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ALTITUDE TRAINING: WHAT USEFUL EFFECT?

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ABSTRACT

The mini-review discusses the results of a study conducted by Russian and Chinese researchers on the effect of natural hypoxia applied by elite athletes in the course of common training presented in an article by Myakinchenko et al., 2019. The authors show that success a training process of elite athletes is influenced by rational and well-balanced planning according to training goals, but not the effect of natural hypoxia. Based on the data from the article, it was concluded that the use of high-altitude training among elite athletes is aimed at creating conditions for better tolerance of hypoxia and reducing the body's acclimatization time during competitions at altitude.

Keywords: Hypoxic training, Preparatory period, Endurance, Elite sportsmen.

REVIEW

On the problem of training in conditions of natural or artificial hypoxia, there are different opinions of scientists. Some scientists report increased endurance. These results of training athletes can be seen in publications [1-3]. But there are studies showing the lack of reliable data regarding the positive impact of hypoxic training on the best athletic performance [4,5]. It is also indicated that positive changes in the respiratory and cardiovascular systems can be achieved with maximum and submaximal intensity training at altitudes up to 3100 m, which is problematic. In addition, many adaptation changes caused by hypoxia in the human body are similar to those that arise as a result of sports training at sea level. In the article “Comparative analysis of the use of moderate-altitude training by top Russian and Chinese athletes” [6], the training data of elite athletes of summer and winter sports were collected and analyzed, which were held in high-altitude conditions. The study was held in the preparatory period, which lasted 4-5 months. The participants of the study were 12 female rowers from the Chinese Olympic team (R-team) and 8 male biathletes from the Russian national team (B-

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team). All the athletes regularly participated in the World Cup and domestic competitions at the national level. The training program for athletes included the following schedule.

The preparatory period in each team was divided into two stages. In the R-team, in the first stage, a training camp was organized at sea level (SL) (200 m, 57 days), and in the second stage, an altitude camp (AC) was held at 2,280 m (40 days). In the B-team, in the first stage, two training camps were held: the first one at 1,100 m (AC, 19 days) and the second one, a sea level camp (SLC), at 140 m (31 days). Thus, the second control test was preceded by 31-day-long training at SL. In the second stage, three training camps were held: the first one at 1,100 m (AC, 19 days), the second one at 150 m (SLC, 13 days), and the third one at 1,100-2,800 m (AC, 11 days). Both teams underwent three control tests: prior to the first training stage, at the end of the first training stage, and 6-8 days after the end of the second training stage. All control tests were performed at SL.

The authors of the article obtained the following results. In the R-team separate training blocks were characterized by progressive growth of aerobic loads during SLC and AC; strength and aerobic workouts were spaced out in time. What is important is that strength training during the AC was performed according to a light regimen. The B-team athletes demonstrated no increase in aerobic indices registered at the end of the SL camp in spite of the large volume and high intensity of aerobic training loads during the SL camp. In the second training stage (AC), strength training loads were slightly reduced, while the volume of aerobic training was increased, which resulted in the improvement of endurance parameter. It is evident that the R-team and the B-team applied different schemes of hypoxic training. B-team athletes participated in three short ACs (11-19 days), whose total duration was 49 days. Athletes from the R-team underwent a single 36-day-long AC. The altitude used for ACs was also different. Two ACs in the B-team were held at 1,100 m, and the third AC was organized according to the "live low (1,100 m) – train high (2,800 m)" plan. The athletes performed 5 aerobic training sessions at the altitude of 2,800 m. The athletes from the R-team underwent "live high – train high" training at the altitude of 2,300 m. In the first stage (SL), the R-team performed a large volume of endurance training loads, executed a high percentage of intensive exercises in zone 4, and did a considerably greater volume of strength exercise. This training schedule improved their aerobic capacity after SL.

In the second stage (moderate-altitude training), the athletes performed the same total volume of exercise but reduced the volume of strength training by 79% and excluded all intensive endurance workouts. The coaches expected that physical fitness would be improved due to combination of aerobic training in zone 3 with the effect of natural hypoxia. However, no increase in physical fitness parameters was found. Most probably, the coaches had to decrease the intensity of aerobic training due to high altitude. The volume of strength exercise was also considerably reduced in order to preserve the total volume of training loads. As a result, the athletes demonstrated no increase in aerobic capacity.

B-team athletes performed intensive strength exercise and a lower volume of aerobic training in the first training stage (the first AC lasting 19 days and the following SLC lasting 31 days). The greatest part of the training was performed in zone 3. However, that training scheme did not lead to significant improvement in functional preparedness.

The second stage consisted of two short training camps at moderate altitude (19 and 11 days) and a short recovery period between them (13 days). The total volume of endurance training load was increased at that stage, and so were portions of training in zones 1, 2 and 5. The volume of strength training in the B-team was reduced, but still remained higher than that in the R-team. This training scheme involving moderate hypoxia (30 days at the altitude of 1,100 m) resulted in significant growth in all parameters of athletic preparedness. It is of note that training at relatively low altitude (1,100 m) led to a significant elevation in hemoglobin and hematocrit at each AC, which might serve as indirect evidence of hemoglobin mass growth.

The authors of the article conclude that monitoring of elite athletes' training in the preparatory period showed positive changes in physical preparedness in both groups, and those positive changes might not be related to an additional effect of natural hypoxia. The authors explain the positive changes in general and specific athletic preparedness as being related to rational and well-balanced planning according to training goals.

The research materials carried out during the real training process of elite athletes demonstrate the difference in the setting of "pure" laboratory experiments aimed at establishing the influence of hypoxia factors on the condition of athletes and solving practical training problems that are complex and multifactorial in their focus.

Accordingly, the use of high-altitude training in elite athletes in the training process can solve the problem of recruiting an individual "high-altitude experience" for better tolerance of hypoxia. In the case of competitions in high-altitude conditions, it is possible to determine an algorithm for reducing the body acclimatization time to these conditions.

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