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Effect of Aerobic Strength Training on Physical Fitness and Weight Loss of Female University Students

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Abstract
There is still a growing global trend of physical inactivity despite several research showing the positive effects of exercise on health. Furthermore, the most effective weight-loss or weight-control approach is still up for debate. The literature has proven that suggested aerobic strength training (AST) enhances a variety of physical performance outcomes in sports, which helps to validate the effectiveness of AST on physical fitness and weight reduction. Even though AST is one of the most popular strength training techniques, more research is needed to fully understand how it affects female university students' ability to lose weight and perform physically. The purpose of this study was to test the impact of 8 weeks of aerobic strength exercises in female students for physical fitness and weight loss. The study sample comprised overall female students of the Islamia University of Bahawalpur (Baghdad-ul-jaded Campus). The participants of the study were (n = 30) females with ages between (M = 254.5; SD = 30.58 years) were divided into two groups: The experimental group (EG; n=15), and the control group (CG; n=15). Prior to and after the intervention, participants experienced physical and anthropometric measurements. Data were analyzed by applying descriptive, paired sample t-test, and independent t-test. Only a significant improvement for LHGS (p = 0.05), agility (p = 0.00), flexibility (p = 0.01), skipping (p = 0.01), 30-m SRT (p = 0.00) were found in all physical fitness parameters and participants significantly losing weight for the EG (*p<0.05)* as compared to the control group. The findings suggest that AST improves female students' physical fitness, and helps to reduce weight.
Keywords: Aerobic strength training, physical fitness, aerobics, weight loss, anthropometry

1. Introduction

Aerobic training is often known as cardiovascular exercise, is a form of exercise that involves long duration exercise which increases heart rate and breathing rate, use of repetitive major groups of muscle, including arms, and legs (Garber *et al*., 2011). The heart and lungs are increased ability by this form of exercise. Further helps in weight reduction and physical fitness. Running, sit ups, jumping jacks, jump rope and walking are a few exercises that are considered aerobic (Reddy, 2012). Strength training is an exercise that increase the muscular growth, strength, and endurance which often referred to as strength or weight training (Greenlee *et al.*, 2016). In order to generate the required strength for muscular contraction with light weights, exercise machines, resistance bands, or bodyweight exercises (Hunter *et al*., 2008).

Faced with threats of a sedentary lifestyle, it looks like physical activity plays an important role in females' daily life routines (Modibbo & Inuwa, 2019; Görner & Reineke, 2020). By reducing obesity and strengthening bones, joints, and the heart, it lowers the risk of cardiovascular disease (Ashira & Ratanavadee, 2010). Physical exercise can take the form of fitness or health training, which enhances the body's important functions while enhancing person's mental and physical fitness. Women who exercised both aerobic and strength-training activities loss more fat and weight compared to those who exercised only aerobic (Hunter *et al*., 2008; Khan, 2018).

When combined with aerobic strength training it can help you lose weight (Lucotti *et al*., 2011). Individuals can lose weight by increasing their energy expenditure and burning calories by engaging in aerobic activity. Strength exercise may also support muscle growth and maintenance, which increases calorie burn (Skrypnik *et al*., 2015). The recommendation of exploration of Individual differences in fitness level, body composition, and other factors may affect the effectiveness of aerobic strength training for female university students. However, this recommendation could help to determine the most effective type of exercise program for female university students looking to improve their physical fitness and promote weight loss. Sloan *et al.*, (2021) investigated the effects of aerobic exercise on young, sedentary people with cardiac reactivity to and retrieval from psychosocial and orthostatic stresses found that conditioning improved aerobic capacity while deconditioning lowered it. In conclusion, cardiovascular reactivity was significantly impacted. Kim *et al.*, (2018) examined the impact of a six-week program of resistance and aerobic exercise utilizing outdoor exercise equipment on the fitness and insulin resistance among Korean adults and found that the combined exercise training was not only beneficial for enhancing fitness but also manifested a significant decrease in insulin. *Said et al.*, (2017) compared the impact of two different modalities of exercises and reported that aerobic and strength training improved body composition, physical fitness in overweight and obese females.it was also reported that low impact aerobics strength training method is more appropriate when the improvement of aerobic fitness and muscle strength is claimed. Muhammad *et al.*, (2021) examined the impact of food and aerobic and strength exercises on pro-inflammatory marker alterations in obese adult females and concluded that programs for losing weight were linked to more inflammation. Moreover, a combination of low-calorie diet and exercise did not offer premenopausal women with excess weight a larger advantage in lowering inflammation than low calorie diet alone. Kennedy's original set point model for the control of body fat. Kennedy was one of the founders in the idea that body fat storage might be a controlled process with a set point. He theorized that fat may generate a signal that is detected by the brain and compares with a goal amount of body fatness (Kennedy, 1953). Furthermore, consistent with the model's projections, extensive research has demonstrated that changes in leptin levels, whether brought on by weight gain or loss or brought on by peripheral or central administration, have a direct impact on eating behavior and energy consumption (Fam *et al.*, 2007; Sousa *et al*., 2009). Kim *et al.*, (2016) investigate the influence of strength and aerobic exercise on body composition in obese adults and reported that body fat was significantly reduced in both groups' exercises. However, it was manifested that strength exercise significantly preserved lean tissue relative to either aerobic exercise or no exercise in dieting obese subjects.

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It seems that the relative efficiency of aerobic strength training in the improvement of an inactive individual fitness and weight loss does not appear to have been settled upon by researchers. it seems probable that the variation in the results of past studies appears to have resulted from various session durations, or different approaches to training (i.e., training load, magnitude, and activities). Therefore, it was hypothesized that there is no significant impact of aerobic strength training on physical fitness and weight loss of female university students. It was also hypothesized that there is no significant difference between aerobic and strength training programs in fitness parameters. Finally, in order to promote physical fitness in obese inactive students, this paper examines the relationship between aerobic strength training and the physical fitness of female university students. The objective of this study was to identify the variables that contribute to obesity and inactivity among university-age girls, as well as the impact of 8 weeks of aerobic strength training on their physical fitness.

2. Methods and Material

This is a true experimental research design. Purposively, more than 60 non-exercising obese students volunteered to participate in this study, but 30 healthy female's students were randomly chosen from The Islamia University of Bahawalpur (Baghdad-ul-jaded Campus), Pakistan. Subjects were randomly assigned to an aerobic strength training group (AST) (N = 15, age 254.5 ± 30.58 years, height 162.99 ± 7.68 cm, body mass 69.61 ± 5.03 kg) and a control group (N = 15, age 260.20 ± 29.71 years, height 158.47 ± 5.53 cm, body mass 65.84 ± 8.51 kg). Criteria for inclusion for this study was only female students were chosen for this study. The participants in the research were untrained, free of injuries and not involved in any aerobic strength training at the time. Throughout the experiment, all participants committed to maintaining their current fitness routines. Participants were also instructed to maintain eating as usual during the workout session. Criteria for exclusion from the research included participating in extracurricular athletics outside of the university, engaging in physical activity more than once a week, and following a hypocaloric diet to lose weight. Furthermore, the presence of any medical records and a self-reported condition that might threaten their health. All participants were fully informed of the objective and process of data collection. All participants provided written informed consent to assure their volitional and active involvement in the study. The ethics board at The Islamia University of Bahawalpur gave approval to this study (under project 833/PESS, March 2023).

2.1. Instruments and Equipment's of Data Collection

This study uses two different variables the anthropometric and physical fitness of the subjects for data collection. Six stations were organizing the anthropometric measurements. The anthropometric measures taken from the participants included eight skinfolds, height, body mass (weight), eight body girths, seven body lengths, and hand grip strength. Physical fitness tests were taken as aerobic capacity, muscular power, flexibility, agility, 30-meter sprint, skipping rope, sit up.

2.2. Anthropometric Data Processing Process

This study examined the anthropometric measurements of subjects. Direct observation was employed as a research approach for this study. Ratio of fat to lean body mass and both total and visceral fat were measured.

- Measurements of skinfolds. Eight skinfolds and measurements were taken from the triceps, subscapular, biceps, iliac-crest, supraspinal, abdomen, frontal thigh, and medial calf. Harpenden caliper (Holtain Ltd, Crosswell, Crymch, UK) was used for the measurements of skinfolds with 0.2 millimeter(mm) as a minimum reading model by ensuring that the surfaces of the two sides of the skinfold were parallel.
- Height was measured with stadiometer (Holtain Ltd., Crymych, Dyfed, UK). The subjects were instructed to stand straight and barefoot on the stadiometer. The stadiometer horizontal bar was set on the subject's vertex, and measurements were taken in centimeters (Koley, 2011).
- Body mass (weight) was determined using a digital weight machine (Seiko, Tokyo, Japan), which was calibrated by setting the scale to zero. The subject was told to stand on the surface of the machine with their feet together, their weight distributed evenly between their left and right feet. The 0.1kg threshold was chosen as the minimal reading model (Kolic *et al*., 2020).
- Measurements of girth. All girths were measured using the cross-hand method, and the measurement was obtained by using a non-elastic metallic tape measure. Nine readings of girth were taken: Arm girth, maximum forearm, minimum wrist, maximum chest girth, minimum waist, maximum hip, maximum thigh, maximum calf. The 0.1 cm was used as a model for reading (Cook *et al*., 2019).
- Measurements of length and strength. A large sliding caliper (Lafayette Instruments Company, LTD, USA) was used to measure the lengths of body segments. Length variables were measured as Upper arm length, Forearm length, total arm length, Hand length, Upper leg length, Lower leg length and total leg length (North & Zealand, 2006). Make sure the subject stands in a relaxed position. The investigator stood behind the subject while holding caliper with the right and left edges. The minimum reading model for all lengths was .01 centimeter (Lucotti *et al*., 2011). To evaluate muscular strength the right-hand grip strength (RHGS) and left-hand grip strength (LHGS) were tested using a Handgrip Dynamometer. The subjects were told about the manner of their performance and measurement before performing individual tests.

2.3. Physical Fitness Tests

Aerobic capacity was measured through the Harvard Step test (HST). The subject goes up on 20-inch platform with both feet completely and then quickly steps down again, one foot at a time and repeated 30 times per minute for 5 minutes (Ibikunle & Ubaezuonu, 2016). Three trials of the standing broad jump (SBJ) were used to test the leg strength of the participants. The starting line was established, and the range between it and the rearmost heel strike were measured. The three trials' top score was recorded (Koch *et al*., 2003). Flexibility was measured through sit and reach test. The score is determined with the last line reached if it seems that the reach is exactly halfway across two lines (French *et al*., 2016). Agility was measured through the 'T-test agility test'. Pointers are placed 10 meters, 5 meters, and 5 meters away from a line drawn on the ground to make a "T". The fastest time was collected after each participant made two maximal tries. Running 30 meters on the track is required for the test. A Stopwatch was used to measure the time. They are instructed to sprint as quickly as possible (Abdullah *et al*.,

2016). All the participants were asked to perform as many successful skips as possible in one minute. Each time they jump, they will need to maintain a slight downward toe point (Tse *et al*., 2017).

2.4. Aerobic Strength Training Protocol Procedure

Collected pre-test data and later on post-test data was recorded. The training was performed for 8 weeks. Before exercise 30 subjects were done 5 to 10 minutes of warm-up. Each exercise had 2-3 min of rest. A wide variety of aerobic strength exercises were performed by the aerobic strength training group over an 8-week training program in order to improve physical fitness and lose weight (Table 1), in contrast to the control group, who did not engage in any aerobic strength exercises.

Table 1: Aerobic strength training programs of the experimental group, respectively

Sr. No	Exercises	Mon	Tue	Wed	Thu	Fri	(Set)
1	Sit Ups	10r		20r		30r	1
2	Push Ups		10r		10r		1
3	Squats	15r		20r		25r	1
4	Lunges		15r		20r		1
5	Walking Lunges	15r		20r		25r	1
6	Jumping Jacks		20r		30r		1
7	High Knee	10r		15r		20r	1
8	Crunches		10r		15r		1
9	Planks	20s		30s		40s	1

Warm-up, intervention, and cool-down exercises were done for 60 minutes, five days a week, with two days off during an eight-week aerobic strength training program (Muthiah, & Lee, 2022; Skrypnik, 2015). The warm-up activity section comprised 10 minutes of a combination of stretches, side steps, static walks, jogging in place, and arm swings. The primary workout was an aerobic strength exercises that included jumping jacks, high knees, planks, crunches, walking lunges, lunges, squats, sit-ups, and push-ups for forty minutes. The cool down workout included 10 minutes of brisk walking, dynamic stretching, deep and relaxing breathing. The control group did not follow the exercise routine. The exercise program took place between March to May 2023, for 08 weeks.

2.5. Statistical Analysis

The collected data was entered into data sheet of SPSS software for analysis. Descriptive statistics mean and standard deviation were used for anthropometry variable height and weight ratio, physical fitness, and health variables for analysis. The means of the pre-and post-tests for the experimental and control groups are compared in order to illustrate the results. They were conducted by using the independent t-test and the paired sample t-test to evaluate the effects of aerobic strength training as intervention. The statistical package of social sciences (SPSS) was used. Significant level of all variables is ($p < 0.05$).

3. Results

Table 2 gives the mean (±standard deviations) for the pre and post data test for experimental and control data tests of the groups for each of the nine tests. One of the main contributors to obesity and chronic illnesses like CVDs is a lack of physical activity. Present study's results are quite positive and show how aerobic strength training may help sedentary female students lose weight and improve their physical fitness. Present study results shows that in skinfold measurements supraspinal 0.05*, biceps 0.05*, iliac crest 0.01*, abdominal 0.04* was significantly difference in experimental group as compared to control group. It was also observed that there was a significant difference in the arm girth 0.04*, forearm girth 0.04*, wrist 0.04*, chest 0.05*, waist 0.00*, hip 0.04*, thigh 0.00*, and calf girth 0.01* after eight weeks of AST training. Breadth measurements result shows that hip breadth 0.00* and chest breadth 0.04* significantly different in post data after eight weeks of aerobic strength training. Body mass of female 0.05* were significantly loss in experimental group after 8 weeks of aerobic strength training as compared to control group. Table 2 presents more detailed results of the covariance analysis (Table 2).

Table 2: Test results from the experimental and control groups both before and after the intervention

	Pre- Data				Post- Data					
	Experimental		Control		Experimental		Control			
Variables	Mean	SD	Mean	SD	Mean	SD	Mean	SD	F	Sig
Harvard step test(min)	151.53	13.1	132.27	10.34	113.2	8.35	127.8	10.51	0.39	0.538
Standing broad jump(cm)	100.07	17.31	100.2	14.72	111.73	16.43	101.13	13.9	0.847	0.365
Flexibility(cm)	25.07	2.91	24.67	3.68	31.73	3.65	25.53	3.66	6.792	0.015*
Agility(sec)	23.73	3.55	17.9	2.81	17.88	1.62	17.35	2.31	11.937	0.002*
30m Shuttle run test(sec)	13.32	1.87	10.1	1.45	10.6	1.43	9.83	1.46	12.612	0.001*
Skipping(m)	81	14.65	69.8	17.57	93.2	13.25	73.53	19.03	6.793	0.014*
Sit ups(m)	15.67	1.88	17.33	2.35	22.27	2.02	18.73	2.02	1.571	0.22
left hand grip strength(kg)	23.73	2.78	22.89	2.62	26.42	2.71	23.45	4.7	4.163	0.051*
Right hand grip strength	23.94	4.81	27.36	3.72	29.4	2.91	27.9	3.67	0.492	0.343

* Significant at 0.05 level

After considering each group's mean values for body mass and physical fitness, the analysis of results revealed a statistically significant difference between the experimental and control groups. In Table 2, When controlling for differences between pre-

and post-tests, the findings show that aerobic strength training (AST) had a significant group impact on the physical fitness and weight reduction of female university students. The results showed a significant group effect on agility (p=0.00), flexibility (p=0.01), skipping (p=0.01), and LHGS (p=0.05), 30m Shuttle run test (SRT) (p=0.00) and experimental group was more capable of helping female university students lose weight than the control group in post-data. Additionally, in Table 2 of the study data, the sit-ups test, RHGS, HST, SBJ test showed no significant difference after eight weeks of AST program. Physical fitness results showed that Harvard step test was used to measure aerobic capacity. SBJ was significantly enhanced after eight weeks of training. A study outcome (Görner & Reineke, 2020) supported by current research. The current study was in line with the research done by (Dieli *et al.*, 2018) AST has significant effects on flexibility. Eight weeks of AST had significantly enhanced LHGS (Sung *et al.*, 2022). The findings of the previous study (Nayasista *et al*., 2022) are supported by the results of the current investigation. Results from the control group's pre- and post-tests showed no significant changes in these variables (Table 2).

4. Discussion

The purpose of the study was to examine the effects of aerobic strength training (AST) on physical fitness and weight loss of female university students. According to the authors' knowledge, this is the first study to look at how aerobic strength training affects weight loss and physical fitness levels among sedentary female students who are still quite young. The key findings of this study revealed that an 8-week AST program significantly increased the physical fitness of female university students and also helped them lose weight. These results corroborate the hypothesis that aerobic strength training induces both anthropometrics and physical fitness improvements. After 8 weeks of the AST program, a larger effect size of the change in weight reduction was seen for the experimental group only. However, the AST program had a significantly greater relationship with anthropometric measurements at the completion of the intervention.

The anthropometric measurements were lesser in the experimental group than in the control group after 8 weeks of AST program. The present study supports the findings of the previous study of *Miller et al*., (2018) where the authors noticed improvements in physical fitness and lean mass following a 6- or 4-week aerobic exercise intervention phase. Thus, the players therefore have superior health than the average person. Another previous study (Sigal *et al*., 2014) finds the significantly decrease fat percentage in experimental group. Our results also confirms that through regular cardiovascular activity, AST burns calories and lowers total body fat. Biceps, iliac crest, abdominal fat were lesser in the experimental group as compare to the control group. The fat percentage was significantly decreased after 8 weeks of AST. Current study supports the findings of (Burich *et al*., 2015) that similar results in reduced the fat ratio in previous study. These findings indicate that both forms of training are efficient. Strength and aerobic exercise combined has a greater impact on weight reduction and enhances body composition (Mosher *et al.,* 1994). However, aerobic activities put a greater emphasis on increasing cardiovascular fitness and calorie burning. They are not expressly meant to target muscle building or strength in the same way that resistance training (RT) is, despite the fact that they can assist reduce total body fat (Miller *et al*., 2018; Khammassi *et al.*, 2018).

It is evident that aerobic exercise can increase calorie expenditure overall and aid in the loss of body fat (Said *et al.,* 2017). Over time, this may cause girth measures to decline, especially in places where you are prone to storing extra fat. Strength training (ST) can help enhance muscle tone and definition in the desired regions even while it doesn't directly target fat loss. ST will help you gain muscle, which can make you seem more sculpted and perhaps change your girth measures (Sporer & Wenger, 2003). In our study, participants who engaged in AST reduced their body fat. However, we have to note that as you reduce your body fat, measures of your waist, hips, and thighs may also decrease which also supports the findings of Sulistyoningrum and colleague, (2017). Additionally, this study assessed the effectiveness of including a variety of aerobic workouts and ST into your daily routine to assist fat reduction, muscular growth, and general fitness. More research is therefore required to evaluate the significance of physical fitness as a result of AST and how it influences weight reduction.

Physical fitness was higher in experimental group after eight weeks of AST (Righi *et al*., 2022). The conducted research was similar effects on physical fitness of aerobic strength training as previously mentions (Görner & Reineke, 2020). In the present study we indicate that AST improves flexibility, agility, skipping, 30m SRT, muscular strength in LHGS, and with a mean impact that is both statistically significant and practically applicable. While there was no significant difference between the groups in the impact of AST on SBJ, RHGS, sit-ups, or HSJ over the pre- to post-intervention period, this result is likely the consequence of a lack of research using AST that focused on inactive individuals (Table 3). Taken together, the results of the current study lend support to previous studies (Kim & O'sullivan, 2013; Rodrigues *et al.*, 2019), which found that combining AT and ST can increase muscle strength, especially among individuals who have been sedentary. Lifting weights or applying resistance to your muscles during strength training works them out. This results in stronger muscles and muscular adaptations over time (Görner & Reineke, 2020). Strength increases and improved total physical capability might result from combining the two forms of training. However, The conducted research supports the findings of previous study (Dieli-Conwright *et al.*, 2018) that, AT and ST can help with better movement control and general body coordination, which can enhance flexibility,30-m shuttle run test and agility. The results of this study demonstrated that the null hypothesis was rejected because aerobic strength significantly influences female weight loss. From this vantage point, AST might be suggested as a powerful method of fitness to support the weight loss of inactive obese people. Considering the risks associated with a sedentary lifestyle, aerobic strength training appears essential for maintaining physical fitness and good health. It lowers the risk of cardiovascular disease, improves physical fitness, strengthens the heart, and joints, and aids in preventing obesity.

5. Conclusion

In this study, it was determined that aerobic strength training can be beneficial for people whose main goals are weight loss or changes in body composition. It was concluded that aerobic capacity significantly increased with both aerobic exercises alone and when paired with strength training that partially replaced the aerobic exercise. By incorporating aerobic strength training into their regular exercise routine, not just obese females but also young people can improve their physical fitness, lose weight, and improve their overall health and well-being. Future researcher's further grasp the impact of aerobic strength training on physical fitness and weight reduction in university females and create more effective programs to encourage healthy lifestyle habits by filling up these research gaps.

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