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Cancellation of Scheduled Exercise and its Influence on Consumption: Exercisers vs. Sedentary Individuals

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**Cancellation of Scheduled Exercise and its Influence on Consumption:
Exercisers vs. Sedentary Individuals**

By

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ABSTRACT

With the obesity epidemic on the rise an effort must be initiated to discover why dietary choices are made. Exercise cancellation in individuals who frequently exercise may cause a decrease in calories consumed. However, exercise cancellation in sedentary individuals may have opposite effect, increasing calories consumed. **PURPOSE:** This study was performed to determine whether the cancellation of regularly scheduled exercise affects an individual's daily food consumption, particularly in individuals who exercise regularly compared to those who are sedentary. **METHODS:** Female college students (n=10) scheduled two morning exercise sessions of 30 minutes of moderate intensity exercise. One session randomly determined by the researcher was canceled. After both days participants recorded their daily food intake. **RESULTS:** A statistically significant decrease in Perceived Health Competence Scale scores and increase in Perceived Stress Scale scores for sedentary subjects ($p<0.05$) occurred, compared to that of physically active individuals. There was also a statistically significant increase in calories and sodium intake for sedentary individuals on the day exercise occurred, compared to active individuals on the day exercise was cancelled ($p<0.05$). **CONCLUSIONS:** Regular exercise may be associated with lower stress and higher perceived health, but sedentary individuals must be cognizant of the compensatory consumption effect after exercise.

KEY WORDS: exercise cancellation, daily intake, stress, nutrition, obesity, health competence

REVIEW OF LITERATURE

Exercise

The health benefits of regularly performed exercise are numerous and span far beyond weight loss and cardiovascular fitness. Exercise and physical activity have been shown to significantly decrease an individual's risk of cardiovascular disease, obesity incidence, hypertension, and depression among a myriad of other health factors (15). Merely performing physical exercise leads to a higher capacity to perform work, as well as other adaptations in the musculoskeletal, cardiovascular and metabolic systems (14). The adaptations in these systems provide a number of positive effects on an individual's health and overall well being. Physical activity has been shown, numerous times, to reduce one's risk for cardiovascular mortality and all other causes of mortality in both healthy and diseased individuals. As well, exercise intensity and duration seem to be inversely related to mortality risk regardless of overall exercise volume (15).

The recommended exercise intensity is in the range of 3 to 6 METs (Metabolic Equivalent of Task) and an overall energy expenditure of at least 1,000 kcals/week (14). MET is a term which refers to the energy cost of performing physical activities and 1 MET is equal to 1 kcal·kg⁻¹·h⁻¹. The recommended exercise above is also equivalent to walking approximately 30 minutes per day, or 150 minutes of moderate intensity exercise per week. However, less than four percent of the adults in the United States are receiving the recommended volume of exercise (1). While many individuals know the risks of not participating in the recommended amount of physical activity, they continually choose to remain sedentary and increase their risk of certain diseases. As well, inactivity is more common among women in the United States than men (2). The Centers for Disease Control and Prevention report in a survey from 2008, over 50% of

women in the United States do not engage in the recommended amount of physical activity. Within that, over 38% of women are classified as insufficiently active and over 14% are not active at all. Exercise is clearly an important factor in obtaining and maintaining a healthy lifestyle for all individuals. Consequently, attention should be placed on ways to increase the frequency and duration of individual's daily exercise or investigate why these decreases in exercise are occurring. With an obesity epidemic on the rise, this becomes increasingly important as inactivity along with improper nutrition are leading causes of this medical condition.

Nutrition

Proper nutrition is often obscure for many Americans. Society and media are often influences encouraging individuals to become increasingly thin, through avenues which are considered "magic bullets" in place of proper diet and exercise. Taking medication or drinking a smoothie once a day seems far easier and less invasive on everyday life than lifestyle change. Over time, researchers and health professionals have come to realize the longest lasting and safest way to proper health is through diet and exercise. Yet, proper diet is rarely understood by many Americans.

The U.S. Department of Agriculture and U.S. Department of Health and Human Services distribute a *Dietary Guidelines for Americans* which includes some of the most important nutritional aspects in a healthy diet (29). The USDA recommends increasing foods like vegetables, fruits, whole grains, low-fat dairy products, and lean protein foods because these foods contain the nutrients an individual would need without too many calories. Increasing these foods can be done in simple ways such as: making half of an individual's plate fruits and vegetables, switching to skim or 1% milk, making at least half of an individual's grains whole

grains, and varying one's protein choices. Many Americans also consume too many solid fats, added sugars and sodium. These excess nutrients are associated with an increase in blood pressure, cholesterol, risk of type II diabetes, and coronary artery disease, so it is important to decrease the amount consumed (13). Foods high in fat and added sugars are often empty calories foods which are not needed in a proper diet (29). Empty calorie foods are ones which have a large number of calories and very few nutrients. Some easy ways to decrease the intake of fats, sugars, and sodium are as follows: choose foods and drinks with little or no added sugars, look out for sodium in foods which are purchased because it adds up very quickly, and eat fewer foods high in solid fats. Finally, each individual has a unique number of calories they are to consume in a day based on activity, height and weight. It is important to stay within this number of calories to avoid a positive energy balance which is associated with weight gain. A positive energy balance is when the number of calories consumed is greater than energy expenditure (or calories burned) throughout the day.

Obesity is the outcome of a chronic imbalance between caloric intake and caloric expenditure (14). Even small additions to our diet, such as 150 calories a day (about the caloric equivalent to a can of pop), can theoretically add up to be a large weight gain over a period of time. This addition of 150 kcals a day is equivalent to 55,000 kcals a year, which results in a weight gain of approximately 15 pounds. However, the news is not all bad, the opposite can be said. Small changes like decreasing one's caloric intake by 150 calories a day can reverse the effect, causing one to lose approximately 15 pounds in a year (in actuality this is not the amount of weight lost or gained due to changes in metabolism and straying from what the body considers its optimal weight).

While the recommended amount an individual should receive of each nutrient varies greatly person to person, the traditional 2,000 kcal diet is generally used as a comparison for the “average” individual and is the basis of food labels. The percent of daily values for a 2,000 kcal diet are as follows: 65g total fat, 20g saturated fat, 300g carbohydrates, 25g dietary fiber, less than 300mg of cholesterol, and less than 2400mg of sodium (29). Protein levels vary greatly from person to person and are therefore rarely given a percent of daily value on a food label, but generally the recommendation is around 50g of protein per day. There is also no recommended value of sugar and it is recommended to limit your intake to less than 10% of the total kilocalories consumed in one day.

Some additional factors which are included in a healthy diet are low saturated fats, and high fruits, vegetables, and whole grains (14). There are three diets in the world which are traditionally associated with good health and longevity. These diets include that of the Japanese, Chinese and Mediterranean. The diet which is most similar to the American diet would be the Mediterranean diet, and can be used as an example of what a proper diet may look like. The Mediterranean diet is low in saturated fat, high in monounsaturated fat, high in complex carbohydrates, high in fiber (mostly coming from fruits and vegetables), and olive oil is the main source of dietary fats. In the Seven Countries Study it was found that those eating the Mediterranean diet had lower mortality rates, lower blood pressure, lower body mass index, and subsequently a decreased chance of atherosclerosis (11). Another study done by Kastorini and others, found that an individual’s adherence to the Mediterranean diet was inversely correlated with the coronary heart disease mortality and a lower prevalence and progression of metabolic syndrome (9). Metabolic syndrome is a series of risk factors which increase one’s chance for coronary artery disease, stroke and type II diabetes. The previously mentioned studies show that

proper nutrition is very important to one's health and is associated with decreases in the risk of many diseases and chance of mortality.

Exercise and Weight Management/Loss

While diet is an excellent tool to use in weight loss and maintaining a healthy lifestyle, exercise is equally important. Exercise is the most robust predictor of sustained weight loss. (1). However, few interventional weight loss techniques stress the importance of this useful tool. For example, weight loss systems such as Nutrisystem or SENSEA boast all an individual needs to do is use their products and they will lose weight.

In a study performed by Jakicic and others, sedentary overweight women were studied to see if differing exercise intensities affected weight loss over a period of twelve months (7). In this study, researchers assigned women to one of four exercise groups: vigorous intensity/high duration, moderate intensity/ high duration, moderate intensity/ moderate duration, and vigorous intensity/moderate duration. Each of the individuals also decreased their energy intake by 1200 to 1500 kcal per day and dietary fat to be between 20-30% of their total energy intake. Researchers found that there was a significant weight loss in all groups. However, there was no significant difference between groups in the amount of weight lost. This leads us to believe there may be no difference between exercise intensity in regards to weight loss (when diet is held constant). This is an important factor to stress, because physical activity of any kind, paired with a decrease in energy intake may be extremely useful for weight loss. However, the results of this study may be altered by factors such as the moderate intensity/moderate duration individuals increasing their daily activity, or they could have been eating a higher number of calories than the high intensity/high duration group. While there could have been confounding variables in the

study done by Jakicic and others, it remains a source stressing the importance of exercise in weight loss (7).

Nonetheless, in a study recently performed by Rosenkilde and others, weight loss was again shown to be much more complicated and puzzling than previously perceived (23). In this study, researchers had about 20 women in three different groups: sedentary, moderate exercise (300kcal/day burned), and high exercise (600kcal/day burned). There was no statistical difference in food intake between the groups, yet even though the high exercise group burned twice as many calories as the moderate exercise group, their resulting body fat mirrored that of the moderate exercise group. Researchers found that the moderate exercise group had a greater than expected negative energy balance, resulting in a greater body fat decrease, whereas the higher exercise group did not lose as much body fat as expected. Regardless of there not being a difference between the moderate and high intensity groups there was a significant difference between each group (moderate and high intensity) and the sedentary group. Again, emphasizing the importance of physical activity of any type. Increasing one's physical activity will not only help in decreasing or maintaining weight, but also may help in many psychological matters.

Perceived Health

Perceived health is the self awareness of an individual's health. This may be not only physical health and the presence of a disease but also physical, mental and social well being. Factors such as unhappiness, life stress, depression, life satisfaction, age, sex, employment status and marital status have all been associated with perceived health (8).

More and more studies are showing that psychosocial factors are extremely important in overall health. Social disconnection, isolation, adverse life events, depression, job problems, life

dissatisfaction, unemployment, personality characteristics, and excessive job strain have all been shown to increase the risk of a number of diseases (27). Individuals with any of these psychosocial factors generally report higher rates of poor perceived health. However, perceived health is a difficult factor to assess, because it is often unknown if a given survey is truly assessing an individual's health status, a correlation between other aspects such as demographic status, psychological state or social functioning, or it may be assessing the overall level of susceptibility and control of one's current health status (8).

A study performed by Kaplan and Camacho, was performed to observe the relationship between perceived health ratings (“excellent”, “good”, “fair”, and “poor”) and mortality (8). In this study, 6928 adults were assessed using a survey (similar to the one used in this study) to evaluate individual's perceptions of health. Researchers then followed up with participants after nine years to determine their status. It was found that the chance of mortality during this nine year period was significantly associated with the perceived health rating at the commencement of the trial. Even when variables such as age, sex, physical health status, health practices, social network participation, income, education, health relative to age peers, anomy, morale, depression and happiness were controlled, there was still an association between perceived health ratings and mortality. However, while mortality is independent of these factors, this does not make them unimportant. Individuals who had poor perceived health tended to be more isolated, disconnected, and performed high risk behaviors such as smoking, or drinking alcohol. Possibly, even more importantly, for the individuals over the age of 29, increasingly poor perceived health was associated with increasing mortality rates.

In another study performed by Mossey and Shapiro, 3128 individuals over the age of 65 were assessed for their perceived health using a survey similar to the one used in this study (18).

This study found that there was a significant increase in mortality over seven years for those who perceived their health as poor compared to those who perceived their health as excellent. In this study, they were also able to control for a number of important factors including a measure of physical health status, which was derived from physician reports of diagnosed conditions, self-reports of conditions, utilization of health care services, number of hospitalizations, surgeries as well as other indicators.

Perceived health is an important factor in indicating one's perceived control over their weight, fitness and nutrition. In this study, it will be seen if perceived health is correlated with an individual's exercise frequency or perceived stress, and what effect perceived health has on dietary intake.

Stress

While often it seems as if all Americans suffer greatly from stress, it seems women may experience higher levels than men. Women are found to suffer more from chronic stress than men, find themselves in more stressful situations than men, show higher stress vulnerability and report more physical symptoms due to stress than men (15). This coupled with the fact that women are more inactive than men, becomes a concern for the health of approximately half of the population (2). Inactivity along with high levels of stress increase one's risk even more for diseases such as high blood pressure, and coronary heart disease among many others (10).

A study performed by Grzywacz and others examined the relationships between flexible schedules at work and employee health (5). Researchers found stress and burnout was lower among workers engaged in flexible work schedules than those who were in a more formal, inflexible work schedule. This study can also be used to show the effect of general flexibility in

life on health. If one is more flexible in everyday life it can be assumed stress levels are decreased with unexpected changes in schedule or activities. In general, greater flexibility in everyday activities of life has been associated with decreased cholesterol, fewer physical symptoms, and lower levels of distress and anxiety (5). When an individual is more flexible with their schedule throughout the day, stress and anxiety levels are lowered, leading to a decreased risk of diseases stemming from these factors over time. As it relates to the present study, a lower score on the perceived stress scale may be important for overall health as it would decrease the risk of high blood pressure, cholesterol, and coronary artery disease.

In a study performed by Rollins and Calder, the relationship between situational stress and problem solving flexibility was studied (22). Situational stress is thought to refer to an individual's feelings of threat to individual security or personal adequacy in a particular circumstance. Generally, it is a more specific aspect of anxiety. As well, problem solving flexibility refers to an individual's ability to utilize a large number of alternatives in resolving a problematic situation. Generally, it is a more specific aspect of creativity. The main finding of this study was that for persons with feelings of personal inadequacy, an increase in situational stress decreased one's problem solving flexibility. The opposite was also found to be true, those with feelings of personal adequacy, when faced with situational stress, had an increase in problem solving flexibility. In relation to the following study this can be thought of in the following manner. Those who have higher perceived health (a feeling of personal adequacy), when faced with the stressful situation of the cancellation of an exercise, may have an increased problem solving flexibility. This could result in changing their schedule to find another time to exercise, or properly altering their diet to account for the now decrease in energy expenditure. As well, the opposite could be true for individual with poor perceived health. When these

individuals are faced with the stressful situation of the cancellation of exercise they may have lower levels of problem solving flexibility. This could manifest itself in ways such as skipping exercise for that day altogether, letting the stress alter other aspects of the individual's day, or eating to compensate for the stressful situation.

Recently, Lutz examined the association between physical activity and psychological stress (15). There is generally a decrease in exercise/physical activity when higher levels of perceived stress or stressful events are present. On the other hand, for a number of individuals exercise is one of the most beneficial manners in which to cope with stress, thus we might expect to see an increase in physical activity with an increase in stress.

Lutz proposes that many unhealthy behaviors provide a temporary affective/coping benefit, even though long term health implications are negative (15). This means, that in a stressful situation, individuals may resort to the activity which brings them the most comfort in order to alleviate the stress, even though they may be aware of the long term effects it will cause. In many cases, this results in an increase in food consumption, an increase in fatty, salty, or sugar filled foods, or a decrease in physical activity. In a study performed by Lutz and others, researchers were investigating the effects of stress on the intensity, time, and frequency of exercise in college aged women (15). This study found that those individuals who met the recommended physical activity guidelines for 6 months or longer increased the frequency, intensity and duration of their exercise with an increase in stress. On the other hand, individuals who have not met the recommended physical activity guidelines for 6 months had a decrease in exercise intensity, frequency and time. This indicates that the presence of stress effects individuals differently based on their exercise frequency.

Sedentary behaviors

Not only should nutrition and exercise be considered for a healthy lifestyle, but the amount of time spent sedentary should also be considered. Often individuals believe if they exercise at a high intensity in the morning, they are free to do whatever they wish the rest of the day. Often this consists of driving in a car, sitting at a desk or watching television for hours on end. Prolonged sedentary behaviors such as those previously listed are known to be associated with higher mortality rates, particularly from cardiovascular disease. In a study performed by Veerman and others, it was found that individuals who spend a lifetime average of 6 hours per day watching television are expected to live 4.8 years less than individuals who do not watch television (30). Not only this, but on average, every hour of television viewed after the age of 25 reduces an individual's life expectancy by 21.8 minutes. This is comparable to the average decrease in life expectancy of smoking two cigarettes (22 minutes). Not only is this sedentary behavior dangerous to an individual's life, but it also tends to lead to lower energy expenditure throughout the day.

Mayer performed a study on mice in laboratory conditions hoping to discover if a decrease in physical activity had an effect on energy intake (16). When the mice were sedentary and had reduced physical activity, researchers found the decrease in energy expenditure was not accompanied with a parallel decrease in energy intake. Therefore, researchers concluded the sedentary behavior of the mice played an essential role in developing obesity. Another study of similar nature, but pertaining to human subjects, was performed by Murgatroyd and others (19). In this study, the influence of inactivity on energy balance was studied in eight normal-weight males. Subjects had two-day measurements of energy expenditure in a respiratory chamber with ad libitum food intake measured. Researchers found the decrease in physical activity did not

result in a decrease in food intake, thus resulting in a positive energy balance. This positive energy balance, as pointed out before, is what, over time, can accumulate and lead to obesity. Finally, these results were also seen in a study performed by Stubbs and others (26). Researchers were trying to discover the affects of an imposed sedentary routine on six lean male subjects. Each subject performed seven days of a sedentary regime (1.4 x resting metabolic rate) and seven days of an active regime (1.8 x resting metabolic rate) in a respiration chamber. Though one would expect the food intake would increase with a decrease in energy, this was not the case. There was no compensatory decrease in energy intake, resulting in a significant positive energy balance. Interestingly, this study also determined that much of the excess energy consumed was stored as fat. The results of this study stress how detrimental a sedentary lifestyle can be to an individual, not only leading to excessive weight gain in fat, but also a number of diseases which greatly increase one's risk of mortality. Therefore, the preferred method of exercise is spread out throughout the day, increasing one's overall physical activity as well as energy expenditure.

The previously examined studies are particularly important to this study because of the use of sedentary participants. A sedentary lifestyle may lead to significant differences in stress, perceived health, as well as dietary intake compared to individuals who exercise on a regular basis.

Exercise and Food Consumption

Leading evidence is showing that combining proper nutrition and exercise has far more successful and longer lasting outcomes than by either of the two regimens alone (14). However, while physical activity may be an extremely useful tool towards weight loss and disease prevention, we must first understand what impact physical activity has on food intake. Because

physical activity increases energy expenditure over time, there are two outcomes in terms of dietary intake: either an individual does not increase the number of calories consumed resulting in weight loss, or there is an increase in food intake to account for the excess energy requirements of the body. In a study by Melzer and others, the increase in energy expenditure with short-term physical activity was not immediately compensated with an increase in food intake for both men and women (17). However, when physical activity was performed at moderate or intense levels for a long-term basis, differences were seen in food intake between individuals who were lean and those who were obese. Individuals who were lean balanced the extra physical activity energy expenditure (calories burned) with the appropriate energy intake (calories consumed). However, individuals who were obese did not compensate their dietary intake with the increase in energy expenditure. Most likely this is because of the excess energy storage these individuals contain, so there is not a need to increase the number of calories in their diet. To maintain a net balance and sustain energy, the body would burn fat instead of call for more calories to be consumed. This is due to a mechanism in the body known as energy homeostasis. This regulation process is associated with variations in protein and fat reserves, but because fat reserves are more unstable, it becomes the more active trigger. The main role of energy homeostasis is to control body fuel stored as adipose tissue. There are a number of physiological mechanisms within this system including those within the central nervous system and hormonal system. Peripheral tissues send information about whether an anabolic effect should take place, stimulating food intake and promoting weight gain, or a catabolic effect, decreasing food intake and promoting the depletion of body fat.

A psychological aspect of calorie consumption after exercise is the idea of “treating yourself” after hard exercise. Often, within 24 hours of an intense exercise individuals rationalize

why they should be able to eat high fat, sugar and carbohydrate meals (28). With the idea that a large number of calories were earned, a resultant increase in the consumption of highly processed, sugary, and high fat foods may be seen. Sometimes this increase in food consumption is a very important aspect to homeostasis and maintenance of weight (31). However, in those who are trying to lose weight, this may not be a good aspect. Even in individuals who are trying to lose weight, the increase in calories often comes in forms which lead to weight gain because they are fatty, high in sugar and highly processed.

Interestingly, in a study performed by Thivel and others, adolescent boys underwent three exercise sessions, each with varying levels of intensity: sedentary, low intensity exercise (40% VO_2max) and high intensity exercise (75% VO_2max) (28). Diets were followed for 24 hours after each exercise session, and the differences in calories between the different intensities were studied. There was a significant decrease in the 24-hour energy balance in high intensity exercise, compared to both low intensity exercise and sedentary. However, there was not a significant difference in the 24-hour energy balance between low intensity exercise and sedentary conditions. Along with the general decrease in 24-hour energy balance after high intensity exercise, there were specific times of the day when food intake would decrease the most. Exercise sessions occurred at 11:00 am for the low intensity and high intensity exercise treatments, and the decreases seen after high intensity exercise in food intake occurred mostly at lunch and dinner. This could be very helpful information for those who are trying to lose weight, as they could plan a high intensity exercise at a certain time of the day where they are known to eat the most calories. For most individuals the largest two meals of the day are lunch and dinner, so 11:00am or 12:00pm exercise sessions may decrease the amount of calories eaten at these two meals.

Similar results were seen in studies by Kissileff and others as well as Staten (12, 25). However, both of these studies take into account different populations, which is an important reminder that all individuals may respond differently to exercise. In the study by Kissileff and others, researchers found food intake was slightly decreased for nonobese women when performing strenuous exercise compared to moderate exercise (12). However, obese women's food intake remained the same throughout both of the exercise intensities. This could lead us to believe there could be a particular reason why the obese women did not decrease their intake after strenuous exercise, and is therefore a factor in their obesity status. In a study observing differences between men and women, Staten found that men increased their caloric intake with an increase in exercise, while women's caloric intake remained the same (25). Yet, the increase in calories seen in men remained below the amount of calories burned by the given exercise, so the individuals remained in negative energy expenditure.

Another study performed by Woo, Garrow and Pi-Sunyer also focused on obese women and the effect of exercise on energy intake and balance (31). The diet of each individual was kept exactly the same with no changes in calories, and only changes in exercise occurred during the trial. The treatments given to each of the subjects included 19 days of a sedentary lifestyle, 19 days with mild treadmill exercise and 19 days with moderate treadmill exercise. As with the study performed by Jakicic and others, researchers found there was a negative energy balance with the treatments of mild to moderate exercise intensity.

Pomerleau and others performed a study in which women were studied to see if differing exercise intensities had an effect on food intake and appetite (20). Each subject performed no exercise, low intensity exercise, and high intensity exercise and ate ad libitum from a buffet style

meal after each treatment. Interestingly, this study found after high intensity exercise these women actually significantly increased their food intake compared to the other two treatments.

Finally, a study performed by Knowler and other combined both exercise and a nutritional intervention. In this study a lifestyle intervention was implemented including at least 150 minutes a week of brisk walking and a low-fat, low calorie diet. Researchers found this intervention to be even more effective in reducing body weight and the prevalence of diabetes than Metformin, a medication manufactured to prevent diabetes (13). It is far healthier to make changes to diet and exercise than remain on a medication for an indefinite amount of time.

Conclusion

With diseases such as obesity, type II diabetes, and cardiovascular disease on the rise it is becoming increasingly important to discover the motives behind why individuals eat, and what can be done to correct the ongoing problem with inactivity and poor diets. This study aims to examine the effect of exercise cancellation on dietary intake, particularly comparing those who exercise regularly and those who are sedentary. Perceived health as well as perceived stress will also be considered in the dietary responses of the individuals after the cancellation of exercise. It is hypothesized that overall perceived stress will be higher in sedentary individuals than in individuals who exercise regularly, as well as perceived health competence will be lower in sedentary individuals compared to active individuals. Also, with the cancellation of exercise it is hypothesized that individuals who exercise regularly will decrease their dietary intake on the day exercise is cancelled, where as sedentary individuals will not decrease their dietary intake on the cancelled exercise day.

METHODS

Experimental Approach to the Problem

The purpose of this research was to determine whether the cancellation of regularly scheduled exercise affects an individual's daily food consumption, particularly in individuals who exercise regularly as opposed to those who are sedentary. The independent variable of this study, the cancellation of exercise, was chosen to be manipulated to observe if there was a difference in subsequent dietary intake among individuals with typically different activity levels. Individuals had two morning exercise sessions scheduled and one of the sessions, random number generator assigned, was canceled. The day the exercise session took place, the participant exercised for 30 minutes at moderate intensity. For both the day the individual came in to exercise and the day the exercise was canceled, they were instructed to record their dietary intake. The dependent variable, the dietary intake, was chosen to be measured because it can be the reason for weight gain in a number of individuals and is an important factor in a healthy lifestyle. The participants were also given a Perceived Health Competence Scale, to determine the level at which they believe they are in control of their health, and a Perceived Stress Scale, to determine if this experience could have caused them stress or anxiety.

The Perceived Health Competence Scale is a measure of the degree an individual feels capable of managing his or her health outcomes (24). The higher the Perceived Health Competence Scale score the more in control of one's own health an individual feels. An individual with a low Perceived Health Competence Scale score may feel as if their health is beyond their control, and whatever they do to change it has little to no effect. Five studies were performed and provided the evidence for the reliability and validity of the Perceived Health Stress Scale. This scale has both good internal consistence and test-retest reliability.

The Perceived Stress Scale is designed to measure the perception of stress (4). Particularly, the scale aims to see how unpredictable, uncontrollable and overloaded the individual perceives their life to be. It contains questions about current levels of experienced stress, which may attempt to answer the question in the present study of whether the sedentary or regularly exercising groups were stressed about the cancellation of the exercise. As well, the study contains numerous questions about the past month's stress levels, and in the present study will aim to see if a particular group, sedentary or exercisers, have higher levels of general stress than the other. The Perceived Stress Scale has been shown to be valid, as higher Perceived Stress Scale scores have been associated with failure to quit smoking, failure among diabetics to control blood sugar levels, greater vulnerability to stressful life-event-elicited depressive symptoms, and more colds. Finally, higher Perceived Stress Scale scores correspond to higher stress levels, where as lower Perceived Stress Scale scores correspond to lower stress levels.

Subjects

This study included ten female subjects (n=10) enrolled at St. Catherine University. Half of the individuals (5 participants) regularly exercised more than 3-4 times per week for more than 30 minutes, while the other half (5 participants) were sedentary or had not exercised regularly (2 times a week) for 6 months prior to the experiment. The average age was 20.6 ± 1.26 years. Height (m) and weight (kg) were measured to the nearest 0.1cm and 0.1kg respectively. The average height was 1.63 ± 0.026 meters. The average weight was 67.76 ± 12.46 kilograms (insert Table 1 here). Consent was given by each of the subjects and the study was approved through the Institutional Review Board at St. Catherine University.

Procedures

After recruitment, subjects reported to the second floor of Fontbonne (at St. Catherine University, St. Paul, Minnesota) in the WHIR Center. At this time they received information about the research and a consent form indicating that they still wished to participate in the trial and their data may be used in analysis. They also were instructed on how to record their dietary intake with a food journal (Appendix B), which was provided, and their exercise with an exercise log (Appendix A), also provided. Finally, they completed the Perceived Health Competence Scale (Appendix D) (24) and their height, weight and age were recorded. Following the initial meeting, subjects scheduled two morning exercises with the primary investigator. Via random number generator assignment, one session was randomly cancelled. For the day where exercise did take place the participant reported to the second floor of Fontbonne (at St. Catherine University, St. Paul, Minnesota) in the WHIR Center. Here they exercised at moderate intensity on a Life Fitness 95Ti Treadmills (Life Fitness, Schiller Park, IL) for a total of 30 minutes. Moderate intensity was defined as 64-76% of the participant's maximal heart rate (as defined by the Gulati formula for women) (6). Speed and incline of the treadmill were adjusted by the researcher to remain within the specified heart rate range. After completion, participants recorded their daily food intake and exercise for the remainder of the day. For the day where exercise was cancelled, the subjects were informed via email, telephone or text messaging the exercise would not take place that morning. However, participants were instructed to continue to record their daily food intake and exercise. Following the completion of all the trials, participants completed the Perceived Stress Scale (Appendix C) (3).

Statistical Analysis

Dietary Recall raw information was analyzed with the use of Cengage Learning - Diet Analysis Plus. This program analyzes an individual's daily diet based on height, weight and activity level. Then, the values above or below the recommended dietary values for a number of nutrients are calculated. Paired t-tests were run comparing the differences in calories, protein, carbohydrates, total fat, cholesterol, dietary fiber, sugar, and sodium of all individuals on the days exercise took place compared to the days exercise was cancelled. Additionally, ANOVA and Post Hoc Tukey tests were run on the dietary recall data: calories, protein, carbohydrates, total fat, cholesterol, dietary fiber, sugar, and sodium comparing sedentary and regularly exercising individuals on both the days where exercise took place and when exercise was cancelled. The analysis was run using IBM SPSS Statistics 20 computer program. Values above or below the recommended dietary values were compared for all nutrients listed above between individuals who exercise regularly on the day exercise took place, individuals who exercise regularly on the day exercise was cancelled, individuals who are sedentary on the day exercise took place, and individuals who are sedentary on the day exercise was cancelled. Finally, an independent t-test was run on the Perceived Health Competence Scale and Perceived Stress Scale scores for sedentary and regularly exercising individuals. The alpha level of $p < 0.05$ was used to indicate statistical significance for all data. The independent variables of this study were the assignment to the regularly exercising group or sedentary group and the cancellation or continuation of scheduled exercise. As well, the dependent variables included the Perceived Health Competence Scale score, the Perceived Stress Scale score, and dietary recall calories, protein, carbohydrates, total fat, cholesterol, dietary fiber, sugar, and sodium.

RESULTS

In this study, there were a number of statistically significant differences between groups. When comparing all individuals on days where exercise took place versus when exercise was cancelled there was a statistically significant difference between the amounts of sodium consumed ($p = 0.02$, $t = 4.387$). There was significantly more sodium consumed when exercise took place than when exercise was cancelled (Insert Figure 6 here). However, there were no other statically significant differences between nutrients when comparing all individuals when exercise took place and when exercise was cancelled. There was no significant difference between protein, carbohydrates, total fat, cholesterol, dietary fiber, or sugar intake when comparing individuals exercising regularly and those who were sedentary, as well as days when exercise was cancelled and days when exercise took place (Insert Figure 3 here). There was a statistically significant difference between the number of calories consumed on the day exercise was canceled in individuals who exercised regularly and calories consumed on the day exercise took place in individuals who were sedentary, as seen in Figure 4 ($p = 0.032$) (Insert Figure 5 here). Individuals who exercised regularly and had the exercise session cancelled, consumed significantly fewer calories than individuals who were sedentary and the exercise session took place. There were no other significant differences between categories relating to calories consumed. Additionally, there was a statistically significant difference between the amount of sodium consumed on the day exercise was canceled in individuals who exercised regularly and the amount of sodium consumed on the day exercise took place in individuals who were sedentary, as seen in Figure 5 ($p = 0.046$) (Insert Figure 7 here). Individuals who exercised regularly, and had the exercise session cancelled consumed significantly less sodium than

individuals who were sedentary and the exercise session took place. There were no other significant differences between categories relating to sodium consumed.

Lastly, there was a significant difference between individuals who were sedentary and those who exercised regularly in regards to both the Perceived Health Competence Scale scores and Perceived Stress Scale scores ($p = 0.002$, $t = -2.071$ and $p = 0.014$, $t = 4.140$ respectively). Individuals who regularly exercised scored higher on the Perceived Health Competence Scale, than individuals who were sedentary, as seen in Figure 1. (Insert Figure 1 here). Individuals who regularly exercised scored significantly lower on the Perceived Stress Scale, than individuals who were sedentary, as seen in Figure 2. (Insert Figure 2 here).

DISCUSSION

In this study, it was found that individuals who exercised regularly and had the exercise session cancelled, consumed significantly fewer calories than individuals who were sedentary and the exercise session took place. This could be consistent with research performed by Thivel and others (28) which states a psychological aspect of calorie consumption after exercise is the idea of “treating yourself” after hard exercise. Within 24 hours of an intense exercise individuals rationalize why they should be able to eat high fat, sugar and carbohydrate meals. This is seen in this study with the increase in calories (and sodium intake) after the one day exercise does take place in sedentary individuals. Interestingly, this effect is only seen in the sedentary population, who generally has a lower perceived health competence, which may be associated with less nutritional knowledge. Additionally, when a paired t-test is run comparing all individuals, when exercise took place and exercise was cancelled, there was no statistically significant difference (Insert Figure 4 here). While there is not a significant increase in the calories consumed when

exercise took place, most likely due to a small sample size, there is a trend forming. This trend of increasing calories with exercise may be associated with a physiological response to increase food consumption when energy expenditure increases. However, the increase of calories with exercise is particularly concerning for individuals who are sedentary as they already start out at a higher calorie point on non-active days than regularly exercising individual. With the addition of exercise their calorie levels may raise above where we would recommend, leaving the individuals in a positive energy balance, often leading to weight gain. It is also important to recognize an increase in calories most often comes in the form of highly processed, sugary, and high fat foods which lead to a gain of unwanted fat tissue.

The compensatory action of eating more calories when exercise takes place may lead to two additional findings in this study. When all individuals were compared, on the days exercise took place and the day exercise was cancelled, there was a statistically significant increase in sodium on the day exercise took place ($p = 0.02$, $t = 4.387$) (Insert Figure 6 here). This means that all individuals, regardless of their exercise status (sedentary or regularly exercising) increased their sodium intake with exercise. This could be associated with the physiological response of increasing sodium consumption with an increase in sweat production and therefore sodium loss. Another finding related to sodium was that individuals who exercised regularly and had the exercise session cancelled, consumed significantly less sodium than individuals who were sedentary and the exercise session took place. Both the increase in calories and increase in sodium on the day exercise occurred for sedentary individuals may be associated with individuals believing a number of calories were burned in the exercise, thus an increase in dietary intake can occur without affect on body composition. However, both an increase in calories and sodium intake are very negative aspects of a diet. An increase in calories over time

may cause weight gain, or eventually obesity, while an increase in sodium is directly related to an increase in blood pressure and coronary artery disease (13). Therefore, individuals, particularly those who are sedentary need to be informed about a proper diet and if dietary intake is to increase due to exercise it should be in the form of fruits, vegetables, and whole grains.

Another finding of this study was individuals who exercised regularly scored higher on the Perceived Health Competence Scale than individuals who were sedentary as seen in Figure 1. Individuals who exercised regularly and had higher Perceived Health Competence scores may be associated with feeling in better control of their health and performing actions to better their health if needed. Individuals who were sedentary scored significantly lower on the survey and may have been associated with feelings of less control of their health and feeling as if no matter what they did to improve it their health would remain the same. While there are no studies which have examined or looked at the relationship between activity level and Perceived Health Competence Scale scores, these results are as we would have expected. In the study by Kaplan and others, individuals with any of the following factors: Social disconnection, isolation, adverse life events, depression, job problems, life dissatisfaction, unemployment, personality characteristics, and excessive job strain, generally reported poorer perceived health (8). Another factor closely associated with these factors is stress. Because sedentary individuals in this study were found to have higher levels of perceived stress, this may be one of the contributing factors to the low perceived health scores. Increasing sedentary individuals' Perceived Health Competence is important, as one's risk of mortality is significantly associated with their perceived health rating (8, 18). The results of this study may be consistent with the fact that exercising regularly may be associated with higher Perceived Health Competence Scale scores,

thus stressing the importance of achieving the recommended amount of 150 minutes of moderate intensity exercise per week (14).

Individuals who regularly exercised scored significantly lower on the Perceived Stress Scale, than individuals who were sedentary. This finding may be consistent with one of two things. Either individuals who exercise regularly may be associated with a decreased amount of stress, or the act of canceling exercise may not have created stress and anxiety. The opposite can be said for individuals who are sedentary. Either sedentary individuals are associated with higher levels of stress, possibly due to not exercise on a regular basis, or the act of cancelling a regularly scheduled exercise session may have caused sedentary individuals a great deal of stress. From the given study we cannot tell which would be the case, but both are in general agreement with research performed by Rollins and Calder (22). This could be consistent with our research where individuals who have higher perceived health, when faced with a stressful situation, such as the cancellation of an exercise, may have an increased problem solving flexibility. This may result in changing their schedule to find another time to exercise, or properly altering their diet to account for the decrease in energy expenditure (Seen in the significant decrease in calories and sodium consumed when exercise was cancelled). The opposite may be true for individual with poor perceived health. When sedentary individuals are faced with a stressful situation, such as the cancellation of exercise, they may have lower levels of problem solving flexibility. This may manifest itself in ways such as skipping exercise for that day altogether, letting the stress alter other aspects of the individual's day, or eating to compensate for the stressful situation.

The results of this study can be applied to college age females. Particularly, those who are currently enrolled in college, as the individuals in this study were. The low sample size (n=10) does not allow us to make vast generalizations about the data which was received.

However, much of the data is in general agreement to similar studies by Kaplan and Camacho, Mossey and Shapiro, Thivel and Rollins and Calder (8, 18, 22, 28). While it cannot be said that these findings will be similar in other populations, they are extremely interesting and worth pursuing further.

There is little research pertaining to the effects of the cancellation of exercise on dietary intake, and this study shows more needs to be done. The biggest aspect which could be bettered in the current study is the sample size. The larger the sample size becomes the more reliable and reproducible the data will become. For this reason, if the research were performed again, a very large sample size would be chosen, of at least n=100 and 50 participants in each of the activity level groups. Additionally, the activity level groups could be further divided. Prochaska and Velicer propose the Transtheoretical Model of behavior change which presents that behavior will move through five stages of “readiness” before engaging in physical activity (21). These five stages include: a) No intention of becoming physically active, called *Precontemplation (PC)*, b) thinking about becoming physically active within the next 6 months, called *Contemplation (C)*, c) making small changes in behavior, called *Preparation (P)*, d) meeting a set level of physical activity in the recent past, generally within 6 months, called *Action (A)*, and e) meeting the set level of physical activity for 6 months or longer, called *Maintenance (M)*. This model would be a very useful tool in creating further subdivisions in subject groups to obtain more information on this topic. Other changes which can be made to further this area of research are: running analysis on more nutrients, vitamins, and minerals, creating a schedule where the participants exercise two or more times and then are cancelled two or more times, including a tool for more specific health and mood stress measures (such as measuring cortisol to measure acute stress) to

determine differences between conditions, or creating another stressful situation for individuals and observing the resulting change in dietary intake.

PRACTICAL APPLICATIONS

The practical applications of this study are abundant, as this research can be directly applied to individuals' daily lives. Exercise is particularly important for those who are at risk for obesity, cardiovascular disease or high blood pressure as an increase in physical activity has been shown to decrease the risk of these diseases. By maintaining regularly scheduled exercise, stress may decrease, perceived health competence may increase, and one may be better able to maintain calories and sodium consumed. Finally, individuals, particularly those who are sedentary need to be informed about a proper diet and if dietary intake is to increase due to exercise it should be in the form of fruits, vegetables, and whole grains.

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Table 1. Subjects' Characteristics*	
Age (years)	20.60 ± 1.26
Weight (kg)	67.76 ± 12.46
Height (m)	1.63 ± 0.026

*Data are mean ± SD

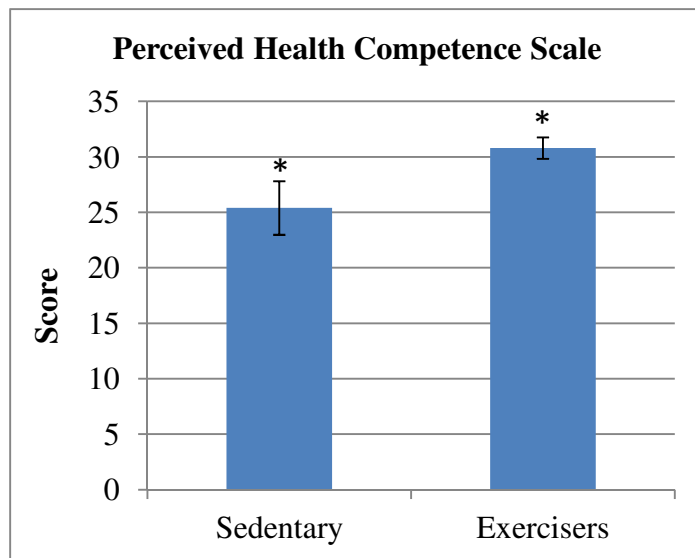


Figure 1: The Perceived Health Competence Scale scores for individuals who are sedentary (had not exercised regularly at 2 times per week for 6 months prior to the experiment) and exercisers (exercise more than 3-4 times per week for 30 minutes). Independent t-test ($p = 0.002$, $t = -2.071$). *Indicates statistically significant difference.

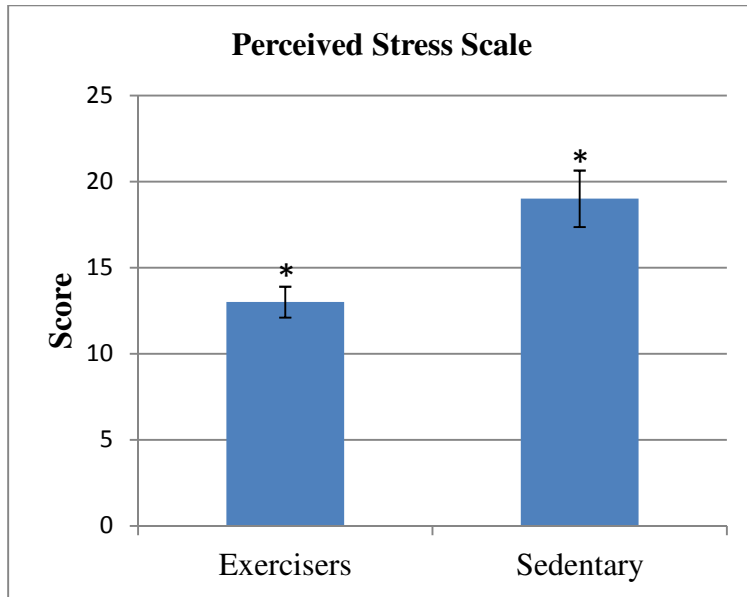


Figure 2: The Perceived Stress scores for individuals who are sedentary (had not exercised regularly at 2 times per week for 6 months prior to the experiment) and exercisers (exercise more than 3-4 times per week for 30 minutes). Independent t-test ($p = 0.014$, $t = 4.140$) *Indicates statistically significant difference.

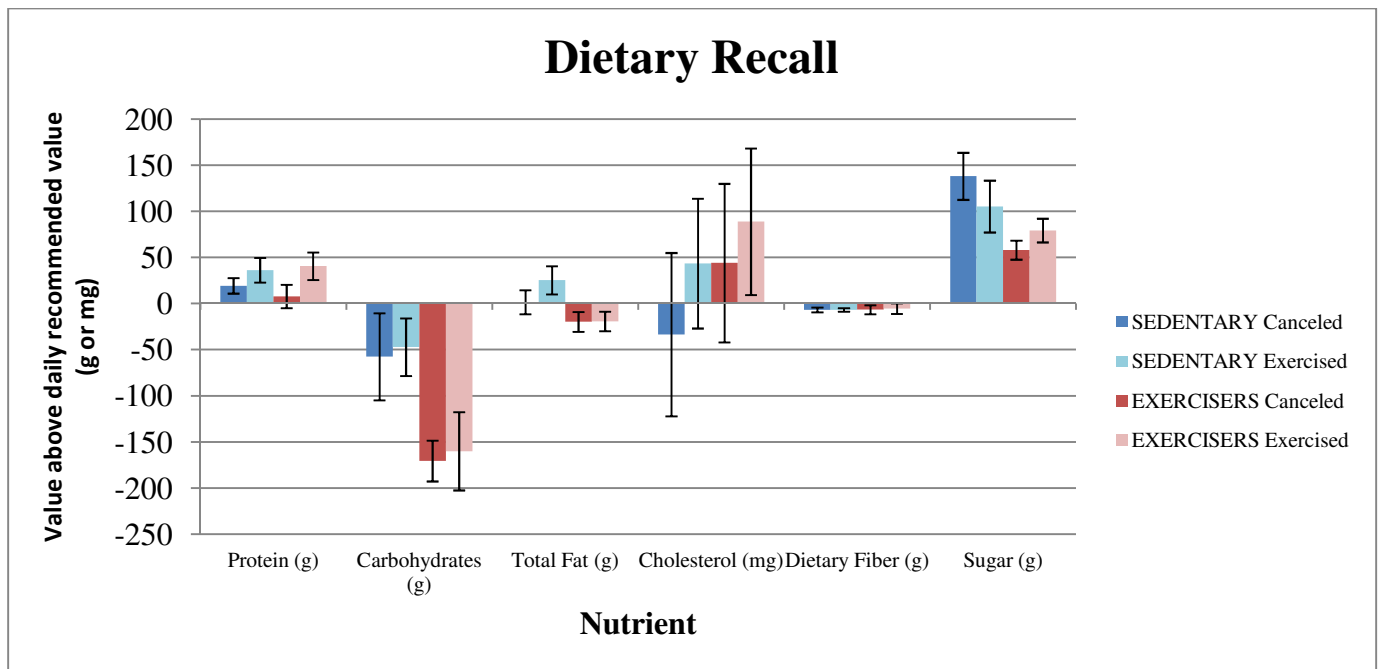


Figure 3: Dietary recall from both sedentary and exercising subjects on days where regularly scheduled exercise took place, as well as days where regularly scheduled exercise was canceled. The nutritional aspects investigated which had no statistically significant difference were daily values of protein, carbohydrates, total fat, cholesterol, dietary fiber, and sugar. The values above represent the grams or milligrams at which the individual was above the recommended daily

value (negative number represent levels which did not yet meet the recommended values). ANOVA and Post Hoc Tukey tests.

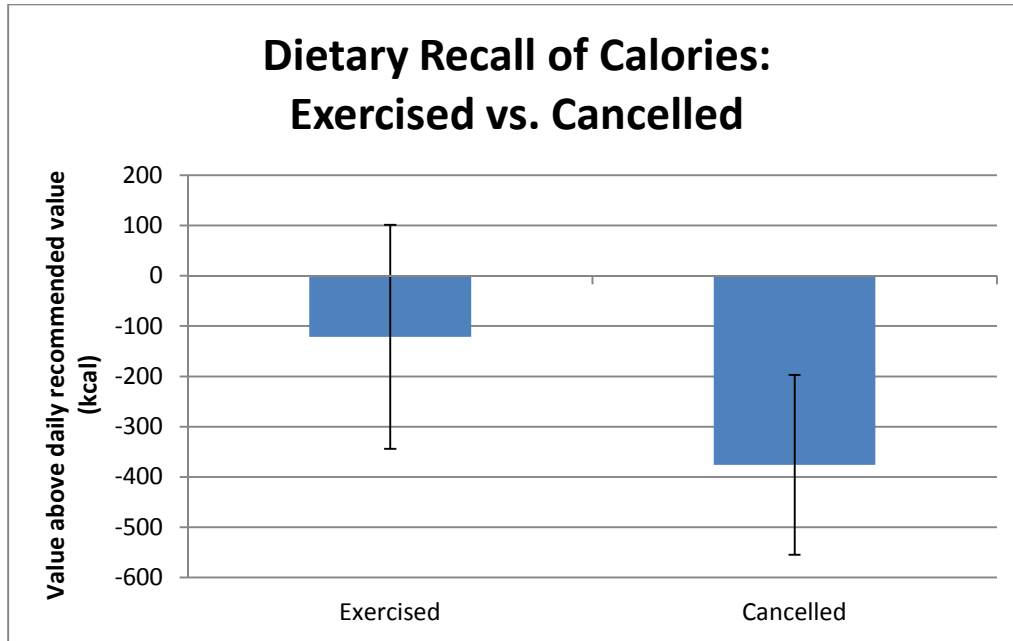


Figure 4: Dietary recall of daily calories from all subjects on days where scheduled exercise took place, as well as days where scheduled exercise was cancelled. (Negative values represent levels which did not meet the recommended daily values). Paired t-test.

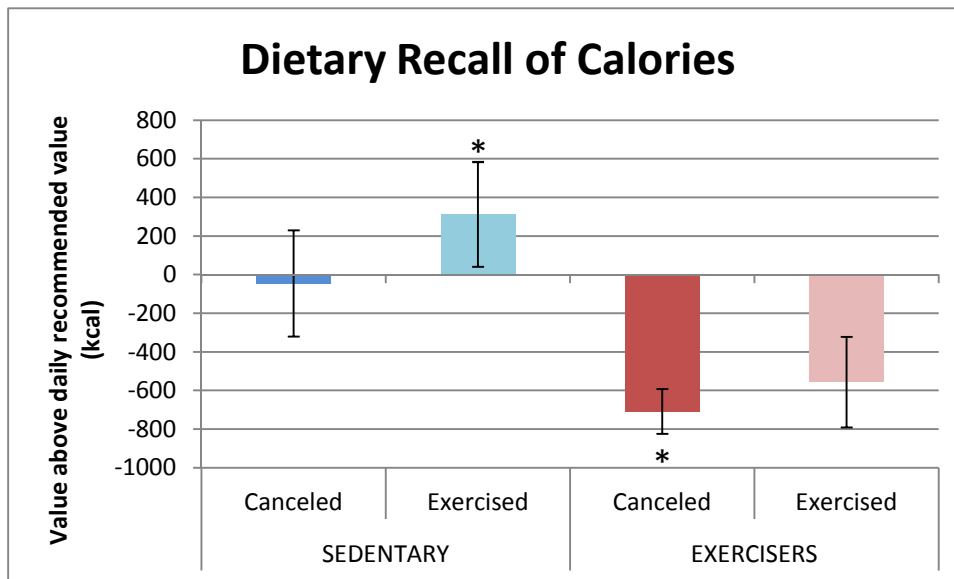


Figure 5: Dietary recall of daily calories from both sedentary and exercising subjects. Recall includes days where scheduled exercise took place, as well as days where scheduled exercise was cancelled. (Negative values represent levels which did not meet the recommended daily values). ANOVA and Post Hoc Tukey tests ($p = 0.032$). *Indicates statistical significance.

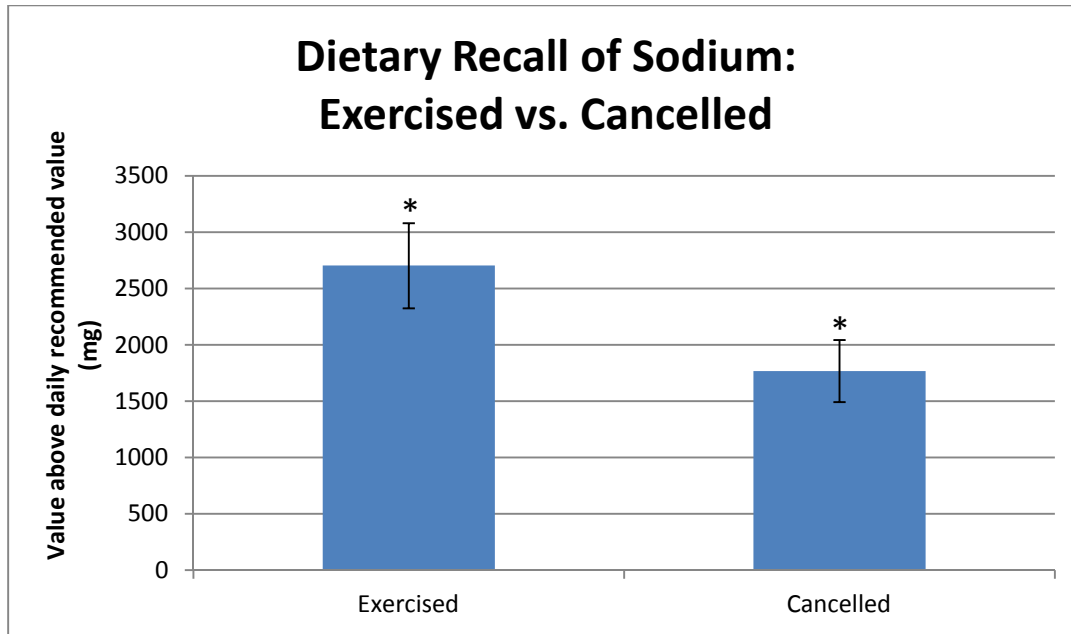


Figure 6: Dietary recall of daily sodium for all individuals on days where scheduled exercise took place, as well as days where scheduled exercise was cancelled. Paired t-test ($p = 0.02$, $t = 4.387$). *Indicates statistical significance.

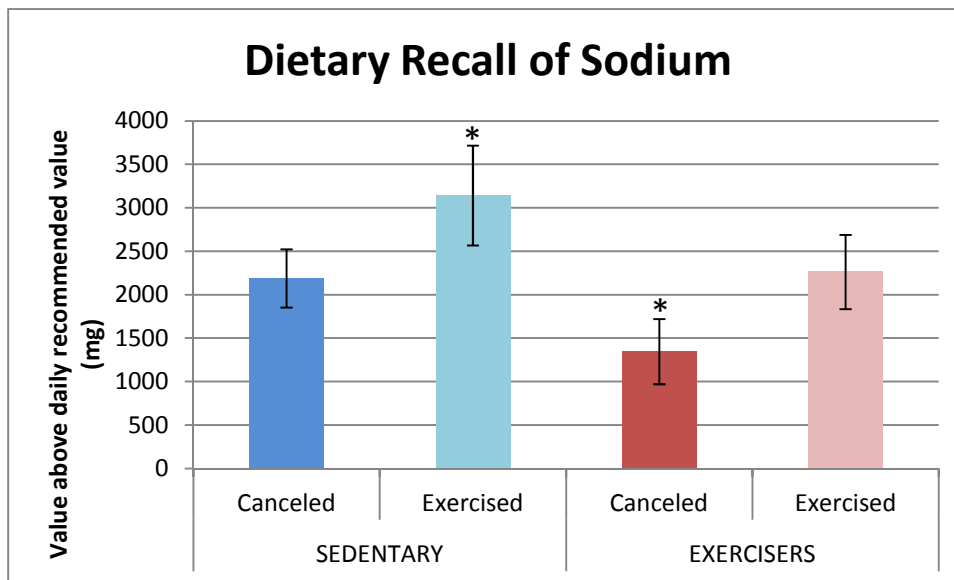


Figure 7: Dietary recall of daily sodium from both sedentary and exercising subjects. Recall includes days where scheduled exercise took place, as well as days where scheduled exercise was cancelled. ANOVA and Post Hoc Tukey tests ($p = 0.046$). *Indicates statistical significance.

Appendix A

Exercise Log

Date	Activity	Length of Exercise Session	Time of Day

***Be as specific and complete as possible.** For example, if you ate a hamburger, what else was on it? Was there a bun? Tomato? Ketchup? If you ate cereal, what kind, how much milk, what kind of milk? (Note on Fast Food: If eating at a major fast food restaurant, for example, at McDonald's, simply record "McDonald's Hamburger," there is no need to break it down into each item on that hamburger).

****Be as accurate as possible.** Refer to serving size definitions if necessary.

1 cup cooked vegetables = one fist
1 medium fruit = a baseball
3 oz of meat = deck of cards
2 tbs peanut butter = large marshmallow
½ cup ice cream = racquetball

Appendix C

Perceived Stress Scale

The questions in this scale ask you about your feelings and thoughts **during the last month**. In each case, you will be asked to indicate by circling *how often* you felt or thought a certain way.

Name _____ Date _____

Age _____ Gender (Circle): **M** **F** Other _____

0 = Never 1 = Almost Never 2 = Sometimes 3 = Fairly Often 4 = Very Often

1. In the last month, how often have you been upset because of something that happened unexpectedly?..... 0 1 2 3 4
2. In the last month, how often have you felt that you were unable to control the important things in your life?..... 0 1 2 3 4
3. In the last month, how often have you felt nervous and "stressed"? 0 1 2 3 4
4. In the last month, how often have you felt confident about your ability to handle your personal problems?..... 0 1 2 3 4
5. In the last month, how often have you felt that things were going your way?..... 0 1 2 3 4
6. In the last month, how often have you found that you could not cope with all the things that you had to do? 0 1 2 3 4
7. In the last month, how often have you been able to control irritations in your life?..... 0 1 2 3 4
8. In the last month, how often have you felt that you were on top of things?.... 0 1 2 3 4
9. In the last month, how often have you been angered because of things that were outside of your control? 0 1 2 3 4
10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?..... 0 1 2 3 4

Please feel free to use the *Perceived Stress Scale* for your research. The PSS Manual is in the process of development, please let us know if you are interested in contributing.

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The PSS Scale is reprinted with permission of the American Sociological Association, from Cohen, S., Kamarck, T., and Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, 24, 386-396.

PERCEIVED HEALTH COMPETENCE SCALE

Please answer the following eight questions by circling the statement which you feel describes how you feel. Thank-you.

1. I handle myself well with respect to my health.

STRONGLY AGREE AGREE UNCERTAIN DISAGREE STRONGLY DISAGREE

2. No matter how hard I try, my health just doesn't turn out the way I would like.

STRONGLY AGREE AGREE UNCERTAIN DISAGREE STRONGLY DISAGREE

3. It is difficult for me to find effective solutions to the health problems that come my way.

STRONGLY AGREE AGREE UNCERTAIN DISAGREE STRONGLY DISAGREE

4. I succeed in the projects I undertake to improve my health.

STRONGLY AGREE AGREE UNCERTAIN DISAGREE STRONGLY DISAGREE

5. I'm generally able to accomplish my goals with respect to my health.

STRONGLY AGREE AGREE UNCERTAIN DISAGREE STRONGLY DISAGREE

6. I find my efforts to change things I don't like about my health are ineffective.

STRONGLY AGREE AGREE UNCERTAIN DISAGREE STRONGLY DISAGREE

7. Typically, my plans for my health don't work out well.

STRONGLY AGREE AGREE UNCERTAIN DISAGREE STRONGLY DISAGREE

8. I am able to do things for my health as well as most other people.

STRONGLY AGREE AGREE UNCERTAIN DISAGREE STRONGLY DISAGREE

(Smith et al., 1995)

Appendix E

Senior Honors Project Essay

The topic of Cancellation of Scheduled Exercise and its Influence on Consumption: Exercisers vs. Sedentary Individuals was one which took a great deal of time, and effort, to formulate and put into action. The process entailed initial production of the topic, acceptance by the institutional review board, significant difficulty recruiting participants, myriad data collecting and analysis, and finally the analysis to make my study better in the future.

When formulating a topic for my senior honors project, I literally had no idea to start. First, I decided to stay within the realm of science, my primary field of study during my undergraduate career. I will be pursuing a career as a physician after I graduate this fall, so additional work within the scientific world will be a huge support in my future endeavors. Additionally, I am interested in why people eat what they do. With obesity and type II diabetes diagnoses skyrocketing at an alarming rate, any research to understand these two topics, and the root causes, are of great importance. After sitting down with my advisor, Mark Blegen, and bouncing ideas off of each other, we both thought it would be interesting to study the effect of exercise cancellation on dietary intake. Other ideas brought about in this meeting involved why we eat, but were turned down because the topic chosen was of most interest, and could be analyzed through an interdisciplinary lens. After this meeting to discuss the topic of my senior honors project, I had planned to specifically compare obese and non-obese individuals. While this would have been an interesting comparison, difficulties with the study were discussed in the initial committee member meeting. These difficulties included, recruitment of obese individuals, outwardly stating obese individuals were needed for the study, and pertinence to the topic of interest. Therefore, the committee members and I decided comparing individuals who exercise regularly and those who are sedentary would provide a better study. This led us to the final topic

for my project: Cancellation of Scheduled Exercise and its influence on Consumption: Exercisers vs. Sedentary Individuals.

After the formulation of the project topic, International Review Board (IRB) acceptance was needed. Because the study was with humans and involved manipulation and deception, approval needed to be given by the IRB and St. Catherine University. However, a seemingly simple process became a large hurdle to overcome. The IRB had been dealing with an application backlog after a clerical error causing application materials to become unorganized and arranged incorrectly. This created a circumstance where the IRB was taking an exceedingly long amount of time to return applications for IRB approval, which ultimately pushed back the time frame of my project. Additionally, when the IRB application and recommended revisions was finally returned, other problems arose. Incorrect annotations and suggestions were made, to the point where a complete restructuring or retraining of individual members of the IRB was suggested. However, once my IRB acceptance was in hand I was ready to recruit participants for my study and collect data.

Two additional problems I faced during my study were the recruitment of a significant number of participants, and the sifting through the large amount of data collected to be analyzed. To recruit individuals for my research project, I asked individuals from each of my Exercise and Sports Science classes to participate. Additionally, I went into a number of Women's Fitness and Wellness classes and created posters to recruit individuals for the study. However, even after all of this work, very few individuals wanted to take two to three hours out of their busy days and participate in research. This created a low sample size (n=10), and interpretation of the data then became circumstantial. However, this was the first time I collected and analyzed the data by myself. With the amount of data collected (calories, protein,

carbohydrates, total fat, cholesterol, dietary fiber, sugar, sodium, exercise log, Perceived Stress Scale Scores, and Perceived Health Competence scores), I often times felt overwhelmed. It was a difficult process to decide how to analyze each piece of data, and then learn how to do that using two different computer programs. All in all, recruitment and data analysis may have seemed like difficult processes, but they were very beneficial for my growth as a researcher and for understanding how the research process works. As in all research projects, there were exciting finds and conclusions, as well as great frustrations and problems.

After my study was completed, data analysis was run, and significant findings were discovered, I realized that this project would be excellent for either myself or others to further study. If the research were performed again, a very large sample size would be chosen, of at least $n=100$ and 50 participants in each of the activity level groups. Additionally, the activity level groups could be further divided based on the five stages of “readiness” before engaging in physical activity. Other changes which could be made to further this area of research are: running analysis on more nutrients, vitamins, and minerals, creating a schedule where the participants exercise two or more times and then are cancelled two or more times, including a tool for more specific health and mood stress measures (such as measuring cortisol to measure acute stress) to determine differences between conditions, or creating another stressful situation for individuals and observing the resulting change in dietary intake.

Overall, my senior honors project, though filled with some difficulties, was an excellent addition to my St. Catherine University education. I learned how to be a researcher, produce a topic, gain IRB approval, recruit participants, analyze data, and discover ways to further the research. This experience helped me grow intellectually, and as an individual, by learning to make connections and working on a team of well established and incredibly intelligent

professors. There were some fascinating findings in the study performed, which will hopefully lead to a better understanding of food consumption and the causes of obesity and type II diabetes in the future.