Journal of Physical Education and Sport ® (JPES), 16 Supplement issue (1), Art. 96, pp. 610 - 615, 2016
online ISSN: 2247 - 806X; p-ISSN: 2247 – 8051; ISSN - L = 2247 - 8051 © JPES

Original Article

Tests for special game speed and endurance in field hockey

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Published online: July 30, 2016
(Accepted for publication June 08 2016)
DOI:10.7752/jpes.2016.s1096

Abstract: One of the effective ways to control the physical and technical preparation in hockey is to develop appropriate tests for each age-sex group to diagnose certain motor skills and evaluate them objectively. This would contribute not only to the management of sports training, but also for effective selection of promising athletes. The need for objective review and selection criteria of talented players led us to develop specific tests for the diagnosis and evaluation of leading conditioning qualities in hockey combined with key elements of sports equipment hockey girls players aged 14-16 years old. The tests carry on information about special game speed and speed endurance and include various versions of slalom performance with and without the ball and shooting away for accuracy. The aim of the study was to determine the reliability and possibilities of application of these tests in research contingent girls located in one of the most important stages preceding sport skills - sports specialization. The tests were conducted twice at an interval of one day establishing their statistical reliability in terms of diagnosed qualities. Analyzed the results of various embodiments, with a view to establishing their diagnostic and applied effect.
Keywords: hockey, physical properties testing

Introduction

As any other sport with game character the result in hockey we can write to the optimum combination of technical, physical and tactical training. The high dynamics of this sport requires good ability to control the stick and the ball, the various techniques and strokes executed with great speed. All these features suggest hockey adequate development of these physical qualities that are most relevant to the interval-changing nature of the game and are a condition for effective implementation of sports equipment.

Therefore the qualities of speed and speed endurance are identified as key components of physical fitness of hockey players, which in combination with the sports equipment is a prerequisite for success in this sport [18, 19, 16, 21, 13]. Lothian and Farrally (1994) [20] indicate that elite female hockey players spend 22% of the total playing time of high intensity sprints and 11.6% of the game in motion with continuous change of direction, which requires tests evaluating the game coordination and technique of dribbling. Sports training must conform to these requirements of the game, on the one hand and on the other - to allow effective control over these physical qualities through their objective diagnosis and evaluation. In the practice are known many diagnostic tests of physical properties and sports equipment in elite athletes [5, 15, 17, 9, 11, 16], but it is less payed attention to young hockey players in the stages of sports development. This led us to develop specific diagnostic tests and evaluation of the leading hockey conditioning qualities combined with basic techniques in order to complete their research. Specifically studied literature found that data sports training research contingent of 14-16 year old girls at the stage of sports perfection are limited and do not allow for an objective diagnosis of their conditioning and technical training, combining speed and endurance qualities of hockey equipment.

The need of diagnosis and evaluation of these characteristics define the purpose of the study: development and experimentation of field tests to diagnose specific game (coordination) speed and speed endurance in order to determine their reliability and relevance in sports practice in research contingent players included in the national team of Bulgaria in 2014. The stage is extremely important to establish the potential conditionals their technical capabilities and conducting scientifically step selection.

Probated variations on the following sports and motor tests: Test for special game speed (TSGS) - Slalom. Presented on drawing 1. Drawing 1 "Slalom"

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Description of the test: The test carries information about special game speed. The variation of the slalom are played with maximum speed in the specified scheme. Length of straight edge - 20 meters. The distance between the cones is 3 meters with deviation from the center line 1 m. Length of the slalom - 27 m. In the exercise of dribbling with the ball (on the forehand) the movement of the player must follow the trajectory of slalom circumvention of the cones. Repeat the test if: the player performs imprecise technique touching the cones, losing control of the ball or pass more than one meter from the cones. Methods of testing. The test is performed consistently in 4 versions by registering relevant times: (1) slalom without a stick - absolute speed in slalom running, registered in time t1 (sec); (2) slalom with a stick - absolute speed in two versions: a / wide double grip, registers the time t2 (sec) and b / single grip and transferring putter from one to the other hand in the corners, registered in time t3 (sec); (3) slalom guidance forehand - for maximum gaming (coordination) speed recorded is the time t4 (s); (4) The time difference between: a / dribbling slalom and sprint forehand slalom without a stick - $\Delta t1$ and b / dribbling slalom and sprint forehand slalom with a stick - $\Delta t2$.

1Hit on left and right with a stick 30/60 seconds - diagnose strength endurance of the lower limbs in combination with one of the key technical elements of the hockey game - hacking upon revocation of the ball (Picture 2).

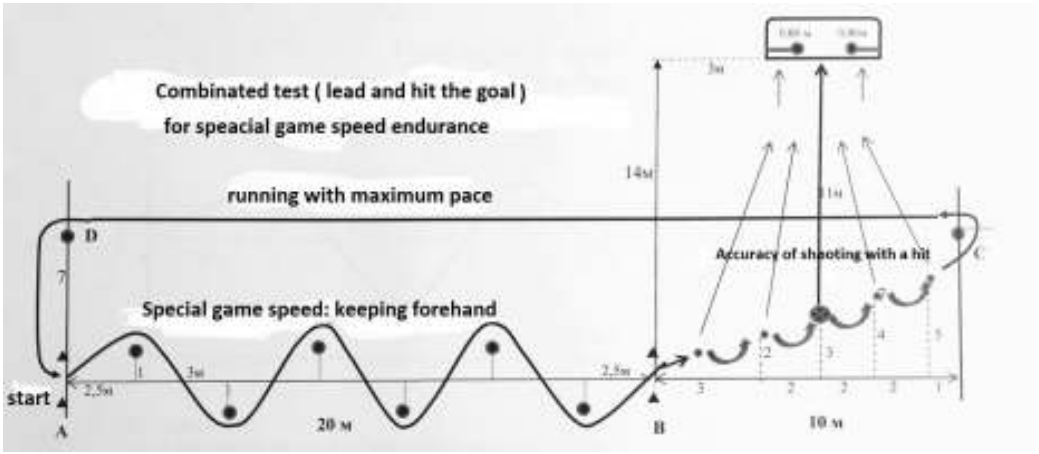
Drawing 2 "Hit on left and right with a stick 30/60 seconds"

Test description: the 3-meter line is divided into 3 parts of 1 meter. On the right and on the left of the line are outlined areas to reach and touch with the putter. Executing stands in the middle of the starting position main hockey standing by the stairs at a distance of 80-100 cm (depending on the growth of the competitor). The test assesses the strength endurance of the muscles of the legs and body.

Methods of testing: The test begins from a major hockey stance. After starting signal is implemented rapidly hitting from the left to the right to transfer the stick from one to the other hand and touch the target areas, such as body weight is transferred from one to the other leg. Record the maximum number of successful touches of the target areas to the left and right of 30/60 seconds.

3. Test for special game speed endurance (TSGSE) - diagnose the game speed endurance combined with keeping the ball and shooting in the door (Fig. 3). The test consists of 3 parts: (1) speed slalom guidance forehand (from position A to position B); (2) hit accuracy outlined in the lateral area of ??the door position B to position C, where they perform 5 strokes accuracy incl. finishing free kick after dribbling; the door is off in 14 meters from the straight line test as balls shooting in a straight line at an angle to the door one meter higher deviation of each subsequent ball from the center line so that the average ball to replace criminal strike - 11 meters from the door; (3) running with maximum tempo to the starting point A (circumvention of points C and D, located just 7 meters from the straight line test). Length of racing off for a round - 80 m. Total length of three rounds - 240 meters.

Drawing 3 "Test special game speed endurance (TSGSE)"



Method of execution: After the starting signal is started with slalom guidance forehand with maximum speed to the line on the 20th meter / point I / O. After passing the point C is executed free kick in the door led ball, followed by another 4 hits for accurate in extreme outlined in the goal with balls over a distance of 2 m / s

as shown in the diagram /. After the last shot, a player returns to run fast to the starting position A, bypassing the stands at points C and D. Perform in 3 consecutive rounds without interruption to maintain the maximum pace. Account the following indicators: (1) transit time of each round; (2) the number of shots on; (3) the total time for the passage of three rounds; (4) heart rate at the end of the test.

For statistical analysis of the results using the following mathematical and statistical methods: analysis of variance test of Mann Withney statistical significance of the difference between the results of two independent samples test of Kruskal Wallis with implementation of Dunns multiple comparison test for statistical significance of the difference in results in more than two independent samples [1]. Experimenting tests took place in 2014 on the artificial field of the National Sports Academy "Vasil Levski", Sofia.

Results

The "Slalom" test diagnose special game speed in hockey. The options of the test reflect the relationship between the speed of movement in space and without a stick and technique of keeping the ball. We investigated this technical trick because dribbling represents between 17.5 to 30% of the time of the race and is considered as a key factor for success in the game (Lothian and Farrally, 1994). The authors point out that the elite players spend a considerable part of the game (11.6 percent) in motion with continuous change of direction. Thus the inclusion of tests that assessed gaming coordination and dribbling are needed to assess in female hockey. Used by us test carries information about the impact of speed on the quality manifestation of sporting equipment, ie reflects the dependence of sports equipment from the state of the speed of the competitors. The more small time difference between slalom runs and dribbling slalom, so art is higher.

For the aim we compare the performances in different versions of the test, bearing information about the absolute speed (slalom without a stick) and special game speed (slalom with a stick and dribbling slalom on forehand). The difference in the times when is running without stick, with a stick and slalom keeping the ball, the ability of the player to move the ball around with greater speed, which we define as speed dribbling. Mean performance in slalom without a stick were 9.69 ± 0.48 seconds and those with a single stick grip and dual grip - respectively 9.80 ± 0.51 and 9.86 ± 0.51 s (Table 1). The data show that the rate at dribbling in comparison with the movement of the stick (with double and single grip) fell by only 1.14-1.75%, which is negligible. For confirmation it applied the criteria of the Kruskal-Wallis and found that there was no statistically significant difference in performance between flee, stick and run with the stick in two variants ($p > 0.05$). Therefore, the speed of movement in the game is not influenced significantly by wearing stick. This fact is confirmed by other authors studied this relationship with such tests [15, 19]. A possible reason for this is that essentially wearing stick an automatic process for hockey players, which is why no significant difficulty in movement.

Table 1. Variation indicators about the test "Slalom"

Indicators	Slalom without a stick t_1 (sec)	Slalom with stick – double grip t_2 (sec)	Slalom with stick- single grip t_3 (sec)	Slalom guidance forehand - dual grip t_4 (sec)	$\Delta t_1=t_4-t_1$ (%)	$\Delta t_2=t_4-t_2$ (%)
X□±SD	9.69±0.48	9.80±0.51	9.86±0.51	13.27±1.50	36.64±11.13	35.31±13.49
CV(%)	4.95%	5.23%	5.20%	11.29%	30.38%	38.20%
V(km/h)	10.03 (100% от Vmax)	9.93 (99% от Vmax)	9.85 (98% от Vmax)	7.32 (73% от Vmax)	-	-
Speed reduce(%)	-	1.14	1.75	27.0	-	-

Comparing the results between different versions of the slalom, we found a statistically significant difference ($p < 0.05$) between slalom and travel without a stick and slalom keeping the ball on the forehand (criterion of Kruskal-Wallis). Therefore, the difference in the speed of free movement with the stick in the space and keeping the ball can be an objective indicator of the level of dribbling technique of the player. As the smaller the difference between a slalom sprint stick and dribbling slalom, so a higher level is the technique of slalom guidance forehand. At analyzes of us girls this difference is significant in terms of dribbling with double grip, indicating difficulty in execution speed of this technical trick.

The low coefficient of variation in the slalom race and without a stick (4.95-5.20%) indicates that the group is homogenous in terms of speed of free movement in the game. Low coefficient of variation in the slalom race and without a stick (4.95-5.20%) indicates that the group is homogenous in terms of speed of free movement in the game. At the same tame occur twice as large individual differences in the slalom guidance forehand (CV = 11.29%). This means the different individual art of slalom guidance forehand. More accurate

picture of the special game speed and the level of dribbling technique makes the difference in the times in slalom and without a stick and dribbling slalom (Δt1 and Δt2). The results showed that the speed of movement in the dribbling is reduced by 27% (Tab. 1) and coefficients of variation show considerable individual differences (30.38-38.20%), which is an indication of difficulty in terms of speed of execution and dribbling.

To determine the statistical reliability of the test "slalom" conducted test-retest in the interval of one day and we calculated the coefficient of rank correlation Rs (by Spearman) between the results of the first and second testing [1, 2]. As a rule, if the test person does not substantially alter your score in double testing, the test is reliable. Baumgarther and Jakson (1999) indicate that values over Rs 0.80 are acceptable for motor tests.

The reliability factor for slalom stick with dual grip showed satisfactory reliability of research by our competitors contingent (0.82) and relatively acceptable reliability (0.73) for the slalom guidance forehand. Similar results were obtained and other researchers. When they are similar to our study of young girl players calculated reliability coefficient of 0.91 with a stick slalom and slalom dribbling 0.78 [19]. Clearly, the inclusion of technical elements in the implementation of conditioning tests lead to some reduction in their statistical reliability, which is understandable given that it is difficult to achieve absolute stability of the art in high variability of the playing conditions even in very well prepared competitors. We believe that the validity and reliability of the test options "Slalom" satisfactory, given the level of training of research contingent players present at the stage of sports perfection.

Our suggested test "shortcut left and right with a stick 30/60 seconds" reflects the movements of hockey for withdrawal of the ball and brings about strength endurance of the lower limbs. This quality is essential for movement in space, and for many of the technical elements of the game. The test is accomplished in two versions - for 30 and 60 seconds to determine which of them has a greater statistical validity and reliability. Mean hacking for 30 sec 36 ± 2,5 units, and 60 seconds 72 ± 5,0). This indicator surveyed girls are a homogeneous group (CV = 6.94%).

To find out which option is more validity, we applied the criteria of Mann-Withney to establish the difference in performance in the first and second 30 sec, i.e. whether the difference in averages between the first and second 30s is correct at significance level p?0.05. The criterion of Mann-Withney showed that when comparing average performance in the first and second 30 seconds of the test found a statistically significant difference in the results (p <0.01). This shows the higher sports educational validity of options for 60 seconds

During the test we traced some functional changes as a result of load indicators through heart rate (HR) as further evidence of the degree of fatigue in both versions. Taking into account the extent of the ensuing fatigue level of heart rate (HR> 180 beats / min with options for 60 sec), we think that for the diagnosis of strength endurance in the lower extremities research contingent of competitors with greater validity and reliability is option 60 sec. The estimated coefficient of reliability of the test by rank correlation showed satisfactory reliability - 0.86, which we consider to be perfectly acceptable for sports practice.

There are a variety of field tests that measure the physiological and technical characteristics of the players, but few tests that diagnose complex conditionals and specifications of players in hockey. The most commonly used tests are shuttle type without the inclusion of technical elements with reliability coefficient above 0.80 [11]. Therefore, we developed the "Test for a special game speed endurance" (TSGSE) that combines quality run speed endurance coupled with speedy implementation of elements of the sports facilities (Picture 3). The test carries information about special game speed endurance, which is one of the determinants of sporting success in hockey. The purpose of the test is to determine the level of special speed endurance under conditions of continuous speed performance sports equipment, taking into account simultaneously several indicators: the dynamics of time to overcome each round, changes in performance sports equipment and values ??of heart rate in the end of the test. The test for special game speed endurance reflects the dependence of hockey equipment from endurance racing in the game, which can be an indicator of conditioning and technical condition of the contestants. The dynamics of time achievements in three rounds is an indicator of advancing fatigue. Comparing the average times for the three rounds (t) is found that the best average time was achieved in Round I (t1 = 33,29 ± 4,04) - Table 2. In II and III round was an increase in time to overcome the circles, indicating occurring fatigue. But at the same time take account of stabilization of results in the II and III round (t2 = 36,51 ± 4,59; t3 = 36,15 ± 3,82).

Table 2. Variation indicators TSGSE (t, HR)

Indicators	t_1 I range (sec)	t_2 II range (sec)	t_3 III range (sec)	t test common time (сек)	$\Delta t = t_3 - t_1$ (сек)	Δt (%)	HR after II range (hits/min)	HR After III range (hits/min)
X□±SD	33,29±4,04	36,51±4,59	36,40±3,70	105,90±10,77	2.87± 2.49	8.62	172±6.49	195±11.47
CV%	12.15%	12.60%	10.61%	10.17%	87%	-	3.78%	5.88%

Following the dynamics of the times to cross the circles, it is clear that due to technical requirements and advancing fatigue performance of three rounds, the time to overcome them increases, respectively decreases speed. To check these timing differences between circles are statistically significant, i.e. talk about fatigue occurring, we applied the criteria of the Kruskal-Wallis for more than 2 independent samples to verify the differences between all pairs of data. This gave us reason to determine the validity of the test in terms of gaming endurance. The results showed a significant difference in the times of circles (Δt) only between I and II range between I and III range (between II and III round of the difference in performance is insignificant) - Table. 2. To determine the functional level of fatigue took into account indicators heart rate (HR), measured immediately after the II and III round. Although achievements to stabilize in these two rounds, changes in HR talk about early signs of fatigue even in Round II (HR = 172 ± 6.49 beats / min.) And significant fatigue in Round III (HR = 195 ± 11.47 beats / min.) - Table. 2. In respect of HR as an indicator of functional load tests examined players a homogeneous group (CV = 3.78-5.88%), confirming their uniform level of operational preparedness, but different individual level of technical preparedness. The decline in the rate of movement and execution is logical, considering the complexity of motor activities and techniques involved in the test - speed execution of dribbling slalom and hit shots on goal accuracy. The criterion of Kruskal-Wallis showed no statistically significant difference between the accuracy of shooting in various circles and generally can be defined as unsatisfactory - a maximum of 15 successful hits average realized only 3.93 ± 1.27 and 26.19 ± 8.46% from shooting up (Chart 3).

Table 3. Variation indicators (accuracy shooting)

Indicators	Accuracy shooting Round I (pcs.)	Accuracy shooting Round II (pcs.)	Accuracy shooting Round III (pcs.)	accuracy of the hits - total (pcs.)	% of hits maximum
X□±SD	1.86±0.95	1.64±0.84	0.93±0.61	3.93±1.27	26.19±8.46
CV%	51.11%	51.25%	66.31%	32.30%	32.30%

In contrast of the indicator turnaround time of TSGSE, to which the study group is relatively homogeneous (CV = 10.17%), the accuracy of the shooting shows very large individual differences - in different circles CV = 51.11-66.31% (Table. 3). Unlike indicator execution time TSGSE in respect of which the study group is relatively homogeneous (CV = 10.17%), the accuracy of the shooting shows very large individual differences - in different circles CV = 51.11-66.31% (chart. 3). Apparently, fatigue and speed of execution included technical elements significantly hinders their successful implementation, affecting accuracy and stability art. Therefore, test with its technical requirements not only indicates the level of functional preparedness with regard to the durability of the gear izsladvanite hokeistki, but also the level and stability of their technical training. This makes it particularly useful for sports practice. Despite the high requirements that test brought to studies contingent players believe that he can be a good integral measure of special gaming endurance and technique in field hockey. Confirming this, a calculation coefficient of rank correlation, which showed satisfactory reliability - 0.83.

Conclusions

The proposed specific field tests bring objective information about the capabilities of the tested players for a special game speed, strength endurance of the lower limbs and the special game speed endurance. Tests showed satisfactory reliability with respect to these important hockey skills and can successfully be applied in coaching practice for their diagnosis and evaluation. This would help both current control over the preparation and selection of young talents in the field of hockey.

The evaluation of physical attributes combined with sports equipment have important diagnostic and prognostic importance for sports practice. The technical requirements of the experimental tests are available for research contingent 14-16 annual players and are an important part of their technical training. Integral diagnosis of conditioning and technical components in the training practice allows for full disclosure of gaming abilities of competitors and more efficient management of sports training. The experimental tests showed that the speed of movement in the game is not influenced significantly by wearing stick. Tests for absolute speed without a stick and a stick carry duplicate information. Therefore, to practice more diagnostic and predictive tests have agility with stick - a stick speed slalom and slalom speed dribbling. The difference in the speed of free movement in the space with a stick and dribble the ball can be an objective indicator for special game speed and the level of dribbling technique of the player. The higher this difference is small, so a higher level is dribble speed of the competitor. The test "Hitting left and right with a stick" diagnose strength endurance of the lower limbs and is

sufficiently reliable for the diagnosis of this quality, with greater predictive value is the option for 60 seconds. The test for special game speed endurance brings integrated information conditionals, technical and functional level of special endurance game and allows monitoring and evaluation of this important hockey quality. Despite the high demands on the performance of the technical elements, the test showed satisfactory reliability coefficient, making it very useful for sports practice. Presented specific tests can serve as a basis for developing measurement scales hockey with different levels of sports training.

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