



Low carb - high carb diet plan to increase special endurance of elite climbers

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Abstract

Objective of the study was to develop and evaluate the effectiveness of the low carbohydrate -high carbohydrate diet plan for climbers to be used in the precompetitive period.

Methods and structure of the study. Sampled for the study were 12 elite climbers (CMS and MS of Russia; Russian, European and World champions). The Harvard step test was used to determine the level of development of the subjects' overall endurance (cardiovascular system functionality). A specific test method was used to evaluate the local muscle endurance in the forearm: standard-grip hang with both hands with 70% of maximum weight for 8 seconds with 5-sec rest intervals. The total execution time was recorded.

The level of development of strength (special) endurance was assessed by the number of grips and finger holds made. The athletes were to climb a moderate-difficulty route as long as possible without rest. The number of grips and finger holds was calculated. This test was performed on an artificial climbing wall.

After initial testing, the climbers were offered a low carb-high carb diet plan.

Results and conclusion. The authors have developed and adapted a 7-day low carb-high carb diet plan for elite climbers. The tests conducted upon its introduction into the climber training process proved to be effective in increasing special and local endurance in the precompetitive period. This diet plan can be recommended to increase the glycogen levels in the climbers in the precompetitive period.

Keywords: competitive climbing, low carb-high carb diet, precompetitive period, strength endurance, local muscle endurance in forearm.

Background. Each sport climbing discipline – speed climbing, bouldering, lead climbing – requires special endurance being developed to the given kind of activity. In addition to strength endurance, athletes must have a highly developed speed-strength abilities. From a biochemical perspective, climbers train mainly in the ATP-CP and anaerobic lactic (glycolytic) energy system. ATP resynthesis is an anaerobic process, which uses glycogen as a substrate [1, 2]. Competitive activities take place in the submaximal power zones [3]. The depletion of glycogen stores in the muscles is a generally recognized factor that limits strength endurance [4]. In order to increase these stores, we developed and

adapted a carbohydrate unloading-loading diet plan for elite athletes from sports that require a well-developed special endurance associated with anaerobic glycolysis (apart from climbing, they include cross-country skiing, long-distance swimming, triathlon, etc.) [5, 6, 8].

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Results and discussion. For climbers performing speed-strength work in the anaerobic mode the percentage of proteins, fat and carbohydrates in the energy supply should equal 17-18%, 30% and 52-53% [6], respectively.

In lead climbing, it is strength endurance that plays a key role. Therefore, athletes are recommended the following diet: proteins – 14-15%, fat – 25%, carbohydrates – 60-61% of total calorie intake.

Climbers' routine food typically has the ratio of proteins, fat, and carbohydrates as follows: 15%, 25%, and 60%, respectively, which is 2.25 g of proteins, 1.66 g of fat, and 9.0 g of carbohydrates per kg of body weight. The caloric value of the diet is 60 kcal per kg of body weight.

We have developed and adapted the most suitable low carb-high carb diet plan for climbers to keep to during trainings by the method of Sherman et al. This diet plan does not exclude carbohydrates, but prefers complex carbohydrates that are rich in fibers. This improves the digestion of large amounts of proteins.

Climbers usually have four meals a day: breakfast - 40% of proteins, fat and carbohydrates of total calorie intake, lunch - 30%, snack - 5%, dinner - 25%.

Low carb-high carb diet plan. It includes an 8-day diet to be kept to before the start of competitions.

Stage 1 – low carbohydrate diet. 3-7 days before the control event (competition), the amount of proteins and carbohydrates was equaled to 3 g, fat – 1.1 g per kg of body weight. The main food products at this stage were egg whites, curdled dairy products,

fish and seafood, meat and meat products, whole-grain bread, vegetables, low-sugar fruits.

Stage 2 – high carbohydrate diet. Carbohydrates were introduced 1-3 days before the competition. Their quantity was gradually increased and the day before the competition reached 9.5 g per kg of body weight, while proteins were decreased to 0.9 g, and fat was 1.3 g per kg of body weight. By the final day of the diet plan, the volume of training loads was decreased, based on the subjective feelings of each athlete.

Stage 3. On the control event day (the day of the intended start), the amount of carbohydrates was 10.5 g per kg of body weight, proteins – 2.25 g, fat – 1 g.

6 days before the control test, the athletes performed an aerobic load with the oxygen cost of 70% oxygen of MOC for 90 min. 5-4 days before the control test, the duration of loading was reduced to 40 min, while its intensity did not decrease. 3-2 days before the control test, with the constant load intensity, the training session lasted 20 min. The athletes had a rest day 24 hours before the control test.

The effectiveness of the developed low carb-high carb diet plan was determined by the extent to which the local, special and overall endurance rates had changed.

The results of the Harvard step test did not show any significant changes in the cardiovascular system functionality throughout the experiment rates. In each test, the cardiovascular system functionality was rated as «good» and «excellent».

The dynamics of endurance rates was positive but did not increase significantly and amounted to 0.3%, i.e. less than 1%.

Since the introduction of the low carb-high carb diet plan in sports training of climbers, the average special endurance level has increased. The maximum growth rate was 23%, the minimum – 11%. The baseline rates increased by an average of 17%. A week after the introduction of the diet plan, the special endurance rates dropped by 5%. However, this level exceeded the baseline by 12%.

The control test showed a positive trend in the local muscle endurance in the forearm. The results of two intermediate tests of local endurance indicated that the average execution time was 104.1 and 114.7 sec, respectively. Therefore, after the introduction of the developed diet plan, the control test results improved on average by 10% (see Figure 1).

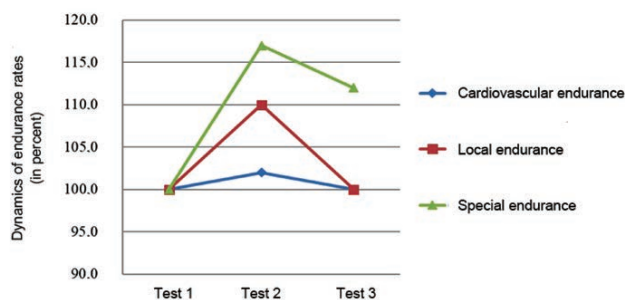


Figure 1. Dynamics of endurance rates

On the 15th day of the experiment, the average test rate was 104 sec, which indicates that the local endurance was reduced to the initial level.

The experiment found that the use of the developed and adapted low carb-high carb diet plan in the sports training of highly-qualified climbers contributes to the increase of their strength endurance – by 17% and local muscle endurance in the forearm – by 10%.

Conclusion. The authors have developed and adapted a 7-day low carb-high carb diet plan for elite climbers. The tests conducted upon its introduction into the climber training process proved to be effective in increasing special and local endurance in the precompetitive period. This diet plan can be recommended to increase the glycogen levels in the climbers in the precompetitive period.

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