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EFFECTIVE PLANNING AND IMPLEMENTATION OF PHYSICAL ACTIVITY PROGRAMS FOR UNIVERSITY STUDENTS

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ABSTRACT

As universities strive to support the holistic development of their students, there is a growing emphasis on implementing comprehensive physical activity programs to promote a healthy body and enhance the student experience. Many universities' physical activity programs may lack accessibility for students from diverse backgrounds, including those with financial constraints or scheduling conflicts. Limited access to facilities, equipment, transportation, and programming may prevent specific student populations from fully participating in physical activity opportunities, exacerbating disparities in health outcomes. This study aims to promote engagement in physical activity by planning and designing a standard physical activity program according to exercise principles. The main objective was to improve fitness, including the standard, which provides guidelines for planning, implementing, and evaluating physical activity programs to ensure their quality and effectiveness. By incorporating evidence-based practices, program evaluation mechanisms, and ongoing quality improvement efforts, universities can enhance the impact and sustainability of their wellness initiatives. Develop an extensive program offering a range of physical activities designed to cater to university students' diverse needs and preferences. The exercise principles serve as the primary guide in planning the program. In the early phase, three experts were appointed to assess the physical activity program. The second phase involved selecting students according to the criteria and pre-test; the third phase consisted of conducting the exercise program; the fourth phase was the post-test. The findings showed that exercise programs improved their physical fitness. Planning and implementing a standardized, evidence-based physical activity program has significant potential to enhance university students' health and overall quality of life. By adopting a systematic approach that emphasizes program evaluation, inclusivity, and student engagement, universities can effectively promote physical activity and address disparities in access. This approach supports the sustainability and quality of wellness initiatives, fostering healthier campus environments that accommodate the diverse needs and preferences of the student population.

Keywords: **Physical activity program, aerobic exercise, resistance exercise, fitness, university students.**

INTRODUCTION

Physical activity programs explicitly tailored for university students play a pivotal role in addressing various aspects of wellness, especially regarding physical health and fitness. These programs aim to empower students to lead healthier lifestyles, manage stress effectively, and achieve their full potential by providing opportunities for regular exercise, recreational activities, and health promotion initiatives. Extensive research has demonstrated a robust association between active physical involvement and enhanced health prospects, as engagement in activities encompassing physical movements can seamlessly integrate bodily functions and operate proficiently to mitigate the risks of contracting diverse ailments. The active and consistent practice of physical activities benefits the human body by reinforcing bodily strength and well-being, rectifying postural issues, and facilitating harmonious physical development (Macovei et al., 2014; Madruga-Parera et al., 2022).

University exercise programs have been identified as particularly influential in predisposing individuals to lifelong enjoyment of physical activity, effectively setting the groundwork for healthier lifestyles (García et al., 2002). Numerous studies have found that physically inactive university students exhibit low levels of physical fitness, experience psychological distress, and report a poorer quality of life compared to their physically active peers (Saffari et al., 2022; Santana et al., 2023; Wei & Ma, 2022). However, a concerning lack of consciousness persists around the benefits of physical activity, underscoring the critical need for more robust health promotion strategies to encourage greater engagement. Planning and developing effective programs to enhance physical activity participation on university campuses is crucial, as the transition to university often coincides with increased sedentary behaviors and poorer health practices.

Recognizing the importance of establishing clear standards and guidelines for physical activity programs on university campuses, this study outlines fundamental principles and recommendations for planning, developing and implementing physical activity programs for wellness among university students. These standards serve as a framework for universities to design, evaluate, and enhance their physical activity offerings, ensuring that they meet diverse student populations' needs and preferences. By adopting these standards, universities can create environments prioritizing student health and well-being, foster a culture of physical activity and wellness, and ultimately contribute to their students' overall success and flourishing. By investing in physical activity programs that align with these standards, universities can play a vital role in shaping their student communities' future health and happiness.

PROBLEM STATEMENT

Many universities' physical activity programs may lack accessibility for students from diverse backgrounds, including those with disabilities, financial constraints, or scheduling conflicts. Besides, insufficient financial resources allocated for physical activity programs can limit the development and maintenance of facilities, equipment, and personnel required for effective programs. Limited access to facilities, equipment, transportation, and programming may prevent certain student populations from fully participating in physical activity opportunities, exacerbating disparities in wellness outcomes. Physical activity can be participated in if the design program is suitable for performing at any place and follows the standard guidelines of a physical activity program.

As a concern, overweight and obesity are growing public health problems in many developing countries, and Malaysia is no exception (Chan et al., 2017; Chong et al., 2023). Based on National Health and Morbidity Surveys (N.H.M.S.s) 2019, Malaysian people stated that 30.4% of adults were overweight and 19.7% obese, while 52.6% were abdominally obese. According to the statistical N.H.M.S.s (2017), the percentage of physical activity practice was the average level among Malaysian people. Many previous studies studied the cause of health problems by inactive physical activity (Alkhatib & Tuomilehto, 2019; Mainous III et al., 2019; Moulin et al., 2019). The WHO (2020) recommended an average of 60 to 150 minutes participation in physical activity for children, adolescents, and older adults. Besides, this exercise can also reduce fat mass or percentage of body fat, which is good for overcoming obesity (Chiu et al., 2017; Monteiro et al., 2015). Therefore, to overcome this problem, a standard physical activity program must be introduced so university students can practice a healthy lifestyle.

Other challenges include poor coordination between administrative departments and agencies, leading to fragmented efforts and inefficiencies in promoting physical activity across education, healthcare, and community development sectors. This study introduced standard guidelines for physical activity programs designed for university students. These guidelines provide a framework for developing and accessing physical activity initiatives, ensuring they address students' diverse needs and preferences while enhancing their overall health and well-being. To reduce health issues, a standard physical activity program was developed to encourage university students to engage in simple exercises that impact their health positively.

Study Objectives

This study aimed to promote engagement in physical activity by planning and designing a standard physical activity program according to exercise principles. The standard provides guidelines for designing, implementing, and evaluating physical activity programs to ensure their quality and effectiveness.

LITERATURE REVIEW

Exercise Principles: F.I.T.T. Principles

Several key principles must be included in planning and developing a structured exercise training program. The F.I.T.T. principles guide in designing an effective training regimen to enhance physical fitness and health. While numerous exercise principles exist, the current study focused on four primary ones (ACSM, 2019). These principles include frequency (how often), intensity (how hard), time (duration), and type (mode). Additional principles assisted in exercise variation and progression. According to ACSM (2019) guidelines, the F.I.T.T. principles are grounded in physical activity's physiological, psychological, cognitive, and health benefits. Exercise is a physical activity that involves several key components, including warm-up, conditioning (specificity of training), cool-down, and stretching. The warm-up phase, which lasts 5 to 10 minutes, prepares the body physically and mentally by meeting physiological, biochemical, and energy demands and setting the stage for tough exercises. Flexibility, or stretching included in the warm-up, improves the range of motion and reduces the risk of injury (Lim, 2018). A study by Paz et al. (2017) found that warming up before exercise makes muscles more elastic and extensible, enhancing movement range. This readiness is crucial for the subsequent conditioning phase, which involves more challenging exercises.

The second phase is conditioning, which consists of aerobics, resistance, flexibility, and any related sports activities; this phase lasts between 20 and 60 minutes per session. Researchers agreed that the provision of timeless and equal 1 hour is sufficient for physiological, psychological and cognitive function and health effects (Bernstein & McNally, 2017; Samuel et al., 2017; Sigal et al., 2018). The training program must be designed per the principles and objectives to achieve the benefits of the exercise. A well-designed exercise training program, especially in the conditioning phase, is crucial for implementing all activities that may affect the program's result. After the conditioning phase is a cool-down session, the advantages are decreased heart rate, blood pressure, and delayed muscle fatigue (Van Hooren & Peake, 2018). The session consists of either light or moderate-intensity aerobic and muscular endurance activity between 5-10 minutes. The stretching phase is specifically for muscles and tendons flexed or stretched to reduce muscular tension and enhance muscular relaxation. This phase closes the exercise training program after participating in various activities. Cooling down sessions allows the body to recover and rest after an extensive muscular contraction. The components of exercise training are very important in achieving the exercise's objective. Therefore, the F.I.T.T. principles have been identified and planned to set the exercise training objectives.

Frequency (F). The F-frequency refers to the number of weekly training sessions contributing to health and fitness. Aerobic exercise is recommended 3 to 5 days per week at varying intensities. Imamoglu et al. (2017) found that a 12-week aerobic exercise intervention, conducted 3 to 5 days per week, significantly reduced blood pressure. Other studies prove aerobic exercise enhances cognitive functions such as attention and memory in both students and the elderly (de Greeff et al., 2018; Kamijo et al., 2019; Tyndall et al., 2018). Different types of aerobic exercise, like jogging and cycling, vary in intensity and stress on the body. Manipulating the frequency of activity on alternate days allows for physiological adaptation. Even sedentary individuals who engage in moderate-intensity aerobic exercise once or twice weekly for 30 minutes can improve physical fitness (Zuniga et al., 2019).

Resistance exercise also benefits physical health and cognitive performance. It focuses on muscular strength and power, targeting the chest, shoulders, back, abdomen, hips, and legs. The recommended frequency for resistance exercise is 2 to 3 days per week, training different muscle groups daily (ACSM, 2019). A study by Katsura et al. (2019) found that resistance exercise on non-consecutive days significantly increased upper and lower body strength and power. Professional athletes often train specific muscle groups according to their sport's demands, such as soccer players focusing on the lower body (Hammami et al., 2019; Zghal et al., 2019), and handball, softball, basketball, and volleyball players focusing more on the upper body (Aloui et al., 2019; Oranchuk et al., 2020). In this study, exercise training programs were designed with the right frequency and other principles to achieve training goals. The frequency helps regulate body systems, improving physical fitness and cognitive functions.

Intensity (I). The next principle, Intensity, pertains to the difficulty level of the exercise, reflecting the force and energy required for the movements. Niven et al. (2018) categorize exercise intensity as low, moderate, or high, each affecting physiological changes in muscles and energy production (Olney et al., 2018). Aerobic exercise intensity is commonly assessed using heart rate and maximal oxygen uptake. Le Meur et al. (2017) used these metrics, while other studies employed the Rating of Perceived Exertion (RPE) scales (Arney et al., 2019). The Karvonen method, or Heart Rate Reserve (HRR), is another tool for calculating exercise heart rate zones (Adiguzel et al., 2019).

Contrastingly, determining resistance exercise intensity involves adjusting repetitions and sets. One repetition maximum (1RM) measures the maximum weight lifted in a single effort and is typically used by athletes (Ignjatovic et al., 2019). For sedentary individuals, standard repetition counts are used. ACSM (2019) guidelines recommend 8 to 12 repetitions per set for muscular strength and 10 to 15 for muscular endurance, with 1 or 2 sets per muscle group. Repetitions and sets are also adjusted for progression. Campos et al. (2002) found that high repetition ranges significantly improved muscular adaptation compared to lower ranges. Similarly, Jenkins et al. (2017) reported that high repetitions effectively increased muscle mass, strength, and power. For beginners or sedentary individuals, performing one set of 10 to 12 repetitions is still beneficial for stimulating muscle adaptation. Determining exercise intensity is crucial for achieving optimal benefits. This study designed exercise programs with appropriate intensity and other principles to meet training objectives.

Time (T). The T-time principle pertains to the exercise duration per session, day, or week. According to ACSM (2019) guidelines, 20 to 60 minutes of moderate-intensity exercise per session is recommended, though even less than 20 minutes can benefit health, particularly for sedentary individuals. Adolescents are advised to engage in 20 to 30 minutes of aerobic exercise per session, emphasizing variety and enjoyment. Research shows that 30 minutes of exercise can enhance mood, memory, hormone levels, and overall physical health (Bartholomew et al., 2005; Pierce et al., 2018; Schubert et al., 2014). Regular physical activity supports a healthy lifestyle across all ages.

Exercise duration should be tailored to the specific goals and population, such as sedentary individuals, athletes, or recreational exercisers. For beginners, starting with 20 to 30 minutes and gradually increasing the duration is effective. Etnier et al. (2016) found that 20-30 minutes of exercise helps sedentary individuals adapt physically and mentally. Typically, a 60-minute session includes a 5 to 10-minute warm-up, 20 to 40-minute main activity and a 5 to 10-minute cool-down. Exceeding 60 minutes may lead to injury and fatigue (ACSM, 2019). Studies suggest that exercise durations under 60 minutes provide optimal physiological responses (Chen et al., 2014; Chiu et al., 2017). Therefore, adjusting exercise duration based on specific objectives is crucial for effective adaptation and injury prevention.

Type (T). The T-type principle refers to the mode of exercise training that should be tailored per factors such as age, fitness level, and any medication. Birrer (2023) emphasizes the importance of designing exercise programs with these criteria in mind to achieve positive outcomes. Game-based activities are particularly effective for adolescents (ages 10-19) as they promote engagement and enjoyment. Pennington (2019) found that students enjoyed and looked forward to game-based activities. Schools are advised to minimize instructional time, highlight health benefits, and choose sports that involve more movement.

For adults and the elderly, exercise is typically aimed at improving health and reducing the risk of non-communicable diseases. Aerobic exercises such as fartlek, interval training, running, swimming, and cycling enhance cardiovascular endurance and lower heart disease risk (McMahon et al., 2017; Wang & Zhang, 2017). Resistance exercises, including weight machines, free weights, bodyweight exercises, and resistance bands, build muscle mass, strength, and power. Balance and stability exercises are crucial for the elderly to prevent falls and injuries (Stanghelle et al., 2018). Adolescents can benefit from a variety of resistance exercises depending on their goals.

Choosing the right type of exercise is essential for creating effective training programs that boost health. Incorporating different exercises on non-consecutive days helps prevent boredom and ensures a well-rounded fitness routine. This study utilized the T-type principle to enhance physical fitness and cognitive benefits for university students.

Physical Fitness

Physical fitness comprises five components in health-related fitness: body composition, cardiovascular endurance, muscular endurance, strength, and flexibility. Engaging in physical activity enhances physical fitness and reduces the risk of obesity.

Body Composition - Body Mass Index (BMI). Body composition in physical fitness describes the total body makeup, encompassing fat and non-fat mass proportions, including lean body mass, bone mass, minerals, and water (Akhavan Rad et al., 2019). Healthy body composition reflects lower body fat percentage and higher lean body mass, minerals, water, and bone mass, indicating overall health and fitness (Akhavan Rad et al., 2019). Body fat percentage specifically measures the proportion of fat in body weight and varies even among individuals of the same age, gender, and body weight. Understanding body composition is crucial, especially in students, amidst concerns over rising obesity rates in children and adolescents, which correlate with increased risks of diseases like diabetes, hypertension, and cardiovascular issues (Davidson et al., 2019; Hatani et al., 2020). Various assessment methods, such as BMI and other advanced techniques like DXA and BIA, help evaluate health status by measuring body composition (Awad et al., 2020; Marra et al., 2019).

Obesity is often defined by a BMI of 25 kg/m^2 or higher, making BMI a widely used indicator of health. It calculates body fat based on the ratio of weight to height squared and categorizes individuals into different health levels. Studies have consistently linked BMI to obesity and body fat percentage (Hudda et al., 2018; Schvey et al., 2019). Recognized by the WHO for its simplicity and effectiveness, BMI was chosen in this study to assess body fat percentage and provide detailed health information. This method was selected to effectively investigate the effects of aerobic and resistance exercises on students' body composition.

Cardiovascular Endurance – Three (3) Minute Step Test. Cardiovascular endurance measures how effectively the heart and lungs supply oxygen during prolonged exercise, indicating overall physical fitness (Sindall, 2020). It reflects the ability of the heart, lungs, and muscles to sustain activity over time (Lang et al., 2018). The gold standard for assessing this is measuring maximum oxygen consumption during exhaustive exercise tests, such as treadmill or cycle ergometer tests (Mintjens et al., 2018). The three-minute step test was chosen for this study due to its cost-effectiveness, minimal error potential, suitability for large groups, and high reliability (ICC agreement of 0.845) (Baptista Teixeira et al., 2020). This test assesses how quickly heart rate recovers post-exercise, which is crucial for gauging fitness levels, especially among university students aged 18 to 25.

Therefore, in this study, the researcher selected the three-minute step test to determine the cardiorespiratory endurance based on heart rate return to normal after exercise as the main test due to sustainability and suitability for university students aged between 18 and 25 years. In addition, the maximal oxygen consumption also was calculated.

Muscular Endurance – Plank Test. Muscular endurance is vital during physical activity, allowing muscles to sustain force over time without fatigue (Vaara et al., 2012). Exercises like planks, lunges, squats, burpees, and sit-ups improve muscular endurance by enhancing muscle properties such as contractility and adaptability. The plank test, for instance, involves maintaining a prone position on forearms with elbows aligned under shoulders for as long as possible to assess endurance. This test targets core muscles like the transverse abdominis and obliques, which are crucial for stabilizing the spine and improving posture and balance in university students (Strand et al., 2014). It effectively measures abdominal strength and endurance for sports performance and daily activities.

University students were required to increase abdominal strength and endurance because it is necessary for sports performance and daily living activities, such as gaining stability, improving posture, and enhancing balance. Therefore, the planks test is suitable for assessing students' muscle endurance in the abdominal core.

Muscular Strength

One-Minute Push-Ups Test -Upper Body Strength. Strength in individuals is defined by their ability to exert maximal force during physical activities (Henriksson et al., 2020). Upper body strength is crucial for daily tasks such as pulling, lifting, pushing, and reaching. The push-up test, a common assessment tool included in military fitness tests, measures upper body strength effectively. This study chose a one-minute push-up test to evaluate the endurance of university students' upper body muscles. This exercise engages multiple joints, particularly strengthening muscles such as the anterior shoulder, pectoralis major, deltoid, and triceps (Hassan, 2018). Strengthening these muscles is essential for maintaining posture and performing lifting and pushing activities typical of young adults. The push-up test's biomechanics involve pushing and lowering the body, validating its role in assessing upper body strength (Zalleg et al., 2020).

Half Sit-Ups Test -Abdominal Strength. This study also chose a sit-up test to assess abdominal strength among university students. This test primarily engages muscles such as the rectus abdominis, transverse abdominis, and obliques, supported by hip flexors, chest, and neck muscles (Ricci et al., 1981). The half sit-up test evaluates these muscles' strength and endurance over 1 minute. Muscular endurance and strength often correlate, but individual muscle capability varies. Endurance training benefits these muscles by potentially reducing lower back pain as individuals age (Jackson et al., 1998). The half sit-up differs from a full sit-up in that it focuses more directly on the abdominal muscles and reduces stress on the lower back (McGill, 1998). By keeping the knees flexed at 30°, the half sit-up maximizes abdominal muscle activation while minimizing the involvement of the hip flexors. This test is well-established, reliable, easy to administer, and validly comparative to the full sit-up test (Diener et al., 1995).

Flexibility – Toe Touch. Stretching activities enhance joint range of motion and muscle length. Flexibility exercises, such as yoga, Tai Chi, or static stretching, are commonly practiced by older adults to increase muscle length. Flexibility varies among individuals due to muscle elasticity and joint mobility differences. The toe touch test assesses flexibility in the hamstrings and lower back muscles, which is crucial for identifying potential hip or back issues (Kippers & Parker, 1987). This test involves participants standing on a box and is recommended by orthopedic associations to gauge thoracolumbar vertebral flexion (American Academy of Orthopedic Surgeons Joint Motion, 1966). The toe touch test correlates closely with the sit and reach test, indicating flexibility in the hip and hamstring muscles. Test-retest reliability coefficients for the toe touch test range from .88 to .97 (Kippers & Parker, 1987), making it a well-established measure for assessing flexibility across different ages and genders. The toe touch test is practical for evaluating muscle elasticity and joint range of motion in university students and was selected as part of this study to investigate the impact of Aerobic and Resistance exercises on physical fitness.

METHODOLOGY

This study had three groups: an intervention group that received Aerobic exercise and resistance exercise and a control group that received an educational program regarding physical activity.

Participants

This study employed a randomized controlled trial (RCT) design to evaluate the effects of aerobic and resistance exercise programs on physical fitness among university students. A total of 72 participants between 18 and 24 years old were recruited based on specific inclusion criteria: full-time university enrollment, sedentary lifestyle, and absence of any medical conditions or physical injuries that would limit participation in exercise. Following eligibility screening, participants were randomly assigned to one of three groups: the aerobic exercise group, the resistance exercise group, or the control group, with 24 participants in each group. Randomization was executed using a computer-generated random number table to ensure equal probability of group assignment, thereby reducing selection bias. To maintain allocation concealment, the randomization process was administered by an independent researcher not involved in the intervention delivery or outcome assessments. This procedure was intended to ensure baseline equivalency and internal validity by distributing potential confounding variables evenly across all groups. The sample size of 72 participants was determined through an a priori power analysis, which assumed a medium effect size (f = 0.25), an alpha level of .05, and a statistical power of 0.80, indicating sufficient sensitivity to detect statistically significant differences in post-intervention physical fitness measures among the three groups.

Protocol of Exercise Program

In this study, Aerobic exercises involved cardio circuit drills designed to enhance cardiovascular endurance over a one-hour session. The program aims to achieve three main training objectives: psychomotor, cognitive, and affective, which are aligned with daily physical and health education lesson plans. The psychomotor objective focused on improving participants' skills in activities with training heart rate zones calculated to ensure exercise intensity matches individual fitness levels. Cognitive objectives included understanding and applying the F.I.T.T. principles to tailor exercise programs to specific goals. Lastly, the affective objective aimed to ensure participants enjoyed the exercise program.

The Aerobic exercise sessions began with a 10-minute warm-up and stretching session, including a 5-minute slow jog to prepare the body for vigorous activity. The main session consisted of a 15-minute brisk walk and four drills: static jogging, skipping, interval sprints, and jumping jacks. Each drill (except interval sprints, which included three sets), was performed for 1 minute across three sets. Participants also engaged in a cognitive stimulation exercise by throwing a ball ten times at a target before transitioning between activities. The session concluded with a 10-minute cool-down or stretching session to gradually reduce heart rate and blood pressure while promoting relaxation.

The second intervention group underwent Resistance exercises tailored to adolescents, using body weight and following standard exercise guidelines (ACSM, 2017). The program was structured over eight weeks: Weeks 1 and 2 involved two sets of 8 repetitions (8x2=16), Weeks 3 and 4 included two sets of 10 repetitions (2x10=20), Weeks 5 and 6 progressed to 2 sets of 12 repetitions (2x12=24), and Weeks 7 and 8 used two sets of 15 repetitions (2x15=30), with a 1-minute rest interval between sets. This progressive approach aimed to apply a moderate training load (Fink et al., 2018). Two sets of exercises (Set A and Set B) were alternated weekly, each comprising six exercises targeting the upper body, lower body, and core muscles, ensuring variety and maintaining participant engagement. The resistance exercise sessions lasted 50 minutes, serving as the primary conditioning activity (Harveson et al., 2016). The third group served as the control, continuing their routine throughout the study, and participated in an educational class 3 times per week. Participants join the class to watch a video and an exercise program without any physical activity.

Table 1. *Set A*

No	Muscle Target	Exercises
1	Lower	Squats
2	Upper	Push-ups
3	Lower	Back Lunges
4	Upper	Dips
5	Lower	Hip Bridging
6	Core	Plank

Table 2. *Set B*

No	Muscle Target	Exercises
1	Lower	Side Lunges
2	Upper	Plank rotations
3	Lower	Walking Lunges
4	Upper	Push-up
5	Lower	Single-Leg Deadlifts
6	Core	Crunches

FINDINGS

Demographic characteristics included age, frequency and percentage. According to the Malaysian Youth Policy (2015), the age range between 19 to 24 years old is middle youth. The sample size in this study was 72 participants. Each group of Aerobic, Resistance, and Control had 24 participants. The outcome measures included toe touch, push-ups, sit-ups, plank, and step tests.

Table 3. *Participant's Age Range between 19-24 years old Based on Groups*

Group	Age (years old)	*f*	Percentage (%)
Aerobic	19	20	83.33
	20	3	12.5
	21	1	4.16

Resistance	19	23	95.83
	21	1	4.16
Control	19	21	87.5
	20	2	8.33
	23	1	4.16

Table 4. *Shapiro-Wilk Value for Physical Fitness in Posttest Based on Groups*

	Group	Shapiro-Wilk		
		Statistic	df	Sig.
Toe touch	Aerobic	.917	24	.049
	Resistance	.926	24	.080
	Control	.944	24	.196
Push-up	Aerobic	.943	24	.193
	Resistance	.947	24	.233
	Control	.893	24	.015
Sit-up	Aerobic	.902	24	.023
	Resistance	.927	24	.084
	Control	.942	24	.181
Plank	Aerobic	.935	24	.126
	Resistance	.958	24	.407
	Control	.944	24	.205
Step test	Aerobic	.888	24	.337
	Resistance	.960	24	.447
	Control	.923	24	.068

a. Lilliefors Significance Correction

Table 5. *Levene's Test of Equality of Error Variance for Physical Fitness in Posttest*

	Levene Statistic	df1	df2	Sig.
Toe touch	2.490	2	69	.090
Push up	.114	2	69	.892
Sit up	10.567	2	69	.000
Plank	4.090	2	69	.021
Step test	5.718	2	69	.005

Table 6. *Multivariate Test for Physical Fitness in Posttest*

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Group	Pillai's Trace	.609	5.774	10.000	132.000	.000	.304

A statistically significant difference in physical fitness based on the exercises group, F (10, 132) = 5.77, $p < .0005$; Pillai's Trace = 0.609, partial $\eta^2 = .30$.

Table 7. *Test of Between-Subjects Effects*

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Group	Post-Toe touch	547.750	2	273.875	5.662	.005	.141
	Post-Push up	523.000	2	261.500	1.823	.169	.050
	Post-Sit up	2788.528	2	1394.264	11.554	.000	.251
	Post-Plank	28000.872	2	14000.436	6.745	.000	.164
	Post-Step test	18.066	2	9.033	.337	.715	.010

The exercise group has a statistically significant effect on toe touch using a Bonferroni adjusted alpha level of .01, F (2,69) = 5.66, p = .005, partial eta squared =.14, sit up .01, F (2,69) = 11.55, p = .000, partial eta squared =.25 and plank 01, F (2,69) = 6.75, p = .000, partial eta squared =.164.

Table 8. *Multiple Comparison*

Dependent variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Post-Toe touch	Aerobic	Resistance	1.250	1.926	.889	-3.55	6.05
		Control	6.375*	1.856	.004	1.75	11.00
	Resistance	Aerobic	-1.250	1.926	.889	-6.05	3.55
		Control	5.125	2.222	.075	-.38	10.63
	Control	Aerobic	-6.375*	1.856	.004	-11.00	-1.75
		Resistance	-5.125	2.222	.075	-10.63	.38
Post-Sit-up	Aerobic	Resistance	-9.208	3.745	.054	-18.55	.14
		Control	5.917*	2.254	.038	.26	11.57
	Resistance	Aerobic	9.208	3.745	.054	-.14	18.55
		Control	15.125*	3.326	.000	6.68	23.57

	Control	Aerobic	-5.917*	2.254	.038	-11.57	-.26
		Resistance	-15.125*	3.326	.000	-23.57	-6.68
Post-Plank	Aerobic	Resistance	2.378	14.800	.998	-34.316	39.073
		Control	42.972*	11.631	.002	13.977	71.967
	Resistance	Aerobic	-2.378	14.799	.998	-39.073	34.317
		Control	40.594*	12.831	.009	8.489	72.699
	Control	Aerobic	-42.972*	11.631	.002	-71.967	-13.977
		Resistance	-40.594*	12.831	.009	-72.699	-8.489

**. The mean difference is significant at the 0.05 level*

The post-test results for university students showed significant differences between the groups in certain fitness measures. For toe touch, the Aerobic group had significantly different scores compared to the Control group ($p < .01$), but there were no significant differences between Aerobic and Resistance ($p = .889$) or Resistance and Control ($p = .075$). In sit-ups, the Resistance group differed significantly from the Control group ($p < .01$) but not from the Aerobic group ($p = .054$), and the Aerobic group was not significantly different from the Control group ($p = .038$). For the plank test, both the Aerobic and Resistance groups were significantly different from the Control group ($p < .01$), but there was no difference between the Aerobic and Resistance groups ($p = .998$).

The results demonstrate that structured physical activity programs, particularly aerobic and resistance exercises, significantly enhance certain aspects of physical fitness among university students compared to an educational-only control group. The analysis began with tests of normality and homogeneity of variance, where most fitness measures met assumptions, allowing for robust comparisons between groups. A multivariate analysis of variance (MANOVA) indicated a statistically significant difference in overall physical fitness outcomes based on the type of exercise intervention. Specifically, the group variable accounted for 30.4% of the variance in the combined fitness scores, confirming that participation in physical training (aerobic or resistance) influenced students' fitness levels.

Further analysis using ANOVA revealed significant differences between groups for toe touch (flexibility), sit-ups (abdominal strength), and plank (muscular endurance). The aerobic group showed a statistically significant improvement in flexibility compared to the control group, likely due to the regular inclusion of stretching exercises during warm-up and cool-down sessions. Sit-up performance differed significantly across groups, with the resistance group showing the most notable gains, followed closely by the aerobic group. This suggests that resistance training effectively targets core muscle development and strength. For muscular endurance measured by the plank test, both the aerobic and resistance groups performed significantly better than the control group, highlighting both training types' benefits in enhancing core stability and endurance.

Interestingly, no significant group differences were observed in push-up (upper body strength) or step test (cardiovascular endurance) outcomes. This may be attributed to the relatively short duration of the intervention or the intensity of the training not being sufficient to elicit significant changes in these specific areas. Post hoc comparisons supported these findings, with significant improvements observed between intervention groups and the control group in flexibility, core strength, and endurance, while differences between aerobic and resistance groups were not always statistically significant, suggesting that both training modalities offer comparable benefits in certain fitness domains. Overall, the results underscore the importance of implementing structured, evidence-based physical activity programs in university settings to improve student's physical health and address sedentary behavior.

DISCUSSION

The current study demonstrated that Aerobic and Resistance group exercises can improve physical fitness. This aligns with research showing similar benefits, including enhanced flexibility, strength, muscular endurance, and cardiovascular endurance (Campanha-Versiani et al., 2017; Nystoriak & Bhatnagar, 2018). Moreover, Aerobic and Resistance exercises are viable training options for students, adults, and the elderly, though the physiological responses may vary depending on the specificity of the training. The findings of this study revealed significant differences in toe touch, sit-up, and plank test results, reflecting the distinct physiological impacts of these exercise types.

Engaging in physical activity can enhance muscle extensibility and elasticity, gradually increasing the range of motion. Therefore, regular exercise is vital for improving flexibility. Interestingly, the Control group showed a higher mean flexibility than the Aerobic group. Previous studies have shown that stretching improves flexibility (Gill et al., 2019; La Greca et al., 2019). A notable finding was the significant difference in toe touch flexibility between the Aerobic and Control groups. The Aerobic group's circuit training included static jogging, skipping, sprinting intervals, and jumping jacks, targeting lower leg muscles to enhance their elasticity. However, flexibility in the control group also improved after eight weeks of a particular education program where students could stretch and do flexibility to increase their range of motion.

The sit-up test revealed significant differences in muscular strength between the Aerobic and Control groups and the Resistance and Control groups. Strongoli et al. (2010) noted that sit-ups can improve breathing by strengthening the muscles involved in respiratory control. Aerobic exercise, which involves breathing techniques such as controlled inhaling and exhaling, enhances oxygen consumption across all ages (Chandra et al., 2019; Clemente-Suárez et al., 2018). This study also found significant improvements in sit-up performance after aerobic exercise, as shown by Karacan's (2010) findings. Therefore, Aerobic exercise is recommended for improving breathing techniques and strengthening abdominal muscles.

In this study, Resistance exercise targeted large muscle groups, including the abdomen, back, and lower legs. The results showed a significant improvement in sit-up strength for the Resistance group compared to the Control group. Stefanaki et al. (2019) found that Resistance exercise increases muscle bulk and hypertrophy, which enhances blood flow and metabolic responses, leading to stronger muscle fibers. They observed improved muscular strength in young women after six weeks of training. Versic et al. (2021) compared Resistance and Aerobic exercises and found that while both reduced body composition, only Resistance exercise significantly improved muscular strength.

The plank test results revealed significant improvements in muscular endurance for both the Aerobic and Resistance groups compared to the Control group. Imai and Kaneoka (2016) studied abdominal muscle endurance in adolescent athletes using side and prone plank tests, finding a strong correlation between muscle endurance and maximal oxygen consumption. This indicates that Aerobic exercise contributes to better plank performance by enhancing abdominal muscle endurance, which is crucial for posture and balance during activities such as running. Myers et al. (2017) also highlighted that Aerobic exercise improves abdominal muscle strength, posture, and balance. In this study, the Aerobic group showed better plank performance due to increased oxygen consumption, whereas the Control group's activities focused on muscle elasticity and extensibility.

The practical implications of this study for university health programs and policy are extensive and underscore the importance of integrating structured, inclusive, and evidence-based physical activity initiatives into campus life. First and foremost, universities should institutionalize standardized exercise programs guided by principles such as F.I.T.T. (Frequency, Intensity, Time, and Type) to ensure consistency and effectiveness across all student populations. These programs must be inclusive, considering the diverse backgrounds, physical abilities, time constraints, and financial limitations of students. This means offering flexible schedules, low-cost or free access, virtual options, and adaptations for students with special needs.

Moreover, the findings demonstrate a strong link between physical activity, mental health, and academic performance. As such, physical activity programs should be integrated with academic support services and mental health resources. This could include fitness-oriented stress-relief workshops during exam periods or participation in wellness activities as part of the university curriculum. To maintain effectiveness, universities should adopt a data-driven approach to continuously monitor and evaluate program outcomes, using pre- and post-assessments to measure fitness improvements and student engagement.

From a policy standpoint, a shift towards preventative health is essential. Rather than focusing solely on treating health issues, universities should invest in infrastructure and programming that promote long-term wellness and mitigate risks such as obesity and cardiovascular disease. This includes encouraging collaborative efforts among departments such as health services, campus recreation, and student affairs to coordinate resources and strategies. Additionally, promoting lifelong healthy habits should be a core objective, with universities supporting graduates through alumni fitness resources and campaigns.

Lastly, given the sedentary nature of university life, there is an urgent need to address physical inactivity through campus-wide initiatives. These may involve promoting active transportation, incorporating movement into classroom settings, and embedding short physical activity breaks into academic routines. Altogether, this study supports the critical role of well-planned physical activity programs in enhancing student health, fostering academic success, and instilling habits that contribute to lifelong well-being.

CONCLUSION

This study's primary contribution lies in developing and validating a standardized, inclusive, and structured physical activity program specifically for university students, with measurable outcomes and practical implementation steps. It addresses key limitations in previous research by ensuring accessibility, applying exercise science principles systematically, and offering a replicable model for institutional use.

The findings highlight the importance of integrating Aerobic and Resistance exercises into university-based physical activity programs to improve overall fitness and address sedentary lifestyles among students. A well-structured program based on training principles (ACSM, 2019) can significantly improve cardiovascular endurance, muscular strength, and flexibility. Notably, Aerobic exercise can enhance flexibility when performed correctly, demonstrating the multifaceted benefits of structured training interventions. To maximize the programs' impact, universities should adopt a systematic approach that includes diverse exercise modalities, personalized training plans, and continuous monitoring of student progress. Additionally, future implementations should consider evaluating mental health, sleep quality, heart rate, and cholesterol levels to provide a more comprehensive understanding of the long-term benefits of physical activity interventions.

The effective planning and implementation of physical activity programs in universities is essential for fostering a healthier student population, improving academic performance, and promoting long-term well-being. By designing structured, inclusive, and evidence-based fitness programs, universities can help students adopt lifelong healthy habits, reduce health risks, and enhance their overall university experience.

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