© Eurasian Journal of Sport Science 2021; 1(2): 143-148
https://eajss.uz

Means of training and monitoring and methods of endurance development of female handball players

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Abstract
Purpose: Development and control of endurance of handball players by studying modern innovative tools and methods of endurance development, as well as improving the effectiveness of endurance training.
Methods: The following techniques are used to train endurance: The technique of evenly performed exercises is used in the training of general endurance. This method is used during training to prepare for maximum continuous training, which is performed regularly with a pulse of no more than 130 beats per minute. In most cases, recovery performed in an evenly executed exercise style can be considered insufficient. Alternating exercise styles are used to improve endurance. It is characterized by continuous work performed with variable intensity, when the maximum pulse rate is 180 per minute. Interval technique exercises are used to increase the endurance of a handball player in one direction. It is also characterized by the repetition of the same exercises, such as repetitive exercise methods performed at specific rest intervals. The competitive style is used to prepare handball players directly for competitions. You don't need to use this technique a lot in the learning process.
Results: This article examines the scientific and practical experience of domestic and foreign scientists in the field of sports for the development of endurance female handball players, scientific and theoretical information presented in the sources of scientific literature. In the course of the study, modern innovative methods were used aimed at developing the endurance of female handball players by analyzing the training process. Scientific and theoretical ideas were put forward and scientific and practical studies were conducted to control the level of training. When comparing the results of the experimental and control groups, the difference between the relative increase was 5.23%, the results of the study were subjected to comparative analysis and the corresponding conclusions were drawn.
Conclusion: In the course of the study, a wide range of work was carried out to develop the endurance of female handball players. In particular, modern means and methods of endurance development were studied, an endurance training program was developed and put into practice. Special tests were taken to determine the endurance of female handball players, and the results were subjected to comparative analysis. According to the results of a comparative analysis, it was noticed that the level of endurance among female handball players increased by a certain percentage.

Keywords: Technology, functional, individual, complex, microcyclic, mesocyclic, “jerk”, “shuttle run”, standard, pulse, adaptation, coordination.

Introduction

At the present stage of development of the handball sport, according to experts, the level of endurance is important in the physical training of handball players. According to the observations of the coach of the Slovakia N. Serdarusik, the average duration of the attack of highly qualified handball players does not exceed 22.5 seconds, while 86% of the total number of attacks in the game are carried out at a speed of (Serdarusic, 2006).

According to the analysis of Romanian experts E. Ksinte and A. Alexandr, the endurance of highly skilled handball players is important both in terms of the number of counter-attacks and the ability to quickly change tactical movements (Pavlov et.al., 2018).

According to experts, a significant period of endurance development of female handball players is the preparatory period.

When studying the training process of our female handball players in the mesocycle of the preparatory period, it turned out that endurance was emphasized by the exercises "shuttle run" in special halls for handball. The distances used ranged from 9 to 30 meters, and the total distance did not exceed 900 meters. But the results of the analysis of the competitive process of the Asian Men's Championship show that the total average distance of handball players in a match is 1600-1700 meters. Athletes run 1200 m in 5.4 seconds, 400-500 m in the sprint position. Analyzing the created scientific methodological and special literature on handball, we see that a lot of scientific work has been done to prepare handball players for competitions and improve their skills. Nevertheless, we have witnessed that scientific research aimed at developing the endurance of female handball players has been poorly conducted.

Methods

Planning of educational activities, the correct setting of goals and objectives in it, the use of

the most effective and reliable means and methods at different stages of preparation are the main factors for achieving a positive, final result.

Judging by the analysis of scientific literature and the opinions of sports experts, the preparatory period in handball is of particular importance. This period also has a great impact on the results that the level shows during the competition because of its effective and correct organization.

In their opinion, during the preparatory period it is necessary to create the necessary conditions and ensure the development of handball players. The training system for endurance training is shown in the figure below (see figure 1).

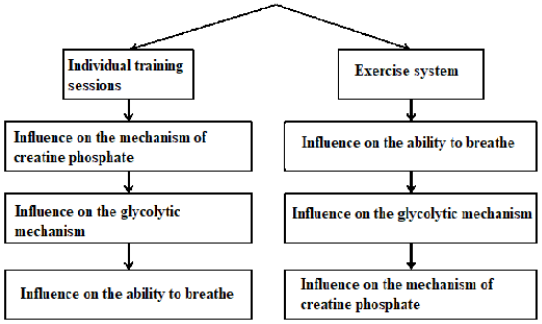


Figure 1. The training system for endurance training.

In the process of physical training of handball players, the technique of the game is used to improve general and special physical training. Handball players use game characters in training, which make them react in a timely manner with appropriate defense and counterattack. The scope and content of the exercise are determined by the task of the trainer.

The circular training style has methodological features of the competitive style. It can also be used by mixing it with methods that are performed with an interval of repetition and rest.

A training program has been developed to develop the endurance of female handball players, according to this program, training was conducted in an experimental group.

The program of classes is based on the study of scientific and practical experience of foreign and domestic scientists (see table 1).

Results and discussion

Research work on the development of endurance of female handball players was carried out in 2020-2021 in the national team of Uzbekistan. In our present study, training loads aimed at developing the endurance of female handball players were studied, and their level of physical fitness was monitored (see table 2).

In the mathematical and statistical calculation of the indicators of the experimental and control groups obtained at the beginning of the experiment, out of 10 handball players of the experimental group on the 100-meter shuttle

Table 1. Special exercises aimed at developing the endurance of handball players.

№	Excercises	Distance, m	Number of repetitions	Time, s	Number	Rest, min
1.	Distance running	20	1	3.2	5-7	-
		22	1	3.25	5-7	-
		30	1	4.35	5-7	-
		40	1	5.45	3-4	-
		60	1	7.8	3-4	-
		100	1	13.0	1-3	-
		200	1	28	2-3	3-4
		400	1	65	1-2	5-6
		800	1	150	1	-
2.	Shuttle run	9	6	12.5	4-5	-
		11	4	8.0	2-3	-
		11	8	18.0	1-3	-
		11	4	10	4-5	1
		15	4	12	3-4	1
		20	2	14	2-3	1
3.	Running with a change of direction	120	1	18.0	1-3	-
		240	1-2	39	1-2	3-4
		360	1	58	1	-

Table 2. Endurance indicators of handball players according to special tests (n=10 at the beginning of the experiment).

№	Tests	Experimental group		Control group		Relative growth, %	t	P
		$\bar{x} \pm \sigma$	V, %	$\bar{x} \pm \sigma$	V, %			
1.	Shuttle run at 100 metres (seconds)	26.36±0.42	1.59	26.77±0.52	1.94	1.53	1.94	>0.05
2.	Running at 400 metres (seconds)	59.53±1.73	2.91	60.81±1.12	1.84	2.10	1.96	>0.05
3.	Cooper's test (6 minutes) metr	967.7±71.52	7.39	933.6±32.42	3.47	3.65	1.37	>0.1
4.	Complex excersis-es (seconds)	25.01±0.66	2.64	25.39±0.47	1.85	1.50	1.48	>0.1

running test with an arithmetic mean of 26.36, a standard deviation of 0.42, a coefficient of variation of 1.59%, out of 10 handball players of the control group on the 100–meter shuttle running test with an arithmetic mean of 26.77, a standard deviation of 0.52, a coefficient of variation of 1.94% were recorded. The relative growth was 1.94%. The theoretically calculated Student distribution according to the degree of significance of P was the value of the criterion T - 1.94, P>0.05, while the degree of significance was assessed as statistically unreliable. The arithmetic mean for the 400-meter running test of the experimental group was 59.53, the standard deviation was 1.73, the coefficient of variation was 2.91%, out of 10 handball players in the control group, the arithmetic mean for the 400-meter running test was 60.81, the standard deviation was 1.12, the coefficient of variation was 1.84%. The relative growth was 2.10%. The theoretically calculated Student distribution according to the degree of significance of P was the value of the criterion T - 1.96, P>0.05, while the degree of significance was assessed as statistically unreliable. The arithmetic mean according to the Cooper test of the experimental group is 967.7, the standard deviation is 71.52, the coefficient of variation is 7.39%, out of 10 handball players of the control group, the arithmetic mean according to the Cooper test is 933.6, the standard deviation is 32.42, the coefficient of variation is 3.47%. The relative growth was 3.65%. The theoretically calculated Student distribution according to the degree of significance of P was the value of the criterion T - 1.37, P>0.1, while the degree of significance was assessed as statistically unreliable. The arithmetic mean according to the test of complex exercises of the experimental group is 25.01, the standard deviation is 0.66, the coefficient of variation is 2.64%, out of 10 handball players of the control group, the arithmetic mean according to the Cooper test is 25.39, the standard deviation is 0.47, the coefficient of variation is 1.85%. The relative growth was 1.50%. The theoretically

Table 3. Endurance indicators of handball players according to special tests (experimental group n=10).

№	Tests	Before the experiment		After the experiment		Relative growth, %	t	P
		$\bar{x} \pm \sigma$	V, %	$\bar{x} \pm \sigma$	V, %			
1.	Shuttle run at 100 metres (seconds)	26.36±0.42	1.59	24.44±1.41	5.73	7.28	3.61	<0.001
2.	Running at 400 metres (seconds)	59.53±1.73	2.91	57.81±1.62	2.85	4.43	3.52	<0.01
3.	Cooper's test (6 minutes) metr	967.7±71.52	7.39	1134.6±95.24	8.39	17.25	4.43	<0.001
4.	Complex excer-sises (seconds)	25.01±0.66	2.64	23.62±0.8	5.56	4.24	3.56	<0.001

calculated Student distribution according to the degree of significance of P was the value of the criterion T - 1.48, P>0.1, while the degree of significance was assessed as statistically unreliable (see table 3).

In the mathematical and statistical calculation of the experimental group indicators obtained at the beginning of the study and at the end of the study, before the study of 10 handball players on the 100-meter shuttle run test, the arithmetic mean was 26.36, the standard deviation was 0.42, the coefficient of variation was 1.59%, after the study of 10 handball players on the 100-meter running test, the arithmetic mean was 24.44, the standard deviation was 1.41, the coefficient of variation was 5.73%. The relative growth was 7.28%. The theoretically calculated Student distribution according to the degree of significance of P was the value of the criterion T - 3.61, P<0.001, at which the degree of significance was assessed as statistically reliable. Before the study, the arithmetic mean for the 400-meter running test was 60.81, the standard deviation was 95.24, the coefficient of variation was 8.39%. The relative growth was 17.25%. The theoretically calculated Student distribution according to the degree of significance of P was the value of the criterion T - 4.43, P<0.001, at which the degree of significance was evaluated as statistically reliable. Before the study, the arithmetic mean for the complex exercises test was 25.01, the standard deviation was 0.66, the coefficient of variation was 2.64%, after the study of 10 handball players, the arithmetic mean for the Cooper test was 23.62, the standard deviation was 0.8, the coefficient of variation was 5.56%. The relative growth was 4.24%. The theoretically calculated Student distribution according to the degree of significance of P was the value of the criterion T - 3.56, P<0.001, at which the degree of significance was assessed as statistically reliable (see table 4).

Before the study, the arithmetic mean for the 400-meter running test was 60.81, the

Table 4. Endurance indicators of handball players according to special tests (control group n=10) .

№	Tests	Before the experiment		After the experiment		Relative growth, %	t	P
		$\bar{x} \pm \sigma$	V, %	$\bar{x} \pm \sigma$	V, %			
1.	Shuttle run at 100 metres (seconds)	26.77±0.52	1.94	26.24±0.49	1.87	1.98	2.35	<0.05
2.	Running at 400 metres (seconds)	60.81±1.12	1.84	59.59±1.61	2.70	2.01	1.97	>0.05
3.	Cooper's test (6 minutes) metr	933.6±32.42	3.47	984.4±35.34	8.58	5.44	1.78	<0.01
4.	Complex exercises (seconds)	25.39±0.47	1.85	24.66±0.46	1.87	2.88	3.51	<0.05

mean for the 400-meter running test was 59.53, the standard deviation was 1.73, the coefficient of variation was 2.91%, after the study of 10 handball players, the arithmetic mean for the 400-meter running test was 57.81, the standard deviation was 1.62, the coefficient of variation was 2.85%. The relative growth was 4.43%. The theoretically calculated Student distribution according to the degree of significance of P was the value of the criterion T - 3.52, P<0.01, at which the degree of significance was assessed as statistically reliable. Before the study, the arithmetic mean according to the Cooper test was 967.7, the standard deviation was 71.52, the coefficient of variation was 7.39%, after the study of 10 handball players, the arithmetic mean according to the Cooper test was 1134.6, standard deviation was 1.12, the coefficient of variation was 1.84%, after the study of 10 handball players, the arithmetic mean for the 400-meter running test was 59.59, the standard deviation was 1.61, the coefficient of variation was 2.70%. The relative growth was 2.01%. The theoretically calculated Student distribution according to the degree of significance of P was the value of the criterion T - 1.97, P>0.05, while the degree of significance was assessed as statistically unreliable. Before the study, the arithmetic mean according to the Cooper test was 933.6, the standard deviation was 32.42, the coefficient of variation was 3.47%, after the study of 10 handball players, the arithmetic mean according to the Cooper test was 984.4, the standard deviation was 35.34, the coeffi-

cient of variation was 8.58%. The relative growth was 5.44%. The theoretically calculated Student distribution according to the degree of significance of P was the value of the criterion T - 1.78, P<0.01, at which the degree of significance was evaluated as statistically reliable. Before the study, the arithmetic mean score on the complex exercises test was 25.39, the standard deviation was 0.47, the coefficient of variation was 1.85%, after the study of 10 handball players, the arithmetic mean on the Cooper test was 24.66, the standard deviation was 0.46, the coefficient of variation was 1.87%. The relative growth was 2.88%. The theoretically calculated Student distribution according to the degree of significance of P was the value of the criterion T - 3.51, P<0.05, while the degree of significance was assessed as statistically reliable (see table 5).

1.61, the coefficient of variation is 2.70%. The relative growth was 4.53%. The theoretically calculated Student distribution according to the degree of significance of P was the value of the criterion T - 3.74, P<0.01, at which the degree of significance was assessed as statistically reliable. The arithmetic mean according to the Cooper test of the experimental group is 1134.6, the standard deviation is 95.24, the coefficient of variation is 8.39%, out of 10 handball players of the control group, the arithmetic mean according to the Cooper test is 984.4, the standard deviation is 84.46, the coefficient of variation is 8.58%. The relative growth was 15.26%. The theoretically calculated Student distribution according to the degree of significance of P was the value of the criterion T - 3.73, P<0.01, at which the degree of significance was assessed as statistically reliable. Ac-

Table 5. Endurance indicators of handball players according to special tests (n=10 at the end of the experiment) .

№	Tests	Experimental group		Control group		Relative growth, %	t	p
			V, %		V, %			
1.	Shuttle run at 100 metres (seconds)	24.44±1.41	5.77	26.24±0.49	1.87	6.86	3.81	<0.01
2.	Running at 400 metres (seconds)	56.89±1.62	2.85	59.59±1.61	2.70	4.53	3.74	<0.01
3.	Cooper's test (6 minutes) metr	1134.6±95.24	8.39	984.4±84.46	8.58	15.26	3.73	<0.01
4.	Complex exercises (seconds)	23.62±0.8	3.39	24.66±0.46	1.87	4.22	3.56	<0.01

In the mathematical and statistical calculation of the experimental and control groups obtained at the end of the experiment, out of 10 handball players of the experimental group on the 100-meter shuttle running test with an arithmetic mean of 24.44, standard deviation of 1.41, coefficient of variation of 5.77%, out of 10 handball players of the control group on the 100-meter running test with an arithmetic mean of 26.24, standard deviation of 0.49, coefficient of variation, he recorded 1.87%. The relative growth was 6.86%. The theoretically calculated Student distribution according to the degree of significance of P was the value of the criterion T - 3.81, P<0.01, at which the degree of significance was assessed as statistically reliable. The arithmetic mean for the 400-meter running test of the experimental group is 56.89, the standard deviation is 1.62, the coefficient of variation is 2.85%, out of 10 handball players of the control group, the arithmetic mean for the 400-meter running test is 59.56, the standard deviation is

cording to the complex training test of the experimental group, the arithmetic mean was 23.62, the standard deviation was 0.8, the coefficient of variation was 3.39%, according to the control test of 10 handball players of the control group, the arithmetic mean was 24.66, the standard deviation was 0.46, the coefficient of variation was 1.87%. The relative growth was 4.22%. The theoretically calculated Student distribution by the degree of significance of P was the value of the criterion T - 3.56, P<0.01, at which the degree of significance was assessed as statistically reliable.

In sports practice , the oscillation of measurement results is evaluated depending on the value of the coefficient of variation as follows:

-Small if -0 ÷ 10% ;
-Average if -11 ÷ 20%;
-Large if V > 20%.

According to the correlation analysis given above, when we compare the results ob-

tained in our study, we find that the coefficient of variation of the results of the speed and endurance test of female handball players is in the range of -0 ÷ 10%, which is a small, that is, a good indicator.

Conclusion

According to the scientific theories of scientists in the field of sports and the analysis of scientific literature, in practice, exercises with and without a ball are used as training loads that allow developing endurance. Exercises performed with a ball increase the level of the three exercises listed below, namely technical, tactical, special physical training and reduce the level of psychological tension of loads.

Exercises performed in a position without a ball differ in that they record the distribution of loads in a strict order with the establishment of dosages and the same values for all participants of training exercises. Therefore, both specialized and non-specialized exercises are selected as the right approach to the manifestation and development of endurance.

Most Russian and European handball experts recommend using distance segments from 30 to 800 meters to increase endurance.

According to many coaches, young female handball players undergo special training aimed at the endurance of girls, as well as technical and tactical training in complex movements or trainings that develop explosive leg strength.

The results of scientific research and analysis of the training loads of young female handball players have shown that during training it is necessary to introduce a complex of high-intensity acyclic exercises aimed at developing endurance. Such changes increase the overall intensity of training, contribute to the elimination of nervous overstrain and gradually increase the activity of the central nervous system of handball players, helping them to withstand an increased volume of complex exercises.

As for the general conclusion of our study, extensive work was carried out during the study to develop the endurance of female handball players. In particular, modern means and methods of endurance development were studied, an endurance training program was developed and put into practice. Special tests were taken to determine the endurance of female handball players, and the results were subjected to comparative analysis. According to the results of a comparative analysis, when the test results of the experimental group obtained at the beginning of the study and at the end of the study were mathematically statistical, the relative increase of 10 female handball players on the 100 meter shuttle running test was 7.28%. The relative increase in mileage by 400 meters was 4.43%. The relative increase in the Cooper test was 17.25%. The relative increase in the test of complex exercises was 4.24%. It was found that the average relative value of the endurance gain of handball players engaged in the experimental group is 8.3%.

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