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# DETERMINATION OF THE CORRELATION BETWEEN THE INDICATORS OF COMPETITIVE AND SPECIAL EXERCISES AND THE MORPHOFUNCTIONAL INDICATORS IN 12-15 YEARS OLD FEMALE WEIGHT-LIFTERS ATHLETES

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**Purpose:** to establish the level of correlation between the sports result of the morphofunctional indicators of female weightlifters aged 12-15 years and the level of special physical fitness.

**Material and Methods:** 30 young athletes of 12-15 years old were involved in the study. The study was conducted on the basis of the department of martial arts of the Kharkov State Academy of Physical Culture and the Children's Sports School No. 16 and the Children's Sports School No. 8.

**Results:** it is established the dependence of competitive and specially-preparatory exercises on morpho-functional indicators between a jerk of a weight of 8 kg per 10 min and anthropometric indicators - body length (r=0,488), upper limb length (r=0,431), chest circumference on inhalation and exhalation (r=0,676; r=0,640) and body weight (r=0,412). The indicators of general physical fitness are pulling up on the bar (r=0,431), bending and unbending the arms in a lying position (r=0,426), hanging on a bar 1.5 cm (r=0,588) and hanging on the bar on one arm (r=0,488). Squats with a weight of 24 kg correlate with morphological indicators and body weight and length of the lower limb (r=0,520; r=0,482, respectively), chest circumference on inspiration - r=0,540; on exhalation - r=0,620, as well as the

circumference of the thigh (r=0,752) of special physical preparedness: with a 30-meter run (r=-0,568) and a standing long jump (r=0,587). The results of a deadlift with a weight of 24 kg correlate with body weight (r=0,695), chest circumference on inhalation and exhalation (r=0,443; r=0,426), as well as the thigh circumference (r=0,654) with a 30 m run (r=-0,495), long jump from standstill (r=0,494), hanging on the bar 1.5 cm (r=0,418) and hanging on the crossbar on one arm (r=0,418). The results in a 8 kg kettlebell press revealed an interconnection only with body weight (r=0,606) and push-ups (r=0,620) and heart rate at rest (r=0,731), lung capacity (r=0,430 ) and breath holding on inhalation (r=0,482).

**Conclusions:** the correlation between the results of competitive exercises and special preparatory exercises that affect the strength training and endurance of female weight-lifting athletes is revealed, which makes it possible to take into account their use in the training process of female weightlifters aged 12-15 years.

**Key words:** sports result, morphofunctional preparedness, competitive exercises, special preparatory exercises.

## Introduction

Studying the dependence of the results of competitive exercises on the level of morphofunctional and special physical fitness of young kettlebells is an important condition for building an effective training program for athletes at the initial stage. A number of studies are devoted to identifying the relationships between indicators of physical development, athletic preparedness, and athletic performance in various strength sports. V.M. Platonov, 2001, 2015; V.V. Prontenko 2010; K.V. Prontenko 2009; V. G. Oleshko, 2011 investigated the correlation between morphological characters, speed-strength qualities and sports and technical indicators in various strength sports [1; 6; 8]. The research results showed that with increasing sportsmanship, the height of a long jump from a place increased and had an average significant relationship with body length, bench press, jerk kettlebell, squats with a kettlebell.

In the research of V.V. Prontenko [12], V.Yu. Jim [4] was revealed a reliable correlation of biomechanical indicators of projectile movement with the level of development of motor abilities, strength and speed-strength parameters of equipment when lifting weights with an indicator of speed and power qualities of highly skilled weightlifters when performing classical exercises. P. Griban [3] recommends using the exercises “bending the arms in the supine position” and “lifting the body from the supine position” as auxiliary to increase the level of strength in the exercises of heavyweights.

In this work, we studied the dependence of a sports result on physical development data, the functional state of the cardiovascular and respiratory systems of the body and the special strength training of weightlifters at the initial training stage.

**Purpose of the study:** to establish the level of correlation between the athletic result of female weightlifters aged 12-15 years and indicators of special physical and morphofunctional preparedness.

## Material and Methods of research

According to the methodological approach in solving the problem and tasks, the research program included a set of research methods: analysis of scientific and methodological literature, pedagogical testing of the level of special physical fitness, measuring anthropometric indicators of young weightlifters and methods of mathematical statistics.

Young pupils of the Children's and Youth Sports School No. 16 and the Children's and Youth School No. 8 of Kharkov took part in this study. 30 female weightlifters aged 12-15 years were involved in the experiment. The research participants trained 3-4 times a week in accordance with the program of the Children's and Youth Sports School.

## Results of the research

To establish the dependence of the sports result on morphofunctional indicators and the level of special physical fitness of athletes, the correlation analysis was carried out, as a result of which it was found that most indicators correlate with each

other, but the degree of these relationships is different. Correlation coefficients range from 0.104 to 0.820 (Tables 1, 2, 3).

*Table 1*

**Value of the correlation between the indicators of competitive and special exercises and anthropometric indicators female weightlifters aged 12-15 years (*n*= 30)**

| Indicators | Body weight.kg | Body length, cm | Body length sitting cm | Length of the upper limb, cm | Length of the lower limb, cm | Chest circumference (inhalation), cm | Chest circumference (expiration), cm | Thigh circumference, cm |
|---|---|---|---|---|---|---|---|---|
| 8 kg kettlebell jerk in 10 minutes | **0,412** | **-0,488** | 0,320 | **-0,431** | 0,231 | **0,676** | **0,640** | 0,320 |
| Squats with a weight of 24 kg, t. | **0,520** | -0,350 | 0,352 | -0,282 | **0,482** | **0,540** | **0,620** | **0,752** |
| Deadlift with a weight of 24 kg, t. | **0,695** | 0,218 | 0,205 | 0,194 | 0,329 | **0,443** | **0,426** | **0,654** |
| Bench press 8 kg, t | **0,606** | 0,104 | 0,155 | -0,238 | 0,193 | 0,320 | 0,333 | 0,155 |

**Remark: reliability of the correlation coefficient r≥0,361 for n=30*

A weak and medium level of relationships between the kettlebell jerk of a weight of 8 kg per 10 min and anthropometric indicators was revealed: body length (r=0,488) length of the upper limbs (r=0,431) chest circumference on inhalation ( =0,676) chest circumference on exhalation (r=0,640) and body weight (r=0,412) (Table 1).

The relationship between the result of squatting with a 24 kg weight and body weight and the length of the lower limb (r=0,520; r=0,482, respectively), the circumference of the chest on the inspiration (r=0,540) and expiration (r=0.620), as well as the hips circumference was also established (r=0,752). A significant relationship between the result of squats and the circumference of the thigh may indicate that in order to achieve the best result in this exercise, increase the mass of the muscles of the thigh.

The results of a deadlift of 24 kg weights correlate with body weight (r=0,695), chest circumference on inspiration and expiration (r=0,443; r=0,426), as well as the circumference of the thigh (r=0,654) (Table 1).

This indicates that during strength training, the deadlift increases due to the volume of the extensor muscles of the trunk and affects the circumference of the chest.

The result in a 8 kg bench press has an average relationship only with body weight (r=0,606). The correlation was observed between the results in the kettlebell jerk of 8 kg per 10 minutes and indicators of general physical preparedness – pulling up on the bar (r=0,431), push-ups (r=0,426), hanging on a bar 1,5 cm (r=0,588) and pull-ups on the crossbar (r=0,488) (Table 2).

This is explained by the fact that fast-contractile muscle fibers of the upper extremities are involved in the kettlebell jerk, which play a decisive role in the performance of these exercises.

Squats with a weight of 24 kg has a relationship with physical preparedness indicators: running 30 meters (r = -0,568) and standing long jump (r=0,587).

*Table 2*

**Value of the correlation between the indicators of competitive and special exercises and the indicators of general physical preparedness of female weightlifters aged 12-15 years (*n*= 30)**

| Indicators | Running 30 m, s | Standing long jump, cm | Pull-ups on the crossbar, times | Push-ups, times | Hanging on a bar 1,5 cm wide, s | Hanging on the crossbar on one arm, s | Lifting legs to the crossbar, times |
|---|---|---|---|---|---|---|---|
| 8 kg kettlebell jerk in 10 minutes | -0,312 | 0,215 | **0,431** | **0,426** | **0,588** | **0,488** | -0,228 |
| Squats with a weight of 24 kg, t. | **0,568** | **0,587** | 0,142 | 0,269 | 0,199 | 0,169 | -0,329 |
| Deadlift with a weight of 24 kg, t. | **0,495** | **0,494** | 0,319 | 0,183 | **0,418** | **0,418** | -0,318 |
| Bench press 8 kg, t | 0,106 | 0,138 | 0,193 | **0,620** | 0,304 | 0,304 | -0,204 |

**Remark: reliability of the correlation coefficient r≥0,361 for n=30*

An average correlation between the result of a deadlift with a 24 kg weight and 30 m run (r=-0,495), a standing long jump, (r=0,494), a 1,5 cm hanging (r=0,418) on

the bar and the crossbar on one arm, (r=0,418) (Table 2) was also established. This may indicate the relationship of speed and strength endurance preparedness of young athletes 12-15 years old, specializing in kettlebell lifting.

The result in a 8 kg kettlebell press has a relationship only with push-ups (r=0,620) (Table 2), which is due to the involvement of the same muscle groups, in particular the deltoid, three-headed shoulder muscles when performing these exercises.

*Table 3*

**Value of the correlation between the indicators of competitive and special exercises and functional indicators of a 12-15-year-old female weight-lifting athletes (*n*= 30)**

| Indicators | Heart rate at rest beats for min | Absolute values PWC 170 (kgm/min) | Vital capacity of the lungs, l | Respiration rate per minute, times | Breath holding on inhalation, s | Breath holding on exhalation, s |
|---|---|---|---|---|---|---|
| 8 kg kettlebell jerk in 10 minutes | **-0,713** | -0,278 | **0,430** | **0,515** | **0,441** | **0,456** |
| Squats with a weight of 24 kg, t. | **-0,771** | **-0,399** | **0,462** | **0,627** | **0,472** | 0,359 |
| Deadlift with a weight of 24 kg, t. | **-0,655** | **-0,470** | **0,390** | **0,534** | **0,399** | **0,483** |
| Bench press 8 kg, t | **-0,506** | -0,104 | 0,355 | 0,338 | 0,293 | 0,120 |

**Remark: reliability of the correlation coefficient r≥0,361 for n=30*

So, when performing competitive exercises in kettlebell lifting, muscle fibers are involved in the work, which allow performing physical work for a long time, which is manifested in the value of the correlation coefficient between the maximum oxygen absorption and PWC170 (r=0,470) (Table 3).

It can also be explained by an increase in aerobic endurance and the level of physical performance of the body that occur in the process of sports training.

A jerk with an 8 kg kettlebell has a relationship between heart rate at rest (r=0,731), lung capacity (r=0,430) and breath holding on inspiration (r=0,482) (Table 3).

We also found a weak correlation between the result of squats with a 8 kg weight and PWC170 data (r=0,399), which can be explained by the dependence of aerobic endurance on the level of physical performance of the body that occurs during the sports training of female young athletes. The results of the deadlift with a weight of 24 k correlate with the indicated exercise and heart rate at rest (r = 0.655).

The obtained results of the correlation relationship between competitive, c-preparatory, specially-preparatory exercises and morphofunctional indicators were taken into account later in the construction of the training process for female weightlifters aged 12-15 years of the experimental group.

**Conclusions / Discussion**

An analysis of the scientific literature confirmed that research in the field of kettlebell lifting was mostly of a singular nature. In recent years, scientists have conducted studies on the content and methodology of the training process of young female athletes, female weightlifters aged 12-15 years with various methods of forming motor skills and strength qualities [1], planning the training process for a one-year macrocycle of female weightlifters aged 12-15 years [8-9 ] and the impact of the training process of female weightlifters aged 12-15 years on the manifestation of physical qualities. However, the question of the correlation relationship between competitive and special-preparatory exercises, which affect the strength preparedness and endurance of female weightlifters aged 12-15 years wasn’t investigated.

Therefore, the main attention should be focused on: the development of general and static endurance, flexibility, strength qualities of the muscles of the back and legs; improving special qualities by performing appropriate special preparatory exercises; improving the functional capabilities of the cardiovascular and respiratory systems; continuous improvement of the technique for performing competitive exercises in general and its individual parameters (reduction of static phases, observing the necessary angles between body parts, observing the appropriate pace during the performance of kettlebell lifting exercises).

We have confirmed that the most significant morphological indicators for ensuring a high sports result in competitive exercises in kettlebell lifting are the

length of the lower limb, the length of the upper limb, chest circumference and body weight. The results of our correlation analysis confirm the data obtained in the study of V. Oleshko [9]. The author shows a high correlation relationship (from r=0,6 to r=0,9) between the level of achievement in competitive exercises of athletes involved in power sports, with competitive exercises and length, body weight, chest circumference [8].

Thus, the study confirmed the results of other authors [1; 2] on the need to take into account the impact of training on the physical performance of female weightlifters aged 12-15 years at the stage of preliminary basic training. Domestic data were also expanded [4-5; 8; 9; 11] and foreign authors [17-22] on raising the level of the most significant indicators of physical qualities on the young body of athletes engaged in weightlifting.

The dependence of competitive and special preparatory exercises on morpho-functional indicators between the kettlebell jerk of 8 kg per 10 min and anthropometric indicators: body length (r=0,488), length of the upper limb (r=0,431), chest circumference on inhalation and exhalation (r=0,676; r=0,640) and body weight (r=0,412) with indicators of general physical fitness: pulling up on the bar (r=0,431), push-ups (r=0,426), hanging on a bar 1.5 cm (r=0,588) and hanging on the crossbar on one arm (r=0,488).

It was found that squats with a weight of 24 kg correlate with morphological indicators and body weight and length of the lower limb (r=0,520; r=0,482, respectively), chest circumference on inspiration (r=0,540), on exhalation (r=0,620), and also the circumference of the thigh (r=0,752), special physical preparedness with a 30 m run (r=-0,568) and standing long jump (r=0,587).

The results of a deadlift with a 24 kg kettlebell correlate with body weight (r=0,695), chest circumference on inspiration and expiration (r=0,443; r=0,426), as well as the thigh circumference (r=0,654) with a 30 m run (r=-0,495), long jump from standstill (r=0,494), hanging on the bar 1,5 cm (r=0,418) and hanging on the crossbar on one arm (r=0,418).

Results in a 8 kg kettlebell press: only a relationship was found with body weight (r=0,606) and push-ups (r=0,620) and the heart rate at rest (r=0,731), lung capacity (r=0,430) and breath holding on inhalation (r=0,482).

The correlation between the results of competitive exercises and special preparatory exercises that affect strength training and endurance of female weightlifters was found, which makes it possible to take into account their use in the training process of female weightlifters aged 12-15 years.

**Prospects for further research** include determining the construction of the training process for female weightlifters aged 12-15 years in separate mesocycles, taking into account the CMC phases.

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