

**Effect of Circuit Training upon Flexibility among Non-Athletes of College Students**

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**Abstract**

Everyone, regardless of age, occupation, or gender, needs to keep up a level of physical fitness that is advantageous to their health if they want to live a long and happy life. Overall health-related physical fitness can be greatly impacted by one's degree of pliability. Examining "The Effect of Circuit Training upon Flexibility among non athletes of College Students" was the focus of this research. Government Post Graduate College students in Karak (Khyber Pakhtunkhwa), Pakistan, who were staying in the college's hostel, participated in the study. Thirty students (n=30) were selected at random to participate in the study by means of the Physical Activity Readiness Questionnaire (PAR-Q). The subjects' degrees of flexibility were measured using the sit and reach test before the intervention as pre-test. Researchers randomly assigned participants to either a group that underwent circuit training or a group that got no treatment. Circuit Training was administered to the experimental group every other day (Monday, Wednesday, and Friday) for a period of twelve weeks, whereas the control group received no treatment and the subjects proceeded with their usual activities. After receiving

treatment, flexibility assessment of the subjects was taken on the basis of procedure that was used to collect pre-test data. descriptive (Minimum, maximum, mean and standard deviation) and inferential statistics (Independent sample t tests and paired sample t-tests) were used to examine the data collected before and after the test, respectively. A significance threshold of 0.05 was chosen. The results of the study showed that flexibility improved significantly among non athletes of college students who participated in Circuit Training. Subjects in the control group did not show substantial increases in flexibility since they were not treated in any way. Since Circuit Training was found to be the most effective strategy for increasing flexibility, it is recommended that people engage in it on a regular basis.

**Keywords:** Circuit Training, flexibility, non athletes, college students

### **Introduction**

Keeping one's body in good shape through frequent exercise is crucial to one's overall well-being. It is a prized possession, and great care has been taken to ensure that its significance permeates every aspect of its owner's life. If you want to live a healthy life and take part in the activities that are part of your daily routine, you need to focus on your physical fitness. This is true regardless of your age, employment, gender, or anything else (Katapally et al., 2016).

Everyone, regardless of age or life situation, knows that staying physically active is crucial. Upholding or improving one's level of physical fitness has been shown to have beneficial effects on health, paving the way for a more dynamic and satisfying way of life. It provides the framework for productive and innovative endeavors (Mondal, Goon & Varghese, 2014). The growth and success of a country are dependent on its citizens' emotional and physical health. Citizens who regularly engage in activities are more prepared for and interested in taking part in those activities. They are more capable of original thought. They are more mentally sharper and physically present and in tune with their body, they are better able to carry out the tasks they have been given each day (Rudkin, 2020). One definition of physical fitness is the capacity to perform the physical demands of one's occupation, one's chosen recreational pursuits, and one's daily life with relative ease (Kokkinos, Giannelou, Manolis&Pittaras, 2009).

There are two main components of physical fitness to consider: skill-based fitness and health-based fitness. Motor performance fitness can also be understood to include general physical fitness related to the acquisition and use of skills. This type of fitness is most common in the

world of sports because of its association with athletic ability (Jarani et al., 2016). Health-related physical fitness got its current moniker because of its relevance to an individual's health in general. The capacity to carry out ordinary everyday tasks without undue fatigue and to avoid the onset of hypokinetic diseases and disorders that diminish a person's physical abilities (Short, 2016).

It is vital to nurture all five components of health-related physical fitness in order to realize one's full potential in terms of their health. Body composition, cardio respiratory endurance, muscular strength, muscular endurance and flexibility are the sections of health-related physical fitness (Ramrez-Vélez, Rodrigues-Bezerra, Correa-Bautista, Izquierdo & Lobelo, 2015). To be flexible is to be able to move your joints, muscles, ligaments, and tendons to their fullest extent without experiencing pain. Flexibility, in its most basic sense, is the degree to which a joint may move (Lins, Lattari, Monteiro, Cid, Neto & Machado, 2020). More than just improving one's ability to perform routine physical duties, flexibility is valuable because it safeguards the joints, which are essential to the body's structural integrity. In sports, flexibility is what allows an athlete to perform a task, no matter how complex it is or how many different body parts must move, with ease and speed. Different people have different degrees of flexibility, and different kinds of flexibility, however it has been shown that having more flexibility overall leads to better performance (Stathokostas, McDonald, Little & Paterson, 2013).

A flexible individual may bend and twist in any direction without straining the soft tissues that surround their joints. Working more efficiently and with fewer injuries aids in overall health. (de Oliveira Medeiros, de Arajo, & de Arajo, 2013) It's beneficial to health. It enhances the effectiveness of other motions, leading to greater productivity in routine activities. It is crucial that this leads to greater acceleration and driving force in movement. The increased force and speed of muscular contractions results in the lowest potential muscle strain and internal resistance during movement. Errors in movement are less likely to occur. It's vital for health, fitness, and performance in all kinds of sports and other physical endeavors (Farinatti, Rubini, Silva & Vanfraechem, 2014).

One of the most accurate ways to measure lumbar flexibility is using the sit-and-reach test. The similar technique may be used to measure the length of the hamstring, the muscle in the rear of the upper leg. One indicator of pliability is the degree to which a certain joint responds to

external stimuli (Lee, Kim, Kim, Lee & Lim, 2019). A box of 30 centimeters in height is built for the sit and reach test. The 23-centimeter mark of the measuring stick is positioned on the edge of the box that is most accessible to the user once it has been attached to the top of the box (the proximal edge). During the test, the box is pressed up against the wall so that any deviation may be easily detected. All shoes must be removed immediately. Don't forget to wrap up your body before the test begins (Diniz et al., 2020). The individual clasps hands with palms facing down and extends both arms equally. Both hands are brought together at the tips of their fingertips, and then dragged as far forward as possible along the scale without jerking. This position must be held for at least two seconds before the individual can resume an upright position. The test is taken three times, and the candidate's highest score is kept. In this case, the value is rounded to the nearest centimeter (Deeminoi&Sripongngam, 2019).

The overall level of adaptability is influenced by a wide range of factors, both internal and external. Some examples of internal factors are joint type, joint resistance, joint temperature, and the pliability of surrounding muscular tissue, ligaments, tendons, and skin. Aspects from the outside include the joints used. Extern factors that can affect flexibility include: (Mosca, 2010). Exercises that include stretching, twisting, bending, and relaxing can help maintain a healthy level of flexibility even if it naturally declines with age (Grabara&Szopa, 2015).

Flexibility is so crucial to athletic success and conditioning programs. Competitive gymnastics and dance both need for a high degree of flexibility from its performers. Preseason evaluation is a major factor in choosing athletes to take part in a wide range of contests, as stated by Batista, Garganta, and Vila-Carvalho (2019). It does this by encouraging bodily motions, which facilitates the development of motor skills and protects against muscular damage. The aforementioned traits are what really make a difference in sports (Gleim& McHugh, 1997). Circuit training is a type of resistance training in which a person performs a sequence of exercises against resistance, such as their own body weight or weight training equipment (Klika& Jordan, 2013). Typically, it involves a series of 10 to fifteen different resistance exercises performed in rapid succession to enhance multiple facets of physical fitness. The routines can be done in a horizontal or vertical orientation. In horizontal training, you finish one set of exercises before moving on to the next. Circuit training routines should be timed and arranged so that different sets of muscles can rest and work at each exercise station in rapid

succession (Nash, van de Ven, van Elk, and Johnson, 2007). Getting your heart rate up requires you to first engage in full-body activities. You can maintain a consistently high heart rate by alternating between upper- and lower-body activities, or vice versa.

The findings of Hamoudat (2008), Ghassab&Oudat (2007), and Al-Rashidi (2006) all indicate to a general deterioration in the physical health and fitness of today's pupils. In Pakistan, and more specifically in the province of Khyber Pakhtunkhwa, there has been a lack of research conducted on the impact of physical exercise on health-related physical fitness, particularly flexibility (KP). Because flexibility is one of the most important aspects of a health-related physical fitness program, we need to determine whether or not circuit training improves flexibility and, if so, to what amount. By employing this approach, the researcher hoped to gain an understanding of the "effects of Circuit Training upon flexibility among non-athletes of college students."

### **Objectives of the study**

- To determine the effects of circuit training upon flexibility among non-athletes of college students (18 to 22 years)
- To suggest a list of recommendations for the enhancement of flexibility among non athletes of college students

### **Delimitations of the study**

- 1) Thirty non-athletes students of GPGC Karak, who were residing in the college hostel, were taken as subjects.
- 2) The ages of the participants ranged from 18 to 22 years old.
- 3) The research was conducted solely on male participants in the study.
- 4) An experimental group and a control group, both consisting of fifteen students apiece, were split up into two separate groups.
- 5) The duration of the Circuit Training program was twelve weeks, with three sessions each week (Monday, Wednesday and Friday).

### **Materials and methods**

#### **Participants of the study**

Subjects, objects, and people who have some connection to the topic being investigated and whose participation is essential to gathering relevant data are referred to collectively as

"participants" in experimental research (Khirikoekkonget al., 2020). GPGC, the district of Karak (Khyber Pakhtunkhwa, Pakistan) was selected for the research. To conduct the research, 142 male students aged 18 to 22 living in the GPGC Karak agreed to take part in the study.

### **Exclusion and exclusion criteria**

The PAR-Q was used to determine eligibility for physical activity. As a diagnostic instrument, the PAR-Q can help find potential problems early on. Before beginning an exercise program, trainers conduct this type of assessment, which consists primarily of closed-ended questions to ensure they are selecting healthy subjects possible (Warburton, Jamnik, Bredin & Gledhill, 2011). 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 randomly each one of fifteen subjects and the groups were experimental group and control group.

### **Research design**

Research design is a plan for the solution of a problem (Jones & Lyons, 2004). This investigation was experimental in nature, incorporating a pre- and post-test design. Each individual in the two groups was given a standardized test (the Sit and Reach Test) to measure their flexibility before receiving treatment of Group A (Experimental) and their pre-test data was recorded. The experimental group underwent Circuit Training three times per week for 12 weeks (on Mondays, Wednesdays, and Fridays). The control group did not get any treatment and was not allowed to engage in any aerobic or anaerobic activity beyond their daily routines. Each subject in both groups A and B was retested on the dependent variable after intervention to the experimental group. Final post-test scores of the subjects of two groups against the dependent variable were recorded.

### **Pilot study**

A pilot research was conducted in order to test the initial capabilities of the individuals and to ensure the suitability, frequency, and duration of each training program (Circuit training). Ten volunteers were chosen at random for this reason, and each of them participated in a Circuit Training session. The performance of ten different subjects was analyzed, and an average was

determined. The average performance of ten subjects was calculated. The protocol of circuit of 12 weeks was designed for the experimental group on the basis of the response of the subjects in the pilot study. During the designing of constructing the training protocol, the researcher made sure to adhere to the fundamental training principles as well.

### **Orientation of subjects**

The gathering of trustworthy information is going to be the focus of the orientation. An introduction class was put together in order to encourage and engage the participants in the various tests and training that were being administered. The researcher gave an explanation as to the significance of the current study, as well as the function that the subjects will play in the investigation. The researcher briefed both groups of participants on the testing technique for the dependent variable, as well as the method of measurement that was expected of them, and provided directions regarding how the procedure should be carried out. In addition to the orientation class, the researcher met with the experimental group three times in order to familiarize the subjects with the methods and procedures involved in the performance of the exercises of the respective training. This was done to ensure that the test subjects would be able to perform the exercises correctly and avoid any potential health injuries. The researcher himself went through each exercise and demonstrated it in front of the subjects of the study.

### **Instrument for collection of data**

The term "instrument" refers to a measuring equipment. An instrument is a tool for the gathering of data in a research project, and researchers employ these instruments (Kola, 2017). There are many different instruments, such as questionnaires, interviews, tests, and so on; the choice of which instrument to use is determined by the type of study being conducted. The purpose of this study was to investigate the effects of Circuit Training on flexibility among non-athletes of college students, the sit and reach test was employed as the criterion measure to collect the relevant data on the dependent variable (Flexibility) in the current study.

### **Test Administration**

Before beginning the test, it was important to complete the warmup. In order to conduct the sit and reach test, a box with a height of thirty centimeters was utilized. The measuring stick was placed on top of the box in such a way that the 23-centimeter mark was located on the side of the

box that was adjacent to the participant. During the test, the box was pressed up against a wall so that there would be no room for movement inside the box. The subject removed his footwear.

The subject brought both hands together, placing one on top of the other with the palms facing down, and then stretched both arms to the same length. He brought the fingertips of both hands together and moved them as far forward along the measuring scale as was possible without jerking them. After maintaining the position for at least two seconds, he then went back to his normal upright position. The measurement was taken to the nearest centimeter. The test was repeated three times and the best score was recorded.

### **Ethical consideration of the study**

As a result of the subjects' decision to take part in the research, it is the researcher's duty to ensure that they are not placed in a precarious circumstance in which they could sustain both bodily and mental harm as a result of their involvement in the project. For this reason, each and every subject was provided with precise information regarding the aim of the study as well as its methodology. The subjects were selected through PAR-Q which ensured that they were free from different diseases. Each subject gave written consent. In a similar fashion, a letter of consent was obtained from the Principal of the institution.

### **Training Protocol**

The subjects who participated in the study that made up group A had to follow a Circuit Training program that lasted for a total of 12 weeks. For the first six weeks of the program, the intensity of the exercise was between 50% and 60% of the participant's Maximum Heart Rate (220-age), and for the final six weeks, the intensity ranged from 60% to 70% of the MHR. Warming up consisted of mild dynamic stretching activities and a walk, while warming down consisted of a walk followed by light stretching exercises while taking deep breaths. Both the beginning (warm up) and ending (warm down) of the training session lasted for a total of 10 minutes each.

A thorough explanation and demonstration of each exercise was provided to the subjects before the beginning of the training session. This ensured that the exercises would be carried out appropriately. After the subjects had completed the warm-up session, they moved on to the Circuit Training exercises, which included the Jumping Jack, Sit ups with straight legs, Heel raising, abdominal crunch, Knee highs, push-ups, Legs raising, Burpees/plank, Light jumping,



and Lunges. These exercises were performed using the interval method, which meant that there was a pause between each exercise. The subjects performed exercises vertically. There were no limits placed on the subjects in terms of the number of repetitions of the exercises; nevertheless, they were required to do the exercises continuously until the conclusion of the allotted period while remaining in the appropriate heart rate zone. At the sound of the whistle, the subjects began the exercise that had been assigned to their individual location. When the allotted amount of time for the activity had passed, the researcher blew the whistle, and the participants were instructed to move on to the next station in the clockwise direction. Additionally, there was respite in between each set.

**Statistical analyses**

**Section A. (Descriptive analyses)**

**Table 1. Anthropometrics/demographic 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)****Matching process****Table 2. Comparison between age, height and weight measurements of Experimental group and Control group before treatment**

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
	Control Group	15	169.27	4.95	1.28			
Weight (kg)	Experimental Group	15	65.53	8.39	2.17	28	.472	.641
	Control Group	15	64.33	5.164	1.33			

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 3. Showing difference between flexibility of Experimental group and Control group before treatment**

Variable	Groups	N	Mean	Std.Dev	Std. Error Mean	df	T	Sig.
Flexibility (cm) pre-test	Experimental Group	15	5.40	2.23	.57	28	.070	.944
	Control Group	15	5.33	2.92	.75			

The table indicates that there is no significant difference ( $.944 > \alpha = 0.05$ ) in flexibility between experimental group ( $M=5.40 \pm 2.23$ ) and control group ( $M=5.33 \pm 2.92$ ) before the treatment (circuit training).

### Comparison section

**Table 4. Pre-test and post-test comparison of flexibility of each group (Experimental group and Control group)**

Groups	Variable	N	Mean	Std. Dev	Mean. diff	Df	Sig.
Experimental Group	Flexibility (cm) pre-test	15	5.40	2.23	5.20	14	.000
	Flexibility (cm) pos-test		10.60	1.92			
Control Group	Flexibility (cm) pre-test	15	5.33	2.92	.06	14	.719
	Flexibility (cm) post-test		5.27	2.52			

The table demonstrates that there is a significant difference ( $.000 = 0.05$ ) in the flexibility of the experimental group between the pre-test and the post-test (5.40 cm 10.60 cm, Improvement= 5.20 cm), whereas there is no significant difference ( $.719 > 0.05$ ) in the flexibility of the control group between the pre-test and the post-test (5.33 cm > 5.27 cm, Improvement= -0.06 cm). This is because the experimental group underwent circuit training.

**Table 5. Post-test comparison of flexibility between experimental group and control group**

Variable	Groups	N	Mean	Std. Dev	Std. Error	Df	t	Sig
Flexibility (cm) post-test	Experimental Group	15	10.60	1.92	.496	28	6.520	.000
	Control Group	15	5.27	2.52	.65			

The table shows that there is significant difference ( $.000 < \alpha = 0.05$ ) between the post test in flexibility of experimental group and control group i.e. the treatment of circuit training has significant effects on flexibility.

### **Discussion**

The outcomes of this study lend credence to the conclusions of a study that was conducted by Al-Haliq (2015) to investigate the benefits of Circuit Training on promoting the physical fitness components among the university students in Hashimit. Participants in the aforementioned research study were given the intervention of Circuit Training for a period of eight weeks, twice per week, during the entirety of the study. The outcomes of the study made it clearly clear that involvement in Circuit Training increased numerous areas of physical fitness among the students attending the Hashemite College. Circuit Training was included in the study as a intervention made by Kim, Ko, Seo, and Kim (2018) who investigated the effects that Circuit Training had on participants' levels of flexibility. Despite the fact that overweight female students were chosen as subjects for the study yety those students' flexibility improved after participating in the Circuit Training. Because of this, the findings of the current study support the findings of the previously mentioned study with regard to the growth of flexibility, which is one of the most important aspects of health-related physical fitness.

### **Finding of the study**

In view of the research that had been done, it was expected that non athletes of college students (18-22 years) would benefit significantly from participating in circuit training in order to increase their flexibility, Following the completion of the data analysis, it was discovered that Circuit Training has substantial effects on flexibility ( $P < 0.05$ ); hence, the hypothesis H1 is now considered to be correct.

### **Conclusion**

The main focus of the study was to investigate effect of Circuit training on flexibility among non-athletes of college students (18-22 years). The findings of the data analysis revealed that non athletes of college students between the ages of 18 and 22 who participated in Circuit Training for a period of 12 weeks reported significant increases in their flexibility when compared to the control group.

## Recommendations

Since the researcher observed in the most recent study that non-athletes college students' flexibility can be improved through the use of Circuit Training activities, it is possible that these program could be included to the college students' regular working schedule. Because of this, it is recommended to the government that a curriculum may be established for the non athletes of college students with selected exercise in order to enhance flexibility in a better method, which is an essential component of health related physical fitness.

It is possible for multiple students to participate in Circuit Training at the same time. To improve students' flexibility, which is the foundation of health-related physical fitness, it is suggested that the government should consider for implementing a comprehensive program of circuit training in educational institutions. Because the exercises of circuit training can be done without any apparatus or equipment, these can be initiated during working hours by government and non-government organizations for the purpose of enhancing flexibility among employees, which is the primary component of health-related physical fitness. The activities that are performed during circuit training are a simple kind of exercise, and it is possible that these exercises might be recommended to the general population in order to improve their level of flexibility.

Strong citizens are an advantage to any nation because they are able to contribute more effectively to the expansion and development of their own nation. This makes strong citizens an asset to any nation. It is recommended that the government make areas for engaging in physical activities both indoors and outdoors available to the general public, as this would pave the way for inhabitants to become more physically fit. This may be accomplished by making the spaces open to the public. Circuit training activities are recommended to be included in training regimens by sports trainers and physical trainers for the goal of enhancing the flexibility of their athletes and trainees. Flexibility is one of the most essential components of skill-related physical fitness, and health-related physical fitness is the bedrock upon which skill-related physical fitness is built.

### **The implications for future researchers**

1. The researcher looked into the effects that doing Circuit Training has on a person's flexibility when they are non athletes of college student. It is possible that future researchers will broaden the scope of the investigations to include students from universities and schools.
2. The participants in this study were all non athletes of college students with ages ranging from 18 to 22. In the future, the researchers might take kids from a variety of age groups to participate in similar investigations.
3. For this particular research study, only male students participated as research subjects. In the future, comparable studies might also be conducted on female students who are either the same age or a different age than the participants in the current study.
4. The researcher used circuit training as an independent variable in the present study. In the future, the researchers may include other methods of training as independent variables in order to determine the effects that each training style has on flexibility.
5. In the current study, flexibility 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. The period of time that participants underwent Circuit Training in this study was twelve weeks, and they participated in three sessions each week on alternating days. The effects of Circuit Training on flexibility may be investigated in the future by researchers using training protocols with varying intensities, frequencies, and times.

### **Limitations and future directions**

1. The current study did not attempt to account for the subjects' psychological variables, eating habits, or lifestyle choices in any way. The upcoming research might be expanded to include the elements that were mentioned in order to improve upon the level of comprehension that is already held.
2. The climatic circumstances, such as humidity, atmospheric temperature, and so on, were not taken into consideration at any point. It is possible that the future researcher would find it

interesting to take into account the weather condition, since this would be beneficial in gaining a better knowledge of the occurrences.

3. The disparities in hereditary makeup were not taken into account in this investigation. In the future, researchers may choose to focus their findings on highlighting the impacts of Circuit Training upon flexibility to a greater depth by taking into consideration the hereditary differences.

4. The social, economic, and cultural backgrounds of the participants in this study were not taken into consideration at any point. In order to widen the scope of the current study, potential future researchers can consider incorporating the aforementioned variables into their own researches.