

Effect of Circuit Training Upon Body Composition of College Students

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ABSTRACT

Health-related physical fitness is indispensable for every person irrespective of age, profession and gender to lead a healthy life. One of the key components of health-related physical fitness is body composition. The current study was carried out to determine the “effect of Circuit Training upon body composition among college students”. Hostel students of Government Post Graduate College (GPGC) Karak Khyber Pakhtunkhwa (Kp), Pakistan were the participants of the study in which a sample of thirty students (n=30) was selected as subjects through Physical Activity Readiness Questionnaire (PAR-Q). The pre-test data on body composition of all the selected subjects was obtained through body mass index (BMI). Experimental group (circuit training) and Control group (no treatment) were formed of the selected subjects dividing them equally and randomly. The treatment of Circuit Training was given to experimental group on alternate days (Monday, Wednesday and Friday) for twelve weeks while at the same duration, no treatment was given to the control group except the subjects continued their routine life engagements. After the treatment, the post-test data on body composition was obtained through the test adopted for the pre-test. The pre-test data and post-test data was analyzed by applying the descriptive statistical sources (mean, standard deviation, minimum and maximum) and inferential statistical tools (independent sample t test and paired t test). The significance level was fixed at 0.05. The results of the study showed that Circuit Training has significant effects on body composition among the college students. The control group did not show significant improvement in body composition. It was concluded that in order for people to ameliorate the body composition, they should partake regularly in Circuit Training.

Keywords: Circuit Training, body composition, college students

INTRODUCTION

The importance of physical fitness has been recognized by everybody and in each and every stage of life. Physical fitness is a gift of life as it improves general health which paves the way to full and enthusiastic living. It provides a base for creative and dynamic activity (Mondal, Goon &

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Varghese, 2014). The progress and prosperity of a nation depends upon its healthy and fit citizens. Fit citizens are more prepared and keener to do things. They are more creative. They are mentally sharper, physically active and more in tune with body and, hence, perform daily assigned tasks efficiently and effectively (Rudkin, 2020). It may be defined as the ability to perform efficiently and effectively the aspects related to sports, occupations and daily activities (Kokkinos, Giannelou, Manolis & Pittaras, 2009).

There are two parts of physical fitness: skill-related physical fitness (specific fitness) and health-related physical fitness (general fitness) (Hartman, Smith, Houwen & Visscher, 2017). Skill-related physical fitness deals with the enhancement of performance for success in sports competition and athletic events. The components of skill-related physical fitness are coordination, speed, reaction time, power, agility and balance. The stated components can be seen as an expansion of the health-related components of physical fitness because they tend to be more associated to human performance than the everyday health needs of an individual (DeMet & Wahl-Alexander, 2019).

Health-related physical fitness is also famous as general fitness. It is the capacity to become and live physically healthy. It is the capability of a person to do physical activities that have need of endurance, strength and flexibility (de Castro Pinto, Cruz, dePinho & de Dias Marques, 2020). Health-related physical fitness is essential for every-body and is equally stressed on by medical people and physical educators. It enhances general health and assists in preventing chronic diseases, injuries and osteoporosis. It also focuses on the elements that develop optimal health and put a stop to the beginning of disease and problems linked with inactivity (American College of Sports Medicine (Ed.), 2013).

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Health-related physical fitness is the combination of five components which are Cardio Respiratory Endurance, Muscular Strength, Muscular Endurance, Flexibility and Body Composition. The mentioned components are not only essential to become and stay physically healthy but also provide a base for skill-related physical fitness (Gu, Zhang, Chu, Keller & Zhang, 2019).

The body composition is one of the key components of health-related physical fitness. Body composition is related with the ratio of fats in the body compared to the overall level of lean body mass. It refers to relative proportion of muscles, bones and fat in human body (Walsh et al., 2020). Body composition is an important measure of healthy fitness. The proper quantity of fat in the body protects the vital organs of the body like heart, liver, pancreas, lungs, intestines etc. (Suet al., 2020). If the amount of fats is stored more than normal under skin and internal organs relative to bone and muscles of the body, it leads to lower the ability to do exercise, engage in strenuous work, perform well in sports and predictor of risk for a wide range of degenerative diseases. Thus, too much fat impairs fitness level and impacts overall state of health. High level of fats in the body directly affects the quality of speed and speed is essential for better performance in most of the daily activities (Weschenfelder, Bentley & Himmerich, 2018). There are various methods that can be used to assess the body composition. BMI, skin fold thickness, waist to hip girth, under water weighing (Louer et al., 2017) and bio electrical impedance are some of the ways commonly used for calculation of body composition (Tovar-Galvez, González-Jiménez, Martí-García & Schmidt-RioValle, 2017). BMI is a statistical which is used to measure and compare the weight and height of a person. It was invented by Belgian Polymath Adolphe Quetelet between 1830 and 1850 during the course of developing “special physics”(Nagpal, Devgun & Chawla, 2015). Though BMI does not calculate exactly the fat ratio in the body yet it is mostly used as a diagnostic tool in the world

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to estimate a healthy body weight through height and weight of the body. After the calculation, a person body composition is compared to the sitting values (Rashmi & Snehalatha, 2019). It is applied as a plain means to categorize the inactive (physically inactive) persons with an average body composition. The current setting values for the individuals are as follow (Twells, Gregory, Reddigan & Midodzi, 2014).

Table 1: Classification of body composition through body mass index

BMI Classification

<18.5 Under weight

18.5-24.9 Normal weight

25.0- 29.9 Over weight

30.0-34.9 Class I obesity

35.0- to 34.9 Class II obesity

> 40 Class III obesity

Lifestyle, nutrition, hydration, proper rest and sleep are some of the essential factors that pave the way to achieve health-related physical fitness. Besides the stated elements, taking of exercises is fundamental for optimal health-related physical fitness (Trajković, Madić, Andrašić, Milanović & Radanović, 2017). Training is a program of exercises which is planned for the improvement of physical fitness (Stewart, Saunders & Greig, 2014).

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Circuit training is like a resistance training in which the weight of the body or equipments are used as resistance for the development of muscular or strength endurance (Ibrahim, Muhamad, Ooi, Meor-Osman & Chen, 2018). There is a series of exercises in Circuit Training. One circuit is usually made up of nine to twelve exercises. Each exercise is performed in a station on time or repetition basis before moving to another station (Paoli et al., 2010). The time or repetitions of exercise is decided in the light of the participants 'fitness level (Ikenna et al., 2020). The range of time for each exercise in a station is 15seconds to 5 minutes. It may include rest interval between the exercises or it can be nonstop (Reddy, 2012). There are 2 to 4 sets and there is little time between the sets (Seo, Noh & Kim, 2019).

Students are the assets of a nation. They are the future builders of a nation for which they must be physically fit so that they may be able not only to enjoy healthy life but also play significant role in the prosperity of a nation (Li, 2018).

In the recent times, man has become sedative because of technological advancement where physical work is almost outdated. The increased sedentary life style and physical inactivity has not only deteriorated the normal body functions but also created many serious medical problems because of overweight and obesity which are coronary heart diseases, obesity, anxiety, hypertension, depression and lower back problems. The stated deplorable situation is the main hurdle in the way to physical fitness (D'Isanto, Manna & Altavilla, 2017). There has been an increase in the prevalence of overweight and decline of physical fitness in adults across all genders, ages and racial/ethnic groups (Kanter & Caballero, 2012).

Overseas reports bring to light that physical activity and physical fitness have reciprocally relation and they exert independent effects on health (Chen, Hammond-Bennett, Hypnar & Mason, 2018;

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Castelli & Valley, 2007; Weiss, Galuska, Khan & Serdula, 2006; Augste, Lämmle & Künzell, 2015; Derri, Aggeloussis & Petraki, 2004). Regular participation in physical activities lessens the risks of deadly diseases like diabetic, heart diseases and respiratory diseases. It minimizes the possibility of premature death to utmost extent (Scott, Oman & John, 2015). It develops a person physically as well as mentally which is directly related to the improvement of a positive self-concept and greater self-esteem. It develops the qualities like assertiveness, emotional stability, self-confidence and independence and self-control (Jones & Stumbrys, 2014). The literature review of Hamoudat (2008); Ghassab & Oudat (2007) and Al-Rashidi (2006) has shown the decline of the components of physical fitness among college students.

With this perspective, the researcher intended to find out the “effect of Circuit Training on body composition among college students”.

Objectives of the study

- To determine the effect of circuit training upon body composition among college students
- To suggest a list of recommendations for the enhancement of body composition among college students

Delimitations of the study

- 1) Thirty students of GPGC Karak, who were residing in the college hostel, were taken as subjects.
- 2) The age range of the subjects was 18-22 years.
- 3) The study was restricted to male subjects only.

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- 4) Two groups were formed each of fifteen students which were experimental group and Control Group.
- 5) The duration of Circuit Training was twelve weeks with three sessions per week on alternate days (Monday, Wednesday and Friday).

Materials and methods

Participants of the study

In experimental research, participants of the study are the aggregate of all the subjects, objects or members that are directly related to the under-taken problem in connection with collection of the necessary data (Khirikoeckong et al., 2020). GPGC of district Karak was chosen for the study. Karak is located in the south of KP (province) of Pakistan. The participants of the study were comprised all the students (18-22 years) who were residing in the hostel of GPGC Karak and the total number of the students was one hundred and forty-two.

3.2.1 Exclusion/inclusion criteria

Physical Activity Readiness Questionnaire (PAR-Q) was used as exclusion and inclusion criteria. The PAR-Q is a screening tool. It usually consists of close ended questions and fitness trainers use it before start of exercise program in order to select right subjects and avoid the possible health risks (Warburton, Jamnik, Bredin & Gledhill, 2011). For this particular study, the students who were not boarding in hostel were excluded. Students with diseases of heart, chest, unconsciousness, musculo-skeletal, hypertension and joints were not made the part of subjects. Further, the students who had been already taking part in aerobic or anaerobic activities for the last six months, past or present smoking history, having any sort of physical deformity, systemic

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illness and on acute or chronic medication were excluded. The subjects age range was 18 to 22 years and no student was included as subject in the study whose age was above or below the stated range.

Selection of subjects

After the distribution and collection of PAR-Q among one hundred and forty-two students, seventy-two students were fit for participation in the study. Among the seventy-two students, thirty students were selected as subjects randomly. Further the thirty subjects were divided into two groups (Experimental group and control group) randomly each one of fifteen subjects.

Pilot study

A pilot study was carried out to evaluate the initial capability of the subjects and ensure the suitability, frequencies and duration of training program (Circuit training). For this purpose, ten subjects were selected at random and went through Circuit Training exercises. The average performance of ten subjects was calculated. The protocol of circuit training of 12 weeks was designed for the experimental group on the basis of the response of the subjects in the pilot study. The basic principles of training were also followed by the researcher while designing the training protocol.

Orientation of subjects

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The aim of the orientation is to get the reliable data. In order to motivate and involve the subjects in the selected test and training, an orientation class was organized. The researcher explained the subjects' role as well as the purpose and importance of the present study. The researcher explained the procedure of testing on dependent variable to all the subjects of two groups and gave instructions about the procedure to be adopted by them for measuring. Besides orientation class, the researcher spent three sessions with experimental group to make acquainted the subjects with the techniques/procedure involved in the performance of exercises of circuit training so that they may perform the exercises properly and avoid the possible health injuries. The researcher himself gave the demonstration of each exercise in front of the subjects.

Instrument for collection of data

Instrument is a measurement device. In research study, instrument is a tool that researcher uses for the collection of data (Kola, 2017). There are various instruments like questionnaire, interview, test etc., and the selection of instrument depends upon the nature of study. The current study was undertaken to determine the effects of Circuit Training upon body composition among college students. According to the available literature, body mass index was used as criterion measure to collect the pertinent data on the dependent variable (body composition) in the present study.

Test Administration

The weight (in kilogram) and height (in centimeter) of each subject was calculated with Digital scale and Stadiometer respectively in bare feet and with as few clothes on as possible. Then the body weight was divided by body height according to the formula (Weight in kg/ (Height (cm)/100) **2).

Ethical consideration of the study

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It becomes the responsibility of the researcher not to put the subjects in a situation where they might be at risk of getting physically and psychologically injured owing to their participation in the study. For this purpose, all the subjects were clearly informed about the purpose and procedure of study. The subjects were selected through PAR-Q which ensured that they were free from different diseases. A written consent was obtained from each subject. Likewise, a consent letter was also got from the head of the institution.

Protocol of circuit training

A self-administered Circuit Training protocol of 12 weeks was developed for the subjects of experimental group. The exercise were Jumping jack, Sit ups with straight legs, Heel raising, Abdominal crunch, Knee highs/running in place, Push-ups, Legs raising, Burpees/plank, Light Jumping, Lunges.

The intensity of exercise was 50% to 60% of Maximum Heart Rate (220-age) for the first six weeks while 60% to 70% of MHR for the last six weeks. Training session was started and concluded with warm up (light dynamic stretching exercises and walk) and warm down (Walk, light stretching exercises with deep breath) respectively each of 10 minutes.

Statistical analyses

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Section A: Descriptive analyses

Table 2. Demographic/Anthropometric measurements of age, height and weight of the subjects of Experimental group and Control group.

Groups	Variables	N	Minimum	Maximum	Mean	Std. Dev
Experimental Group	Age (years)		18.00	22.00	19.47	1.35
	Height (cm)	15	163.00	184.00	173.07	6.82
	Weight (kg)		55.00	80.00	65.53	8.39
Control Group	Age (years)		18.00	22.00	20.47	1.46
	Height (cm)	15	160.00	178.00	169.27	4.95
	Weight (kg)		59.00	78.00	64.33	5.16

Section B: Inferential analyses

Pre-treatment matching process

Table 3. Pre-treatment Comparison among age, height and weight measurements of Experimental group and Control group

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Variables	Groups	N	Mean	St. Dev	Std. Error	Df	t
							Sig.
Age (years)	Experimental Group	15	19.47	1.35	.35		
							28
							1.946
							.062
	Control Group	15	20.47	1.46	.378		
Height (cm)	Experimental Group	15	173.07	6.82	1.76		
							28
							1.747
							.092

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Control Group	15	169.27	4.95	1.28	
Weight (kg)	Experimental Group	15	65.53	8.39	2.17

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.472

.641

Control Group	15	64.33	5.164	1.33	
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The table shows that there is no significant difference (0.05) among age, height and weight between the Experimental group and Control group before the treatment.

Table 4. Pre-treatment difference between body composition of Experimental group and Control group

Variable	Groups	N	Mean	Std. Dev	Std.Error Mean	Df	t	Sig.
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each other with reference to positive effects of Circuit Training on body composition and oxygen uptake.

Similarly, a study was also conducted by Kim, Ko, Seo & Kim (2018) to find out the effects of Circuit Training on body composition. Though obese female students were selected as subjects for the study yet the Circuit Training enhanced their body composition. Thus, the findings of the current study endorse the findings of the mentioned study in perspective of the development of body composition which is one of the key components of health related physical fitness.

Finding of the study

The hypothesis of the study was about the effects of Circuit Training upon body composition among college students (18-22 years). On the basis of the written available literature, It was hypothesized that 12 weeks' treatment of Circuit Training would have significant effects on body composition. On analyzing the data, it came to light that 12 weeks' Circuit Training has significant effects on body composition ($P < 0.05$) among college students (18-22 years), hence the hypothesis H1 is hereby accepted

Conclusion

The objective of the study was to identify the effects of Circuit training on body composition among college students (18-22 years). After analyses of the data, it was concluded that Circuit Training of 12 weeks has significant effects on body composition among the college students (18-22 years) compared to control group.

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Recommendations

As the researcher found in the current study that Circuit Training exercises can improve body composition of college students hence these programs may be added to their regular working schedule. For this purpose, it is recommended to the government that a curriculum may be designed for the college students with selected exercise in order to enhance the body composition in better way which is a key element of physical fitness.

In Circuit Training a number of students can be engaged at a time. It is recommended to the government that a comprehensive program of Circuit Training may be introduced in other educational institutions for the enhancement of body composition of students that is the basic element of health-related physical fitness.

The exercises of Circuit Training can be performed without any apparatus/equipment and hence these may be initiated by government and non-government organizations during working hours for the enhancement of body composition among employees which is the key element of health-related physical fitness.

The exercises of Circuit Training are simple form of exercises and these may be recommended for the masses in order to ameliorate their quality of body composition.

Fit citizens are the assets of a nation for they may play their role in better way in the development of country. It is recommended to the government to provide infrastructure (indoor and outdoor) to the masses for physical activities that will pave the way for fitter citizens.

It is recommended for the sports trainers and physical trainers to include exercises of Circuit Training in their training protocols for the improvement of body composition of their

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athletes/trainees which is one of the key components of health-related physical fitness and health-related physical fitness provides a base for skill-related physical fitness.

The implications for future researchers

1. The researcher investigated the effects of Circuit Training upon body composition among college students. The future researchers may extend the studies to university and school students.
2. The current study was confined to the students of 18 to 22 years' age. In future, the researchers may take different age group students to conduct similar studies.
3. Only the male students were taken as subjects for the current study. In future, similar studies may also be made on female students of the same as well as of different age group.
4. The researcher took the Circuit Training method as independent variable. In future, the researchers may take other training methods as independent variables in order to identify its effects on body composition.
5. In the current study, body composition was dependent variable. The researchers may include psychological, physiological, sociological and bio chemical variables to conduct similar studies by applying the same training protocol.
6. In the present study, the duration of Circuit Training was 12 weeks with three sessions per week on alternate days. The future researchers may investigate the effects of Circuit Training on body composition with different intensity, frequency and duration.

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Limitations and future directions

1. In the current study, psychological factors, food habits and life style of the subjects were not controlled. The future investigations may be extended to the stated variables in order to enhance the existing understanding.
2. Weather conditions like humidity, atmosphere temperature etc. was not taken into consideration. The future researcher might be interested to take into account the weather condition which would be helpful in better understanding of the phenomena.
3. The heredity differences were overlooked in the current study. The future researchers may take into account the heredity differences in their investigations in order to highlight the effects of Circuit Training upon body composition in depth.
4. In the present study, there was no consideration of the subjects' social, economic and cultural background. The future researchers may include the stated variables in their investigations in order to broaden the scope of current study.

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