

ORGANIZATION AND CONTROL OF
SPECIAL STRENGTH TRAINING OF
QUALIFIED FOOTBALL PLAYERS



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Annotation

Introduction. The relevance of the study is related to the importance of evaluating the effectiveness of various training methods aimed at developing the strength abilities of football players, as well as the need to determine the optimal options for combining them with other training influences in the process of training players at various structural units of the annual cycle. **The purpose of the study** is to develop and scientifically substantiate the methodology for assessing and monitoring the special strength training of qualified football players. **Research methods.** To assess the strength indicators, as well as to track the dynamics of their development, the use of the method of computer strain-kinamography is the most effective and efficient, which allows not only to detail and accurately determine the dynamometric characteristics of the subjects, but also to quickly process and analyze the results in sufficient detail.

The results of the study. The data obtained showed that with an increase in the power component, an increase in speed abilities follows, which has a positive effect on the playing activity of football players. The individualization of special strength training of qualified football players, carried out by selecting the optimal weight for each player, as well as a set of speed and strength exercises, had a positive effect on the indicators of the dynamic characteristics of the players. The variation in different modes (isometric, dynamic, and statodynamic) of individually directed training actions allowed for a more complete effect on the muscle fibers of the players, which contributed to the qualitative manifestation of the players' conditions in training and competitive activities. **Conclusions.** The rational organization of special strength training of football players and the development of objective control over the level and dynamics of their strength characteristics should be considered as a potential reserve that contributes to the qualitative improvement of the training process of qualified football players of various playing roles.

Keywords: Strength; technique; game; exercises; training process, speed, players, football.

Анотація

Вступ. Актуальність дослідження пов'язана зі значущістю оцінки ефективності різних методів тренування, спрямованих на розвиток силових здібностей футболістів, а так само необхідністю визначити оптимальні варіанти їх поєднання з іншими тренувальними впливами в процесі підготовки гравців на різних структурних одиницях річного циклу. **Мета дослідження** – розробити та науково обґрунтувати методику оцінки та контролю спеціальної силової підготовленості кваліфікованих футболістів. **Методи дослідження.** Для оцінки силових показників, а також відстеження динаміки їх розвитку найбільш ефективно і результативно використання методу комп'ютерної тензодинамографії, що дозволяє не тільки деталізувати і точно визначити динамометричні характеристики випробовуваних, але швидко, а також досить детально обробляти і аналізувати отримані результати.

Результати дослідження. Отримані дані показали, що зі збільшенням силового компонента йде підви-

щення швидкісних здібностей, що позитивно позначається на ігровій діяльності футболістів. Індивідуалізація спеціальної силової підготовки кваліфікованих футболістів, здійснювана шляхом підбору оптимальної ваги обтяження для кожного гравця, а також комплексу швидкісно-силових вправ позитивно позначилися на показниках динамічних характеристик гравців. Варіація в різних режимах (ізометричному, динамічному, статодинамічному) індивідуально спрямованих тренуючих впливів дозволила більш повноцінно впливати на м'язові волокна гравців, що сприяло якісному прояву кондицій гравців в тренувальній і змагальній діяльності. **Висновок.** Рациональну організацію спеціальної силової підготовки футболістів і розробку об'єктивного контролю за рівнем і динамікою їх силових характеристик слід розглядати як потенційний резерв, що сприяє якісному вдосконаленню тренувального процесу кваліфікованих футболістів різного ігрового амплуа.

Ключові слова: Сила, техніка, гра, вправи, тренувальний процес, швидкість, гравці, футбол.

Аннотация

Введение. Актуальность исследования связана со значимостью оценки эффективности различных методов тренировки, направленных на развитие силовых способностей футболистов, а так же необходимостью определить оптимальные варианты их сочетания с другими тренирующими воздействиями в процессе подготовки игроков на различных структурных единицах годового цикла. **Цель исследования** – разработать и научно обосновать методику оценки и контроля специальной силовой подготовленности квалифицированных футболистов. **Методы исследования.** Для оценки силовых показателей, а также отслеживания динамики их развития наиболее эффективно и результативно использование метода компьютерной тензодинамографии, позволяющего не только детализировать и точно определять динамометрические характеристики испытуемых, но быстро, а также достаточно подробно обрабатывать и анализировать полученные результаты.

Результаты исследования. Полученные данные показали, что с увеличением силового компонента следует повышение скоростных способностей, что положительно сказывается на игровой деятельности футболистов. Индивидуализация специальной силовой подготовки квалифицированных футболистов, осуществляемая путем подбора оптимального веса отягощения для каждого игрока, а также комплекса скоростно-силовых упражнений положительно сказалось на показателях динамических характеристик игроков. Варіація в різних режимах (ізометричному, динамічному, статодинамічному) індивідуально направлених тренуючих впливів дозволила більш повноцінно впливати на м'язові волокна гравців, що сприяло якісному проявленню кондицій гравців в тренувальній і змагальній діяльності. **Выводы.** Рациональную организацию специальной силовой подготовки футболистов и разработку объективного контроля за уровнем и динамикой их силовых характеристик следует рассматривать как потенциальный резерв, способствующий качественному совершенствованию тренировочного процесса квалифицированных футболистов различного игрового амплуа.

Ключевые слова: Сила, техника, игра, упражнения, тренировочный процесс, быстрота, игроки, футбол.

Problem statement. Football is a sport that includes the manifestation of all physical qualities. At the same time, qualified players must have high indicators of the power component to realize themselves in competitive activity [2, 4, 5, 8, 9, 12, 22, 23]. However, the opinions of football coaches-practitioners are not always the same. Some believe that for the game implementation, a football player should take the time to develop this quality. Others - that athletes should not perform the load with an external load. In our opinion, players are required to perform strength exercises that, by strengthening the muscle fibers, will reduce

the risk of injuries and increase the effectiveness of competitive activities. Thus, an increase in the power capabilities of a football player directly affects the speed of hitting the ball, since the speed of the latter's flight depends on the force applied to it [14, 15].

Analysis of scientific research and publications. It is important for football practice to evaluate the effectiveness of various training methods aimed at developing strength abilities, as well as the need to determine the optimal options for combining them with other training influences in the process of training players at various structural units of

the annual cycle [3, 11, 13, 18, 18, 19, 20, 21, 24, 27]. To date, there are a large number of tools, methods and methodological techniques that underlie the development of a certain type of strength, taking into account the specifics of this sport [1, 6, 7, 10, 16, 17, 18, 19]. At the same time, the measurement of power characteristics and the process of changing them over time cannot always be determined using pedagogical tests. To assess the strength indicators, as well as to track the dynamics of their development, it is most effective and efficient to use the method of computer tensodynamography, which allows not only

to detail and accurately determine the dynamometric characteristics of the subjects, but also to quickly process and analyze the results in sufficient detail.

Methods and organization of the study. The testing took place on the basis of the foot-sick club "Lokomotiv" in Gomel, which plays in the second division of the Republic of Belarus. The study involved 20 players aged 18 to 34 years (8 defenders, 8 midfielders and 4 forwards). The research took place throughout the entire season, from January to November 2020. For an instrumental assessment of the strength and speed-strength capabilities of the muscles of football players, the method of computer tensodynamography was used, which made it possible to record the "strength-time" curve, as well as to observe the rate of increase in muscle strength [1, 25, 26]. The maximum force registered at the manifestation of the isometric tension of the muscle group without fixing the time was determined, the "explosive" muscle contraction in the isometric mode was estimated - the force gradient (the ratio of the maximum manifested muscle effort to the time of its achievement) and the values of strength indicators that athletes can develop in 0.1 s [1, 24].

The obtained tensodynamograms of the strength characteristics of the muscle groups involved in leg extension in the knee and hip joints were recorded and processed.

The purpose of this study is to develop and scientifically substantiate a methodology for assessing the special strength training of qualified football players.

The training process was designed in such a way that anaerobic strength training was performed twice a week. On Wednesdays, strength training was carried out, and every Sunday, the focus was on toning the muscle fibers on the day after the friendly matches.

Research results and their discussion. Analysis of the results of dynamometry showed that the strength indicators of the players at the beginning of the experiment are approximately at the same level (Table 1). The values of the maximum isometric force and the maximum explosive force of the players are almost identical ($p > 0.05$). There were no significant statistical differences between these groups in all power manifestations. It should be emphasized that a very significant indicator is the manifestation of force in 0.1 seconds. The latter is due to the fact that the running speed is determined by a number of

parameters, the main of which is the repulsive force, which directly affects the length of the athlete's running step. Football players spend approximately 0.1-0.2 s when interacting with the foot support [15, 20]. Therefore, in our opinion, the determining factor in assessing the strength characteristics of football players should be the strength of the player shown during this period of time.

Based on the tasks which were set to increase the strength component of the players, a training plan was drawn up based on the method of unsaturated effort. The control group players performed anaerobic strength training once every two weeks. The football players of the experimental group performed similar training exercises twice a week. For each player of the experimental group, their optimal weight was selected in all exercises. The duration of the training session for the athletes of the control group was 150 minutes per month, for the players of the experimental group - 540 minutes per month.

Taking into account the above, the main means of developing force effects were selected, which included the following exercises:

1. Exercises with external weights, performed on the number

Table 1

Dynamometric indicators of qualified football players before the experiment

Dynamometric Indicators	Group		Validity of differences	
	Control n=10	Experimental n=10	t-criteria	p
Right leg				
Maximum isometric force, kg	206,9±8,3	205,4±9,4	0,12	>0,05
Force gradient, kg / s	165,7±8,5	171,4±6,2	0,54	>0,05
Force exerted in 0,1 s, kg	111,9±7,0	120,5±8,1	0,80	>0,05
Left leg				
Maximum isometric force, kg	196,5±7,6	196,7±8,3	0,02	>0,05
Force gradient, kg / s	159,1±7,9	152,1±8,1	0,62	>0,05
Force exerted in 0,1 s, kg	110,4±4,6	117,6±6,3	0,91	>0,05

Table 2

The most common exercises used to develop the strength abilities of football players

Name of the exercise	Description
Squat	S.P. - stand legs apart. The squat was performed to an angle of 90° and fixed for 3 seconds, then a quick rise to the starting position.
Bench press	S.P. - lying on the bench, holding the barbell bar. The head is pressed against the bench, the shoulder blades are brought together, the feet rest on the floor. During the exercise, the barbell moves in a vertical plane.
Block traction on the simulator	S.P. - Stand legs apart, legs slightly bent at the knee joints, shoulder blades brought together, pull from top to bottom, up to waist level.
Ascents of the platform	Platform height of 40-50 cm, stepping on the platform to perform an angle of 90°. The same goes for the barbell neck.
Lifting barbells	S.P. - stand legs apart, legs slightly bent at the knee joints, shoulder blades brought together, barbells in the hands. Perform arm flexion.
Lifting the torso with emphasis on one leg	S.P. - lying down, the heel of one foot rests on the floor. Lift the torso, leaning on the floor with the shoulder blades and one leg.
Lifting barbells from a sitting position	S.P. - sitting, hands with barbells to the sides, forearms up. Lifting your hands up, touch the barbells, then return to the starting position.
Jumping	S.P.- half-squat. Jumping on the pedestal followed by a quick jump up.
Flexion and extension of the torso	S.P. - lying on your back. Simultaneous lifting of the torso and bent legs so that the chin is close to the knees. The body after performing the exercise is completely lowered to the floor.
Hip turns with medball	S.P. - lying down, hold the medball between your knees. Make a movement with your hips to the right and left, do not touch the floor with your feet.

of times.

2. Exercises with external weights, performed for a time.

3. Exercises performed in the static-dynamic mode.

4. Jumping exercises performed on the number of times.

In our opinion, the most popular way to develop maximum strength is the method of unsaturated effort (within 80-85% of the individual maximum), the number of repetitions in the exercises varies from 8 to 16 repetitions. This method allows for a longer impact on the muscle fibers through a relatively large number of motor actions, which allows you to simultaneously increase the strength and mass of the muscle fibers [20]. The exercises used in the experiment are presented in Table 2.

Note: weights are selected individually

The strength training for the experimental group consisted of two parts:

1. Training on the method of unsaturated repeated efforts, which was of a complex nature.

2. Tonic training based on the circular method with a weight gain (40% of the maximum weight), but with an increase in the number of repetitions. The strength training of football players was not limited to the above set of exercises, it was changed every training cycle (the most frequently used exercises are described).

Table 3 shows that statistically significant differences between the experimental and control groups were found in all the analyzed values of power characteristics at the end of the pedexperiment ($p < 0.05$).

Discussion. The value of the force displayed in 0.1 seconds can be attributed to the factor of determining the speed abilities of football players. With an increase of 26.8 kg for the right leg and 19.5 kg for the left leg, the players were

able to improve their result in the 30-meter run by 4.02%. Before the experiment the players ran this segment, on average, for 4.23 seconds, whereas after that, the time was 4.06 seconds.

The analysis of individual indicators of football players revealed that the defensive line players have the largest increase in the maximum isometric strength, and the offensive players have a lower increase in the manifestation of this indicator. At the same time, attack players have the highest rates in the manifestation of force for 0.1 s and "explosive" muscle contraction (force gradient).

Conclusions. The individualization of special strength training of qualified football players, which was carried out by selecting the optimal weight for each player, as well as a set of speed and strength exercises, had a positive effect on the indicators of the dynamic characteristics of the players. The varia-

Table 3

Dynamometric indicators of qualified football players after the experiment

Dynamometric Indicators	Group		Validity of differences	
	Control n=10	Experimental n=10	t-criteria	p
Right leg				
Maximum isometric force, kg	236,1 ±4,6	263,2±9,4	2,57	<0,05
Force gradient, kg / s	210,5±7,2	234,9±6,8	2,46	<0,05
Force exerted in 0,1 s, kg	124,3±6,8	147,3±6,2	2,50	<0,05
Left leg				
Maximum isometric force, kg	223,3±7,4	246,3±4,6	2,64	<0,05
Force gradient, kg / s	193,1±6,0	212,0±6,0	2,23	<0,05
Force exerted in 0,1 s, kg	118,4±7,4	137,1±6,8	2,56	<0,05

tion in different modes (isometric, dynamic, and statodynamic) of individually directed training actions allowed for a more complete effect on the muscle fibers of the players, which contributed to the qualitative manifestation of the players' conditions in training and competitive activities.

The implementation of motor actions shown by football players in the game is not directly related

to the indicators of the maximum isometric strength shown by players when extending the leg in the knee and hip joints. At the same time, athletes with higher performance in this parameter will be able to jump higher to fight for riding balls. The same players who can show their maximum power capabilities in a short time, have higher indicators in the manifestation of high-speed effects, which is one of the most im-

portant characteristics in the game activity of a football player.

Thus, the rational organization of special strength training of football players and the development of objective control over the level and dynamics of their strength characteristics should be considered as a potential reserve that contributes to the qualitative improvement of the training process of football players of various roles.

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