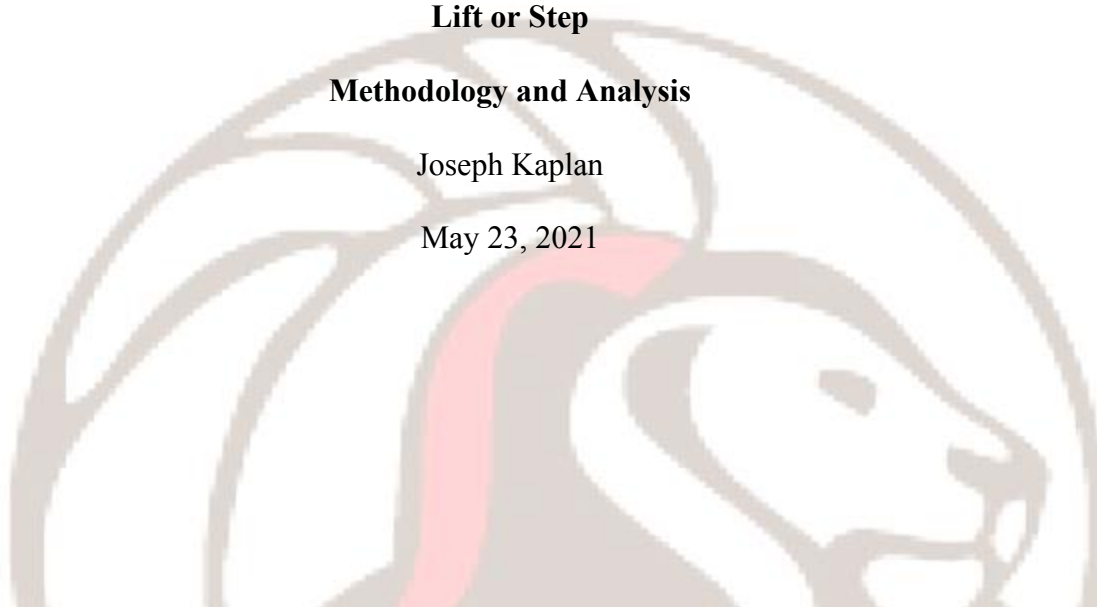


Lift or Step

Methodology and Analysis

Joseph Kaplan

May 23, 2021



Lift or Step

In an ideal world everyone would like to be healthy, and exercise has always been attributed to enhancing one's health. It has been proven that exercise causes the release of mood-altering chemicals such as endorphins, distribution of fluids, increase efficiency of heart and lungs, improves responsiveness of blood vessels, strengthen muscles, increases bone density, increases metabolism, increase oxygen and blood flow to the brain, increase of HDL (good fats), decrease of LDL (bad fats), reduction of muscle tension and stress, and improves body composition. In order to reap the benefits of all the potential adaptations, the design of the exercise routine must have all the essential components commensurate with the individual's goals. There are many different modalities, programs, diets, and people who claim they have the secret to the fountain of youth. The truth is there are not any magic pills, and no shortcuts to obtain sustainable positive results from training, only through hard work. In this discourse we will observe various documents researching walking and resistance training to determine which method would deliver greater results for the trainee.

Walking has always been touted as one of the best forms of exercise, some of the reasons behind it may have to deal with the accessibility, level of difficulty, and the fact that when engaged in aerobic activity the oxidative pathway for energy is used, which is said to burn fat. Technology has made walking a goal for many people who like to interact with their friends, challenging each other, and even receiving discounts from insurance companies for the number of steps their wearable tracks. The pedometer is not a new invention, and the number of steps an individual is prompted to take by the device has a basis as well. Believe it or not the concept of 10,000 steps started after the 1964 Olympics. It was a marketing campaign, "in 1965 under the

name of Manpo-Meter (manpo in Japanese means 10,000 steps)” (Tudor-Locke, 2002). While the “10,000 steps” was thought to be the standard, and oddly is still believed to be by some, they found it was rare if the average person achieved those number of steps in a day. It was actually found that 3,100-4,000 steps are equivalent to 30 minutes of walking at a low to moderate intensity. In another study conducted on a South African population of 317 people between the ages of 28-46 classified into three different groups also found majority of participants did not obtain 10,000 steps in a day. It was noted the average steps were approximately 6,000 with a variance of 3,500. One would imagine if they walked more, they would achieve better results, but within the study they determined otherwise. They found there was no significant difference between those who walked 10,000 steps or more and those who walked as little as 5,000 within their target heart rate zone for 21 minutes per day. Meaning if the individual reached a level where they obtained at least 55% of the V02 max or 60% of their target heart rate, they received approximately the same results as those who achieved their 10,000 steps. If we recall from the previous research 30 minutes is equivalent to roughly 3,000-4,000 steps, so 21 minutes could even be less than that.

Another reason that might cause individuals to engage in walking versus lifting weights could be the belief of holding one’s breath or exerting themselves while lifting results in a dangerous elevation of heart rate and blood pressure. However, a study was conducted in which a holding breath technique while performing compound movements such as the bench press, and leg press revealed a rise in systolic and diastolic blood pressure. Even though within this research it shows an elevated heart rate and blood pressure they concluded controlled breathing and breath holding do not elevate the heart rate to dangerous levels while lifting weights. Indicating that lifting weights does not cause undue stress to the heart, making it safe for average

individuals without conditions such as hypertension. There have been other studies conducted proving that resistance training is effective in reducing body fat percentage and increasing lean muscle and expenditure of calories. The larger the muscle one has increases their ability to burn more calories at rest, which causes an adaptation in the basal metabolic rate. One could argue they are directly proportional attributing to overall caloric expenditure contributing to true weight loss. It is very clear that the amount of calories burned has a significant impact on one's body composition and therefore overall health. This is consistent with the findings of Schuenke, Mikat, & McBride (2002), where they found not only did participants have elevated $\dot{V}O_2$ for two days after weight training, but there was also an expenditure of 773kcal as well. When an individual uses more calories than they consume, the body will respond with physiological changes. For this reason, it is imperative to reference the research conducted on the Hadza people who are hunter gatherers, spending majority of their day walking approximately 5-11 km. One would assume that the more an individual walks, the more the body will burn calories, and need more to replenish for fuel. It was found that the Hadza people did not expend anymore calories per day than their Western and European counterparts. The reason for this could be because of the specificity principle. The body adapts to the stresses imposed on it, if one continually follows the same training protocol, eventually, they will hit a plateau and will no longer obtain results.

Conclusion

Walking is one of those exercises that is easy for anyone to accomplish and takes very little skill or knowledge, and with the assistance of modern day technology individuals may find it motivating to go out and walk. There are health benefits to walking using the aerobic pathway for energy expenditure is beneficial to the cardiovascular system. In contrast, resistance

training requires practice, knowledge, and somewhat of a learning curve before an individual receives optimal results. However, the research has shown resistance training not only strengthens one's muscles, but causes a greater caloric expenditure than walking in addition to increasing oxygen consumption. With this one could surmise if they have the ability and time, lifting weights would be more effective than taking 10,000 steps.

Study Design:

Research Objective/Purpose:

There is a precedent in the new tech wearable world, if one wants to be healthy, they must walk 10,000 steps per day. The purpose of this study is to ascertain whether or not the amount of steps one takes on a daily basis is an indicator of good health.

Research Question:

I wonder how a bout of strength training compares to walking 10,000 steps and which elicits greater results?

Hypotheses

H_0 = Walking 10,000 steps will not elicit greater results than strength training.

H_a > Walking 10,000 steps will elicit greater results than strength training.

Type of Study and Data:

The main focus of this study is to monitor the heart rate and caloric expenditure of individuals participating in the study. The study consists of three different training regimen of weight training, walking, and walking while achieving one's target heart rate. The data will be collected

with use of a wearable sensor and analyzed using ANOVA method. While 10,000 steps are listed as a gauge, research has shown from studies conducted by Pillay et. al., (2015), and Tudor-Locke, C. (2002) most people do not accumulate 10,000 steps in a day, rather 7,000 plus or minus 3,000 roughly. It has also been noted a bout of 21 minutes achieved the same results as those who walked the 10,000 steps. With the use of this information, one could obtain accurate results with exercise bouts between 21-30 minutes.

Population and Sample:

The study will consist of sample size of 30 people willing to participate in the training protocol. The people will be randomly selected, consisting of men and women between the ages of 38-52, and categorized into three groups. The three groups are sedentary those are individuals who mainly sit throughout the day engaging in light walking, fitness enthusiast who mainly exercise aerobically one hour, one to three times a week with light weight training, and athlete defined as those who perform manual labor in addition to two to four hours of intense weightlifting. Participants would then be randomly selected as to which modality they are assigned to.

List and label the variables:

Independent: Training protocol, the modality used to test participants.

Dependent: Individuals participating in the training protocol

Data Collection:

The resistance training will consist of three lifts bench press, squat, and deadlift of 3-4 sets at 65%-85% of participants 1 repetition maximum for 6-10 repetitions. The walking of 10,000 steps will be tested by using the Karvonen formula to find the target heart rate and keeping it at

70%-85%, which is equivalent to a VO2 max of 60%-80%. Then the other group would just walk 10,000 steps throughout the day. Daily pulse rates and caloric expenditure will be taken with the use of wearable sensors.

Data Analysis:

The analysis of variance statistical test or ANOVA could be used in a one-way test as there are three different categories. The ANOVA test will show differences between each modality giving a statistical analysis and p value as to which hypothesis is accepted or rejected. In simple language if the p-value is less than five percent one must reject the null hypothesis.

In the study conducted by Pillay et. al., (2015) on a South African population of 317 people between the ages of 28-46, where they classified the participants into three different groups of no, low, or high aerobic activity three different analysis were implemented. They used an analysis of covariance (ANCOVA), a post-hoc Bonferroni test, and bootstrapping. In another case where the researchers tested three different groups, one engaging in weightlifting and cardiovascular activity, one strictly cardiovascular, and the other weight training only. In this study they conducted analysis of variance, PLSD post hoc analysis, and a two-tailed t-test.

Based on the similarities of these studies and testing whether 10,000 steps, 10,000 steps achieving target heart rate, or weightlifting elicits greater results, a one-way ANOVA test will be adequate in obtaining statistical results.

Conclusion

To bring the research out into reality I went a step further implementing a training protocol where I would walk one day, walk to obtain target heart rate on another, and lift weights on a

third day. The weightlifting consisted of the three lifts described in the study, bench press, dead lift and squat. I initially was walking to 10,000 steps per day but scaled it back to time between 20-40 minutes based on previous research. The data collected is displayed in appendix one, input into STATDISK using analysis of variance (ANOVA). This shows a P value less than 5% for heart rate which indicates the null hypothesis is to be rejected, but for calories burned the P value is greater than 5% so the null hypothesis is accepted.

However, when reviewing the box plots for both heart rate and calories burned, the lifting results are closer toward the center, and this is a factor when dealing with a normal distribution. In appendix V, one can see a snapshot of different training zones during exercise. The first is during lifting weights, the next is walking within target heart rate or attempting to, and the last is just walking. From these charts it is clear weightlifting is superior as it even encompassed aerobic exercise while strengthening the muscles whereas with walking it was difficult to elevate the heart rate. The only way to create a demand on the cardiovascular system was to increase the incline while walking. One must be cognizant of the fact that cardiovascular activity does not stimulate or maintain muscle mass or bone density, this can only be achieved through resistance training. Exercise is not simple, there is not one specific method that is better than the other, rather a culmination of many forms based on goals. Although if one is short on time a bout of weight training of three to four sets, 10-12 repetitions, resting 30 seconds between sets will yield aerobic and anaerobic results.

References

- Hatfield, F. (2001). *Fitness*. 8th ed. Santa Barbara, CA: International Sports Science Association.
- Liu, Y., Lee, D., Li, Y., Zhu, W., Zhang, R., & Sui, X. et al. (2019). Associations of Resistance Exercise with Cardiovascular Disease Morbidity and Mortality. *Medicine & Science In Sports & Exercise*, 51(3), 499-508. <https://doi.org/10.1249/mss.0000000000001822>
- Pillay, J., van der Ploeg, H. P., Kolbe-Alexander, T. L., Proper, K. I., van Stralen, M. M., Tomaz, S. A., van Mechelen, W., & Lambert, E. V. (2015). The association between daily steps and health, and the mediating role of body composition: A pedometer-based, cross-sectional study in an employed South African population. *BMC Public Health*, 15(1), 174-174. <https://doi.org/10.1186/s12889-015-1381-6>
- Pontzer, H., Raichlen, D. A., Wood, B. M., Audax, Z. P. M., Racette, S. B., & Marlowe, F. W. (2012). Hunter-Gatherer Energetics and Human Obesity. *PLoS One*, 7(7) <http://dx.doi.org.ezproxy.libproxy.db.erau.edu/10.1371/journal.pone.0040503>
- Schuenke, M. D., Mikat, R. P., & McBride, J. M. (2002). Effect of an acute period of resistance exercise on excess post-exercise oxygen consumption: implications for body mass management. *European Journal of Applied Physiology*, 86(5), 411-7. <http://dx.doi.org.ezproxy.libproxy.db.erau.edu/10.1007/s00421-001-0568-y>

Tudor-Locke, C. (2002). Taking steps toward increased physical activity (pp. Series 3 n17).

President's Council on Physical Fitness and Sports.

Willis, L. H., Slentz, C. A., Bateman, L. A., Shields, A. T., Piner, L. W., Bales, C. W., Houmard, J. A., & Kraus, W. E. (2012). Effects of aerobic and/or resistance training on body mass and fat mass in overweight or obese adults. *Journal of applied physiology (Bethesda, Md.: 1985)*, *113*(12), 1831–1837. <https://doi.org/10.1152/jappphysiol.01370.2011>



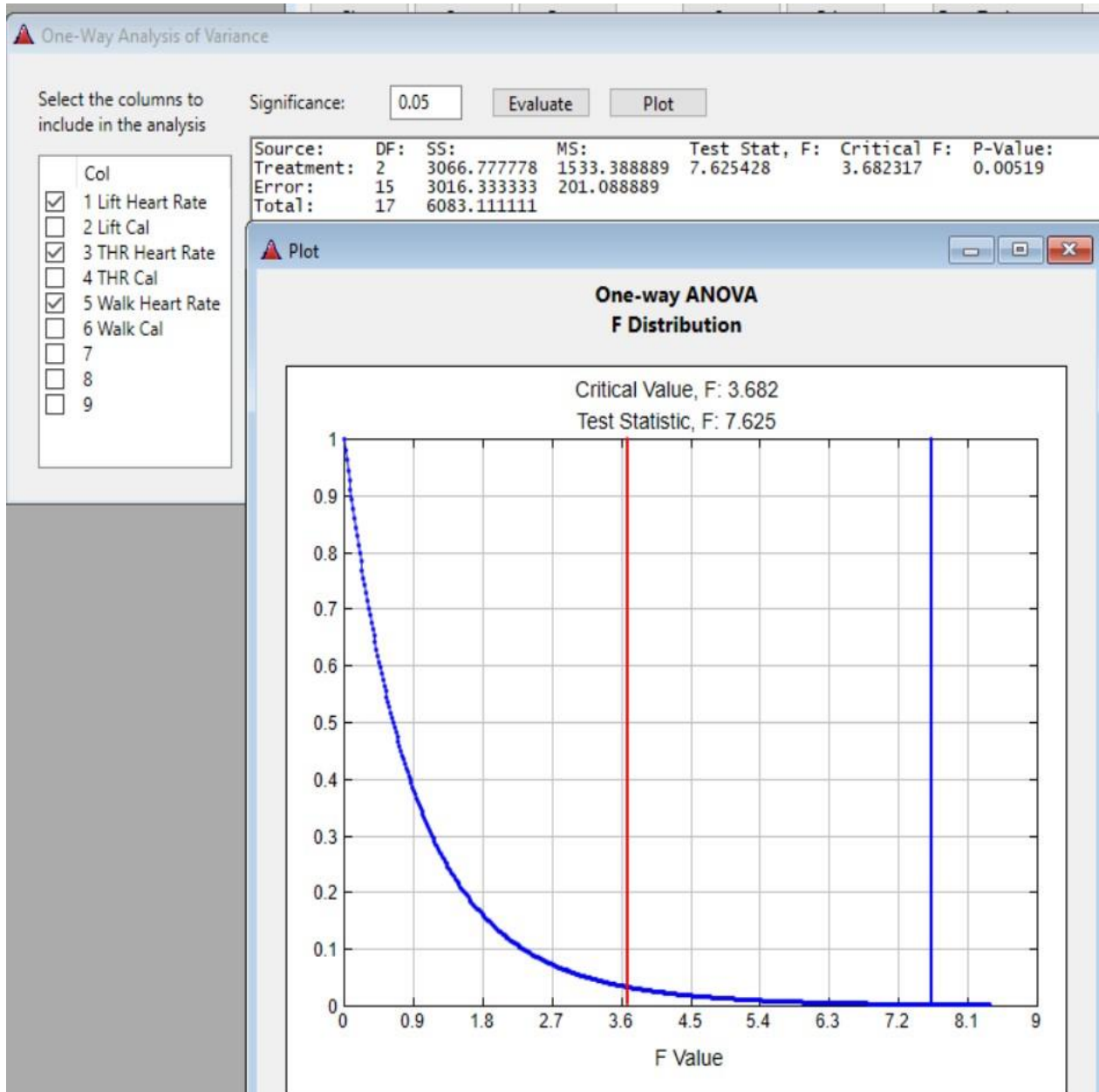
Appendix I

LIFTING			
BPM	CALORIES	DURATION	DATE
169	245	0:45:28	14/04/2021
101	126	23:28	23/04/2021
129	359	1:06:34	28/04/2021
134	134	0:24:52	5/5/2021
133	193	0:35:48	14/05/2021
131	203	0:37:34	21/05/2021

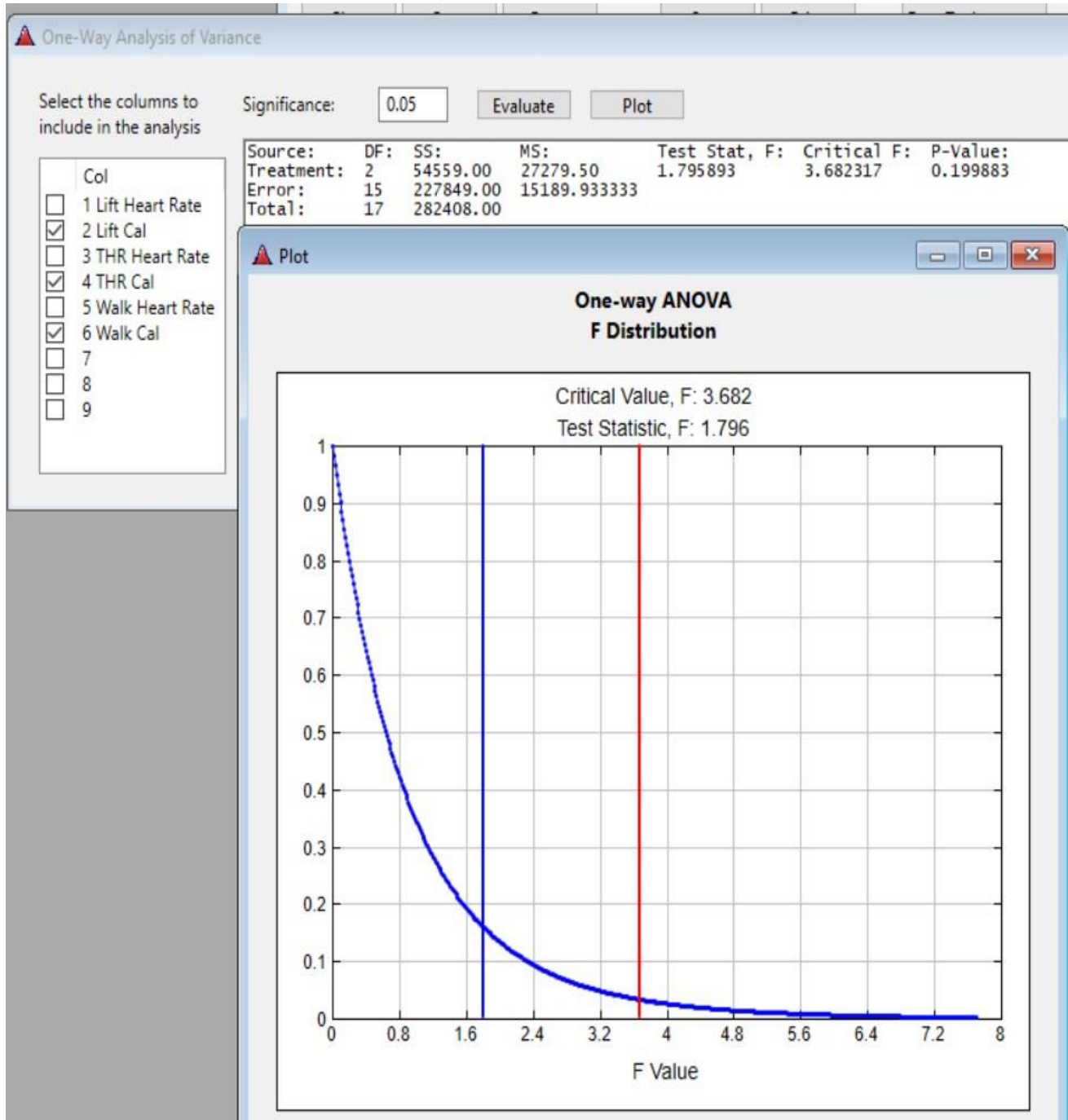
WALKING THR				
BPM	CALORIES	STEPS	DURATION	DATE
137	232	5110	0:44:44	16/04/2021
115	463	3667	0:52:31	19/04/2021
120	589	5249	1:32:07	29/04/2021
112	195	1483	0:27:10	3/5/2021
110	258	1200	0:36:34	10/5/2021
123	234	3521	0:35:16	17/05/2021

WALKING				
BPM	CALORIES	STEPS	DURATION	DATE
101	220	4448	0:47:37	15/04/2021
109	416	8456	1:02:51	17/04/2021
103	236	3488	0:39:46	27/04/2021
101	82	1668	0:24:33	4/5/2021
102	149	2563	24:56:00	9/5/2021
90	178	2280	0:35:21	15/05/2021

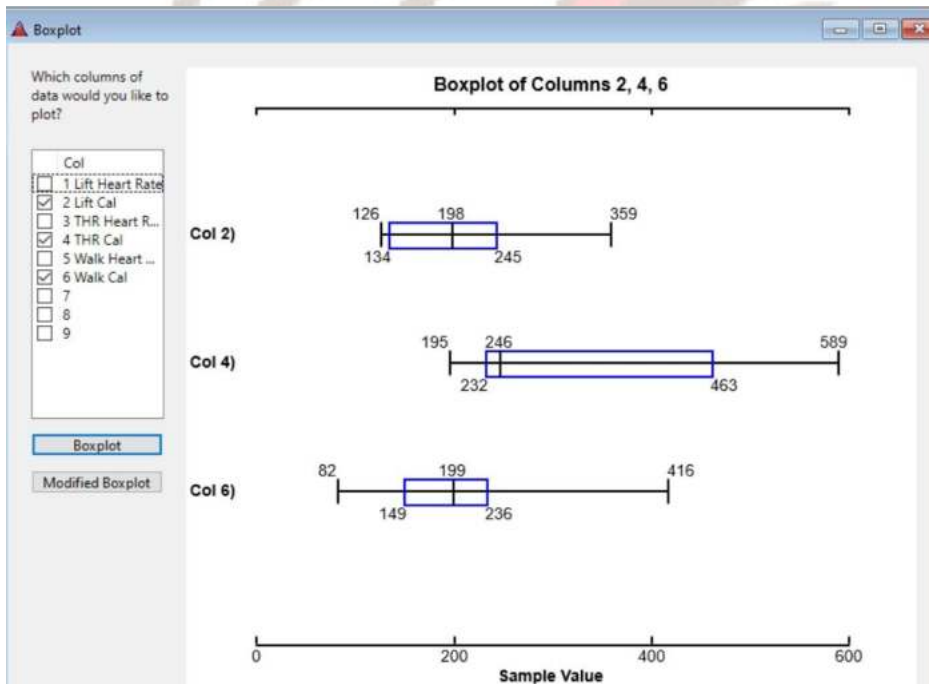
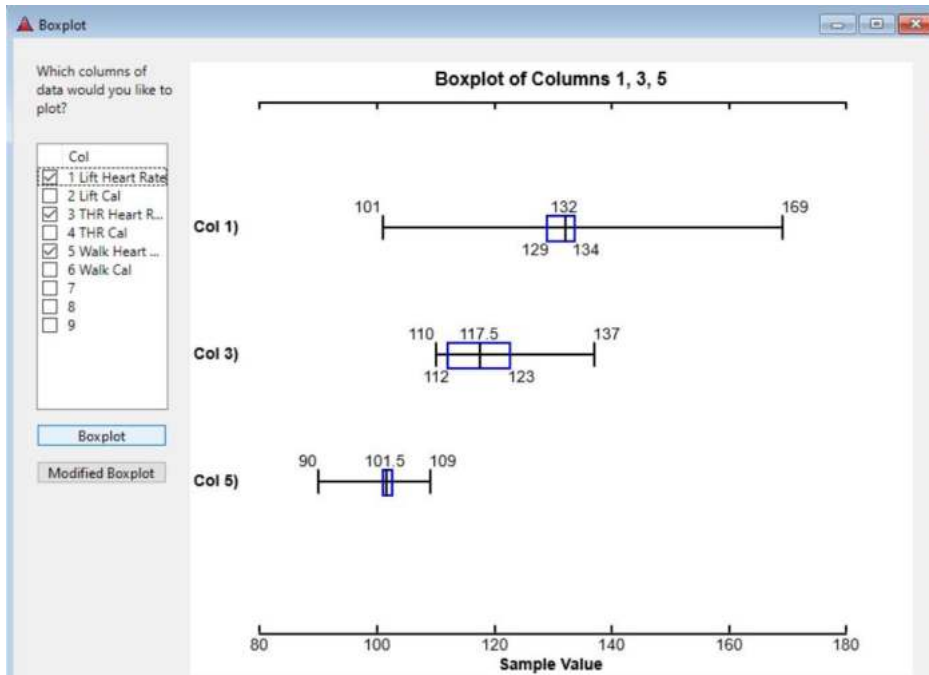
Appendix II



Appendix III



Appendix IV



Appendix V

