

Research Article

Research on the Relationship between Dietary Intervention and Game Performance of Middle-and-long Distance Race Athletes

Tingjun Wang

College of Physical Education, Dalian University, China

Abstract: The supply of dietary nutrition is an important guarantee for athletes to deliver a good performance in training and games and a foundation to maintain a good economic status and it plays a vital promoting role in eliminating post-training and post-game fatigue. Currently constant improvements are witnessed in skills and achievements of middle and long distance running and one of the measures is the employment of science in athlete training. Then a question arises whether a rational dietary intervention will greatly influence athletes' game performance. This study will elaborate on this question. The study, by means of literature analysis, questionnaire and other methods, takes the middle-and-long-distance runners at 15 to 18 years old from some vocational college as study subject, namely, 40 randomly selected from the total number of such 70 runners for studying the correlation between dietary intervention and game performance. Through empirical analysis, it shows that scientific and rational proportion of dietary nutrition plays a decisive role in middle-and-long distance runners' training and game performance, because dietary intervention can make such runners' body composition change, increase their anaerobic threshold power and maintain a high hemoglobin concentration *in vivo*.

Keywords: Dietary intervention, game performance, middle-and-long-distance runner, training

INTRODUCTION

Features of middle and long distance items: As a typical cyclical race with a great demand for physical agility as well as endurance and speed, it includes middle-distance items, long and ultra-long-distance items. Generally speaking, 800 and 1500 m fall into the middle distance items with great intensity; rather, 3000, 5000 and 10000 m, respectively belong to long distance items with higher intensity; 20000 and 30000 m and Marathon is classified as ultra-long distance items. Therefore, it can conclude that middle and long distance race is marked by time-consuming, large amount of exercise, without a break as well as mainly about oxidative metabolism, in which body consumption is very large (Zi, 2014). Due to a quite long-time exercise and great body consumption, such race will have a great impact on runners' metabolism and athletic ability to metabolize, which makes athletes take a long time to recover. Especially in respect of long and ultra-long distance items, these features are more prominent. Long time exercise needs a certain concentration of blood sugar which is directly affected by glycogen reserves, so in order to increase the glycogen reserves *in vivo*, sugar should be supplied and the rate of glycogen utilization during exercise should be reduced so as to shorten the post-exercise recovery time and improve athletes' exercise capacity (Yihai *et al.*, 2014).

Nutrient characteristics of middle and long distance

items: According to the features of middle and long distance items, the nutrients necessary shall include providing adequate carbohydrate, keeping adequate glycogen *in vivo* and controlling fat content. During middle and long distance items, anaerobic carbohydrate glycolysis and aerobic metabolism system together complete the re-synthesis of ATP to guarantee athletes to continuously move. Glycogen decomposition and fat burning directly produce ATP-CP which is the most convenient way to produce energy, so glycogen plays an important role in quickly replenishing energy, while reducing the formation of acidic substances. For middle and long distance runners, it is essential to take in certain fat, as well as vitamin B, protein, inorganic salt and iron-rich food. In order to maintain the level of hemoglobin, athletes should take in much protein and iron-rich food so as to eliminate post-training and post-game fatigue as soon as possible through supplementing adequate vitamins.

Relationship between dietary intervention and nutrition supply:

In order to effectively protect runners' athletic ability and physical health, scientific nutrition must be supplied and, depending on the characteristics of various games athletes attend and their consumption features during training, reasonable energy supply must be provided for mechanism according to the scientific method of nutrition. That is to say, dietary survey shall be carried out for different

Table 1: Dietary change during the second 4th weeks

Week	Training item	Training method
5 th	Specific technique	Persistence, decomposition
6 th	Specific technique	Repetition, interval training
7 th	Specific technique	Complete training
8 th	Pre-game adjustment	Competition
Week	Nutrients	Proportion
5 th	Grains, meat, vegetables, fruits	Gradually increase
6 th	Grains, meat, vegetables, fruits	Large amount
7 th	Grains, meat, vegetables, fruits	High quality and appropriate amount
8 th	Grains, meat, vegetables, fruits	High quality and appropriate amount

games, so as to adjust and change irrational diet for athletes and improve their athletic ability through nutritional testing and nutrition matching (Jiang and Chang, 2002).

Energy demand is very different in respect of various games. Therefore, in order to help middle-and-long distance runners achieve best competition results, we shall ensure that such runners can take in adequate and reasonable energy to provide the necessary nutrients for their organism and make their energy balance.

MATERIALS AND METHODS

The supply of dietary nutrition is an important guarantee for athletes to deliver a good performance in training and games and a foundation to maintain a good economic status and it also plays a vital promoting role in eliminating post-training and post-game fatigue. Currently constant improvements are witnessed in skills and achievements of middle and long distance running and one of the measures is the employment of science in athlete training. Then a question arises whether a rational dietary intervention will greatly influence athletes' game performance. This study will elaborate on this question (Zhao *et al.*, 2005).

Various competitions in respect of middle and long distance items are increasingly fierce. It becomes a new trend to conduct dietary intervention to athletes on the basis of scientific training so as to help them further improve their performance in games, especially in case that the achievement gap is getting smaller and that training intensity and scientific-ness have reached a certain degree, reasonable dietary nutrition has become a decisive factor to improve game performance. Therefore, the paper will take the middle-and-long-distance runners at 15 to 18 years old from some vocational college as subject, namely, 40 randomly selected from the total number of such 70 runners for studying correlation between their dietary intervention and game performance.

Study subject and method:

Subject: Forty middle-and-long-distance runners at 15 to 18 years old from some vocational college, including 24 male and 16 female, items selected including male 800, 1500 and 10000 m and female 800, 1500 and 3000 m, respectively.

Method: First of all, experimental method is adopted. Experiment begins from June, 2014 to August, 2014, 8 weeks in total. Training time for subject includes: in the morning 6:00~7:00 (total 1 h); in the afternoon 15:50~17:50 (total 2 h).

The intensive training program and dietary nutrition are set out before experiment; after experiment begins, the proportion of dietary nutrition shall be kept relatively stable during the first four weeks, while changing the proportion of dietary nutrition in accordance with training content, intensity and amount during the second four weeks, from increasing the amount of nutrition to improving nutritional quality, especially food quantity and quality. The detailed comparison analysis is set out in the following (Table 1).

The study analyzes the changes of athletes' anaerobic threshold, their anaerobic threshold power and the relevant statistical results by comparing the dietary nutrition of the 4th week with that of the 8th week, so as to find the correlation between game performance and dietary nutrition.

After the above two steps, we obtain athletes' training performance through testing, which is compared with the best post-winter training performance in the early March of this year so as to analyze the influence of dietary nutrition on athletes' game performance.

RESULTS AND DISCUSSION

An analysis of the correlation between athletes' dietary nutrition and game performance: Currently, middle and long distance items are games demanding for heavy load of athletes who will consume a large amount of energy both physically and mentally after training or competition, which deepens their fatigue. If there is no enough time for athletes to supplement nutrients for physical recovery, it is likely that their health and subsequent training and competition will be affected. Therefore, it is impossible to eliminate post-training fatigue without appropriate nutritional supplements, which is an important issue that cannot be ignored. The study shows: Athletes' physical recovering and body function strengthening have a lot to do with the proportions of various dietary nutrients, namely, there is need for rational proportioning among

Table 2: Dietary structure and dietary adjustments

	Dietary structure	Dietary adjustments
Carbohydrate	45% of the athletes with insufficient intake	Increasing principal food of 400–500 g every day
Vitamin, inorganic salt	30% of the athletes with insufficient intake	Supplementing inorganic for daily exercise
High quality protein	40% of the athletes with insufficient intake	Supplementing whey protein powder of 25–30 g every day

protein, fat, vitamins, carbohydrates and other substances so as to further promote athletes' physical recovery. Thus, in order to effectively compensate for the consumption of physical agility and nutrition, we must make use of nutrients in a scientific and rational manner for restoring the body structure damaged, helping athletes recover from fatigue and further improving their game performance.

Specific method and analysis for diet survey: We conduct surveys on athletes' dietary nutrition respectively during the 2nd and 6th week, in which athletes feed on their own. Mainly by means of weighing, every day, we measure in an accurate manner the weight of athletes, that of various food and fruits before and after cooking as well as that of the post-dinner residual; we also record and measure the weight of the food and fruits consumed by each athlete for each meal and calculate nutritional intake, three-meal heat proportion and nutritional food sources and dietary structure for each athlete by means of "Dietary nutrition analysis and management system for athletes and mass". The survey results are set out as the following Table 2 and 3.

Diet statistics and analysis: The survey shows that, prior to dietary intervention, athletes' intakes of carbohydrate, protein, inorganic salts and vitamins are all lower than the recommended amount, but during the 7th week after dietary intervention begins, athletes' intakes of carbohydrate, vitamins, inorganic salt and high quality protein all have increased significantly, as shown in the following Table 3.

It is clear that athletes' intake of protein, fat and carbohydrate significantly increase by means of adjusting their dietary structure and supplementing the nutrients necessary.

Influence of dietary intervention on athletes' game performance: The aerobic training quality of athletes depends on their anaerobic threshold power and adequate energy supply is the foundation of aerobic training, especially the high hemoglobin concentration and carbohydrate which are the key to maintaining a stable status *in vivo*. Therefore, the diet structure of athletes should be adjusted and certain chalybeate should be supplemented before, during and after exercise to increase their hemoglobin concentration, so that their body can provide appropriate substance for aerobic training. The experimental observations indicate that the training amount of athletes during the 7th and 8th weeks is significantly increased and that their

Table 3: Comparison of average nutrition intake between pre- and post-dietary intervention

	Pre-dietary intervention	Post-dietary intervention
Total heat	3855.3	4570.8
Protein	128.7	138.9
Fat	133.9	112.2
Carbohydrate	465.8	676.5

Table 4: Performance comparison between post-winter training and post-experiment

Item	Best post-winter training performance	Best post-experiment performance
Male 800	1:52.40	1:51.70
Female 800	2:12.58	2:11.89
Male 1500	3:56.67	3:54.56
Female 1500	4:34.00	4:31.45
Male 5000	14:28.00	14:26.56
Female 3000	9:56.50	9:53.33

training effect is also improved accordingly, especially that various training indicators in the latter part of the training meet the relevant requirements, with their body functions in a good status. Experiment shows that dietary intervention can improve the level of athletes' training and maintain their competitive state before game.

The study compares the experimental data with the average anaerobic threshold and anaerobic threshold power of athletes from the vocational college after winter training, finding that the average anaerobic threshold and anaerobic threshold power of athletes before experiment are lower than that of athletes after winter training. However, during the whole experiment period, athletes' anaerobic threshold power is increased with their anaerobic threshold decreased after the first three-week training; during the period from the 4th to 7th week, their average anaerobic threshold power increases gradually to the post-winter training level while their anaerobic threshold is lower than the post-winter training level. There is no significant difference between pre-experiment and post-experiment. After intensive training from June to August, 2014, athletes' training effect is significantly improved, which justifies that dietary intervention plays an effective role as Table 4 shown.

From the above table, the comparison among the best game performance in each male and female middle and long distance item shows, the diets, which meet the requirements and are provided for athletes, can give full play to the healthy functions of nutrients, making athletes optimize their physiological status and competition state. After experiment, athletes' load capacity is significantly strengthened and game performance in various middle and long distance items

has been improved to some extent. In respect of male and female 1500 m, athletes' anaerobic threshold power is higher than that of common ones, so athletes of such items will bear a larger amount of load. On the basis of the improved average game performance, we should notice that game performance is not stable and that athletic ability varies for different runners.

We should pay attention to athletes' energy supplementation during training, especially to their sugar supplementation before and after long-distance or long-time training, i.e., 100~150 g sugar, which will maintain athletes' body blood sugar level and protect their glycogen; we should also pay close attention to athletes' anaerobic threshold and their anaerobic threshold power so as to maintain their physical functions in a good status. After experiment, the average game performance shows that dietary intervention can effectively regulate and control athletes physically and mentally and play a role in improving athletes' game performance.

CONCLUSION

The study analyzes the relationship between athletes' game performance and their dietary intervention by means of experiment, finding that dietary intervention is an effective measure to improve athletes' game performance which can not only affect athletes' body nutritional composition but also fully motivate athletes' potential. According to the features of middle and long distance items, the nutrients necessary shall include providing adequate carbohydrate, keeping adequate glycogen in vivo and controlling fat content. In order to achieve scientific middle and long distance training, we should monitor and supplement the nutritional intake of athletes in a comprehensive and

systematic manner. Only on the basis of strengthening nutrition, further improving dietary structure, paying attention to individual sensitivity of load and monitoring the training recovery in according with the relevant game performance indicators, we can help athletes further improve their game performance.

ACKNOWLEDGMENT

The authors wish to thank the helpful comments and suggestions from my teachers and colleagues in intelligent detection and control lab of HIT at Weihai. And also thank Beijing Up-tech to provide part hardware. This study is supported by the study fund of HIT at Weihai (No. IMVQ02020003 and IMJQ21080002).

REFERENCES

- Jiang, G. and G. Chang, 2002. Dietary survey methods [J]. *Occup. Health*, 8(3).
- Yihai, H., Q. Jianhua, Z. Shengkang and H. Jinghua, 2004. A study on constraints and countermeasures to the development of China's rowing [J]. *J. Wuhan Inst. Phys. Educ.*, 2004(01).
- Zhao, Z., L. Xue, Y. Hu *et al.*, 2005. *A Full Practice on Modern Sports Medicine Function Evaluation, Medical Supervision, Clinical Diagnosis and Treatment, Sports Injury Prevention, Health Care and Rehabilitation and Nutrition* [M]. Far Press, Hohhot.
- Zi, T., 2014. Influencing factors of catering and food service industry based on principal component analysis. *Adv. J. Food Sci. Technol.*, 6(2): 191-197.