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Programming the Stage of Direct Preparation and Participation in the Main Competitions of the Sports Season for Highly Qualified Field Hockey Players

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Abstract

Background. The modern stage of training highly qualified athletes is characterized by the introduction of technologies into the training process aimed at effective planning and monitoring of training effects. This technology considers programming, which provides an ordered content of the training process, taking into account the main components of training loads.

Objectives. The study purpose was to experimentally determine the effectiveness of building a training process for highly qualified field hockey players at the stage of direct preparation and participation in the main competitions of the sports season based on programming methods.

Materials and methods. A total of 21 highly qualified field hockey players involved in the study. The participants had attained the rank of sports qualification – Master of Sports of Ukraine. The athletes' mean age was 25.6 ± 5.29 years. The study was conducted in 2021 during the preparation and participation of the Ukrainian national field hockey team in the European Championship "Championship 2" (Gniezno, Poland). The scientific search was carried out on the basis of the following methods: theoretical analysis and generalization of scientific and methodical literature; pedagogical observation, pedagogical testing, and methods of mathematical statistics.

Results. The stage structure of direct preparation and participation in the main competitions of the sports season for highly qualified field hockey players was determined. It consisted of three mesocycles: basic — 4-day retractable microcycle, 4-day shock microcycle, 3-day recovery microcycle; special training – 4-day shock microcycle, 3-day recovery microcycle, 4-day preparatory microcycle; competitive – 7-day competitive, 3-day recovery microcycles.

Conclusions. One of the most rational technologies for training athletes is programming, which ensures an ordered content of the training process, taking into consideration the key elements of training loads. Programs of training tasks were developed, which became the basis for micro- and mesocycle programs.

Keywords: field hockey, team game sports, programming method, means of training work, training loads, coordination difficulty modes.

Introduction

The optimal combination of training and competition loads in the competitive period to ensure the maintenance of the second phase of sports form is one of the debatable issues today (Dubois et al., 2020; Kostiukevych, Lazarenko, Shchepotina et al., 2021; Buy, 2023). In this regard, at the current stage in the system of training athletes, which is based on the theory of periodization of the training process, scientists single out the stage of direct preparation for the main competitions of the sports season (Bompa, Buzzichelli, 2018; Platonov, 2018; Kasper, 2019, etc.). It should ensure the solution of such tasks as recovery, maintaining the achieved

level of training, creating conditions for the manifestation of the delayed training effect, psychological preparation for the competition, working out the details of preparation according to the model of competitive activity (Platonov, 2018; Shchepotina et al., 2021; Adamchuk et al., 2023). Thus, the problem of developing the structure and content of this stage was defined by many scientists as urgent, in accordance with the demands of the theory and practice of a certain sport (Malikova et al., 2018; Andrade et al., 2021; Leibo et al., 2021).

The analysis of literary sources allowed us to come to the conclusion that the training process of athletes at the stage of direct preparation for the main competitions of the sports season is mainly carried out on the basis of modeling methods (Kostiukevych, 2019; Kostiukevych, Shchepotina, Shynkaruk et al., 2019; Teixeira et al., 2022) and programming (Veličković et al., 2018; Bui, 2022; Bonder, Shim, 2023). It is worth noting that the programming method is used both to improve physical preparedness (Bohuslavska, 2021; Lisenchuk et al., 2023; Hidayah et al., 2024) and technical-tactical (Imas et al., 2018; Pizarro et al., 2019; Perepelitsa, 2021) and integral preparedness (Turliuk, 2017; Kozina et al., 2019; Kostiukevych, Shchepotina, Shynkaruk et al., 2020) of athletes.

Therefore, the analysis of literary sources allows us to state that the scientific search for relatively optimal training of athletes at the stage of preparation for the main competitions of the sports season based on programming methods is relevant for the Olympic sport – field hockey.

Purpose of research – to experimentally determine the effectiveness of building a training process for highly qualified field hockey players at the stage of direct preparation and participation in the main competitions of the sports season based on programming.

Material and Methodology

Participants

21 highly qualified field hockey players participated in the study. Sports qualification – master of sports of Ukraine. The age of the athletes is 25.6 ± 5.29 years. Informed consent was obtained from all players to participate in the study. Research was conducted in accordance with the ethical principles of the Declaration of Helsinki.

Research Organization

The study was conducted in 2021 during the preparation and participation of the Ukrainian national field hockey team in the European Championship "Championship 2" (Gniezno, Poland). National teams took part in the competition: Austria, Iran, Italy, Poland, Switzerland, Scotland, Croatia, Ukraine.

Achieving the goal of the research was carried out on the basis of the following methods: theoretical analysis and generalization of scientific and methodical literature; pedagogical observation, pedagogical testing, methods of mathematical statistics.

The theoretical analysis and generalization of literary sources became the basis for determining the purpose of the research and building a scientific search algorithm for the given problem.

Pedagogical observation was carried out in order to control and analyze the training and competitive activities of the players.

Pedagogical testing made it possible to determine the indicators of physical and functional readiness of players during the stage of direct preparation for the main competitions of the 2021 sports season.

Tests were used to assess speed and speed-strength qualities: a 30 m run from a high start and a long jump from a standing position. General endurance was assessed using the Cooper test (continuous running for 12 min).

Speed endurance was determined on the basis of the test – a shuttle run of 180 m (Fig. 1). Three racks were placed on a straight line at a distance of 15 m from each other. At the coach's signal, the player started running from the first to the second post, ran around it and returned to the first post, then he ran to the third post, ran around it and returned to the first post. After that, the exercise was repeated without stopping.

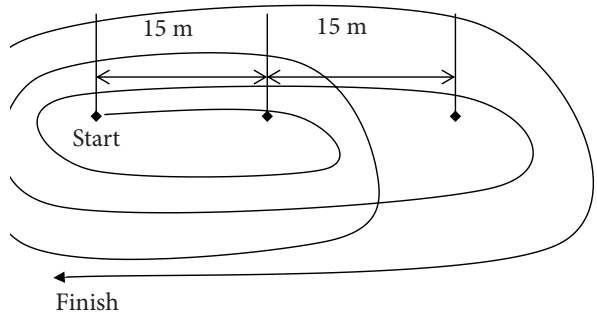

Fig. 1. Scheme of execution of the test "180 m shuttle run"

When performing this test, the following indicators were determined:

- time to cover the distance (s);
- integrative adaptation index (IAI):

$$IAI = t\,(f_1 + f_2 + f_3), \quad (1)$$

where: t is test execution time;

f_1, f_2, f_3 – heart rate in 10 seconds at the end of the first, second and third minutes of recovery.

Index of operational adaptation (IOA):

$$IOA = \frac{(fw - fr)}{t} \cdot 100, \quad (2)$$

where: fw is heart rate 10 seconds after the end of the test;

fr – heart rate in 10 seconds at the end of the first minute of recovery;

t – duration of test performance.

The functional fitness of the players was assessed based on the indicators of maximum oxygen consumption in absolute terms (VO_2max abs, l·min^{-1}) and relative (VO_2max rel, ml·min^{-1}·kg^{-1}) values.

The running version of the test was used to determine these indicators PWC_{170}(V).

Determination of VO_2max indicators was carried out according to the following algorithm.

1st step. Without warm-up, ran 800 m in 5 minutes (at a steady pace without acceleration throughout the entire distance).

2nd step. Heart rate fixation immediately after overcoming the first distance (f_1).

3rd step. Determination of running speed when covering the first distance (V_1).

$$V_1 = \frac{S_1}{t_1}, \quad (3)$$

where: S_1 is first distance duration (m);

t_1 – duration of overcoming first distance (s).

4th step. 5 minute rest (stretching).

5th step. 1200 m run in 5 minutes.

6th step. Heart rate fixation immediately after overcoming the second distance (f_2).

7th step. Determination of running speed when covering the second distance (V_2).

$$V_2 = \frac{S_2}{t_2}, \quad (4)$$

where: S_2 – length of the second distance (m);

t_2– duration of overcoming the second distance (s).

8th step. Determination of physical capacity $PWC_{170(V)}$ using the formula:

$$PWC_{170(V)} = V_1 + (V_2 - V_1)\frac{170 - f_1}{f_2 - f_1} \quad (5)$$

9th step. $PWC_{170(V)}$ ($m \cdot s^{-1}$) value is transferred into PWC170 (kgm×min-1) using the formula:

$$PWC_{170} = 417 \cdot PWC_{170(V)} - 83 \quad (6)$$

10th step. Determination of absolute value of VO_2max.

$$VO_2max\ abs = 1{,}7 \cdot PWC_{170} + 1240 \quad (7)$$

11th step. Determination of relative value of VO_2max.

$$VO_{2\max} rel = \frac{VO_{2\max} abs}{BM}, \quad (8)$$

where: BM is player's body mass.

The coefficient of the load magnitude is determined by the formula:

$$CLM = \sum_{i=1}^{n} t_i \cdot I_i, \quad (9)$$

where: *CLM* is coefficient of load magnitude (points);

t_i – duration of a separate training exercise (minutes);

I_i – the intensity of a separate exercise depending on the heart rate (HR). Heart rate – 114 bpm – 1 point, 120 bpm – 2 points, 126 bpm – 3 points, 132 bpm – 4 points; 138 bpm – 5 points; 144 bpm – 6 points; 150 bpm – 7 points; 156 bpm – 8 points; 162 bpm – 10 points; 168 bpm – 12 points; 174 bpm – 14 points; 180 bpm – 17 points; 186 bpm – 21 points; 192 bpm – 25 points; 198 bpm – 33 points.

In addition to CLM, the coefficient of intensity of training load (CIt.l.) was also determined, which reflected the intensity of the training session:

$$CI_{t.l.} = \frac{CLM}{T}, \quad (10)$$

T – duration of the training session (minutes).

Statistical analysis

Mathematical statistics methods were used to process and analyze the research results. Descriptive statistics using parametric criteria for linked samples were used (Albert et al., 2017; Byshevets et al., 2019; Kostiukevych, Lazarenko, Vozniuk et al., 2020). Determination of the mean value (mean) and the mean square deviation (SD) was assumed. Statistical reliability in the difference between indicators of physical and functional fitness of the studied players was determined using the Student's t-test. Differences were considered significant at $p < 0.050$. Statistical processing of the research results was carried out on a personal computer using Microsoft Excel XP and Statistica 10.0 application software packages developed by Microsoft and Stat Soft (USA).

Results

The working hypothesis of this study assumed that the content of training classes of highly qualified field hockey players should be determined by clear criteria for planning and control of managerial influences. Programming was chosen as the most optimal scientific and methodical approach to building the players' training process. On the basis of which, step-by-step management influences are carried out, taking into account the appropriate ratio of means of training work and loads of different orientations, taking into account the level of preparation of athletes.

It was determined that the components of the structure of the training process of highly qualified field hockey players at the stage of direct preparation and participation in the main competitions of the sports season (SDP for MC) should be programs of training tasks and various types of microcycles.

The program of the training task is a strictly regulated content of the sportsmen's motor activity, taking into account the types and components of the training work and corresponds to the main purpose and direction of the training process.

The structure of the training task program (TTP) is presented in table 1.

The structure of the training task program (TTP) was determined by:

- the duration of the training task;
- means of training work – general preparatory exercises (GPE), special preparatory exercises (SPE), preparatory (technical and tactical) exercises (PE), competitive exercises (CE);
- load orientation – aerobic (A), mixed (Mx), anaerobic-alactate (AAA), anaerobic-glycolytic (AAG);
- modes of coordination complexity (CMM) of performing exercises: the 1st CCM included exercises performed on the place or at a convenient speed of movement; the 2nd CCM (average coordination difficulty) included exercises performed in motion with limited space and time; the 3rd CCM included exercises performed in conditions of active interference from an opponent (partner) or complex gymnastic and acrobatic exercises;
- coefficient of load magnitude (CLM);
- coefficient of training load intensity (CIt.l.);
- content and scheme of TTP execution;
- TTP execution algorithm;
- components of training work – the duration of a single exercise (t), the intensity of its performance (I), the rest interval between exercises (s), the heart rate during the exercise (HRw), the heart rate at the end of the rest interval (HRr).

This structure of the TTP allows you to clearly define the parameters of training work, both in a separate training session and in a training microcycle (table 2).

Planning of training work in microcycles was carried out on training (competitive) days, taking into account

Table 1. Training task program for improving the speed endurance of highly qualified field hockey players

TTP code	duration of TTP	orientation of TTP	CLM (points)	CIt.l. (points·min^{-1})
TTP: SE (5)	**23 min**	**mainly alactate-glycolytic**	**232**	**10.1**

Content and scheme of TTP execution		**TTP is aimed at increasing the level of high-speed endurance of players. TTP is held in a stadium with a 400-meter track. TTP is performed in shock microcycles, before performing TTP, a "warm - up" WU: SPT: SPE (3) is performed.**									
TTP algorithm (steps)	**Content of individual actions (steps) of the TTP**	**components of training work**									
		t	**I**	**CCM**	**GPE**	**SPE**	**PE**	**CE**	**Heart rate**	**CLM (points)**	**$CI_{t.l}$ (points· min^{-1})**
1st	400 m run (V=3.8 m·s^{-1})	105"	H	2	-	2' (Mx)	-	-	168	24	12.0
2nd	Walking, stretching	2'	L	1	2' (A)	-	-	-	120	4	2.0
3rd	400 m run (V=4.0 m·s^{-1})	100"	H	2	-	2' (Mx)	-	-	174	28	14.0
4th	Walking, stretching	2'	L	1	2' (A)	-	-	-	120	4	2.0
5th	Running 400 m (V=3.8 m·s^{-1})	88"	M / Max	2	-	2' (AAG)	-	-	186	50	25.0
6th	Walking, stretching	2'	L	1	2' (A)	-	-	-	120	6	3.0
7th	400 m run (V=3.8 m·s^{-1})	88"	M / Max	2	-	2' (AAG)	-	-	186	50	25.0
8th	Walking, stretching	2'	L	1	2' (A)	-	-	-	126	6	3.0
9th	400 m run (V=3.8 m·s^{-1})	88"	M / Max	2	-	2' (AAG)	-	-	186	50	25.0
10th	Walking, stretching	2'	L	1	5' (A)	-	-	-	120	1	2.0

Total	t	I	CCM	means				loads				CLM	$CI_{t.l.}$
				GPE	SPE	PE	CE	A	Mx	AAA	AAG		
	23	L-M/ Max	1st - 13' 2nd - 10'	13	8	-	-	13'	4'	-	6'	232	10.1

Notes: CCM – coordination complexity mode; t – exercise duration; I – exercise intensity: L – low, M – medium, H – high, Max – maximum; GPE – general preparatory exercises; SPE – special preparatory exercises; PE – preparatory exercises; CE – competition exercises; loads: A – aerobic, AAG – anaerobic-glycolytic, Mx – mixed; AAA – anaerobic alactate; CLM – coefficient of load magnitude; $CI_{t.l.}$ – coefficient of intensity of training load

morning and evening classes (games). This structure of the microcycle made it possible to plan and register not only training tools, taking into account CCM and training loads of different directions, but also the amount of training effects at each training session or in the game.

The programs of pull-up, shock, preparatory, competitive and recovery microcycles became the basis for developing the structure and content of the stage of direct training and participation in the main competitions of the sports season of highly qualified field hockey players (fig. 2). This stage consisted of three mesocycles – basic, special-preparatory and competitive. This stage structure made it possible to consistently solve the problems of adapting players to training loads and specific competitive activities.

It is important to note that planning of the magnitude and intensity of training impact in microcycles of the stage was carried out on the basis of the principle of undulation of training loads (fig. 3).

This made it possible to optimally combine the processes of exercise and rest both in microcycles and in general throughout the entire stage of direct preparation and participation of players in the main competitions of the sports season.

The volume and ratio of the means of training work of players at the stage of direct preparation and participation in the main competitions of the sports season is presented

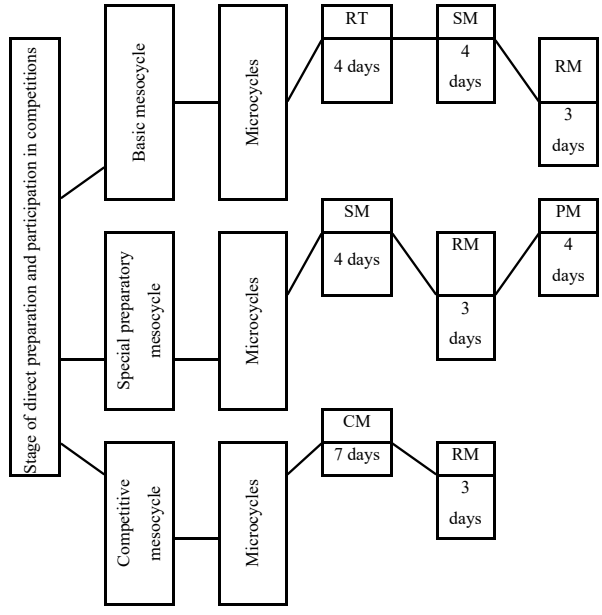

Fig. 2. Structure of the stage of direct training and participation in the main competitions of the sports season of highly qualified field hockey players: Notes: microcycles: RT – retractable; SM – shock; PM – preparatory; CM – competitive; RM – recovery

Table 2. Structure and content of the 4-day lead microcycle for training highly qualified field hockey players

Types and components of training work			Training days																	Total
			1st				2nd						3rd				4th			
			MT	ET			MT			ET			MT	ET			MT			ET	
				W	TTP		W	TTP		W	TTP			W	TTP		W	TTP			
TTP code				CC (6)	TTM S (2)	GT FVM (1)	TTP (9)	TTM (3)	TP RP (1)	GPE (8)	TP RTS (1)	VSP (1)		CC (6)	SV (2)	TP SP (1)	GPE (8)	TP NP (1)	VSP (1)		
Means, min; CCM	GPE	1	Theoretical class	15	6	6	10	-	8	12	18	10	Recovery measures	15	7	8	12	8	10	Recovery measures	145
		2		-	-	-	-	-	-	-	-	-		-	-	-	-	-	-		-
		3		-	-	-	-	-	-	-	-	-		-	-	-	-	-	-		-
	SPE	1		-	-	-	-	-	-	-	-	-		-	-	-	-	-	-		-
		2		7	-	-	7	-	-	13	-	-		7	10	-	13	-	-		57
		3		-	-	-	-	-	-	-	-	-		-	-	-	-	-	-		-
	PE	1		3	-	-	-	-	-	-	-	-		3	-	-	-	-	-		6
		2		4	16	6	7	20	-	6	-	-		4	6	-	6	-	-		75
		3		-	-	-	6	10	-	4	-	-		-	-	-	4	-	-		24
	CE	1		-	-	-	-	-	-	-	20	-		-	-	-	-	-	-		20
		2		-	-	9	-	-	10	-	20	-		-	-	15	-	20	-		74
		3		-	-	9	-	-	10	-	20	-		-	-	15	-	15	-		69
Load, min	A			15	6	12	12	10	8	23	18	10		15	13	8	23	8	10		191
	Mx			14	-	18	18	20	20	7	60	-		14	-	30	7	35	-		243
	AAA			-	16	-	-	-	-	-	-	-		-	-	-	-	-	-		16
	AAG			-	-	-	-	-	-	5	-	-		-	10	-	5	-	-		20
Total, min				29	22	30	30	30	28	35	78	10		29	23	38	35	43	10		
				81			88			123				90			88				470
CLM, points				170	204	267	190	260	332	266	764	10		170	224	384	266	384	10		
				641			782			1040				660			650				3773
CI_{tl}, points·min^{-1}				5.9	9.3	8.9	6.3	8.7	11.9	7.6	9.8	1.0		5.9	9.7	10.1	7.6	8.7	1.0		
				7.9			8.9			8.5				7.3			7.4				8.0
Load value				M			H			H				M			M				M
Orientation				A-Mx			Mx			Mx				Mx			Mx				Mx

Notes: MT – morning training; ET – evening training; W – warm-up; TTP – training task program; CCM – mode of coordination complexity of performing exercises; GPE – general preparatory exercises; SPE – special preparatory exercises; PE – preparatory (technical and tactical) exercises; CE – competitive exercises; loads: a – aerobic; Mx – mixed (aerobic-anaerobic); AAA – anaerobic alactate; AAG – anaerobic glycolytic; CLM – coefficient of the load magnitude; $CI_{t.l.}$ – coefficient of the training load intensity; Load value: M – medium, H – high

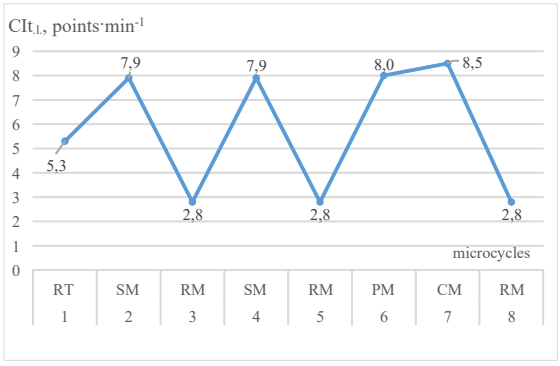

Fig. 3. Dynamics of the intensity of training loads at the stage of direct training and participation in the main competitions of the sports season of highly qualified field hockey players. Notes: microcycles: RT – retractable; SM – shock; RM – recovery; PM – preparatory; CM – competitive

in Table 3. Depending on the type of microcycle in the training process, general preparatory, special preparatory, preparatory and competitive exercises were performed in different proportions.

In the retractable microcycle, only general preparatory exercises were used. Percussion is characterized by the predominant performance of general preparatory (36.0 %) and special preparatory (33.8 %) exercises. Preparatory and competitive exercises were most often used in preparatory (22.3 % and 34.7 %) and competitive (17.9 % and 41.7 %) microcycles.

Training influences on the level of preparedness of players at the stage of direct preparation and participation in the main competitions of the sports season were carried out both through the use of various means and through the application of loads of different orientations (Fig. 4). Training exercises based on aerobic loads were most often used in the 3-day recovery microcycle (85.4 %). Mixed (aerobic-anaerobic) loads were mainly used in 4-day shock

Table 3. The volume and ratio of training facilities for highly qualified field hockey players at the stage of direct training and participation in sports season competitions

Microcycles	Training means, min (%)				Total
	General preparatory exercises	Special preparatory exercises	Preparatory exercises	Competitive exercises	
4-day retractable	350 (100)	-	-	-	350
4-day shock	192 (36.0)	180 (33.8)	71 (13.3)	90 (16.9)	533
3-day recovery	156 (75.7)	7 (3.4)	43 (20.9)	-	206
4-day shock	192 (36.0)	180 (33.8)	71 (13.3)	90 (16.9)	533
3-day recovery	156 (75.7)	7 (3.4)	43 (20.9)	-	206
4-day preparatory	145 (30.9)	57 (12.1)	105 (22.3)	163 (34.7)	470
7-day competitive	240 (33.3)	51 (7.1)	129 (17.9)	300 (41.7)	720
3-day recovery	156 (75.7)	7 (3.4)	43 (20.9)	-	206
Total	1587 (49.2)	489 (15.2)	505 (15.7)	643 (19.9)	3224

(36.4 %), 4-day preparatory (51.7 %) and 7-day competitive (56.5 %) microcycles. As for anaerobic loads, when compiling microcycle programs, the greatest use of anaerobic-alactate loads was planned in 4-day shock (14.6 %) and 4-day preparatory (3.4 %) microcycles.

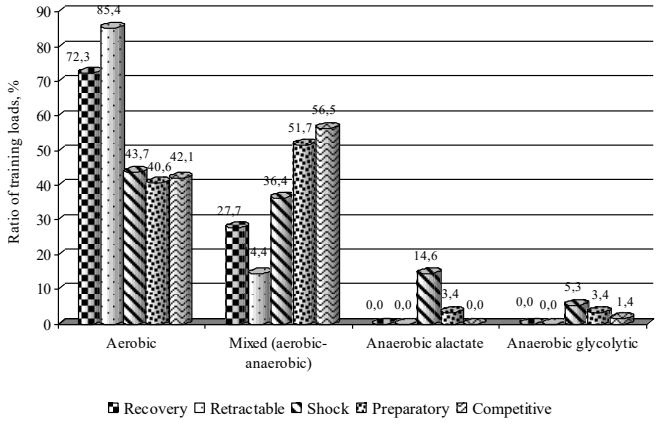

Fig. 4. The ratio (%) of training loads of different directions in microcycles of training highly qualified field hockey players at the stage of direct training and participation in competitions of the sports season

Anaerobic-glycolytic loads were mainly used in 4-day shock (5.3 %) and 4-day preparatory (3.4 %) microcycles. For effective participation of players in competitive activities in field hockey, it is necessary to show a high level of speed and speed-strength qualities, as well as speed and general endurance (table 4).

Comparative analysis of the indicators of physical fitness of players allows us to state that during the SDP for MC of the sports season there were statistically significant changes in the manifestation of speed and strength qualities (1.9 %; $p = 0.032$), speed (3.9 %; $p = 0.013$) and general (2.4 %; $p = 0.027$) endurance. Positive changes in the manifestation of speed qualities were 0.7 % ($p = 0.186$). No less important for the effective competitive activity of highly qualified field hockey players is their level of functional fitness.

To analyse the level of functional readiness of players, the following criteria were selected: VO_2max abs ($l \cdot min^{-1}$), VO_2max rel ($ml \cdot min^{-1} \cdot kg^{-1}$), IAI (integrative adaptation index, rel. units), IOA (index of operational adaptation, rel. units), table 5.

The first two criteria characterize the athletic performance of athletes and the overall level of fitness in accordance with the chosen sport. IAI characterizes the recovery processes of players within a 3-minute rest interval. The IOA indicates that the players' performance is restored during the first minute of rest.

Table 4. Indicators of physical fitness of highly qualified field hockey players at the stage of direct training and participation in competitions of the sports season

Fitness indicators (tests)	At the beginning of SDP for MC			At the end of SDP for MC			Changes		t	p
	n	mean	SD	n	mean	SD	absolute values	%		
Running 30 m from a high start, s	21	4.20	0.14	21	4.17	0.12	0.03	0.7	1.37	0.186
Standing long jump, m	21	2.56	0.19	21	2.61	0.16	0.03	1.9	2.31	0.032
Shuttle run 180 m, s	21	37.68	0.95	21	36.21	0.74	1.47	3.9	2.74	0.013
Cooper's test, m	21	3042.0	126.14	21	3118.1	96.16	76.1	2.4	2.38	0.027

Note: SDP for MC is a stage of direct preparation for the main competitions

Table 5. Indicators of functional readiness of highly qualified field hockey players at the stage of direct training and participation in sports season competitions

Fitness indicators (tests)	At the beginning of SDP for MC			At the end of SDP for MC			Changes		t	p
	n	mean	SD	n	mean	SD	absolute values	%		
VO_2max abs, l·min^{-1}	21	3.89	0.24	21	4.01	0.21	-0.12	2.9	2.16	0.043
VO_2max rel, ml·min^{-1}·kg^{-1}	21	53.1	4.22	21	59.8	4.33	1.7	3.1	2.32	0.031
IAI, rel. units	21	2148.0	114.38	21	2064.4	101.16	83.6	3.8	2.86	0.001
IOA, rel. units	21	20.7	1.18	21	21.4	1.26	0.7	3.3	2.63	0.016

Notes: SDP for MC – stage of direct preparation for the main competitions; VO_2max abs – absolute value of maximum oxygen consumption; VO_2max rel – relative value of maximum oxygen consumption; IAI – integrative adaptation index; IOA – index of operational adaptation

At the end of the SDP for MC of the sports season, the values of the criteria for functional readiness of players increased statistically significantly compared to its beginning. In particular, the values of VO_2max abs increased by 0.12 l·min^{-1} (2.9 %, p = 0.043), VO_2max rel by 1.7 ml·min^{-1}·kg^{-1} (3.1 %, p = 0.031); IAI by 83.6 rel. units (3.8 %, p = 0.001), IOA by 0.7 rel. units (3.3 %, p = 0.016).

Discussion

The current stage of sports development is determined by the scientific search for the most effective methods of training athletes. This encourages conducting various studies using various technologies for monitoring the training process, building training programs both during long-term improvement and within the framework of annual macrocycles (Leibo et al., 2021; Bui, 2022).

This problem remains relevant for team game sports, including the Olympic sport of field hockey.

The calendar of international competitions of players of the national field hockey team of Ukraine determines participation in the main competitions of the season annually. Usually, these are European Championships, the World League, qualifying tournaments for the Olympic Games. Therefore, the chosen research topic is important both from a scientific point of view for obtaining new knowledge about the parameters of training effects, and from the practical implementation of such a scientific and methodological approach, which is the programming of the training process.

In our study, unlike many authors (Turliiuk, 2017; Platonov, 2018, etc.), we combined the stage of direct preparation for the main competitions of the sports season with the competitions themselves. This allows us to consider the training process of athletes at this stage of the annual training cycle, taking into account the three phases of sports form. Based on this, the structure of the stage of direct training and participation in the main competitions of highly qualified field hockey players in a logical sequence consisted of retractable – shock – recovery – shock – recovery – preparatory – competitive – recovery microcycles.

That is, we can consider such a structure as a corresponding model of the training process of athletes of team game sports when preparing and participating in the main competitions of the sports season.

It is also worth noting that the main basis of programs of structural formations of the training process was developed programs of training tasks, which distinguishes our research from other scientific studies of this problem (Turliiuk, 2017; Imas et al., 2018; Kostiukevych, Shchepotina, Shynkaruk et al., 2019).

The program of each training task is made taking into account all the components of training actions – the duration of the training task, the direction of the load, the ratio of training work tools, the ratio of modes of coordination complexity of performing exercises, coefficients of magnitude and intensity of the training load, and so on.

This approach to the construction of training task programs allows, on the one hand, to program the formation of urgent and delayed training effects, and on the other, to specifically determine the parameters of training work in microcycles and mesocycles of training players at a certain stage of the annual macrocycle.

The lack of statistically significant improvement in 30 m running performance in the studied players is associated with objective difficulties that arise in the process of developing speed abilities in adulthood (Platonov, 2018). At the same time, we observe a positive dynamics of results in this test. In addition, the statistically likely improvement of most indicators of physical and functional fitness of players during the SDP for MC determines the statement about the feasibility of building the training process of highly qualified hockey teams at this stage on the basis of programming, which is also justified in our previous studies (Shchepotina et al., 2021; Adamchuk et al., 2023).

So, the conducted scientific research, which was of an experimental nature, confirmed the predictions regarding the feasibility of using programming in the training process of athletes of team game sports.

Conclusions

The modern stage of training highly qualified athletes is characterized by the introduction of new technologies into the training process, aimed, first of all, at increasing the effectiveness of training effects.

One of the most rational technologies for training athletes is programming, which provides for an ordered content of the training process taking into account the main components of training loads.

It has been experimentally proven that the construction of the training process of highly qualified field hockey players at the stage of direct preparation and participation in the main competitions of the sports season based on programming is effective. The structure of this stage consists of a 4-day retractable, 4-day shock, 3-day recovery, 4-day shock, 3-day recovery, 4-day preparatory, 7-day competition and 3-day recovery microcycles.

It is determined by the ratio of the means of training work and the load of different orientations of the 32-day stage of direct preparation and participation in the main competitions of the sports season of highly qualified field hockey players. Means: 49.2 % – general training, 15.2 % – special training, 15.7 % – preparatory (technical-tactical), 19.9 % – competitive exercises. Training loads: 54.0 % – aerobic; 37.9 % – mixed aerobic-anaerobic, 5.3 % – anaerobic-alactate; 2.8 % – anaerobic-glycolytic.

The prospects of further research will be determined by the scientific search for programming the training macrocycle of highly qualified field hockey players.

Conflict of interests

The authors note that there is no conflict of interests.

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Програмування етапу безпосередньої підготовки та участі в головних змаганнях спортивного сезону висококваліфікованих хокеїстів на траві

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 10 с., 5 табл., 4 рис., 29 джерел.

Історія питання. Сучасний етап підготовки спортсменів високої кваліфікації характеризується впровадженням у тренувальний процес технологій, спрямованих на ефективне планування та контроль тренувальних впливів. Такою технологією розглядається програмування, що передбачає упорядкований зміст тренувального процесу з урахуванням основних компонентів тренувальних навантажень.

Мета дослідження. Експериментально визначити ефективність побудови тренувального процесу висококваліфікованих хокеїстів на траві на етапі безпосередньої підготовки та участі в головних змагання спортивного сезону на основі методів програмування.

Матеріал і методи. У дослідженні брали участь 21 висококваліфікований хокеїст на траві. Спортивна кваліфікація – майстер спорту України. Вік спортсменів 25,6 ± 5,29 років. Дослідження проводилося у 2021 році в період підготовки та

участі національної збірної команди України з хокею на траві до чемпіонату Європи «Чемпіоншіп 2» (м. Гнєзно, Польща). Науковий пошук здійснювався на основі таких методів: теоретичний аналіз та узагальнення науково-методичної літератури; педагогічне спостереження, педагогічне тестування, методи математичної статистики.

Результати дослідження. Визначено структуру етапу безпосередньої підготовки та участі в головних змаганнях спортивного сезону висококваліфікованих хокеїстів на траві, що складалася з трьох мезоциклів: базового – 4-денний утягувальний, 4-денний ударний, 3-денний відновлювальний мікроцикли; спеціально-підготовчого – 4-денний ударний, 3-денний відновлювальний, 4-денний підвідний мікроцикли; змагального – 7-денний змагальний, 3-денний відновлювальний мікроцикли.

Висновки. Однією з найбільш раціональних технологій підготовки спортсменів є програмування, що забезпечує впорядкований зміст тренувального процесу з урахуванням ключових елементів тренувальних навантажень. Були розроблені програми тренувальних завдань, які стали основою для мікро- і мезоциклічних програм..

Ключові слова: хокей на траві, командні ігрові види спорту, метод програмування, засоби тренувальної роботи, тренувальні навантаження, режими координаційної складності.

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