Effectiveness of the Multistage Jumping Rope Program in Enhancing the Physical Fitness Levels among University Students

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Abstract Several studies have shown that there has been a sudden decrease in physical activity levels among University students. This is alarming as physical inactivity is a known risk factor for many chronic diseases. Hence, Universities are in the best position to examine the personal and professional lifestyles among their students. The study was conducted in order to determine the effectiveness of the eight week multistage jumping rope training program in enhancing the physical fitness levels of Filipino university students. The study utilized a quasi-experimental research design and employed a purposive sample of 70 participants, who were screened using Physical Activity Readiness Questionnaire+ and were required to undergo a progressive eight-week jumping rope test. Cardiovascular endurance was assessed through volume of oxygen uptake or VO_2 max before and after the multistage jumping rope training program. Data was analyzed using frequency, percentage, mean, standard deviation and paired t-test. The results revealed a significant difference in the VO_2 max of males and females after the multistage jumping rope training program. The study affirms the effectiveness of the multistage jumping rope test in increasing the VO_2 max of the participants. Hence, integrating the said program in the school curriculum can significantly enhance their cardiovascular fitness.

Keywords Cardiovascular Endurance, Physical

Fitness, Skipping Rope Test, University Students

1. Introduction

In recent years, the number of university students who have low physical fitness levels and observe unhealthy dietary patterns has increased dramatically [1]. Their physical activity behaviors are also affected by complex interaction of motivation and self-regulatory skills together with a distinct social and physical environment encompassing college life [2]. These include increase academic workloads and substandard sporting facilities [3-4]

In the Philippines, studies have shown that Filipino youth have low physical activity and that they do not meet the recommended physical activity per week due to lack of time [2, 5]. This is alarming as physical inactivity is a known risk factor of many chronic diseases [6]. Hence, promoting physical activity among university students is crucial in order to ensure that they develop regular physical activity patterns which they can extend throughout their adult life.

One of the important indicators of physical activity is cardiovascular (or cardiorespiratory, cardiopulmonary)

endurance. It is defined as the “combined ability of the pulmonary system to promote gas exchange between the outside air and the circulating blood through the capillaries in the lungs, the cardiovascular system to transport oxygen to the working muscles, and the muscular system to utilize the oxygen [7]. Moreover, it also has mental health benefits along with other long-term effects like improved ability to extract oxygen from air during exercise, increased sweat rate, reduced risk of cancer, and increased density and breaking strength of bones, ligaments, and tendons, among many others. Thus, when one has an ideal cardiovascular endurance level, it would take less effort for that person to fulfill daily routine especially difficult tasks that require more physical exertion [8].

Despite the importance of having a high level of cardiovascular endurance, Macfarlane and Tomkinson [9] revealed that there has been a global decline in the cardiovascular endurance test performance of children and adolescents (6 to 19- year-olds) at a rate of 4-5% per decade since 1970. The performance of Asian children has declined at an average rate of -0.44% per year since 1970. Specifically, the Philippines were among the countries that performed the worst, below the overall Asian average [9]. Since then, there was no update on the Philippines’ status as it was not included in the follow up study after 25 years. Thus, the current physical fitness status, specifically cardiovascular endurance, of Filipino university students in general is not yet known.

Studies have shown that rope-jump test was shown not only to have improved physical fitness status of an individual but can also their coordination, balance, agility, rhythm, speed. Further, constant performance of the said activity may increase static or dynamic muscular strength and may contribute to the development of motor skills [10, 11]. Hence, an eight-week training program was to develop in order to determine its effectiveness in increasing the cardiovascular endurance of the subjects by measuring the VO_2 max.

2. Methods

2.1. Research Design

The study utilized a quasi-experimental research design in order to determine the effectiveness of an eight-week jumping rope training program on the cardiovascular endurance of the subjects using the 1-Mile Walk Fitness Test [12].

2.2. Research Participants

The study involved male and female students and whose age ranged from 18 to 20 years old, and were also non-smokers and non-alcoholics. A total of 70 bonafide first year level students who were enrolled from physical fitness class (HKD-01) - a prerequisite of all physical education course subjects was recruited through purposive

sampling. All the participants were required to have a physical examination under the supervision of the university doctor and passed all screening test under the Physical Activity Readiness Questionnaire+ (PAR-Q+ 2019) [13].

2.3. Measurement and Instrumentation

2.3.1. The 1-Mile Walk Test

A 1-mile walk test is a fitness assessment that measures an individual’s level of cardiorespiratory fitness or is referred to as the maximal oxygen consumption which is constructed on the quantity of the time it takes someone to finish a mile of brisk walking. This fitness test is applicable to individuals who are unable to run for having a low fitness level or even injuries. It induces an exercise heart rate of at least 120 beats per minute (bpm) at the end of the fitness test [8]. Following the protocol of Hoeger, W. & Hoeger, S. [12], a premeasured 1.0 mile course was selected where the test was conducted. Upon completing the 1-mile brisk walking, the participants were instructed to measure the time that it takes them to complete the course and to count their heart rate using the radial artery for 10 seconds and multiplied it by 6 to convert it to beats per minutes (bpm). In order to determine the time to walk, it was converted from a 00:00 value in order to allow for a numerical computation within the regression equation.

2.3.2. Computation for VO_2 max

Table 1 shows the fitness level classification of VO_2 max for Men and Women. The formula that was used to assess the cardiovascular endurance levels of the participants [12] is as follows:

Where: VO_2 max = ml/kg/min

Wt = Body weight in kilograms

Age = Age in years

Gender (G) = Zero (0) for females, One (1) for males

*Time (T) = Time to walk 1 mile (00:00)

^HR = Post Exercise Heart Rate (bpm)

$VO_2\text{max} = 132.6 - (0.17 \times \text{weight in kg}) - (0.39 \times \text{age}) + (6.31 \times \text{gender [0 for females; 1 for males]}) - (3.2 \times \text{time to walk 1 mile}) - (0.156 \times \text{post-exercise heart rate [bpm]})$.

2.3.3. Multistage Jumping Rope Program

Table 2 shows the multistage jumping rope program for eight weeks which was held in a school gym. It started with the usual warm-up exercise which is dynamic stretching for 10 minutes except for the first week with only 5 minutes. The jumping rope test that was done is progressive to which 100 repetitions are added per week which starts at 100 in Week One and ends in 800 in Week Eight. All tests ended with a 5-minute static stretching for cool down.

2.3.4. Profile of the Participants

The profile of the subjects was collected in the study which includes the age in years, sex, height in centimeters, weight in kilograms, and resting heart rate (bpm).

Table 1. Fitness Level Classification for Men and Women

Fitness Classification for Male						
Age (year)	Very Poor (under)	Poor	Fair	Good	Excellent	Superior (over)
18 - 28	37.9	38.0 - 41.0	41.7 - 44.8	45.6 - 48.5	51.1 - 54.0	55.5
Fitness Classification for Female						
Age (year)	Very Poor (under)	Poor	Fair	Good	Excellent	Superior (over)
18 - 28	30.9-32.2	32.3 - 35.2	36.1 - 38.5	39.5 - 42.4	43.9 46.8	49.6

Source: Hoeger, W. & Hoeger, S. (2016)

Table 2. Multistage Jumping Rope Program

Week	Intensity (jumps/min)	Warm up: Dynamic Stretching	Exercise	Cool down: Static Stretching
1	100	5 mins.	100 repetitions per minute with 30-second rest	5 mins.
2	200	10 mins.	200 repetitions per minute with 30-second rest	5 mins.
3	300	10 mins.	300 repetitions per minute with 30-second rest	5 mins.
4	400	10 mins.	400 repetitions per minute with 30-second rest	5 mins.
5	500	10 mins.	500 repetitions per minute with 30-second rest	5 mins.
6	600	10 mins.	600 repetitions per minute with 30-second rest	5 mins.
7	700	10 mins.	700 repetitions per minute with 30-second rest	5 mins.
8	800	10 mins.	800 repetitions per minute with 30-second rest	5 mins.

2.4. Data Analysis

The data collected was analyzed using the SPSS version 21.0 (IBM Corporation, Armonk, NY). Descriptive statistics such as frequency, percentage, mean and standard deviation were used for the profile of the subjects while paired t-test was used to determine the subjects' VO₂ max before and after the multistage jumping rope program.

3. Results

Table 3 shows the profile of the subjects. It was revealed that the mean age of the participants was 18.27 (SD=0.61) while there were 37 (52.86%) female and 33 (47.14%) male participants. The mean height was 158.2 (SD=19.6), the mean weight was 72.12 (SD=38.09) while the mean resting heart rate (bpm) was 69.79 (SD=16.95).

Table 3. Profile of the Participants (n=70)

Profile	n (%)	Mean (SD)
Age (years)		18.27 (0.61)
Sex: Male	33 (47.14)	
Female	37 (52.86)	
Height (cm)		158.2 (19.6)
Weight (kg)		72.12 (38.09)
Heart rate (bpm)		(69.79 (16.95)

On the other hand, Table 4 depicts the comparative analysis for the pre-test and post-test mean VO₂ max of the subjects after undergoing the multistage jumping rope program. It was revealed that the pre-test VO₂ max among males was very poor, with a mean score of 36.1 (SD=8.68) while the pre-test VO₂ max among females was poor with a mean score of 32.53 (SD=3.90).

Focusing on the post-test result, it can be gleaned that the VO₂ max among males became good with a mean score of 47.62 (SD=8.95) after the Multistage Jumping Rope Program. On the other hand, the post-test VO₂ max among females was 37.34 (SD=3.71) which can be interpreted as fair.

The result of the paired t-test among males revealed a t value of -8.756 and a computed p-value of 0.000 while among females the result yielded a t value of -8.859 and p-value of <0.05.

4. Discussion

The objective of the study was to determine the effectiveness of the eight-week training program in increasing the cardiovascular endurance of the subjects by measuring the VO₂ max among University students. Currently, there is limited research whether jump-rope based program can be used as a training method to

improve the physical fitness among University students [14]. The main findings of the study revealed that the 8-week training program significantly improves the cardiovascular endurance among the participants. Specifically, the VO₂ max among males changed from very poor to good; while for females, it changed from poor to fair after undergoing the training program.

The study indicates that the Multistage Jumping Rope Program is an effective method for improving cardiovascular endurance among University students.

Table 4. VO₂ max Before and After the Multistage Jumping Rope Program (n=70)

Variables	Pre-test		Pos-test		t-value	p-value
	Mean	SD	Mean	SD		
Male (n=33)	36.1	8.68	47.62	8.95	-8.756	*0.000
Female (n=37)	32.53	3.90	37.34	3.71	-8.859	*0.000

*p value is significant at 0.05 level

These findings are supported by the study of Partavi [14] who concluded that the 7-week rope jump training is an effective method for improving cardiovascular endurance among adolescent boys and Chao-Chien and Yi-Chun [15] who showed that the 12-week jumping rope training significantly influence the cardiovascular endurance among students who are intellectually impaired. Further, the study is consistent with previous literatures which reported that a rope-jump based training program significantly improves cardiovascular endurance [14, 16-19].

The findings of the study offered empirical evidence on the effectiveness of a jump-rope based program in enhancing the physical fitness among University students. Despite the positive findings of the study, there are some limitations that should be recognized. The study only included first year level students which was purposely selected and did not include other students, thereby limiting its generalizability. Also, other measures of physical fitness such as muscular strength and endurance, flexibility, agility, and speed were not included

5. Conclusions

The study affirms the effectiveness of the multistage jumping rope test in increasing the VO₂ max of the subjects. The school administrators are advised to adapt the Multistage Jumping Rope Program to improve physical fitness among University students. It includes providing adequate infrastructure to support such activities and create awareness of such programs. Further, integrating a jump rope-based program in the curriculum and afterschool activities is recommended.

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