

Effect of Concurrent Training on Selected Physical Fitness of Male Middle Distance Runners

Eshetie Teshager Beyene^{1*}, Dr. Marko's Yohannis (Phd)¹

¹College of Natural and Computational Science, Department of Sport Science, Jigjiga University, Jigjiga, Ethiopia

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*Corresponding author: Eshetie Teshager Beyene

College of Natural and Computational Science, Department of Sport Science, Jigjiga University, Jigjiga, Ethiopia

Abstract

The aim of this study was to examine the effect of concurrent training on cardiorespiratory endurance, flexibility and speed on male middle distance runners. The study employed experimental research design. All 26 Awuscod male middle distance runners were taken with EG and CG and divided randomly into two equal groups. Both the (EG= 13) and (CG= 13) had taken PT and POT of 12-minute run test, sit-reach test, and 30 meter acceleration test to assess cardiorespiratory endurance, flexibility and speed respectively. EG participated in additional 10 weeks concurrent interventions. While, the CG continued with their usual training. The data collected from the study subject were analyzed using SPSS version 25 software by using descriptive statistics (mean and SD) and inferential statistics (paired t-test and independent t-test) with level of significant 0.05. The results showed concurrent training has significantly improved cardiorespiratory endurance and speed on EG ($p < 0.05$). But no significant difference was observed in flexibility. Furthermore, no more significant differences were found in all of the variables in CG ($p > 0.05$). Based on this finding, it can be concluded that concurrent training has a positive impact on the improvement of cardiorespiratory endurance and speed. Therefore, concurrent training is suggested for middle distance runners to improve physical fitness for athletic performance.

Keywords: Concurrent Training, Cardiorespiratory Endurance, Flexibility, and Speed.

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1. INTRODUCTION

Athletics is a popular sport all over the world that primarily consists of running, jumping, throwing, and walking (Point, 2015). Running is also popular; a wide range of in disciplines such as track, road, mountain, and ultra-endurance running (Haugen *et al.*, 2019).

Middle-distance events are traditionally defined as track events that fall between short-distance events like the 100m, 200m, 400m, and longer distance events like the 10000m, half-marathon (21.1km), and marathon (Point, 2015).

African athletics was introduced to the world at the 1960 Olympic Games. Ethiopian and Kenyan athletes have dominated middle- and long-distance events in athletics since the 1968 Mexico Olympics; this dominance has been attributed to physiological, anatomical, psychological, traditional, social, and cultural factors (Wilber and Pitsiladis, 2012)

Athletics in Ethiopia athletes have been shining in the world of athletics since the legend Abebe Bikila laid the groundwork for Ethiopians and all black Africans to be gold medalists at the 1960 Rome Olympics (Gebregiorgis and CK, 2022).

Physical fitness is the body's ability to perform moderate to- vigorous levels of physical activity without becoming fatigued (Corbin, 2020). Physical fitness components such as endurance, speed, strength, and flexibility are factors that influence overall athletic performance (Zulakbal, 2020)

Regular physical training is critical for the health and wellbeing of all athletes, it can improve athletes' functioning and physical fitness level (Kirandi, 2016).

Concurrent training is a program that combines resistance and endurance training to maximize all aspects of physical performance, Unless an athlete is competing in a pure-endurance sport such as long distance running or a combination of power and endurance attributes are

required to excel in mixed-type sports (Tolasa, 2020). Some Recently studies recognized that combining strength and aerobic training in the same session provides more benefits for neuromuscular and cardiorespiratory functions (Geoff, 2017)

2. MATERIALS AND METHODS

2.1. Description of the Study Area

The study was conducted in Debre tabor city which is located in the north part of Ethiopia in the Amhara Region particularly at kimir dingay, which found in 108km far from bahir dar, capital city of Amhara region; and 592 km far from Addis Ababa, capital city of Ethiopia. It is located at 11°51'N 38°1'E, with an elevation of 2,706 meters above sea level.

2.2. Study Design

Experimental research design and census sampling technique was used. All male middle distance runners from those athletes by using simple random sampling techniques, the EG was consisting of 13 athletes, while the remaining 13 athletes were included in CG that are not participating in designed training program. Data was collected in the field from PT and POT measurements of both EG and CG at the start and end of the training program.

2.3. Measurement Tools and Procedures

First medical examination was taken from all participates of the study. Runners were familiar with the tests and had performed the test prior to the present study at least once. Testing was conducted at the same time of day and on the same field for both pre- and post-testing sessions. Anthropometric data such as age, height, weight, assessment were recorded first. Performance testing consisted of the 12-minute run test for cardiorespiratory endurance, Sit and reach test for Flexibility and 30 Meter Acceleration Test for speed. Prior to the testing, the participants followed the same supervised warm-up procedure with 10 minutes Walking, Jogging Exercise & Synchronized movement of hands, leg, arm, and dynamic exercise. Consequently the experimental group performed on separate days of concurrent training in addition to the running training

and continued with their regular training. After the experimental period of 10 weeks, both testing sessions were repeated.

2.4. Methods of Data Analysis

The quantitative data was collected through fitness tests. In the form of PT and POT results and data was analyzed using descriptive and inferential statistics such as means, SD, independent sample t-tests, and paired sample t-tests in the statistical package for social science (SPSS) version 25.00. P-values for statistical significance was set at <0.05.

3. RESULTS

Analysis of data collected from the samples of study and its results have been discussed. The purpose of study was to investigate effect of ten week concurrent training on cardiorespiratory endurance, flexibility and speed of Awuscod male middle distance runner. A pretest of cardiorespiratory endurance (12-minute run test), Flexibility (Sit and reach test) and speed test of 30 Meter Acceleration Test were given. The trainees continued their running training which was given three times per a week; simultaneously half of them were randomly selected and subjected to ten week concurrent training. Consequently during test on the same parameters and tests were given after ten week concurrent training and Then at the end of ten week concurrent training (post) similar tests were given for all 26 middle distance trainees regardless of their groups so as to evaluate whether concurrent training affects cardiorespiratory endurance, Flexibility and speed of middle distance trainees or not. Then finding obtained after ten week concurrent training program are presented below in tables. Tables 1 shows Demographic Characteristics of Study Participants, Tables 2, 3, 4 shows the Descriptive statistics for cardiorespiratory endurance, Flexibility and speed test results. And table 5, 6 shows Paired and Independent Samples t-Test for Study Variables. The abbreviations used in the research were as follows: Experimental Group (EG), Control Group (CG), mean difference (SD), pretest (PT) and Post test (POT).

Table 3.1: Demographic Characteristic of Study Participants

Group	N	Age (in year)	Height (in meter)	Weight (in kg)
		Mean ± SD	Mean ± SD	Mean ± SD
EG	13	21.31±.630	1.6923±.08852	52.4615± 6.14567
CG	13	21.00 ±1.000	1.6777±1.09719	50.38 ± 3.776

3SD=standard deviation, N=number of Participants in a group, EG=Experimental groups, CG=control groups.

Table 3.2: Descriptive statistics of cardiorespiratory endurance

Subjects								
Test	EG(n=13)				CG(n=13)			
	Mean		SD		Mean		SD	
	PT	POT	PT	POT	PT	POT	PT	POT
12 minute run test	3588.461	3728.846	311.0157	274.2121	3530.769	3480.769	341.8933	321.8038

The table 3.2 shows that the mean and SD of the EG and CG of the 12-minute run test. The mean values of the 12-minutes run PT and POT of the EG were 3588.4615m and 3728.8462m, and the SD was 311.01571m and 274.2121m respectively. Whereas the mean values of the CG 12-minutes run test were 3530.7692m and 3480.7692m, while their SD were

341.89330m and 321.80381m respectively, this reveals that improvement were observed in the EG cardiovascular endurance, After intervention the mean of EG in athletic trainees was increased on PT to POT from 3588.4615 to 3728.8462 EG due to the after the 10 weeks concurrent training, but improvements were not seen on the CG side.

Table 3.3: Descriptive statistics of Flexibility

Subjects								
Test	EG(n=13)				CG(n=13)			
Sit and reach test	Mean		SD		Mean		SD	
	PT	POT	PT	POT	PT	POT	PT	POT
	14.8462	14.9231	5.78570	5.79456	15.8462	15.9231	6.01174	5.83754

Table 3.3 indicates that the mean and SD of the sit and reach test PT and POT results of both EG and CG. The mean values of the EG, PT and POT result sit and reach test were 14.8462cm and 14.9231cm and their SD were 5.78570cm and 5.79456cm respectively. On the other hand the mean values of the PT and POT results CG sit and reach test were 15.8462cm and 15.9231cm,

while their SD were 6.01174 and 5.83754 respectively. This indicates that there were no change in the mean values of EG sit and reach test results from PT to POT (14.8462cm to 14.9231cm). On the other hand, the mean values of the CG were homogenous from PT to POT result (15.8462 to 15.9231).

Table 3.4 Descriptive data between pre and post- test of speed

Subjects								
Test	EG(n=13)				CG(n=13)			
30meter acceleration test	Mean		SD		Mean		SD	
	PT	POT	PT	POT	PT	POT	PT	POT
	4.3538	3.3577	0.37340	0.82540	4.5292	4.6231	0.49461	0.5485

The table 3.4 indicated that the PT of EG and CG mean value of speed was 4.3538 and 4.5292 which indicates that the PT mean value was almost the same for both group of speed fitness. Before training there was no change between the two groups. But in the POT mean

value of EG and GC was 3.3577 and 4.6231 which show there was moderate change between EG and CG of the POT result because of the ten weeks concurrent training. There was indicated moderate improvement of speed fitness level.

Table 3.5: Paired Samples t-Test for Study Variables

Variables	Subjects		Paired difference				T	Sig.(2-tailed)
					95% confidence interval			
			Mean	Std .d	Lower	Upper		
12-minute run test	EG	POT-PT	140.38462	83.87644	89.69859	191.07064	6.035	0.00
	CG	POT-PT	50.00000	106.06602	-114.09505	14.09505	-1.700	0.115
Sit-reach test	EG	POT-PT	0.07692	0.95407	-.49962	0.65346	0.291	0.776
	CG	POT-PT	0.07692	1.03775	-.55018	0.70403	0.267	0.794
30Meter Acceleration Test	EG	POT-PT	-.99615	0.82816	-1.49660	-.49570	-4.337	0.001
	CG	POT-PT	0.09385	0.18800	-.01976	0.20745	1.800	0.097

Table 3.5 demonstrates the MD and SD values of cardiovascular endurance variables, EG (MD=140.38462 SD=83.87644, CG, MD=50.00000. SD=106.06602), respectively. The p value was .000. So, after CT interventions in cardiovascular endurance variables the POT measurement on EG show significance differences since P-value is less than 0.05. So, alternative hypothesis is accepted. This value indicates that cardiovascular endurance of the EG shows a statistically significance improvement from PT to POT results (p < 0.05) but not in CG (p > 0.05). Likewise, the MD and SD values of the EG and CG pre and post- test

result Sit- reach test were 0.07692, 0.95407, and .07692, 1.03775 respectively. This indicates that EG hadn't been significantly improved (P= 0.776) on flexibility by concurrent training. So that EG didn't show a statistical significance difference between PT and POT measurements. This means that 10 weeks concurrent intervention was not vital for improvement of flexibility, since p value of EG is greater than 0.05. Table 3.5 demonstrates the mean and SD values of speed variables. There was significance difference 30 Meter Acceleration Test from PT to POT for EG after 10 week concurrent training. Because mean = -.99615 SD=0.82816, T = -

4.337 and $P = 0.001$ for CG and Mean = 0.09385, SD = 0.18800 $T = 1.800$ and $P = 0.097$ for EG. So when $P < 0.05$) which indicates that the group members who had 10 week concurrent training programmed (EG) were

performed better than the CG who had not participated in 10 weeks concurrent training. This means that 10 weeks concurrent training intervention was vital for improvement of speed.

Table 3.6: Independent Samples t- test between experimental and control group

Variable Equal variances assumed	Levine's Test for Equality of variances		t-test for Equality of Means						
	F	Sig	T	Df	Sig.2 tailed	Mean Difference	Std.Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
12-minute post run test	0.276	0.604	2.116	24	0.045	248.0769	117.26039	6.06336	490.09048
Sit and reach test	0.106	0.748	-.438	24	0.665	1.00000	2.28126	-5.7082	3.70829
30 Meter Acceleration Test	3.237	0.085	-4.604	24	0.000	-1.26538	0.27487	-1.83270	-.6980

Levine's Test is used to check the assumption of equal variance between the two groups (EG and CG) after intervention. It is tested by using F-test. The results of Levine's Test for Equality of Variances from table 3.6 showed that: There is significance difference ($P=0.045$) between EG and CG for cardio-respiratory fitness. So that, of concurrent training has shown a statistical significance difference between EG and CG on cardiorespiratory fitness, since p value between two groups is less than 0.05. There is no significance difference ($P= 0.665$) for sit-reach test between EG and CG for flexibility. So that, of concurrent training didn't show a statistical significance difference between EG and CG on flexibility of participants, since p value between two groups is greater than 0.05. There is significance difference ($P=0.000$) for 30 Meter Acceleration speed Test between EG and CG for speed. So of concurrent training has shown a statistical significance difference between EG and CG on speed of participants, since p value between two groups is less than 0.05. Therefore, the assumption of equal variance between groups is satisfied, because the p-value of Levine's assumption of equal variance for those four variables is less than 0.05. Therefore, alternative hypothesis is accepted for the cardiorespiratory fitness, and speed between two groups. But null hypothesis is accepted for flexibility. This implies, EG is better than CG on cardiorespiratory fitness, and speed because of concurrent training intervention.

4. DISCUSSIONS

The result of the study indicates that there was significant improvement on cardiovascular endurance due to the effect of concurrent training among athletic trainees when compared in 12-minute run test, did show significant improvement after the intervention of the training. ($P= 0.00$). When we compare the mean score of 12-minute run test results of the EG before concurrent training with the mean score of after 10 weeks concurrent training, there was significant difference were happened.

The gradual increment in the mean of athletes from PT to POT due to the training given for the athletic trainees was observed. Since improvement were observed in the cardiovascular endurance fitness level of EG. and Some study shows that ten weeks of concurrent training has beneficial effects on cardiovascular endurance of 1500m track and field athletes (Alotaibil and Nabia,2016) And also 12-week concurrent training improves in maximal oxygen uptake (VO_2 max) of a runner (Nelson *et al.*,2012). But Some studies have shown that concurrent training inhibits the development of strength and power of middle distance athletes, but does not affect the development of aerobic fitness when compared to either mode of training alone (Maniazhagu, 2019).but.Some studies have found that combining strength training and aerobic training in the same session and in this order provides more benefits for neuromuscular and cardiorespiratory functions of track runner. In addition to these some research has been shown to after eight weeks concurrent training increase vo_2max , especially in prepubescent children athletic trainee (Robineau *et al.*, 2018). And also the finding of these study revealed that concurrent training showed improvement on cardiovascular endurance on athletic trainees. Those and other many findings supported the result of this study.

In the case of the effects of concurrent training on flexibility of middle distance athletic runner there was no significant difference between PT to POT score in EG when assessed in sit and reach test, didn't show significant improvement after the intervention of the training. ($P= 0.665$) for sit-reach test between EG and CG for flexibility. When we compare the mean score of sit-reach test results of the EG before concurrent training with the mean score of after 10 weeks concurrent training was no significant difference were happened. The gradual increment in the mean of athletes from PT to POT due to the training given for the athletic trainees was not observed. This result has been shown contradiction with different researches done in different times. The

result of the study indicates that there was a no significant improvement on lower body flexibility due to the effect of concurrent training among middle distance athletic trainees when EG to CG and PT to POT in EG. So, EG were didn't show significant improvement than CG. but also other research contradict to these finding of study, concurrent training program can significantly improve flexibility of track and field athletes (Davis *et al.*,2015). In addition to these Concurrently 10 weeks training interventions, strength training before endurance training, strength training after endurance training group have produced significant improvement on flexibility, of junior sprinter athletes (Maniazhagu, 2019). But other research supported to these finding of study,8 weeks concurrent training has no significant changes in lower body flexibility in female athletic track runner (Davist, 2016). Because of those and other unknown reasons, the result of this study didn't show a statically significant improvement on lower body Flexibility.

The result of the study indicates that there was a significant improvement on speed due to the effect of concurrent training among athletic trainees so, EG were significant improvement for PT to POT exercise on concurrent training for Male middle distance athletic runner. Those, as it is indicated the average value of speed was significantly decreased(improved) for the EG after 10-weeks designed concurrent training program, the mean value of speed for EG was 4.3538 before they participate to a 10 week concurrent training program and after they begin(start) and finish the 10 weeks concurrent training program the mean value of speed became 3.3577 when compared to the mean value of speed for CG pretest mean value was 4.5292 and 4.6231 was post mean value of speed which was taken as PT and POT result respectively with the mean value difference were considered statically significant at $p \leq 0.05$. So, as we can say that there was significance change in speed of POT result on EG because of 10-week concurrent training. Besides in the CG there was a little difference from PT to POT result but not significance when compare to the EG within ten weeks 'concurrent training. Therefore, based on this result 10-week concurrent training has a better effect on speed of middle distance runner. That means the null hypothesis was rejected while the alternative hypothesis was accepted.

And other researches to support these finding of study, effective 8 weeks of continuous concurrent training program was improve in performance of running speed, and different fitness levels of adolescents track runner (Marta *et al.*,2013).and also concurrent training have positive effects for maintaining and optimising speed fitness levels of track athletes (Kraemer *et al.*,2015). Concurrently the strength training before endurance training, have produced significant improvement on speed track athletes (Maniazhagu,2020). And 8 week concurrent training has significant effect on speed fitness level on female long and middle distance track runner (Aldof *et al.*,2018).The

finding of these study revealed that 10-week concurrent training showed improvement on speed of middle distance athletic trainees. Those and other many findings supported the result of this study.

5. CONCLUSIONS

The result of the study showed that 10-week concurrent training has relative positive effect on cardiovascular endurance and speed of male middle distance trainees as measured by 12-minute run test and 30 Meter Acceleration Test. The output of the study showed that 10-week concurrent training hasn't a significant improvement on flexibility of male middle distance trainees. The Finding of this study yields a significant benefit on improvement of middle distance trainees. In general after 10-week concurrent training, statistically significant improvement and change were observed in middle distance trainees on cardiovascular endurance and speed.

6. Recommendations

Based on the results of the study concurrent training would be attached in the regular training and coaching schedules to be incorporating the program to enhance physical fitness performance of track runner. Further studies could be conduct on other specific fitness components through increasing subjects on different samples of age and sex by selecting other physical and physiological variables on other athletics event. And this research program was focused on 10 weeks but other researchers may be extended the concurrent training program for a better performance enhancement in other physical and physiological variable.

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