

HEART BEATS RATE INDICATORS AND STRUCTURE OF ELITE FOOTBALL REFEREES' AND THEIR ASSISTANTS' MOTOR FUNCTIONING IN COMPETITION PERIOD

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Abstract. *Purpose:* to analyze structure of motor functioning and heart beats rate indicators in elite football referees' and their assistants' competition activity. *Material:* in the research 15 referees and referees' assistants of Ukrainian Prime League, 30 referees and referees' assistants of first and second professional leagues of Ukraine participated. Observations over referees' movements in 21 professional matches of Ukrainian professional leagues were fulfilled. Distance, passed by a referee in one match was determined. *Results:* It was found that during one match referee (depending on his functions – referee or referee's assistant) passes distance from 6000 to 12 000 meters. This scope of motor functioning depends also on motor activity of players and qualification level of teams-participants in the match. Motor actions of referees' assistants change every 5 seconds during a match. During one match referee's assistants fulfill about 20 sprints and 74 accelerations. A high temp of match total distance makes 1.2 km. *Conclusions:* Referees' and referee assistants' motor functioning and heart beats rate indicators can vary from aerobic-restoration to anaerobic-glycolytic zone. This fact shall be considered when planning program on special physical training. It should be noted that with heart beats rate of more than 180 bpm concentration of attention significantly weakens as well as ability to take prompt and correct decisions. In such cases probability of mistakes significantly increases.

Key words: referee, motor functioning, heart beats rate, competition functioning.

Introduction

Referees' activity takes place in the eyes of millions of spectators. Popularity of football pre-conditions high responsibility of referees: sport and show sides of every match to large extent depend on their qualification and authority [9]. Modern football match can be conducted by referee only under condition of his high motor functioning. Otherwise he simple would lag behind the temp of game. It can result in a lot of mistaken decisions [1-3, 12, 15].

Referee's high motor functioning in football match and during all season facilitate higher quality of his work as well as ability to cope with constantly increasing competition load [2, 7, 8, 14, 18].

Referees' and referee assistants' actions show that fulfillment of their duties is connected with significant motor activity and high indicators of heart beats rate (HBR). It is conditioned by exclusively dynamic character of the game itself [1, 18]. These indicators depend on intensity of movements, means of movements (sprints, acceleration, slow or moderate run speed and etc.) different movements of arms (illustrating the character of noticed violations; pointing at kinds of penalties).

Specialists in football refereeing, such as A.N. Spirin (2003), A.D. Budogoskiy (2008), A.B. Abdula (2013), T.G. Chopilko (2014) note that modern football match is characterized by great number of technical-tactic actions and high intensity of football players' movements as well as by quick change of game situations, which can cause referee's wrong decisions.

Thus, the structure of referees' motor functioning in competition period has much in common with motor functioning of football players. The most significant qualities of referees' special physical fitness include special endurance and quickness (first of all quickness of motion) to less extent referees have to demonstrate strength, dexterity and flexibility [1, 3, 7, 19].

Purpose, tasks of the work, material of the research

The purpose of the work is to analyze structure of motor functioning and heart beats rate (HBR) indicators in elite football referees' and their assistants' competition activity.

For solution of our tasks we used the following *methods and organization of the research*:

1. Pedagogic: studying, analysis and generalization of scientific-methodic literature, pedagogic observations, photographing and video recording of different game situations, questioning;

2. Medical-biological methods: registration of heart beats rate (HBR bpm⁻¹). HBR was registered with the help of transmitter «Polar T31» («Polar Electro Oy», Finland0) with telemetric transmission of data;

3. Statistical analysis of results.

Results of the research

Observations over referees' movements in 21 professional matches of Ukrainian professional leagues were fulfilled. It was found that during one match referee (depending on his functions – referee or referee's assistant) passes distance from 6000 to 12 000 meters. This scope of motor functioning depends also on motor activity of players and qualification level of teams-participants in the match.

The researches permitted to quantitatively characterize total scope of referees' motor functioning. We found that in refereeing of competitions of not the highest level (matches of second professional league of Ukraine) referees pass distance of 6-8 km during one match. Referee assistants pass from 2 to 6 km. It is directly connected with intensity of game itself and qualification level of the participants.

Motor actions of referee's assistants change every 5 seconds during one match. In one match they fulfill about 20 sprints and 74 accelerations. Total distance is 1.2 km in match of high temp. Main means of motion are: ordinary run of different intensity and side step run. Referee's assistant passes distance of 1.2-2.0 km with side step (in average 1.5 km) see table 1).

The presented in table data show that referee fulfills work of anaerobic character: walk, slow run and average rate run. It should be noted that referee uses more quick accelerations and less quick sprints. Backwards running permits for referee to control players' actions with ball depending on their location on field. But these indicators are insignificant in relation to total volume of fulfilled work [2, 10].

Referees' and referee assistants' motor functioning takes place with variable power of work and reflects in change of HBR during match. This assumption was experimentally tested by registration of HBR of referees and referee assistants. First of all, the fact, that with increasing of competition level HBR of all referees rises, attracts attention. Scope of motor functioning of second professional league of Ukraine referee assistants mainly consists of walk and slow side step run. HBR is within the range of 91-120 bpm (62.4% of playing time). During matches of the same level referees' motor functioning also consists of walk and slow run. Their HBR is within 111-140 bpm (60.5-73.5 % of playing time). игрового времени).

Scope of motor functioning of first professional league of Ukraine referees mainly consists of slow run, average speed run and run with accelerations. HBR was within 121-150 bpm (46.2-55.7 % of playing time).

Concerning referees of Prime league (some of them have qualification "referee of FIFA" HBR in competition period is in the range of 150-170 bpm. Maximal indicators of HBR were 184 bpm. These data witness that referees fulfill work with rather high HBR. Mean HBR indicators were 162 bpm. These indicators practically do not change in first and second times. Mean values of percent relation of working time in different pulse ranges [4-6], are given in table 2.

Mean HBR indicators of referee assistants of Prime league are 137 bpm. Indicators lower than 130bpm. are 33%. HBR indicators within 130-150 bpm are 38% of total time; indicators 150-170 bpm - 23% ; indicators higher than 170 bpm. - 6%.

Discussion

Observations over referees' actions during matches show that their fulfillment of duties is connected with significant motor activity. Such activity is conditioned by exclusively dynamic character of the game itself [20]. This motor activity manifests as constant movement of referees at different distances. All actions of referees take place on rectangular of football field (90-120 m – length and 45-90 m – width). It is a distinctive feature of refereeing in modern football [1-5]. Referees' motor functioning takes place with variable power and reflects in changes of heart beats rate during game [16].

This assumption was experimentally tested by registration of HBR of referees and referee assistants, who work on matches of Prime league, in first and second professional leagues of Ukraine. It was found that structure of referees' motor functioning has a lot in common with football players' motor functioning [17].

The most significant physical qualities of referees include: special endurance, quickness (first of all quickness of motion). It is necessary to distinguish start and distance speed, which are interconnected. Strength, dexterity and flexibility are demonstrated by referees to less extent [9, 18].

Table 1. Structure and scope of motor functioning of elite referees and referee assistants depending on level of competitions

Соревнования	Specialization	Scope of motor functioning, m		Kind of motor functioning, m					
		Walk	Slow run	Side step and backwards run	Run at average speed	Accelerations	Run with maximal speed (sprint)		
Вторая профессиональная лига Украины	Referee (n=5)	2067 ±245	1745 ±164	68 ±16	1245 ±108	1030 ±93			
	Referee assistant (n=10)	738 ±85	532 ±61	624 ±78	108 ±14	118 ±22			
Первая профессиональная лига Украины	Referee (n=5)	2236 ±211	2418 ±198	54 ±23	1846 ±171	1820 ±167	102 ±28		
	Referee assistant (n=10)	862 ±93	766 ±88	802 ±94	274 ±27	540 ±49	60 ±12		
Премьер-лига Украины	Referee (n=5)	2056 ±213	2233 ±244	63 ±28	2456 ±197	1904 ±108	184 ±22		
	Referee assistant (n=10)	798 ±57	845 ±86	1023 ±101	340 ±46	598 ±37	78 ±24		

Table 2. Mean values of heart beats rate (HBR) in % from total time of elite referees' and referee assistants' work depending on level of competition

Competitions	Specialization	HBR (bpm) of different pulse intervals in % from total working time													
		70-80	81-90	91-100	101-110	111-120	121-130	131-140	141-150	151-160	161-170	171-180	181-190		
Вторая профессиональная лига Украины	Referee (n=5)		1.2 ±0.9	1.9 ±1.6	9.7 ±2.8	22.7 ±5.6	31.2 ±4.3	19.6 ±5.8	10.9 ±4.7	3.0 ±1.2					
	Referee assistant (n=10)	5,5 ±2.7	15.0 ±3.2	22.4 ±4.4	23.1 ±3.8	16.9 ±2.9	10.3 ±3.6	5.1 ±2.9	1.7 ±1.1						
Первая профессиональная лига Украины	Referee (n=5)	1.5 ±1.1	4.0 ±2.8	6.8 ±3.1	7.1 ±2.7	12.2 ±4.5	15.1 ±3.4	20.3 ±2.9	20.3 ±3.2	9.8 ±2.2	2.9 ±1.1				
	Referee assistant (n=10)	0.6 ±0.3	9.0 ±3.3	12.3 ±3.8	11.7 ±3.4	23.0 ±2.4	27.3 ±2.9	10.2 ±3.3	3.9 ±2.7	2.0 ±1.6					
Премьер-лига Украины	Referee (n=5)	1.5 ±1.1	3.0 ±2.4	2.8 ±2.6	5.7 ±1.9	3.0 ±1.3	11.6 ±1.4	11.7 ±2.2	20.4 ±2.9	21.7 ±3.6	10.3 ±3.1	7.0 ±2.8	1.3 ±0.7		
	Referee assistant (n=10)	2.4 ±1.6	3.1 ±1.8	6.3 ±2.3	7.9 ±2.2	15.0 ±3.2	15.2 ±3.6	8.1 ±3.6	12.9 ±2.8	10.2 ±2.8	5.1 ±1.9	3.8 ±2.1			

Conclusions

The results of our researches permit to conclude that in competition functioning of elite referees and referee assistants amount of motor functioning and HBR indicators depend on level of competitions. They can vary from aerobic-restoration to anaerobic glycolytic zones. It shall be considered when planning program on special physical training. Knowledge of these factors permits to sufficiently accurately determine main parameters of training load: scope and intensity.

It is noted that with HBR more than 180 bpm, concentration of attention as well as ability to take prompt and correct decisions significantly weaken. In such cases probability of mistake significantly increases.

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Conflict of interests

The authors declare that there is no conflict of interests.

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