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The Effect of High Intensity Interval Training in Different Forms Applied to Combat Athletes on Body Composition and Muscular Strength

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Abstract

The aim of this study was to investigate effects of two different high intensity interval program for 3 weeks on body composition and strength of combat sport athletes. Twenty-nine combat sport athletes (karate, judo, taekwondo, wrestling) (age 21.41±1.50 years) voluntarily participated in this study. Participants were randomly assigned to two groups; Tabata protocol and running based high intensity interval protocol. Both methods were applied to participants 3 days per week for 3 weeks. Body composition, leg strength, back strength and hand grip strength of the participants were measured before and after the application. Paired Sample T Test was used to determine intragroup changes while Independent Sample t-test as used to determine intergroup changes. There was no significant difference between groups during the first measurement ($p>0.05$). No significant change was found in the variables between two measurements. When groups were compared, there was difference in back strength in favour of Tabata group.

Keywords: Combat sports, high intensity interval training.

INTRODUCTION

Effective usage of time has gained importance with the developments in technology. The changes and developments in science and communication directly or indirectly significantly affect sport activities and training science (5,18). The notion of time that is one of the most important elements of training sciences has led researchers to look for new training methods (15).

It is well-known that regular and systematic exercises increase work capacity and performance parameters (17). Physical characteristics are one of the factors affecting athletic performance because they affect physiological outputs. Unless the physical characteristics do not fit a specific sport desired level of performance cannot be achieved. Moreover, physical characteristics positively affect sport performance as well as other performance variables such as strength, flexibility, speed, endurance, and agility (23). Of those parameters, endurance and strength are of great importance for many sports. Aerobic capacity can be developed with endurance trainings. Developing aerobic capacity requires long training periods (6). Strength development is a more complicated period.

Sport sciences and training methods have been constantly updated with new findings. Scientists, coaches, and athletic performance specialists expect adaptation to intensity of new training methods applied to athletes and sedentaries and try people to benefit from them as much as possible (20). One of the most common methods for athletic performance is high-intensity interval training (HIIT). (2). HIIT that helps athletes acquire high development is preferred by many coaches and sport scientists (1). HIIT leads to fast and high developments as well as saving of time (10,27). Especially during short preparation periods, HIIT is expected to help coaches and athletes acquire important gains. Although the literature suggests that HIIT improves especially aerobic and anaerobic performance in sedentaries and athletes, its effects on strength of combat sports athletes have not been studied enough (3). Moreover, the number of studies comparing different methods of HIIT method in terms of strength is quite low. Therefore, the aim of this study was to compare two different HIIT methods for 3 weeks on body composition and strength in combat sport athletes. To reveal which methods of high intensity interval training will be more effective in combat sports will make a significant contribution to the literature.

Methods

Participants

Twenty-nine combat sport athletes (karate, judo, taekwondo, and wrestling) whose mean age was 21,41± 1,50 years voluntarily participated in this study. Athletes were chosen from those who were without any health problem, did not use drugs regularly and smoke. Measurements were repeated before and after the exercise program and body mass, body mass index, body fat percentage and back, leg and handgrip strength of the participants measured. The study was designed in accordance with the rules and principles of Helsinki Declaration and approved by the Ethical Committee of Gazi University (91610558-302-08-01 and dated 07.01.2020). The approval form for volunteering were filled by the participants.

Participants were randomly assigned to either the Tabata method or the Repeated Sprint Method. Both groups applied the exercise protocols 3 times a week every other day for 3 weeks. Fifteen minutes of warm-up was done before each training season 10 minutes of cool down was done after the exercise. Both groups continued their technical practices on the other days.

Training Methods

Tabata Method: This method included 5 movements with 4x8 of 20 second work periods. It has been suggested that high-intensity exercise when carried out at an appropriate level developed aerobic and anaerobic energy systems (29). Burpees, crunches, jumping jacks and push up movements were implemented during Tabata method for 3 weeks. Sets were 4x8 for the first week, 5x8 for the second week and 6x8 for the third week with 1-minute recovery between sets. Also 10 seconds recovery was given between repetitions.

Repeated Sprint Method: Repeated sprint is defined as the ability to apply repeated sprints with minimum recovery time or presenting the best mean sprint performance of successive sprints (12,21). Both linear and change-of-direction repeated sprints are frequently used to enhance physical capacities of the athletes in many sports (13,28). This method was applied as 4 reps in the first week, 5 reps in the second week, and 6 reps in the third week with all-out effort and covered 150 meters. Four mins recovery was given between each repetitions.

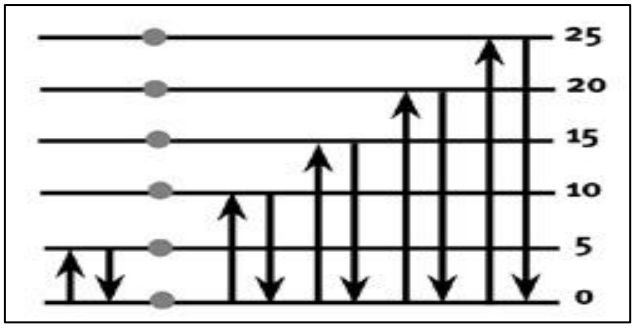

Figure 1. Repeated Sprint Method.

Body Composition Measurements

The height of the participants was measured with a stadiometer (Holtain, England) to the nearest 1 cm. Body mass index (BMI), Basal Metabolism Rate (BMR), Body Fat Percentage (FB%) Total Fat Mass (FAT MASS) were measured using TANITA Body Composition Analyzer. The measurements were taken while the participants were hungry.

Hand-grip Strength

Participants hold the dynamometer (Takei-Back & Lift) for 3-5 seconds in a standing position with 45 degrees between body and arm. Measurements were

taken from both hands. Dominant hands of the participants were the right hands.

Back Strength Measurement

Back muscle strength was measured with a calibrated dynamometer (Takkei-Back & Lift) and recorded in kilograms (kg). For the test, the length of the chain was adjusted to the participants' height by asking the subject to stand on the base of the dynamometer with extended knees. Subsequently, the handle was positioned at the height of the intra-articular space of the knee joint. For the test, participants had to stand on the base, with knees and hips flexed slightly while the lower back had to maintain an appropriate lordotic curve. Subjects were asked to lift in a vertical direction by providing continuous isometric contractions of the extensors of the knees, hips, and lower back while holding the handle. Participants were asked to increase the pull in a safe manner gradually and reach the maximal force in three seconds while keeping this pull for another two seconds. After a demonstration and a familiarization trial, three trials were performed, with rest periods of 30 seconds between trials.

Leg strength measurement

Leg strength was measured with a calibrated dynamometer (Takkei-Back & Lift) and recorded in kilograms (kg). The participant was asked to stand erect with knees bent so that the grasping hand rests at a proper height. They then lifted the handle of the dynamometer, bending his legs, and then straightened the legs. The strength of the leg muscles was recorded on the dial of the dynamometer as for the best of three trials in kg. Thirty-second-time intervals separated each leg strength test.

Statistical Analyses

Data normality was verified using Skewness and Kurtosis values. Paired Sample t-test was used to determine intragroup changes while the Independent Sample t-test was used to determine intergroup changes. P-value was set at $p<0.05$.

Results

Mean values and standard deviations of the physical variables of the participants were shown in Table 1.

Table 1. Physical characteristics of the participants.

	N	Minimum	Maximum	Mean	SD
Age (y)	29	19	24	8,85	2,79
Height (cm)	29	163,00	186,00	176,72	5,47
Body mass (kg)	29	60,20	87,50	72,25	6,53
BMI (kg/cm2)	29	20,10	25,60	23,34	1,41

BMI=Body mass index, SD=standard deviation

Mean values, standard deviations, and 95% confidence intervals of the variables obtained in the first measurement are presented in Table 2.

Table 2. First measurement results of the groups

	Group		t	*p*
	Running (N=15)	Tabata (N=14)		
	Mean±SD	Mean±SD		
Fat percentage (%)	12.30±4.23	12.00±2.67	0.231	0.819
Fat mass (kg)	8.99±3.40	8.71±2.05	0.265	0.793
Back strength	128.97±25.13	145.57±18.30	-2.021	0.053
Leg strength	126.91±26.54	134.36±25.33	-0.772	0.447
Hand grip right	42.04±6.93	44.50±7.96	-0.890	0.382
Hand grip left	40.55±4.80	43.69±6.69	-1.460	0.156

There was no significant difference between groups during the first measurement ($p>0.05$). Mean values, standard deviations and 95% intervals of the variables obtained in the second measurement are given in Table 3.

Table 3. Second measurement results of the groups

	Group			
	Running (N=15)	Tabata (N=14)	t	p
	Mean±SD	Mean±SD		
Fat percentage	12,52±4.18	12,64±2.49	-0.095	0.925
Fat mass	9,26±3.50	9,16±2	0.089	0.929
Back strength	126,14±17.94	146,31±22.71	-2.663	0.013
Leg strength	130,15±26.64	142,52±23.37	-1.325	0.196
Hand grip right	46,30±6.65	46,628.72	-0.111	0.913
Hand grip left	44,77±7.68	43,97±7.18	0.288	0.775

The intragroup changes of the participants can be seen in Table 3. No significant change was found in the variables between two measurements.

Table 4. Comparison of two measurements of two groups

	GROUP	First Measurement	Second Measurement	Sig
Body mass (kg)	Running	72.3±6.6	72.8±6.5	,059
	Tabata	72.1±6.6	72.8±6.5	,149
BMI	Running	23.02±1.61	23.49±1.32	,317
	Tabata	23.68±1.12	23.49±1.32	,634
Fat percentage	Running	12.30±4.23	12.52±4.18	,591
	Tabata	12.0±2.67	12.64±2.49	,286
Fat mass	Running	8.99±3.40	9.26±3.50	,373
	Tabata	8.71±2.05	9.16±2	,289
Back strength	Running	128.91±25.13	126.14±17.94	,557
	Tabata	145.57±18.30	146.31±22.71	,900
Leg strength	Running	126.91±26.54	130.15±26.64	,595
	Tabata	134.36±25.33	142.52±23.37	,121
Hand grip right	Running	42.04±6.93	46.30±6.65	,073
	Tabata	44.50±7.96	46.62±8.72	,247
Hand grip left	Running	40.55±4.80	44.7±7.68	**,037**
	Tabata	43.69±6.69	43.97±7.18	,864

p<0.05

Discussion

The aim of this study was to investigate effects of two different high-intensity interval exercise methods for 3 weeks on body composition and strength parameters. It has been proven that the high-intensity exercise method had scientifically positive effects on aerobic and anaerobic performance (8,9,13). Unlike, this study investigated body composition and strength components.

The main finding of the study was that the back strength of the athletes who attended the Tabata protocol was found higher. It is thought that this difference may stem from Tabata protocol during which athletes work out with their body mass and which includes especially strength exercises. When with-in group pre and post test results are investigated, there were percental changes in body mass, BMI, leg strength, hand-grip right parameters despite not being statistically significant. There was a significant difference in hand-grip left parameter (p=,037). In Tabata group, there were also percental changes in body mass, BMI, back strength, leg strength, hand-grip right and hand-grip left parameters. Fat percentage did not present any change in both groups.

Pinillos et al. (24) applied two different HIIT methods on long-distance runners and suggested that 40x100 m all-out effort positively affected counter movement jump and squat jump performance. Another study stated that HIIT leads to improvement in body fat percentage (26). Bermejo et al. (11) implemented two different HIIT methods (cycling and functional training) on physically active young individuals for 4 weeks and stated significant improvements in fat mass and fat percentage. These studies lasted longer than our study and diet of the participants were not altered during the present study, so it is thought that there were differences especially in fat mass and fat percentage.

Ribeiro et al. (25) applied routine BJJ (Brazilian Jiu-jitsu) training to the control group (n = 9) and high-intensity interval training program to the experimental group (n = 9) in a study they performed on Brazilian 18 Jiu-jitsu athletes for 10 weeks. When the parameters of muscular endurance body composition of high-intensity interval training athletes are examined, it is stated that there is more decrease in body fat masses and fat percentages compared to the control group. In addition, high-intensity interval training is reported to be more effective in muscle endurance.

In the study where Monks et al. (22) Examined the effects of 4-week high-intensity running training on taekvondo's athletic performances, the groups had 2 different running-based HIIT training. They found that the high intensity short-term sprint group had a greater decrease in body weight and body fat percentage than the long-term sprint group.

There are not enough study in the literature investigating the effects of HIIT methods on the strength parameters of the athletes. When related studies were investigated, Pinillos et al. (24) implemented running-based HIIT on triathletes for 4 weeks and suggested no difference in control group while indicating significant interactions in vertical jumping ability and athletic performance in the study group. Pinillos et al. related these results with muscle strength increase.

In the study conducted by Alsairavan et al. (4). It was reported that high-intensity interval workouts with 6-week sessions and high-intensity interval training significantly improve the back force and are in line with our study.

In another study, Eather et al. (16) significantly increased muscle mass and muscle strength in the body for 8-12 minutes, 8 weeks and 3 sessions per week for 8 weeks and 3 sessions a week in their study reported that they have developed.

Another study applied Tabata protocol to 64 female volleyball players for 8 weeks and significant differences were presented between pre and post test measurements in standing long jump, vertical jump and slam dunk performance (7).

Related studies have indicated that HIIT enhanced strength performance. The duration of the protocols ranged from 4 to 8 weeks. This study was implemented 3 days for 3 weeks and investigated effect of HIIT on specifically strength performance. It can be suggested that more than 3 weeks are needed to improve strength parameters with HIITs. Moreover, adaptation to HIITs in terms of strength is thought to last more than 3 weeks. Diet of the athletes should also be altered in order HIIT affect body composition and body fat percentage.

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