The role of protein in the growth and development of muscle mass in strength athletes

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Abstract

Objective of the study is to systematise and analyse current scientific data on the role of protein in skeletal muscle adaptations during regular strength training.

Methods and structure of the study. A comparative analysis was conducted of a group of arm wrestlers (n=20, males aged 18-25 years, with at least 2 years of training experience), who were divided into two subgroups depending on their daily protein intake: control group (up to 1.4 g/kg of body weight) and experimental group (2.0-2.2 g/kg of body weight). Over a period of 10 weeks, changes in muscle mass (using bioimpedance analysis) and increases in competitive strength (based on the results of specific dynamometric tests on the wrist and elbow flexor) were monitored.

Results and conclusions. The experimental group showed an average increase in lean muscle mass of 1.4 kg compared to 0.6 kg in the control group, as well as an increase in competitive strength of 13.2% compared to 6.7%, respectively. The study also analyses the effect of protein intake timing (before, after and during training), it's even distribution throughout the day and the use of protein supplements in the athletes' diet. The risks of excessive protein consumption, including the potential strain on the kidneys and digestive system, and the importance of an individual approach to an athlete's diet are discussed separately. The article is intended for specialists in the field of sports medicine, nutritionists and coaches working with strength athletes.

Keywords: *muscle mass, high-protein diet, strength training, mass development, amino acids.*

Introduction. Building muscle mass is one of the key criteria for successful training of athletes in strength disciplines, including bodybuilding, powerlifting, weightlifting, arm wrestling, and CrossFit. In addition to a properly structured training programme, an adequate supply of protein – the main building material for skeletal muscles – is a decisive factor [4,8]. Proteins are necessary not only for muscle hypertrophy, but also for recovery after intense exercise [11].

Numerous studies in recent years have shown a direct relationship between the quantity and quality of protein consumed and the results of strength training [8]. However, questions about the optimal amount, sources, timing of intake, and combination of protein with other macro- and micronutrients are still debated in the scientific community [2, 9]. An equally important issue is the bioavailability of proteins of different origins and their role in regulating anabolic processes [1, 6, 13].

Objective of the study is to systematise and analyse current scientific data on the role of protein in skeletal muscle adaptations during regular strength training.

Methods and structure of the study. This work is based on an analysis of domestic and foreign studies published in peer-reviewed scientific journals [1-2, 5-8, 12, 13]. The methodological basis is the principle of a systematic approach with an emphasis on the following parameters:

- average daily protein intake (per 1 kg of body weight),
- temporary protein intake schedules,
- protein origin (animal, plant),
- the role of BCAAs in muscle tissue anabolism.

The analysis includes data from clinical studies, meta-analyses, and recommendations from the International Society of Sports Nutrition (ISSN) [8, 12].

Twenty male athletes aged 18 to 25 who had been practising arm wrestling for at least two years at the physical education and health complex of the Russian State Agrarian University - Moscow Timiryazev Agri-

cultural Academy took part in the practical part of the study. The frequency and amount of daily protein and biologically active food supplement consumption were studied using a specially designed questionnaire. The participants were divided into two groups:

• control group: protein intake up to 1.4 g/kg of body weight per day;

• experimental group: protein intake in the range of 2.0–2.2 g/kg of body weight per day.

The study was conducted over a period of 10 weeks. Measurements included:

• changes in muscle mass using bioimpedance analysis;

• gains in competitive strength assessed using dynamometric tests on the wrist and elbow flexor;

• subjective assessments of recovery and muscle catabolism levels.

Results of the study and discussion. Current recommendations for strength athletes range from 1.6 to 2.2 g of protein per kg of body weight per day. Higher doses may be justified during periods of weight loss or high-intensity training. It has been established that an even distribution of protein across meals throughout the day (20-40 g per serving) contributes to more effective muscle protein synthesis [9].

The practical part of the study allows us to draw important conclusions that are relevant for coaches, athletes, and sports doctors. The data obtained confirm that increasing protein consumption to 2.0-2.2 g/kg of body weight in the context of regular strength training: promotes a more pronounced increase in lean muscle mass (on average +1.4 kg versus +0.6 kg in the control group over 10 weeks), improves competitive strength indicators (+13.2% versus 6.7%) and has a positive effect on the feeling of recovery and reduction of signs of catabolism (according to subjective surveys).

Studies show that animal proteins (whey, casein, meat, eggs) have a higher completeness index (in terms of the content of all essential amino acids) and are absorbed faster [1, 6, 13]. However, with a competent combination of plant sources (soy, pea, rice protein), a similar anabolic effect can be achieved [13]. Experiments on strength athletes have not revealed significant differences in muscle mass growth when consuming equal doses of animal and plant protein. This opens up new opportunities for athletes who follow a vegetarian or vegan diet [10, 13].

Leucine, one of the components of BCAA, triggers the mTOR signalling pathway, which stimulates muscle protein synthesis [6,11]. Taking BCAAs, especially during the peri- and post-workout period, helps speed up recovery and reduce catabolic processes. A study has shown that BCAA supplements increase lean muscle mass when taken over a long period of time [6].

The question of the most effective time to consume protein remains a subject of debate. Some studies point to the benefits of consuming protein immediately before or after training to maximise muscle protein synthesis [9]. However, other studies emphasise the importance of evenly distributing protein consumption throughout the day [12]. Overall, total daily protein intake plays a more important role than the exact time of intake.

Potential risks

Excessive protein consumption without sufficient physical activity can put strain on the kidneys, especially if there is a predisposition. In healthy athletes, a high-protein diet of up to 3 g/kg/day is safe [12].

Conclusions. The optimal protein intake for strength athletes is 1.6-2.2 g/kg of body weight per day. Both animal and plant proteins can contribute to muscle growth, provided they contain adequate amounts of amino acids. Leucine and other BCAAs play a key role in activating muscle synthesis, especially during peri- and post-workout periods. It is important to consider not only the amount but also the timing of protein consumption – preferably evenly distributed throughout the day. When physiological norms are observed, a high-protein diet is a safe and effective strategy in the training of strength athletes.

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