

Peculiarities of the Influence of Fitness Special Means on the Speed and Strength and Coordination Indicators of Young Football Players

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Abstract *Background:* The problem of increasing coordination and conditioning abilities of young football players largely determining the level of manifestation of such motor qualities as agility, speed and strength can be solved with the help of additional means of fitness. The purpose is to study the effect of a specialized fitness program on the indicators of speed-force and coordination abilities of young football players. *Material and methods:* The pedagogical experiment lasted 6 months, involving 40 athletes-football players in the age of 8.97±0.04 years old (height: 139.72±1.08 cm; body mass: 31.71±0.66 kg). Children of the experimental group (n=24) were engaged in a specially designed fitness program, including exercises with different fitness equipment in the transitional mesocycle 2 times a week for 45 min, and in the preparatory one - once a week (45 min). The remaining 16 players served as a control group and continued their traditional training. Coordination abilities were determined with the help of tests "running 30 m with the ball at least 3 touches", "hitting a stationary ball from a running distance" (corridor of 10 m) and "juggling with a ball". To assess the speed and strength abilities we used "speed of running for 30 m", "long jump from a place", "pulling up from the high bar". Statistical processing was performed using Microsoft Excel and software package "STATISTICA 10.0". The parametric Student's t-test was used in the study.

Differences were significant at $P < 0.05$. *Results:* We found that the experimental group significantly improved the speed of running for 30 m and long jump by 5.1% and 1.9% ($p < 0.01$), as well as the pull-up from hanging on the bar by 20.9% ($p < 0.01$). Coordination indicators (running for 30 m with ball handling and juggling) changed more significantly by 30.7 % and 26.6 % ($p < 0.001$), respectively. Kicking a stationary ball from a running distance changed by 4.10% ($p < 0.05$). *Conclusion:* If we apply additional fitness programs with different sports equipment during the training of football players of 8-9 years old, the indicators of coordination and speed-force abilities will improve considerably.

Keywords Young Football Players, Speed and Strength, Coordination, Fitness

1. Introduction

The development trend of modern football predetermines a multi-year systematic process of achieving the highest skill, dictates the need to improve the system of its step-by-step formation [1]. The effectiveness of the process of sports training depends largely on the proper planning of means and methods of development of physical

qualities. It is known that the most important qualities of a football player are speed and coordination of movements. The strength and endurance should only support these qualities [2]. It is the most appropriate to develop physical abilities from childhood. If everything in an athlete's training cycle is systematized and competently built, not only classic techniques, but also innovations are used, so, the chances of winning multiply. In this regard, coaches, sports physicians and profile specialists are looking for innovative technologies that allow a multi-faceted and, most importantly, balanced effect on the athlete [3].

Currently, in the preparation of qualified athletes (England, Germany, France and Italy) there is a clear tendency to use non-traditional means in sports training. For example, various forms of fitness (aerobics, aqua-aerobics, Pilates, functional training), health-improving Chinese methods, yoga, joint gymnastics, etc. are widely used. [4]. For the last decades aerobics has been used in sports training not only by football players, but also by boxers, wrestlers, gymnasts and figure skaters [4].

Among a lot of methods of general and special physical training, fitness has a significant role because of the following:

- step aerobics contribute to the development of coordination, aerobic endurance, rhythm and agility [5];
- training on gliding discs (sliding discs) allows developing a sense of balance and strengthen the muscular corset, helps to improve metabolism, strengthen the cardiovascular, respiratory and nervous systems [6,7];
- use of fitness balls in various unsupported positions contributes to the development of "balance", coordination and strengthening the muscular corset [8];
- sets of exercises with weights and shock absorbers increase resistance and develop strength abilities [9].

Russian specialists have also begun to use various forms of aerobic exercise in the training process. However, this phenomenon is rather fragmentary than systemic one. Most often the simplest sets of exercises with music are used only as a warm-up or to increase the emotional background of training [10]. The possibilities of aerobic gymnastics as a complex coordinated sport activity are not taken into account and are not fully realized in practice [11]. The influence of fitness for the development of the leading physical qualities in childhood and adolescence is also not fully studied.

Thus, the purpose of the research is to study the impact of a specialized fitness program on the indicators of speed and strength and coordination abilities of young football players.

2. Materials and Methods

The study involved 40 young football players of 8-9 years old, studying at the stage of initial training at the football club FC TSK Simferopol (8.97±0.04 years old; height: 139.72±1.08 cm; body mass: 31.71±0.66 kg). Experimental protocol of the study was approved by the local ethical committee: commission on bioethics of V.I. Vernadsky Crimean Federal University (Protocol № 3 from January 17, 2018).

During six months (August-January), 24 young athletes (experimental group), training according to the traditional methodology, additionally performed a specialized fitness program developed at the department of medical and biological bases of physical culture of V.I. Vernadsky Crimean Federal University, 2 times a week for 45 minutes during the transition period and once a week (45 minutes) during the preparatory period, including sets of exercises on step-platforms, use of fitballs, medical balls, aerobic classes, functional training and Pilates. The remaining 16 players served as a control group and continued their traditional training.

The sportsmen of the experimental group, in addition to the above equipment, used an innovative gliding (sliding disc) trainer [6,7] for gliding and bringing arms and legs in various combinations. Each lesson contained an element of novelty, which influenced the formation of motor coordination in young football players. Coordination complexity of the lessons increased due to the increasing number of variations of exercises; requirements for accuracy of performance, speed and stability of performance increased. Rhythm and speed of performance increased, as well as there were changes in loads and resistances.

Before and after the experiment, the most important indicators for young football players were tested (speed-force and coordination) according to the method approved in the standard training program of sports training for children and sports school and specialized children's and youth sports school of Olympic reserve, developed by the Russian Football Union as control-transfer norms [15]. To assess the speed and strength abilities we used the test "speed of running for 30 m", long jump from a place, pulling up from the hang. To assess coordination, we evaluated running for 30 m with a ball (at least three touches), hitting a stationary ball from a running distance (corridor 10 m) and juggling with a ball.

Test "running speed at 30 meters". On the command "Start", the subject stood in the high start position at the starting line. Then the command "March" followed. The athlete had to run 30 meters at an extremely high speed. The stopwatch was turned on by the command "March" and turned off when the subject crossed the finish line. The result was recorded with an accuracy of a tenth of a second.

Long jump from a place. The athlete, on command, took, on a marked horizontal platform, the starting position:

half-squat, feet are parallel and arms are back, after that he performed a long jump with a push with two legs and a swing with his arms. The best result out of three attempts is recorded. The result is the distance from the line where the toe of the shoe was located to the closest touch point after landing in centimeters.

Pull-ups on a high gymnastic bar from a hang. The athlete, on command, with a grip from above (palms are forward), grabbed the crossbar shoulder-width apart and did hang on straight arms, while the legs should not touch the floor. After that, he began to perform the maximum number of pull-ups. The result is the number of successful pull-ups in which the chin was directly over the bar.

Running 30 meters with dribbling. It was carried out from a high start, the ball was allowed to be dribbled in any way, making at least three touches of the ball on the segment, not counting a stop behind the finish line. The exercise was considered complete when the player crossed the finish line. The judge at the start recorded the correctness of the start and the number of touches of the ball, and the judge at the finish recorded the running time.

A hit on a stationary ball from a running start to a distance was performed with a dominant foot on a stationary ball with a running start in any way. The range of the ball was measured from the point of impact to the point of the first contact of the ball on the ground in a 10 m wide corridor. The best result out of three attempts was counted.

Ball juggling. The athlete performed blows with the right and left leg (middle, inner and outer parts of the instep), hip and head in any sequence without repetition of one blow more than two times in a row. Only strikes performed in different ways were taken into account, of which at least once with the head, right and left hip.

2.1. Statistical Analysis

During the pedagogical research, Microsoft Excel 2021 and «STATISTICA 10.0» programs were used. Statistical processing of the results was performed using the

«STATISTICA 10.0» program, wherein the parametric Student's t-test criterion and the reliability of the results was considered at $p < 0.05$. In mathematical processing, the average value of indicators in groups was determined using Microsoft Excel 2021 [16].

3. Results

The studies performed and their quantitative assessment indicate that at the beginning of the experiment all the initial indicators of the subjects are at an average and below average level of development, correspond to the evaluation of "satisfactory" and reveal a low level of training [15]. As it is shown in the Table 1 the athletes did not meet the standard requirements for some indicators. Only the test "juggling a ball" corresponded to the score "excellent".

After training with a specialized fitness program, the indicators of all strength tests significantly improved (Table 1, Figure 1). Time of running 30 m from the place has decreased by 5.10% ($p < 0.01$), long jump has improved by 1.90% ($p < 0.01$), curl up from the bar by 20.9 % ($p < 0.01$). Consequently, the consequence of fitness training is an increase in overall strength, which already in training on the field and need to be converted into special strength and performance.

We have shown that index of ball running 30 m after the experiment has improved by 30.7% ($p < 0.001$), juggling has improved by 26.6% ($p < 0.001$), and the rate of hitting the stationary ball from a running distance has changed by 4.1% ($p > 0.05$) (Table 1, Figure 2).

After exercising on a specially designed fitness program in the experimental group, almost all of the studied indicators corresponded to the normative score "good" [15].

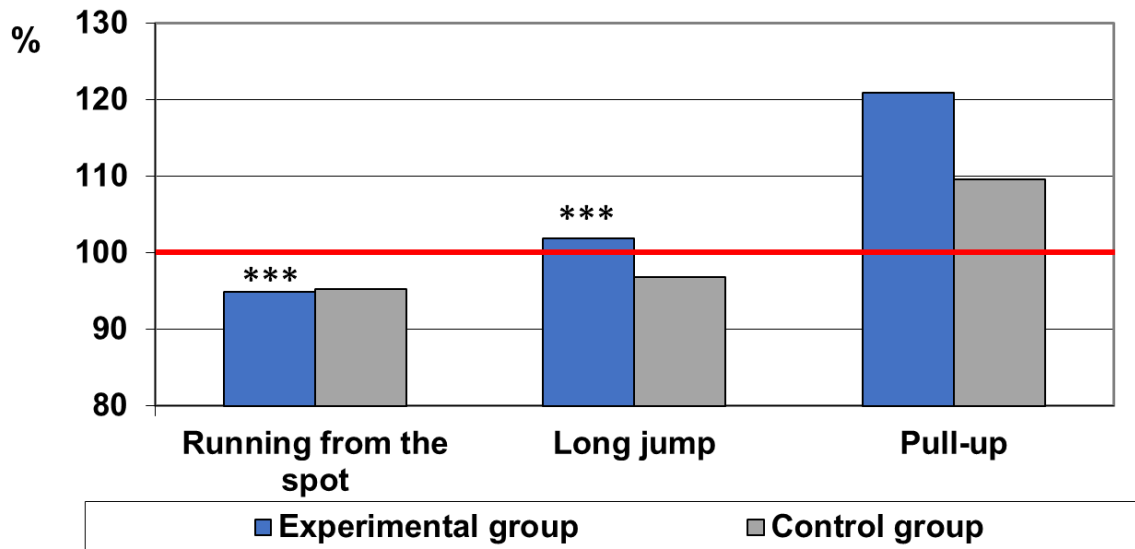
As for the control group, the statistical analysis shows a slight improvement in three parameters, but in this case, the increase is insignificant (Table 2).

Table 1. Dynamics of speed-power and coordination indicators of football players in the experimental group

Indicators, units	Regulatory requirements			Before	After	Percentage difference (%)	95% Confidence Interval of the Difference		t	df	Sign. (Two-tailed)
	excellent	good	satisfactory				Lower	Upper			
Running 30 m from a place (s)	5.3-5.4	5.4-5.5	5.5-5.6	5.74±0.38	5.50±0.33	-5.1	0.22	0.35	9.73	23	0.000
Long jump from a place (m)	1.7-1.8	1.70-1.60	1.60-1.50	1.57±0.11	1.60±0.11	1.9	-0.04	-0.02	-8.76	23	0.000
Pulling up from a hanging position (number of times)	11<	6-10	5-7	4.79±3.58	5.79±3.95	20.9	-1.55	-0.44	-3.71	23	0.001
Running for 30 m with the ball (s)	6.5-7.0	7.0-7.5	7.5-8.0	8.46±1.0	5.86±0.31	-30.7	-2.10	7.29	0.001	23	0.264
Kicking at a stationary ball from a running distance (m)	28	24	20	20.93±3.09	21.79±2.32	4.10	-1.70	0.00	-2.06	23	0.050
Juggling a ball (number of times)	18<	12-17	8-11	18.79±9.95	23.79±11.3	26.6	-8.70	-1.29	-2.78	23	0.010

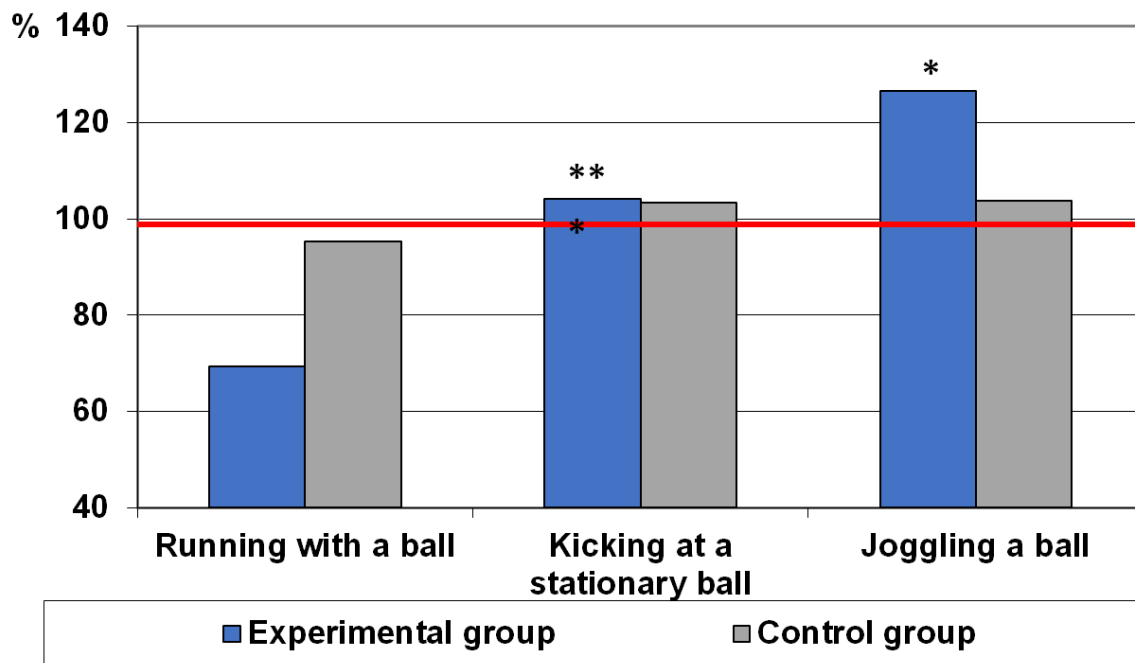
Table 2. Dynamics of speed-power and coordination indicators of football players in the control group

Indicators, units	Regulatory Requirements			Before	After	Percentage Difference (%)	95% Confidence Interval of the Difference		t	df	Sign. (Two-tailed)
	excellent	good	satisfactory				Lower	Upper			
Running 30 m from a place (s)	5.3-5.4	5.4-5.5	5.5-5.6	5.75±0.40	5.47±0.34	-4.8	0.19	0.36	6.99	15	0.000
Long jump from a place (m)	1.7-1.8	1.70-1.60	1.60-1.50	1.56±0.12	1.51±0.18	-3.2	-0.01	0.10	1.71	15	0.106
Pulling up from a hanging position (number of times)	11<	6-10	5-7	4.56±3.57	5.00±3.44	9.6	-0.91	0.04	-1.96	15	0.068
Running for 30 m with the ball (s)	6.5-7.0	7.0-7.5	7.5-8.0	6.18±0.39	5.89±0.33	-4.7	0.19	0.38	6.57	15	0.000
Kicking at a stationary ball from a running distance (m)	28	24	20	21.12±3.38	21.81±2.61	3.26	-1.84	0.46	-1.27	15	0.222
Juggling a ball (number of times)	18<	12-17	8-11	18.00±7.83	18.68±7.31	3.7	-1.11	-0.26	-3.46	15	0.003



Note: *, **, *** is the significance of differences $p < 0.05, 0.01, 0.001$, respectively (Student's t-test).

Figure 1. Changes in speed and strength indicators (%) in young football players engaged with the use of a specialized fitness program



Note: *, **, *** is the significance of differences $p < 0.05, 0.01, 0.001$, respectively (Student's t-test).

Figure 2. Changes in speed and strength indicators (%) in young football players engaged with the use of a specialized fitness program

4. Discussion

The problem of improving coordination and conditioning abilities, which largely determine the level of manifestation of such motor qualities as agility, speed and strength, is constantly in the field of scientific interests of specialists in the field of sports medicine, physical rehabilitation, as well as educators and coaches of sports teams [3]. Among the methods aimed at improving the coordination and speed and strength performance of muscles, there is currently a preference for different types

of aerobics and fitness, as well as methods borrowed from other sports [17,18]. They differ significantly from the classical means of physical training by the lack of monotony, high emotional background of classes, numerous arsenal of motor actions, positive trace effects from performing combinations and ligaments, constant updating of logically built and scientifically grounded programs [19]. Russian specialists, following the example of leading football countries, have started to use various forms of aerobics in the educational and training process. However, this phenomenon is rather fragmentary than

systemic one [20].

In the course of a pedagogical experiment it is shown that at the beginning of the study, based on the normative requirements, the speed and strength and coordination indicators of young football players were average and below average level of development, corresponded to the assessment "satisfactory" and revealed a low level of training. Experts attribute this to the problems of the educational and training process in childhood and adolescence and the lack to date of a unified methodological approach in this matter (perhaps this fact should not be considered a negative point) and points to the need for further research [21,22].

The results of the pedagogical experiment confirm the effectiveness of the use of special means of fitness, performed in aerobic and anaerobic mode with musical accompaniment and with the use of different fitness equipment, which is confirmed by a significant increase in the speed, strength and coordination indicators of young football players. After lessons on a specially designed fitness program, almost all the studied indicators corresponded to the normative evaluation "good" [15]. The results of the pedagogical experiment prove the fact that the junior school age is a sensitive period for the development of all coordinate abilities, and the adolescent age is a period for the development of speed-force abilities, which is confirmed by the opinion of a lot of researchers [23,24]. We see prospects for further research of the problem in a more detailed study of the influence of fitness training on the development of accuracy of reproduction and differentiation of spatial, temporal and force parameters of movements, balance, coordination of movements, rhythm, orientation in space, as well as speed abilities (reaction and frequency of movements) and endurance to loads in football players of different ages [25].

5. Conclusions

At the initial stage of sports training, versatile training is the most effective. Excessive enthusiasm for highly specialized exercises often leads to a delay in the growth of skill in the next stages. The possibility of including special means of fitness in the program of sports training of football players of 8-9 years old is shown. Six months after the start of fitness training all athletes have improved the indicators of coordination and speed-force abilities. The most pronounced effect of fitness training was found in coordination tests: running with ball handling and juggling. A high level of coordination and speed-force parameters will allow young football players to increase the efficiency and success of competitive activity. Further research with a larger sample size and long-term follow-up is needed. The research results can be used by coaches and teachers of regular and sports schools in the classroom with children. The study is promising as it opens up new possibilities for studying the effect of fitness aids on motor development in

children.

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