Implicit Attitudes and Self-Esteem Towards Food Images After Consuming a Sugar or Diet Beverage.

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Abstract

An Independent measure between groups design was applied to examine implicit attitudes towards sugary and diet food images, after consuming a sugary or diet beverage. Forty participants (13 males, 27 females) took part in the double-blinded condition using Open Sesame software. This true experiment employed Implicit Association Test measuring reaction times and correct/incorrect responses in the computer task. Self-Esteem was assessed using Rosenberg scale. Independent Sample T-tests on the D-scores examined three hypotheses. For the first hypothesis, no significant implicit food preference bias was seen. Also, no significant difference in the number of correct responses between the two conditions for hypothesis 2. There was no effect on sex on D-scores as predicted by hypothesis 3. Linear Regression did not show association between Self-Esteem and number of correct responses. However, certain patterns deserve further research.
Introduction

Introduction of sugar as a part of diet

Sugar is a widely used dietary substance, and an important part of our human diet. Consumption of sugar has grown dramatically since 18th Century, with average individual consumption per year in UK of 2kg, in 19th century was 5kg, and in 20th century is estimated to be about 45kg. However, recent statistics indicate that usage of sugar is decreasing among developed countries, and consumption of artificial sweeteners has increased (Wittekind and Walton, 2014). There is an ongoing debate about the health risks associated with both sugar and artificial sweeteners.

Consumption of high calorie sugar is associated with various negative health outcomes, such as obesity and cardiovascular disease (Malik and Hu, 2015). It also affects satiety and digestion (Clemens, Jones, Kern, Lee, Mayhew, Slavin and Zivanovic, 2016). The 2015-2020 Dietary Guidelines for Americans have proposed to limit added sugar intake to 10% of daily calories. This ten per cent reduction would lead to decreasing only 200-250 Kcals yet people usually consume close to 680 calories every day in sugar alone. Sweet beverages are a very common part of diets in many households. The USA is the third leading country for the consumption of sugary beverages like non-diet sodas, sport drinks like Red Bull ©, and beverages with artificial sweetener. A regular 12 oz can contain about 150 calories equivalent to 10 teaspoons of table sugar. It is important to note that many of these sugary drinks are researched in science due to the psychoactive properties of some ingredients (glucose and caffeine mainly), as well as the health effects of their high
calorie content. Scientists try to understand how these ingredients affect human CNS and so modify our perception of foods and the food choice.

Aims and Objectives

This study aims to experimentally investigate the effects of sugary drinks on cognitive performance with a sample of random, healthy participants. The researcher measured reaction time and numbers of errors scored using a computer task Implicit Association Test. Participants drink either a common sugary beverage or its artificially sweetened counterpart, and then are presented with two different food type images – healthy low sugar versus unhealthy high sugar and associated words. The speed of their reactions in the test, and the frequency of errors, may reveal information about if consuming sugar changes our attitude toward certain foods. This study also will examine the level of self-esteem of each participant using inventory RSE scale and see if there is any association with food choice.

Effects of sugar and caffeine on the performance

For decades, cognitive psychologists have studied mental performances in human participants and how it is affected by diet. Glucose supplies the brain with energy and acts on cognitive performance (Scholey, Harper and Kennedy, 2001), and caffeine is a stimulant, and both elevate heart rate and blood pressure. Researchers have argued over whether caffeine itself could enhance performance, or whether caffeine and glucose work together. Adan and Sera-Grabulosa, (2010) tested human participants in reaction times and concluded that caffeine 75g, and sugar 75g, (glucose) administered together does influence cognition like attention and learning,
more than sugar alone or caffeine alone. The effects of glucose on the central nervous system was researched also by Gagnon, Greenwood and Bherer in 2010.

Following the consumption of a high sugar beverage, the blood glucose elevates and therefore improves performance (Kennedy and Scholey, 2000). According to Dye, Lluch and Blundell (2000), glucose has a positive effect on cognitive performance. A double-blind study (glucose versus placebo) on Stroop test task, suggested that participants in experimental glucose group were faster with reaction times than control group. Owen, Scholey, Finnegan, Hu and Sunram-Lea (2012) also researched effects of glucose administration on human cognition tasks. Interestingly, they argued that several factors can be involved in moderation of glucose intake and affect (physiological state, dose, type of cognitive task or length of fasting prior consumption).

Frazer (2006) tested Red Bull (caffeine) versus placebo on cognitive performance. The test conditions involved computer gaming tasks with 21 healthy participants who regularly played computer games. The results showed that the energy drink improved overall gaming performance but not reaction time during the task.

**Artificial sweetener and its effects on food choice**

In 1965, the artificial low-calorie sweetener, aspartame, was introduced into the food environment. Aspartame is an artificial sweetener that consist of two amino acids, phenylalanine and aspartate (Yang, 2010) Artificial sweeteners are widely used in carbonated beverages as well as in a variety of foods. Consumers may choose low-sugar foods with sweetener thinking that it is a healthier food choice. Artificial sweeteners such as aspartame have been questioned in regard to effect on the nervous system. It is a controversial food additive because it impacts on neurobehavioral
functions (Lindseth, Coolahan, Petros and Lindseth, 2014). Aspartame is metabolised to aspartic acid, phenylalanine (involved in neurotransmitter regulation), and methanol. Research shows that use of non-caloric but artificial sweeteners, such as aspartame, may be linked to obesity. People can often consume products that are low in sugar, for example “diet” or “light” to lose weight, however research shows that artificial sweetener can contribute to weight gain (Yang, 2010).

Some people may believe that weight loss can be associated with food energy reduction. A twelve-week study where participants were asked to consume diet or regular beverage (Williams, Strobino and Brotnanek, 2007) while keeping to 1,500kcal per day, concluded that, aspartame was linked to higher energy intake. Aspartame intake also is associated with higher motivation to eat, greater cravings, and greater selection of foods (Rogers, Carlyle, Hill and Blundell, 1988).

Results on healthy participants reveal high consumption of high doses of aspartame in drinks did not influence working memory but did worsen cognitive tasks as a result. For example, Hill, Prokosch, Morin and Rodeheffer (2014) conducted experiments to test individual responses to food items. Participants were asked to consume a beverage which contained artificial sweetener, or a sugar-sweetened beverage, or a drink that contained both. Results show that consuming the beverage with aspartame influenced decisions with food selection, so that participants were choosing more frequently high dense sugar food images. Sundram-Lea, Foster, Durlach and Perez (2002) in double-blind experiment tested effect of glucose-based drink versus aspartame, and enhancement in human cognition with reaction times. Glucose was significantly correlated with elevated reaction times in comparison to aspartame.
**Aspartame and source of calories**

People who consume food or beverage containing artificial sweetener are more likely to replace the missing calories through other sources of foods, and therefore eat more and crave more calories (Strawbridge, 2012). Low caloric beverages could lead to increased consumption because beverages fail to trigger satiety. Non-nutritive sweeteners, for example aspartame, promote food intake, increased body weight or metabolic disorders (Swithers, Martin and Davidson, 2009). Artificial sweeteners, have been questioned in regard to effect on the nervous system. It is a controversial food additive because it impacts on neurobehavioral functions (Lindseth et al., 2014). With a large consumption of beverages, sweet taste is no longer the indicator of high calories, then this can result in increased caloric intake. In the other words, the ability of sweet taste for energy regulation is degraded.

**Appetite and hunger related to foods**

According to the European Food Safety Authority (EFSA), there is a relationship between specific nutrients and appetite, so that cognitive sensory signals generated at the time of consumption influence the consumers experience of satiety (Chambers, McCrickerd and Yeomans, 2015). Studies have shown that food labelled as low fat (low energy) lead consumers to over consume these foods relative to control foods (high energy), up to 34 % more than the control (Davison, Sample and Swithers, 2013). Control of the appetite may be associated with functional foods. The goal of appetite control is to provide the subsequent energy intake that will not exceed energy expenditure, and therefore is designed to control energy intake. Sweet taste of food or beverage have been research widely in terms of enhancement of an appetite. Neural and hormonal signals are sensed and processed, and these are known to
control the appetite. Hunger also must be identified and managed to achieve control over appetite function. Drewnowski, (1995) argues that sweet taste with no added calories can promote appetite and therefore greater consumption of the food. Furthermore, replacing sugar with artificial sweetener may result in higher energy compensation. With a large consumption of artificially –sweetened beverages, sweet taste is no longer the indicator of high calories then this can result in increased caloric intake. In the other words, the ability of sweet taste for energy regulation is degraded.

**Satiation and Satiety with food**

The effect of satiation can be observed in real life studies. Nutrients in food could affect psychological and behavioural functions and impact on cognitive performances such as; reaction times or information processing. (Dye and Blundell, 2002). Energy density in foods, tend to be proportional to palatability and effect satiety (Drewnowski 1995). Palatability is the pleasurable experience of eating and desire the food that would be eaten. Higher energy dense foods also seem most palatable (Drewnowski, 1995).

Common carbonated drinks are tending to be carbohydrates, which are made of glucose. Depend on the form of carbohydrate is how it can affect satiety. Satiation can be explained as a capacity that supresses further eating and has a powerful effect on biological drive for food (Benelam, 2009).

The function of a satiety cascade starts when food is consumed, thus this is affected within sensory and cognitive factors (taste, smell). Next, food and drink travels to gastrointestinal tract where is digested and absorbed. Within the process of digestion in the stomach, signals about the energy from food reaches the brain, the satiation
then is stimulated. Satiation and satiety can both be influenced by several factors such as demographic features, sex and age, or factor such as personal diet. However, food or drink’s energy density can affect satiety and satiation. They both play important parts in eating behaviour (Dye and Blundell, 2002), appetite control and limitation of energy intake to distinguish energy intake (Benelam, 2009). To determine the strength of these is reflected in levels sensation of hunger. Biological sensation of hunger provides the information for the body, that it needs energy. Physiologically aspect of satiety begins during and just after initiation of eating. According to Wooley (1972), participants who had high calorie milkshake, felt fuller and therefore sated, and ate less at the next meal, then those who did not have high calorie drink. However, responses as hormonal, neural, metabolic also are involved in promotion of efficient energy use. Furthermore, sweet taste may be a predictor of energy content and should be able to evoke the cephalic phase responses that promotes energy regulation. Metabolism of sugar occur in liver (hepatic) and other cells in the body (extrahepatic). Eating behaviour and food selection can be related to neurochemical activity including serotoninergic neurons with carbohydrates in diets. Furthermore, sweet carbohydrate can relate to pleasurable feelings by oral afferent stimulation of sweet receptors. Consuming diets high in sugar (high calories) affect hippocampus areas in such way that it enhances reward signals (Davidson, Sample, Swithers, 2013).

**Hormonal involvement in sugar metabolism**

Several hormones from the gut are released from stomach and intestine (Simpson and Bloom, 2010), and allow the brain to receive appetite’ signals, so they are strongly connected to central nervous system as regulators of energy homeostasis.
(Figlewicz and Sipols, 2010). Some hormones such as leptin and insulin are related to fat stored in the body and help regulate satiation and satiety. Leptin affects energy intake and use. Insulin is a metabolic hormone that is released from the pancreas and increases rapidly after meal and acts to control blood glucose levels. Ghrelin another hormone that causes hunger, affects appetite and is produced in the stomach. This rises before any meal. The peptide hormone stimulates appetite and promotes food consumption. Carbohydrates play many crucial roles in the metabolic process. They are an energy source and therefore synthesis and usage of glucose, fuels the organism including central nervous system (McKee and McKee, 2011). Artificial sweeteners enhance different brain regions then sugar does in terms of metabolic and hormonal factors because the energy will be less. Artificial sweetener does not stimulate insulin. No changes also were observed in insulin, ghrelin hormones when artificial sweeteners were delivered into stomach or intestines (Swithers 2013).

**Implicit Association Test**

In 1998 Greenwald, McGhee, Jordan and Swards contributed toward social cognition research and created Implicit Association Test (IAT). This measures implicit attitudes. These are the hidden unconscious bias that may affect our behaviour towards objects or concepts. Therefore, IAT measures the strength of associations between pairs of concepts labelled as when categories are closely associated.

The IAT is based on a double discrimination task. In the test, the participants are asked to assign stimuli (for example images,) as fast as possible, to target categories (for example ‘positive’ OR ‘negative’) to allow interpretation of the strength of
association between the concepts (Hoffman, Gawronski, Gschwendner, Le and Schmitt, 2005).

IAT has been used as a measurement in various research: for example, in consumer choices. Richetin, Perugini, Perstwich and O’Gorman (2007), where attitudes towards healthy food versus snacks were examined. Barnes-Holmes, Murtagh, Barnes-Holmes and Steward (2010) studied implicit attitudes of people who were vegetarians versus meat eaters using IAT. Eschenbeck, Heim-Dreger, Steingilber and Kohlmann (2016), used it to measure nutritional behaviour (food choices) and intake of a liquid – mineral water versus soft drink food choice. IAT has been a useful tool also in predicting consumer behaviour in marketing research (Maison, Greenwald and Bruin, 2004).

**Self Esteem**

Self-esteem can influence food choices people make in life. In 1965, Morris Rosenberg has developed ten item scales called Rosenberg Self-Esteem (RSE) to measure self-esteem among young school students. Over the years, the measurement has been used also among adults in variety fields of research. RSE measures positive and negative feelings about the individual’s self-esteem. It is used as a self-report instrument.

In this investigation, participants will answer several questions, based on either positive or negative self-descriptive statements, on a 4-point agreement scale. The data will be examined to see if this factor influenced decisions made in the IAT task.

**Rationale**
The high sugar content of the beverage should give an energy boost to the participant and so lower the overall response times. (result in faster response times). But it may also affect choice of image to be more biased toward high sugar foods. Elevation in blood glucose will improve performance of reaction time tasks (Dye and Blundell, 2002). Food with high glycaemic index expect to promote Reaction time. A sweet-tasting beverage whether they are sweetened with sugar or a calorie-free sugar substitute—might stimulate the appetite for other sweet, high-energy foods. Food cues and associated rewards are particularly interesting in psychology. “Food is more attractive and tastes better when we are hungry and becomes less appealing when we have just eaten” (Higgs, 2015, p.10). Sugar may enhance cognitive high load performance due to increased levels of arousal. Low self-esteem has been associated with bad performance (Baumeister, Campbell, Vohs, 2003), so therefore participants who score low on self-esteem may score insufficiently in IAT. Demographic background variables like gender could have influence on food choice. Women had more positive attitude to functional foods. These foods are termed as having a positive impact on health, promoting optimal health (Ares and Gámbaro, 2007). Social modelling also could affect food choice (Cruwys, Bevelanser and Hermans, 2014).

Food choices may be correlated to lifestyle or personal taste. Low self-esteem individuals are more likely to keep into social norms of food choice. The lack of confidence can lead to unhealthy outcomes such as obesity. Adolescence with low self-esteem trait are at higher risk for unhealthy outcomes. (Trzesniewski, Donnellan, Moffitt, Robins, Poulton and Caspi, 2006), including development of eating disorders (obesity), 63 per cent of females were at risk and carried low self-esteem. (O’Dea and Abraham, 1999).
Hypotheses

Formally, the experimental hypotheses are:

1. It is hypothesised that using Implicit Association Test, D-scores will differ between participants in experimental and control group.

2. It is hypothesised that using Implicit Association Test, the number of correct responses will differ between participants in experimental group and a control group.

3. It is hypothesised that using Implicit Association Test D-scores will differ across males and females.

4. It is hypothesised that self-esteem will predict higher number of correct responses.
Methods

Participants

Overall forty Dublin Business School students took part in this experiment (males =17; females = 23). Participants were healthy individuals with no self-reported health issues at the time of the experiment, that could affect the results of the study. All students were 18 years and over. The mean age was M=23.90 and standard deviation SD=5.89. The age ranged from 19 to 40 years-old. Participants were randomly selected, and were attending a variety of college courses, both daytime and evening, at DBS, and came from various ethnic backgrounds. The level of understanding English language was very good among all volunteers. Participants did not receive any monetary reward from the researcher or any other source in regard to this experiment. The main inclusion criterion for selection was that the participant was willing to consume a sugary beverage. Most potential participants were either approached on their way to their lectures, where agreement from the lecturer was previously settled via email, or approached in the common areas within DBS. The researcher also recruited students during their classes. During those times, the aims and ethical considerations of the study were briefly explained, and information sheet was given to each student (see Appendix A). Many students gave their student email address to the researcher so that they could be contacted later to arrange a time and day for participation. After students read the information sheet and agreed to participate, they were asked to go to the Laboratory Room immediately or later the same day. If possible, participants were asked to not consume sugary drink at least 3 hours prior to coming to the lab. There, participants received one of two experimental stimuli, either a high sugary drink, or a control drink with low sugar
properties. Each participant received written Consent (See Appendix B) prior to the test procedure and was allocated to a group (experimental or control). Sampling technique employed in this experiment was nonprobability due to subjective judgment of a researcher.

**Design**

In this true experiment, Independent measures between groups design was applied. All participants were allocated to one of the conditions (experimental or control), received one stimuli drink and were tested only once.

**Variables**

The main Independent Variable was the type of beverage consumed (condition) and its effect is tested during the experiment. Other independent Variables were gender (males versus females) and self-reported self-esteem based on the Rosenberg Self-Esteem scale. Dependent variables were measures such as Reaction Time (RT) to respond to on screen food image and number of correct responses (CR).

**D-algorithm scoring for Implicit Association Test**

Means and Standard Deviations of RT and Totals for CR were calculated for each participant final scores. The response latency is a measure of the time in milliseconds that participant has waited since the onset of the trial. The raw response latency for each participant was transformed into D-scores using a D-algorithm developed by Greenwald, Nosek, and Banaji (2003). D-scores allow to measure differences between groups using the response time paradigm. The D-algorithm that was employed in the current experiment had to sustain conditions such as; (1) all
latencies above 10,000 ms removed from data set, (2) data containing less than 10% of 300 ms per trial with latencies must be also removed, (3) means were computed for blocks 1, 2 and 3, 4. (4) standard deviations were calculated for all trials in blocks 1, 2, 3, and 4 (5) data were computed by removing sugar positive condition block from diet condition block (6) each difference was divided by its associated standard deviation, finally, scores were added and divided by 2 (Barnes-Holmes et al, 2010).

With respect to the interpretation of results, positive $D$-scores are associated with a preference for sugary food images, and negative scores signify an implicit preference for diet food images. Scores of zero (0) indicate of no preference (Greenwald, Nosek and Sriram, 2006).

**Division of participants into randomised blocks**

Participants were divided into 2 groups (20 in each) where 1 group was the experimental, and the other was a control group. This study was double blinded (both participants and the researcher are blinded to eliminate subjective, unrecognised biases). Neither the researcher nor the participants knew which group each participant belonged to, and what stimulus beverage they were drinking. Two 3rd parties assisted with the procedure of blinding the drinks (1 woman and 1 man). The assistant was asked to prepare a stimulus beverage for each participant, assign each participant a number and condition, in either an odd or even sequence. Participants were allocated randomly to either a group A (experimental) or B (Control) therefore creating two groups and 2 conditions. Each participant was allocated to a condition only once. Random allocation provided equal chance to be assigned to A or B.
**Materials**

**Stimuli**

The experiment was carried out using two types of drinks - experimental and control. Each participant received 250 ml of drink in a 570 ml clear plastic cup (“Party Mania”). Stimuli were an identical brown colour. Experimental one was *Freeway Cola*, a high sugary drink that contains 103 Kcal of energy per 250ml, and 25g of sugar. The Control drink was *Freeway Diet Cola*, a low sugary beverage containing 3Kcal per 250ml single serving, with less than 0.5g of sugar, and sweetened with the artificial sweetener aspartame. Participants consumed one 250ml beverage, 20 minutes prior to the test.

These beverages were chosen as previous published work has shown that 25 g of glucose dissolved in 250ml of water improved performance of memory and non-memory tasks in healthy young adults (Kennedy and Scholey, 2000). Also, Anderson and Woodend (2003) found an effect of 25g of glucose in that it lowered the effect of satiety, and 50 g or more increased satiety and reduced food intake. And Reid, Hammersley, Hill and Skidmore (2007) used 1800 kJ of sucrose and 170 kJ of aspartame and found participants who consumed sucrose changed their energy intake whereas the group with aspartame did not.

**Stimulus Images**

Several studies have investigated food images (non-diet versus diet) using Implicit Association Testing. IAT therefore is a useful tool in measuring the reaction times (RT) and errors in tasks during food selection investigations. Reaction time measures
the speed of responses to different stimuli. Each participant was presented with visual images of different foods, one image at a time for 5s. All images presented on the computer screen had an average resolution of 500x333. All stimulus food images were retrieved without legal obligation from www.pexels.com. Ten healthy (diet) and ten unhealthy (non-diet sugary) food images were used in random order within trials. Sugary food images were - chocolate lollipops, chocolate sundae, gummy bears, sugar cookie, muffin, chocolate desserts, chocolate cookies, macaroons, and doughnuts (see Appendix C). Diet images presented were basil herb, mushrooms, paprika, cauliflowers, cabbage, peas, red tomatoes, broccoli, courgette and asparagus (See Appendix D).

Internal consistency of number of implicit measures, IAT showed reliability Cronbach Alpha = 0.78. (Greenwald, McGhee and Schwartz, 1998). IAT is also useful tool in terms of its validity (Greenwald, Poehlman, Uhlmann and Banaji, 2009).

*Rosenberg Self-Esteem scale*

Morris Rosenberg’s Self-Esteem scale is a 10-item scale with 4-point items. It is designed to measure self-esteem (Rosenberg, M. 1979), (Appendix E). The Self-Esteem Scale (RSE) is a Guttman scale to measure self-worth by measuring positive and negative feelings about self. Scorings for the scale are: Items 2,5,6,8 and 9 are reversed scores and apply to negative feelings about self. “Strongly agree” replies to 1 point, “Disagree” 2 points, “Agree” 3 points, and “Strongly Agree” 4 points. Scores then need to be summed for all the items. A higher score indicates a high self-esteem and a low score, low self-esteem. The 4-point items also are scored by reverse-scoring the negatively worded items.
Reliability demonstrates a Guttman scale coefficient of reproducibility of .92, and therefore indicates excellent internal consistency.

Validity of RSE: Demonstrates concurrent, predictive and construct validity using known groups (Baumaister, Campbell and Vohs, 2003).

**Apparatus**

Four stationary computers (EPrime Dell) were used, as well as one private laptop owned by the researcher. All devices had Open Sesame program installed (Mathot, Schreji and Theeuwes, 2012), with the Implicit Association Test with specific food images. IAT was designed by the Laboratory Technician in Psychology Department of Dublin Business School. Open Sesame recorded all participants data: age and sex, reaction times and number of errors. The Self-esteem scale was assessed for each participant individually.

Laboratory’s computers used in this study were Dell OptiPlex 760 PCs running Windows7, E7400 Intel Core 2 Duo processors with 2 GB of system memory. Personal laptop used for the experiment was Windows 10 HP Intel Celeron N3060, at 1.6 GHz, 4GB Ram, 64 Bits.

**Procedure**

An initial pilot study was carried out with 2 people, after the test was fully planned and before gathering real data. This allowed me to test for any flaws in the experimental procedure.
At the beginning of every procedure, a consent form (see Appendix B) was given to each participant. Next, they were asked to read it, agree to participate, and sign it. A copy of the consent form was given to everyone, while the original was held by the researcher. After collecting the consent forms, the assistant was asked to prepare and mask stimulus drinks.

An odd or even number was given to each volunteer depending on the order of their participation. They consumed their drink and started the IAT test 20 min after. Each participant was allocated randomly to a computer, briefly informed of the test procedure and told they could stop the test at any time if they felt uncomfortable or distressed. Participants stated their “age” in an open question and their “sex” (either male or female) and completed the 10-item Rosenberg Self-Esteem Scale assessment.

Next, participants were allowed a practice session on the computer, so that they were familiar with the apparatus and the types of images to be portrayed. A series of 20 food images were presented on the screen individually, each for 5s. Also, on the screen were presented the words “Positive” and “Negative”. Participants were asked to press the “Q” or “P” keys of a QWERTY keyboard, in the direction of the word associated with the food image. The correct responses were not used in statistical analysis later. In the Practice session, participants were asked to associate healthy diet food images (low sugary content) with “Positive” and high sugary foods with “Negative”. No time limit was set. No data from these practise sessions were used in the later statistical analysis. The Core test of the Implicit Association Test was designed with four blocks and 20 trials in each block (see Table 1).
Table 1. Overview of the IAT employed in the present experiment

<table>
<thead>
<tr>
<th>Blocks</th>
<th>Number of Trials</th>
<th>Stimuli assigned to sequence A</th>
<th>Stimuli assigned to sequence B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>Sugar positive/diet negative</td>
<td>Diet positive/sugar negative</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Diet negative/sugar positive</td>
<td>Sugar negative/diet positive</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>Sugar positive/diet negative</td>
<td>Diet positive/sugar negative</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
<td>Diet negative/sugar positive</td>
<td>Sugar negative/diet positive</td>
</tr>
</tbody>
</table>

In Block 1, For participants presented with sequence A, the instructions require them to associate high sugar food images with “Positive” (See Figure 1) and low sugary food images with “Negative” (see Figure 2). The word “Positive” was displayed on the left upper corner of the computer screen, and the word “Negative” was displayed in the upper right corner. In the next block of trials for sequence A, participants were required to associate diet low sugary food images with “Positive”, and high sugary images with “Negative”.

In the third block of trials, the direction of association to images were resemble block 1, and for fourth block of trials, was same as for block 2. For the participants in the sequence B the same food images were employed as well as appeared randomly on the screen.
For sequence B, in contrast, participants were told to associate low sugar diet food images with “Positive” and sugary food images with “Negative” for block 1. For block 2, high sugar images were to be associated with the word with “Positive” and low sugar diet images with “Negative”. For block 3, the direction of word associated with images were like in block 1, and for block 4 like in block 2. Each block contained 20 trails.

A Fixation dot appeared for 5s, the food image and words (positive/ negative) were also displayed giving each participant a time of 5 seconds to respond to each image. No feedback was given to participants during trials. Each participant was asked to respond as quickly as possible to each image. Each participant has responded to 80 trials seeing 80 food images in the core test.

Figure 1. Image represents a trial from the IAT computer task, where a high sugar food image is presented with positive or negative association.
The participants number (even/odd) determined the order of the 4 blocks. There were two combinations (A or B), of the 4 blocks of trials (counterbalancing). Open Sesame (Mathot, Schreji and Theeuwes, 2012), used the even/odd participant number to execute one of the two combinations.

This design randomised the way the different sequences of images were presented to participants during the testing and kept the testing protocol as fair as possible. After the test, each participant received written Debrief (see Appendix F) and a short description about the nature of the study. They could also ask the researcher any question about the study.

Protocol
Experimental protocol was submitted on October 2017, to Dublin Business School Moodle account for Ethics Committee approval and was approved the following month.

**Ethics**

Ethical considerations were taken into account. The researcher consulted ethical guideline code of conduct for Psychological Society of Ireland PSI

[www.psihq.ie/Documents/Code%20of%20Professional%20Ethics.PDF](www.psihq.ie/Documents/Code%20of%20Professional%20Ethics.PDF)

The Ethics Committee had approved the proposal for this experiment in November 2017. Ethical considerations included the health and comfort of participants. Participation in this experimental research was voluntary and required individuals who were willing to consume a high sugar beverage and had time to do so. Due to the high content of sugar in the Cola, care was taken to make sure people with sensitivity to glucose or aspartame, or with health issues like cardiovascular problems or diabetes were not involved. All participants were treated with respect and dignity by the researcher and could stop the experiment at any time if they felt uncomfortable or distressed. No monetary goods were given to participants or collected from other sources. All sources for the experiment like stimuli and cups were covered from researcher’s private budget. The researcher was aware all collected data is stored safely for required limit of time of up to five years.
Results

*Descriptive Statistics*

Raw data was collected from all computers using Open Sesame. Data was saved into Excel for every participants’ responses. The Mean and Standard Deviations for reaction times (in milliseconds) were calculated. *D*-scores were calculated using *D*-algorithm paradigm, and total scores were copied to SPSS. Mean and Standard Deviations were calculated. Self-Esteem scale was computed with Open Sesame for each participant. Age and gender raw data was copied to SPSS. Data is the software have showed that all parametric assumptions for tests were met and data distribution was normal, 2-tailed.

Table 2 presents totals for *D*-scores, Correct Reponses and Mean of Self-Esteem scale. Total *D*-score for experimental group (N=20) was M=0.16, and SD=0.73. Total *D*-score for control group (N=20) were M= -0.15, and SD=0.62. Total *D*-score for males (N=13) were M=0.05, and SD= 0.77. Total *D*-score for females (N=27), were M= -0.02, and SD=0.65. Total Correct Responses for experimental group (N=20) were M=59.70, and SD=15.10. Total Correct Responses for control group (N=20) were M=56.35, and SD=17.19. The Rosenberg Self-Esteem scale was completed by all participants (N=40). Mean of Self-Esteem calculated was M=20.30, and SD=58.20. Total of all Correct Reponses for all participants (N=40) was M=58.20, and SD=16.06.
Table 2. Descriptive Statistics

<table>
<thead>
<tr>
<th>Variables</th>
<th>Groups</th>
<th>Number of participants</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total D Score</td>
<td>Experimental group</td>
<td>20</td>
<td>0.16</td>
<td>0.73</td>
</tr>
<tr>
<td></td>
<td>Control Group</td>
<td>20</td>
<td>-0.15</td>
<td>0.62</td>
</tr>
<tr>
<td>Total D Score</td>
<td>Males</td>
<td>13</td>
<td>0.05</td>
<td>0.77</td>
</tr>
<tr>
<td></td>
<td>Females</td>
<td>27</td>
<td>-0.02</td>
<td>0.65</td>
</tr>
<tr>
<td>Total Correct Responses</td>
<td>Experimental group</td>
<td>20</td>
<td>59.70</td>
<td>15.10</td>
</tr>
<tr>
<td></td>
<td>Control group</td>
<td>20</td>
<td>56.35</td>
<td>17.19</td>
</tr>
<tr>
<td>Rosenberg Self-Esteem scale</td>
<td></td>
<td>40</td>
<td>20.30</td>
<td>58.02</td>
</tr>
<tr>
<td>Total Correct Responses</td>
<td></td>
<td>40</td>
<td>58.02</td>
<td>16.06</td>
</tr>
</tbody>
</table>

**Inferential Statistics**

The first hypothesis was tested using Mean Total IAT $D$-scores for two groups experimental and control. Measuring an implicit bias towards sugar or diet food images it was found that experimental group, the participants drinking sugary cola, showed positive implicit preference bias towards high sugary food images over low sugary (See Figure 3).
An Independent samples t-test was carried out, and it was found (Table 3), however, that there was no statistical difference between $D$-scores on experimental ($M=0.16$, $SD=0.73$) and control group ($M=-0.15$, $SD=0.62$) ($t(38)=1.44$, $p=.16$, CI (95%) $-0.12 \rightarrow .74$). Therefore, the null hypothesis is accepted. The IAT identified there was no significant between-group difference.

Table 3. Table presents scores for Independent Samples T-test with $D$-scores and two conditions.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Groups</th>
<th>Mean</th>
<th>SD</th>
<th>T</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total $D$-scores</td>
<td>Experimental group</td>
<td>0.16</td>
<td>0.73</td>
<td>1.44</td>
<td>38</td>
<td>.16</td>
</tr>
<tr>
<td></td>
<td>Control group</td>
<td>-0.15</td>
<td>0.62</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 3. Figure presents Mean IAT $D$-scores, with standard errors bars, for experimental and control group. A greater pro-sugar bias is indicated by larger positive scores -responding more quickly on sugar positive and diet negative.
The second hypothesis was tested comparing the Mean number of Correct Responses between the two groups (conditions) experimental and control. Figure 4 shows no association between the number of correct responses during the and the two group conditions. (see Figure 4).

An Independent samples t-test found (Table 4), that there was no statistical difference in correct responses between experimental (M=59.7, SD=15.10), and control group (M=56.35, SD=17.19), (t (38) = 0.65, p=.516, CI (95%) -7.00 \rightarrow 13.70. Therefore, the null hypothesis is accepted.

Table 4. Table presents scores for Independent Samples T-test, Total number of Correct Responses in the two conditions.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Groups</th>
<th>Mean</th>
<th>SD</th>
<th>t</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Number of Correct Responses</td>
<td>Experimental group</td>
<td>59.70</td>
<td>15.10</td>
<td>0.65</td>
<td>38</td>
<td>.52</td>
</tr>
<tr>
<td></td>
<td>Control group</td>
<td>56.35</td>
<td>17.19</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 4. Figure presents Total Mean of correct Responses, with error bars, for experimental and control group. No significant differences were recorded between these two groups.
The third hypothesis was tested, using Mean Total of IAT $D$-scores for two groups males and females. Measuring an implicit bias towards sugar or diet food images, it was found that males showed a small positive implicit bias towards high sugary food images over low sugary, and the opposite pattern in females (See Figure 5).

An Independent samples t-test found that there was no statistical difference between $D$-scores of males ($M=0.06, SD=0.77$), and females ($M=-0.02, SD=0.66$) ($t(38) = 0.32, p=.75, C: (95\%) -0.401 \rightarrow 0.553$). Therefore, the null hypothesis is accepted.

Table 5. Table presents scores for Independent Samples T-test, Total $D$-scores for males and females.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Groups</th>
<th>Mean</th>
<th>SD</th>
<th>T</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>Males</td>
<td>0.05</td>
<td>0.77</td>
<td>0.32</td>
<td>38</td>
<td>.75</td>
</tr>
<tr>
<td>$D$-scores</td>
<td>Females</td>
<td>-0.02</td>
<td>0.65</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 5. Figure presents Mean IAT $D$-scores with standard error bars, for males and females.
The fourth hypothesis tested for any association between Correct Responses and levels of Self-Esteem. Using Simple Regression test, it was found that the number of correct responses did not predict self-esteem ($F (1,38) = .058, p = .811, R^2 = -.025$), (Rosenberg self-esteem beta = .039, $p = .811$, CI (95%) -0.96 $\rightarrow$ 1.22. However, Figure 6, shows definite positive correlation between Correct Responses and Self-Esteem.

Figure 6. Figure presents Plot of Regression association between correct responses and Self-Esteem.
Discussion

Implicit attitudes

The current study employed a two-group approach to measure IAT implicit attitudes towards food images after consumption of two types of beverage. Two groups, experimental and control, were presented with food images with different types of stimuli. The gathered results for the first hypothesis showed that neither experimental nor control group varied significantly in their implicit preference for the other types of food cues. The results indicate, that individuals from the experimental group (high sugar condition) had a greater pro-sugar bias, were faster with reaction times responses towards high sugary images than the individuals in the control group. Total D-scores showed that participants in both conditions preferred food cues that resemble the type of the stimuli they consumed. However, statistical analysis showed that there was no significant result indicating no differences between two conditions. So the first hypothesis is rejected. These findings do not support the beginning prediction. It was predicted that the individual drinking the high sugar cola would have significantly shorter reaction times then the control group.

To continue with implicit attitudes, the third hypothesis was also measuring the two conditions, but also the number of correct responses, to see if those numbers will differ. The third hypothesis also measured the implicit attitudes using the $D$-score paradigm, and assessed the two groups, males and females. Implicit attitudes $D$-scores results indicated that males scored more positive than females, having therefore larger positive scores for implicit bias towards the high sugary food cues (positive implicit preference bias). Females, in the other hand, had low sugary food
cues bias, indicating that females preferred slightly more the diet food images. The reaction times scores showed that gender did not signify whether someone scores faster or slower towards food images. This slight difference however was not statistically significant, and therefore this hypothesis is rejected.

**Correct responses**

Correct responses for this experiment were measured with Implicit Association Test, where overall scores of participants were first viewed, and incorrect responses were removed from the data. The higher number of correct responses would indicate that the group or condition have more positive preference towards a target. Based on the results for the second hypothesis, the total of correct responses was tested with two conditions, experimental and control. However, no statistical significance was found.

The fourth hypothesis was measuring the total correct responses and the association with the self-esteem of the respondent. All participants were asked to state their general feelings about themselves using the Rosenberg Self-Esteem scale (RSE). The average total results of the traits were varied among all tested population. The data gave a non-significant result between both variables using Simple Regression test.

**Reintroducing the Aims and Results**

With reintroducing current research aims, where two types of stimuli were assessed and experimentally tested (diet and non-diet beverages), and two conditions (experimental and control) using Implicit Association Test where all participants were presented with food images, the result reveal that beverages did not change implicit preference towards certain types of foods within this tested population. There was also no effect seen of self-reported self-esteem and food choice.
Support from previous research

Several previous researchers have conducted studies that test the effects of sugar on mental abilities. Some results have some mixed findings in terms of whether sugar enhance the performance or not. This current research supports the theory that sugar has the ability to enhance tasks on reaction times, and therefore supports several previous studies. For example, Dye, Lluch and Blundell, (2000), Kennedy and Scholey (2000). The experimental group that consumed the high sugary beverage scored greater pro-sugar bias with larger positive scores towards sugary images. A study looking at food preference between vegetarians and meat-eaters (Barnes-Holmes, Murtagh, Barnes-Holmes and Steward, 2010), found people who claimed to be vegetarians preferred vegetables over meat. In the current study, individuals who consumed high sugar beverage were more likely to associate faster those images that were attributed with high sugar content. IAT is a useful tool to measure food preference only if these two types of foods show different properties. For example, healthy versus non-healthy, diet versus non-diet, to be valid for the research, and to predict behavioural preference towards any type (Richetin, Perugini, Prestwich and O’Gorman, 2007).

It is believed that artificial sweetener such as aspartame, enhance the nervous system impacting therefore neurobehavioral function. Aspartame is a well-known but also controversial sugar substitute that seems to be added to a variety of foods, both solids and liquids. People may receive information that low sugary content of food indicates it helps to lose weight. However, scientific researchers argue that large quantity of aspartame in beverage consumption have the opposite effect, such can be
linked to greater hunger due to low calorie content, and so resulting weight gain (Williams, Strobino and Brotnak, 2007), (Yang, 2010), (Strawbridge, 2012), also it can promote food intake and increase consumption (Swithers, Martin and Davidson, 2009). In the current study, artificial sweetener (aspartame) was an ingredient of a beverage that the control group received. The result however, did not support previously mentioned studies on aspartame. These participants who received diet type stimuli did not crave more sugar, so the beverage had the opposite effect what was suggested and hypothesised. On the other hand, this research may give some suggestions to support an idea of health beneficial effect of low calorie drink.

**Strengths of the current study**

Research in psychology tends to have always some strengths and weaknesses. This also applies to this study. Strengths of this current research is that the true experiment design was used. So therefore, the principle of a causation (cause and effect) was attempted. This study measured the effects of a sugary drink versus diet on implicit attitudes. However, the results did not show any statistically significant results, but the idea of measuring beverages that are widely available to all population and their possible effects on human cognition is interesting and important to research. These possible effects may apply to choose of foods that all people do, and possible impact on health and well-being (Wittekind and Walton, 2014), (Malik et al, 2015). All data was tested for the parametric assumption in regard to the distribution. The strengths are the non-probability sampling with individual’s differences showing 2-tailed distribution of the population.
Limitations

The main focus of this study was to use Implicit Association Test (Greenwald and Banaji, 1995) to look for an implicit association, but one disadvantage is that the $D$-scores have to be calculated, so raw data is not available to carry out other statistical tests. Although, accepted are null hypotheses for four tests, it would be interesting to look at the raw data for further statistical analysis.

Some limitations of this research can be mentioned, and these may the factors giving non-significant results. This study applied consumption of widely available beverages that contain common ingredients (sugar and aspartame). This true experiment was assessed in the laboratory environment, so therefore it lacks in ecological validity. It is impossible to control for certain what each participant had consumed (food and drink) before the experimental procedure. Even though participants were asked not to consume a sugary drink for 3 hours beforehand experiment, not all of them did this. The amount and type of food or drinks could have some impact on either metabolism of each participant, before, during or after the consumption of the sugary / diet stimuli (Swithers, Martin and Davidson, 2009). The metabolism of an individual, could also be considered. Each person has an ability to digest sugar quicker or slower (Clemens et al, 2016). Also, some participants could be a regular cola beverage consumer, so the drink would not have the expected effect on computer task. Furthermore, sample were unevenly divided in relation to sex (13 males and 27 females). The third hypothesis resulted in non-significant $p$ value for sex and number of correct responses. However, the graph 5
showed that males scored more positively with number of correct responses than females. Perhaps with a larger sample size and even numbers of males and females would show statistical significance. Time of the day for the procedure, morning, afternoon or evening, also could be having an effect on participants, in relation to better performance (Dye and Blundell, 2002), memory (Lewandowska, Wachowicz, Marek, Oginska and Fafrowicz, 2017). In this experiment, participants were tested at different times of the day. Some volunteers were tested in the morning, some in the afternoon, and two females were tested after 5 p.m. The best design would be to test everyone at the same place and the same time but this would be impossible. Another aspect of the methodology to critique is the time of administration of the beverage. The current study applied a 20-minute duration between consumption of sugar or diet stimuli and the computer task. Some research suggests that time duration for the onset from consumption of food and performance can be changeable (Gadah, Kyle, Smith, Brunstrom and Rogers, 2016).

**Conclusion**

The main aim of this study was to measure high sugary and low sugary beverage towards implicit attitude bias using Implicit Association Test (IAT). Aim was succeeded when two different conditions were created, experimental and control. However, the all result does not support any of four hypotheses, suggesting there was no significant differences with scoring and other tasks, and therefore both created conditions did not show significant change after consumption of the beverage. Looking at the Figure 3 it can be seen that, the experimental group is biased towards high sugar foods and this pattern although is not significant would suggest further research with larger sample size. In this way it could be seen if this pattern can be
replicated or not. Figure 5 also showed an interesting pattern in that it shows slight contrast between males and females towards food images. Women may unconsciously choose the low sugary food images due to bias toward functional foods as shown in previous research (Ares and Gambaro 2007). Self-esteem was not associated with correct responses in this research.

However, giving the limitations to this study and the patterns seen after measuring with the IAT, there are possible directions for a future research.


IBM SPSS. Statistical Package for Social Science version 14.0


www.pexels.com
Appendix A

Welcome!

My name is Anna Gruszczak and I am final year student of Psychology.

You are invited to take a part in an experiment for a psychology thesis. The aim of that experiment is to test the effects of sugary drink on cognitive abilities and will involve consuming some popular beverage approximately 200-300 ml. The test will take an approximately 30 minutes for all procedure including simple computer task.

All participants must be attending an undergraduate program and must be 18 years and over.

It is not recommended that you participate if you have any allergies to sugar, caffeine, aspartame, phosphoric acid (common ingredients in popular drinks). Also, you cannot participate if you take any medication that may interferes with time reaction or absorption of stated above ingredients, if you are diabetic, have heart or blood related medical condition, (for women) - if you are pregnant or breastfeeding. Or any other related medical condition that you think may be related with negative outcomes when drinking these beverages.

An information sheet with further details will be provided to each participant before the test will begin.

The participation for this study is also voluntary and you will be allowed to stop at any time of participation if you want to.

If you are willing to participate, please contact me on,

xxxxxxx@mydbs.ie

Thank you for your attention and hope to see you soon.
Appendix B

Welcome!

You are going to participate in an exciting experiment for the purpose of my psychology thesis.

The AIM of this experiment is to EXAMINE ANY EFFECT OF the sugar and coffee content of a common beverage on cognitive ability. You will be required to drink an assigned amount of liquid, wait for a designed time to allow the drink to affect (approximately 10-15 minutes) while relaxing reading newspapers.

Afterwards, you will be asked to sit in front of the computer and asked to state your age and sex. Next, you will respond to a 10-item questionnaire about general feelings about yourself. The tests are simple tasks and contain practice, to allow you to give more confidence while doing the “Core test”. You will make sure to read all instructions provided on the computer screen carefully, but if you feel would need more explanation just let me know.

All tests will involve displaying images of food and being asked to respond to a question on these foods by pressing a certain key on the keyboard. Please notice that you will have a set time of 5 seconds to answer in Core test.

Before taking part in the experiment, please make sure that you are aware that you do not have diabetes, or heart and blood related medical conditions, that you are not on any medication that will interfere with reaction time, that you are not allergic to any of the following; sugar, aspartame, coffee, also you cannot take part if you are pregnant or breastfeeding. It is important to NOTE that

- High sugary beverage contains chemicals (for example caffeine) that might elevate your heart rate,
- sugar is absorbed in your intestine into blood as glucose giving you an energy rush,
- aspartame E951 is an artificial sweetener used as a substitute to sugar in major popular drinks,
- Phosphoric acid is a mineral acid and is made of phosphorus which is found naturally in the body. All stated ingredients are not harm to the body in a moderate quantity.

You are also informed that you can withdraw from the experiment at any time and don’t have to give any reason. This experiment is voluntary, so you may not agree to consent.

CONSENT FORM experiment involving sugary drink consumption and cognitive testing

I have read and understood the attached information letter regarding this study. I have had the opportunity to ask questions and discuss the study with the researcher and I have received satisfactory answers to all my questions.

I understand that I am free to withdraw from the study at any time without giving a reason.

I agree to take part in this study.

Participant’s Signature ………………………………… Date…………………………
Participant’s Name in print ………………………………………..
Appendix C

Appendix C presents images of Doughnuts, Cookies, Waffles, Chocolate Desert, Cookie, Gummy Bears, Muffin, Ice Cream Sundae, Chocolate Lollipop, Macaroons.
Appendix D

Appendix D presents images of Peppers, Mushrooms, Cabbage, Spinach, Peas, Courgettes, Cauliflower, Asparagus, Broccoli, Tomatoes.
### Appendix E - Rosenberg Self-Esteem Scale (Rosenberg, 1965)

The scale is a ten item Likert scale with items answered on a four point scale - from strongly agree to strongly disagree. The original sample for which the scale was developed consisted of 5,024 High School Juniors and Seniors from 10 randomly selected schools in New York State.

Instructions: Below is a list of statements dealing with your general feelings about yourself. If you strongly agree, circle **SA**. If you agree with the statement, circle **A**. If you disagree, circle **D**. If you strongly disagree, circle **SD**.

<table>
<thead>
<tr>
<th></th>
<th>Statement</th>
<th>SA</th>
<th>A</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>On the whole, I am satisfied with myself.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>At times, I think I am no good at all.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>I feel that I have a number of good qualities.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>I am able to do things as well as most other people.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>I feel I do not have much to be proud of.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>I certainly feel useless at times.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>I feel that I’m a person of worth, at least on an equal plane with others.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>I wish I could have more respect for myself.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>All in all, I am inclined to feel that I am a failure.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>I take a positive attitude toward myself.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Scoring: SA=3, A=2, D=1, SD=0. Items with an asterisk are reverse scored, that is, SA=0, A=1, D=2, SD=3. Sum the scores for the 10 items. The higher the score, the higher the self-esteem.

The scale may be used without explicit permission.
Appendix F
Debrief letter

Thank you for your participation in this experiment. The goal of this study was to determine the effects of sugary drinks on your performance in a computer task. I was measuring both reaction time and accuracy (errors). Many cognitive psychology researchers are interested on how the brain and behaviour is affected by various stimuli, and so these measurements of the performance will be very valuable.

The beverage we gave you to drink could influence your score. Your score could suggest that you prefer one type of food instead of the other one. For this experiment, we created two conditions; one was an experimental and the other was a placebo. The design of this study was double blinded which means that neither you nor the researcher knows what group you were allocated to.

In this experiment, you were using a valid scientific procedure that looks at unconscious bias in people. We were interested in how well you would score after drinking a particular stimulus. So therefore, the overall result of this study may suggest that the active ingredients of the drink affect your performance.

The images that you were sorting during the test are just examples of food that everyone could easily discriminate as either high or low sugar. The same images were displayed for every participant randomly but in different sequences.

You were also responding to short ten items questionnaire that focuses on levels of self-esteem. This measurement could help to determine whether high self-esteem trait helps with people’s performance.

Your participation is not only greatly appreciated by the researcher, but the data collected could possibly aid further developments in this field of psychology.

It is important to notice that all data collected will be used for scientific analysis, but the names of participants will not be displayed anywhere. Your name in consent form is only used for the agreement of participation. Researcher’s interest is to evaluate results by looking at numbers. Researcher will also be responsible for storage all data in safe place when not in use. All data will be destroyed carefully by shredding and deleting from computer disk at the end of the study. The data could be stored for up to five years.

If you have any questions about this study, please contact us.

Researcher: Anna Gruszczak  xxxxxxxx@mydbs.ie

Supervisor:  Dr.Patricia Frazer  xxxxxxxx@dbs.ie

Finally, researcher urges you not to discuss this study with anyone else who is currently participating or might participate at a future point in time. As you can certainly appreciate, to maintain fairness, I will not be able to examine participants who know about the true purpose of the project beforehand.

Thank you!