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Original Article

Strength, endurance and speed development using functional strength training (FST) program for recreational runners performance

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Abstract:
Our aim was to analyze and compare functional strength training (FST) on strength, cardiorespiratory fitness (CF), and speed of recreational runners. Forty two man (25-40 years old) completed 6 weeks (3 times a week) of intervention randomly assigned to 3 groups- functional strength training (FST) [(EMOM = 14, AMRAP = 14, FOR TIME = 14)]. The functional strength training groups was given an exercise program for 30 minutes constant load with 50% 1 RM and high intensity (90%) HRMax using Airbike, Barbell, Kettlebell and Sandball equipments The author analyzes the scientific literature and methodology with quantitative research methods Independent T-test and MANOVA were conducted to compare cardiovascular endurance (CF), strength and speed between groups. The FST all groups participated in CF test using balke test, strength test using leg dynamometer test, and speed test using 20 m sprint test were measured pre-intervention (Pre) and post-intervention (Post). FST as many rounds as possible (AMRAP) increased CF and Strength ($p < 0.05$) significantly (Pre vs. Post) in the FST FOR TIME (7.5%) and FST every minute on the minute (EMOM) (10.8%) groups. Speed significantly ($p < 0.05$) improves (Pre vs. Post) in FST AMRAP (4.4%) and FST FOR TIME (5.1%). Endurance Cardiovascular showed significantly ($p < 0.05$) improves (Pre vs. Post) in FST AMRAP (3.4%), FST FOR TIME (4.6%) and FST EMOM (3.2%). In conclusion, FST AMRAP, EMOM and FOR TIME showed that 6 weeks functional strength training in three time a week improved the strength, endurance and speed profile of recreational runners performance.
Key Words: **Strength, Endurance, Speed, Functional Strength Training.**

Introduction

In principle, exercise is an activity that is carried out in a programmed manner and a comprehensive improvement process to improve the components of physical fitness, improve physical quality, functional abilities of body equipment, and healthy psychological qualities. Exercise is basically a load (motor stimulation) on the body, giving rise to the body's responses in the form of responses (Cassemiro et al., 2017) and adaptations (Doma & Deakin, 2013). Adaptation is the body's response to training load that occurs in a relatively long period of time and is relatively permanent. Weight training is also called resistance training (Zaton & Michalik, 2015). The weights used can utilize the weights of one's own body weight (Campiotti et al., 2021) or can also use functional training tools such as dambles (Latorre Román et al., 2015), barbells, kettle bells, bosu, resistance tubing, rip trainers, TRX, or other gym machines (Zhang, 2018).

This is a short 6-week study that can cover the benefits of the experimental intervention. Also, generalizations should be avoided because the findings of this study only apply to whether functional strength training (Falatic et al., 2015) has an effect on the participants' strength, cardiovascular endurance and speed (Latorre Román et al., 2015). The inclusion of strength functional training performance variables can assist in interpreting aspects of strength, cardiovascular endurance and speed. Future studies that consider the limitations of current research should be justified. Functional Strength Training (FST) is one of the most popular fitness exercises among the population of recreational runners and fitness ethusiasts (Feito et al., 2018). Functional exercise also includes exercise that uses both aerobic and anaerobic energy systems. (Ismail et al., 2012). FST exercises are designed to improve general physical readiness (Tomljanovi et al., 2011). Functional strength training (FST) is an exercise modality that emphasizes dynamic functional media (Liu et al., 2017), multi-joint movements can be modified to help improve fitness (Castro et al., 2020) and elicit greater muscle strength. than with weight training using traditional, static equipment.

The purpose of this study was to determine the effect of the treatment of 6 weeks of functional strength training with a frequency of exercise 3 times a week systematically using 3 exercise models for 3 groups, namely the As many reps as possible (amrap) group, the every minutes on the minute group (emom) and for time by using functional strength training (FST) media[(EMOM = 14, AMRAP = 14, FOR TIME = 14)] given an exercise program for 30 minutes constant load with 50% 1 RM and high intensity (90%) HRMax using

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Airbike, Barbell, Kettlebell and Sandball to improve strength, endurance cardiorespiratory and speed for recreational runners.

Material & methods

An experimental, randomized-controlled design was used to assess the effect of FST on changes in endurance, strength and speed. Forty two man (25-40 years old) completed 6 weeks (3 times a week) of intervention randomly assigned to 3 groups- functional strength training (FST) [(EMOM = 14, AMRAP = 14, FOR TIME = 14)]. The FST groups was given an exercise program for 30 minutes constant load with 50% 1 RM and high intensity (90%) HRMax using Airbike, Barbell, Kettlebell and Sandball. This study was approved by State University of Surabaya. Sample of this treatment was recruited via wellness community in Surabaya, east Java. The author analyzes the scientific literature and methodology with quantitative research methods Independent T-test and MANOVA were conducted to compare cardiovascular endurance (CF), strength and speed between groups. The FST all groups participated in CF test using balke test, strength test using leg dynamometer test, and speed test using 20 m sprint test were measured pre-intervention (Pre) and post-intervention (Post). Forty-two participants from the running community (Table 1) agreed to participate, and signed informed consent from a health professional that all participants were declared healthy and able to start the study. Participants were randomly selected from the population who were physically active 20-60 minutes a day twice a week and were healthy as many as 92 participants. Each individual was classified as having no history of injury or internal disease and subsequently had no disturbances in blood pressure or heart rate. The study lasted for six weeks from March to April 2021.

Table 1. Baseline characteristics of participants. *

	EMOM (n = 14)	AMRAP (n= 14)	FOR TIME (n=14)
Age (y)	25.49 0.98	27.50 0.95	26.21 0.95
Height (cm	175.77 9.03	176.56 6.20	173.46 6.20
Weight (kg)	71. 45 6.77	72.83 10.22	71.43 10.22
Body mass index (kg. m^{-2})	22,82 4.51	22, 85 4.15	21, 85 4.15
Viscelar Fat	4 9.33	4 9.11	4 5.11

Participants reported to the laboratory; assessed for endurance cardiovascular test using MFT (VO2Max test), strength with leg strength dynamometer test and speed with 20m run.

Statistical Analyses

The author analyzes the scientific literature and methodology with quantitative research methods Independent T-test and MANOVA were conducted to compare cardiovascular endurance (CF), strength and speed between groups. The FST all groups participated in CF test using balke test, strength test using leg dynamometer test, and speed test using 20 m sprint test were measured pre-intervention (Pre) and post-intervention (Post) using SPSS for Windows (version 20). In the case of a significant interaction of time 3 group, post hoc analysis (t-tests) was used to determine where differences occurred. If no interaction was evident, the main effect of each factor was explored. Where interactions are nonsignificant, only the main effects are reported. In the case of significant was set at $p < 0.05$ for all tests.

Results

There were no significant differences at baseline among the four groups for age, height, and physical activity level (Tables 1 and 3). Subjects in all groups exhibited a very low level of aerobic fitness ($\dot{V}O_2max<25ml \cdot kg^{-1} \cdot min^{-1}$) with no significant differences among the four groups (Table 1). FST groups (Amrap, EMOM, For Time) showed improvements strength, endurance cardiovascular and speed, FST AMRAP increased CF and Strength ($p < 0.05$) significantly (Pre vs. Post) in the FST FOR TIME (7.5%) and FST EMOM (10.8%) groups. Speed significantly ($p < 0.05$) improves (Pre vs. Post) in FST AMRAP (4.4%) and FST FOR TIME (5.1%). Endurance Cardiovascular showed significantly ($p < 0.05$) improves (Pre vs. Post) in FST AMRAP (3.4%), FST FOR TIME (4.6%) and FST EMOM (3.2%). In conclusion, FST AMRAP, EMOM and FOR TIME increased improved the strength, endurance and speed profile of recreational runners performance.

Table 1. Pre Test Results

Group	Var	Mean	Median	Min	max	Std dev	N	Depression Score	P-value
AMRAP	Strength	130	115,13	93	155,5				
	Endurance	50,31	49,11	48,13	56,37				
	Speed	4,13	3.59	3.48	4,56				
EMOM	Strength	120	105	115	135				
	Endurance	49,81	45.31	44,18	51,30				
	Speed	3,55	3.45	3,4	4,35				
FOR TIME	Strength	130	120	115	145				
	Endurance	49,31	46,05	45,95	52,34				
	Speed	4,34	4,11	3,91	5,13				

Table 2. Post Test Results

Group	Var	Mean	Median	Min	max	Std dev	N	Depression Score	P-value
AMRAP	Strength	145	130	124,5	165				
	Endurance	54,31	52,16	51,34	59,53				
	Speed	3,43	3.39	3.33	4,35				
EMOM	Strength	135	115	100	155				
	Endurance	52,38	50.39	50,43	56,44				
	Speed	3,30	3.15	3,21	3,53				
FOR TIME	Strength	150	135	125	155				
	Endurance	54,51	52,79	51,45	53,56				
	Speed	3,54	3,43	3,4	4				

Table 3. Score of normality pre test (Shapiro-Wilk)

Group	Var	Statistic	df	Sig.	Keterangan
AMRAP	Strength	0,916	12	0,824	Normal
	Endurance	0,923	12	0,746	Normal
	Speed	0,902	12	0,723	Normal

Group	Var	Statistic	df	Sig.	Keterangan
EMOM	Strength	0,939	12	0,838	Normal
	Endurance	0,921	12	0,741	Normal
	Speed	0,913	12	0,723	Normal
For Time	Strength	0,923	12	0,821	Normal
	Endurance	0,916	12	0,754	Normal
	Speed	0,918	12	0,704	Normal

Table 4. Score of normality pre test (Shapiro-Wilk)

Group	Var	Statistic	df	Sig.	Keterangan
AMRAP	Strength	0,956	12	0,813	Normal
	Endurance	0,934	12	0,732	Normal
	Speed	0,912	12	0,712	Normal
EMOM	Strength	0,941	12	0,876	Normal
	Endurance	0,917	12	0,787	Normal
	Speed	0,945	12	0,703	Normal
For Time	Strength	0,963	12	0,834	Normal
	Endurance	0,943	12	0,761	Normal
	Speed	0,927	12	0,710	Normal

Based on the table above, it is known that the pre-post test results in all groups have obtained a significance value greater than 0.05. From these results it can be concluded that the overall data from the pre-post test results in all groups are normally distributed. Furthermore, after it is known that the pre post test data is normally distributed, then the post test data will be analysed.

Table 5. Post Test Description and Result

Group	Var	Mean	Median	Min	max
AMRAP	Strength	145	130	124,5	165
	Endurance	54,31	52,16	51,34	59,53
	Speed	3,43	3.39	3.33	4,35
EMOM	Strength	135	115	100	155
	Endurance	52,38	50.39	50,43	56,44
	Speed	3,30	3.15	3,21	3,53
For Time	Strength	150	135	125	155
	Endurance	54,51	52,79	51,45	53,56
	Speed	3,54	3,43	3,4	4

The results showed good results and had a significant effect on improving strength, speed and endurance. Functional training with AMRAP, EMOM and FOR TIME also have the effect of increasing the strength, endurance and speed. Even AMRAP better than EMOM and FOR TIME method to effective improving strength, FOR TIME better than AMRAP AND EMOM to improving endurance cardiovascular and EMOM better than AMRAP and FOR TIME to improves speed for recreational runners.

Dicussion

From a functional strength training point of view, resistance training serves a specific means within a context (Shaikh, 2012). As mentioned before, larger improvements in terms of absolute strength gains do not necessarily result in larger functional benefits (Gliemann et al., 2015). However, including unstable surfaces within a training regime seems to have functional advantages over traditional stable resistance training. With

enhanced activation of trunk muscles and stabilising function of smaller and major muscles the transfer of angular momentum and power between the lower and upper extremities is facilitated resulting in improved strength, speed and endurance. This notion is mainly supported by this study's larger improvements of the FST after exercising on running program. This is the first work to use a functional strength training program in recreational runners with the aim of increase leg muscle strength, cardiovascular endurance and speed. The most important finding of this investigation is that the FST program with Emom, Amrap and For Time is included in an effective continuous training program with more improvements in the variables of strength, cardiovascular endurance and speed. Pulse reaction showed that the maximum value of the subject reached 95% of maximum pulse. From pulse reactions to functional strength training exercises, we conclude that participants move in a mixed zone from the green or low zone to the red or high zone, where the intensity of the aerobic-anaerobic load is. Our findings are in agreement with previous authors' recommendation [16,17] that high-intensity intermittent exercise can be included in the strength training program for healthy recreational runners. Based on the results of this study, we observed a positive effect at the end of week 6 in AMrap. Where Amrap ($p<0.05$, $d = 0.687$) from other studies These results should encourage practices and clinical programs to consider adding AMRAP, EMOM and FOR TIME as an exercise modality to their programs. Due to the instability-related reduction of load this exercise modality is potentially suitable for a variety of recreational runner, who cannot endure high loads. Further, when administered in a progressive order with gradually increasing complexity to be a feasible and safe training program.

Conclusions

Based on the results, we may conclude that functional strength training using amrap, emom and for time was confirmed positive changes of increase strength, endurance cardiovascular and speed. This study demonstrated the feasibility and effectiveness of different types of FST (i.e., EMOM, AMRAP and FOR TIME) on measures of lower-extremity muscle strength, endurance cardiovascular and speed in healthy communities (men recreational runners). Amrap results dominate the increase in leg muscle strength, cardiovascular endurance and speed, while emom dominates strength results compared to the amrap and for time training models, although FOR TIME is not superior in terms of overall training improvement, but for time has good results in increasing cardiovascular endurance in the sixth week so that all exercise models can improve the performance of recreational runners. So this could meet the need for a training program in runners and this could be a new finding in six weeks of physical improvement with an adult audience.

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