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‘An experimental project evaluating the effects of different intensities of exercise on food cravings.’

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DECLARATION

I certify that the whole of this work is the result of my individual effort, and that all sources have been acknowledged.

Signed Izabela Pietrzyk (Student)

Date 31/03/2025

DECLARATION

I am satisfied that this work is the result of the Student's effort.

Signed (Lecturer)

Date

I confirm that I have not used any AI tools in the research and creation of this assignment. I confirm that I have not presented any AI generated materials as my own work. I confirm I have copies of my drafts, notes, and other resources I used, which I may be asked to provide in evidence.

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Abstract

Introduction: According to Sultana *et al.* (2019) and Donati-Zeppa *et al.* (2020), it is known that exercise plays a crucial role in maintaining overall health, influencing factors such as weight management or cardiovascular function. Nevertheless, one important yet less understood aspect of exercise is the impact on appetite regulation (Hubner, Boron and Koehler, 2021; Thackray and Stensel, 2023) due to different factors such as intensity, duration, type of exercise or individual differences and therefore there is a selection of controversy studies regarding changes in appetite after exercise (Hu *et al.*, 2023). Nevertheless, understanding how high or low exercise intensities affect hunger, satiety and energy intake can provide an important insight into development of strategies for weight control and dietary planning (Thackray and Stensel, 2023).

Method: This experimental study employed a cross-sectional design gathering numerical data from a quantitative collection using a questionnaire to assess food cravings and consumption patterns following high-intensity versus moderate-intensity exercise. Participants were recruited through university mailing lists and social media platforms. The questionnaire was answered by 4 males and 8 females, and the questionnaire was designed to assess three primary domains: (1) usual eating patterns, (2) physical activity habits, and (3) food cravings in response to exercise. The collected and raw data was analysed using the SPSS statistical analysis software (SPSS, 2023).

Results: None of the t-tests show a statistically significant difference between moderate and vigorous exercise groups for any of the food cravings and craving-related variables ($p > 0.05$ across all variables). While moderate exercise group shows some higher mean cravings for most foods and craving related behaviors, the differences were not statistically significant.

Discussion: The results of this study showed no significant differences in food cravings between moderate and vigorous exercise groups. Although the moderate group showed slightly higher mean cravings for most variables, these differences were very small and not statistically significant suggesting that exercise intensity

alone may not be a decisive factor in regulating food cravings, at least in a short term.

Practical implication: Understanding the impact of different exercise modalities on appetite regulation and food choices is crucial for developing effective strategies for weight management, overall health, psychological well-being or athletic performance and may provide a mechanistic insight into exercise-induced alterations in food and beverage intake (Schubert, et al., 2014).

Introduction

Physical activity and healthy diet interventions are both known for reducing the risk of non-communicable diseases such as cardiovascular disease, cancer, type 2 diabetes, hypertension, obesity or respiratory diseases (Nitschke *et al.*, 2022). General recommendations for a healthy diet include a consumption of meals rich in fruit and vegetable, lean proteins, whole grains and healthy fats (Cullum, 2024). Additionally, reducing salt, sugar, saturated fats and alcohol play a crucial role in reducing the risk of developing diseases (Nitschke *et al.*, 2022; Cullum, 2024). The weekly recommendations for physical activity performance include a minimum of 150 to 300 minutes of moderate intensity activity or 75 to 100 minutes of vigorous aerobic activity with an addition of resistance training for at least two days per week (Nitschke *et al.*, 2022).

Exercise training is commonly categorised into intensities such as high intensity or low intensity exercise which may in turn benefit health in different ways (Shiraeve and Barkley, 2012). Despite the fact that any physical activity is beneficial for overall health (Wisløff, Ellingsen and Kemi, 2009; Barkley, 2012; Maillard, Pereira and Boisseau, 2018; Ballesta-Garcia *et al.*, 2019; Miguet *et al.*, 2020), according to some literature being engaged in more high intensity programs may be more beneficial for overall fitness, cardiac function, weight and abdominal and visceral fat mass percentage reduction, as well as is considered as time-efficient alternative (Wewege *et al.*, 2017; Hariadi, Nusri and Juanda, 2019; Menz *et al.*, 2019; Sultana *et al.*, 2019; Donati-Zeppe *et al.*, 2020). Furthermore, training protocol such as high intensity interval training (HIIT) involves repeated bouts of movement at a high/maximum intensity separated by a short aerobic recovery period (Wisløff, Ellingsen and Kemi, 2009; Shiraeve and Barkley, 2012). Conversely, low intensity steady state (LISS) training is a sustained activity which is performed at a consistent pace, lower intensity and lower heart rate for a period of around 30-60 minutes (Pereira and Boisseau, 2018).

Exercise intensity refers to the rate of metabolic energy demand during exercise (MacIntosh *et al.*, 2021). As explained by MacIntosh *et al.* (2021) high intensity exercise is any workout such as running, cardio training, cycling at high speed, HIIT, fast swimming, walking briskly up a hill and many other that makes the heartbeat fast

and makes it harder to breath. These exercises may help to build strength and burn a lot of calories quickly (MacIntosh *et al.*, 2021). On the other hand, low-intensity training is slower and easier on the body, like walking, gardening, light cycling, light yoga and many more which keep the heart rate steady, is great for improving endurance and may be beneficial for minimising certain mental health problems (Herbert, 2022).

It is known that exercise plays a crucial role in maintaining overall health, influencing factors such as weight management or cardiovascular function (Sultana *et al.*, 2019; Donati-Zeppa *et al.*, 2020). Nevertheless, one important yet less understood aspect of exercise is the impact on appetite regulation (Hubner, Boron and Koehler, 2021; Thackray and Stensel, 2023). Some studies suggest that high intensity exercise may suppress appetite in the short term (Schubert *et al.*, 2013; Hu *et al.*, 2023; Thackray and Stensel, 2023), others indicate that different intensities may have different or no effect on food intake (Sim *et al.*, 2014; Martins *et al.*, 2015). Additionally, exercise intensity influences several physiological factors that regulate food cravings and consumption patterns, primarily through its effect on energy expenditure, metabolism and appetite regulating hormones (Kawano *et al.*, 2013). Hormones such as ghrelin, leptin and insulin regulate appetite and energy balance with exercise known to modulate their levels (Kawano *et al.*, 2013). Moreover, psychological influences such as mood, stress and cognitive restraint may further impact food choices (Donati-Zeppa *et al.*, 2020). Additionally, the food reward system driven by dopamine and other neurotransmitters may also play a role in cravings (Beaulieu, Oustric and Finlayson (2020). Therefore, understanding how high or low exercise intensities affect hunger, satiety and energy intake can provide an important insight into development of strategies for weight control and dietary planning (Thackray and Stensel, 2023).

The main aim of this study was to investigate whether intensities of exercise such as high-intensity and low-intensity generate different cravings for foods like chocolate, sweets, other tasty foods that are not sweet, starchy foods as well as healthier options such as fruit and dairy foods. Additionally, the objectives of the project were: (1) to differentiate and separate high intensity and low-intensity exercise according to the answers from the questionnaire, (2) to identify what kinds of foods people crave after participating in higher intensity workouts, (3) to identify what kinds of foods

people crave after being involved in lower intensity exercise, (4) to explore if exercise intensity influences food choices or cravings.

This study hypothesises that vigorous intensity exercise will be more effective in reducing cravings for high-calorie foods compared to moderate intensity exercise. Additionally, high intensity exercise will lead to greater suppression of food cravings compared to moderate intensity exercise resulting in less frequent and weaker food cravings, less difficulty to resist food cravings and less eating in response to food cravings.

Literature review

Responses to exercise have been widely studied showing that exercise can affect homeostatic mechanisms influencing appetite control by both appetite-suppressing and appetite-stimulating effects (Wuorinen, 2014; Beaulieu, Oustric and Finlayson, 2020). Nevertheless, effects of physical activity on appetite are complex and not completely understood as it is influenced by many factors such as intensity, duration, type of exercise or individual differences and therefore there is a selection of controversy studies regarding changes in appetite after exercise (Hu *et al.*, 2023).

1.1 The Compensatory Health Beliefs Model and Self-regulation Theory

Exercise-induced appetite changes can be explained through several theories that fit under the topic of how different exercise intensities influence food patterns and cravings (Hall and Fong, 2007; Petersen *et al.*, 2019). The Compensatory Health Beliefs Model suggests that a healthy behaviour such as exercise can be rewarded by an unhealthy behaviour such as a dietary treat or unhealthy behaviour could lead to and be compensated by a healthy behaviour (Petersen *et al.*, 2019). This compensatory eating hypothesis explains that individuals who engage in high intensity workouts may overconsume calories post-exercise either due to physiological hunger or psychological reward mechanisms (Petersen *et al.*, 2019). Conversely, the self-regulation theory explains how individuals control their thoughts, emotions and behaviours and it involves goal setting, monitoring and control over behaviours such as food intake (Hall and Fong, 2007). Moreover, high-intensity may cause ego depletion increasing the preference for high-calorie foods (Petersen *et al.*, 2019). However, if individuals perceive intense workouts as goal-congruent they might regulate cravings (Hall and Fong, 2007). In addition, moderate intensity exercise may not deplete self-control as much allowing for more mindful eating decisions (Hall and Fong, 2007).

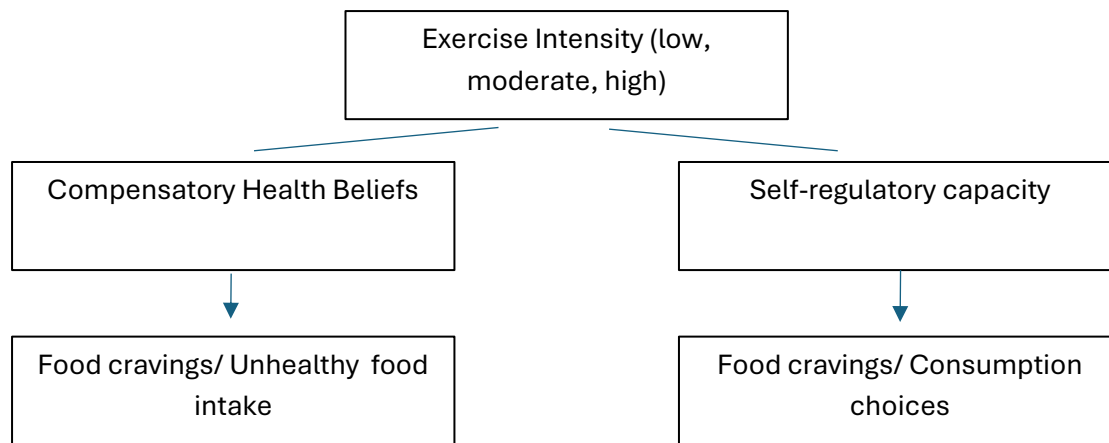


Figure 1. The impact of exercise intensities on food cravings through the Compensatory Health Belief model and Self-regulation theory (Hall and Fong, 2007; Petersen et al., 2019).

1.2 Appetite regulating hormones

Moreover, concentration of hormones such as ghrelin, leptin, GLP-1 (Glucagon-like peptide-1) and PYY3-36 (Peptide YY) play key roles in triggering hunger, reducing appetite or promoting fullness while maintaining energy balance and regulating food intake based on the individuals' needs (Blundell *et al.*, 2003; Martins *et al.*, 2007; Kawano *et al.*, 2013; Wuorinen, 2014). Ghrelin is mostly produced in the stomach and is referred to as a 'hunger hormone' because it can stimulate appetite and increase food intake when the stomach is empty (Deighton *et al.*, 2013b; Wuorinen, 2014). Moreover, leptin also known as a 'satiety hormone' is released from adipose tissue signalling the brain that the body has enough stored fat and energy when there is an energy surplus (Wuorinen, 2014). Similarly, Wuorinen (2014) explains that GLP-1 and PYY3-36 both secreted in the intestines may increase after exercise and therefore can decrease food consumption since they slow gastric emptying and stimulate insulin secretion.

Some studies report a decrease in acylated ghrelin concentrations and increase in leptin, GLP-1 and PYY3-36 post-higher intensity exercise resulting in reduced short-term hunger and effectively lowering and suppressing appetite potentially leading to a reduction in overall energy intake (Broom *et al.*, 2009; Deighton *et al.*, 2013a; Deighton *et al.*, 2013b; Hallworth *et al.*, 2017; Hu *et al.*, 2023). Similarly, a study conducted by Thackray and Stensel (2023) explain that exercise bouts may affect loss of appetite during and immediately post exercise also known as 'exercise-

induced anorexia'. The article is consistent with several others included in this literature review and explain that acute moderate to vigorous intensity may affect the suppression of ghrelin and elevation of satiety hormones such as peptide YY (PYY) and glucagon-like peptide-1 (GLP-1) (Thackray and Stensel, 2023). Interestingly, research suggests that hormonal responses usually return to normal within few hours, explaining that exercise may temporarily reduce hunger but does not make individuals eat less or more later in the day when they have freedom to eat as much as they want from a meal or a buffet (Schubert *et al.*, 2013). Additionally, energy deficit created by high intensity exercise may lead to compensatory eating later in the day particularly in individuals who are unaccustomed to intense exercise (King *et al.*, 2010). Moreover, some research evaluating appetite control in overweight or obese individuals suggests no difference between moderate or high intensity (Sim *et al.*, 2014; Martins *et al.*, 2015). The study carried out by Martins *et al.* (2015) found that exercise intensity whether moderate or high did not significantly impact appetite compared to a study by Sim *et al.* (2014) where they found that certain appetite hormones were affected and found a reduction in food intake after higher-intensity exercise. However, those different results could be affected by the different protocols between the studies such as one study involved exercising on an empty stomach and the intensity was much higher than most obese individuals could sustain (Sim *et al.*, 2014).

1.3 Psychological Influences

Furthermore, regular exercise positively influences mood and self-control which may turn the behaviour in a healthy direction resulting in less frequent binge-eating (Donati-Zeppa *et al.*, 2020). However, there are many studies explaining that exercise intensity can influence psychological processes differently (Beer *et al.*, 2020). Moreover, Beer *et al.* (2020) suggests that high intensity exercise is known to suppress appetite but may also reduce enjoyment, adherence and motivation compared to other forms of exercise which in turn may negatively impact long-term exercise participation and eating behaviours. Moreover, more acute stress response post high-intensity exercise may potentially lead to cravings for high-calorie or palatable foods as a form of a reward (Beer *et al.*, 2020). Conversely, low to moderate intensity exercise is associated with improved mood through the release of endorphins and reduction in anxiety and depression which in turn may lead to

healthier food choices (Beer *et al.*, 2020). Similarly, a scoping review by Porter *et al.* (2025) analysed twenty-three studies and suggests that individuals may eat healthier or less healthily depending on their exercise motivation, enjoyment and beliefs about eating after exercise such as a belief about eating to refuel or eating as a reward. Additionally, moderate intensity exercise may be linked to enhanced executive function and self-regulation which may lead to better control over food choices reducing impulsive eating and unhealthy cravings (Porter *et al.*, 2025). Moreover, the demanding nature of high intensity exercise may lead to ego depletion where an individual experience temporary reduction in self-control and may turn to be more prone to consuming high-calorie foods post exercise especially if they perceive the workout as requiring compensation (Hagger *et al.*, 2010).

1.4 Food cravings

Food craving is defined as an intense desire for a particular type of food and individuals typically report cravings for processed, palatable foods high in sugar, salt, fat or refined carbohydrates (Taylor, 2019). It is suggested that food craving may play a central role in the development of obesity (Drenowatz *et al.*, 2017). Moreover, Beaulieu, Oustric and Finlayson (2020) explain that appetite or food cravings may be guided by the food reward system which is encoded by neural pathways in the brain affecting the types of food people crave and choose post-exercise. According to the literature, exercise intensities may impact frequency and strength of cravings differently resulting in reduced or increased difficulty to resist food cravings (Drenowatz *et al.*, 2017). Some research evaluating the combined effects of the food reward systems and hypothalamic regulation suggests that high-intensity exercise is more effective than low-intensity exercise at temporary reducing food cravings (Dorling *et al.*, 2018). However, there is many inconsistent findings between exercise participation and cravings due to factors such as different energy expenditures, fuel utilization or sex differences (Drenatowatz *et al.*, 2017; Dorling *et al.*, 2018). Therefore, understanding the impact of different exercise modalities on appetite regulation and food choices is crucial for developing effective strategies for weight management, overall health, psychological well-being or athletic performance and may provide a mechanistic insight into exercise-induced alterations in food and beverage intake (Schubert, *et al.*, 2014). Moreover, understanding the patterns could

help fitness professionals, dietitians and healthcare providers tailor exercise recommendations to support better eating behaviors (Schubert *et al.*, 2014).

Many existing controversy studies on exercise and appetite regulation focus mainly on acute bout of resistance exercise or aerobic training (Martins, Morgan and Truby, 2008; Broom *et al.*, 2009; Wuorinen, 2014; Blundell *et al.*, 2015; McNeil *et al.*, 2015; Drenowatz *et al.*, 2017; Donati-Zeppa *et al.*, 2020; Halliday *et al.*, 2021). Fewer specifically compare high intensity and low intensity resulting in little knowledge about the effect of those exercise protocols on dietary preferences (Martins *et al.*, 2015; Miguët *et al.*, 2020; Thivel *et al.*, 2020; Hu *et al.*, 2023).

1.5 Impact of exercise intensities on food cravings

Hu *et al.* (2023) concluded that higher intensity exercise suppressed hunger perception 30-to-90 minutes post exercise possibly inducing more prolonged effect on appetite regulation. Similarly, Broom *et al.* (2009) explained that vigorous treadmill running suppressed hunger during and immediately after exercise. Also, McNeil *et al.* (2015) suggest that regardless of intensity, being active reduced the preference for high fat foods while resistance training reduced the 'liking' for high fat foods. Similarly, Donati-Zeppa *et al.* (2020) explained that nine weeks of HIIT promoted a reduction in spontaneous energy intake during lunch and dinner shifting to a healthier diet where participants reported eating more fish, vegetable oils, nuts, fruits and cereals. Moreover, Drenowatz *et al.* (2017) found that aerobic exercise was associated with cravings for fruit and vegetables which may be a result of a diet and behaviour-intervention (Schneider *et al.*, 2016) and found more difficulty to resist food cravings in women compared to men. This finding could be due to a combination of biological, hormonal and psychological factors which women may experience making cravings more intense and harder to resist (Drenowatz *et al.*, 2017). Nevertheless, walking was associated with an increased craving for chocolate (Drenowatz *et al.*, 2017). Moreover, Drenowatz *et al.* (2017) explain that increased food cravings could be a result of aerobically trained individuals wanting to meet their increased energy demands. Additionally, men participating in resistance training may experience an enhanced control of eating (Drenowatz *et al.*, 2017).

However, some studies such as Halliday *et al.* (2021) did not find any differences in food cravings between exercise types. Similarly, a study by Cornier *et al.* (2011)

carried out on 12 adult participants investigated the effects of acute and chronic exercise on eating behaviours and summarised that exercise program did not change how people behaved when it came to appetite. However, the study found that long-term exercise affected how brain reacted to images of food, specifically the parts of the brain involved in food cravings and hunger regulation were less responsive (Cornier *et al.*, 2011). This finding may suggest that exercise could influence food intake through the way that the brain perceives and processes food-related cues (Cornier *et al.*, 2011).

Method

2.1 Design

This study employed a cross-sectional design using a questionnaire to assess food cravings and consumption patterns following high-intensity versus moderate-intensity exercise. Gathering numerical data from a quantitative collection help to uncover behaviours and trends but not the motivations behind observed behaviours (Goertzen, 2017). Experimental protocols using surveys or questionnaires allow for a larger sample size and efficient data processing making it easier to derive meaningful conclusions compared to time intensive qualitative interviews (Goertzen, 2017). Participants were asked about their usual eating patterns, physical activity levels, and food cravings after being involved in a typical week of physical activities. Direct questions in the quantitative research aimed to answer the 'what' or 'how' allowing to better understand what food people tend to consume after different exercise or how strong was the desire to eat a particular food after exercise (Goertzen, 2017).

2.2 Participants

Participants were recruited through university mailing lists and social media platforms. Eligibility criteria included individuals aged 18–over 54 years, with no diagnosed metabolic disorders, no known food allergies that could influence food cravings, and no history of eating disorders. The questionnaire was answered by 12 participants who have been selected through a non-probability convenience sampling which was based on the individuals' willingness to participate (Tyrer and Heyman, 2016). The data included 4 male and 8 female participants. This sampling method was simple, cost-effective and less-time consuming (Tyrer and Heyman, 2016). To ensure a balanced sample, recruitment targeted a mix of genders, fitness levels, and exercise preferences. Additionally, to maintain the highest ethical standards, guidance from organisations such as Association for Nutrition (2021) and University of Wales Trinity Saint David (2022) was followed.

2.3 Ethical Considerations

The study was approved by the university ethics committee, and all participants provided informed consent before completing the questionnaire to ensure clear understanding (Crow *et al.*, 2006). All gathered information was confidential and anonymous to encourage honest participation. Additionally, all participants were informed of their right to withdraw at any time as well as all data was securely stored to maximise privacy (Wiles *et al.*, 2008). No invasive procedures were involved, and participants were not required to alter their exercise or eating habits for the study.

2.4 Questionnaire Development

The questionnaire was designed to assess three primary domains: (1) usual eating patterns, (2) physical activity habits, and (3) food cravings in response to exercise. The selected method was inexpensive, quick, easy and anonymous therefore provided more honest and frank answers which consequently minimised bias (Marshall, 2005). The questionnaire was created using Microsoft Forms tool and send out to participants through email. It was structured in four main sections:

2.4.1 Demographics and Baseline Information

Participants provided basic demographic details, including age, gender and ethnicity.

2.4.2 Dietary intake

This section asked about usual eating patterns. Participants reported what food they usually consume by answering questions from the 9-item validated brief dietary screener that correlates well with a comprehensive 'Food Frequency Questionnaire' (Rothenberg *et al.*, 2021; Lara-Breitinger *et al.*, 2023). This helped control for potential confounding factors such as habitual dietary behaviours.

2.4.3 Physical Activity and Exercise Intensity

To measure participants' habitual physical activity, the International Physical Activity Questionnaire (IPAQ) short-form was adapted (Danquah *et al.*, 2018). This section assessed the frequency and intensity of participants' exercise routines. This allowed to separate individuals into groups of low and high intensity exercise. High-intensity exercise was defined as any activity that caused heavy breathing and a heart rate of approximately 70–85% of maximum (e.g., sprinting, HIIT workouts, competitive sports) (Danquah *et al.*, 2018). Moderate-intensity exercise was defined as activities

that allowed for normal conversation and maintained a heart rate of around 50–60% of maximum (e.g., brisk walking, yoga, light jogging, light cycling, recreational sports) (Danquah *et al.*, 2018).

2.4.4 Food Cravings and Consumption Patterns

Food cravings were assessed using a valid questionnaire such as ‘Control of Eating Questionnaire’ which is a widely used tool for measuring food cravings (Drenowatz *et al.*, 2017). This questionnaire assessed the difficulty in resisting food cravings and difficulty to control eating, frequency, strength and specificity of food cravings as well as appetite and affective state across the same time period (Drenowatz *et al.*, 2017). The Control of Eating Questionnaire has previously been used to measure food cravings in doctoral thesis investigating food cravings in people engaged in weight management (Smithson, 2014). All questions used a 10-point rating scale, ranging from 0 (Not at all) to 10 (Extremely). The questions in this section of the questionnaire were as follow: ‘How hungry have you felt?’, ‘How full have you felt?’, ‘How strong was your desire to eat sweet foods’, ‘How strong was your desire to eat tasty foods that are not sweet?’, ‘How happy have you felt?’, ‘How anxious have you felt?’, ‘How alert have you felt?’, ‘How contented have you felt?’, ‘How often have you had food cravings?’, ‘How strong have any food cravings been?’, ‘How difficult has it been to resist any food cravings?’, ‘How often have you eaten in response to food cravings?’. Also, participants had to choose how often they had food cravings for different types of food/drink such as chocolate, sweet foods, fruit, dairy, starchy foods, tasty foods that are not sweet on a scale 0 (not at all) to 10 (extremely often). Lastly, participants had to state whether they did or did not feel difficulty to control their eating by choosing an option from 0 (not at all difficult) to 10 (extremely difficult).

2.5 Procedure

Participants were instructed to complete the questionnaire online in the same week of their participation in physical activity. To minimize recall bias, they were encouraged to answer questions based on their most recent high or moderate intensity workout rather than relying on general past experiences. The whole nature of the study was carefully explained to participants as well as brief information of the experiment was summarised at the front page of the questionnaire.

2.6 Data Analysis

The collected and raw data was analysed using the SPSS statistical analysis software (SPSS, 2023). The analysis helped to understand if there were any differences between two groups such as high intensity and moderate intensity exercise. The responses from the questionnaire were based on Likert scale. Comparisons of craving intensity and food consumption patterns between high and moderate intensity exercise were analysed using parametric test such as independent t-test to measure valid conclusions on the phenomena observed (Mircioiu and Atkinson, 2017). Descriptive statistics (means, standard deviations, and frequencies) were used to summarize demographic data, exercise participation as well as feelings and cravings after participating in exercise.

Results

A total of 12 participants (N=12) were included in the study. The mean age of participants was 37.50 years (SD = 7.54), indicating that most participants were in their late 30s to early 40s. The standard deviation suggests a moderate level of variation, meaning that while some participants were younger or older, the majority were within approximately 7.5 years of the mean age. The sample consisted of 33.3% male participants (N=4) and 66.7% female participants (N=8). Participants in the study were all White, with no diversity in the ethnicity represented in the sample. Among participants, 50% engaged in moderate-intensity exercise and 50% engaged in vigorous-intensity exercise.

Table 1. Descriptive statistics of participants' demographics and exercise background.

Variable	Values are Mean $\pm$ SD and frequencies %.
Age (years)	37.50 $\pm$ 7.54
Sex -Male -Female	33.3% (n=4) 66.7% (n=8)
Ethnicity -White	100% (n=12)
Exercise Background -Moderate Activities -Vigorous activities	50% (n=6) 50% (n=6)

Moreover, participants reported a moderate level of hunger (M=3.5). There is a wide range of variability, as indicated by the standard deviation (SD=2.71), meaning participants had varied responses ranging from not hungry at all to quite hungry. Participants felt moderately full (M=5.42), with a moderate amount of variability (SD=2.43). Some participants may have felt quite full, while others felt less so. On average, participants reported a low to moderate desire for sweet foods (M=3.08). The standard deviation indicates that there is some variability in the responses, with some participants desiring sweets more intensely than others. The average desire for tasty foods is moderate (M=3.83), with some variability in responses (SD=2.59), suggesting that while some participants felt strongly about wanting tasty foods,

others did not. Additionally, participants reported being quite happy ($M=7.08$). The standard deviation ($SD=3.06$) shows there was some variation in how happy participants felt, with some feeling extremely happy and others less so. On average, participants reported low anxiety ($M=2.67$), with a wide range of variability ($SD=2.74$), meaning that some participants experienced anxiety more strongly than others. Participants generally felt alert ($M= 7.42$), with moderate variability in alertness levels ($SD=2.84$). Participants felt moderately content ($M= 7.08$), with some variability in contentment levels, as indicated by the standard deviation ($SD=2.78$). Participants reported that food cravings occurred moderately frequently ($M=4.0$), with moderate variability in responses ($SD = 1.91$). Furthermore, participants experienced moderate strength of cravings ($M=3.92$), with variability in how strongly cravings were felt ($SD = 2.07$). On average, participants had moderate difficulty resisting cravings ($M=3.5$), with variability in how hard they found it to resist ($SD =2.07$). Lastly, participants ate in response to cravings to a moderate extent ($M=3.33$), with moderate variability in responses ($SD=1.72$).

Table 2. Descriptive statistics of the feelings after participating in exercise (mean and standard deviation).

Variable	Mean	Standard Deviation
Hunger	3.50	2.71
Fullness	5.42	2.43
Desire for sweet foods	3.08	2.11
Desire for tasty foods	3.83	2.59
Happiness	7.08	3.06
Anxiety	2.67	2.74
Alertness	7.42	2.84
Contentedness	7.08	2.78
How often food cravings occur	4.00	1.91
How strong craving was	3.92	2.07
Difficulty resisting cravings	3.50	2.07
Eating in response to cravings	3.33	1.72

Table 3 summarizes the results for different types of food cravings after participating in exercise including mean and standard deviation. Moreover, cravings for fruit had the highest mean ($M=4.67$). On average, participants craved fruit more than other food types. The high standard deviation ($SD=2.67$) indicates that responses varied widely with some participants strongly craved fruit, while others did not. Craving for starchy foods was also relatively high ($M=4.33$), starchy foods (bread, pasta) were one of the most craved categories, with moderate variability in responses ($SD=2.06$).

Craving for dairy was moderate ($M=3.75$) but had the largest variability ($SD=2.99$). The high standard deviation suggests some participants strongly craved dairy, while others had very little desire for it. Chocolate craving was lower ($M=3.25$). However, the standard deviation ($SD=2.45$) indicates significant variation, some participants craved chocolate intensely, while others did not. Sweet food craving was the lowest ($M=2.67$). Tasty but not sweet cravings were also low ($M=3.17$).

Table 3. Descriptive statistics of the cravings for types of food after exercise (mean and standard deviation).

Food craving type	Mean	Standard deviation
Chocolate	3.25	2.45
Sweet	2.67	1.87
Fruit	4.67	2.67
Dairy	3.75	2.99
Starchy	4.33	2.06
Tasty but not sweet	3.17	1.85

Independent-samples t-tests were conducted to compare food cravings between moderate and vigorous exercise groups. There was no significant difference in chocolate cravings between moderate and vigorous intensity groups ($t=1.065$, $df=10$, $p=0.312$). The moderate group had a slightly higher mean craving ($M=4.0$) compared to the vigorous group ($M=2.5$), but this difference is not statistically significant. Moreover, craving for sweet has showed no statistically significant difference between the two groups ($t=0.000$, $df=10$, $p=1.000$). Additionally, the mean for sweet craving scores for both groups are identical ($M=2.67$), indicating no variation in craving based on exercise intensity. Furthermore, fruit cravings resulted in $p>0.05$ showing no significant difference ($t=0.415$, $df=10$, $p=0.687$). The moderate group had a slightly higher mean craving ($M=5.0$) compared to the vigorous group ($M=4.33$), but the difference is not statistically significant. Similarly, cravings for dairy resulted in no significant difference ($t=-0.092$, $df=10$, $p=0.928$) as the $p>0.05$. The mean craving scores for dairy was nearly identical ($M=3.75$), with a very small non-significant difference. Also, no statistically significant difference was found in starchy foods ($t=0.268$, $df=10$, $p=0.794$). The moderate group reported slightly higher cravings for starchy foods ($M=4.5$) compared to the vigorous group ($M=4.16$), but the difference is not significant. Lastly, there was no significant difference between the different intensity and cravings for tasty non-sweet foods ($t=0.299$, $df=10$, $p=0.771$).

The moderate group reported slightly higher cravings ($M=3.33$) compared to the vigorous group ($M=3.0$), but the difference is not significant.

In order to assess the strength of food cravings and explore whether exercise intensity influences food craving or consumption patterns further independent-samples t-test analysis was conducted. Difficulty to resist cravings showed no significant difference between moderate and vigorous groups ($t=-0.826$, $df=10$, $p=0.428$). The mean difference was -1.00 between vigorous ($M=4.00$) and moderate ($M=3.00$) reporting the vigorous group had a slightly lower difficulty in resisting cravings, but the difference was not significant. Moreover, eating in response to cravings also reported no significant difference ($t=-0.652$, $df=10$, $p=0.529$). The group statistics showed that the vigorous group ($M=3.67$) reported slightly lower tendency to eat in response to cravings compared to moderate group ($M=3.00$) but the difference is not statistically significant ($p>0.05$). Similarly, there was no significant difference in cravings strength ($t=-0.133$, $df=10$, $p=0.897$) and the mean difference is extremely small between the groups (mean difference= -17) showing that vigorous group reported slightly weaker cravings. Additionally, craving frequency showed no significant difference between two groups ($t=0.900$, $df=10$, $p=0.389$) and the moderate group had slightly higher craving frequency (mean difference= 1.00) but the difference is not statistically significant. Moreover, statistical analysis checked the desire for sweet and tasty foods. Once more, no statistically significant differences were found for desire for sweet foods ($t=1.265$, $df=7.016$, $p=0.234$) and desire for tasty foods ($t=-0.652$, $df=10$, $p=0.529$). Lastly, the moderate group reported a slightly higher mean desire for sweet foods ($M=3.83$) compared to vigorous ($M=2.33$) and the vigorous group reported a slightly lower desire for tasty foods ($M=4.33$) than the moderate group ($M=3.33$) but the differences are not statistically significant.

Discussion

This study aimed to investigate whether exercise intensity such as moderate and vigorous influences food cravings. While the moderate group reported slightly higher cravings and craving related behaviours in most cases, none of the tests show a statistically significant difference between moderate and vigorous exercise groups. The results of this study showed that there were no statistically significant differences in food cravings between moderate and vigorous exercise groups across all measured categories including chocolate, sweet, fruit, dairy, starchy, and tasty non-sweet foods. Despite the lack of significance, the moderate-intensity group reported slightly higher mean cravings in several categories such as chocolate, fruit, and starchy foods, while the vigorous-intensity group showed slightly lower mean craving scores. However, these small differences failed to reach statistical significance, suggesting that exercise intensity may not be a primary factor influencing food cravings, at least in the short term.

The lack of significant differences in this study is consistent with previous research that has reported no significant differences in appetite regulation or food cravings between moderate and vigorous exercise intensities (Cornier *et al.*, 2011; Sim *et al.*, 2014; Martins *et al.*, 2015; Halliday *et al.*, 2021). Moreover, studies such as Halliday *et al.* (2021) similarly found no major difference in cravings between exercise types, indicating that factors other than intensity such as individual metabolic responses, psychological factors, or dietary habits may play a larger role in post-exercise food cravings. Similarly, Cornier *et al.* (2011) found that exercise programs did not significantly alter participants' appetite-related behaviours, although they did influence neural responses to food cues suggesting that exercise may affect cravings through psychological rather than physiological pathways. Interestingly, despite the lack of significant differences, the slight trend toward higher cravings in the moderate group aligns with studies suggesting that lower-intensity exercise may be associated with greater enjoyment and relaxation, potentially leading to a more permissive attitude toward food consumption (Beer *et al.*, 2020). Conversely, while vigorous exercise is often linked to temporary appetite suppression due to hormonal changes (Broom *et al.*, 2009; Deighton *et al.*, 2013a), the current study did not detect

a measurable difference in cravings between the two intensities. This could be due to the small sample size, short duration of the intervention, or individual variations in hormonal responses.

Furthermore, the findings in this study diverge from some previous research that reported reductions in appetite and cravings following higher-intensity exercise. For instance, Broom *et al.* (2009) and Deighton *et al.* (2013a) found that higher-intensity exercise suppressed acylated ghrelin (the hunger hormone) and increased satiety-related hormones (GLP-1 and PYY3-36) while effectively reducing short-term hunger. However, the current study did not replicate these effects, which may be due to differences in exercise protocols, sample characteristics, or the timing of cravings assessments. On the other hand, the non-significant results in this study are supported by Sim *et al.* (2014) and Martins *et al.* (2015) who found no significant differences in appetite regulation between moderate and high-intensity exercise. These studies highlight the variability in individual responses to exercise, as well as the potential influence of confounding factors such as participants' fitness levels, diet, and baseline appetite regulation. Moreover, Schubert *et al.* (2013) emphasized that while acute exercise may temporarily suppress appetite, it does not necessarily reduce overall food intake later in the day, which may explain the lack of significant differences observed in this study. This aligns with the theory that compensatory eating behaviours can offset any temporary appetite suppression induced by vigorous exercise (King *et al.*, 2010).

From a theoretical perspective, the lack of significant differences challenges the assumption that exercise intensity has a major influence on food cravings. The results suggest that other factors, such as individual psychological responses, exercise enjoyment, and post-exercise reward mechanisms may play a more prominent role in shaping food cravings (Beaulieu, Oustric and Finlayson, 2020; Donati-Zeppa *et al.*, 2020; Porter *et al.*, 2025). For instance, Porter *et al.* (2025) suggest that individuals' beliefs about food for example viewing food as a reward or refuel may influence post-exercise eating behaviours more strongly than the actual intensity of the exercise itself. Additionally, from a practical standpoint, these findings imply that both moderate and vigorous exercise may be equally beneficial for individuals seeking to manage food cravings. Since no significant differences were

found, individuals may choose the intensity that they enjoy and can adhere to over time, promoting consistency in their exercise regimen. This is particularly relevant given that Beer *et al.* (2020) noted that high-intensity exercise while potentially more effective in suppressing appetite, may reduce adherence due to lower enjoyment and increased fatigue.

There are several limitations to this study that should be considered when interpreting the findings. Firstly, the small sample size may have limited the statistical power, making it harder to detect potential differences between the groups. Future studies with larger sample sizes are needed to confirm whether exercise intensity has a more substantial impact on food cravings. Secondly, the study only measured short-term craving responses. As Schubert *et al.* (2013) noted, appetite-related hormonal changes often normalize within hours making it difficult to capture long-term effects. Future research could benefit from assessing food cravings and intake over a longer post-exercise period to determine whether any delayed effects emerge. Additionally, individual differences in fitness levels, diet, or psychological factors such as stress or mood were not accounted for in this study. Given that previous research (Beer *et al.*, 2020) has highlighted the influence of psychological factors on cravings, future studies could incorporate measures of mood, stress, and emotional eating tendencies.

Conclusion

In conclusion, this study found no significant differences in food cravings between moderate and vigorous exercise intensities. While previous research has linked higher-intensity exercise to temporary appetite suppression, the current findings suggest that exercise intensity alone may not be a decisive factor in regulating food cravings, at least in a short term. Instead, individual variations, psychological responses, and post-exercise behaviours may play a more substantial role.

Furthermore, both forms of exercise appear to have a similar impact and from a practical perspective, this suggests that individuals can choose the exercise intensity they find most enjoyable and sustainable without worrying about its direct impact on food cravings. This could encourage greater adherence to regular physical activity, which is important for overall health and well-being. Due to the limitations of the study, future and further research with larger sample sizes, longer observation periods and consideration of individual differences is needed to further explore and fully understand the complex relationship between exercise intensity and food cravings.

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Appendices

Appendix 1) Questionnaire front page/consent form

The influence of exercise intensities on food cravings and consumption patterns.

The purpose for this questionnaire is to identify whether intensities of exercise impact different cravings for high refined carbohydrate, high fat or sugary foods. Additionally, this study will clarify whether individuals tend to consume healthier or less healthy foods after participating in different physical activities.

By pressing submit at the bottom of the survey you are agreeing to the following:

I have been fully informed of the research project and have discussed the research and future publication opportunities for the lead researcher.
I agree for my answers from the questionnaires to be used within the study.

I understand that:

- I will not benefit financially, or otherwise, from taking part in this research.
- I am free to withdraw from the project at any time and free to decline to answer particular questions.
- I will not be identified, and individual information will remain confidential.
- I may withdraw at any time from the session or the research completely.

This questionnaire is made up of 4 sections:

-**First** section is all about participants information.

-**Second** section will be based on the usual food intake -Questions are taken from the 9-item validated brief dietary screener that correlates well with a comprehensive food frequency questionnaire (Rothenberg et al., 2021; Lara-Breitinger et al., 2023).

-The **third** part of the survey is based on the usual physical activity in accordance with the participants' intensity (Danquah et al., 2018).

-The **last** section is based on food cravings and the questions are taken from the validated questionnaire such as the 'Control of Eating Questionnaire' (Drenowatz et al., 2017).

Appendix 2) Control of eating questionnaire

Please read each question carefully and choose a number on the scale that best represents your experience, from 0=not at all to 10=extremely. Answer all questions according to your experience **over the past 7 days**

1. How hungry have you felt?
Not at all 0 1 2 3 4 5 6 7 8 9 10 Extremely
hungry hungry

2. How full have you felt?
Not at all 0 1 2 3 4 5 6 7 8 9 10 Extremely
full full

3. How strong was your desire to eat sweet foods?
Not at all 0 1 2 3 4 5 6 7 8 9 10 Extremely
strong strong

4. How strong was your desire to eat savoury foods? (french fries, crisps, burgers, pizza etc)?
Not at all 0 1 2 3 4 5 6 7 8 9 10 Extremely
strong strong

5. How happy have you felt?
Not at all 0 1 2 3 4 5 6 7 8 9 10 Extremely
happy happy

6. How anxious have you felt?

Not at all 0 1 2 3 4 5 6 7 8 9 10 Extremely
anxious anxious

7. How alert have you felt?
Not at all 0 1 2 3 4 5 6 7 8 9 10 Extremely
alert alert

8. How contented have you felt?
Not at all 0 1 2 3 4 5 6 7 8 9 10 Extremely
contented contented

A food craving is a strong urge to eat a particular food or drink

9. During the last 7 days how often have you had food cravings?
Not at all 0 1 2 3 4 5 6 7 8 9 10 Very
often

10. How strong have any food cravings been?
Not at all 0 1 2 3 4 5 6 7 8 9 10 Extremely
strong strong

11. How difficult has it been to resist any food cravings?
Not at all 0 1 2 3 4 5 6 7 8 9 10 Extremely
difficult difficult

12. How often have you eaten in response to food cravings?

How often have you had food cravings for the following types of food/drink?

13. Chocolate or chocolate flavoured foods
Not at all 0 1 2 3 4 5 6 7 8 9 10 Extremely
often

14. Other sweet foods (cakes, pastries, biscuits, etc)
Not at all 0 1 2 3 4 5 6 7 8 9 10 Extremely
often

15. Fruit or fruit juice
Not at all 0 1 2 3 4 5 6 7 8 9 10 Extremely
often

16. Dairy foods (cheese, yoghurts, milk, etc)
Not at all 0 1 2 3 4 5 6 7 8 9 10 Extremely
often

17. Starchy foods (bread, rice, pasta, etc)
Not at all 0 1 2 3 4 5 6 7 8 9 10 Extremely
often

18. Savoury foods (french fries, crisps, burgers, pizza etc)?
Not at all 0 1 2 3 4 5 6 7 8 9 10 Extremely
often

19. Generally, how difficult has it been to control your eating?

Not at all 0 1 2 3 4 5 6 7 8 9 10 Extremely
difficult difficult

20. Which **one** food makes it most difficult for you to control eating?

21. How difficult has it been to resist eating this food during the last 7 days?

Not at all 0 1 2 3 4 5 6 7 8 9 10 Extremely
difficult difficult

Appendix 3) Physical activity questionnaire

Common introduction	Physical activities in your free time The following questions concern how physically active you are <u>in your free time and during transport</u> (including your commute to and from work/school/classes)
MYPA question	On a typical week, how much time do you spend <u>in total</u> on <u>moderate and vigorous physical activities</u> where your heartbeat increases and you breathe faster (e.g. brisk walking, cycling as a means of transport or as exercise, heavy gardening, running or recreational sports). <i>Only include activities that lasted at least 10 minutes at a time.</i>
MYPA, closed-ended	☐ Less than ½ an hour (less than 30 minutes) ☐ ½ an hour - 1 ½ hours (30-90 minutes) ☐ 1 ½ - 2 ½ hours (90-150 minutes) ☐ 2 ½ - 5 hours (150-300 minutes) ☐ More than 5 hours (more than 300 minutes)
MYPA, open-ended	() Hours pr. week () Minutes pr. week
VPA question	How much of the time that you spend on physical activities in a typical week, which you indicated above, do you spend <u>in total</u> on <u>vigorous physical activities</u> ? This includes activities that get your heart racing, make you sweat and leave you so short of breath that speaking becomes difficult (e.g. swimming, running, cycling at high speeds, cardio training, weight-lifting or team sports such as football). <i>Only include activities that lasted at least 10 minutes at a time.</i>
VPA, closed-ended	☐ Less than ½ an hour (less than 30 minutes) ☐ ½ an hour - 1 hours (30-60 minutes) ☐ 1 - 1 ½ hours (60-90 minutes) ☐ 1 ½ - 2 ½ hours (90-150 minutes) ☐ More than 2 ½ hours (more than 150 minutes)

Appendix 4) SPSS Descriptive statistics

Descriptives

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Age_Midpoint	12	30.00	50.00	37.5000	7.53778
Valid N (listwise)	12				

Frequencies

Statistics			
	GENDER	ETHNICITY	
N	Valid 12	12	
Missing	0	0	

Frequency Table

GENDER				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid man	4	33.3	33.3	33.3
woman	8	66.7	66.7	100.0
Total	12	100.0	100.0	

ETHNICITY				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid white	12	100.0	100.0	100.0

Frequencies

Statistics		
	LOW1_HIGH2	
N	Valid 12	
Missing	0	

LOW1_HIGH2				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 1.00	6	50.0	50.0	50.0
2.00	6	50.0	50.0	100.0
Total	12	100.0	100.0	

Descriptives

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
HUNGER	12	.00	9.00	3.5000	2.71360
FULNESS	12	.00	8.00	5.4167	2.42930
DESIREforSweet	12	.00	7.00	3.0833	2.10878
DESIREforTasty	12	.00	8.00	3.8333	2.58785
HAPPINESS	12	.00	10.00	7.0833	3.05877
ANXIETY	12	.00	7.00	2.6667	2.74138
ALERTNESS	12	.00	10.00	7.4167	2.84312
CONTENTED	12	.00	10.00	7.0833	2.77843
HOWoftenCRAVING	12	.00	7.00	4.0000	1.90693
HOWstrongCRAVING	12	.00	8.00	3.9167	2.06522
DIFFICULTYresistCRAVING	12	.00	8.00	3.5000	2.06796
EATINGinResponseToCRAVING	12	.00	6.00	3.3333	1.72328
Valid N (listwise)	12				

Descriptives

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
CRAVINGchocolate	12	.00	8.00	3.2500	2.45412
CRAVINGsweet	12	.00	6.00	2.6667	1.87487
CRAVINGfruit	12	.00	8.00	4.6667	2.67423
CRAVINGdairy	12	.00	8.00	3.7500	2.98861
CRAVINGstarchy	12	.00	8.00	4.3333	2.05971
CRAVINGtastyNOTsweet	12	.00	6.00	3.1667	1.85047
Valid N (listwise)	12				

Appendix 5) SPSS T-test for specific food types cravings

T-Test

[DataSet7]

Group Statistics					
	LOW1_HIGH2	N	Mean	Std. Deviation	Std. Error Mean
CRAVINGchocolate	1.00	6	4.0000	2.75681	1.12546
	2.00	6	2.5000	2.07364	.84658
CRAVINGsweet	1.00	6	2.6667	1.96638	.80277
	2.00	6	2.6667	1.96638	.80277
CRAVINGfruit	1.00	6	5.0000	2.89828	1.18322
	2.00	6	4.3333	2.65832	1.08525
CRAVINGdairy	1.00	6	3.6667	2.80476	1.14504
	2.00	6	3.8333	3.43026	1.40040
CRAVINGstarchy	1.00	6	4.5000	2.73861	1.11803
	2.00	6	4.1667	1.32916	.54263
CRAVINGtastyNOTsweet	1.00	6	3.3333	2.06559	.84327
	2.00	6	3.0000	1.78885	.73030

Independent Samples Test										
Levene's Test for Equality of Variances					t-test for Equality of Means					
		F	Sig.	t	df	Significance One-Sided p	Two-Sided p	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower Upper
CRAVINGchocolate	Equal variances assumed	.177	.683	1.065	10	.156	.312	1.50000	1.40831	-1.63791 4.63791
	Equal variances not assumed			1.065	9.286	.157	.314	1.50000	1.40831	-1.67093 4.67093
CRAVINGsweet	Equal variances assumed	.294	.599	.000	10	.500	1.000	.00000	1.13529	-2.52959 2.52959
	Equal variances not assumed			.000	10.000	.500	1.000	.00000	1.13529	-2.52959 2.52959
CRAVINGfruit	Equal variances assumed	.255	.625	.415	10	.343	.687	.66667	1.60555	-2.91071 4.24405
	Equal variances not assumed			.415	9.926	.343	.687	.66667	1.60555	-2.91432 4.24765
CRAVINGdairy	Equal variances assumed	.433	.526	-.092	10	.464	.928	-.16667	1.80893	-4.19721 3.86388
	Equal variances not assumed			-.092	9.620	.464	.928	-.16667	1.80893	-4.21987 3.86554
CRAVINGstarchy	Equal variances assumed	1.471	.253	.268	10	.397	.794	.33333	1.24276	-2.43570 3.10237
	Equal variances not assumed			.268	7.232	.398	.796	.33333	1.24276	-2.58634 3.25300
CRAVINGtastyNOTsweet	Equal variances assumed	.026	.875	.299	10	.386	.771	.33333	1.11555	-2.15226 2.81893
	Equal variances not assumed			.299	9.800	.386	.771	.33333	1.11555	-2.15915 2.82582

Independent Samples Effect Sizes				
		Standardized ^a	Point Estimate	95% Confidence Interval Lower Upper
CRAVINGchocolate	Cohen's d	2.43926	.615	-.562 1.763
	Hedges' correction	2.64348	.567	-.518 1.627
	Glass's delta	2.07364	.723	-.520 1.906
CRAVINGsweet	Cohen's d	1.96638	.000	-1.132 1.132
	Hedges' correction	2.13101	.000	-1.044 1.044
	Glass's delta	1.96638	.000	-1.132 1.132
CRAVINGfruit	Cohen's d	2.78089	.240	-.902 1.370
	Hedges' correction	3.01371	.221	-.833 1.264
	Glass's delta	2.65932	.251	-.903 1.380
CRAVINGdairy	Cohen's d	3.13316	-.053	-1.184 1.080
	Hedges' correction	3.39547	-.049	-1.092 .997
	Glass's delta	3.43026	-.049	-1.178 1.086
CRAVINGstarchy	Cohen's d	2.15252	.155	-.993 1.285
	Hedges' correction	2.33273	.143	-.907 1.185
	Glass's delta	1.32916	.251	-.903 1.380
CRAVINGtastyNOTsweet	Cohen's d	1.93216	.173	-.966 1.302
	Hedges' correction	2.09395	.159	-.891 1.202
	Glass's delta	1.78885	.186	-.960 1.315

a. The denominator used in estimating the effect sizes.
Cohen's d uses the pooled standard deviation.
Hedges' correction uses the pooled standard deviation, plus a correction factor.
Glass's delta uses the sample standard deviation of the control (i.e., the second) group.

Appendix 6) SPSS t-test for strength of food cravings

Group Statistics					
	LOW1_HIGH2	N	Mean	Std. Deviation	Std. Error Mean
DIFFICULTYresistCRAVING	1.00	6	3.0000	2.00000	.81650
	2.00	6	4.0000	2.19089	.89443
EATINGinResponseToCRAVING	1.00	6	3.0000	2.00000	.81650
	2.00	6	3.6667	1.50555	.61464
HOWstrongCRAVING	1.00	6	3.8333	2.13698	.87242
	2.00	6	4.0000	2.19089	.89443
HOWoftenCRAVING	1.00	6	4.5000	2.42899	.99163
	2.00	6	3.5000	1.22474	.50000
DESIREforSweet	1.00	6	3.8333	2.63944	1.07755
	2.00	6	2.3333	1.21106	.49441
DESIREforTasty	1.00	6	3.3333	2.33809	.95452
	2.00	6	4.3333	2.94392	1.20185

Independent Samples Test										
Levene's Test for Equality of Variances					t-test for Equality of Means					
		F	Sig.	t	df	Significance One-Sided p	Two-Sided p	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower Upper
DIFFICULTYresistCRAVING	Equal variances assumed	.200	.664	-.826	10	.214	.428	-1.00000	1.21106	-3.69841 1.69841
	Equal variances not assumed			-.826	9.918	.214	.428	-1.00000	1.21106	-3.70144 1.70144
EATINGinResponseToCRAVING	Equal variances assumed	.032	.862	-.852	10	.264	.529	-.86667	1.02198	-2.94378 1.61045
	Equal variances not assumed			-.852	9.289	.265	.530	-.86667	1.02198	-2.98762 1.63428
HOWstrongCRAVING	Equal variances assumed	.024	.881	-.133	10	.448	.897	-.16667	1.24944	-2.95060 2.61727
	Equal variances not assumed			-.133	9.994	.448	.897	-.16667	1.24944	-2.95084 2.61750
HOWoftenCRAVING	Equal variances assumed	.930	.358	.900	10	.195	.389	1.00000	1.11056	-1.47447 3.47447
	Equal variances not assumed			.900	7.388	.198	.396	1.00000	1.11056	-1.59834 3.59834
DESIREforSweet	Equal variances assumed	5.104	.047	1.265	10	.117	.234	1.50000	1.18556	-1.14160 4.14160
	Equal variances not assumed			1.265	7.016	.123	.246	1.50000	1.18556	-1.30212 4.30212
DESIREforTasty	Equal variances assumed	1.000	.341	-.652	10	.265	.529	-1.00000	1.53478	-4.41971 2.41971
	Equal variances not assumed			-.652	9.512	.265	.530	-1.00000	1.53478	-4.44362 2.44362

Independent Samples Effect Sizes

		Standardizer ^a	Point Estimate	95% Confidence Interval	
				Lower	Upper
DIFFICULTYresistCRAVING	Cohen's d	2.09762	-.477	-1.616	.685
	Hedges' correction	2.27324	-.440	-1.491	.632
	Glass's delta	2.19089	-.456	-1.600	.729
EATINGinResponseToCRAVING	Cohen's d	1.77012	-.377	-1.511	.776
	Hedges' correction	1.91832	-.348	-1.394	.716
	Glass's delta	1.50595	-.443	-1.585	.740
HOWstrongCRAVING	Cohen's d	2.16410	-.077	-1.207	1.057
	Hedges' correction	2.34528	-.071	-1.114	.975
	Glass's delta	2.19089	-.076	-1.205	1.060
HOWoftenCRAVING	Cohen's d	1.92354	.520	-.646	1.661
	Hedges' correction	2.08498	.480	-.596	1.533
	Glass's delta	1.22474	.816	-.450	2.018
DESIREforSweet	Cohen's d	2.05345	.730	-.461	1.899
	Hedges' correction	2.22537	.674	-.425	1.743
	Glass's delta	1.21106	1.239	-.157	2.554
DESIREforTasty	Cohen's d	2.65932	-.376	-1.510	.776
	Hedges' correction	2.88086	-.347	-1.394	.716
	Glass's delta	2.94392	-.340	-1.474	.826

a. The denominator used in estimating the effect sizes.
Cohen's d uses the pooled standard deviation.
Hedges' correction uses the pooled standard deviation, plus a correction factor.
Glass's delta uses the sample standard deviation of the control (i.e., the second) group.