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A Comparison of Changes in Women's Cardiovascular Fitness and Body Composition After
Performance in Zumba, Tabata, and Cycling

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Honors Research Project

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Abstract

Aerobic group exercise is important to prevent against cardiovascular, pulmonay, and metabolic diseases. Regular exercise can help to reduce the risk of these diseases and premature death. Group exercise classes have shown to be effective in reducing weight, blood pressure, and body composition Further research is necessary to evaluate the effectiveness of these aerobic group exercise classes to one another. **PURPOSE:** To evaluate and compare the potential health benefits that may occur for women who participate in regular group exercise classes at the Kohl Family YMCA. **METHODS:** A survey and body measurements were taken of females enrolled an eight-week aerobic group exercise class: Zumba, cycling or tabata (n=8). **RESULTS:** On average, weight decreased by 2.18 pounds (± 1.44 pounds), BMI lowered by 0.68 kg/m^2 ($\pm 0.88 \text{ kg/m}^2$), and body fat percentage decreased by 2.85% (± 1.29). There was a significant difference in body weight, body composition, body fat percentage, and girth measurements after participation in the group exercise class. **CONCLUSION:** These three group exercise classes at the Kohl Family YMCA are all effective in helping women with their physical fitness. Further studies are required to further compare the three classes.

Chapter 1: Introduction

Cardiovascular fitness is one of five health-related components of fitness. Aerobic exercise is important to decrease the risk of cardiovascular disease (CVD), pulmonary diseases, and metabolic diseases (Pescatello, Arena, Riebe, & Thompson, 2013). Research has shown that various aerobic group exercise classes taken regularly are effective in controlling weight, blood pressure, and body composition. Examples of effective aerobic group exercise classes include cycling, tabata, and Zumba (Delextrat, 2016; Faulkner et al., 2015; Lbujojevic et al., 2016; Tabata, 1996; Thompson, 2016). There are a variety of group exercise classes where individuals can perform aerobic exercise with other people in Akron, including any of the Akron Area YMCAs. Group exercise may be preferable to some because there is an instructor leading the exercise and because of the social aspect. There are many different options for aerobic exercise for all experience levels.

While aerobic exercise is beneficial for an individual's physical and mental well-being, there is little research comparing the benefits of different group exercise classes against each other.

The purpose of the study was to identify potential health benefits for women who participated in certain group exercise classes at the Kohl Family YMCA in downtown Akron. Women had their cardiovascular and body composition measurements taken before and after the participation in one of the eight-week group exercise classes. This research will examine aerobic fitness and body composition of participants who took part in various group exercise classes. The group exercise classes analyzed were Zumba, Cycling, and Tabata. The research question that guided this study was "Is there any significant differences in the changes that occur to

participant's body composition and/or cardiovascular fitness among participants based on the type of class attended?"

The hypothesis was that all the group exercise classes will be effective in controlling weight, blood pressure, body mass index (BMI), body fat percentage, and waist and hip circumference. The hypothesis suggested that although all of the classes would be effective in providing health benefits to their participants, there would not be a significant difference between the three group exercise classes.

This study focused on women only because that has shown to be the dominant population in group exercise classes at the YMCA in this location. It was predicted that there would not be a sufficient male sample size for this study to show significant results. Zumba, cycling, and tabata were chosen as the classes to be analyzed because they are all aerobically-based. They are all some of the most popular group exercise classes at the Kohl Family YMCA, and also worldwide the last few years (Thompson, 2016).

Chapter 2: Literature Review

Aerobic exercise is important to maintain a healthy lifestyle. Exercise that requires the repetitive use of large-muscle groups for a prolonged period is classified as being aerobic (Ehrman, Gordon, Visish, & Keteyian, 2009). Some of the most common examples include walking, running, bicycling, dancing, and swimming. Acute physiological responses to aerobic exercise include increased heart rate, blood pressure, breathing rate, and tidal volume. Long-term aerobic exercise participation is proven to increase the amount of maximal oxygen consumption during intense aerobic exercise (VO_2 max), lower resting blood pressure and heart rate, lower body fat mass, and increase muscle mass, while low levels of cardiovascular fitness are associated with increased risk of premature death (Ehrman et al., 2009).

The American College of Sports Medicine (ACSM) is one of the largest sports medicine and science organizations in the world. Their mission is “to advance and integrate scientific research to provide educational and practical applications of exercise science and sports medicine” (ACSM, 2017). They put together position stands on exercise for various populations. One of their position stands, *Quantity and Quality of Exercise for Developing and Maintaining Cardiorespiratory, Musculoskeletal, and Neuromotor Fitness in Apparently Healthy Adults: Guidance for Prescribing Exercise* (2011), states the recommendations for aerobic exercise for healthy individuals. The primary recommendation is that moderate aerobic exercise should be performed 30-60 minutes a day for five days a week, at minimum. Vigorous aerobic exercise should be performed 20-60 minutes a week, 3-5 days per week, or a combination of moderate and vigorous activity. Healthy individuals should aim to perform at least 150 minutes total of aerobic exercise each week to redeem the minimum benefits (Garber et al., 2011)

Aerobic exercise is shown to reduce the risk of developing many disease and injuries, including coronary heart disease (CHD), stroke, diabetes, and certain cancers (Pescatello, Arena,

Riebe, & Thompson, 2013). Regular aerobic exercise helps to decrease risks associated with sedentary lifestyles. Cardiorespiratory physical activity decreases the risk of CVD and premature mortality. Increase in aerobic exercise lowers the risk of atherosclerosis by increasing high-density lipoprotein (HDL) levels, lowering low-density lipoprotein (LDL) levels and total cholesterol levels. Exercise helps to boost insulin production, control blood glucose levels, and lower body fat to decrease the risk of diabetes (Pescatello et al., 2013).

Studies reviewed by ACSM show that benefits of exercise can occur even when an individual is performing slightly below the baseline recommendations of aerobic exercise, showing that some form of aerobic exercise is better than nothing (Garber et al., 2011). Furthermore, aerobic exercise performed in repetitive short bouts of energy, called interval training, has also shown many benefits to both untrained and trained individuals, including improving cardiovascular fitness and blood glucose concentrations (Garber et al., 2011).

There have been many changes in exercise trends over the years. ACSM conducts a survey every year from health and fitness professionals to see what trends are occurring worldwide. The survey aims to educate fitness professionals on what the next year will look like in fitness. According to the surveys, there has been an increase in focus on aerobic exercise over the past ten years.

One exercise trend that has become more prevalent in the last ten years is “high-intensity interval training” (HIIT). On the 2017 Worldwide Fitness Trend list, HIIT was listed as #3. This form of exercise is performed by doing short bursts of high-intensity exercise with a short period of rest, repeated over and over again. It is meant to be short, but effective. It can be performed with both aerobic and resistance training exercise. HIIT can be performed anywhere relatively quickly, which makes it favorable for those with a busy schedule (Thompson, 2016).

Also making it onto the 2017 Worldwide Fitness Trend list was #6 “group training”. Group exercise classes can be motivating for newcomers. Instructors help to lead and encourage participants to reach their goals (Thompson, 2016).

Other exercise trends in the past decade that have included aerobic exercise include “Zumba” (Thompson, 2012-2013) and “spinning”, also known as indoor-cycling (Thompson, 2012). Outcome measurements stayed within the top 20 fitness trends every year for the past decade (Thompson, 2017).

It is well established that exercise is important for all populations. There are many benefits especially important for women’s health. Exercise will help to regulate hormonal changes during menopause and the symptoms of menopause, including hot flashes, fatigue, weight gain, joint aches and pain, sleep disturbances, loss of bone density minerals, and depression and anxiety (Eshbach, 2016). Exercise during pregnancy can help to improve cardiovascular function, limit risk of hypertension, limit body weight gain and fat retention post-pregnancy, reduce back pain, and allow for easier delivery (Ehrman et al., 2009).

The International Health, Racquet and Sportsclub Association (IHRSA) is focused on educating and promoting health and fitness. A study done by IHRSA in 2014 found that approximately 48% of gym or club members are male and 52% are female. However, only 38% of those gym members who participate in group exercise were male (Spiegel, 2014). The majority of group exercise participants are female (62%). Although the gender ratio for males to females with memberships is approximately 1:1, group exercise participation is closer to 1:2.

Spiegel, a reporter for IHRSA, wrote a blog about the reasons women dominate group exercise classes. An interview with a previous exercise physiologist at the American Council on Exercise, Jessica Matthews, stated that men may be turned away from group fitness because of

outdated misconceptions of group exercise from the 1970s and 1980s outfits and music. The blog went into further possible explanations for the women-dominated group fitness realm. Men may be turned away from the current music present in certain group exercise classes that may be deemed as feminine, such as Katy Perry. Also, they stated that a possible explanation for the discrepancy is that women prefer to work in groups, where men more prefer to work individually (Spiegel, 2014).

There are a variety of group exercise classes where individuals can perform aerobic exercise with other people. There are many opportunities in Akron to find group exercise classes, including any of the Akron Area YMCAs. There are many different options for aerobic exercise for all experience levels.

Cycling has been around for centuries. Indoor cycling (also referred to as spinning) started in the 1980s (Wolfe, 2012). Stationary bicycles come in many shapes and forms, but all have the same function: to stimulate interval training by altering the resistance of the stationary bike. There are a variety of classes available for all fitness levels at all of the Akron Area YMCAs. Cycling is an effective form of aerobic exercise, providing a low-impact form of exercise. A study done by Loughborough University in London (Faulkner, Pugh, Hood, Menon, King, & Nimmo, 2015) showed that spinning classes are an effective exercise regimen for overweight and physically inactive adults. The results showed that after performance in an eight-week studio cycling class three times a week, individuals had increased their VO₂ max, along with having decreased their body fat percentage, total cholesterol, and low-density lipoprotein cholesterol (Faulkner et al., 2015).

Zumba is a dance fitness class focused on whole-body rhythmic movements. It is based on Hispanic and Latino music with a mixture of pop music. Zumba classes include a total time of

45 minutes-1 hour, based on the class (Zumba, 2017). It has gained much popularity in the last two decades. A study done in two Bosnian universities showed that Zumba was effective in lowering body fat mass in women participating in the class for three times a week, for eight weeks (Ljubojevic, Jovanovic, Zrnic, & Sebic, 2016). Body fat mass was measured as a total, for each limb, and the trunk with a TANITA body analyzer. There was a significant difference for weight loss in each area measured for all the women.

Another study looked at the changes in aerobic fitness with Zumba performance (Delextrat, Warner, Graham, & Neupert, 2016). Compared to the control subjects who did not take part in the class, the Zumba participants showed on average a greater increase in VO₂ max. Multiple studies have also shown that the energetic dance class is effective increasing psychological well-being and quality of life for women (Delextrat et al., 2017; Nieri & Hughes, 2017).

Tabata exercise was studied by a team of experts at the National Institute of Fitness and Sports in Tokyo (Rosenzweig, 2017). Named after a Japanese scientist in 1980, Dr. Izumi Tabata, tabata exercise is a form of high intensity interval training (HIIT). The protocol for tabata includes performing an exercise routine in a 20 second bout, followed by a 10 second rest, repeated eight times, for a total of four minutes. The original study performed by Tabata, et al. (1996) was performed by male athletes on stationary cycles in a five-six week study. They found that the benefits of tabata exercise included improvements to both the aerobic and anaerobic systems. The tabata exercise protocol can be performed with any kind of exercise. It can be performed anywhere and is a very quick form of exercise. Due to the brevity of the routine, an hour long tabata group exercise class can include up to 8-12 different exercise routines.

Regardless of what type of exercise is performed, it is important to track fitness levels. Physical fitness testing is important because it allows clinicians and clients to keep track of their health over time. Fitness testing allows clinicians to identify risk factors clients may have and educate them on how to properly address such issues. Moreover, seeing positive progress may motivate and encourage clients to continue with regular exercise (Pescatello et al., 2013).

There are many ways to measure aerobic fitness. One of the gold standard measurements for cardiovascular fitness is to measure a patient's maximal oxygen uptake ($VO_2\text{max}$). This measurement allows exercise specialists to evaluate a client's cardiorespiratory functional capacity. $VO_2\text{max}$ testing can be performed either with a maximal or submaximal test. Since maximal testing takes more equipment and technical expertise than a regular gym would typically possess, a submaximal test is usually preferred outside of a clinical setting.

One submax test that can be performed in a fitness facility is a YMCA 3-minute step test. This test requires the use of a step bench raised 12 inches (usually 4-risers high), a metronome, and a stopwatch. Subjects are to step up and down onto the step bench to the beat of a metronome set to 96 bpm. With every beat, the subject takes a step. This should be performed for three (3) minutes or until the patient can no longer keep with the rhythm of the metronome. The heart rate is recorded for one (1) minute post-exercise either with a heart rate monitor or by palpitation to the radial artery (wrist palpitation). This heart rate can be used to calculate an estimated $VO_2\text{max}$ (Pescatello et al., 2013).

Other measurements for cardiovascular fitness include a resting blood pressure and heart rate. According to ACSM, the goal for a resting blood pressure reading should be 120/80 mmHg or below. Having a blood pressure of 140/90 mmHg indicates that the patient is hypertensive, increasing risk for cardiovascular and metabolic diseases. Resting heart rate can be anywhere

from 60-90 bpm. Having a resting heart rate above 90 bpm also increases risk for diseases (Pescatello et al., 2013).

Body composition measurements help to estimate the amount of body fat a person carries in relation to their total body weight. Increased levels of body fat increase risk of cardiovascular diseases and metabolic diseases. In the United States, about two-thirds of Americans are overweight, with 33% classified as obese (Ogden, Carroll, Fryar, & Flegal, 2015). Body composition measurements can be obtained many different ways. One of the simplest form of measuring body composition is by calculating a body mass index (BMI). BMI is the body weight of the individual (kg) divided by the height (m²). A measurement of >25 kg/m² indicates the individual is overweight, and a reading >30kg/m² is classified as obese. While this is a simple and easy calculation to estimate the height-to-weight ratio, it does not take into factor the type of weight the individual is holding (fat mass vs lean mass). This measurement is best accompanied by other body composition measurements to indicate health status (Pescatello, 2013).

The circumference of an individual can indicate where the individual is holding their fat mass. Increased waist and hip circumferences are associated with overweight and obese individuals. A waist circumference greater than 90 cm for women and 100 cm for men indicates high risk of diseases. A waist-to-hip ratio (WHR) is measured by dividing the waist circumference (cm) by hip circumference (cm). A WHR >0.86 for young women and >0.95 for young men shows increased risks. Older adults have more lee-way with risks starting at >0.90 for women 60-69 years-old >1.03 for men the same age (Pescatello et al., 2013).

Lastly, body fat percentage measurements allow for an estimated body fat content in the body. A simple way to measure body fat percentage in a non-clinical setting would be to use a bioelectrical impedance analysis device (BIA). They are a less expensive and easier to utilize

than other forms of body fat percentage measurements. They can be fairly accurate, with up to +/-5-7% error for individuals who are not well hydrated (Pescatello et al. 2013).

There is much research on the benefits of performing various group exercise classes (Delextrat, 2016; Faulkner et al., 2015; Lbujojevic et al., 2016; Tabata, 1996; Thompson, 2016). However, there is minimal research that compares the performance results between each of these classes.

Chapter 3: Research Design and Methods

Women between the ages 18-64 years were recruited to take part in this seven-week study. Subjects were to complete at least 6 of 8 sessions in one of three aerobic-based group exercise classes at the Kohl Family YMCA (Zumba, cycling, and tabata) in order to be considered for data analysis. Men were not included in the study because these classes are predominantly attended by women, and because men respond differently from women in regard to the way exercise influences aerobic strength and body composition.

Participant recruitment started the second week of the eight-week group exercise session due to delays in IRB approvals. Participants were given information pertaining to the study at the end of their group exercise class during the second class (see Recruitment Script, Appendix A). Interested participants met with the Principal Investigator to receive a detailed overview of the study and to have any questions answered. After questions were answered, participants were instructed to fully read and sign the informed consent. (Appendix B).

Individual appointments were made with the Principal Investigator before the next class to complete the pre-study survey (see Pre-Participation Survey, Appendix C) and have measurements recorded with a Wellness Coach at the Kohl Family YMCA (see Fitness Assessment Form, Appendix D). All measurements are components of a the *YMCA Wellness 101* protocol. Wellness Coaches are trained to properly execute these tests. Measurements for aerobic fitness included resting blood pressure (mmHg), resting heart rate (bpm), and exercising heart rate (bpm). Body composition measurements were recorded using weight, body mass index (BMI), body fat percentage, and waist and hip circumferences. Other information collected included height, age, and a phone number used to contact the participant. All measurements were measured on-site before any exercise that day. All measurements were done with a scale,

automated blood pressure cuff, pulse oximeter, bioelectrical impedance analysis device (BIA) for BMI and body fat percentage, and tape measure for circumferences.

The exercising heart rate was taken following the YMCA 3-minute step test protocol. To perform the 3-minute step test, the participants were instructed to step up and down on a 4-riser high stepper (approximately 12 inches high). Participants stepped to the beat of a metronome set at 96 beats per minute, with each beat indicating a new step. Participants were instructed to step up and down on the riser for three minutes or until they could no longer keep with the rhythm of the metronome due to fatigue.

Participants took part in the class as usual until the end of the session. They were called again before the final week of the session to schedule for a post-participation survey (see Post-Participation Survey, Appendix E) and measurement. The post-participation measurements were completed in the same manner as the pre-participation measurements. The post-participation survey included self-report measures for the number of classes the participant took, along with six questions to measure participant's satisfaction with the class using a 5-point Likert Scale.

Participant confidentiality was protected by assigning a study ID number. The ID/participant list was kept in a locked file in the Wellness Director's office at the Kohl Family YMCA. All data collected was secured daily in a locked file in the director's office. For analysis, the deidentified data was entered in SPSS. The data and ID list will be deleted/shredded upon conclusion of the study.

This study was a quasi-experimental design using three comparison groups, identified by the type of group exercise completed: Zumba, cycling, and tabata. The statistical analysis of this study included measuring the mean, standard deviation, minimum and maximal changes in

weight, resting heart rate, waist and hip circumferences, BMI, and body fat percentage over the eight-week course of the group exercise classes. A two-tailed t-test was measured to find the p-values of the changes in weight, waist and hip circumference, BMI, and body fat percentage in order to examine any significant differences after performance in group exercise. Further statistical assumptions performed included a test for Skewness and Kurtosis measurements for all data collected pre- and post-participation in group exercise class. All statistical analyses were done using Excel spreadsheets.

Chapter 4: Results

Ten female subjects volunteered for the study and completed pre-participation measurements and survey. With two participants dropping out during the middle of the study, the post-study sample size was eight ($n=8$). There was one cycling subject, two tabata subjects, and five Zumba subjects. The average age of participants was 43 years old, with a range of 21-64 years. All participants took part in their group exercise class for at least six (6) out of the eight (8) sessions of the group exercise class during the eight-week session.

Of those eight participants, seven ($n=7$) of them reported having taken part in regular exercise within the past two months. Of those seven, five ($n=5$) of them reported having exercised at least 3 days of the week for the past two months.

There were not enough total subjects for each group exercise category to compare any significant differences to one another. However, the total difference in pre- and post-measurements were looked at as a whole for all three group exercise classes together.

On average for all eight subject, the change in weight before and after participation in the eight-week group exercise classes was -2.18 pounds, with a range of 1.44 pounds. Using a two-tailed t-test, there was a significant difference in weight loss found from after participation on average for the three classes ($p=0.005$).

For waist circumference, there was also a significant reduction found after participation in the three group exercise classes on average ($p=0.021$). The critical value was found to be less than the test statistic ($t(7)=2.980$, critical two-tail= 2.365). The difference in waist circumference on average for all eight participants was -1.99 cm.

There was also a significant difference found in pre- and post-participation BMI and body fat percentage on average for all eight participants. The critical value was found to be less than the test statistic (BMI: $t(7) = 3.729$, critical two-tail=2.365. BF%: $t(7) = 2.931$, critical two-tail=2.365). Using a two-tailed t-test, a significant difference was found for both BMI and body fat percentage (BMI: $p = 0.007$. BF%: $p = 0.022$).

There was a heavy skew found in the data collected for both pre- and post-measurements for waist and hip circumference, along with systolic and diastolic blood pressure. Moreover, there was not a significant difference found in average hip circumference after participation in the three group exercise classes ($p = 0.436$). Therefore, there cannot be a conclusion made for the changes in hip circumference and changes in blood pressure after the participation in the three group exercise classes.

All pre- and post-participation body composition variables can be seen in Table 1 below. Included for each variable are measures of central tendency, as well as upper and lower bounds of 95% confidence interval. Also included in Table 1 are pre- and post-measures for resting heart rate (RHR).

Table 1 shows all of the average data for all eight participants for this study. It shows the averages for age and height (inches and centimeters), along with the pre- and post-participation measurements on average. This table also shows the standard deviation, minimum and maximum values, range, and 95% confidence intervals (CI) for all eight participants.

<i>Time</i>	<i>Variable</i>	<i>Mean</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>	<i>Range</i>	<i>95% CI</i>	
							<i>Lower Bound</i>	<i>Upper Bound</i>
Static	Age	42.8	17.3	21.0	64.0	43.0	30.7	54.8
	Height (in)	64.6	1.1	63.0	66.0	3.0	63.9	65.4
	Height (cm)	164.1	2.7	160.0	167.6	7.6	162.3	166.0
Pre	Weight (lbs)	158.0	18.7	130.2	183.2	53.0	145.0	170.9
	Weight (kg)	71.8	8.5	59.2	83.3	24.1	65.9	77.7
	RHR (bpm)	81.1	9.7	68.0	98.0	30.0	74.4	87.8
	Waist(cm)	75.7	30.5	24.4	102.0	77.6	54.6	96.9
	Hip(cm)	89.5	34.7	33.0	115.0	82.0	65.5	113.5
	BMI	26.5	3.2	23.0	30.4	7.4	24.3	28.6
	BF%	33.1	6.3	24.4	44.4	20.0	28.7	37.4
Post	Weight (lbs)	153.2	18.0	130.0	179.5	49.5	140.7	165.6
	Weight (kg)	69.6	8.2	59.1	81.6	22.5	64.0	75.3
	RHR (bpm)	87.0	10.0	73.0	104.0	31.0	80.1	93.9
	Waist(cm)	73.8	29.5	24.5	99.0	74.5	53.3	94.2
	Hip(cm)	96.4	26.3	33.0	116.0	83.0	78.1	114.6
	BMI	25.8	3.0	22.5	30.1	7.6	23.7	27.9
	BF%	30.2	7.0	22.4	43.3	20.9	25.4	35.1

Table 1. Descriptive statistics of the average data collected pre- and post-participation.

Table 2 shows the Skewness and Kurtosis values for the pre- and post-participation measurements. Skewness measures for the asymmetry of the probability distribution, or how skewed the data collected appears. A value greater than ± 1 standard deviation shows a violation of normality. For the Kurtosis measurement, this measures how heavy the measurements are in the tails of the probability distribution. Values that are above ± 3 indicate large tails. Values for the pre- and post-participation measurements are shown in Table 2.

	Variable	Skewness	Kurtosis
Static	Age	0.0	-2.2
	Height (in)	0.0	-0.9
	Height (cm)	0.0	-0.9
Pre	Weight (lbs)	-0.1	-1.4
	Weight (kg)	-0.1	-1.4
	RHR (bpm)	0.5	-0.1
	SBP (mmHg)	0.7	-0.3
	DBP (mmHg)	0.3	-0.8
	Waist(cm)	-1.3	-0.1
	Hip(cm)	-1.3	-0.1
	BMI	0.2	-2.1
	BF%	0.3	0.7
	E HR (bpm)	-0.3	-0.5
	Post	Weight (lbs)	0.2
Weight (kg)		0.2	-1.6
RHR (bpm)		0.3	-0.1
SBP (mmHg)		2.4	6.1
DBP (mmHg)		1.6	3.7
Waist(cm)		-1.3	-0.1
Hip(cm)		-2.5	6.8
BMI		0.3	-1.8
BF%		0.7	0.5
E HR (bpm)	-0.8	-0.3	

Table 3. Skewness and Kurtosis measurements for the pre- and post-participation measurements performed. Highlighted data for Skewness represents data greater than -1 or 1 for heavy skewness. Highlighted values for Kurtosis are values greater than 3 or -3, indicating large tails.

The p-values were found for the average difference in weight, waist and hip circumference, BMI, and body fat percentage after the seven-week study. Weight, waist circumference, BMI, and body fat percentage all showed $p < 0.05$. Blood pressure and resting heart rate were not tested for p-values because there was too much variability within their values.

<i>Data</i>	<i>Mean Difference</i>	<i>SE</i>	<i>p-value</i>
Weight (lbs)	-2.18	1.44	0.005
Waist (cm)	-1.99	2.74	0.021
Hip (cm)	6.88	2.76	0.436
BMI	-0.68	0.88	0.007
Body Fat %	-2.85	1.29	0.002

Table 3. Mean difference in weight, waist and hip circumference, BMI, and body fat percentage, along with their standard deviation values. Highlighted values show $p > 0.05$.

Results of the post-participation evaluation indicate participants (n=8) were highly satisfied with the group exercise classes. Respondents were asked to choose a number on a Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree). On average, all survey questions resulted in a 4 or greater. Results are shown in Table 3.

Post-Participation Survey Question	Average score
1. I enjoyed taking part in this group exercise class	5
2. This group exercise class and the instructor provided a challenge for me	4.4
3. Group exercise classes make me feel more confident in being able to stay physically active	4.8
4. I feel stronger and more alert in the days following the group exercise class	4.5
5. I would take this group exercise class again	4.6
6. I would recommend this group exercise class to a friend	4.6

Table 4: Summary of average responses collected from the post-participation satisfaction survey for group exercise classes.

Chapter 5: Conclusions

This study's focus was to compare the potential benefits that may occur for women who participate in aerobic group exercise at the Kohl Family YMCA. The goal was to compare the benefits of three different aerobic-based group exercise classes to each other to see if one class may offer more physiological benefits than another. The hypothesis stated that there would be a significant difference in weight, blood pressure, BMI, body fat percentage, and waist and hip circumference after participation in a seven-week group exercise class. Although the recruited sample size for each class was too small to make comparisons between classes, there was a significant difference in weight loss after taking part in either Zumba, cycling, or tabata, along with a decrease in body mass index, body fat percentage, and waist circumference. There was a heavy skew in the data collected for hip circumference and blood pressure for all three classes, which prevented any further evaluation of these measurements.

The changes in weight loss, while statistically significant, are not very clinically significant. According to ACSM, effective weight loss programs focus on losing 1-2 pounds per week. However, on average, the participants lost approximately 2 pounds for the entire eight weeks. There could be many reasons for these differences. For one, five out of the eight participants reported that they have been exercising about 3 days a week already on their own. Because a lot of these participants already classified as being in a healthy range for BMI and body fat percentage, it was expected that those subjects would not show a drop in weight over the eight week course. Much of the weight loss found was for those who did not exercise regularly before participation in the study.

It was also expected to see a larger difference in waist circumference than hip circumference for all women. Typically, women lose weight faster in their waist than their hips (Pescatello et al., 2013).

There was not a significant difference found in resting heart rate, systolic and diastolic blood pressure on average for the eight participants. This study did not control for diet, medications and stress during the study, which could have altered these values found. Furthermore, there was not enough evidence found that would suggest that any of these three group exercise classes are effective in lowering blood pressure in an eight-week group exercise class.

There were many limitations for this study. For one, data collection was delayed until the second week of the group exercise class while waiting for IRB approval. All subject data collection was done in a seven-week span, not eight as originally intended. The study period may not have been adequate time to assess changes in physiological measures such as blood pressure and resting heart rate. Also, data collection was done between multiple testers. This could result in between-tester variance. Furthermore, seven out of the eight participants took part in other forms of aerobic exercise during the week. Although participants were chosen upon by being registered for one of the three group exercise classes listed for the study, many of them took part in other group exercise classes outside of the study. This could lead to a variability in the results; any changes found after seven-weeks could be due to taking multiple group exercise classes instead of just the one for the study. This study also did not control for other variables, such as changes in diet and medicine.

Future studies should further look to increase sample size to allow for further comparison between the three group exercise classes. Future studies should look to control for exercise

outside of the group exercise class being examined. The studies examined in the literature review looked at the benefits that occurred for individuals who took part in the group exercise class three days a week, whereas this study only had participants take part in the class once a week. Future studies could examine how much difference there is in the potential health benefits between taking part in the group exercise class once a week versus three times a week: does an increase in time commitment mean more improvement?

Future studies should also try to control for various populations. This study looked at only female participants with a wide range of class. Some more specific populations could be menopausal women, college female athletes, or pregnant women. Another way to look at the difference in benefits of group exercise would be to compare males to females and their outcomes in different classes. Future studies should also try to examine the potential health benefits between different categories of exercise, such as aerobic to resistance group exercise.

References

- About ACSM: Who We Are. (2017). ACSM ®. Retrieved from:
<http://www.acsm.org/about-acsm/who-we-are>
- Delestrat, A.A., Warner, S., Graham, S., Neupert, E. (2016) An 8-week exercise intervention based on Zumba improves aerobic fitness and physiological well-being in healthy women. *Journal of Physical Activity and Health*, 13. 131-139.
- Ehrman, J.K., Gordon, P.M., Visich, P.S., Keteyian, S.J. (2009). *Clinical Exercise Physiology* (2nd ed.). Champaign, IL: Human Kinetics.
- Eschbach, Chris. (2016). Exercise recommendations for menopause-aged women. ACSM: *Public Information*. Retrieved from:
<http://www.acsm.org/public-information/articles/2016/10/07/exercise-recommendations-for-menopause-aged-women>
- Faulkner, S.H., Pugh, J.K., Hood, T.M., Menon, K., King, J.A., & Nimmo, M.A. (2015). Group studio cycling; an effective intervention to improve cardio-metabolic health in overweight physically inactive adults. *Journal of Fitness Research*, 4(2), 16-25.
- Garber, C.E., Blissmer, B., Deschenes, M.R., Franklin, B.A., Lamonte. M.J., Lee, I., Nieman, D.C., & Swain, D.P. (2011). Quality and quantity of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: Guidance for prescribing exercise. *American College of Sports Medicine: Medicine & Science In Sports & Exercise*, 1334-1359.
- Ljubojevic, A., Jovanovic, S., Zrnica, R., & Sebic, L. (2016). Zumba fitness cardio exercise: the effects on body fat mass reduction of woman. *Homo Sporticus*, 1. 32-35.
- Nieri, T., & Hughes, E. (2016). All about having fun: women's experience of Zumba fitness. *Sociology of Sport Journal*, 33. 133-135.
- Ogden, C.L., Carroll, M.D., Fryar, C.D., & Flegal, K.M. (2015). Prevalence of obesity among young adults and youth: United States, 2011-2014. *NHCS Data Brief: no 219*. Hyattsville, MD: National Center for Health Statistics.
- Pescatello, L.S., Arena, R., Riebe, D., & Thompson, P.D. (2013). *ACSM's guidelines for exercise testing and prescription*. (9th ed.). Baltimore, MD: Wolters Kluwer: Lipincott, Williams, & Wilkins.
- Rosenzweig, F. (2017). What is tabata training? *Active*. Retrieved from:
<http://www.active.com/fitness/articles/what-is-tabata-training>
- Spiegel, B. (2014). Why are there more women in group exercise?. *IHRSA®*. Retrieved from:
<http://www.ihrsa.org/home/2014/9/10/why-are-there-more-women-in-group-exercise.html>

- Tabata, I., Nishimura, K., Kouzaki, M., Hirai, Y., Ogita, F., Miyachi, M., Yamamoto, K. (1996). Effects of moderate-intensity endurance and high-intensity intermittent training on anaerobic capacity and VO₂ max. *Medicine & Science in Sports & Exercise*, 28(10). 1327-1330.
- Thompson, W.R., (2010). Worldwide survey of fitness trends for 2011. *American College of Sports Medicine's Health and Fitness Journal*, 14(6), 8-17.
- Thompson, W.R., (2012). Worldwide survey of fitness trends for 2013. *American College of Sports Medicine's Health and Fitness Journal*, 15(6), 9-18.
- Thompson, W.R., (2013). Worldwide survey of fitness trends for 2014. *American College of Sports Medicine's Health and Fitness Journal*, 16(6), 8-17.
- Thompson, W.R., (2016). Worldwide survey of fitness trends for 2017. *American College of Sports Medicine's Health and Fitness Journal*, 20(6), 8-17.
- Wolfe, D. (2012). The history of spinning ® and indoor cycling. *Ryde On!*. Retrieved from: <http://www.rydeoncycling.com/the-history-of-spinning-and-indoor-cycling/>
- Zumba classes. (2017). *Zumba* ®. Retrieved from: <https://www.zumba.com/en-US/party>

Appendix A: Recruitment Script

Script to be given at the end of the first class session of Zumba, Tabata, and Cycling Week of 1/17

Hello, my name is Kristi Kester. I work here at the YMCA as a Wellness Coach and am a student at the University of Akron. If you are a female aged 18-64 years old and plan to continue with this class, I'd like to talk to you about a research project I am conducting with the YMCA and the university.

Here at the YMCA, we provide a variety of group exercise classes. I am looking for females, aged 18-64 years old who are participating in either our Zumba, Tabata, or Cycling class (and only one of those classes). The purpose of the research is to identify changes in aerobic fitness and body composition that may occur as a result of participating in these classes. The study involves comparing measures of aerobic fitness and body composition before and after a six week fitness class.

Any women who are 18-64 years old participating in this class are eligible to join the study. You must be participating in only one of the group exercise classes mentioned. You must attend at least six out of the eight sessions.

If you would like to join the study, you can let me know and we will set up an appointment before the next class to get you started. If you decide to participate we will measure height, weight, age, body mass index, body fat percentage, waist and hip circumferences, blood pressure, resting heart rate, and exercising heart rate. The exercising heart rate is measured using a 3 minute step test. This means you will step up and down a 12 inch riser for 3 minutes, and we will measure your heart rate after that.

You must also be able to perform a 3-minute YMCA step test stepping up and down onto a 12-inch riser.

Participating in this study will take altogether about 40 minutes, 20 minutes each for measuring before the next session and after the class is completed. The study is entirely voluntary, and your decision to participate or not will not affect your status at the YMCA in any way.

Any questions? If you would like to get started, I will be available for the next twenty minutes following this class to meet. I will be available at the Wellness desk upstairs Monday, Tuesday, and Thursday evenings from 5-9pm. I am also available through email (knk21@zips.uakron.edu). Thank you everyone so much for your time and I look forward to working with some of you.



Appendix B: Informed Consent Documentation

Title: A comparison of changes in women's cardiovascular fitness and body composition after performance in Zumba, Cycling, and Tabata

Introduction: You are invited to participate in an research study conducted through the University of Akron School of Sport Science and Wellness Education to observe changes in aerobic fitness and body composition after completing an eight week group exercise course (Zumba, Cycling, or Tabata) at an Akron area YMCA location.

Purpose: The purpose of this study is to identify potential health benefits for those participating in aerobic-based group exercise classes at Akron area YMCAs. This study will examine changes in aerobic fitness and body composition of those taking part in various group exercise classes before and after completion of the class. Approximately 60 people will be in the study. The group exercise classes to be analyzed are Zumba, Cycling, and Tabata.

Procedures: If you choose to be in the study, you must attend at least 6 of the 8 scheduled sessions, and can attend only one of the research study classes. To sign up for the study you must make an appointment before your next class with a Wellness Coach for some pre-study measures of aerobic fitness and body composition that include: a pre-participation survey, height, weight, age, body mass index (BMI), body fat percentage, waist and hip circumferences, blood pressure, resting heart rate, and exercising heart rate. These will be measured using a scale, automated blood pressure cuff, bioelectrical impedance analysis device (BIA) for BMI and body fat percentage, tape measure for circumferences, stopwatch and four-riser-high stepper for exercising heart rate. Upon completion of the class, participants in the study will be asked to make an appointment within one week of the final ~~group exercise~~ class to complete a post-participation survey and a re-measurement of their aerobic fitness and body composition.

Risks: Participants are allowed to see their results following the conclusion of the study. Participants may become discouraged or bothered if their results do not have the effect that they had anticipated. In the unlikely event that a participant becomes upset about any aspect of the study, he/she will be referred to the Wellness Director, Nick Ferguson, or their primary care provider. Also, participants are at risk for personal injury when taking part in any group exercise class and the YMCA 3-minute step test. The staff are trained to respond to injury, and will also assess emergency services if needed.

Benefits: There are no known benefits to participating in this study. Participants may experience a health benefit from participating in the class. The information obtained from the study may help identify more effecting programming for future gym members.

Confidentiality: Participants will be given a coding number to replace their name that will be used for data analysis. The participant's information and match list will be kept locked in the office of the Wellness Director at Kohl Family YMCA during the time of the study. After completion of the study, the match list and participant's information will be shredded. The individuals who will have access to the data will include the Principal Investigator and the Faculty Advisors overseeing the study: Melissa Smith, Brian Miller, and Rachele Kappler, and the Kohl Family YMCA Wellness Director and reader for the study, Nick Ferguson.

Data will only be presented in aggregate form so no individual information will be identifiable.

Right to Refuse or Withdraw: Participants taking part in this study have the right to drop-out of the study at any given point in time. There will be no effect on your YMCA membership or participation in group exercise classes for those who decide to no longer take part in the study.

Contact Information: For further information pertaining to this research study, please contact any of the following people:

Principal Investigator: Kristi Kester at 330-434-9622 or knk21@zips.uakron.edu
Faculty Advisor: Melissa Smith mgsmith@uakron.edu
Kohl Family YMCA Wellness Director: Nick Ferguson nickf@akronymca.org

I, _____, agree to take part in this research study with The University of Akron School of Sport Science and Wellness Education, along with the Akron area YMCA. I allow for the collection of data through survey, aerobic fitness and body composition measurements, to be used for research purposes by the Principal Investigator, Kohl Family YMCA, and the University of Akron.

I acknowledge all risks and benefits of the research study, and that I may withdraw from the study at any given time. I acknowledge that there will be no monetary compensation for taking part in this study.

Signature

Date

Witness

Date

Appendix D: Fitness Assessment Form



School of Sport Science & Wellness Education
 Akron, OH 44325-5103
 (330) 972-ZATA, Office
 (330) 972-5293, Fax

A comparison of changes in women's cardiovascular fitness and body composition after performance in Zumba, cycling, and Tabata

Investigator Use Only:

Participant # _____

Pre-Participation Fitness Assessment

Name: _____

Date: _____

Age: _____

Height: _____ in Weight: _____ lbs

Resting heart rate: _____ bpm

Resting blood pressure: _____ mmHg

Waist circumference: _____ cm

Hip circumference: _____ cm

BMI: _____ Body Fat %: _____ %

Exercising heart rate: _____ bpm

*Measured during a YMCA 3-minute step test, using a four-riser stepper, stopwatch, and metronome set to 96 bpm.

Post-Participation Fitness Assessment

Name: _____

Date: _____

Age: _____

Height: _____ in Weight: _____ lbs

Resting heart rate: _____ bpm

Resting blood pressure: _____ mmHg

Waist circumference: _____ cm

Hip circumference: _____ cm

BMI: _____ Body Fat %: _____ %

Exercising heart rate: _____ bpm

*Measured during a YMCA 3-minute step test, using a four-riser stepper, stopwatch, and metronome set to 96 bpm.

Wellness Coaches: This form is to be used for research purposes. This form is to be sealed in an envelope and turned into the Wellness Director (or locked office) upon completion of the assessment. Any questions on data collection, please contact Kristi Kester (knk21@zips.uakron.edu).

Appendix E: Post-Participation Survey

- Name: _____ Date: _____
- Age Group: (Circle)

18-29 years	30-39 years	40-49 years
50-59 years	60-64 years	
- Group Exercise Class: (Circle)

Zumba	Tabata	Cycling
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- Were you able to attend at least six out of eight of the group exercise classes for this session? (Circle)

Yes	No
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- If yes, please rank your thoughts on the class on a scale of 1-5: (Circle)

	Strongly Disagree				Strongly Agree
I enjoyed taking part in this group exercise class	1	2	3	4	5
This group exercise class and the instructor provided a challenge for me	1	2	3	4	5
Group exercise classes make me feel more confident in being able to stay physically active	1	2	3	4	5
I feel stronger and more alert in the days following the group exercise class	1	2	3	4	5
I would take this group exercise class again	1	2	3	4	5
I would recommend this group exercise class to a friend	1	2	3	4	5

- Did you participate in any other exercise outside of the group exercise class for this study? If yes, please list the type of exercise and how often: (Circle) Yes No

- Any other comments about the group exercise class and the study
