords: Overweight and Obesity, Calorie Labeling, Food Choice, Food Choice Aspects, Consumption, Number of Calories

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1. Introduction

Obesity is an increasing global public health issue and has nearly tripled since 1975 (WHO, 2020). According to the report of the World Health Organization (WHO) 39% and 13% of adults aged 18 years and over were overweight and obese in 2016.

Most of the world's population live in countries where overweight and obesity kills more people than underweight (WHO, 2020). It is also estimated that by the year 2030 3.3 billion (57.8%) of the adult population worldwide might be overweight or obese and with higher rates in developing countries than in developed countries (WHO, 2020).

The increase of obesity is caused by an increase in intake of energy-dense foods that are high in fat and sugars. Decreased physical activity due to the sedentary nature of modern life also affects the obesity rate (WHO, 2020). Another cause of obesity can be linked to genetic components that are linked to increased weight gain and obesity (Wang & Brownell, 2005). Another factor that can influence the growing rates of being overweight or obese is culture. People from different cultural backgrounds eat different foods and these preferences result in patterns of food choices (Marcone, Madan, & Grodzinski, 2020).

The growing rates of individuals being overweight is of concern due to the consequences that being overweight or obese can carry. These can be both health consequences and financial consequences. These consequences can burden the individual that is overweight or obese. The most common consequences of being obese or having a higher BMI is the increased risk of cardiovascular diseases such as coronary heart disease, heart failure and hypertension as well as a higher risk of developing certain cancers (Finer, 2015) (Hruby, et al., 2016). Being overweight or obese is the leading cause of preventable death in the world. All over the world around 2.8 million people die due to being overweight or obese or conditions that are caused by these diseases (WHO, 2020). Being overweight or obese can also have a significant effect on the psychological wellbeing of adults who are more likely to experience depressive symptoms (Lin & Li, 2021).

The increasing prevalence of being overweight and obese requires initiatives and policies aimed at fighting it to reduce the growth of this epidemic (Teixeira, et al., 2015). Weight loss has shown a significant outcome in reducing health risks related to overweight and obesity (Elmer, et al., 2006). However, for overweight and obese people to be able to participate in weight management programs, the awareness of weight related health risks is

important. This awareness is strongly associated with attempting to lose weight and developing healthy behavior (Lemon, Rosal, Zapka, Borg, & Andersen, 2009). To successfully create awareness all concerned parties: consumers, the government and food distributors must cooperate to find a solution. Consumers can adjust their eating habits and monitor their calorie intake to better control their weight and remain at a healthy weight. The government can create programs and legislation that limits the consumption of unhealthy meal choices and implement programs to encourage a healthier lifestyle. Food distributors can create healthier versions of their product or inform the consumers of the contents and risks of the products.

A method to increase awareness of people is the use of calorie labeling or menu labeling. Calorie labeling or menu labeling is a practice in which restaurants offer nutritional information to customers. This is to reduce the consumption of fast food at the point where it is being purchased (Elbel, Kersh, Brescoll, & Dixon, 2009). The additional nutritional information is meant to discourage the choice to consume certain meals based on the given information. Several countries have started using calorie labeling on food products and some have made calorie labeling mandatory. Several fast food corporations have the nutrition and caloric information of their products online. Providing the information online allows customers to see the information and allows customers to make a more conscious decision of their meals. Calorie labeling holds promise as an obesity prevention program.

Remarkably, consumers are not aware that nutritional information is available on restaurants' websites or in restaurants and just a very small percentage actively seeks out this information. Consumers often are also not aware of calories in items purchased from fast food restaurants (Kiszko, 2014).

To reduce obesity, it is therefore important and necessary to use calorie labels at the point of purchase as a source of information for consumers. It is also relevant to notify consumers, in conjunction with calorie labels, about the dietary or nutritional value of the food, because it helps them to make informed decisions about the foods they consume.

It is important to test possible obesity prevention methods and methods to adjust eating behavior of overweight and obese people and contribute to the research of obesity solutions and prevention to reduce obesity as an increasing, global public health issue.

Changing the behavior of consumers is complicated as forcefully changing the behavior is extremely hard to manage. However, consumer behavior can be changed by

slightly influencing their behavior by using calorie labeling or menu labeling. Therefore, this study is conducted to research and assess the effectiveness of the calorie labeling method to influence consumer's behavior. Furthermore, it would be interesting and insightful to make comparisons between the developing Caribbean region and the developed European region.

1.2 Research Question

This thesis will be investigating whether calorie labeling along with informing individuals their daily calorie intake can increase the effectiveness of calorie labeling. Therefore, the following research questions will be answered:

1   What is calorie labeling and what are the effects of calorie labeling on consumption of higher calorie foods?

2   Can calorie labeling along with dietary information have more of an effect on the consumption of fast food than normal calorie labeling?

3   What is the effectiveness of calorie labeling on individuals between 18 and 27 years of the developing Caribbean region and the developed European region?

1.3 Research Objective

The study aims to research and assess the effectiveness of the calorie labeling method to reduce the number of calories consumed.

The calorie reduction effectiveness of calorie labeling will be tested in two forms. The tests will be done through an online survey that will include hypothetical food choices. The hypothetical Food Choice Scenarios are hypothetical situations where participants are meant to make a choice of what meal they will eat. The participants will receive a link and they will be randomly assigned into two groups: one treatment group with two different assignments and one control group.

In the treatment group the following interventions will be used in the hypothetical food choices to test the effectiveness of calorie labeling:

1.   Treatment 1: Direct calorie labeling will be done by directly adding the number of calories that will be consumed with any meal.

2. Treatment 2: Daily calorie intake information and calorie labeling. Participants will receive the daily caloric intake on a daily basis to maintain or lose weight as well as the same information as the direct calorie labeling.

1.4 Scientific relevance

The scientific relevance of this research is that there will be added literature on the effectiveness of calorie labeling and variations of calorie labeling. Furthermore, the impact of culture on the effectiveness of calorie labeling will also be investigated. There is little to no research on the impact of calorie labeling on the Caribbean population and this research will add to this body of knowledge.

2. Literature review

This chapter gives a brief account of theoretical and empirical reviews about causes and consequences of overweight and obesity. Other parts covered are health and social consequences of being overweight and obesity, food choices and culture and prevention programs.

2.1 Causes of overweight and obesity

The causes of weight gain are when energy intake is higher than the energy expenditure (Wyatt, Winters, & Dubbert, 2006).The main method for the intake of energy is by eating. We expend energy through the normal function of the metabolism or by doing activities that expend any extra energy such as exercises or any physical activity. The main method of calorie intake is by eating food and drinking. Overeating of the calories that are needed to function can lead to an increase in the calorie balance and lead to weight gain. There are various causes for obesity, overeating is among the leading causes. The causes of overeating vary for each person and there are ways to prevent this.

Besides increased energy expenditure another option to lose weight is to decrease the amount of energy that is consumed (Swift, Johannsen, Lavie, Earnest, & Church, 2014). The best option to decrease the amount of energy that is taken into the body is by lowering the number of calories that are taken in. Calories that are taken in are transformed into energy for the body to function properly. The amount of energy that is needed varies from person to person due to their Basal Metabolic Rate. "The BMR can be affected by age, lifestyle and size. The average number of calories that needs to be consumed by the average man is 2.500 calories and 2.000 calories for the average woman" (NHS, 2019). Calories can also be avoided by eating foods that contain less calories per serving and less sugars. Fast food is a difficult issue because it can contain more calories than an average meal.

2.1.1 Emotional and genetic causes for obesity

From a meta-analysis of multiple studies discussing the relationship between obesity and depression, it was determined that there was a bidirectional relationship between obesity and depression (Luppino, et al., 2010). Emotional eating can be an unhealthy coping

mechanism that increases the likelihood of obesity. Emotions and stress are causes for overeating and lead to weight gain if not balanced with a healthier lifestyle.

Social relationships and networks have also been observed to increase the likelihood of becoming obese. Spousal and familial relationships have been found to increase the probability of becoming obese if one of the individuals had previously become obese (Christakis & Fowler, 2007). Creating an environment that encourages a healthy lifestyle with healthy food options could be a vital part of obesity prevention. Social causes of obesity show that tackling the problem on a personal level might not have the desired effect and thus the change needs to happen on a national level to achieve the desired effect.

There are also genetic factors that increase the likelihood of retaining weight and environmental components that affect how these genes can present themselves. The genetic factors with the environmental factors, such as less access to places to exercise, proximity to fast food restaurants and the level of urbanization, can play a large role in the development of obesity (Thaker, 2017). With the knowledge that the environment coupled with the genetic factors can affect weight is essential for prevention of obesity. Genetic factors that impact weight are predetermined genetics that are determined through DNA and cannot be altered. However, the impact of genetic factors for increased weight gain can be mitigated by being in an environment where the issue is less likely to be exacerbated.

2.2 Health, Social and economic consequences of overweight and obesity

Individuals suffering from overweight and obesity have various health, social and economic consequences that affect many aspects of their life. The consequences of obesity vary per person and also vary with the severity of the obesity.

2.2.1 Health consequences

The health consequences of being overweight or obese is that the rate of many diseases increases the likelihood of cardiovascular disease (Finer, 2015) (Hruby, et al., 2016) and certain types of cancers (Amarya, Singh, & Sabharwal, 2014). The result of developing these types of diseases is that the life expectancy could be lowered and that their medical cost could increase based on the medication and medical care that they must pay for to remain healthy. Many diseases have an increased risk of being developed due to a consumption of

unhealthy foods and being overweight. Diabetes and many coronary diseases are associated with increased weight and the consumption of unhealthy foods (Weschenfelder, Bentley, & Himmerich, 2018). All these diseases associated with obesity can negatively impact those who suffer from these conditions. The amount of conditions that can be associated with increased weight can increase medical cost and the costs to manage all conditions that are associated with weight problems.

2.2.2 Social consequences

According to Must and Strauss (1999), "studies of children as young as six years of age suggest that overweight individuals are most likely to be described as lazy, lying, cheating, sloppy, dirty, ugly and stupid." This type of behavior towards obese people can have long term psychological effects. Bullying victimization can also be a major issue that can affect obese or overweight individuals (Griffiths, Wolke, Page, & Horwood, 2006). The stereotypes are often reinforced in popular media especially in movies where the "obese" character is portrayed as a stereotypical version of obese people. The characterization of fat in the media is an issue prevalent in all age groups and can lead to bullying and further stereotyping of overweight and obese individuals.

Obesity has also been significantly linked with depression (De Wit, et al., 2010). The social aspects of obesity have an effect on the mental health of the person suffering from obesity as well as the relationship between them and their relationships. The stigma towards obese and overweight people can lead to mental health problems because of the negativity surrounding them being overweight or obese.

2.2.3 Financial consequences

The medical conditions that are associated with increased weight can cause those that suffer from obesity to have to pay more for their lives or quality of life. Some people suffering from obesity cannot perform their daily activities and need to hire people to help them with these tasks (Uzogara, 2017).
Paying for the treatments of the various diseases can have an impact on the finances of those suffering from obesity. All the extra medication will also have an impact on the

finances of obesity sufferers (Tsai, Williamson, & Glick, 2011). Even though the cost related to buying medicine and medication varies per country.

Although, some financial consequences are not directly related to the medical conditions caused by obesity. Multiple studies have found that obese individuals have a higher rate of absenteeism than individuals with a normal body type (Cawley, 2011). The amount of missed workdays account for a portion of missing wages and obese individuals could have lower wages due to increased absenteeism.

2.3 Food choice and culture

Food choice is a complex decision made by individuals every single day and there are various factors that determine the choice made. Factors such as availability, hedonic likes and the internal state of the person play a major role in the food choice process (Mela, 2001). Culture can also be one of the factors that influence the choice of consumers (Franchi, 2012). Eating and nutrition are shaped by the culture of the individual, thus making comparisons between cultures gives insight into different food choices (Anna, 2001). Difference in culture is an important factor for different food choices and can determine the choices made by consumers. Some customs and food that are more common in one region of the world might be completely unknown to a different region. The choice of fast food consumption can also fall into this category.

2.3.1. Fast food Consumption
According to the National Institutes of Health (NIH) in the United States fast foods are characterized as quick, easily accessible and cheap alternatives to home-cooked meals. Fast food often uses a high content of fat, grease and sugar and has more calories on average due to the higher amount of unhealthy ingredients. Increased rates of fast food consumption have many causes that can differ among individuals and impacts each individual differently. A lack of time is a factor in the increasing popularity of fast food chains. Exhausting commutes, other household chores and stress. These factors are leading to less time to prepare meals (Kaushik, Narang, & Parakh, 2011). The availability of fast food is also a contributing factor to the increased consumption of fast food. The prevalence of fast food restaurants is a contributing factor in obesity rates. More fast food restaurants mean a higher level of obesity due to the increased availability thus more consumption

(Maddock, 2004). Over the last decades increased urbanization and globalization of the food industry have been cited as reasons for a shift in consumption toward more unhealthy food options (Garza, Owensby, & Zizza, 2016). The proximity of people, specifically young teens and pregnant women to fast food establishments influences the rates of consumption of fast food. The increases are slight but the closer the proximity that a school is to a fast food restaurant has an increased rate of obesity (Currie, DellaVigna, Moretti, & Pathania, 2010).

Other cause for fast food intake is that particularly consumption of highly palatable and calorie dense foods, stimulates dopamine activity, either directly or indirectly through action on other neurotransmitters, creating a subjective feeling of pleasure and satisfaction (Abizaid & Horvath, 2006) (Barry, Clarke, & Petry, 2009). The pleasurable feeling one gets from eating is confirmed to affect the dopamine that induce the feeling of pleasure and gratification (Hoebel, 1985) (Volkow & Baler, 2011). This pleasurable feeling might lead to overeating or food addiction.

2.4 Prevention programs

There are various prevention programs and policies to reduce the increasing number of individuals that are overweight or obese. Policies fall into six categories that vary in effectiveness and feasibility (Roberto & Gorski, 2015):

1. Mandates: these required policies for industries or individuals are designed to protect against the adverse effects of an unhealthy substance or environment.
2. Restrictions: these policies are designed to limit access to an unhealthy substance or environment.
3. Economic incentives: these policies aim to better align price incentives with health outcomes, encouraging higher consumption of healthy products and lower consumption of unhealthy products.
4. Marketing limits: these policies try to limit advertising and promotion of an unhealthy substance or environment.
5. Information provision: these policies provide the public with important health information, including encouraging healthy behaviors and warning about the dangers of an unhealthy substance or environment.

6. Environmental defaults: these policies preserve the freedom of individuals to expose themselves to an unhealthy substance or environment, but makes it easier for them to avoid it.

Most government policies fit in one of these six categories. But, policies that inform the public are often met with less resistance than the more restrictive interventions (policies 1 through 4) (Roberto & Gorski, 2015).

2.4.1 Mandates, restrictions and marketing limitations

Although some laws and programs exist to reduce the increasing number of individuals that are overweight or obese, yet the number of individuals continues to increase. Examples of laws and programs that have been suggested are to increase the cost of unhealthy foods such as sugar specifically in drinks as well as food that have a high amount of fat. Another way that has been used to reduce obesity is to create programs that encourage exercise and healthy eating.

A notable law that was put into place was a Health Reform bill passed in 2010 in the United States that required restaurants with more than 20 locations nationally to display the caloric content of all regular menu items on the menu board or on the menu if it is a normal restaurant (Schulman, 2013).

An increasing number of governments worldwide have introduced a tax on sugar-sweetened beverages (SSB) for public health (Eykelenboom, et al., 2021). As sugar is calorie dense, limiting the consumption of sugar would be important in limiting the energy intake. The increase in sugar tax is believed to deter people from purchasing products with sugar due to their increased price. Although there are many supporters of increasing a sugar-based tax, increasing taxes might not have any effect on the consumption if the price differences are not significant.

Governments took action against harmful food marketing and implemented bans and restrictions on the advertising of fast food products towards children. According to the World Health Organization, advertising can significantly impact food preferences and consumption. This effect is especially strong for children under the age of 10. They tend to view advertising as an impartial and unprejudiced source of information, making it arduous for them to respond sensibly to these ads (Story & French, 2004).

The United Kingdom has banned the advertising of junk food advertising toward children and The United States Federal trade commission recommended that companies restrict advertising to children to healthier food products. Advertising bans on fast food have been implemented in the province of Quebec and countries such as Sweden, Norway, and Greece (Dhar & Baylis, 2011).

A study on the children of Quebec from 1984 to 1992 on limiting advertisements of fast food companies found evidence that the ban reduced fast food expenditures by 13% per week. This decrease was primarily with the children of French-speaking households of the province of Quebec. The English-speaking children did not experience the same decrease in consumption due to access to English advertising from the other Canadian territories and from the U.S. (Dhar & Baylis, 2011).

2.4.2 Calorie labeling

Calorie labeling is a method to achieve a lower amount of calorie consumption by informing the individuals of how many calories that they are ingesting by indicating how many calories any item on the menu has in a restaurant or fast food establishment. This type of information can be seen as a slight nudge on the individual to persuade them to choose a different option for consumption. Labels on food in supermarkets can also be considered calorie labels or nutritional labels. For example, the USA has passed a law requiring menu labeling in large chain restaurants (Roberto & Gorski, 2015).

Research on the impact of restaurant calorie labels on consumer food choice and intake has had varied results (Deb & Vargas, 2016), with some studies finding that labels encourage lower calorie choices, while others found no effect on food choices. Meta-analysis from several studies of calorie labeling found that there is a small difference in the number of calories purchased or consumed after having a number of calories labeled (Long, Tobias, Cradock, Batchelder, & Gortmaker, 2015). A possible method to increase the effectiveness of calorie labeling is to add information on the daily calorie intake in order to give a clearer image to consumers on what they can eat. This was tested in conjunction in the United States after a mandate to provide the calorie information was put in place. In the experiment the calorie labeling in fast food restaurants was supplemented with the daily calorie recommendations through slips of paper. The results showed there was no impact nor did the recommendations moderate the effect of calorie labeling. There was even

evidence that it promoted purchase of higher calorie items due to the false sense of staying within the calorie allowance (Downs, Wisdom, Wansink, & Loewenstein, 2013).

There has also been a growing interest in placing labels on the front of packaged foods to improve consumer understanding of the nutritional profile of foods and/or improve the healthfulness of their dietary choices (Roberto & Gorski, 2015). In the UK, some food manufacturers have adopted a multiple traffic light labeling system on packaged food and beverage products to signal whether products have low (green), moderate (yellow), or high (red) levels of sodium, sugar, and unhealthy fats (Roberto & Gorski, 2015). The results showed that the intervention had little impact on the number of calories consumed (Hammond, Goodman, Hanning, & Daniel, 2013). Another study using both the traffic light format and calorie labeling found there was a decrease of the number of calories consumed when using these interventions (VanEpps, Downs, & Loewenstein, 2016). The varying results of the studies on calorie labeling as well as accompanying interventions make it difficult to make a concrete assumption of the effect of calorie labeling.

The Netherlands, along with several other countries, have implemented the "Choices" check mark symbol, which is used as a supermarket shelf tag to flag products that meet dietary guidelines for healthfulness as established by an independent international scientific committee (Dötsch-Klerk & Jansen, 2008). While further research is necessary on the impact of front-of-package or shelf-tag labeling system, several studies indicated that these methods of labeling motivated purchases of healthier products. Any subsequent research needs to assess what the optimal design of nutrition labeling would be and what the impact would be on purchasing habits and consumption (Roberto & Gorski, 2015).

The proper use of calorie labels to select a meal is dependent on whether consumers understand the information they are given or whether the calorie label is either noticed or disregarded by the consumer (Krukowski, Harvey-Berino, Kolodinsky, Narsana, & DeSisto, 2006). So, having more knowledge of nutrition and diet could lessen the consumption of unhealthy food and promote healthier living (Said, et al., 2020) (Brissette, Lowenfels, Noble, & Spicer, 2013). This could possibly improve the effectiveness of any calorie reduction interventions.

A similar program to calorie labeling is the Kilojoule labeling scheme that is used in various states and territories of Australia to require large chain food businesses and supermarkets to display (Health, 2018):

- the average Kilojoule content of standardized, ready-to-eat food and non-alcoholic drinks on menus, menu boards, food labels and price tags.
- the statement 'The average adult daily energy intake is 8,700 kJ' on menus, menu boards and on each display cabinet, stand or area.

According to an analysis in 2018 by researchers of The Victorian Government of Australia after implementation of this law. Evidence suggests that such programs lead consumers to choose meals with fewer kilojoules, most notably in overweight people. The effectiveness of the menu labelling systems in Australian jurisdictions is being reviewed and various improvements on menu labeling are being researched. (Health, 2018).

Another experiment, the choice experiment used by (Balcombe, Fraser, & Di Falco, 2010) was designed and implemented so as to examine consumers' willingness to pay for reductions in the nutrients in the Traffic Light System (TLS). The lights indicate whether the food has a certain amount of a certain nutrient. Red light indicates a very high level of a specific nutrient, amber light indicates a medium amount and green light indicates a low amount. The experiment was designed around a basket of goods as opposed to specific food items. The choice for a basket was because the Traffic light system is designed to help consumer food choice as part of achieving a healthy diet. The task of the experiment was to select the basket containing a variety of food at different set prices and different values for the nutrients. The different nutritional information given was to measure the willingness of consumers to pay more or pay less for reductions in the nutrients that they are receiving.

The consumers were asked to answer the question of which of the baskets they would select as if it were real even though the choices were all hypothetical. The idea by Balcombe, Fraser and Di Falco was to use the basket instead of single items to better reflect the purchasing behavior of the consumers. This decision was made because consumers can tolerate high levels of nutrients in some items but not others.

The results of this study showed that UK consumers are very inclined to reduce the amount of nutrients marked with a red light. From this response, the researchers concluded that they appear to understand the role of TLS in informing consumers. They also found that when evaluating nutritional content, consumers were most concerned about salt and saturated fat and not by fat and sugar. All in all, the results provide strong evidence for the use of TLS in consumer understanding and planning shopping behavior.

2.5 Prevalence of Obesity Caribbean and Europe

The average rate of being overweight within all countries in the European Union is 36% and the average obesity rate of the European countries in the European Union is 17% (Eurostat, 2021).

The total percentage of the European Union population that is overweight is 53%. The rate of being overweight in the American region is staggeringly high at 62.5% total with 28% being obese and 34.5% being overweight (Obesity Prevention, 2014). The obesity rates around the region are far worse in the American region, showing that the nutrition of this region is much worse than that of Europe.

The rates of being overweight in the Dutch Caribbean exceed 60% of the population with an obesity rate over 25% for both men and women (CBS, 2018). It becomes clearer that the health in the Caribbean and the surrounding regions is quite poor and there is a need for a way to prevent further growth of this epidemic.

To further explore the above mentioned I have conducted an experiment based on the choice experiment by Balcombe, Fraser and Di Falco. The methodology and outcome will be brought forward in the next chapter.

3. Methodology

3.1 Research design

For this experiment an adapted version of the choice experiment based on the Traffic Light System survey by Balcombe, Fraser and Di Falco was used. The choice experiment was adapted to test calorie labeling instead of the Traffic Light System. The design tested the effectiveness of calorie labeling on the consumption of fast food and if the effectiveness can be increased by changing the participant's information. To measure the effectiveness of the calorie labeling system, various scenarios where participants need to select a certain meal was used in order to see if their choice changes per scenario. The choice was between three options: a healthy option, a mixed option and an unhealthy option.

The methods for data collection for this research consist of a single survey. The survey was distributed among groups in Europe and groups in the Caribbean. The survey is important to gather data on the effectiveness of calorie labeling to lower the consumption of fast food. The variations between results of the survey groups were analyzed to determine the effectiveness of the treatments and to answer the research question and the sub questions. The survey was distributed digitally via email and other messaging platforms. A function within Qualtrics was used to randomize the various participants to each group. Randomization ensured that a broader variety of participants was gathered in each group. The demographics of the participants was important to measure the different effect levels of calorie labeling on each demography. The study was conducted on one hundred-twenty-five subjects between 18 and 27 years old of the Caribbean islands and from European countries. Due to both regions being a melting pot of different cultures, other cultures were also considered. But the main focus of the study remained on the Caribbean and European cultures and the data that these groups will provide.

The online survey included hypothetical food choices. The hypothetical Food Choice Scenarios are hypothetical situations where participants are meant to make a choice of what meal they will eat. Several questions from the Food Choice Questionnaire (FCQ) were used to gauge the reasoning behind certain choices made by the participants (Corallo, Latino, Menegoli, & Spennato, 2019). The reasoning behind using these questions is to gauge whether certain value profiles are related to culture and how they affect the effectiveness of calorie labeling. Furthermore, the calories in the Food Choice Scenarios

were determined based on online restaurant menus. The FCQ was scaled on a five point Likert scale with 1 being the lowest score and 5 being the highest score.

The participants received the choice between various food items of various calorie values and they must select one of three potential food options: healthy option, mixed option, and an unhealthy option. The scenarios vary to see if the circumstances also play a role in the choice of food that is consumed. The Food Choice Scenarios were various described circumstances where the participants were given several options of meals to eat.

Example Food choice questionnaire

In my diet, I eat fruits/ vegetables

In my diet, I eat meat

In my diet, I eat fish

When buying something to eat, I look carefully at the health effect

When buying a food product, I prefer easy preparation

When buying a food product, I prefer a lower cost

When buying a food product, I prefer lower fat content

I choose food according to taste

I choose food according to visual appeal

I choose food according to advertising

I choose food according to calorie information

I choose food according to price

I choose food according to brand

Example Treatment 1

Food choice Scenario

You have just arrived at home in the afternoon and are hungry, which do you choose to eat?

- Grilled chicken, rice and vegetables (370 calories)
- Lasagna (800 calories)
- Hamburger, fries and a drink (1080 calories)

Example treatment 2

Calorie information statement

The number of calories that can be consumed per day is 2500 for an average adult male and 2000 calories for an average adult female. You must consume between 500 to 1000 calories below average per day to lose 0.5 kilograms per week. (NHS, 2019) (Mayo_Clinic, 2020)

You have just arrived at home in the afternoon and are hungry, which do you choose to eat?

- Grilled chicken, rice and vegetables (370 calories)

- Lasagna (800 calories)

- Hamburger, fries and a drink (1080 calories)

There were three groups for the Food Choice Scenarios to test the effect of calorie labeling. The control group where no intervention was done on the participants. Treatment group one where the described calorie labeling was used in the Food Choice Scenarios. The second treatment group included both the calorie labeling and informing the participant of the daily recommended caloric intake information.

3.2 Survey

Upon entering the survey program, the participants were randomly assigned to a treatment group or baseline group. The participants were randomized into two separate treatment groups and one control group. The treatment of the first treatment group included calorie labeling referred to as "Treatment 1". In Treatment 1 the number of calories that will be consumed with any meal was directly added behind the meal choice. The second treatment group uses both the calorie labeling and includes information regarding the average number of calories consumed per day referred to as "Treatment 2". Prior to starting the Food Choice Scenarios, the calorie information statement regarding the average calories consumed per day was given. Lastly, the final group was the control group that will have no treatment added and the food scenarios will remain unchanged. All groups had several scenarios that participants had to decide between the different food options. The scenarios were not the focus of the research but whether circumstances will affect the choice between the various food options. All groups also included images of the meals with the various Food Choice

Scenarios to better visualize what is meant with each meal choice. *See appendix for the detailed survey.

3.3. Hypothesis

Data and research shows that the obesity rates in European regions are lower than the rates in America and the Caribbean. This leads to the first hypothesis:

H1: Europeans have a lower consumption of calories opposed to Caribbean.

Literature indicates that there is an effect of calorie labeling on calories consumed. This leads to the second hypothesis:

H2: Treatment 1 will lower the average calories consumed from the Food Choice Scenarios.

According to literature there is an increased effectiveness of calorie labeling when there are added measures such as the indicate calorie information. This leads to the third hypothesis:

H3: Treatment 2 will lower the average calories consumed more than Treatment 1.

4. Results

4.1 Descriptive statistics

The descriptive statistics for the demographics of the study are shown in table 1 and the demographics of each of the survey groups are shown in table 2. There was a total of 125 participants in the study of which 62 were from the Caribbean, 44 were from Europe, 8 were from Latin America and 11 were from other backgrounds outside the ones that were mentioned. The gender breakdown of this research consists of 44 males, 77 females and 3 other, meaning those that do not identify themselves as male or female.

The Average Calories consumed is calculated by dividing the total number of calories selected from the Food Choice Scenarios by the number of scenarios.

Table 1. Descriptive Statistics

Demographic Variable	Frequency	Percentage
Gender		
Male	44	35.20
Female	78	62.40
Other	3	2.40
Total	125	100.00
Age categories		
18-21	44	35.20
22-24	42	33.60
25-27	39	31.20
Total	125	100.00
Nationality		
Caribbean	62	49.60
European	44	35.20
Latin American	8	6.40
Other	11	8.80
Total	125	100.00
Survey Group		
Baseline	40	32.26
Calorie Labeling	42	33.87
Calorie Labeling and Dietary information	42	33.87
Total	124	100.00

The number of subjects in the three treatment conditions were approximately equally divided.

Table 2. Demographics per treatment

	Treatment			
Demographics	Baseline	Calorie Labeling	Calorie Labeling and dietary information	Total
Gender				
Male	16	16	12	44
Female	24	25	28	77
Other	0	1	2	3
Total	40	42	42	124
Age Category				
18-21	14	15	14	43
22-24	15	12	15	42
25-27	11	15	13	39
Total	40	42	42	124
Nationality				Total
Caribbean	16	21	24	61
European	14	16	14	44
Latin America	4	1	3	8
Other	6	4	1	11
Total	40	42	42	124

Table 3. Linear Regression

Average calories consumed	Coefficient	Robust Standard. Error	t	P > t	95% confidence Interval	
Age[A]						
22-24	-54.64577	33.82515	-1.62	0.109	-121.6595	12.36796
25-27	-37.62128	32.45405	-1.16	0.249	-101.9186	26.67604
Nationality[B]						
European	-36.66569	30.26678	-1.21	0.228	-96.62963	23.29826
Latin American	221.6622	44.03762	5.03	0.000	134.4157	308.9087
Other	2.798028	56.58215	0.05	0.961	-109.3014	114.8975
Gender[C]						
Female	-9.319806	28.50145	-0.33	0.744	-65.78632	47.14671
Other	-156.0758	32.71108	-4.77	0.000	-220.8823	-91.26921
Survey groups[D]						
Calorie labeling	25.22864	32.90624	0.77	0.445	-39.96456	90.42184
Calorie labeling and Dietary Information	19.5255	33.82525	0.58	0.565	-47.48842	86.53943
Constant	701.746	39.40267	17.81	0.000	623.6822	779.8098

Observations = 123
F (11,111)   = 7.02
Prob > F   = 0.0000
R-squared   = 0.2001
Root MSE   = 144.24

Note. [A] 18-21 as Reference category [B] Caribbean as reference category [C] Male as reference category [D] Baseline as reference category

A Ramsey Reset test was done on the linear regression model to see whether there was any form misspecification. The Ramsey Reset tests whether the linear regression model that was estimated has any missing variables. The results show that there is no model misspecification and that there are no missing variables. **($F_{(3, 110)}$ =0.18 p =0.9088)**

The table and graph below shows the means scores of the different important aspects of food choice per nationality. The scores of the different important aspects are calculated as the average from the different subject matter from Food Choice Questionnaire. The average scores are calculated as averages from the following questions from the Food Choice Questionnaire:

Taste Category
In my diet, I eat fruits/ vegetables
In my diet, I eat meat
In my diet, I eat fish
I choose food according to taste

Health category
When buying something to eat, I look carefully at the health effect
When buying a food product, I prefer lower fat content
I choose food according to calorie information
When buying a food product, I prefer low calorie foods

Convenience Category
When buying a food product, I prefer easy preparation
When buying a food product, I prefer a lower cost
I choose food according to price
When buying a food product, I prefer value for money is important

Packaging Importance
I choose food according to visual appeal
I choose food according to advertising
I choose food according to brand

Table 4. Table by nationality: Mean score per category

Nationality	Taste	Health	Convenience	Packaging
Caribbean	3.875	2.491935	3.709677	2.924731
European	3.823864	2.738636	3.727273	2.939394
Latin American	3.75	2.3125	3.9375	3.166667
Other	3.431818	2.227273	3.75	2.818182
Total	**3.81**	**2.544**	**3.734**	**2.936**

Figure 1 Average Likert score by nationality
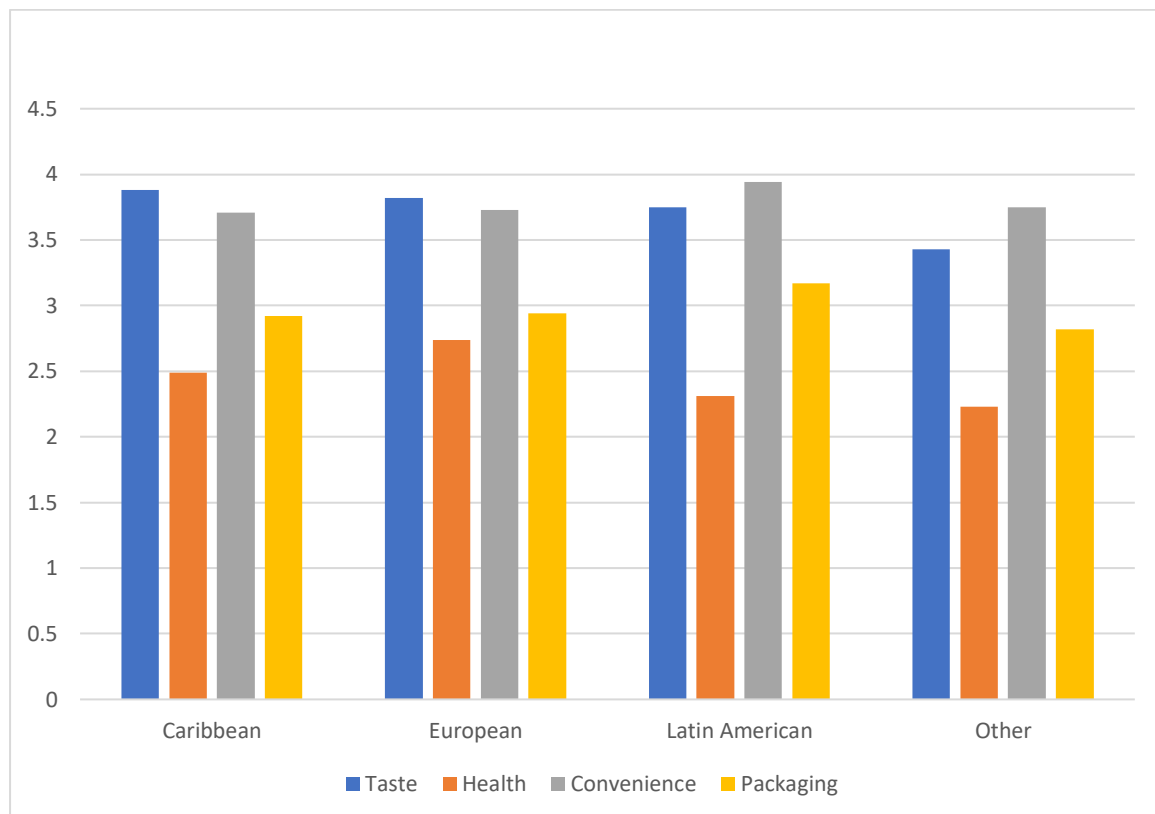
Kruskal-Wallis test were performed on all the categories in the Food Choice Questionnaire to test whether the difference between the scores is due to the difference between the groups. The Kruskal-Wallis equality of rank tests test whether the difference between independent groups are statistically significant.

Table 5. Kruskal-Wallis equality of rank test (Taste category)

Nationality	Frequency	Rank Sum
Caribbean	62	4099.50
European	44	2831.50
Latin American	8	494.50
Other	11	449.50

Chi-squared	4.637 with 3 d.f.
Probability	0.2004
chi-squared with ties	4.705 with 3 d.f.
probability	0.1947

Nationality	Mean
Caribbean	3.875
European	3.823
Latin American	3.750
Other	3.432
Total	3.810

The Kruskal Wallis test on the category of Taste shows that the difference between the groups is not statistically significant and that there is no significant difference between the groups. We fail to reject the null hypothesis of the Kruskal-Wallis that the scores are equal. There is not sufficient evidence that there is a statistically significant difference between the mean score of the Taste category.

Table 6. Kruskal-Wallis equality of rank test (Health category)

Nationality	Frequency	Rank Sum
Caribbean	62	3755.00
European	44	3092.50
Latin American	8	438.50
Other	11	589.00

chi-squared	3.217 with 3 d.f.
probability	0.3594

chi-squared with ties	3.242 with 3 d.f.
probability	0.3557

Nationality	Mean
Caribbean	**2.492**
European	2.739
Latin American	2.313
Other	2.227
Total	2.544

The Kruskal Wallis test on the category of Health shows that the difference between the groups is not statistically significant and that there is no significant difference between the groups. We fail to reject the null hypothesis of the Kruskal-Wallis that the scores are equal. There is not sufficient evidence that there is a statistically significant difference between the mean score of the Health category.

Table 7. Kruskal-Wallis equality of rank test (Convenience category)

Nationality	Frequency	Rank Sum
Caribbean	62	3783.50
European	44	2801.00
Latin American	8	554.00
Other	11	736.50

chi-squared	0.568 with 3 d.f.
probability	0.9037
chi-squared with ties	0.575 with 3 d.f.
probability	0.9021

Nationality	Mean
Caribbean	3.71
European	3.727
Latin American	3.934
Other	3.750
Total	3.734

The Kruskal Wallis test on the category of Convenience shows that the difference between the groups is not statistically significant and that there is no significant difference between the groups. We fail to reject the null hypothesis of the Kruskal-Wallis that the scores are equal. There is not sufficient evidence that there is a statistically significant difference between the mean score of the Convenience category.

Table 8. Kruskal-Wallis equality of rank test (Packaging category)

Nationality	Frequency	Rank Sum
Caribbean	62	3900.00
European	44	2734.00
Latin American	8	578.00
Other	11	663.00

chi-squared	0.609 with 3 d.f.
probability	0.8943
chi-squared with ties	0.621 with 3 d.f.
probability	0.8916

Nationality	Mean
Caribbean	2.925
European	2.940
Latin American	3.167
Other	2.818
Total	2.936

The Kruskal Wallis test on the category of Packaging shows that the difference between the groups is not statistically significant and that there is no significant difference between the groups. We fail to reject the null hypothesis of the Kruskal-Wallis that the scores are equal. There is not sufficient evidence that there is a statistically significant difference between the mean score of the Packaging category.

4.2 Hypotheses Testing

H1: *Europeans have a lower consumption of calories opposed to Caribbean*

Hypothesis 1 states that European participants have a lower calorie consumption than Caribbean participants within the data analysis. This is based on the research that Europeans have a lower rate of obesity than individuals from America and the Caribbean. The model regression that was used to estimate was a linear regression using the average from all the Food Choice Scenarios (FCS) as a dependent variable and several independent variables to see their effect on the dependent variable.

Based on the output file of the linear regression of the questionnaire, the results show that being European decreases the number of calories consumed by -36.666 as compared to being in the reference category of being from the Caribbean region. The result however is not significant at the 10% significance level. The results cannot be said to be definitive due to the lack of significance of the results. The results would indicate that Europeans consume less calories on average than their Caribbean counterpart, but the results lack statistical significance. This is not in line with the hypothesis that individuals having a European background consume less calories based on the data. The lack of significance of the coefficient of European nationality means that there is no statistical difference between the consumption of calories for participants with a European background compared to the reference category Caribbean background.

Due to the lack of significance, there is a reason to not accept the hypothesis.

H2: *Treatment 1 will lower the average calories consumed from the Food Choice Scenarios*

The second hypothesis relates to the first treatment in that it analyzes if the intervention influences the number of calories consumed in the experiment. The hypothesis states that the first treatment will lower the average number of calories consumed by the participants within the first treatment group. The first treatment group received calorie labeling on each of the choices in the Food Choice Scenarios. The data from other studies suggest that there could be a decrease of calories consumed from calorie labeling.

The data from this research indicates that the calorie labels from Treatment 1 increases the average number of calories consumed from Food Choice Scenarios compared to the reference category. The results from the regression show that there is an increase in

the number of calories by 25.228 calories when the number of calories is labeled compared to the reference category of having no intervention.

The result of the analysis is not significant at the 10% significance level. Therefore, the conclusion is that there was no evidence that the first treatment had an impact on calorie consumption.

H3: *Treatment 2 will lower the average calories consumed more than Treatment 1*

The third hypothesis analyzes if the intervention influences the number of calories consumed in the experiment. The hypothesis states that the second treatment will lower the average number of calories consumed by a higher rate than the first treatment group. The second treatment group received calorie labeling on each of the choices in the Food Choice Scenarios as well as dietary information prior to starting the Food Choice Scenarios. The data from other studies suggest that there could be a little decrease of calories consumed from calorie labeling when using extra methods.

The data from this research indicates that the calorie labels from Treatment 2 increases the average number of calories consumed from Food Choice Scenarios compared to the reference category. The results from the regression show that there is an increase in the number of calories by 19.525 calories when the number of calories is labeled compared to the reference category of having no intervention. This increase in calories is less than that of treatment 1, but based on the lack of significance there is no evidence that it is significantly less.

The results show that both treatments increase the number of calories consumed compared to the reference category. The results of both treatments are not statistically significant meaning it cannot be definitively said that the treatments negatively impacted the average number of calories consumed.

The result of the analysis is not significant at the 10% significance level. Thus, there is no evidence that the treatments had an impact on calorie consumption.

5. Conclusion

5.1 Discussion

Much must be done to reduce and prevent the growing rates of individuals becoming heavily overweight, obese or severely obese. Culture and upbringing could be aspects that impact the caloric intake on a daily basis. Understanding the implications of a higher calorie intake can help establish a comprehensive method to fight and reduce the growing epidemic. This research aimed to study and assess the effectiveness of calorie labeling on calorie intake through an online survey. However, my research on calorie labeling and calorie labeling with additional dietary information found no effect on the average number of calories consumed. The data analyzed also indicates that there is no difference between the populations when it comes to food choice aspects such as personal taste, healthiness of a meal, packaging or personal convenience. This could suggest that there is a different underlying reason for the difference in obesity rates between these groups.

Proving that an intervention method has a different effect on various culture could lead to creating a healthy eating intervention that is better suited to the culture where it is implemented instead of a one size fits all intervention that lacks effectiveness over certain groups. Further evidence is needed to see whether there are other methods of calorie labeling intervention that have more effective results on the different cultures. Although the data points to calorie labelling and calorie labelling with dietary information having a negative impact on the number of calories consumed it is not statistically significant. Testing these methods on a larger sample with more descriptive statistics could offer a better view of what descriptive statistics can affect the effectiveness of the calorie labelling.

The analysis of the data showed no significant effect of treatments on the average number of calories consumed from the Food Choice Scenarios. The insignificant results make a definite conclusion based on the data of the research inconclusive. The cultural aspect was also not significant therefore we cannot say that there is a difference between the consumption of calories between different cultures.

5.2 Limitations and Future research

A limitation of this research is that the result from the regression shows that there are multiple coefficients that are not statistically significant. This could be a justification for a replication of the study with more sample participants in order to find if the results are

replicated or if the results will differ under other circumstances. The lack of significance makes it difficult to make a remark on whether the calorie labelling is effective or not. Receiving statistically significant results would mean that the research would need to be repeated on a larger sample to avoid any estimation errors. A larger sample pool could also prove if the data implying that there is no statistical difference between the groups on aspects of food choice hold or if it is proven false.

Another limitation of the research is that there are external factors that could have affected the outcome of the study for example the upbringing of the participants. The upbringing of the participants could instill certain values like healthy or unhealthy eating habits that could influence the choice of their meals. The circumstances surrounding the survey could also impact the choices made in the Food Choice Scenarios. For example, if the survey was made around dinner or lunch time participants might choose larger meals (more calories) due to them being hungry. This is comparable to doing groceries in a supermarket while being hungry. To mitigate this issue a subsequent study would need to try to keep the survey participation within a certain timeframe of the day on successive days.

Another external factor that could have impacted the eating pattern of the participants and the population in general is the COVID-19 pandemic. The COVID-19 pandemic has influenced eating behavior through factors such as anxiety, other emotional aspects or changes in income (Janssen, et al., 2021). These aspects could have impacted the results of this study. Any similar study done needs to be in a situation after the eating patterns revert to their pre-COVID 19 eating behaviors or other mayor situation that can largely influence human behavior.

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7. Appendix

Survey

How old are you?
- 18-21
- 22-24
- 25-27

What is your gender?
- Female
- Male
- Other

What is your cultural background?
- Caribbean
- European
- Latin American
- North American
- Asian
- African
- Australian

Do you eat 3 meals a day (breakfast, lunch and dinner)
- Yes
- No

How many meals do you skip a day? (multiple choice permitted)
- Usually skip breakfast
- Usually skip lunch
- Usually skip dinner
- I do not skip meals

How many meals do you eat a day including snacking?
- 1
- 2
- 3
- 4
- 5
- Other:

How often do you eat junk food per week (not including snacks)?
- 0
- 1-2
- 3-4
- 5-7
- 7+

How often do you eat healthy foods per week(not including snacks)?
- 0
- 1-2
- 3-4
- 5-7
- 7+

Do you want to lose weight?
- Yes
- No
- I don't care

Five Point Likert scale questions
Likert points of Importance
1. never 2. Rarely 3. Sometimes 4. Frequently 5. always

Food choice
In my diet, I eat fruits/ vegetables
In my diet, I eat meat
In my diet, I eat fish
I choose food according to taste

Health focus
When buying something to eat, I look carefully at the health effect
When buying a food product, I prefer lower fat content
I choose food according to calorie information
When buying a food product, I prefer low calorie foods

Convenience
When buying a food product, I prefer easy preparation
When buying a food product, I prefer a lower cost
I choose food according to price
When buying a food product, I prefer value for money is important

Packaging focused
I choose food according to visual appeal
I choose food according to advertising
I choose food according to brand

Choice experiment

Control group

Food Choice Scenario

Which food option would you choose in the following scenarios?

You have just arrived at home in the afternoon and are hungry, which do you choose to eat?

- Grilled chicken, rice and vegetables
- Lasagna
- Hamburger, fries and a drink

It is past 9p.m. and you start feeling a little hungry, which do you choose to eat?
- Yogurt and berries
- Sandwich
- A half pint of ice cream

You are not in the mood to make something to eat for dinner, which do you choose to order?
- Fried Rice
- Cream chicken pasta
- Pizza

You go out with friends and want to eat, which do recommend to your friends?
- Subway
- Sushi
- Fried chicken meal

You go out to celebrate an event, which do you prefer to eat?
- Wok restaurant
- Steak dinner
- Barbeque

Treatment 1

Food Choice Scenario

Which food option would you choose in the following scenarios?

You have just arrived at home in the afternoon and are hungry, which do you choose to eat?

- Grilled chicken, rice and vegetables (370 calories)
- Lasagna (800 calories)
- Hamburger, fries and a drink (1080 calories)

It is past 9p.m. and you start feeling a little hungry, which do you choose to eat?
- Yogurt and berries (120 calories)
- Sandwich (300 calories)
- A half pint of ice cream (500 calories)

You are not in the mood to make something to eat for dinner, which do you choose to order?
- Fried Rice (240 calories)
- Cream chicken pasta (600 calories)
- Pizza (1100 calories)

You go out with friends and want to eat, which do recommend to your friends?
- Subway (500 calories)
- Sushi (750 calories)
- Fried chicken meal (1000 calories)

You go out to celebrate an event, which do you prefer to eat?
- Wok restaurant (600 calories)
- Steak dinner (1000 calories)
- Barbeque (1800 calorie)

Treatment 2

Calorie information statement

The number of calories that can be consumed per day is 2500 for an average adult male and 2000 calories for an average adult female. You must consume between 500 to 1000 calories below average per day to lose 0.5 kilograms per week. (NHS, 2019) (Mayo_Clinic, 2020)

Food Choice Scenario
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