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RESEARCH ARTICLE

The Effect of Skipping rope Exercise on Physical and Cardiovascular fitness among Collegiate Males

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ABSTRACT:

OBJECTIVE OF THE STUDY: To determine the effect of skipping rope exercise on physical fitness and cardiovascular fitness among collegiate males. **BACKGROUND OF THE STUDY**: Sedentary life style is contributing to the early onset and progression of life style disease such as cardiovascular disease, hypertension, diabetes and obesity. Cardiovascular fitness reduces the risk of cardiovascular diseases like diabetes or Hypertension. Skipping rope is a low-cost physical activity. Thus, its impact on the physical fitness is being studied by various researchers. Skipping rope involves the muscles in arms and legs, and it also improves cardiovascular function. **METHODOLOGY**: This experimental study was conducted among collegiate males of age group between 18 and 25 years at Faculty of physiotherapy. Study duration was twelve weeks. Subjects were selected by simple random sampling method. Inclusion criteria were inactive subjects based on IPAQ-S. Exclusion criteria were minimally active and active subjects based on IPAQ-S, sports population, those with heart disease, any lung disease and anemia. Outcome measure for cardiovascular fitness is VO_2 max by step test and Physical fitness by FMS (Functional Movement Screening) and by IPAQ-S (International Physical Activity Questionnaire – Short form). **PROCEDURE:** International Physical Activity Questionnaire-short form (IPAQ-S) was given to participants initially Inactive subjects were recruited based on IPAQ-S values and randomly divided into two groups Group A (experimental) and Group B (control group). Subjects were selected based on inclusion criteria. Pre-Assessment of the cardiovascular fitness and physical fitness were noted. Experimental group received skipping rope exercise two sessions per day from moderate to vigorous intensity based on target heart rate including warm up and cool down period to avoid injuries. Exercise began with 55% of target heart rate and then progressed to 65% by 2nd week and progressed to 70% by 3rd week and 75 % by 4th week and finally 85% by 5th week. Group B (control group) were suggested to do their as usual routine activities. Heart Rate was periodically noted. Post test scores were recorded after 12 weeks of intervention. **RESULT:** On comparing the pre and post test values between groups, it shows statistically significant improvement in Group A (Experimental group) at $p \leq 0.001$ on $VO_{2\ max}$ and FMS.

KEYWORDS: Vo_2 max, FMS, Cardiovascular fitness, Physical fitness, Step test, Target Heart Rate, Pulse ox meter, IPAQ-S, Skipping rope, Exercise intensity.

INTRODUCTION:

Skipping rope is a cheap and portable material which is affordable to everyone and also needs only minimum space. It is a low-cost physical activity, thus its impact on the physical fitness is being studied by various researchers Skipping rope exercise involves the muscles in arms and legs, and it also improves cardiovascular function and metabolism(1). Many researchers suggested that physical activities including skipping rope would give better result in physical fitness(2,3,4,5,6,7). During initiation of this skipping rope, arms rotate the rope and

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both legs would perform repeated jumping, at the same time it aims to maintain constant vertical take-off and landing phases and body also needs to control the balance and force through a coordinated action of upper and lower body muscle groups. The role of skipping rope exercises within training programs has been proved that it gives positive effects on physiological parameters of cardiovascular and respiratory systems[8,9,10]. Epidemiological study has shown that sedentary life style will lead to onset and progression of life threatening disease such as hypertension, cardiovascular disease and obesity[11]. It is a serious growing health problem. Thus, it is essential to be fit physically and improve the cardiovascular fitness. Causes of mortality indicated that both the low physical fitness and low cardiovascular fitness have higher risk factor and is relatively associated with higher mortality rate among both men and women[12,13]. Krahenbuhl in 1985 had demonstrated that VO_2max and reduction in O_2 consumption at submaximal workloads which predicts the endurance fitness or cardiovascular fitness[14].

When performing skipping rope exercise, it is necessary to coordinate the upper and lower body to maintain balance and rhythm. Skipping rope can enhance the precise coordination of multiple muscle groups, which is why it is used widely in athletic training programs. Skipping rope combines the angular momentum of the rope and vertical displacement of the body. Also, skipping rope involves upper and lower synchrony (hand-foot coordination) where positioning and timing is critical. The ability of time reproduction makes it possible to reproduce specified time periods with great precision. Skipping rope skill involves good perception of time reproduction[15,16] In spite of numerous publications on various general physical capacities (i.e. jumping or running), there haven't any investigation related to the effects of skipping rope exercise on physical fitness and cardiovascular fitness among inactive college students. Thus this study is intended to study the effects of skipping rope exercises on physical and cardiovascular fitness among collegiate males.

METHODOLOGY:

This experimental study was conducted among collegiate males of age group between 18 and 25 years at Faculty of physiotherapy Dr. MGR Educational and Research Institute. Study duration was twelve weeks. Subjects were selected by simple random sampling method. Inclusion criteria were inactive subjects based on IPAQ-S. Exclusion criteria were minimally active and active subjects based on IPAQ-S, sports population, those with heart disease, any lung disease and anemia. Outcome measure for cardiovascular fitness is VO_2 max by step test and Physical fitness by FMS (Functional Movement Screening) and by IPAQ-S (International Physical Activity Questionnaire–Short form). Skipping rope and Pulse ox meter were the materials used.

PROCEDURE:

Inactive subjects were recruited based on IPAQ-S values and randomly divided into two groups Group A (experimental) and Group B (control group). Subjects were selected based on inclusion criteria.

All the subjects signed informed consent before initiation of the exercise. Experimental group received skipping rope exercise two sessions per day from moderate to vigorous intensity based on target heart rate including warm up and cool down period to avoid injuries. Exercise began with 55% of target heart rate and then progressed to 65% by 2^{nd} week and progressed to 70% by 3^{rd} week and 75 % by 4^{th} week and finally 85% by 5^{th} week. Group B (control group) were suggested to do their as usual routine activities. Heart Rate was periodically noted. Post test scores were recorded after 12 weeks of intervention. Experimental group received exercise as per ACSM's guidelines; exercise prescription was made to the subjects of experimental group. Exercise prescription comprises of mode, frequency, intensity and duration of the exercise. There are many techniques in skipping rope in which basic jump or easy jump technique was used for experimental group. In this technique, jump with both feet slightly apart over the rope and it was performed individually.

EXERCISE PRESCRIPTION:

According to American College of Sports Medicine recommended aerobic training intensity of 55% or 60% to 90% of one's maximum heart rate (HR max) or 40% or 50% to 85% of $VO_{2\ max}$.

EXERCISE MODE:

Aerobic Exercise: EXERCISE FREQUENCY: Frequency of this exercise program is 6 days per week and 2 sessions in a day. EXERCISE DURATION: Cardiovascular conditioning with endurance exercise periods as brief has 5 to 10 minute per day.

EXERCISE INTENSITY:

As discussed earlier, exercise intensity will be prescribed according to target heart rate. 55% of target heart rate for the first week, 65% by second week, 70% by third week, 75% by fourth week and finally 85% of target heart rate so on.

CARDIOVASCULAR FITNESS:

Cardiovascular endurance was measured for all the subjects in both groups and recorded by $VO_{2\ max}$ by 3 minutes Mc Arld step test. This assessment was taken individually. In this test, subject has to step up and step

down over the step bench for the duration of 3 minutes and their heart rate noted and calculated using the following formula. FORMULA: $VO_{2\ max}$ (ml/kg/min) = 111.33–(0.42×heart rate (bpm))

$Vo_{2\ max}$ BY McArld STEP TEST:

The Harvard Step Test was first developed by Brouha, Graybriel and Heath in 1943 (Brouha, Graybiel & Heath, 1943, found in Maud & Foster, 1995). It is a simple 3 minute step test that uses a step bench that is 40cm high for males. It can be used for both men and women of various ages and relies on the linear relationship between heart rate and VO2 to predict maxVO2.

PHYSICAL FITNESS:

Physical fitness was assessed for all the participants in both groups. Physical fitness was assessed by FMS (Functional Movement Screen) which comprises of 7 different movement patterns and each movement pattern score ranges from 0 to 3. The attained score was recorded.

FUNCTIONAL MOVEMENT SCREENING:

The movement patterns are designed to provide observable performance of basic locomotor, manipulative and stabilizing movements by placing an individual in extreme positions where weaknesses and imbalances become noticeable if appropriate mobility and motor control is not utilized. Once these deficiencies have been identified through the FMS Screen, a program of corrective exercises is then developed with the goal of preventing musculoskeletal injuries[17]. The FMS consists of seven movement patterns which require mobility and stability.

The seven following movement patterns were scored from 0-3 points, with the sum creating a score ranging from 0-21 points. [18, 19] The Functional Movement Screen is made up of seven different movements 1) Deep squat 2) Hurdle step 3) Inline lunge 4) Shoulder mobility 5) Active Straight leg raise 6) Trunk Stability Push Up 7) Rotary Stability

DATA ANALYSIS:

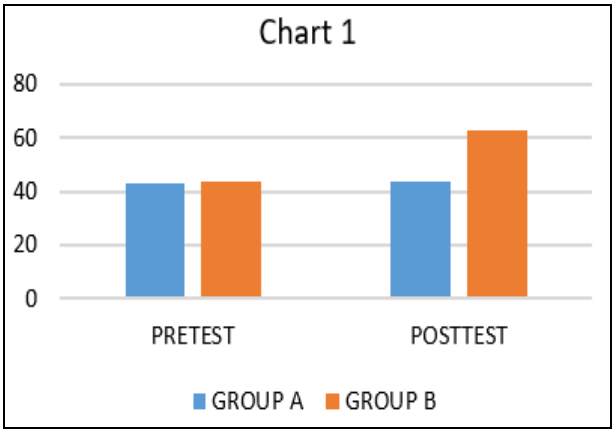
The collected data were tabulated and analyzed using both descriptive and inferential statistics. All the parameters were assessed using statistical package for social science (SPSS) version 17.0. Paired t-test was adopted to find the statistical difference within the groups & Independent t-test (Student t-Test) was adopted to find the statistical difference between the groups.

Table–1 Comparison of $Vo_{2\ Max}$ Between Group–A and Group-B in Pre and Post Test

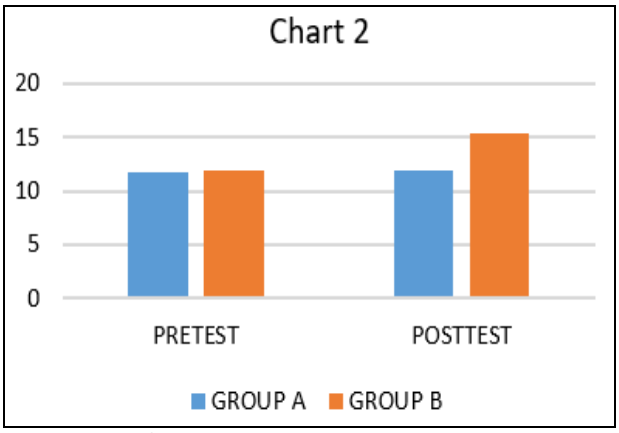
Vo_{2max}	#GROUP - A		#GROUP - B		t-test		
	MEAN	S.D	MEAN	S.D		df	SIGNIFICANCE
PRE	43.28	5.88	43.84	4.75	-.331	38	0.742*
POST	43.71	5.86	62.95	3.03	-13.042	38	0.000**

Table – 2 Comparison of fms Between Group-A and Group - B in Pre And Post Test

FMS	#GROUP - A		#GROUP - B		t - TEST		
	MEAN	S.D	MEAN	S.D		df	SIGNIFICANCE
PRE	11.80	1.321	11.95	1.190	-.377	38	0.708*
POST	12.00	0.973	15.40	0.820	-11.943	38	0.000**



***Comparison of $Vo_{2\ Max}$ Between Group – A and Group - B In Pre And Post Test**



***Comparison of Fms Between Group – A and Group - B In Pre And Post Test**

RESULT:

On comparing the pre and post test values within experimental group, it shows statistically significant improvement on $VO_{2\ max}$ where p value is ($p \leq 0.001$) And also in pre and post test values of experimental group, it reveals significant difference on Functional Movement Screen where p value is ($p \leq 0.0001$)* whereas in control group, there is no difference or improvement on analyzing pre and post test values of mean.

DISCUSSION:

The present study gives a clear picture that experimental group showed better results and it was observed that there is a significant difference in the physical fitness by functional movement screen and cardiovascular fitness by vo_{2max} (queens college step test).

Our study supports the findings of Mahboobeh Sohrabi in 2015 on 9 to 10 years old female to improve their physical fitness up to 23.88%. This study also confirms the findings of Chen et al in 2010 related to the positive impact of jump-roping on the balance of children with slight mental disorders[20].The study done by Dharmendra singh in 2015 proved that skipping rope exercises improved the leg strength and agility among girls. In this study, there was a better performance in experimental group as compared to control group due to the progressive training program for the duration of eight weeks. It was concluded that regular conditioning or training of optimum intensity brings specific changes in various parameters like cardiovascular system, muscular system and body composition[21].

Another study done by Fatemeh Fallah in 2014 showed the effect of jump rope training on static balance in male and female students with intellectual impairment. The results of this study showed that one can suggest these exercises in order to improve the (static) balance. However, the researchers believe that the jump rope workout, have specific advantage, since these exercises are of the dynamic activities, which causes vigor in the people, while strengthening the pivotal muscles. John A. Baker in 2013 compared skipping rope exercise with jogging and finally concluded that 10 minutes of skipping rope exercise is more beneficial than 30 minutes of jogging where both interventions were used to improve cardiovascular efficiency[22]. When power improves, strength should also increase. Jump-rope exercises may cause muscle protein degradation, as a result of increased strikes and resistance. However, this process also causes a potential increase of muscle size and power. With the increase in power, when speed stays still, the strength also improves.

It should be noted that jump-roping is a jumping exercise and it is highly similar to the Plyometric Exercises. Similar to the Plyometric exercises, jump-roping also have two levels of extrovert contraction and rapid introvert contraction. During the extrovert contraction, when the Quadriceps and twin muscles are stretched, the elastic components are also stretched. Thus, part of the energy is stored in the form of elastic potential energy. During the introvert contraction, this energy releases and results in the increase of power and the speed of movement. An increase in the mentioned factors also causes the improvement of strength. Additionally, the nervous coordination that occurs as a result of power exercises, such as Plyometric and jump-roping (the stretching reflex of muscle spindles), results in the increase of power[23,24]. This study showed a significant improvement in physical fitness and the cardiovascular fitness among collegiate males those who performed skipping rope exercise and thus has a potential to minimize long term lifestyle diseases.

CONCLUSION:

By the obtained result from this experimental study, it is concluded that the skipping rope exercise has a better improvement on cardiovascular fitness as well as physical fitness which is proved. Skipping rope training is really a good exercise for those people who want to maintain their fitness level and also it needs only lesser space to perform this exercise and affordable to everyone in this society. Hence, skipping rope training is a good choice for those who're having a sedentary lifestyle.

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