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Effect of Circuit Training on Selected Physical Fitness Components in Middle School Students in Baghdad

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Abstract: The major goal of this study was to determine the effects of implementing circuit training on selecting physical fitness components of intermediate school students in Baghdad, Iraq. This study used a quantitative research type and an experimental design. A total of 60 students (15 years old) were randomly chosen as a sample for this study. 30 students were assigned as the experimental group, while the other 30 students were considered as the control group. Circuit training was given to the experimental group, while the control group received no practice of circuit training. The circuit training program includes two sessions per week, each session lasting for 40 min, 12 weeks: 30-meter acceleration test, muscular endurance (sit-and-reach test), muscular endurance (sit-up test), lower body strength (standing long jump), and upper body strength (push-up test). The data in this study were analyzed using SPSS Version 26 software by paired and independent sample t-tests with a significance level of 0.05. The tests were applied two times during pre- and post-test training. In this study, the circuit exercises were performed with orientations, instructions, and supervision by the researcher and the school's physical education teacher. The results indicated that after the twelve weeks' circuit training program, all physical fitness selected significantly improved in the experimental group ($p < 0.05$), while there was no change or improvement in the control group. According to the results, it could be assumed that twelve weeks of circuit training had a significant effect on the improvement of the selective physical fitness components. These results could help physical education teachers design circuit training programs that help school students develop their physical fitness.

Keywords: physical education lesson, circuit training, physical fitness components.

循环训练对巴格达中学生体能选择的影响

摘要: 本研究的主要目标是确定实施循环训练对伊拉克巴格达中学生身体素质选择的影响。本研究采用定量研究类型和实验设计。随机抽取 60 名学生（15 岁）作为本次研究的样本。30 名学生被指定为实验组，另外 30 名学生被视为对照组。实验组进行循环训练，对照组不进行循环训练。循环训练计划包括每周两次，每次持续 40 分钟，持续 12 周：30 米加速测试、肌肉耐力（坐姿前伸测试）、肌肉耐力（仰卧起坐测试）、下半身力量（ 立定跳远）和上身力量（俯卧撑测试）。本研究的数据采用统计软件 26 版软件通过配对和独立样本 t 检验进行分析，显着性水平为 0.05。在测试前和测试后培训期间进行了两次测试。在这项研究

中，循环练习是在研究人员和学校体育老师的指导、指导和监督下进行的。结果表明，经过 12 周的循环训练计划，实验组所有选择的身体素质均显着改善（p < 0.05），而对照组则没有变化或改善。根据结果，可以认为十二周的循环训练对选择性体能成分的改善有显着效果。这些结果可以帮助体育教师设计循环训练计划，帮助学生发展身体素质。

关键词：体育课、循环训练、体能训练等组成部分。

1. Introduction

A quality physical education program helps to ensure better development of students' health and fitness, and this depends on how the physical education program is implemented inside schools. Good implementation of a physical education program leads to better student health and fitness. The need for quality physical education is clear, based on the current trends of obesity and physical inactivity among children and adolescents [2]. Quality physical education programs are needed to increase physical competence, health-related fitness, self-responsibility, and enjoyment of physical activity for all students so that they can be physically active for a lifetime. Physical education programs can only provide these benefits if they are well planned and implemented [3].

Physical education or any other academic subject in the schedule should be taught with a new strategy that brings satisfaction to students and should increase students' engagement during the physical education period. 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 and muscular endurance. An exercise "circuit" is one completion of all prescribed exercises in the program [4].

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 after another. Each exercise is performed for a specified number of repetitions or for a set time before moving on to the next exercise [5]. Each exercise is performed in a circuit training workout one after another with little to no rest in between exercises. Usually, there will be 8-10 exercises in a circuit; although this number can vary depending on how much time you have [6].

It could be assumed that circuit training is popular because it is the most time-efficient way to perform a full workout. Circuit training has many benefits for individuals and could be simplified as follows: develops strength and endurance, appropriate form of training for most sports, can be adjusted to suit the age, fitness, and health of athletes, exercises are simple enough to make each athlete feel achievement in completing them, and various exercises to select, from which the athletes' enthusiasm will maintain [7].

[8] mentioned that according to the instructions of the Ministry of Education, all students should participate actively in physical education classes in school. Through physical education classes, students are given opportunities to express their emotions, develop their mental processes, foster healthy relationships, and conduct physical activities in a safe, conducive environment [8]. This study aimed to examine the presence of a statistically significant difference between the experimental and control groups with respect to speed, flexibility, muscular endurance, and muscular strength in the lower and upper body. To be effective and productive, school students need to be fit and good performers physically and mentally. If that is so, circuit training exercise will be a suitable means and an excellent intervention to improve the physical fitness qualities of the above physical fitness components.

1.1. Objective of This Study

The first objective of this study was to determine the effects of circuit training on selected physical fitness components of intermediate school students in Baghdad.

2. Methodology

2.1. Study Design

This research was a quasi-experimental study designed for 12 weeks to implement suggested circuit training exercises on selected physical fitness components of the third-year intermediate school students in Baghdad, Iraq. In this study, all 60 students were considered as a sample that was randomly selected. Among 60 students, 30 of them were experimental group while the other 30 students were considered as the control group. The age group of the sample was 15 years old. The circuit training exercises were given to the experimental group for 12 weeks (2 days per week). The circuit training program was scheduled for the participants, and the circuit exercise training was given by the researcher and his assistants. The control group performed the traditional training designed for the physical education lesson for this study. Tests were taken two times during pre- and post-training for both the control and experimental groups.

Table 1 Examples of repetition circuit exercises (Adopted from [1])

Day	Time (minutes)	Exercise	Repetitions	Rest	No. of the circuits	Intensity	Rest
		Squat Jumps	10-15	1 min.			
		Push up	10-15	1 min.			
		High Knee	15-20	1 min.			
		Bench Dips	10-15	1 min.			
Monday	40	Jump Rope	60 seconds	1 min.			3 min.
		Sit up	5	1 min.	3	High	
		Walking Lunges	20	1 min.			
		Twist Crunches	20	1 min.			
		Jumping Jacks	20	1 min.			
		Push up	20	1 min.			
Thursday	40	Bench Dips	20	1 min.			3 min.
		Squat Jumps	20	1 min.	3	High	

2.2. Methods of Collecting the Data

This study was conducted on 60 intermediate school male students in Baghdad. The quantitative research method was used to implement this study. The quantitative data for this study were collected through appropriate physical fitness tests. The sample for this study was divided into two groups: 30 in the experimental group and 30 in the control group. In this study, students with health condition problems that would contribute to circuit training exercises and physical fitness tests were not included. The variables of this study were speed, flexibility, endurance, and strength for the lower and upper body. The data from the pre- and post-tests were recorded by three qualified and trained members. The dependent variables in this study were speed, flexibility, muscular endurance, and upper and lower body strength.

Table 2 The study design layout

Treatment	Circuit exercises
Frequency	2 days per week
Total duration time	12 weeks
The training duration	40 min
Intensity of the exercises	Low to high
Time of the training	Morning

Variables of the study

Dependent variables			**Independent variable**
No.	**Physical fitness components**	**Measuring Unit**	Circuit training
1	Muscular endurance	Repetition	
2	Upper body muscular strength	Repetition	
3	Speed	Seconds	
4	Lower body muscular strength	Meters	
5	Flexibility	Centimeters	

To collect data from the experimental and control groups of this study, the researcher used standard fitness and technical skills test instruments. These instruments are one-minute bent-knee sit-up, 1-min push-up, sit-and-reach, standing long jump, and 30-meter sprint test for speed. Before the experimental group went to implement the circuit training exercises, the pre-tests were taken from both the control and experimental groups. Then, the twelve weeks' circuit training was completed, and a post-test was also taken from the experimental and control groups. The students were familiarized with all physical fitness test procedures at the beginning of the study.

2.3. Data Collection Procedures

Physical fitness tests are commonly used by researchers to evaluate performance strengths and weaknesses relative to sport and physical activities to monitor the effectiveness of training and provide short-term fitness goals [9].

2.3.1. 30-meter speed test

The objective of this test is to monitor the development of the students' ability in this test by comparing the results of pre- and post-test results to analyze the improvement in the two test results. Before implementing the test, a subject should perform a short warm-up. Students will have three attempts with approximately a 2-5-minute recovery period, and the best time will be considered.

2.3.2. Sit-and-Reach Test

Before implementing the test, the student should perform a short warm-up. This test measures the flexibility of the lower back and hamstring muscles [10]. Samples should do some practice on this test. After the practice, a student reaches out and holds that position for one-two seconds while the distance is

recorded by the team assistant. Three trials were given to the subject, and the highest was a record.

2.3.3. Sit-Up Test

The sit-up test was found to be inexpensive, safe, and appropriate for core muscle endurance measurement for both males and females [11]. Before implementing the test, the student should perform a short warm-up. The sit-up test provides a good estimation of torso strength. The test is relatively easy and can therefore be done at home. A student should tighten his muscles and slowly sit up. His hands should touch the top of his knees. Then, the sample should lie back in his starting position and repeat the exercise. The number of repeats within one minute is recorded.

2.3.4. Standing Long Jump Test

It is common and easy to administer tests of explosive leg power. A short warming-up time was given to the students who performed the test. Three trials were given to the subjects, and the highest was a record.

2.3.5. Muscular Strength and Push-Up Tests

The purpose of this test is to measure upper body strength and explosive power (arm, shoulder, and chest muscles) to monitor progress during strength and physical fitness training. Students should do some practice and warm-up before implementing this test. The number of correct push-ups the student can perform in one minute is recorded.

2.4. Data Analyzed

In this study**,** the quantitative data were used to collect fitness and skill tests before and after the implementation of circuit training exercises. The data were recorded from the pre- and post-test results. A 0.05 level of confidence was fixed to test the level of significance that was considered appropriate. Besides, the mean, standard deviation, and t-test were used to summarize and describe the findings. The researcher used the statistical software package SPSS Version 26 for data analysis.

3. Results

The selected physical fitness tests in this study included 30-m speed, sit-and-reach, sit-up, standing long jump, and push-up. Tables with the analyzed data are displayed before and after 12 weeks of circuit training exercises. As has been stated before, the purpose of this study was to determine the effect of a circuit training program on selected physical fitness components.

3.1. Background of the Study Participants

Table 4 shows the students characteristics of this study in terms of age, height, and weight. Data presented in this table show that the students were nearly identical in terms of age, height, and weight at the start of the training. The descriptive statistics (mean and standard deviation) of the data obtained from the pre- and post-test of the experimental and control groups were computed using SPSS software 26 to determine the significant effect of circuit training on selected physical fitness components.

Table 4 Demographic characteristics of the participants

Group	Number of students	Sex	Age	Height	Weight
		Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Experimental Group	30	Male	15.00 ± 0.000	1.56 ± 0.06	49.6 ± 3.85
Control Group	30	Male	15.00 ± 0.000	1.57 ± 0.03	49.6 ± 2.70

Note: SD - standard deviation

Table 5 presents the analyzed data of the physical fitness components of the experimental and control groups for the pre- and post-test results before and after the circuit training exercises. The mean value and standard division of all physical fitness components mentioned in this table for the experimental pre-test changed and significantly increased in the post-test after 12 weeks of the circuit training program. However, the mean value and standard deviation of the control group remained very close from the pre- to post-test of all physical fitness components (muscular endurance, upper body muscular strength, lower body muscular strength, flexibility, and speed).

Table 5 Descriptive statistics of physical fitness components

Group				
Experimental group (30) (Mean ± SD)			Control group (30) (Mean ± SD)	
Physical fitness	Pre-test	Post-test	Pre-test	Post-test
Muscular Endurance	35.56 ± 7.78	45.2 ± 7.82	36.9 ± 6.86	37.4 ± 6.71
Upper body Muscular Strength	19.6 ± 4.21	28.83 ± 5.63	20.03 ± 6.41	21 ± 6.38
Lower Body Muscular Strength	1.5 ± 0.09	1.70 ± 0.09	17.87 ± 48.73	6.66 ± 26.98
Flexibility	27.7 ± 6.55	35.77 ± 5.98	30.7 ± 5.44	31.14 ± 5.58
Speed	5.06 ± 0.26	4.28 ± 0.23	5.05 ± 0.42	5.01 ± 0.41

Table 5 shows noticeable mean differences between the pre- and post-test of the experimental and control groups. However, it is impossible to state whether these differences were statistically significant. Therefore, a

paired dependent sample t-test was applied to determine whether the pre- and post-test scores differed statistically. Table 6 shows the test of significance between the experimental and control groups.

Table 6 Paired t-test results for physical fitness components in the two groups in the pre- and post-test

Physical fitness	Group	MD	T	DF	Sig. (2-tailed)
Muscular Endurance	Exp. pre-post	9.6400	4.7866	58	0.0001
	Con. pre-post	0.5	0.2854	58	0.7764
Upper Body Muscular Strength	Exp. pre-post	9.23	7.1913	58	0.0001
	Con. pre-post	7.1913	0.5875	58	0.5592
Lower Body Muscular Strength	Exp. pre-post	0.2000	8.6066	58	0.0001
	Con. pre-post	11.2100	1.1023	58	0.2749
Flexibility	Exp. pre-post	8.0700	4.9837	58	0.0001
	Con. pre-post	0.4400	0.3093	58	0.7582
Speed	Exp. pre-post	0.7800	12.3073	58	0.0001
	Con. pre-post	0.0400	0.3733	58	0.7103

Notes: Exp. - experimental group, Con. - control group, MD - mean differences between the pre- and post-test, T - calculated differences, DF - degree of freedom

Table 6 shows the results of the test of significant differences in the pre- and post-test of muscular endurance between the experimental and control groups. After 12 weeks of circuit training exercises, the students' performances in muscular endurance improved (MD = 9.6400, T = 4.7866, DF = 58, p = 0.0001). These results suggest a significant development in the experimental group, following circuit training exercises. However, no significant change was seen in the control group (MD = 0.5, T = 0.2854, DF = 58, p = 0.7764), which means that no significant differences were seen between the pre- and post-test of the control group.

Table 6 also shows the test results of upper body muscular strength of the experimental and control groups. There were significant differences between the pre- and post-test of the experimental group (MD = 9.23, T = 7.1913, DF = 58, p = 0.0001). These results suggest a statistically significant change in the experimental group. On the other hand, there were no significant differences between the pre- and post-test in the control group with respect to upper body muscular strength.

Table 6 presents the lower body muscular strength test results of the experimental and control groups. According to the results (MD = 0.2000, T = 8.6066, p = 0.0001), there was a statistically significant development in the experimental group between the pre- and post-test with respect to lower body muscular strength. No significant differences were observed in the control group between the pre- and post-test with respect to lower body muscular strength.

Table 6 shows the test of significant differences in flexibility results between the experimental and control groups. According to the results in the table, there was a statistically significant difference in the experimental group between the pre- and post-test of flexibility (MD = 8.0700, T = 4.9837, DF = 58, p = 0.0001). According to this result, $p < 0.05$ indicates a significant effect in the case of EG after 12 weeks of the circuit training exercises. On the other hand, there were no significant differences between the pre- and post-test of the control group with respect to flexibility.

Table 6 presents significant differences in the speed pre- and post-test results between the experimental and control groups. The results of speed show a statistically significant difference in the experimental group after exposure to circuit training exercises for 12 weeks. The experimental group significantly improved speed performance (MD = 0.7800, T = 12.3073, DF = 58, p = 0.0001). This result indicated that the students reduced the time to cover the 30-m sprint. However, no significant change in control group's speed was observed between pretest and post-test (MD = 0.0400, T = 0.3733, DF = 58, p = 0.7103). In the control group, $p > 0.05$ means that no significant change was noticed between the pre- and post-test.

4. Discussion

The major goal of this study was to evaluate the effect of circuit training exercises on selected physical fitness components of middle school students in Baghdad. The experimental group took part in the 12-week circuit training program, whereas the control group did not take part in it. Before the beginning of the study, the researcher explained the procedure and guidelines on how to implement the circuit training program.

The result reveals that school students in the experimental group significantly increased muscular endurance performance as seen by the paired t-test results ($p = 0.0001$, $p < 0.05$). On the other hand, the results of the control group show no significant improvement in muscular endurance performance between the pre- and post-test results ($p = 0.7764$, $p < 0.05$). The results also revealed that school students in the experimental group significantly increased upper body muscular strength performance as seen by the paired t-test results ($p = 0.0001$, $p < 0.05$). However, the results of the control group showed no significant improvement between the pre- and post-test results ($p = 0.5592$, $p < 0.05$). The results show that the school

students in the experimental group significantly increased lower body muscular strength performance as seen by the paired t-test results ($p = 0.0001$, $p < 0.05$). However, the results of the pre-test and post-test of the control group revealed no significant increase in the lower body muscular strength performance as seen by paired t-test results ($p = 0.2749$, $p < 0.05$). According to the study findings, the experimental group significantly increased flexibility performance between the pre- and post-test results ($p = 0.0001$, $p < 0.05$). No significant increase in flexibility was observed in the pre- and post-test of the control group, as seen by the paired t-test results ($p = 0.7582$, $p < 0.05$). The result reveals that school students in the experimental group significantly increased speed performance, as seen by the paired t-test results ($p = 0.0001$, $p < 0.05$). On the other hand, the results of the control group showed no significant improvement in speed between the pre- and post-test results ($p = 0.7103$, $p < 0.05$).

The results of this study are consistent with [5]; the results of the study indicated that circuit training has a statistically significant effect on muscular strength, muscular endurance, and flexibility of the study sample. The results of the current study are also supported by [12], who suggested that circuit training for 12 weeks may be effective in improving physical fitness and preventing metabolic diseases. This study is consistent with [13]. The results of the study found statistically significant differences in muscular endurance, flexibility, and cardiopulmonary endurance in swimming groups tested for the differences within groups.

[14] reached the same results as this study. They mentioned that the circuit training program was effective in increasing and maintaining both muscular and cardiovascular endurance among schoolchildren. Some other previous studies also associated with the results of this study, in which children performed an extra-curricular circuit training program confirmed a significant improvement in both muscular and cardiorespiratory fitness [15].

5. Conclusions

According to the results of this study, it could be concluded that the physical fitness components of the control group showed significant improvement in the studied physical fitness variables, namely speed, flexibility, endurance, and strength for the lower and upper body, when compared with the control group. These results showed that circuit training exercises can improve the physical fitness variables of school students. Accordingly, it could be assumed that 12 weeks of a well-designed circuit training program can enhance students' physical fitness and performance during physical education lessons. Therefore, physical education teachers should consider including circuit training exercises in their physical education lessons to develop students' abilities and enhance their physical fitness. Circuit training is highly recommended for developing fitness as it involves performing a huge number of exercises on different parts of the body at the same time with little rest. Therefore, within a very short time, an individual can increase their overall strength, lose weight, and gain muscle mass. Circuit training also provides many other benefits, such as increased strength and muscular endurance and better heart health and mood. Circuit training could be considered as the best way to save children and adults who are physically inactive and others who live a sedentary lifestyle. There is a relationship between sedentary lifestyle and physical activity. Physical activity is the best way to promote health as well as to change the sedentary lifestyle of individuals, and circuit training could be considered as the best way to promote health and better lifestyle for school students and adults. Therefore, college programmers in the field of teaching methodology in colleges and universities and the Ministry of Education should consider these new ideas of circuit training exercises in teaching physical education at their schools.

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Appendices

Appendix A Profile of the study participants

1. The students' experimental group

No.	Name of students	Sex	Age	Weight (kg)	Height (m)
1	E. G1	M	15	43	1.62
2	E. G2	M	15	52	1.56
3	E. G3	M	15	44	1.60
4	E. G4	M	15	46	1.64
5	E. G5	M	15	52	1.64
6	E. G6	M	15	44	1.58
7	E. G7	M	15	55	1.49
8	E. G8	M	15	52	1.46
9	E. G9	M	15	43	1.53
10	E. G10	M	15	45	1.59
11	E. G11	M	15	51	1.48
12	E. G12	M	15	46	1.56
13	E. G13	M	15	48	1.48
14	E. G14	M	15	55	1.59
15	E. G15	M	15	49	1.55
16	E. G16	M	15	53	1.65
17	E. G17	M	15	55	1.65
18	E. G18	M	15	47	1.68
19	E. G19	M	15	49	1.59
20	E. G20	M	15	51	1.55
21	E. G21	M	15	55	1.62
22	E. G22	M	15	53	1.66
23	E. G23	M	15	48	1.59
24	E. G24	M	15	43	1.64
25	E. G25	M	15	55	1.66
26	E. G26	M	15	49	1.58
27	E. G27	M	15	45	1.56
28	E. G28	M	15	53	1.67
29	E. G29	M	15	48	1.60
30	E. G30	M	15	50	1.58

2. Control group

No.	Name of students	Sex	Age	Weight (kg)	Height (m)
1	C. G1	M	15	49	1.48
2	C. G2	M	15	51	1.59
3	C. G3	M	15	55	1.55
4	C. G4	M	15	46	1.65
5	C. G5	M	15	52	1.64
6	C. G6	M	15	44	1.58
7	C. G7	M	15	46	1.49
8	C. G8	M	15	52	1.46
9	C. G9	M	15	44	1.53
10	C. G10	M	15	55	1.59
11	C. G11	M	15	51	1.56
12	C. G12	M	15	46	1.48
13	C. G13	M	15	48	1.59
14	C. G14	M	15	55	1.59
15	C. G15	M	15	49	1.55
16	C. G16	M	15	45	1.65
17	C. G17	M	15	53	1.58
18	C. G18	M	15	47	1.49
19	C. G19	M	15	49	1.46
20	C. G20	M	15	51	1.53
21	C. G21	M	15	55	1.59
22	C. G22	M	15	53	1.66
23	C. G23	M	15	48	1.59
24	C. G24	M	15	43	1.64
25	C. G25	M	15	55	1.66
26	C. G26	M	15	49	1.58
27	C. G27	M	15	46	1.48
28	C. G28	M	15	52	1.59
29	C. G29	M	15	44	1.55
30	C. G30	M	15	55	1.65

Appendix B Demographic characteristics of the study participants

Group	Number of students	Sex	Age	Height	Weight
		Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Experimental Group	30	Male	15.00 ± 0.000	1.53 ± 3.12	49.3 ± 14.94
Control Group	30	Male	15.00 ± 0.000	1.57±	49.6±

Notes: N - number of the participants, SD - standard deviation

Appendix C Selected physical fitness and technical skill test description

No.	Parameter	Type of test	Unit	
1	Repetition	Bent-knee sit-up	Muscular endurance	Repetition
2	Repetition	Push-up	Upper body muscular strength	Repetition
3	Seconds	30-meter acceleration run	Speed	Seconds
4	Meters	Standing long jump	Lower body muscular strength	Meters
5	Centimeters	Sit-and-reach	Flexibility	Centimeters

Appendix D Pre- and post-test results for muscular endurance, flexibility, speed, and lower and upper body muscular strength in the experimental group

Names of the students	Fitness tests									
	Muscular endurance		Upper body Muscular strength		Speed		Lower body muscular strength		Flexibility	
	Bent-knee sit-up		Push-up test		30-meter acceleration run		Standing Long Jump		Sit-and-Reach	
	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
EG1	38	52	12	17	4.9	4.6	1.66	1.72	23	30
EG2	43	54	16	20	5.3	4.8	1.57	1.67	28	35
EG3	39	50	11	19	5.1	4.4	1.70	1.82	22	29
EG4	33	40	14	21	5.0	4.2	1.50	1.64	32	39
EG5	44	54	19	26	4.9	4.1	1.63	1.75	34	40
EG6	43	50	20	28	5.1	4.2	1.66	1.76	25	32
EG7	44	52	18	28	4.9	4.2	1.69	1.78	29	37
EG8	43	53	20	31	4.5	4.1	1.67	1.80	30	38
EG9	45	54	21	33	4.9	4.1	1.77	1.86	34	40
EG10	43	55	21	32	4.8	4.2	1.58	1.67	27	36
EG11	43	54	22	31	5.4	4.3	1.59	1.71	33	40
EG12	39	44	21	32	5.3	4.2	1.69	1.82	40	49
EG13	34	46	24	32	4.8	4.0	1.45	1.55	29	37
EG14	36	44	18	26	5.3	4.1	1.50	1.62	16	24
EG15	33	47	16	21	5.6	4.9	1.53	1.64	22	34
EG16	25	32	20	33	5.1	4.4	1.49	1.58	29	37
EG17	22	32	25	34	5.3	4.6	1.56	1.66	33	39
EG18	42	49	14	25	4.6	4.1	1.77	1.87	31	38
EG19	44	50	20	32	4.9	4.0	1.73	1.88	15	24
EG20	37	45	19	31	5.2	4.4	1.64	1.75	19	26
EG21	47	55	17	26	4.8	4.1	1.48	1.57	31	38
EG22	34	40	18	27	5.1	4.3	1.53	1.66	33	40
EG23	28	37	29	39	5.2	4.3	1.49	1.61	13	25
EG24	18	29	30	41	4.9	4.1	1.65	1.76	19	26
EG25	27	39	25	38	5.5	4.6	1.48	1.60	28	34
EG26	29	38	19	26	5.0	4.2	1.62	1.76	36	44
EG27	31	44	22	31	5.3	4.6	1.45	1.54	24	32
EG28	24	33	19	26	5.5	4.3	1.57	1.65	33	39
EG29	27	35	21	29	4.8	4.0	1.73	1.84	35	40
EG30	32	49	18	30	4.9	4.2	1.56	1.69	28	35

Appendix E Pre- and post-test results for muscular endurance, muscular strength, and speed in the control group

Names of the students	Fitness tests									
	Muscular endurance		Upper body Muscular strength		Speed		Lower body muscular strength		Flexibility	
	Bent-knee sit-up		Push-up test		30-meter acceleration run		Standing Long Jump		Sit-and-Reach	
	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
EG1	34	33	18	19	5.3	5.2	1.7	1.71	34	36
EG2	40	40	20	21	4.9	4.9	1.80	1.81	25	25
EG3	38	39	19	20	5.3	5.2	1.60	1.61	29	30
EG4	50	48	11	12	4.9	4.8	1.71	1.72	30	32
EG5	37	36	29	30	5.3	5.1	1.57	1.57	34	36
EG6	40	41	17	18	5.5	5.4	1.69	1.70	34	35
EG7	22	23	28	29	5.1	5.2	164	1.66	28	29
EG8	26	27	30	31	5.2	5.1	170	1.71	36	37
EG9	33	34	29	28	4.8	4.8	1.67	1.69	24	24
EG10	38	37	24	26	5.8	5.7	1.77	1.78	33	34
EG11	33	34	29	30	5.6	5.6	1.58	1.60	28	29
EG12	42	43	22	23	5.7	5.6	1.59	1.61	36	37
EG13	44	45	30	32	4.8	4.9	1.57	1.59	30	31
EG14	41	40	23	23	4.9	5.0	1.70	1.71	35	35
EG15	27	28	17	19	4.8	4.6	1.50	1.52	29	29
EG16	42	43	18	19	5.4	5.3	1.63	1.63	39	40
EG17	36	34	23	24	4.7	4.7	1.66	1.67	40	42
EG18	33	34	28	29	4.2	4.3	1.57	1.58	32	33
EG19	40	42	16	17	5.4	5.6	1.77	1.78	30	31
EG20	34	33	11	12	4.9	5.0	1.73	1.74	22	24
EG21	37	38	10	11	4.6	4.7	1.64	1.65	31	32
EG22	47	48	17	18	4.9	4.9	1.48	1.50	32	33
EG23	50	51	19	19	5.4	5.3	1.53	1.54	36	37
EG24	29	30	28	29	5.4	5.2	1.77	1.78	27	28
EG25	26	28	18	19	4.7	4.6	1.54	1.55	33	34

Continuation of Appendix E

EG26	31	32	12	13	4.3	4.2	1.63	1.64	40	41
EG27	38	39	17	18	5.8	5.7	1.69	1.70	29	29
EG28	33	34	12	14	4.3	4.2	158	1.59	16	17
EG29	41	42	11	12	4.7	4.6	1.67	1.68	22	23
EG30	45	46	15	15	5.1	5.0	1.51	152	27	28

Circuit training program for one week

Day	**Time (minutes)**	**Exercise**	**Repetitions**	**Rest**	**No. of the circuits**	**Intensity**	**Rest**
		Squat Jumps	10-15	1 min.			
		Push up	10-15	1 min.			
		High Knee	15-20	1 min.			
		Bench Dips	10-15	1 min.			
Monday	40	Jump Rope	60 seconds	1 min.			
		Sit up	5	1 min.	3	High	3 min.
		Walking Lunges	20	1 min.			
		Twist Crunches	20	1 min.			
Thursday	40	Jumping Jacks	20	1 min.			
		Push up	20	1 min.			
		Bench Dips	20	1 min.			
		Squat Jumps	20	1 min.	3	High	3 min.