Optimization of the methodology for assessing the specific endurance of football players

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PhD, Associate Professor **V.V. Lavrichenko**[1]
Dr. Biol., Professor **I.N. Kalinina**[1]
PhD, Associate Professor **M.R. Grigoryan**[1]
M.M. Deb[1]
[1]Kuban State University of Physical Culture, Sports and Tourism, Krasnodar

Corresponding author: football.70@mail.ru

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Abstract

Objective of the study was to determine the physiological focus of the modified J. Bangsbo football sprint test, where the reliability of data on the development of anaerobic and aerobic energy supply mechanisms ensures the validity and reliability of the assessment of the special endurance of football players.

Methods and structure of the study. In the improved version of the football sprint test developed by J. Bangsbo, the emphasis is on simulating competitive conditions. The lactate level in blood taken from a peripheral vein was determined by the sports team doctor using a compact Lactat Scout analyzer 3-5 minutes after the test was completed.

The study involved young athletes from the Youth Sports School "Football Academy" of the Krasnodar Territory, as well as members of the youth teams of the Krasnodar Territory and Rostov Region. The selection of participants was carried out according to the following criteria: age compliance with passport data with an acceptable deviation of ±0.5 years (15.5-16.5 years for 16-year-olds; 16.5-17.5 years for 17-year-olds; 17.5-18.5 years for 18-year-olds) and at least 8 years of training experience.

Results and conclusions. Based on the analysis of lactate concentration in blood taken from the peripheral area, the researchers claim that the adapted sprint test can serve as a tool for assessing the efficiency of both anaerobic and aerobic energy supply processes at maximum work intensity. This is evidenced by the relatively low lactate level recorded after the test task in participants of different age groups, which reflects the specific motor activity characteristic of football players during the game.

Keywords: *physiological orientation, modified football sprint test by J. Bangsbo, aerobic mechanisms, energy supply, validity, reliability, assessment of special endurance, competitive conditions.*

Introduction. The modern game of football is characterized by alternating high-speed and low-intensity actions both with and without the ball, the player performing accelerations and sprints against the background of self-regulation of motor activity. It is also known that the intermittent nature of a football match can be characterized as a constant sequence of short actions of the player at maximum and high power with a change to relative inaction.

Of the most informative parameters for assessing the motor activity of football players, experts believe that the assessment of the ability to repeatedly perform maximum-intensity running. It is this ability of the player, as a rule, that provides him with certain advantages over the opponent during the game. Episodes of maximum activity of football players, in which the fight for the ball takes place, according to the observations of researchers [2], last up to 4-5 seconds. After that, episodes of relative inaction follow, lasting from 30 to 60 seconds.

Consequently, the intermittent nature of a football match can be characterized as a constant sequence of short actions of the player at maximum and high speed with a change to relative inaction (recovery). In this regard, it is noted that performance in football largely depends on both anaerobic (sprints) and aerobic (recovery rate) capabilities of the players' bodies. Athletes work, on average, at 70% of their maximum oxygen consumption, at 80-90% of their maximum heart rate, with a blood lactate level of

about 2-10 mmol / l-1 [9], while they cover a distance of 8-12 km during a football match at a professional level [7, 8].

All these and a number of other features of the manifestation of motor activity of football players establish increased requirements for special endurance, ensuring such game actions. This necessitates the use of more specific assessment methods that would fully take into account these features, and the results shown by athletes would characterize specific aspects of special endurance of football players from the standpoint of competitive performance. For this purpose, interval sprint tests are used in the practice of such sports, in which the work is provided by aerobic processes by 38%, anaerobic glycolysis by 45% and anaerobic alactic processes by 17% [10].

Consequently, interval sprint tests provide data that allow us to evaluate to a greater extent the anaerobic capabilities of the body [11], and reflect mainly the ability to resist fatigue in conditions of running intensive segments exceeding the limit of 4-5 seconds identified for football players. The closest in terms of established requirements is the football sprint test developed by J. Bangsbo [6] and studied by us from the standpoint of physiological orientation [4]. Nevertheless, the issue of developing more effective methods for assessing the special endurance of football players in conditions as close as possible to competitive ones remains relevant to this day.

The aim of the study is to determine the physiological focus of the modified J. Bangsbo football sprint test, where the reliability of data on the development of anaerobic and aerobic energy supply mechanisms ensures the validity and reliability of the assessment of the special endurance of football players.

Methods and structure of the study. The modification of J. Bangsbo football sprint test involved changes in the conditions of implementation, which are as close as possible to competitive ones: the time allotted to a football player for recovery after performing the next sprint and returning to the starting line is no more than 60 s; the football player independently controls the process of recovery, returning to the starting line and performing a sprint based on a subjective assessment of his own physical capabilities; the athlete begins the subsequent sprint from a mobile state from within the permitted 5-meter zone located behind the starting line; the coach records the start time of the sprint when the football player starts from a mobile state. The concentration of lactate in the peripheral blood was measured by the team's sports physician using a portable Lactat Scout analyzer at 3-5 minutes of the recovery period after the sprint test. This made it possible to assess the involvement of the anaerobic glycolytic system in the energy supply of the football player's movements during the modified sprint test [3]. Since the test involves long-term running loads, the maximum concentration of lactate in the peripheral blood, according to numerous observations [1, 5], is detected from the third to the fifth minute of recovery.

To determine the validity and reliability of assessing the special endurance of football players, a comparison of the results of the modified J. Bangsbo sprint test was conducted among young men of different ages.

The survey was conducted with athletes from the Youth Sports School "Football Academy" of the Krasnodar Territory, the national youth teams of the Krasnodar Territory and the Rostov Region. Inclusion criteria for the group of subjects: passport age of football players ±0.5 years (16 years old – 15.5-16.5 years old; 17 years old – 16.5-17.5 years old; 18 years old – 17.5-18.5 years old), training experience of at least 8 years.

To achieve maximum productivity in the proposed control exercise, the indicators of the total time of the sprint test, the best and worst time, the difference between the best and worst time of a single sprint were ranked and points were assigned for each studied parameter. The sum of points for all test parameters determined the place of the football player in the overall ranking of the group, which created additional motivation to achieve maximum results in the considered control exercise.

Testing was conducted during the rest period after official competitions. All subjects gave voluntary informed consent to be included in the survey groups in accordance with the Helsinki Declaration of the World Medical Association, written permission to process personal data. Statistical analysis of the experimental data was performed using the program "Statistica 13.0". To characterize the dynamics of the indicators, the arithmetic mean (x) and standard deviation ( ) were calculated. The critical level of significance (P) when testing statistical hypotheses was taken as 0.05.

Results and conclusions. The table presents the results of the modified J. Bangsbo sprint test for football players of the age groups studied.

Results of the modified J. Bangsbo sprint test for junior football players

Parameters		Best time, (s)	Worst time, (s)	Difference, (s)	Total time, (s)
Test results, (±σ)	16 лет, (n=41)	6,26±1,3	6,38±1,3	0,12±0,2	270,1±4,8
	17 лет, (n=63)	5,91±1,4*	5,97±1,4*	0,06±0,1*	242,5±5,4*
	18 лет, (n=37)	5,01±1,2**	5,03±1,1**	0,02±0,06**	228,4±4,7**
Blood lactate concentration, (±σ)	16 лет, (n=41)	7,8±1,4 mmol/l-1			
	17 лет, (n=63)	6,1±1,5* mmol/l-1			
	18 лет, (n=37)	4,8±1,2** mmol/l-1			

*Note: * – level of significance of differences between 16 and 17 year old football players; ** – level of significance of differences between 17 and 18 year old football players.*

As a result of comparison of the obtained data, changes in the indicators of all four considered parameters of the sprint test assessment, characterizing individual aspects of the special endurance of football players, were revealed. It can be argued that the unregulated 60-second rest pause in the test modified by us, compared to the regulated conditions of the original sprint test by J. Bangsbo in 25 seconds, contributes to a more rapid deployment of the aerobic mechanism in the energy supply of the working muscles, and also allows you to independently regulate the load, and receive more relevant information about the special endurance of football players. When analyzing the results obtained for the indicators of the difference between the minimum and maximum sprint time, a stable positive trend was noted, indicating the conditions of the testing task, under which the possibilities for the recovery of the body increase.

This situation is typical for most episodes of a football match, where high-intensity segments are replaced by relative inaction. This is confirmed by the absence of under-recovery of the football players' bodies during the performance of seven repetitions of sprints (the difference between the worst and best sprint times), which took place in the J. Bangsbo sprint test and was manifested in a significant "drop" in the results [4]. Considering that the lactate levels after performing the testing exercise in football players were relatively low (4.8-7.8 mmol/l-1), it can be concluded that the modified sprint test is suitable for assessing both the anaerobic and aerobic capabilities of the body under conditions of maximum exercise performance.

Conclusions. Thus, the modified sprint test by J. Bangsbo allows obtaining reliable results characterizing other aspects of special endurance during intermittent work than the original sprint test.

The modified sprint test, which includes four parameters for assessing special endurance, reflects the involvement of all energy supply mechanisms in specific work and makes it possible to control changes in the athlete's behavior when performing a testing task under conditions close to competitive ones.

Moreover, the sprint test under consideration contains a set of tasks that are optimal in composition and sequence, the nature of movements and pauses for rest, which can be used as a valid and reliable method for assessing the special endurance of football players, since it has undergone an experimental test with the participation of sports doctors and coaches and received a positive assessment.

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