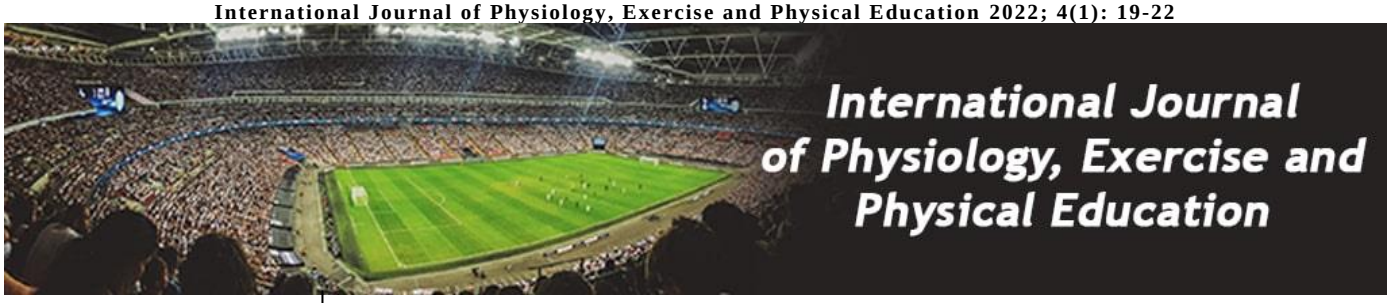

ISSN Print: 2664-7249
ISSN Online: 2664-7257
IJPEPE 2022; 4(1): 19-22
www.physicaleducationjournals.com
Received: 06-02-2022
Accepted: 09-03-2022

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Effect of a circuit training program on selected physical fitness components of female students in the case of Mekdela Amba University freshman students

Biniyam Gebreabe Abebe and Getasew Gashaw Molla

Abstract
Objectives: The purpose of this study is to determine the effect of a circuit training program on selected physical fitness components of female students. To achieve the objective of the study, a purposive sampling technique was used to select thirty participants from 325 freshman female students of Mekdela Amba University, aged between 18 to 20. The research design was an informal experimental with pre-post control group design.
Methods: All participants were evaluated using the sit-up test, Illinois test, and 30-meter dash test. The collected data were analyzed by using paired sample t-test by using SPSS software with a pair-wise comparison of means at a 95% confidence interval was performed. To determine the difference between pre-and post-training mean values after 12 weeks of continuous training. Results. Significant improvements in each selected physical fitness component were found. 3.53 mean differences were registered by sit-up test, from 30-meter dash test of speed was improved by 0.83sec after12 weeks of exercise. The mean difference value in the agility test was decreased by -3.07, The result indicates that an effective change was observed in participants' agility performance. The result obtained in this study indicates that there was a significant improvement in all selected physical fitness components.
Conclusions: The main finding of the study showed that the effect of circuit training program has a positive effect on the improvement in physical fitness components of female students.

Keywords: Circuit, strength, agility and speed

1. Introduction
Circuit training is a form of conditioning combining resistance training and high-intensity aerobics. It is designed to be easy to follow and target strength building as well as muscular endurance. An exercise "circuit" is one completion of all prescribed exercises in the program [1] Circuit training is a significant way to improve mobility, strength, and stamina. The circuit training comprises 6 to 10 strength exercises that are completed one exercise after another. Each exercise is performed for a specified number of repetitions or for a set time before moving on to the next exercise [2, 4]. The exercises within each circuit are separated by a short rest period, and each circuit is separated by a longer rest period. The total number of circuits performed during a training session may vary from two to six depending on your training level (beginner, intermediate, or advanced), your period of training (preparation or competition), and your training objective [1, 5].
The main problem related to physical fitness is its expected decrease after a period of detraining. Several authors confirm that after 8 to 12 weeks of detraining, children lose a significant part of the physical fitness gains. A possible solution for this problem could be the periodical introduction of short maintenance programs throughout the academic course. During these intervals, physical education teachers will be able to develop other curricular content and at the same time, they could be improving the previous physical fitness gains [4, 6]. Educational areas are mainly attempting to increase the pupils' health level by using measures such as the improvement of their physical fitness through physical activity. It has been concluded that health promotion policies and physical activity programs should be designed to improve physical fitness [7, 8]. The circuit training effectively reduces the time devoted to training while allowing an adequate training volume to be achieved moreover; it permits a greater motor engagement time. This methodology has multilevel effects on fitness, especially for beginners.

The effect of selected circuit training on muscular strength, flexibility, and muscular endurance is essential. Many studies analyzed about effects of the circuit training program. However, there was not enough research that studied the effects of selected circuit exercises in improving muscular strength, muscular endurance, and flexibility at university level students and here in our country. A study on the effects of a circuit training program on muscular and cardiovascular endurance [8]. The purpose of this study is only to evaluate the effects of a circuit training program along with a maintenance program on muscular and cardiovascular endurance in children in a physical education setting. This study was not examined muscular strength and flexibility.

Another study was done on the effects of a circuit training program on muscle strength, agility, anaerobic performance, and cardiovascular endurance [9] but, this study does not examine muscular endurance and flexibility. The study aimed to examine the effects of a circuit training program on muscle strength, agility, anaerobic performance, and cardiovascular endurance.

The above research analysis works are not examining the impact of chosen circuit coaching on a mix of muscular strength, speed, and agility. And its not well known that the chosen circuit training exercise is best in transferal enhancements in physical fitness components. Thus, this analysis was conducted to fill this gap. The final objective of this study was to judge the impact of circuit training on the chosen physical fitness of Mekdela Amba University female freshman students.

Therefore, the present study tried to look at the presence of a statistically vital distinction between the experimental and management teams' relevance in speed coaching, muscular strength, and agility coaching. To be an effective and productive practice, freshman students are required to be fit and active physically and mentally. If that is so, circuit training exercises are a method, and smart interventions to enhance the condition quality of muscular strength, speed, and agility are very necessary [9]. Thus,this study helped us to identify whether or not the chosen circuit training on the development of aerobic fitness, muscular strength, agility, and speed or not. It's a motivating topic for exercise scientists, education lecturers, coaches, athletes, exercise physiologists, and different specialists in sports and exercise science. This study was expected to put down the idea for future investigation during this space. The above research analysis works are not examining the impact of chosen circuit coaching on a mix of muscular strength, speed, and agility. And its not well known that the chosen circuit training exercise is best in transferal enhancements in physical fitness components. Thus, this analysis was conducted to fill this gap. The final objective of this study was to judge the impact of circuit training on the chosen physical fitness of Mekdela Amba University female freshman students.

2. Methods

Thirty female students (age 18-20 years) from 325 fresh female students participated in this study. Subjects who fulfilled the health history questionnaire and whole females aged 18-20 depending on their interests were included in this study. The subjects who had a recent injury, chronic disease, and other medical restrictions by a physician and whose age is <17 were not part of this study.

Data were obtained from thirty-six training sessions that passed between March and July. Measurements were collected throughout the student's regular training routine. To avoid inconsistencies, warm-up, injury prevention, and recovering exercises were excluded from the info set. Therefore, information from the pre-test and post-test were enclosed for the analysis as follows: the first information was collected from the experimental study cluster through the Pre-Test and post tests on the physical fitness test. Tests were chosen as information assortment instruments choosing physical fitness ability parameters. The secondary information was collected from totally different written materials like journals, previous researches, materials, revealed books, and alternative documented materials.

3. Statistical analysis

Means and standard deviations (M+SD) were calculated for each parameter. The collected data were analyzed using descriptive statistics and inferential statistics. Descriptive statistics involves; mean, standard deviation, frequency distribution, and graphics of meaningful ideas using SPSS Version 20 software to the selected physical fitness observed in the participants. Inferential statistics including paired t-tests were used to observe within-group differences from pre-test to post-test results for both experimental and control groups. To justify the normality of the data under consideration, the results of the study were analyzed by an independent sample t-test to compare the selected physical fitness variables between the control group and the experimental group. The level of significance was 0.05.

4. Results

The result of 12 weeks of circuit training-based sit-up test of pretest and posttest mean was 11.66 and 15.2 repetitions per 30 seconds. This shows that there was a significant difference in pretest and posttest sit-up tests with 12 weeks of circuit training on muscular strength.

The finding of pretest and posttest of the 30-meter dash, 12 weeks of circuit training on the performance speed was observed with significant changes. This study shows that the best performance was observed during 12 weeks of circuit training on the performance in 30-meter dash of PRT and POT mean difference(5.15767 -5.96) in which the mean difference was -0.8023 seconds. A significant difference was observed in the pre-test and post-test of the 12-week circuit training Illinois test. This study shows that the results pretest and post were 21.35167 sec and 18.2813 sec, in which the mean difference was -3.0703 sec

5. Discussion of findings

Female students' muscular strength after 12 weeks of circuit training was a significant difference between the pre to post-test scores. The mean score value for the sit-up test before the exercise training program was 11.66 and after training the mean score value was 15.2. When we compare the mean value before the training test with the mean score values after 12 weeks of the exercise training program, where the mean difference value increased by 3.53. This result indicated the effective change was the participant's muscular strength level. The maximum number of sit-ups done within 30 seconds was taken as her score. Depending on the results agreeing with the idea of "Circuit training appears to have multiple benefits on health and fitness, as various studies have shown that it may elicit significant

increases in aerobic capacity, and muscular strength, muscular endurance, lean body weight, and significant decreases in resting diastolic blood pressure and body fat [10]

Table 1: Mean values of sit-up (number) for 12 weeks of circuit training for Mekdela Amba University freshman students

Dependent variable	PRT	POT
SIT UP	11.67±2.324	15.2±2.417

Values are mean ± SD, PRT = pre-training test which was taken before circuit training, and POT=post-test which was taken after 12 weeks of circuit training.

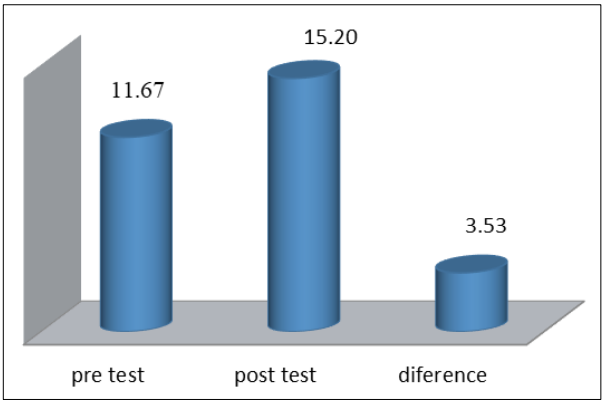

Fig 1: Mean values and significant levels of sit-up test

Table 2: Mean values of speed for 12 weeks of circuit training

Dependent variable	PRT	POT
30 meter dash	5.960±0.44394	5.167667±0.470

Values are mean ± SD, PRT = pre-training test which was taken before circuit training, and POT post-test which was taken after 12 weeks of circuit training.

Female students' speed pre-and post-test scores on the 30-meter dash test mean value was 5.96 and 5.16 respectively. When we compare the performance of an individual before training and after training, the difference is -0.8023. Therefore, according to [11] "the effect of circuit training directed to motion and action velocity over the sprint agility and anaerobic endurance". From this result, it is possible to conclude that a training program has positive effects on the speed of performance

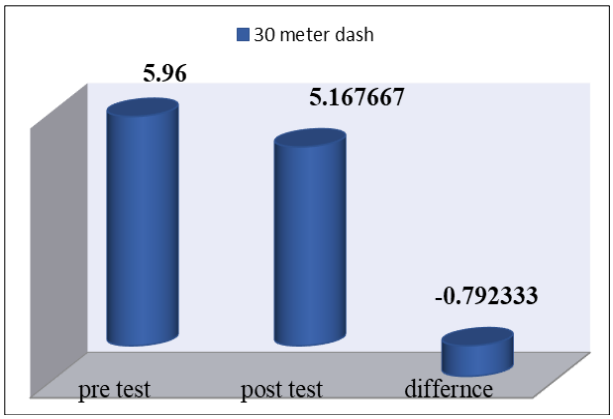

Fig 2: Mean values of speed for 12 weeks of circuit training

Table 3: Mean values of Illinois (second) for 12 weeks of circuit training

Dependent variable	PT	POT
Illinois	21.351667±1.2241453	18.174667±0.9158442

Values are mean ± SD, PT = pre-training test which was taken before circuit training, and POT=post-test which was taken after 12 weeks of circuit training

The effect of circuit training on agility before and after training was 21.35167, 18.2813 sec,respectively. Difference= -3.0703. The mean difference in this regard, the negative mean difference value shows that the time to cover a given distance has been decreased. This result indicated the effective change was observed on motion and action velocity over the sprint agility and anaerobic endurance. Therefore, According to [11] conducted a study to determine "the effect of circuit training is directed.

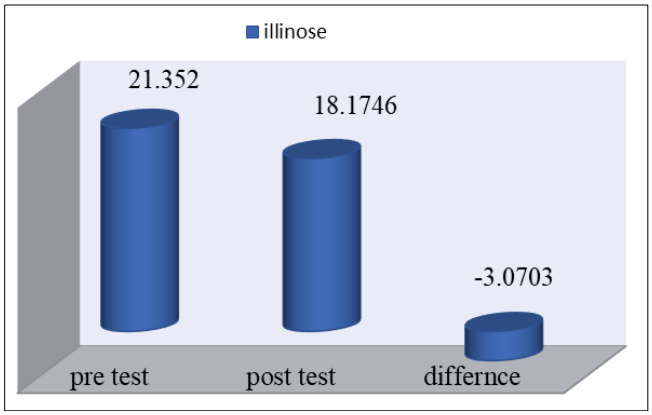

Fig 3: Mean values and significant levels of Illinois test

6. Data Availability

The data used to support the findings of this study are included in the article.

7. Disclosure

No funder support was involved in the manuscript writing, editing, approval, or decision to publish.

8. Conflict of Interest

The author(s) declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article. The authors declare that they have no conflicts of interest.

9. Acknowledgments

All authors would like to thank Mekdela Amba University of freshman students, common course college, and sport science department. They helped us in the data collection and contributed to this study.

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