ANALYSIS OF METROLOGICAL REQUIREMENTS FOR TESTS DESIGNED TO EVALUATE THE MOVEMENT SKILLS OF FOOTBALL PLAYERS

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Abstract.
this article provides detailed information on the assessment of the level of physical fitness of athletes and the organization of training in the system of training athletes. The reliability of the proposed tests is proven by the example of football. The obtained data are tests on sports of developed countries, their reliability and variability are studied, and their advantages are also determined.
Keywords: sports results, test reliability, efficiency, variability, physical capabilities, evaluation standards, testing objectivity, mathematical-statistical reasoning.

Research was conducted to determine the impartiality of tests in a group of 52 students specializing in football at the Gojuva-Velkopolsky Institute of Physical Education. Two trainers and one of the authors of this paper were selected by the evaluators as observers. The results of the studies obtained by each specialist were carried out in correlation. A clear standardization of the test and a detailed explanation of the method of calculating the number of hits on the ball had a positive effect on the consistency of the results between each observer. The correlation coefficients obtained between them turned out to be r = 1.0.

Based on this, it can be noted that this test can be considered as objective as possible if the researcher quickly and accurately counts the number of hits on the ball in a short period of time.

Test reliability studies were conducted twice. In the first case, 98 athletes who participated in the International Spring Tournament in Seville (Spain) were studied. Each subject performed the test twice (after the entanglement exercises), with a 5-minute rest between attempts. The test was conducted in natural game conditions (in the stadium) with the participation of 7 teams of different age groups.

By comparing the results of the first and second attempts, the following correlation coefficients were obtained for individual teams (Table 3).

Table 1

Correlation of the results of two attempts in a test designed to evaluate the movement abilities of football players.

	Football team	Age	Correlation coefficient
	Gojuva-Velkopolsky team	17 – 18	0,96
	TSV, Waldhausen	17 - 18	0,94
	Gojuva-Velkopolsky team	15 -16	0,93
	FS, Calella	15 – 16	0,93
	Gojuva-Velkopolsky team	13 – 14	0,91
	FS, Calella	13 – 14	0,89
	Gojuva-Velkopolsky team	10 - 12	0,91

As can be seen from the table, such high correlation coefficients testify to the very high reliability of the test, as well as the reproducibility of the results in each subsequent study conducted under the same conditions. A second similar study was conducted under gym conditions. 120 athletes took part in it, divided into four age groups: youngsters, teenagers, young adults (all athletes from the sports club "Varta" (Gojuva-Velkopolsky), 30 people in each group), as well as the senior team of the sports club "Zavisha" (Gjmiens). The obtained correlation coefficients between the results of the first and second attempts were also high and amounted to:

in the adult group – 0.97;

in the youth group – 0.92;

in the group of teenagers – 0.96;

in the group of youngsters – 0.96.

When drawing conclusions about the reliability of the proposed test, it should be noted that the correlation coefficient between the results of repeated studies conducted in stadium conditions was r = 0.924 (the number of players studied was 98), and the correlation coefficient between the results of repeated studies conducted in gym conditions r = 0.962 (the number of players studied was 120).

In the analysis of events related to sports activities, the determination of reliability criteria must be taken into account. In this case, based on the results of the conducted research, it can be noted that this test has excellent reliability when conducted in indoor conditions, and good

reliability when conducted in stadium conditions. It should also be noted that the high reliability of the proposed test is shown in all age categories of football players.

In order to recognize the test as informative from the point of view of motor skills assessment, it is necessary to accept the following conditions that it must meet:

1. The results of the test should have a high correlation with the effectiveness of the game of players in different age categories. A talented athlete should stand out from the background of his team with high technical training conditioned by movement skills.

2. The results of the test should not be determined by the sports experience, and the determination of the grade should not be a measure of the achievements obtained during the training process.

3. The final fact confirming that the test measures genotypic elements should be the results of longitudinal studies. That is, if relatively constant results are observed in the same group of athletes over a number of years, this is evidence that the test is considered informative in assessing human movement abilities.

Research conducted in Spain on athletes of 7 teams of different age groups confirms that the results of the test are correlated with the effectiveness of the players' game (Table 4). The criterion of playing efficiency was served by color sheets of three experts (the coach of the given team and two independent observers), who evaluated each athlete on a special scale of 1-10 points in the games played. The averaged indicators of the observers formed the performance criteria of each concrete player's game.

Analysis of the results of the research (Table 4) shows that the test data are reliably correlated with the performance of the players' game, regardless of the age category. It is also worth noting that the arithmetic mean value of the test results does not differ much in different communities. A careful analysis of the results of the study (especially the columns with maximum results) leads us to very interesting observations. The following showed the best results:

– 10-year-old representative of the Gojuva team (124 beats/min). This young athlete was recognized by coaches and observers as a "football super talent";

– The 15-year-old Spanish player (126 beats/min) was also recognized as a great talent by pedagogues;

– 16-year-old representative of the Gojuva team (126 beats/min). This athlete is included in the Polish national team in his age category.

– 40-year-old former first league player, currently a football coach (127 beats/min).

– 30 m run (test of special quickness);

– shuttle run: with a turn up to 5 m, with a turn up to 10 m and with a turn up to 15 m ("football turn test");

– Starosta test: maximum jump with a right turn, next time - maximum jump with a left turn. This test assesses general coordination skills. In this test, the sum of the maximum turns in degrees to both sides is considered as the score. In this work, this sum is divided by 2 in order to get a more precise target for a full 360° turn. The results of the studies are presented in Table 5.

The numbers in the table refer to the following teams:

No. 1 – Gojuva team (17-18 years old),

No. 2 – TSB, Waldhausen, Germany (17–18 years old),

No. 3 – Gojuva team (15-16 years old),

No. 4 – FS, Capella, Spain (15–16 years old),

No. 5 – Gojuva team (13-14 years old),

No. 6 – FS, Calella, Spain (13–14 years old),

No. 7 – Gojuva team (10-12 years old).

As can be seen from the data in the table, the arithmetic mean value of the result in running for 30 m is largely related to the age of the subjects. The younger the players, the smaller the speed at this distance.

In order to determine the difference between the mean values (therefore, the effect of age on the result), a test based on the analysis of variability data was performed.
R-Snedekor test function

R(calculated) = 15.77; R(0.05) = 2.20; R(0.01) = 3.01

The calculated value confirms the actual difference between the average values.

Table 2

The average results of the members of the studied teams in running 30 m

№	Number	Average result	Standard deviation	Average mistake, m	Coefficient of variation. cv %	Minimum result	Maximum result
1	12	4,61	0,158	0,046	3,43	4,41	5,00
2	13	4,65	0,265	0,073	5,68	4,28	5,18
3	17	4,66	0,175	0,042	3,76	4,25	4,91
4	12	4,65	0,210	0,061	4,52	4,25	4,91
5	16	4,95	0,286	0,071	5,77	4,47	5,56
6	12	4,99	0,233	0,067	4,67	4,71	5,56
7	16	5,28	0,317	0,079	6,01	4,91	6,06

The calculated test value of the R-Snedekor function (R=15.77) testifies that the difference between the average performance of the teams in the 30 m run is very large. This is also confirmed by the data in Table 6.

The analysis of the obtained results shows that the difference between the average scores of the teams in the general coordination test can be considered statistically reliable. In contrast to the 30 m dash tests and the "football flex" test, R(calculated) is slightly higher than R(0.05) = 2.20. This is self-explanatory if we consider that Starosta's test is a measure of some manifestations of coordination, primarily dynamic coordination or rotational coordination. Movement tasks in this test require coordinated movements of different parts of the body, wide aiming, precise and simultaneous quick movements.

When summarizing the results of the test based on the analysis of variability, it should be noted that the greatest differences were obtained in the "flexibility" test, then in the 30 m run, and finally in the general coordination test according to Starosta. Since the studied groups are compared according to their age (from 10 to 18 years old), it can be noted that the tests (which are considered as a measure of certain qualities) in ontogenetic development are more or less related to the influence of external environmental conditions and innate qualities. reflects the situation.

The analysis of variance of the test shows that the effect of the environment and the effect of age are not significant in this test.

Given that all tests are correlated (reliably) with game performance measures, the question naturally arises as to which of the four tests under study has the greatest discriminating feature in relation to game performance across all teams.

The test provides a precise instrument designed to detect innate movement qualities.

Table 3

Reliability of differences in the average scores of the studied teams in the general coordination test

Teams	Difference (calculated), t	Critical values	
		t (0,05)	t (0,01)
2 – 1	33,49	24,54	32,50
3 – 1	9,59	23,11	30,61
4 – 1	23,33	25,02	33,14
5 – 1	30,35	23,41	31,00
5 – 4	7,92	23,41	31,00
6 – 1	51,83	25,02	33,14
6 – 4	28,50	25,02	33,14
7 – 1	43,73	23,41	31,00
7 – 4	20,40	23,41	31,00
3 – 2	23,90	22,58	29,91
4 – 2	10,16	24,54	32,50
5 – 2	3,14	22,89	30,31
6 – 2	18,34	24,54	32,50
6 – 5	21,48	23,41	31,00
7 – 2	10,24	22,89	30,31
7 – 5	23,37	21,67	28,70
4 – 3	13,74	23,11	30,61
5 – 3	20,70	21,35	28,28
6 – 3	42,24	23,11	30,61
7 – 3	34,14	23,35	28,28
7 - 6	8,10	23,41	31,00

For this purpose, after pre-standardization, all 7 teams were combined into one group, after which multiple regression analysis was performed with the selection of the best option of the independent variables.

Full set of variables – 4 tests. They are given the following numbers:

1. Run for 30 m.

2. "Flexibility" test.

3. The author's test.

4. Starosta general coordination test.

Multiple regression analysis with the best selection of variable data of the full set of tests (1, 2, 3, 4) shows that partial normalization of the regression coefficient gave the following results:

– 0.049 × (1); – 0.059 × (2); 0.590 × (3); 0.345 × (4).

Regression equation:

u = -0.000-0.049 × (1) -0.059 × (2)+0.590 × (3)+0.345 × (4).

correlation coefficient - 0.84,

coefficient of determination - 70.12%,

average squared deviation – 0.292.

Further analysis leads us to the need to search for the best choice of the given variables from the composition of the three tests (2, 3, 4). The following partially normalized regression coefficients were obtained:

– 0.080 × (2); 0.600 × (3); 0.349 × (4).

Regression equation:

u = -0.000-0.080 × (2)+0.600 × (3)+0.349 × (4).

correlation coefficient - 0.84,

coefficient of determination - 69.96%,

average squared deviation – 0.291.

We continue the mathematical processing of the obtained data and try to find the best choice of variables from two test structures (3, 4). The following partially normalized regression coefficients were obtained:

0.626 × (3); 0.362 × (4).

Regression equation:

u = – 0.000 + 0.626 × (3) + 0.362 × (4).

correlation coefficient - 0.83,

coefficient of determination - 69.42%,

average squared deviation – 0.293.

The only option left is to complete the mathematical treatment of test #3. Normalized regression coefficient:

0.763 × (3).

Regression equation:

u = -0.000 + 0.763 × (3).

correlation coefficient - 0.76,

coefficient of determination - 58.21%,

average squared deviation – 0.396.

Multiple regression analysis shows that the author's test has the greatest distinguishing feature, its coefficient of determination is equal to 58.21 %. Adding other variables increases this coefficient to even higher values. In this case, the test that follows the author's test, which increases the coefficient of determination, is a test that evaluates general (rotational) coordination, then a test that evaluates the "turning run" and finally the 30 m run. The maximum coefficient of determination in four tests is 70.12% (Table 4).

Table 4.

Summary of the best test selection

Number of variables	Coefficient of determination	Average squared deviation	The best selection of tests
4	70,12	0,292	1, 2, 3, 4
3	69,96	0,291	2, 3, 4
2	69,42	0,293	3, 4
1	58,21	0,396	3

Athletes of youth football club "Junior" (Gojuv-Velkopolsky) were the object of research to investigate the informativeness of the tests.

The research was conducted in a sports hall with the participation of four football teams of three age groups.

2 teams with 18 and 22 players in the 10-11 age group were studied.

16 athletes in the 12-13 age group and 16 athletes in the 14-16 age group were studied.

Summary. Assessing the level of physical fitness of athletes is one of today's urgent issues. The reliability of the tests used to assess the level of engagement of football players is a very important factor. The purpose of these studies was to determine the informativeness of tests conducted in gym conditions. Based on the classification sheets of three independent experts, the results of the test were correlated with the performance of the game (averaged data of expert coaches). The high reliability and variability of the mentioned and studied tests guarantee their applicability and effectiveness in the players of our country.

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