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ORIGINAL SCIENTIFIC ARTICLE

THE EFFECT OF THE PYRAMID EXERCISE METHOD ON THE MAXIMUM STRENGTH OF THE WRESTLER'S ARM MUSCLES

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

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Abstract

Study purpose. The purpose of this study was to determine the effect of reverse grip barbell curls and barbell triceps extension exercises on increasing the maximum strength of the arm muscles of wrestling athletes.

Materials and methods. This type of research is quasi-experimental. The population in the study was 24 wrestling athletes. Sampling was carried out using purposive sampling techniques, namely 10 male wrestling athletes. The research instrument was carried out by lifting a load that was only able to be lifted 1 time or expressed ability (maximum strength) using a barbell. The data analysis technique used is hypothesis testing using the t-test formula.

Results. The results of this study showed that the exercises of reverse grip barbell curls and barbell triceps extension have an effect on the increase in the maximum strength of the arm muscles of wrestling athletes; from the initial test and the final test results, there was an increase with a difference of 1.04, namely from an average score of 29.9 kg in the pre-test to 32.3 kg in the post-test.

Conclusions. The conclusion in this study is that there is a significant influence of the reverse grip form of barbell curls and barbell triceps extension on the increase in maximum strength of the arm muscles in wrestling athletes.

Keywords: reverse grip barbell curls; barbell triceps extension; maximum strength.

Introduction

Physical exercise is very important for athletes because of a systematic process to improve physical qualities aimed at improving the appearance of sports. Athletes who have the good physical condition will have a great chance of getting a champion in a match. Physical condition is the ability to face the physical demands of a sport to perform optimally (Sabillah et al., 2022). Good physical condition is one of the supporting elements in the optimal achievement of various kinds of activities. Sports achievements are inseparable from the element of physical condition. Physical exercise and proper, regular and sustainable exercise are components that also affect the improvement of a person's physical fitness condition (Bile & Suharharjana, 2019; Fachrezzy et al., 2021)

Physical condition is a whole of components of interrelated components. Improving physical condition cannot be done casually, if you want to improve the physical condition of an athlete, then all components contained in the physical condition must also be developed and cannot be separated (Jäger et al., 2017). Physical condition is one of the physical components possessed by a person (Lloyd et al., 2014; Nugroho et al., 2021; Raiola & Aliberti, 2021).

Improving the physical condition of athletes aims to make physical abilities excellent and useful in supporting sports activities to achieve athletes' achievements. Mansur et al., (2018) said that to achieve great achievements in competitive sports, it takes a prime body condition according to the needs and demands of the sports branch. This is supported by citations by Gumantan & Fahrizqi (2020) which say that to achieve high achievements in competitive sports, an athlete urgently needs excellent physical condition according to the needs and demands of sports. Physical condition is the most important factor in exercise programs

aimed at achieving high abilities (Anderson et al., 2015; Petruk et al., 2021). Training is a process in sports activities to improve the abilities found in athletes most importantly in the skills and skills that are possessed systematically and tried to match the established period (Busch et al., 2013; Drain et al., 2017). Every exercise process always requires an exercise program of both physical and skill nature. The given exercise program must be appropriate due to the ever-changing human condition.

Training planning is an important factor in sports practice to improve performance. Intensive practice will increase the maximum skill. Athletes who are champions have good performance in terms of physique, technique, and motor abilities (Wiguna, 2017). Athletes who have good abilities and fitness can increase their self-confidence (Kuloor & Kumar, 2020). Athletes with good self-confidence, have high motivation, thus affecting their (Chaabene et al., 2017; İhsan et al., 2015; Levine et al., 2022; Lochbaum et al., 2022).

Wrestling is one of the sports that rely on strength and endurance (Juhanis, 2016). The most dominant element of physical condition in wrestling is using the element of strength, so the strength parameters will certainly be different from other sports. In the sport of wrestling, more components of maximum muscle strength are needed. In addition to the strength of other physical condition elements needed in the sport of wrestling, namely the compensatory strength, muscular endurance, power, flexibility, and cardiovascular general endurance, it is the parameters of success as presented in the collection of physical condition training materials.

At the 2021 national sports week (known in Bahasa Indonesia as Pekan Olahraga Nasional or PON) in Papua, data showed that of the 10 classes of wrestling athletes who competed could not reach the expected target, which was targeted to get 5 gold medals but none of them got a gold medal. This is due to the lack of incentives for the exercises performed and the lack of well-programmed forms of arm muscle strength training, and the frequently carried out programs are aerobic exercises and infiltrating techniques. Thus, cardiovascular endurance is not balanced with the strength of the arm muscles.

Based on the results of observations with PGSI coaches in January 2022, it is known that during training and competitions, it turns out that there are still many athletes who perform improper pulling and rolling techniques due to the strength of the arm muscles that are still weak so that when doing matches athletes are easily pushed and locked by their co-stars. When the athlete performs the roll often fails due to the lack of strength of his arm muscles. According to information from wrestling coaches, athletes' ability to withstand pushes and pulls from opponents is not optimal due to the lack of training in the strength of their arm muscles. Researchers obtained the latest data in the field from a wrestling coach when athletes performed an attractive and pushing muscle strength test using an expanding dynamometer test showing that the average muscle strength of 24.50 kg, these results fall into the category of less. Therefore it needs to be improved through a physical exercise program that corresponds to the performance of the sport of wrestling to produce better physical condition in particular on the indicators of the muscle strength of the arm muscles of the arm muscles of wrestling athletes.

The maximum strength of the arm muscles is used to attract and encourage the opponent to eliminate the stability of the defense. Great strength is to allow a person to have a more suitable slam planned, to create optimal performance. Nasrulloh & Wicaksono (2020) said that muscle strength should be able to be trained by observing the number of sets in the training stage. Training is a process in sports activities to improve the abilities found in athletes most importantly in the skills and skills that are possessed systematically and tried to match the established period (Busch et al., 2013; Coledam & Ferraiol, 2017; Ridley et al., 2018). It is not easy for a person to have good arm muscle strength ability in wrestling, to have good strength ability certainly requires systematic, progressive, continuous, and programmatic training. This is done to achieve the desired goal.

This study focused more on increasing the maximum strength of the arm muscles of wrestling athletes. Sotiropoulos et al. (2022) The maximum force is the highest force that can be displayed by the system during maximum contraction. A suitable exercise method for increasing maximum strength is the pyramid system of training. The pyramid system or better known as pyramid training is a special method used to develop strength. Training with this pyramid system is characterized by a constant increase in external load (load intensity) accompanied by a decrease in the repetition of the repetition, in other words, an increase in the intensity of the load (weight of the load) is carried out in conjunction with a decrease in the repetition or repetition. For more details, you can pay attention to the following Figure1:

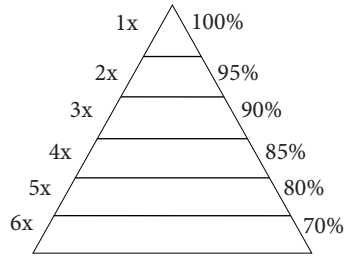

Fig. 1. Pyramid Method System
Source: Formation of physical condition (Bafirman & Wahyuri, 2019)

This strength is displayed with the highest load that can be lifted at one time. The maximum power in wrestling works when the athlete is about to attack to take down the opponent or by looking for points. The Maximum Strength assessment is carried out after the heating process, using the 1-RM test. 1RM is determined using a validated testing procedure and is defined as the heaviest load that a participant can lift once with the right lifting technique, without compensatory movement (Haff & Dumke, 2021). A general warm-up before testing consists of a light cardiovascular exercise that lasts about 5 to 10 minutes. This muscle strength strengthens athletes in carrying out movements in any sport (Suchomel et al., 2016, 2018). A person who has good muscle strength can carry out and carry heavy work for a long time. Nasrulloh & Wicaksono (2020) said that the increase in muscle work skills due to exercise is caused by physiological changes that are intertwined in the neuromuscular system (adjusting the neuromuscular system). The increase in muscle strength leads to more sturdy muscle contractions (increased power), more lightning repetition of contractions (increase speed),

as well as a long-lasting training period (increase muscle endurance).

It is not easy for a person to have a good maximum strength ability of arm muscles in wrestling, to have good strength abilities certainly requires systematic, progressive, continuous, and programmatic training. This is done to achieve the desired goal. Exercises that can increase the maximum strength of the arm muscles in wrestling are reverse grip barbell curls and barbell triceps extension exercises. Barbell curls reverse grip exercise is a form of exercise to strengthen the strength of an athlete's arm muscles. And barbell triceps extension exercise is a good form of exercise to strengthen the strength of an athlete's arm muscles (Nasrulloh et al., 2018).

The form of exercise above is a form of exercise to increase the strength of the arm muscles in wrestling. The increased strength of the arm muscles of the wrestling athlete can improve the achievements of wrestling athletes in West Sumatra. Therefore, the author wanted to conduct a study related to the maximum strength of the arm muscles, and according to the problem that the author saw in the field that the failure of wrestling athletes in some attack and defense techniques was due to the low maximum strength ability of the arm muscles of wrestling athletes. In addition to the strength of the arm muscles, the method of exercise, as well as the quality of the trainer greatly affects a feat. For this reason, it is necessary to conduct a study to find out the cause of the low achievement of wrestling athletes in the south coast district, because if this is allowed to continue, the maximum expected achievement will be difficult to achieve. The purpose of this study was to determine the effect of the exercise method of the pyramid system on the improvement of the maximum strength of the arm muscles of wrestling athletes.

Materials and methods

Study participants

The population in this study was 24 wrestling athletes. The sampling applied was Purposive sampling, which is with the following criteria: 1) athletes are not in a state of illness 2) athletes can follow the training program given 3) athletes who actively participate in training in wrestling gyms 4) athletes of the male sex, Researchers take samples of 10. This study has received approval from all samples who have filled out a statement of ability to become a research sample and have met the requirements of the research code of ethics.

Study organization

This study used a quasi-experimental type of experiment. The research design used in this study was a "one group pretest-postest design". The research was conducted at the PGSI building in West Sumatra in November-December 2022. The method of collecting data in this research is to carry out tests and measurements. The form of the test is carried out by lifting a load that is only capable of being lifted 1 time or expressing the ability (maximum strength) with a barbell (Fenanlampir & Faruq, 2015). In the early stages of the meeting, the researchers took pre-test data aimed at finding out the initial data on the average maximum strength of the arm muscles of wrestling athletes. After that, it is given treatment with an arm muscle strength training program for 18 sessions with freshness 3 times a week using the pyramid system method with a load of 70%-80%-85%-90%-95%-100% of the maximum load characterized by a constant increase in the external load (load intensity) accompanied by a decrease in the number of repeats of the series-preset in other words, an increase in the intensity of the load (weight of the load) is carried out simultaneously with a decrease in the number of repeats or reps. And ended with the final data collection by conducting a post-test to measure maximal muscle strength using a barbell to recognize the comparison of the maximum strength score of the arm muscles after the treatment.

Statistical analysis

The data analysis technique used in this study for hypothesis testing in this study is using a t-test formula that is related to a significant level of ą: 0.05%. Data description using m.s excel by testing hypothesis testing analysis requirements in this study can be processed using the t-test formula. Before the t-test, a data normality test was carried out using the Liliefors test.

Results

Based on the explanations and descriptions that have been collected previously, in this case, an analysis of the research results and discussions obtained in the research will be carried out. The results of this study will be described according to the objectives of the previously proposed hypothesis.

Pre Test Ability

Pre-test measurements of the maximum strength of the arm muscles were carried out before being given treatment, which is a form of reverse grip barbell curls and barbell triceps extension exercises for 10 wrestling athletes. From the results of the pre-test measurement of the maximum strength of the arm muscles, the highest score was 34.00 kg and the lowest score was 26.00 kg. The distribution of scores produces an average (mean) of 29.9 and a standard deviation of 2.51 The distribution of more data can be seen in the Table 1.

Table 1. Frequency Distribution of Pre-Test Maximum Strength of Arm Muscles

No	Interval Class	Absolute Frequency	Relative Frequency	Information
1	<26,12	1	10%	Very Lacking
2	26.13-28.64	3	30%	Less
3	28.65-31.15	3	30%	Keep
4	31.16-33.67	2	20%	Good
5	>33.68	1	10%	Excellent
Sum		10	100%	

Source: (Fenanlampir & Faruq, 2015)

Based on the frequency distribution table above of the 10 people sampled, 1 person (10%) belonged to the interval of less than 26.12 kg classified in the category of very less, 3 people (30%) belonged to the interval 26.13-28.64 kg classified in the less category, 3 people (30%) belonged to the interval 28.65-31.15 kg belonged to the moderate category, 2 people (20%)belonged to the interval 31.16-33.67 classified in the good category, 1 person (10%) belonging to the interval of more than 33.68 kg belongs to the category of excellent. For more details, it can also be seen in the histogram Figure 2.

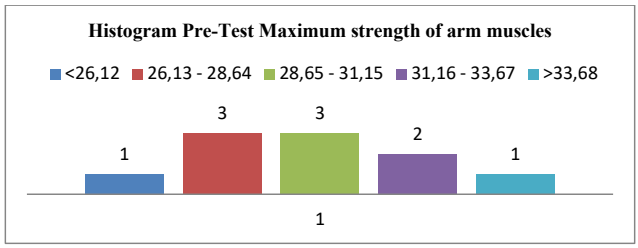

Fig. 2. Histogram Pre-Test Maximum strength of arm muscles

Post Test Ability

Post-test measurements of the maximum strength of the arm muscles were carried out after being given treatment, namely the form of reverse grip barbell curls and barbell triceps extension exercises to 10 wrestling athletes. From the results of the post-test measurement of the maximum strength of the arm muscles, the highest score was 36.00 kg and the lowest score was 28.00 kg. The distribution of scores yields an average (mean) of 32.3 and a standard deviation of 2.71 The full distribution of data can be seen in the Table 2.

Table 2. Frequency Distribution Post Test Maximum Strength of Arm Muscles

No	Interval Class	Absolute Frequency	Relative Frequency	Information
1	<26.12	0	0%	Very Lacking
2	26.13-28.64	0	0%	Less
3	28.65-31.15	4	40%	Keep
4	31.16-33,67	3	30%	Good
5	>33.68	3	30%	Excellent
Sum		10	100%	

Source: (Fenanlampir & Faruq, 2015)

Based on the frequency distribution table above of the 10 sample people, 0 people (0%) belonged to the interval of less than 26.12 kg classified in the very less category, and 0 people (0%) were included in the interval 26.13-28.64 kg were classified as less, 4 people (40%) were included in the interval 28.65-31.15 kg were classified in the moderate category, 3 people (30%) were included in the interval 31.16-33.67 were classified in the good category, 3 people (30%) belonging to the interval of more than 33.68 kg belong to the excellent category. For more details, it can also be seen in the histogram Figure 3.

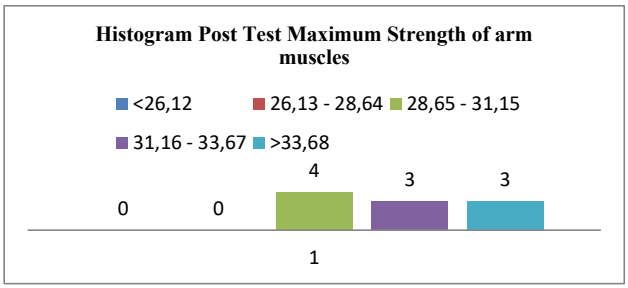

Fig. 3. Histogram Post Test Maximum Strength of arm muscles

The normality test was carried out using the killer's test with a real level (α) = 0.05. The test criteria are that reject the null hypothesis if the Lobservation (Lo) obtained from the observational data exceeds Ltabel (Lt) and instead accept the null hypothesis if the Lobservation (Lo) obtained is smaller than Ltabel (Lt) in simple terms can be used the following formula:

Ha rejected if, Lobservation (Lo) > Ltabel (Lt)

Ha accepted if, Lobservation (Lo) < Ltabel (Lt).

Table 3. Normality Test The effect of reverse grip barbell curls and barbell triceps extension exercises and On The Increase in Maximum Strength of The Arm Muscles of Wrestling Athletes.

Group	Lilliefors Test		Conclusion
	L_o	L_{tabel}	
Pre-test	0.184	0.258	Usual
Post-test	0.143	0.258	Usual

Based on the summary Table 3 the normality test results of the reverse grip exercise data of barbell curls and barbell triceps extension, it can be seen that the difference between the initial test and the final test obtained by Lo < Lt, so can be concluded that the sample of the exercise group is normally distributed.

The proposed working hypothesis is that Ho has no effect on barbell curls and barbell triceps extension reverse grip exercises and On The Increase in Maximum Strength of Wrestling Athletes' Arm Muscles. Ha, there is an effect of reverse grip barbell curls and barbell triceps extension exercises On The Increase in Maximum Strength of The Arm Muscles of Wrestling Athletes. Based on the comparative analysis with the mean difference test formula (t-test) carried out, the results of the mean difference test analysis (t-test) are obtained as shown in Table 4.

Based on the Table 4, shows that Ho's hypothesis is rejected while Ha's hypothesis is accepted. This is seen from the results of the analysis, where it was obtained the = 7.894 > Tt = 1.833 At the significance level a = 0.05. In a sense of the word, there is an influence of reverse grip barbell curls and barbell triceps extension exercises on increasing the maximum strength of the arm muscles of wrestlers.

Discussion

The discussion in this study is carried out based on theoretical studies and statistical calculations and refers to the conclusions of the analysis that has been carried out,

Table 4. Hypothetical Test Results Summary

Variable		Average-Flat	N	T count	T table	Information	
Maximum power Muscle Arm	Pre Test	29,9	10	7,894	1,833	Significant	Ho rejected Ha Accepted
	Post Test	32,3					

then the discussion will be carried out. This discussion will refer to the hypothesis proposed in the study:

"The effect of reverse grip barbell curls and barbell triceps extension exercises on increased maximum strength of wrestling athletes' arm muscles".

From the results of the data analysis that has been described earlier, it can be said that the exercise of reverse grip barbell curls and barbell triceps extension increased the maximum strength of the arm muscles of wrestling athletes from the initial test and the final test there was an increase with a difference of 1.04, namely from an average score of 29.9 kg in the pre-test to 32.3 in the post-test. The occurrence of this increase is due to the physical adaptation of the application of the barbell reverse grip method and barbell triceps extension curls to the physical condition of the body which supports the maximum strength ability of the arm muscles. This was strengthened after the t-test was carried out, where a calculation result of 7,894 was obtained which was greater than the t table in the level of $\alpha = 0.05$ of 1,833. The results of this study mean that the hypothesis proposed is acceptable to be true, in another sentence, it can be concluded that the practice of reverse grip barbell curls and barbell triceps extension exerts a significant influence on the increase in the strength of the arm muscles of wrestling athletes. This is supported by previous research by Buckner et al., (2017) which explained that high load conditions cause a greater increase in maximum strength. These changes obtained after eight weeks can be attributed to the principle of specificity. Maximum strength is optimized by a combination of increased muscle CSA and increased nerve efficiency (Schoenfeld et al., 2015). The results of this study are also supported by the theory from (Baechle & Earle, 2019) said that the exercise of reverse grip barbell curls and barbell triceps extension is a type of weight training to increase, and develop strength, especially in the muscles of the arms. Reverse grip barbell curls and barbell triceps extension exercises are a form of exercise to strengthen the strength of an athlete's arm muscles. Nasrulloh et al. (2018) barbell curls and barbell triceps extension reverse grip exercises are a form of weight training variation by using barbells to increase muscle strength, especially the arm muscles.

In designing an exercise program, it is certainly inseparable from the principles of exercise. Bompa & Buzzichelli (2018) explained that there are several principles of strength training including the principle of the whole body, loading, progressive enhancement, stretching, utilization according to naivety, exercise sequence, and speciation.

In this study, researchers used the pyramid system exercise method to increase the maximum muscle strength of wrestling athletes which was carried out 3 times a week for 8 weeks. Baechle & Earle, (2019) explains that the pyramid exercise method is part of the maximum strength training method. This maximal strength training method is generally used for sports that are direct body contacts (body contact), such as wrestling and weightlifting. The way to train the maximum strength that can be done is by training using the pyramid system method with a load intensity of 70%-80%-85%-90%-95%-100% of the maximum load.

The results of previous studies Fischetti et al., (2019) found that the strength training method using the pyramid system with freshness 3 times a week for 8 weeks can increase maximum muscle strength. The Pyramid System theoretically allows training with higher loads, at least during the final set of exercises, without reducing the volume of exercises from the point of view of the loading zone, thus maintaining a favorable anabolic environment for the improvement of muscle hypertrophy and thus strength gains (Fischetti et al., 2019). Strength is the ability of muscles to contract to generate stress against a prisoner (Hartmann et al., 2015).

Harsono (2015) arm strength is the ability of an arm to arouse the tension of a prisoner and lift weights. The role of arm muscle strength in wrestling has a very meaningful use, for example when athletes perform techniques in wrestling sports such as pulls, pushes, slams, rolls, and locks without being released by the opponent so that the athlete gets the maximum points (Maki et al., 2021; Özbay & Ulupınar, 2022; Podrihalo et al., 2020). The reverse grip exercises of barbell curls and barbell triceps extension can help wrestling athletes in developing the maximum strength of their muscles because, in wrestling sports, extra energy is needed. After all, in wrestling sports, physical contact between the two opposite athletes is needed. Therefore, it is very necessary to practice reverse grip barbell curls and barbell triceps extension in wrestling sports to get good muscle strength to be able to perform techniques in wrestling.

This study has some limitations that must be considered when extrapolating conclusions based on the results. The study period lasts only 8 weeks. While this duration is sufficient to produce a significant increase in maximum muscle strength, it is unclear whether the results between the groups will diverge for a longer time. In addition, our subject population consists exclusively of male wrestling athletes. Therefore, the findings cannot be generalized to other populations including adolescents, women, and the elderly. It is possible that the difference in hormonal influences. researchers concluded that the exercise of the pyramid system is an effective method of promoting a long-term positive adaptation of the maximum muscle strength of a wrestling athlete.

Conclusions

Based on data analysis and discussion, it can be concluded that there is a significant influence of reverse grip barbell curls and barbell triceps extension exercises on increasing the maximum strength of the arm muscles of wrestling athletes. With an average pre-test the maximum strength of the arm muscles of 29.9 kg while the post-test increased to

32.3 kg (an increase of 2.04 kg). This was strengthened after a t-test, where a calculation result of 7.894 was obtained which was greater than the t table in the level of 0.05 = 1.833. Recommendations for researchers are further suggested to be able to examine other forms of exercises and compare them with barbell curls and barbell triceps extension reverse grip exercises that are related to the maximum strength ability of arm muscles in wrestling.

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Conflict of interest

We as the author confirm that there is no conflict of interest in this publication and that the manuscript has been approved and submitted by all the authors mentioned above.

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ВПЛИВ ВИКОНАННЯ СИЛОВИХ ВПРАВ МЕТОДОМ ПІРАМІДИ НА МАКСИМАЛЬНУ СИЛУ М'ЯЗІВ РУК БОРЦЯ

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 8 с., 4 табл., 3 рис., 40 джерел.

Мета дослідження. Метою цього дослідження було визначити вплив вправ на підйом штанги на біцепс зворотним хватом і французький жим штанги на трицепс на збільшення максимальної сили м'язів рук спортсменів-борців.

Матеріали та методи. Цей тип дослідження є квазіекспериментальним. Генеральна сукупність учасників дослідження складалася з 24 спортсменів-борців. Вибірку проводили за допомогою методів цілеспрямованого відбору, а саме 10 спортсменів-борців. Інструмент дослідження здійснювали шляхом підйому ваги, яку можна було підняти лише 1 раз, або яка виражала здатність (максимальну силу), за допомогою штанги. Як техніку аналізу даних використовували перевірку гіпотези за допомогою формули t-критерію Стьюдента.

Результати. Результати цього дослідження показали, що вправи на підйом штанги на біцепс зворотним хватом і французький жим штанги на трицепс впливають на збільшення максимальної сили м'язів рук спортсменів-борців; за результатами початкового тесту та заключного тесту спостерігалося збільшення з різницею 1,04, а саме від середнього показника 29,9 кг під час попереднього тестування до 32,3 кг під час підсумкового тестування.

Висновки. Висновок цього дослідження полягає в тому, що форма зворотного хвату під час виконання вправ на підйом штанги на біцепс та французький жим штанги на трицепс значно впливає на збільшення максимальної сили м'язів рук у спортсменів-борців.

Ключові слова: підйом штанги на біцепс зворотним хватом; французький жим штанги на трицепс; максимальна сила.

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