OPEN ACCESS Freely available online

ISSN: 2157-7110
Journal of Food Processing & Technology

Research Article

Suggestions for Food Self-management by Athletes-Investigation of the Effectiveness of Food Frequency Questionnaire by Soccer Player

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ABSTRACT

A proper diet is essential for athletes. However, in a few cases, athletes have the opportunity to receive dietary management and advice from a dietitian concerning an appropriate diet. If athletes could manage their own diets, they would be able to check their diets regularly, which would alleviate dietary concerns and improve their performance. The study was conducted on 28 students who were members of a university soccer team. The subjects completed a self-administered Food Frequency Questionnaire (FFQ) using the FFQ NEXT software program. The survey forms were distributed to the participants by their coaches, and the participants completed the forms on their own. For comparison purposes, the nutritional value of each meal was calculated by a dietitian and compared using a recording method. The results showed that protein, fat, phosphorus, zinc, and fiber levels were significantly lower in the FFQ than in the recording method. However, phosphorus, zinc, and fiber levels were within the target ranges. The FFQ NEXT can be used as a means for athletes to assess their diet at their own pace. It is also suggested that it could be used to screen athletes in need of dietary guidance.

Keywords: Athlete; Food; Food Frequency Questionnaire (FFQ); Self-management

INTRODUCTION

Athletes have become increasingly concerned about being underweight in recent years. Relative Energy Deficiency in Sport (RED-S) is a condition in which energy intake is low relative to total energy expenditure. This condition has been shown to affect athletes' health [1]. RED-S has been an international cause for concern since the 1990s; however, no effective screening tool has been clearly demonstrated. It has also been reported that it is difficult to assess energy intake and consumption in sports settings [2]. In athletes, eating meals plays an important role in maintaining one's condition and improving performance [3]. It is also desirable to supplement nutrients through daily dietary management for safety and economy, but it is not easy to plan menus that provide sufficient amounts of trace minerals and vitamins that are not included in the common diet, and there are limitations in teaching this to male university students and implementing such menus [4]. It has been pointed out that it is difficult to prepare a menu that provides sufficient amounts of trace minerals and vitamins, which are scarce in the food supply. Dietary surveys for athletes have historically used the dietary record method [5], 24-h recall method (24 hDR) [6], and semi-quantitative Food Frequency Questionnaire (FFQ) method [6,7].

While it has been pointed out that the support of dietitians and nutritionists is necessary for conducting high-quality dietary surveys [8], this approach is also commonly used in the United States and Europe [9,10]. The International Olympic Committee (IOC) statement on sports nutrition states that "adequate energy from the many types of foods normally available will provide the carbohydrate, protein, fat, and micronutrient requirements needed for training and competition" [11]. This reaffirms the concept that sports nutrition is not anything that is particularly special. In fact, good sports nutrition it is not that much different from a normal diet [12]. University students are in a period of great change in their eating environment, as many are living on their own for the first time. For athletes aiming to

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Received: 17-Jan-2024, Manuscript No. JFPT-24-24632; **Editor assigned:** 19-Jan-2024, PreQC No. JFPT-24-24632 (PQ); **Reviewed:** 01-Feb-2024, QC No. JFPT-24-24632; **Revised:** 08-Feb-2024, Manuscript No. JFPT-24-24632 (R); **Published:** 15-Feb-2024, DOI: 10.35248/2157-7110.24.15.1084

Citation: Takahashi R, Kobayashi Y, Fujii T (2024) Suggestions for Food Self-management by Athletes- Investigation of the Effectiveness of Food Frequency Questionnaire by Soccer Player. J Food Process Technol.15:1084.

become professionals, it is essential to have an appropriate diet. However, there are few opportunities to receive dietary management and guidance from dietitians to ensure that their diet is appropriate; so many athletes need to improve their diet. If athletes could manage their own diets, they would be able to check their diets regularly, which would eliminate concerns about their diets and improve their performance. In addition, we believe that such a system would be useful for screening athletes who require nutritional guidance.

Therefore, the diets of university athletes were evaluated using the FFQ, the simplest dietary survey method available. We then compared these results with those that were obtained using the record method which was performed by a nutritionist.

MATERIALS AND METHODS

Body measurements

Height was measured with a height. Body weight, body fat percentage, and skeletal muscle weight were measured using the impedance method with an InBody 770 body composition measuring device (In Body Japan Inc.). Body Mass Index (BMI) was calculated using weight and height. The following equation was used to estimate energy requirements:

Lean body mass (LBM) × 28.5 × PAL=Estimated energy requirement [13].

PAL for ball games is 2.0 (seasonal) and 1.75 (off-season).

Dietary survey

Subjects completed a self-administered questionnaire using the FFQ NEXT (National Cancer Center, Kenpakusya Co., Tokyo, Japan) and Excel Eiyokun Plus (Kenpakusya Co., Tokyo, Japan) [14,15]. No explanation or assistance was provided by the dietitian. The coaches distributed the forms to the participants, who then completed the forms by themselves. The dietary survey was conducted using a recorded diet and a photographic diet. Surveys were conducted on two consecutive days, in any order, with or without training. When giving the subjects the diet record forms, we explained the precautions regarding the diet survey and asked them to use their student ID card (placed next to the item in question) in place of a scale when taking photo-recording examples and photographs. For commercial products and restaurant food, the participants were asked to take pictures so that the nutritional information and menu labels of the product names could be seen. For the diet survey form, students were asked to record the name of the dish they ate, the name of the ingredient, and the amount (approximate) of the food they ate, as much as possible.

Life activity survey

A survey form was developed to evaluate life activity. The subject's self-records were used to determine how much time was spent sleeping, eating, going to school, participating in club activities, and working part-time for two consecutive days. The energy consumption was calculated using the factorial addition method.

Statistical analysis

Descriptive statistics included means (SD). Differences in mean values between 2 groups were analyzed t-test. $p<0.05$ was considered to be statistically significant.

RESULTS AND DISCUSSION

The average estimated energy requirement was 3248 (580) kcal.

The average estimated energy requirement obtained from the body composition was 3248 (580) kcal.

A comparison of the FFQ and the recording method is shown in Table 1. The FFQ showed significantly lower protein, fat, phosphorus, zinc, and dietary fiber levels than the recording method. There were no significant differences in the energy, carbohydrate, potassium, calcium, magnesium, iron, copper, vitamins A, D, E, K, B1, B2, B6, B12, folic acid, C, or salt equivalent levels. There were no significant differences between the groups (Table 1).

		FFQ	Record method	Target amount
Energy	kcal	2705 (690)	2932 (657)	3500
Protein	g	113 (32)*	133 (39)	130
Fat	g	78 (22)	104 (35)	105
Carbohydrate	g	377 (146)	393 (107)	500
Potassium	mg	3070 (422)	3437 (1047)	
calcium	mg	723 (366)	622 (344)	1200
Magnesium	mg	348 (85)	369 (119)	
Phosphorus	mg	1275 (188)*	1562 (450)	

Iron	mg	10.4 (2.3)	11.5（3.4）	16.3
Zinc	mg	11.3 (2.9)*	15.2（4.7）	
Copper	mg	1.6 (0.3)	1.7（0.5）	
Vitamin A	μg	834 (514)	680（359）	1300
Vitamin D	μg	17.8 (15.3)	12.8（13.3）	
Vitamin E	mg	9.5 (3.9)	10.2（4.0）	
Vitamin K	μg	371 (132)	465（251）	
Vitamin B1	mg	2.0 (1.1)	2.1（0.9）	1.9
Vitamin B2	mg	2.4 (1.3)	2.1（1.0）	2.5
Vitamin B6	mg	2.9 (2.2)	2.8（1.5）	
Vitamin B12	μg	9.6 (2.2)	10.7（13.9）	
Folic Acid	μg	469 (139)	451（147）	
Vitamin C	mg	200 (157)	166（117）	230
Dietary fiber	g	18.3 (6.4)*	27.5（8.2）	28～35
Salt Equivalent	g	12.3 (1.4)	11.0（2.6）	

Note: Mean: (SD); FFQ: food frequency questionnaires; * : *vs.* Record method.

Table 1: Comparison of food frequency questionnaires and food recording method.

Figure 1, shows the percentage of athletes with sufficiency relative to their dietary intake goals. The FFQ was higher than the standard value of vitamin B1. The FFQ consumed less than the target amounts of energy, protein, fat, carbohydrate, iron, and vitamins A, B2, and C, while the record method consumed target amounts of protein, fat, and vitamin B1. Levels of energy, carbohydrates, calcium, iron, and vitamins A, B2, and C were lower than the target values. The athletes' food intake of grains, potatoes, starches, sugar/sweeteners, fruits, eggs, milk, and oils and fats was low, while their intake of legumes, vegetables, seaweed, mushrooms, seafood, and meat was high (Figure 1).

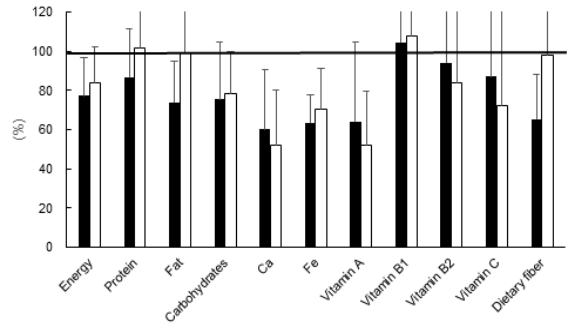

Figure 1: Fulfillment rate against target volume. Note:▬ Food Frequency Questionnaire (FFQ); ▭: Record method.

Considerations

If athletes could conduct their own dietary surveys, they would be able to regularly check their dietary content, leading to improved performance. Therefore, we evaluated the diets of university soccer players using several different methods. The results showed significantly lower values for protein, lipids, phosphorus, zinc and fiber than those obtained using the record method. Yokoyama et al. compared and reviewed the 12-day dietary record and the FFQ and found that protein, fat, and fiber were underestimated by 6%, 2%, and 14% [16]. In addition, they reported similar ratings for 1% phosphorus and 3% zinc. In this study, the FFQ had less protein (15%), fat (25%), phosphorus (18%), zinc (26%) and fiber (33%) than the results obtained by the record method. Of note, protein (20 g; -80 kcal) and fat (-26 g; -234 kcal) were underestimated in the present study, possibly due to the fact that athletes eat more than the general population and that they did not have the advice of a nutritionist or other assistance in completing the survey. The fact that such items were also underestimated in previous studies suggests that they may be easily underestimated.

The amounts of phosphorus, zinc, and fiber were underestimated in the FFQ. Therefore, they were compared with the Dietary Reference Intakes for Japanese (2020 edition) [17]. The recommended daily intake of phosphorus is 1,000 mg for

men, with 3,000 mg as the upper tolerable limit. Both the FFQ and recording method showed a range of 1,000 mg –3,000 mg.

Although there was a significant difference in phosphorus intake, this was not considered a problem in the dietary assessment. The recommended daily intake of zinc is 7.0 mg for 18 to 29-year-old men, with an upper limit of 40 mg. As with phosphorus, both groups had intakes within the reference range; therefore, the significant difference was not considered problematic.

The target daily intake of dietary fiber is defined as at least 21 g for 18- to 64-year-old men. The dietary record method showed that the target amount was exceeded, whereas the FFQ showed that the intake was below the target amount. The National Health and Nutrition Survey reported that the recommended daily intake of dietary fiber was 15 g/day for individual's ≥ 20 years old. In addition, the Dietary Reference Intakes for Japanese (2020 version) [17] defines the intake amount while considering the prevention of lifestyle-related diseases. Based on the above, a dietary fiber intake of 20 g or less is considered to be acceptable for athletes who exercise daily. Taken together, these results indicate that the intake of most nutrients met the Dietary Reference Intakes for Japanese and the recommended intake for athletes, even after considering that they were underestimated. These results suggest that the FFQ NEXT may be used to screen athletes in need of a nutritional assessment of their own diet or nutritional guidance, even if they are not knowledgeable about this area of study themselves.

The FFQ NEXT can also be used to assess one's food intake. In this survey, the intake of carbohydrate-rich grains, potatoes, starches, sugar and sweeteners was low. In addition, the intake of eggs, milk and oil was also low. A previous study also reported a low intake of potatoes and starches among college student athletes [18]. The results of the FFQ also showed that the consumption of potatoes and starch was low among university student athletes [18].

However, one important point to note is that the FFQ is a dietary assessment method used for the general population, whereas the subjects of this study were athletes. Athletes take more supplements than the general population, and the FFQ does not take supplements into account. Therefore, in this study, nutritional calculations for supplements were performed separately and added to the FFQ values. The FFQ may thus be used to assess athlete nutrition, but nutritional calculations for supplements should be performed separately. The FFQ can be used to aid athletes in conducting dietary assessments at their own pace. In addition, it may be able to be used to screen athletes in need of dietary guidance.

CONCLUSION

The FFQ NEXT is not designed for use by athletes, and individual nutritional calculations should be performed if supplements are administered. However, the FFQ NEXT was able to be used by college athletes without the assistance of a nutritionist or similarly skilled individual and with no particularly detailed knowledge of food and nutrition to obtain results that were not significantly different from those obtained with the dietary recording method performed by a nutritionist. Dietary assessments using the FFQ are a useful tool that can be used by athletes for self-checks in sports settings, as well as by nutrition staff for primary screening prior to performing detailed dietary surveys. In the future, such assessments may be used not only by dietitians and other people involved in nutrition but also by athletes, coaches, and other sports personnel, which will further encourage their use and thereby enable dietary management for a large number of athletes.

CONFLICT OF INTEREST

The authors declare that they have no competing interests.

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