

## Research Article

### Analysis of Sport Nutrition and Diet for Swimming Athletes

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**Abstract:** This current study analyzed nutrition and dietary structure of swimming athletes to clarify issues in nutrition and dietary structure of swimming athletes, based on which we designed achievable nutrition and diet strategies to equip the swimming athletes with the tools to achieve an adequate sport nutrition which helps them improve results. Firstly, we collected literatures about nutrition and diet of swimming athletes. Secondly, 40 swimming athletes were assigned to the test group and the control group to receive follow-up for 8 weeks. Twenty were provided with proper diet and calcium and vitamin supplements. Twenty athletes in the control group failed to reach standard expected for a swimming athlete due to inadequate intake of multiple nutrients. Twenty athletes in the test group reached to relevant standards. The athletes in the test group also achieved better performance than those in the control group. Proper nutrition and dietary structure not only substantially improve physical fitness but also improve performance of swimming athletes.

**Keywords:** Dietary structure, recommendation, sport nutrition, swimming athletes

#### INTRODUCTION

Proper Nutrition and Dietary Structure (NDS) are necessary to improve physical fitness and performance of athletes. They are directly associated with performance of swimming athletes. Recently, more importance has been attached to NDS of athletes. But issues related to NDS are not rare and substantially impact performance of athletes. It is necessary for athletes to improve NDS to cope with fierce competition. Proper NDS strategy should be developed to help athletes improve fitness and performance (Huang, 2013).

**Subjects:** Forty swimming athletes with a mean age of 22.21 years were randomly assigned to the test group and the control group in the study. There were 25 men and 15 women. The average weight of male athletes was 70+3.25 kg, while it was 55+2.25 kg for female athletes.

#### METHODOLOGY

**Literature collection:** Literatures related to energy consumption and NDS of swimming athletes were collected via network or library, which laid solid theoretical foundation.

**Comparative study:** Twenty swimming athletes in the test group maintained a diet strategy based on principle of balanced diet designed by dietitian. They had a bag of milk for the breakfast, took oral vitamin B1, B2 and C after lunch and took active calcium granule before sleeping. The duration was 8 weeks. Twenty athletes in

the control group had meals supplied by the dining hall. The effectiveness of proper NDS for athletes was analyzed by comparison of the results of body weight, composition and performance between the test group and control group.

#### RESULTS

**Intake of nutrients:** The intake of nutrients of these 40 athletes was compared to the standard for athletes. The results showed the test group had comparable intake of nutrients, while the control group had less intake of some nutrients compared with the standard for swimming athletes (Table 1).

**Analysis of dietary structure:** The results Table 2 of mean dietary structure of two groups showed that the test group had more types of foods and more rationale dietary structure, while the diet for the control group did not include dairy product and had less vegetables and seafood.

**Comparison of performance:** There was no significant difference in performance between two groups during 400 m freestyle prior to experiment. After 8 weeks, 20 athletes in the test group had significant better performance than the control group.

#### DISCUSSION

**Characteristics of energy consumption of swimming athletes:** During swimming, athletes have to overcome resistance against water and are subjected to stress of

Table 1: Comparison of mean intake of nutrients of two groups and the standard for athletes

	Calorie (MJ)	Calcium (mg)	Iron (mg)	Zinc (mg)
Standard	14.325	1200	25	25
Control group	11.456	960	19	24
Test group	14.145	1185	25	26
	A (mg)	B1 (mg)	B2 (mg)	C (mg)
Standard	1500	4.5	2.5	140
Control group	1350	4.3	2.1	138
Test group	1520	4.5	2.4	139

Table 2: Comparison of dietary structure between two groups

	Control group	
	Weight (g)	(%)
Rice and noodles	350.8	41.9
Beans	41.6	5.0
Poultry	65.8	7.9
Seafood	16.2	1.9
Milk	0.0	0.0
Eggs	35.7	4.3
Vegetable	68.9	8.2
Fruits	162.8	19.4
Oil	96.2	11.5
Total	838	100
	Test group	
	Weight (g)	(%)
Rice and noodles	390.2	31.0
Beans	50.2	4.0
Poultry	90.5	7.2
Seafood	70.5	5.6
Milk	227.0	18.0
Eggs	80.6	6.4
Vegetable	168.9	13.4
Fruits	86.0	6.8
Oil	96.0	7.6
Total	1259.9	100

water temperature, so they need great deal of energy. Generally, short-distance swimming ranging from 20 to 50 m demands energy equivalent to short-distance running of 50 m. Four hundred meter swimming demands energy equivalent to 1,500 m running. 1,500 m swimming demands energy equivalent to 10,000 m running. Additionally, the cerebral cortex receives a large amount of single repeated stimulus during swimming. These cause fatigue in neural and muscular system of athletes. Meanwhile, the heart and pulmonary systems are at high stress. Sometimes the heart rate reaches to 190-195 bpm at maximum. And the level of blood lactic acid reaches to 17 mol/L at maximum. Overall, swimming requires high physical function of athletes, which may be associated with the following factors.

**Impact of water temperature:** Water temperature is an important factor that impacts energy during swimming. Generally, the efficiency of heat transmission via water is thirty times as much as that via air. The heat that dissipates increases with the reduction of water temperature, so swimming athletes need more energy. For instance, the amount of energy adequate for swimming in water for 20 min at about 18°C is run out in only 5 min for swimming in water at 12°C despite the intensity remains the same. But that is equivalent to the amount of energy that people needs for exercise of same intensity at 18°C on the ground (Ming, 2012).

**Distance and speed:** Similar to other exercises, the energy that consumes during swimming is closely associated with distance and speed. The resistance from water increases as with the speed. And athletes need more energy. For instance, swimming at 50 m/min consumes 3 times more energy than swimming at 25 m/min. Five hundred meter swimming consumes 3 times more energy than 300 m swimming. It can be concluded that athletes need more energy if they want to swim faster and longer.

**Mechanical efficiency:** Research shows that the Mechanical Efficiency (ME) of swimming athletes is just 5-7%. Even excellent swimming athletes only have ME of about 8.1%. The ME for athletes engaged in sports on the group is 23-28%. The low ME also contributes a lot to great consumption of energy in athletes.

**Imbalanced nutrition and diet in swimming athletes in China:** Due to some limitations, the NDS for swimming athletes in China is not balanced in the following aspects.

**Inadequate intake of carbohydrates:** Some survey reveals that swimming athletes eat their meals in the form of buffet dinner. The concept of “eat more meat, more nutrition” misleads athletes to eat more poultry and neglect rice, noodle and some fresh carbohydrates. This leads to inadequate intake of carbohydrates and impacts exercise quality and mobility of swimming athletes (Liu *et al.*, 2014).

**Inadequate intake of some vitamins:** Evidence reports that many swimming athletes do not have adequate intake of some vitamins such as vitamins A, B1 and C. The insufficient of vitamin B significantly worsens the inadequate supply of energy and impacts performance of swimming athletes especially when the intake of carbohydrates is not adequate.

**Inadequate intake of calcium, iron and zinc:** According to relevant data, many swimming athletes have inadequate intake of microelements such as calcium, iron and zinc. The inadequate intake of calcium accounts for about 30% of total inadequate intake of microelements. This is most likely due to neglecting dairy products and beans, which impacts muscle contraction and neural excitability and hence impacts mobility of swimming athletes.

**Irrational energy allocation in three meals:** Irrational energy allocation in three meals is also one of the biggest problems in diet of swimming athletes. Some athletes get up late because of high intensity, so they probably have bad breakfast that impacts results of exercise.

### CONCLUSION

Swimming performance is influenced by many factors (Nan and Guangming, 2012). But proper NDS can effectively enhance functions of the body and improve mobility of swimming athletes. The swimming training center must focus more on NDS of swimming athletes. The dietitians should develop proper NDS and add vitamins and microelements based on individual conditions of athletes to improve functions and performance of swimming athletes.

### RECOMMENDATION OF PROPER NDS FOR SWIMMING ATHLETES

Scientific and proper NDS not only improves fitness of swimming athletes, but also significantly improves mobility. It is necessary for relevant authority to pay attention to the NDS of swimming athletes (Liu *et al.*, 2014).

**The recruitment of sport dietitians:** The director of swimming training center should recruit some professional sport dietitians to design NDS strategies for swimming athletes. On one hand, these dietitians need to know information about fitness of swimming athletes and their nutrition needs. Based on practical conditions of swimming athletes, they develop scientific and proper NDS for them. Also, they need to supervise and educate those who fail to keep regular diet. They should develop schedule of morning exercise and supervise swimming athletes to have regular meals and sleep. On the other hand, dietitians need to strengthen the importance of proper NDS, make athletes aware of it and stick to proper NDS.

**Ratio of top three nutrients:** Swimming athletes consumes sugar firstly, followed by fat. The protein is not consumed as energy. Proper ratio of sugar, fat and protein not only helps metabolism of swimming athletes, but also helps them achieve better performance. Generally, the optimum ratio of sugar, fat and protein intakes is 4.3:1.1:1.1. But the content of sugar must increase during high-intensity exercise. And add more fat to protect from cold. In addition, dietitians have to increase supply of foods rich in proteins during high-intensity exercise. This may improve CNS excitability and reflex of the nervous system and hence improve mobility. Overall, scientific and proper ratio of sugar, fat and protein ensures good metabolism of swimming athletes during exercise and improves their performance.

**Proper vitamin supplementation:** The primary property of vitamins in the body is catalyst for chemical reactions. They are critical for the regulation of energy release, tissue constitution and food consumption. During swimming, athletes develop fatigue and have less mobility if they have inadequate vitamins, so it is important to add vitamins in NDS of swimming athletes. Firstly, swimming athletes should eat more animal livers and eggs to achieve adequate vitamin A. They should eat more cod-liver oil and dairy products that contain more vitamin D to maintain excitability of the nervous system. Secondly, they should eat more corn and green leafy vegetables to add adequate vitamin E, improve body strength and endurance, reduce oxygen consumption of tissue at maximum, improve circulation of the body, improve heart function and hence improve performance of swimming athletes. Finally, they should eat more cereal grains to get adequate intake of vitamin B that effectively relieves fatigue (Nan and Guangming, 2012).

**More focus on multiple inorganic salts supplementation:** Inorganic salts such as potassium, sodium, calcium, magnesium and chloride are important to maintain the stability of internal environment, the excitability of nerve and muscle and increase the alkali store, so swimming athletes should have more intakes of multiple inorganic salts. First of all, swimming athletes should eat more seafood and animal giblets to achieve adequate zinc that improves muscle strength and endurance. Secondly, they should eat more foods rich in calcium such as shrimps, kelp and bean products. They can also drink calcium supplement if necessary. It helps maintain excitability of nerve and muscle and improve results of competitions. Phosphorus is the main part of many enzymes in the body. The metabolism of sugar and fat requires phosphorus compounds, so swimming athletes must increase intake of phosphorus and eat more food rich in protein to gain adequate phosphorus and enhance functions of the body.

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