THE UNIVERSITY OF LAHORE

IJPESS International Journal of Physical Education and Sports Sciences

Research Article

Volume 8, Issue 2, Jul-Dec 2024

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

Junaid Riaz[1], Kai Ma[1*], Nabila Sharif[2], Nerges Batool[2]

[1]Department of Sports, China University of Geoscience Beijing, China
[2]Department of Physical Education, The Islamia University of Bahawalpur, Pakistan

*Corresponding Author's Email: makai@cugb.edu.cn

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 in 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 = 25.45; 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 analysed by applying descriptive, paired sample t-test, and independent t-test. Only a significant improvement for Left Hand Grip Strength (LHGS) (p = 0.05), agility (p = 0.00), flexibility (p = 0.01), skipping (p = 0.01), 30-m Shuttle Run Test (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 fitness, cardio respiratory exercise, Obesity, Slenderize*

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 (Reddy, 2012). 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 (Görner & Reineke, 2020). By reducing obesity and strengthening bones, joints, and the heart, it lowers the risk of cardiovascular disease (Hiruntrakul et al., 2011). 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).

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

DOI: https://doi.org/10.51846/the-sky.v8i2.3881 Received: 03-07-2024; Revised: 20-08-2024; Accepted: 02-09-2024

THE SKY-International Journal of Physical Education and Sports Sciences (IJPESS) (uol.edu.pk)

Published by: Department of Sports Sciences and Physical Education, Faculty of Allied Health Sciences, The University of Lahore, Pakistan.

© 2024 The Author(s)

weight loss. Sloan et al. (2021) investigated the effects of aerobic exercise on young, sedentary individuals with cardiac reactivity to and retrieval from psychosocial and orthostatic stresses, finding that conditioning improved aerobic capacity while deconditioning lowered it, with 47 participants randomized into three groups: control, resistance exercise, or combined exercise (aerobic and resistance exercise).

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 (Kennedy, 1953). He theorized that fat may generate a signal that is detected by the brain and compares with a goal amount of body fatness. 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. 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. 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.

MATERIALS & METHODS

This is an 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. The participants of the study were randomly divided into two groups. Subjects were assigned to an aerobic strength training group (AST) (N = 15, age 25.45 ± 30.58 years, height 162.99 ± 7.68 cm, body mass 69.61 ± 5.03 kg) and a control group (N = 15, age 26.20 ± 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 Islamia University of Bahawalpur gave approval to this study (under project 833/PESS, March 2023).

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 tests. Physical fitness tests were taken as aerobic capacity, muscular power, flexibility, agility, 30-meter sprint, skipping rope, sit up.

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. 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., 2021).

- 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 (Cook et al., 2021). 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.

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 & VS, 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 (French 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).

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, (r) is repetition, while (s) is time in seconds.

Table 1. Aerobic strength training program of the experimental group, respectively.

S. 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 (Sporer & Wenger, 2003; Sung, Son, Baek, & Kim, 2022). 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.

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 ($p < 0.05$).

RESULTS

Table 2 gives the mean (±standard deviations) for the 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 cardio vascular diseases are due to the 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 experimental group 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 before and after the intervention among study participants.

	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

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. A previous study outcome (Görner & Reineke, 2020) supported by current research. Physical fitness results showed that Harvard step test was used to measure aerobic capacity. SBJ was significantly enhanced after eight weeks of training. The current study was in line with the research done by previous researcher that AST has significant effects on flexibility (Dieli-Conwright et al., 2018). Eight weeks of AST had significantly enhanced LHGS (Sung et al., 2022). The findings of the previous studies (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).

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 compared to the control group. The fat percentage was significantly decreased after 8-weeks of AST.

Current study supports the findings that similar results reduced the fat ratio in previous study (Burich et al., 2015). 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 (Khammassi et al., 2018; Miller 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 previous study outcomes (Luglio et al., 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.

Previous study examined that the 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 2). Taken together, the results of the current study lend support to previous studies (Kim & O'sullivan, 2013; Rodrigues et al., 2021), 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 (Muthiah & Lee, 2022).

Strength increases and improves total physical capability might result from combining the two forms of training. However, The conducted research supports the findings of previous studies of (Cohen et al., 2010; Dieli-Conwright et al., 2018) that, AT and ST can help with better movement control and general body coordination, which can enhance flexibility,30m 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.

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.

DECLARATION

Authors' Contribution Statement: Junaid Riaz contributed to the study's conceptualization and methodology design. Kai Ma led the project's overall coordination, including resources, data analysis, and the final manuscript's preparation. Nabila Sharif was responsible for data collection and formal analysis. Nerges Batool contributed to software development, validation, and visualization efforts. All authors have read and approved the final manuscript, ensuring its integrity and accuracy.

Ethical statement: This research adheres to the ethical guidelines established by the Committee on Publication Ethics (COPE). All procedures and methodologies used in this study comply with COPE standards, ensuring transparency, integrity, and respect for all participants involved.

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

Burich, R., Teljigović, S., Boyle, E., & Sjøgaard, G. (2015). Aerobic training alone or combined with strength training affects fitness in elderly: randomized trial. *European Journal of Sport Science, 15*(8), 773-783.

Cohen, D., Voss, C., Taylor, M., Stasinopoulos, D., Delextrat, A., & Sandercock, G. (2010). Handgrip strength in English schoolchildren. *Acta Paediatrica, 99*(7), 1065-1072.

Cook, J. G., Kelly, A. P., Cook, R. C., Culling, B., Culling, D., McLaren, A., Watters, M. (2021). Seasonal patterns in nutritional condition of caribou (Rangifer tarandus) in the southern Northwest Territories and northeastern British Columbia, Canada. *Canadian Journal of Zoology, 99*(10), 845-858.

Dieli-Conwright, C. M., Courneya, K. S., Demark-Wahnefried, W., Sami, N., Lee, K., Sweeney, F. C., Tripathy, D. (2018). Aerobic and resistance exercise improves physical fitness, bone health, and quality of life in overweight and obese breast cancer survivors: a randomized controlled trial. *Breast Cancer Research, 20*, 1-10.

Fam, B. C., Morris, M., Hansen, M., Kebede, M., Andrikopoulos, S., Proietto, J., & Thorburn, A. (2007). Modulation of central leptin sensitivity and energy balance in a rat model of diet-induced obesity. *Diabetes, Obesity and Metabolism, 9*(6), 840-852.

French, G., Grayson, C., Sanders, L., Williams, T., & Ward, M. (2016). A comparative analysis of the traditional sit-and-reach test and the RS Smith sit-and-reach design. *The Corinthian, 17*(1), 5.

Garber, C., Blissmer, B., Deschenes, R., Franklin, A., Lamonte, J., Lee, I.-M., Swain, D. P. (2011). Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: guidance for prescribing exercise. *American College of Sports Medicine: ACSM.*

Görner, K., & Reineke, A. (2020). The influence of endurance and strength training on body composition and physical fitness in female students. *Journal of Physical Education and Sport, 20*, 2013-2020.

Hiruntrakul, A., Nanagara, R., Emasithi, A., & Borer, K. T. (2011). Effect of once a week endurance exercise on fitness status in sedentary subjects. *Journal of the Medical Association of Thailand, 93*(9), 1070.

Hunter, G. R., Byrne, N. M., Sirikul, B., Fernández, J. R., Zuckerman, P. A., Darnell, B. E., & Gower, B. A. (2008). Resistance training conserves fat-free mass and resting energy expenditure following weight loss. *Obesity, 16*(5), 1045-1051.

Ibikunle, O., & VS, U. (2016). Cardiorespiratory responses of professional male volleyball and basketball players to Harvard step test. *Journal of Sports and Physical Education, 3*, 54-61.

Kennedy, C. (1953). The role of depot fat in the hypothalamic control of food intake in the rat. *Proceedings of the Royal Society of London. Series B-Biological Sciences, 140*(901), 578-592.

Khammassi, M., Ouerghi, N., Hadj-Taieb, S., Feki, M., Thivel, D., & Bouassida, A. (2018). Impact of a 12-week high-intensity interval training without caloric restriction on body composition and lipid profile in sedentary healthy overweight/obese youth. *Journal of Exercise Rehabilitation, 14*(1), 118.

Kim, I., Lee, H., Hong, S., Jo, S., Won, Y. & Jeon, J. (2018). Six weeks of combined aerobic and resistance exercise using outdoor exercise machines improves fitness, insulin resistance, and chemerin in the Korean elderly: A pilot randomized controlled trial. *Archives of Gerontology and Geriatrics, 75*, 59-64.

Kim, J., Lee, J., So, B., Son, S., Yoon, D., & Song, W. (2016).

Effect of aerobic training and resistance training on circulating irisin level and their association with change of body composition in overweight/obese adults: a pilot study. *Physiological Research, 65*(2), 271.

Kim, S. B., & O'sullivan, D. M. (2013). Effects of aqua aerobic therapy exercise for older adults on muscular strength, agility and balance to prevent falling during gait. *Journal of Physical Therapy Science, 25*(8), 923-927.

Koch, J., O'bryant, S., Stone, E., Sanborn, K., Proulx, C., Hruby, J., Stone, M. H. (2003). Effect of warm-up on the standing broad jump in trained and untrained men and women. *The Journal of Strength & Conditioning Research, 17*(4), 710-714.

Koley, S. (2011). A study of anthropometric profile of Indian inter-university male cricketers. *Journal of Human Sport and Exercise, 6*(2), 427-435.

Kolic, J., O'Brien, K., Bowles, K. A., Iles, R., & Williams, C. M. (2020). Understanding the impact of age, gender, height and body mass index on children's balance. *Acta Paediatrica, 109*(1), 175-182.

Lucotti, P., Monti, L. D., Setola, E., Galluccio, E., Gatti, R., Bosi, E., & Piatti, P. (2011). Aerobic and resistance training effects compared to aerobic training alone in obese type 2 diabetic patients on diet treatment. *Diabetes Research and Clinical Practice, 94*(3), 395-403.

Luglio, F., Sulistyoningrum, C., Apriliana, L., Putri, E., Larasati, A., Tsani, A. F. A.,. Huriyati, E. (2017). The effect of combined aerobic and strength training on a weight loss and metabolic profile: Development of an effective lifestyle-based weight loss program. *Topics in Clinical Nutrition, 32*(2), 152-160.

Miller, T., Mull, S., Aragon, A. A., Krieger, J., & Schoenfeld, B. J. (2018). Resistance training combined with diet decreases body fat while preserving lean mass independent of resting metabolic rate: a randomized trial. *International Journal of Sport Nutrition and Exercise Metabolism, 28*(1), 46-54.

Mosher, E., Underwood, S. A., Ferguson, M. A., & Arnold, R. O. (1994). Effects of 12 Weeks of Aerobic Circuit Training on Aerobic Capacity, Muscular Strength, and Body. *Journal of Strength and Conditioning Research, 8*(3), 144-148.

Muhammad, L., Pahdarina, D., Zahara, N. P., Nugraheni, F., Hanny, T. A., Ermamilia, A., & Huriyati, E. (2021). Diet or exercise: The role of diet and/or exercise on changes of pro-inflammatory markers during a weight loss program in adult women with overweight. *Clinical Nutrition ESPEN, 44*, 337-341.

Muthiah, A., & Lee, Y.-C. (2022). Comparative analysis of male cyclist population in four Asia countries for anthropometric measurements. *International Journal of Environmental Research and Public Health, 19*(16), 10078.

Nayasista, H., Tinduh, D., Pawana, A., Wulan, M., Utomo, N., & Soenarnatalina, M. (2022). Effect of combined locomotor training and aerobic exercise on increasing handgrip strength in elderly with locomotive syndrome: A randomised controlled trial. *Annals of Medicine and Surgery, 78*, 103800.

Reddy, M. (2012). Comparison of circuit training methods on performance variables of sc/st non-sc/st boys. *International Journal of Multidisciplinary Research, 2*(4), 2231-5780.

Righi, A., Schuch, B., Tolves, T., De Nardi, T., Righi, N. C., Signori, U., & da Silva, V. (2022). Combined aerobic and strength training for fitness outcomes in heart failure: meta-analysis and meta-regression. *Disability and Rehabilitation, 44*(16), 4149-4160.

Rodrigues, A., Santos, C., Medeiros, H., Gonçalves, C., & Júnior, C. R. (2021). Effects of different periodization strategies of combined aerobic and strength training on heart rate variability in older women. *The Journal of Strength & Conditioning Research, 35*(7), 2033-2039.

Said, M., Lamya, N., Olfa, N., & Hamda, M. (2017). Effects of high-impact aerobics vs. low-impact aerobics and strength training in overweight and obese women. *Journal of Sports Medicine & Physical Fitness, 57*(3), 278-288.

Sigal, R. J., Alberga, A. S., Goldfield, G. S., Prud'homme, D., Hadjiyannakis, S., Gougeon, R., Doucette, S. (2014). Effects of aerobic training, resistance training, or both on percentage body fat and cardiometabolic risk markers in obese adolescents: the healthy eating aerobic and resistance training in youth randomized clinical trial. *JAMA Pediatrics, 168*(11), 1006-1014.

Skrypnik, D., Bogdański, P., Mądry, E., Karolkiewicz, J., Ratajczak, M., Kryściak, J., Walkowiak, J. (2015). Effects of endurance and endurance strength training on body composition and physical capacity in women with abdominal obesity. *Obesity Facts, 8*(3), 175-187.

Sloan, P., Shapiro, Lauriola, V., McIntyre, K., Pavlicova, M., Choi, C., Scodes, J. M. (2021). The impact of aerobic training on cardiovascular reactivity to and recovery from psychological and orthostatic challenge. *Psychosomatic Medicine, 83*(2), 125-137.

Sousa, M., Brás-Silva, C., & Leite-Moreira, A. (2009). The role of leptin in the regulation of energy balance. *Acta Medica Portuguesa, 22*(3), 291-298.

Sporer, B., & Wenger, H. (2003). Effects of aerobic exercise on strength performance following various periods of recovery. *The Journal of Strength & Conditioning Research, 17*(4), 638-644.

Sung, H., Son, R., Baek, H., & Kim, B.-J. (2022). The association of aerobic, resistance, and combined exercises with the handgrip strength of middle-aged and elderly Korean adults: a nationwide cross-sectional study. *BMC Geriatrics, 22*(1), 676.

Tse, C., Fong, Wong T., & Masters, R. (2017). Analogy motor learning by young children: a study of rope skipping. *European Journal of Sport Science, 17*(2), 152-159.

Cite this paper as:

Riaz, J., Ma, K., Sharif, N., & Batool, N. (2024). Effects of Aerobic Strength Training on Physical Fitness and Weight Loss of Female University Students. *THE SKY-International Journal of Physical Education and Sports Sciences*, 8(2), 63-71