



Improving the strength capabilities of qualified female weightlifters in the preparatory period of the annual training cycle

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Abstract

Objective of the study To develop practical recommendations for improving strength abilities, taking into account the nutrition and endocrine system performance of qualified female weightlifters.

Methods and structure of the study. We conducted a pedagogical experiment involving six female weightlifting masters of sport and three amateur athletes. The study was conducted at the Batyr Sports Complex in Kazan. We studied performance in competitive events (snatch and clean and jerk) and results in control exercises for explosive strength.

Results and conclusions. While studying the hormonal levels of female weightlifters during the preparatory period, we identified two types of hormonal imbalances: low triiodothyronine levels and high thyroxine levels. We developed a retracting microcycle for low triiodothyronine levels and high thyroxine levels. Improving strength abilities requires not only a well-designed training plan and high motivation, but also maintaining normal levels of endocrine hormones.

Keywords: *strength abilities, explosive power, qualified female weightlifters, preparatory period, hormonal background, nutritional features.*

Introduction. The contemporary development of international sport is characterized by a steady trend toward expanding gender equality, manifested in the active inclusion of women in sports previously associated primarily with male participation, particularly martial arts and weightlifting. In this regard, studying the place and role of women in sport, which historically developed as a space for predominantly male self-realization, is particularly relevant. At the same time, a modern scientific approach requires abandoning value judgments about women's "natural" inability to demonstrate results comparable to those of men, as the level of athletic achievement is determined by a complex of biological, psychophysiological, methodological, and social factors [7, 8].

The relevance of research into improving the strength capabilities of qualified female weightlifters

is driven by the rapid growth of athletic achievements in women's weightlifting and the need for a scientifically sound training process that takes into account the physiological characteristics of the female body. In modern high-performance sport, traditional methods borrowed from men's weightlifting are often ineffective or lead to overtraining [6, 9]. At the 2025 World Weightlifting Championships in Førde, Norway, the highest total score for women in the snatch and clean and jerk was 283 kg.

The high level of competitive results in women's weightlifting (the 2021 women's world record is 335 kg based on total points) requires the search for new theoretical, methodological, and methodological approaches to improving the effectiveness of the educational and training process, especially in the preparation of athletes for national teams.



The preparatory period is the foundation of the annual cycle, as it is during this stage that the morphofunctional prerequisites for achieving maximum strength performance in competition are established. The need to find the optimal balance between volume and intensity of training, as well as the specific selection of exercises for developing explosive strength and absolute muscle strength in women, remains one of the most pressing issues in sports education.

Research by L.G. Shakhlina indicates the need to consider the ovarian-menstrual cycle (OMC) when planning strength training during the preparatory period, while irrational intensity distribution without regard to hormonal levels reduces training effectiveness [5]. V.N. Platonov established in his research that qualified female weightlifters reach the limit of their adaptive capabilities, which requires the implementation of innovative muscle contraction regimens and load variability to overcome the «strength plateau» [4].

Improving strength abilities is impossible without understanding the biomechanical characteristics of competitive exercises, as it is crucial to maintain a balance between developing overall strength and maintaining movement structure during the preparatory period [3]. It is becoming clear that the rate of improvement in athletic performance will depend on the growth dynamics of maximum strength and explosive power of the major muscle groups involved in the work, ensuring the effective performance of competitive exercises [1, 2].

Purpose of the study: to develop practical recommendations for improving explosive strength, taking into account the nutrition and endocrine system performance of qualified female weightlifters.

Methods and structure of the study. We conducted a pedagogical experiment involving six female weightlifting masters of sport and three amateur athletes. The study was conducted at the Batyr Sports Complex in Kazan. We studied the performance in competitive exercises (snatch, clean and jerk) and the results in control exercises for explosive strength.

Results of the study and discussion. Hormonal levels are a key factor influencing the development of explosive power in skilled female weightlifters. While studying the hormonal levels of female weightlifters during the preparatory period, we identified two types of hormonal imbalances: low triiodothyronine levels (Table 1) and high thyroxine levels (Table 2). With normal thyroxine (T4) and thyroid-stimulating hormone (TSH) levels, but low triiodothyronine (T3) levels, athletes experience rapid fatigue, persistent weakness, inattention, absent-mindedness, sleep disturbances, limb cramps, and swelling.

The athletes from Table 2 have a high level of the T4 hormone; with elevated values of this hormone, athletes experience irritability, fatigue, tachycardia, and weight loss.

For comparison, three amateur-level female athletes were invited to join the experimental group. The weightlifters also underwent testing, and their levels

Table 1 – T3 hormone levels in female weightlifters

Units of measurement	T3	T4	TSH
	pmol/L	pmol/L	μIU/ml
Norms	2.63-5.7	9-19.05	0.35-4.94
Sportswomen			
No. 1	2.22 / below normal	12:55	2.5800
No. 2	2.01 / below normal	13.65	2.5500
No. 3	2.77 / below normal	16.80	2.3200

Table 2 – T4 hormone levels in female weightlifters

Units of measurement	T3	T4	TSH
	pmol/L	pmol/L	μIU/ml
Norms	2.63-5.7	9-19.05	0.35-4.94
Sportswomen			
No. 1	4.38	19.12 / above normal	2.5900
No. 2	4.80	21.08 / above normal	3.4200
No. 3	4.55	19.15 / above normal	3.6600



Table 3 – Levels of T3, T4 and TSH hormones in female athletes who are not qualified in weightlifting

Units of measurement	T3	T4	TSH
	pmol/L	pmol/L	μIU/ml
Norms	2.63-5.7	9-19.05	0.35-4.94
Sportswomen			
No. 1	3.11/ norm	12.15/ normal	2.1600
No. 2	4.30/ normal	14.08/ normal	3.5700
No. 3	5.10/ norm	17.01/ normal	3.8000

were normal for all three endocrine hormones: T3, T4, and TSH (Table 3).

Based on the results of the three tables, we see the following: qualified female athletes have endocrine system disorders and are more susceptible to the risk of developing various diseases due to hormonal imbalances than unqualified athletes who have stable hormonal levels.

After analyzing the athletes' training plan and nutrition diary, we concluded that while the training plan was well-designed, there were nutritional deficiencies. Further discussion with the athletes revealed the cause of the endocrine hormonal imbalance: a desire to lower their weight class. After analyzing the weightlifters' results, we recommend reducing their workout loads to 50-60% of their maximum possible weight and alternating training and rest days while under observation by a sports medicine specialist.

An example of the content of a retracting microcycle with low levels of the hormone triiodothyronine.

% - indicated from the maximum possible weight taken

A, B – circuit training

1 workout:

Warm-up: 10 minutes of running, 3 sets of abdominal crunches (p) x 15 times, 3 sets of hyperextension (p) x 15 times

Barbell snatch - 20% - 10 times, 25% - 8 times, 30% - 5 times, 40% - 5 times, 50% - 5 reps x 5 times, 40% - 6 times, 30% - 3 reps x 8 times

Barbell push – 20% - 10 times, 30% - 2p x 8 times, 40% - 5 times

A) squat push-up – lying push-up – squat push-up – jump – 15 times

B) 24kg kettlebell swings – 15 times

B) Press – 15 times

D) Hyperextension with weight – 10 times

D) Squats with a 30 kg barbell – 10 times (5 rounds, 3 minutes rest between rounds)

5. Stretching

6. Treadmill 20 minutes, speed 10

Training:

Warm-up: 10 minutes of running, 3 crunches x 15 reps, 3 hyperextensions x 15 reps

Squats with a barbell 20% - 10 times, 30% - 8 times, 40% - 6 times, 50% - 5 reps x 5 times, 60% - 3 reps x 1 time

Bench press 20% - 10 times, 30% - 8 times, 35% - 6 times, 40% - 5 reps x 5 times, 50% - 3 reps x 1 time, 55% - 1 time, 50% - 3 times, 40% - 3 reps x 4 times, 35% - 6 times, 30% - 10 times

Stretching

Exercise bike 20 minutes

3rd workout:

1. Warm-up: 10 minutes of running, 3 sets of crunches x 15 reps, 3 sets of hyperextensions x 15 reps

2. Barbell push - 20% - 10 times, 25% - 8 times, 30% - 5 times, 40% - 5 times, 50% - 5 reps x 5 times, 40% - 6 times, 30% - 2 times x 5 reps

3. Barbell Snatch 40% - 5 reps x 5 times

4. A) Barbell squats 30% - 8 times

B) Bench press 30% - 10 times

B) 16kg kettlebell swings – 15 times (4 rounds, 2 minutes rest between rounds.)

5. Stretching

6. Treadmill 20 minutes, speed 10.

An example of the content of a retracting microcycle with a high level of the thyroxine hormone.

training

Warm-up: cardio 10 minutes, press 3p x 15 times, hyperextension 3p x 15 times

Squats with a barbell 20% - 12 times, 30% - 10 times, 40% - 8 times, 55% - 5 reps x 5 times, 60% - 3 reps x 1 time, 55% - 2 reps x 3 times, 40% - 6 times, 30% - 8 times, 20% - 10 times

Bench press 20% - 10 times, 30% - 8 times, 35% - 6 times, 40% - 5 reps x 5 times, 50% - 3 reps x 1 time, 60% - 2 reps x 1 time

Stretching



Exercise bike 20 minutes training

Warm-up: cardio 10 minutes, press 3p x 15 times, hyperextension 3p x 15 times

Barbell snatch - 20%-10 times, 25%-8 times, 30%-5 times, 40%-5 times, 50%-5 times x 5 times, 40%-6 times, 30%-8 times x 3 times

3. Barbell push – 20% - 10 times, 30% - 8 times x 2 reps, 40% - 5 times x 7 reps

4. A) Squat push-up – lying push-up – squat push-up – jump – 15 times
 B) 24kg kettlebell swings – 15 times
 B) Press – 15 times
 D) Hyperextension with weight – 10 times
 D) Squats with a 25 kg barbell – 10 times
 3 rounds, rest between rounds 1 minute

5. Stretching

6. Treadmill 20 minutes, speed 10 training

Warm-up: cardio 10 minutes, press 3p x 15 times, hyperextension 3p x 15 times

Barbell snatch - 20%-10 times, 25%-8 times, 30%-5 times, 40%-5 times, 50%-5 times x 5

Barbell Jerk - 20% - 10 times, 30% - 8 times, 35% - 6 times, 40% - 5 reps x 5 times, 50% - 3 reps x 1 time, 55% - 1 time

Stretching

Treadmill 30 minutes, speed 9.

We also developed nutritional recommendations that take into account the specific functions of the endocrine system. To stabilize endocrine hormones, it is also recommended to adhere to a calorie maintenance plan calculated individually for each weightlifter. It is also important to remember the ratio of proteins, fats, and carbohydrates. The optimal values during the maintenance phase are: protein – 1.7-1.8 grams

per 1 kg of body weight, fat – 1 gram per 1 kg of body weight. Carbohydrates during the maintenance phase are calculated as the remaining calorie intake using the formula: daily calorie intake (kcal) – kcal (protein) – kcal (fat), and divide the result by 4 kcal (the calorie content of 1 gram of carbohydrate).

For two months, qualified female weightlifters underwent treatment with an endocrinologist and sports nutritionist, followed a balanced diet, and minimized training loads. The athletes' endocrine hormone levels after two months (Table 4) demonstrate the effectiveness of this comprehensive approach to improving explosive strength.

Thus, the results of our experiment allow us to recommend that qualified female weightlifters adhere to a balanced diet and monitor their endocrine hormones.

A test to assess the maximum strength of qualified female weightlifters (Table 5) was conducted to examine how changes in hormonal levels affect the strength performance of female athletes.

After recovery, the athletes' performance in the competitive snatch and clean and jerk exercises increased by at least 5,5% (Table 6).

Thus, we see a direct link between improvements in strength, increased strength performance, and hormonal levels in qualified weightlifters. Based on these results, we can conclude the following: the lower the endocrine hormone levels, the less effective the improvement in strength in qualified weightlifters.

Testing of speed-strength abilities was also carried out before and after restoration of endocrine system hormones (Table 7).

The study results demonstrate the positive impact of normal hormonal levels on the speed-strength performance of qualified female weightlifters. While performing the complex before hormonal levels were re-

Table 4 – Endocrine hormone levels of qualified female weightlifters after two months of training

Units of measurement	T3	T4	TSH
	pmol/L	pmol/L	μIU/ml
Norms	2.63-5.7	9-19.05	0.35-4.94
Sportswomen			
No. 1	2.90/norm	12:55	2.1600
No. 2	3.15/norm	13.65	3.5700
No. 3	5.10/norm	16.80	3.8000
No. 4	4.38	10.11/norm	2.1500
No. 5	4.80	13.18/norm	3.7800
No. 6	4.55	18.05/norm	2.6500



Table 5 – Indicators of development of strength abilities of female weightlifters before restoration of endocrine system hormones

Athlete	Dash (max)	Thrust (max)	In/to
No. 1	70	60	48
No. 2	50	80	48
No. 3	85	90	53
No. 4	60	100	63
No. 5	75	80	63
No. 6	95	80	75

stored, the athletes experienced cramps, dizziness, limb weakness, absent-mindedness, and inattention. After recovery (Table 7), the athletes, in addition to successfully completing the tests, were in good physical condition, productive, and motivated.

Thus, we can draw the following conclusion: to improve strength abilities, not only a well-designed training plan and high motivation are necessary, but also maintaining normal levels of endocrine hormones.

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Table 6 – Indicators of development of strength abilities of female athletes after restoration of endocrine system hormones

Athlete	Dash (max)	Thrust (max)	In/to	Xcp±σ	Increase, %
No. 1	75	65	48	70,0±7,07	7,2
No. 2	60	85	48	72,5±17,7	10,4
No. 3	90	95	53	92,5±3,5	5,5
No. 4	65	110	63	87,5±31,8	8,6
No. 5	80	85	63	82,5±3,5	6,1
No. 6	100	85	75	92,5±10,6	5,5

Table 7 – Performance of female athletes after hormonal restoration endocrine system

Name of the test	Sportswomen (before/after)						Xcp±σ	Growth, %
	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6		
1. Bending and unbending arms in a lying position for 30 seconds, number of times	31/ 38	29/ 33	30/36	22/28	23/29	26/32	32.6± 3.8	17.9
2. Squat push-up – lying push-up – squat push-up – jump in 30 seconds, number of reps	18/ 23	20/23	20/24	17/21	16/20	13/16	21.2± 3.8	18.2
3. Long jump from a standing position, see	210/ 230	221/ 233	230/ 237	207/ 211	218/ 225	207/ 215	225.2± 10.3	4.3
4. Barbell snatch, 50% of maximum weight, for 30 seconds, reps	3/5	3/4	5/8	5/8	3/5	2/4	5.7± 1.9	38.3



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