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The Impact of the Preparation Season Training Periodization on Motoric and Physiologic Parameters of Elite Male Handball Players

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Abstract

The combined training method and the conventional preparation training method are the most important phase of the workload covering a season. In the present study, during the 8-week preparation period, the preparation period training, a combined training 8-10 times in 6 days a week, was applied to the experimental group. The control group performed a conventional preparation period training for 4 days and 6 times per week. The findings indicate that statistical significances in the pretest and posttest values of the 30-m sprint, There were statistically significant differences in the Cooper test and left-hand claw strength values by the conventional preparation training method. The heart rate variable showed statistical significance as the maximum heart rate, and anaerobic threshold values from the group performed the conventional preparation training method. A statistical significance was discovered in aerobic threshold capacity values from the group performed the combined training method. Although there were differences in body composition measurements and flexibility values, they were not statistically significant.

Introduction:

Handball is a competitive team sport that demands full participation with physical, technical, mental, and tactical abilities. Considering team tactics and performance required in handball, athletes have extraordinary physical abilities individually and as a team to achieve success. Handball is a very dynamic sport discipline. Short actions no more than 10-20 seconds during the competition require high-intensity repetition. Anaerobic energy systems support approximately 30-35% of the playing time. Techniques (fakes, jumps, multi-direction sprints, etc.) and tactical behaviors (dribbling, individual defensive moves, direct contact with the opponent, etc.) used during the competition require the players to maintain a high-performance level. The extent of competition depends on the performance level, applied technique, and tactics (Gorostiaga *et al.*, 2006; Povoas *et al.*, 2012; Wagner *et al.*, 2017; Ilkim *et al.*, 2018). Contemporary education theory was developed in the early 1960s by Matveyev (1964) and Ozolin (1970). This theory was later referred to as the conventional or traditional periodization training model in the 1970s. The frequent and high-intensity workloads are reduced with the beginning of the competition period as

their performances improve (Carmen *et al.*, 2017; Issurin, 2008). Considering the workload covering a season in handball, the most crucial phase of the annual training period is the preparation period for performance maximization, injury prevention, and completing physical and mental preparations. Athletes are expected to be physically and mentally prepare themselves during the preparation period for the competition period, an intense and comprehensive period. The aim is to develop motoric properties such as general strength, endurance, maximum strength, speed, and quickness at the beginning of the preparation period. The training progress from the general and continue as branch-specific exercises. The load scopes are broad with low intensity. As the competition period approaches, the scope is specified, and the intensity is increased (Sevim, 1996). Contemporary scholarship on the physical and physiological images of athletes is in a development trend (Bilge *et al.*, 2000). Productive results of well-planned loads necessitate thorough planning towards the intensity, frequency, and density. Several studies reported that training loads with shorter duration and high intensity are more effective (Fox *et al.*, 1988). Change and development have become an integral part of team sports.

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Thanks to the scientific development and improvements for the tools, studies are better conducted with scientific principles. It was observed that more efficient training plans and programs could be prepared through the evaluation of the results (Sevim, 1996). This research aims to compare the Men's Handball Super League team of Antalyaspor handball team and the 2018-2019-year universities Turkey indoor and beach handball champions Akdeniz University Men's Handball Team preparation period training in 2018-19. The combined training method was applied to the Antalyaspor Handball Team for 8 weeks in the preparation period training, while the conventional load training method was applied to the Akdeniz University men's handball team during the preparation period. Preparation period training sessions are planned as 8 weeks in a single period. Both team players are top elite male handball players. The study presents a comparative analysis of two different training methods applied in the preparation period..

Materials and methods:

The experimental group participants were given training for 6-8-10 days a week, double training in a day as the stages progress, (120 minutes/day) prepared by the combined training method. The control group performed a conventional preparation period training for 3 days and 5 times (120 minutes/day) per week.

Training program content: it includes physical preparations through the combined training method to improve aerobic and anaerobic capacity, strength, mobility, endurance, motoric properties such as speed, and quickness, recovery speed, and decrease the body fat percentage. Control group training content included physical preparations with a conventional training method including pyramidal strength, sub-maximal, maximal, quick strength, aerobic and anaerobic endurance, cross, speed, and quickness training. All athletes participating in the study were tested before the preparatory period and at the beginning of the competition period (at the end of 8 weeks). The study covers 8-weeks in total, including initiation, outcome measurements, and preparation period training.

Population and sample: Antalyaspor men's handball team competed in the 2018-2019 Super League n16 comprised the experimental group and the Akdeniz University men's handball team n16 from the Interuniversity 1st League is included in the control group.

Data Collection Tools: Cooper Test, digital heart rate measurements (resting heart rate, maximum heart rate, VO₂Max), 30-m sprint test, hand claw strength measurement, leg and back strength measurement, flexibility test (sit and reach), body composition measurements, weight and height measurements. The heart rate of the participants was determined with the

digital heart rate measurement tool and Polar Precision Performance Software computer package program. Based on these measurements, the maximum oxygen consumption capacity, maximum heartbeat, resting heart rate, aerobic threshold, and anaerobic threshold data was predicted by the program. These data were used to monitor the instantaneous status of the athletes during heavy load training protocols. Statistical research results were calculated by using the IBM statistics data editor package program.

Results :

The preparation period training in the study including the physical, mental, emotional and psychological preparation of the athletes for intense loading, the application of the conventional high loading principle and the combined training method, the adaptation and concentration to the high load, the physiological and psychological renewal processes of adapting to the competition were applied. The measurements applied to the experimental and control groups before and after the preparation period are presented below.

Table-1:Heart rate measurements of sample groups (n=16)

Variables	Group	Avg.±Sd	P
Maximum oxygen consumption capacity (ml/kg/min)	Exp.	51.00±2.00	0.959
	Con.	50.93±4.37	
Maximum heart rate (beats/min)	Exp.	191.68±3.52	0.000 ^{*b}
	Con.	199.00±2.73	
Resting heart rate (beats/min)	Exp.	65.62±4.80	0.970
	Con.	65.68±4.48	
Aerobic threshold (beats/min)	Exp.	143.50±2.58	0.000 ^{*a}
	Con.	149.25±1.98	
Anaerobic threshold (beats/min)	Exp.	174.93±7.08	0.036 ^{*b}
	Con.	179.06±2.49	

There was a statistically significant difference between the aerobic and anaerobic threshold values and the maximal oxygen consumption capacity between the groups. The difference between the maximum heartbeat and anaerobic threshold values is in favour of the control group, while the difference in aerobic threshold values is in favour of the experimental group. These differences between the groups are thought to be due to the age differences of the athletes.

No statistical significance was found between the flexibility test values from the experimental and control groups. It was observed that there was a statistically significant difference in the experimental group 30-m sprint pretest and post-test averages. It was observed that there was a statistically significant difference between Cooper test pretest and post-test averages. There was a statistically significant difference in favour of the control group in the Cooper test (pretest) comparisons, while no statistically significant difference was found when the posttest averages of the groups were compared.

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Table-2: Experimental and control group. flexibility. 30-m sprint test. cooper test measurements

Variables						
Group	Protocol (test)	N	Mean±Sd		P	
Flexibility (cm)						
Exp.	Pre	16	30.69±6.19		0.189	
	Post	16	32.53±6.51			
Con.	Pre	16	30.26±10.08		0.888	
	Post	16	32.28±6.3			
	Pre-Pre	32				0.890
	Post-Post	32				0.913
30 m Sprint Test (sec.)						
Exp.	Pre	16	4.58±0.24		0.003*	
	Post	16	4.43±0.17			
Control	Pre	16	4.37±0.2		0.140	
	Post	16	4.30±0.17			
	Pre-Pre	32				0.140
	Post-Post	32				0.043 ^{*a}
Cooper Test (m.)						
Exp.	Pre	16	2612.5±192.79		0.018*	
	Post	16	2687.5±170.78			
Control	Pre	16	2262.5±250		0.000*	
	Post	16	2593.75±335.59			
	Pre-Pre	32				0.000 ^{*b}
	Post-Post	32				0.327

Table-3: Force test measurements of sample groups

Variables						
Group	Protocol (test)	N	Mean±Sd		P	
Leg Force (kg.)						
Exp.	pre	16	127.11±19.72		0.572	
	post	16	129.39±16.45			
Con.	pre	16	137.75±11.79		0.305	
	post	16	141.89±17.48			
	pre-pre	32				0.048 ^{*b}
	post-post	32				0.053 ^{*b}
Back Force (Kg.)						
Exp.	pre	16	133.81±18.84		0.194	
	post	16	139.16±16.92			
Con.	pre	16	139.56±12.61		0.490	
	post	16	145.62±13.37			
	pre-pre	32				0.346
	post-post	32				0.270
Right-hand claw force (Kg.)						
Exp.	pre	16	51±6.54		0.045 ^{*a}	
	post	16	53.13±6.01			
Con.	pre	16	48.2±7.56		0.679	
	post	16	48.70±6.70			
	pre-pre	32				0.276
	post-post	32				0.096
Left-hand claw force (Kg.)						
Exp.	pre	16	51.31±5.33		0.598	
	post	16	52.06±5.16			
Con.	pre	16	46.47±7.83		0.158	
	post	16	48.31±8.86			
	pre-pre	32				0.860
	post-post	32				0.164

There was no statistically significant difference in leg strength, back strength, right-hand claw strength, and left-hand claw strength values. A statistically significant difference was observed in favour of the control group in terms of leg strength (posttest) values and in favour of the experimental group in terms of right-hand claw strength (posttest) values.

Table-4: Body composition measurements of sample groups

Variables	Group	Protocol (test)	N	Mean±Sd	P	
Body Fat Percentage (%)						
Exp.	Pre		16	16.49±3.75	0.196	
	Post		16	16.71±3.82		
Con.	Pre		16	16.20±4.97	0.855	
	Post		16	16.66±5.83		
	Pre-Pre		32			0.873
	Post-Post		32			0.984
Fat Mass (Kg.)						
Exp.	Pre		16	15.41±4.90	0.318	
	Post		16	15.61±4.89		
Con.	Pre		16	15.08±7.00	0.324	
	Post		16	15.78±8.75		
	Pre-Pre		32			0.334
	Post-Post		32			0.950
Muscle Mass (Kg.)						
Exp.	Pre		16	70.94±7.61	0.481	
	Post		16	70.76±7.70		
Con.	Pre		16	69.32±9.53	0.679	
	Post		16	69.49±10.17		
	Pre-Pre		32			0.593
	Post-Post		32			0.669
Weight (kg)						
Exp.	Pre		16	91.64±12.26	0.598	
	Post		16	91.53±12.33		
Control	Pre		16	87.80±17.02	0.158	
	Post		16	88.19±19.16		
	Pre-Pre		32			0.497
	Post-Post		32			0.576

No statistical significance was observed regarding the experimental and control group variables.

Discussion and Conclusion:

Results of several scholars such as Sentürk (2016), Hermassi *et al.*, (2014), Zorba *et al.*, (2014), Nikolaidis *et al.*, (2016), Koç (2010), Wagner *et al.*, (2017), Po'voas *et al.*, (2012), Sporis *et al.*, (2010) Sýnýrkavak *et al.*, (2004), Eler & Eler (2018) and the scholarship confirm the generalizability level of the results. The experimental group averaged a maximum oxygen consumption capacity of 51.00±2.00, as the maximum heart rate average was 191.69±3.52, with a resting heart rate average of 65.63±4.80, aerobic threshold average of 143.50±16.00, and mean anaerobic threshold was measured as 174.94±7.08. The Control group maximum oxygen consumption capacity average was 50.94±4.37 with a maximum heart rate average of 199.00±2.73, resting heart rate average of 65.69±4.48, aerobic threshold average of

149.25±1.98 as the anaerobic threshold average was calculated as 179.06±2.49. The study results coincide with contemporary scholarship and relevant findings (Cselkó *et al.*, 2013; Wagner *et al.*, 2017; Po'voas *et al.*, 2012; Sporis *et al.*, 2010; Sýnýrkavak *et al.*, 2004). No statistical significance was found between the pretest and post-tests of the flexibility test values from the experimental and control groups. It was observed that there was a statistically significant difference in the experimental group 30-m sprint pretest and posttest averages. The 30-m sprint test and pretest averages of the experimental and control groups revealed no statistically significant differences. However, it was observed that there was a statistically significant difference in favor of the experimental group in the 30-m sprint posttest scores. It was observed that there was a statistically significant difference between the experimental and control groups' Cooper test pretest and posttest averages. There was a statistically significant difference in favour of the experimental group in the Cooper test pretest results, while no statistically significant difference was found after the post-tests. The study results coincide with contemporary scholarship with close average values and similarities (Atepođlu *et al.*, 2011; Koç & Aslan, 2010; Kiliñç & Özer, 2011; Aktuđ 2013; Zorba *et al.*, 2014; Arabaci *et al.*, 2007; Chaouachi *et al.*, 2009; Massuca *et al.*, 2015; Koç *et al.*, 2011; Wagner *et al.*, 2017; Zorba *et al.*, 2014; Alp *et al.*, 2015; Eler *et al.*, 1999). There was no statistically significant difference between the pretest and post-test averages of the strength test values of the experimental group in terms of leg, back, left-hand claw strength values. Moreover, there was a significant difference in right-hand claw strength values in favour of the experimental group and the leg strength in favor of the control group. The study results coincide with contemporary scholarship with close average values and similarities (Zorba *et al.*, 2014; Ýri *et al.*, 2003; Senel & Göral 2014; Alp *et al.*, 2015; Eler *et al.*, 1999). The study revealed no statistically significant differences between the pretest-posttest body composition averages of the experimental and control groups while the fat percentage, fat mass, muscle mass, and weight variables proved significant differences. The study results coincide with contemporary scholarship with close average values and similarities (Cselkó *et al.*, 2013; Povóas *et al.*, 2012; Sporis *et al.*, 2010; Sýnýrkavak *et al.*, 2004; Eler *et al.*, 1999).

The results show that several physical fitness parameters for handball players are correlated and their average values regarding strength, sprint speed, heart rate, body composition, and flexibility characteristics are substantially good in comparison to contemporary scholarship. The research results revealed that starting the preparation period with a conventional training method and applying the combined training method towards the end of this period should more beneficial for the development of the athletes. It was observed that the 8-

week preparation period training is not sufficient to maintain the athletes' physical fitness level in the competition period. The results indicate that the 8-week preparation period is not sufficient considering the process in a complete season. Considering factors such as the transfer movements in the pre-season, the disruptions in the initial planning of the season, social and economic problems, and the stress caused by the intensive training at the season-opening, more thorough planning for further studies and athletes should be protected from the negative circumstances in the pre-season. Furthermore, it is thought that dominant hand and leg preferences should be taken into consideration for strength measurements, and psychosocial data such as the readiness, satisfaction, and anxiety levels of the athletes should be included in the pre-season studies.

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