

NUTRITIONAL STATUS AND PERFORMANCE OF SEPAK TAKRAW PLAYERS FOLLOWING INTERVENTION BY A SPORTS DIETITIAN

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Abstract

The high demand for sports abilities causes decreased performance in athletes. Nutrition may be closely related with performance decline. Dietitians play an important role in providing proper nutrition for athletes. This study aimed to determine the effect of nutrition intervention by a sports dietitian on the nutritional status and performance of sepak takraw players in The State Senior High School for Sports (SMANOR) Sidoarjo. A pre-experimental study was done using a one-group pre-post test without control design, on 27 sepak takraw players (20 boys, 7 girls) aged 14-18 years from SMANOR Sidoarjo. Participants were given nutrition interventions by a sports dietitian comprising nutrition education, nutrition counseling, and food assistance for three weeks. Nutritional status was evaluated using BMI-for-age and body fat percentage (BFP) and athletic performance using VO₂ max (Bleep test method). Statistical analyses used were paired *t*-test and Wilcoxon signed-rank test. The results indicated a significant decrease in BMI-for-age (pre = -0.26 ± 0.52 and post = -1.23 ± 0.55 , $p \leq 0.001$), an insignificant increase in the male BFP (pre = $13.06 \pm 2.22\%$ and post = $13.44 \pm 1.70\%$, $p = 0.162$), a significant increase in the female BFP (pre = $22.54 \pm 2.25\%$ and post = $23.47 \pm 1.91\%$, $p = 0.028$), and there was no significant difference in the athletes' performance (pre = 46.82 ± 6.22 and post = 46.34 ± 5.36 , $p = 0.360$). Nutrition interventions by a dietitian have a significant effect on nutritional status according to BMI-for-age and female BFP, but not on male BFP and performing sepak takraw players in SMANOR Sidoarjo.

Keywords: Athlete's Performance, Body Fat Percentage, Nutritional Status, Sepak Takraw Player, Sports Dietitian

Introduction

Sepak takraw is a high-impact team sport with the game being played using all parts of the body, except the hands (1). The demand for high athletic ability causes fatigue in sepak takraw athletes. Nutritional issues can be linked to the problems (2).

As many as 67.53% of sepak takraw athletes at the Student Sports Education and Training Center of Central Java have very poor energy adequacy levels (3). Another study conducted by Yanti et al. (4) also found that 100% of female sepak takraw athletes in Riau have less than optimal physical performance due to poor daily nutrition intake. Based on these findings, it is possible to conclude that an imbalance between nutritional needs and intake

cause nutritional problems. This is characterized by the athlete's poor physical condition, thus affecting the athlete's performance (5).

Sports dietitians can help sepak takraw players in providing proper nutrition. The role of a sports dietitian has been regulated in Indonesia's Law Number 3 of 2005 article 63 (6). Sports dietitians use the nutritional care process which depends on nutritional periodization during training or competition. Along with managing the right meal planning, sports dietitians have the right to provide food assistance during meal times to control the composition of the athletes' food by using meal etiquette. Sports dietitians also handle nutrition for athletes in special circumstances, such as those who have food allergies or are injured. (7).

Moreover, sports dietitians play a role in education: in a group or individually or in counseling. Nutrition education and counseling is specifically to increase athletes' knowledge regarding nutrition and exercise, which in the long term can change eating habits for the better (8).

Based on this context, a study was carried out to investigate the effect of nutrition interventions by a sports dietitian on the nutritional status and performance of sepak takraw players at The State Senior High School for Sports (SMANOR) Sidoarjo. There is a limited number of sports dietitians at SMANOR, which affects the implementation of appropriate sports nutrition practices (9). Therefore, planned nutritional interventions which consist of nutrition education, nutrition counseling, and food assistance, at SMANOR Sidoarjo are expected to achieve optimal nutritional status and peak performance of sepak takraw players in every game (6).

Materials and Methods

Study design

The one-group pre-post test without control design was used in this pre-experimental study. The study was conducted without randomization of subjects and a control group, ensuring that all subjects received the same treatment and assessments.

Participant

The participants of this study were sepak takraw players from SMANOR Sidoarjo who met inclusion criteria, including youth athletes aged 12-18 years, were SMANOR Sidoarjo students, in good health and actively participating in the team for at least 6 months. Athletes who met the exclusion criteria, such as having an injury, a history of respiratory and heart disease, or have had surgery within the last 3 months, were excluded from the study. The sample was determined using a total sampling technique.

Pre and post-assessment

Sepak takraw players chosen as research subjects received a three-week nutritional intervention from a sports dietitian who has completed a dietetic internship. To assess the effectiveness of the intervention, each subject completed a pre-test and post-test, in the form of nutritional status and performance. Nutritional status was evaluated using BMI-for-age and body fat percentage. BMI-for-age included height, weight, and age which were calculated with WHO-Anthro plus. Height was measured with a microtome, to the nearest 0.1 mm, and weight was measured with a Bioelectrical Impedance Analysis (BIA) OMRON Body Composition Monitor HBF-375. Body fat percentage was also measured using the same weight measurement instrument to minimize error calculation. Athlete performance was assessed using the VO_2 max or bleep test method.

Nutrition intervention

The nutrition intervention program consisted of nutrition education, nutrition counseling, and food assistance. Nutrition education aimed to improve athletes' nutritional knowledge. It was given twice during the intervention with topic 1 being "Hydration and Meal Etiquette" and topic 2 being "The Role of Nutrients in Sports." The materials were presented in the form of a presentation to all athletes in a class by a sports dietitian. Athletes were also given educational modules to improve their understanding of sports nutrition. To assess the athletes' knowledge, pre-test and post-test were carried out in each educational activity.

Nutrition counseling was provided to athletes one-on-one with a sports dietitian to deeply motivate athletes to adopt healthy eating habits while also increasing nutritional knowledge. Each athlete was given 20-30 minutes of nutrition counseling. The individual athlete's nutrition profile was used by a sports dietitian as a tool to educate the athletes personally. The data of the nutrition profile were obtained from the pre-assessment, including anthropometrics, dietary history, physical findings, and family history.

Food assistance was provided eight times and only at breakfast. The food assistance schedule was adapted to the athlete's training schedule as determined by the coach. The sports dietitian would compare the athlete's food portions, such as carbohydrates, protein, and vegetables, to those specified in the meal etiquette which was created based on the athlete's training load. The data are partly taken from the thesis of Ghany (10).

Statistical analysis

The normality test with Shapiro-Wilk is the first step in bivariate analysis. If the data is normally distributed, a paired sample *t*-test was used to compare nutritional status and athletes' performance before and after the intervention. If the data is not normally distributed, a non-parametric test using the Wilcoxon signed-rank test was performed. All data were analyzed with SPSS version 25.00 and were considered significant if $p < 0.05$.

Results

The results in this study consist of the explanation about the characteristics of subjects followed by comprehensive descriptions regarding the results of each nutrition intervention. The effect of nutrition intervention on nutritional status and athletes' performance is explained in the last part.

Characteristics of participants

This study involved 27 sepak takraw players (20 boys and 7 girls) who met the inclusion criteria. The characteristics of the athletes are presented in Table 1. Based on Table 1, sepak takraw players have a minimum age of 14 years and a maximum age of 18 years with an average of 16.81

± 1.11 years. The length of playing life of sepak takraw players is a minimum of 1 year and a maximum of 10 years with an average length of play of 5.15 ± 2.48 years. Sepak takraw athletes have an average weight of 56.35 ± 5.20 kg, height of 165.07 ± 6.15 cm, BMI-for-age -0.26 ± 0.52 SD, total body fat percentage of 15.51 ± 4.77% with a mean for male body fat percentage of 13.06 ± 2.22% and female body fat percentage, 22.54 ± 2.25%; the bleep test results were 46.82 ± 6.22 mL/kg/min.

Table 1: Subject characteristics (n = 27)

Characteristics	Minimum	Maximum	Mean ± SD
Age (years)	14.00	18.00	16.81 ± 1.11
Length of play (years)	1.00	10.00	5.15 ± 2.48
Weight (kg)	44.10	63.60	56.35 ± 5.20
Height (cm)	151.00	174.80	165.07 ± 6.15
BMI-for-age (SD)	-1.06	0.94	-0.26 ± 0.52
Body Fat Percentage (%)			
Boys	9.40	16.80	13.06 ± 2.22
Girls	19.80	26.00	22.54 ± 2.25
Total	9.40	26.00	15.51 ± 4.77
Bleep test (mL/kg/min)	33.25	58.20	46.82 ± 6.22

Nutrition education

Nutrition education was provided twice during the intervention. A pre-test was administered to athletes before the start of the activity, followed by a post-test after the education was completed. The pre-test and post-test were in the form of a quiz. Athletes were asked to answer the questions given from the presentation slides within the given time, around 1 minute for each question. The questions tested in the pre-test and post-test were the same, but the number of questions in each test was randomized. Several important points were discussed in nutrition education topic 1, such as the role of fluids, how to check hydration status, how to prevent dehydration, and types of sports drinks. In nutrition education topic 2, several other points were discussed, such as the introduction of macro and micronutrients, food recommendations for athletes during competitions, food supplements, and sports nutrition tips for adolescent athletes.

Table 2: The Effect of nutrition education on athletes' knowledge

Education Session	n	Mean ± SD		p
		Before	After	
Session 1 – Hydration & Meal Etiquette	21	77.78 ± 15.20	82.53 ± 15.34	0.338
Session 2 – Role of Nutrients in Sports	20	68.00 ± 15.08	89.00 ± 15.18	0.004**

** p < 0.01 Statistical analyses used was Wilcoxon signed-rank test

Table 2 shows that in the first education session attended by 21 sepak takraw players, the average pre-test score was 77.78 ± 15.20 and increased in the post-test result with an average score of 82.53 ± 15.34. In education 1, 6 questions were given, with 4 questions regarding hydration and 2 questions regarding meal etiquette. In the secondary education which was attended by 20 sepak takraw athletes, the average pre-test score was 68.00 ± 15.08 and increased in the post-test result with an average score of 89.00 ± 15.18. The questions given in education session 2 were 5 questions.

Based on the statistical analysis, education 1 did not significantly affect the athlete's knowledge (p = 0.338). Meanwhile, education 2 had a significant effect on athlete knowledge (p = 0.004).

Food assistance

A sports dietitian was given a scoring form with name, date, and checks columns for assessing the suitability of food portions taken during the food assistance activity. Athletes who followed the meal etiquette were assessed as capable of taking the food portion on the form by a sports dietitian.

Table 3: Food assistance assessment result

Food Assistance (FA)	Number of Athletes Able to Take Food Portion According to Meal Etiquette (n (%))			
	Rice	Animal Protein	Plant Protein	Vegetable
FA 1	13 (48%)	1 (4%)	0 (0%)	1 (4%)
FA 2	14 (52%)	0 (0%)	0 (0%)	0 (0%)
FA 3	18 (67%)	3 (11%)	0 (0%)	6 (22%)
FA 4	16 (59%)	0 (0%)	0 (0%)	5 (19%)
FA 5	21 (78%)	0 (0%)	0 (0%)	4 (15%)
FA 6	11 (41%)	0 (0%)	2 (7%)	5 (19%)
FA 7	16 (59%)	1 (4%)	0 (0%)	6 (22%)
FA 8	14 (52%)	0 (0%)	0 (0%)	0 (0%)
Average of Athletes' Ability (%)^a	56.9	2.3	0.9	12.5

^aThe total average of athletes' ability to take food portions according to meal etiquette from the 1st FA to the 8th FA; FA: food assistance

Table 3 showed the results of the food assistance assessment on the athletes. In each food assistance program, the percentage of athletes who could take food portions according to the meal etiquette varied greatly. For the suitability of the rice portion, the percentage of athletes capable of the 1st to 8th food assistance (FA 1 – 8) varied from 41% to 78%. For the suitability of animal protein, about 4% to 11% of athletes were capable between the 1st to 8th FA. While for the suitability of the portion of plant protein, there were no athletes who were capable of FA 1 to FA 8, except for FA 5, where 7% of athletes were capable.

The effect of nutrition intervention by a sports dietitian

The nutritional status and athlete's performance before and after intervention are shown in Table 4. Prior to statistical analysis, the normality test used was performed using the Shapiro-Wilk test. The normality test indicated that all data were normally distributed for BMI-for-age (pre = 0.532, post = 0.502), male body fat percentage (pre = 0.458, post = 0.240), female body fat percentage (pre = 0.615, post = 0.831), and performance (pre = 0.524, post = 0.298).

Paired *t*-test analysis indicated that there was a significant decrease ($p < 0.001$) in nutritional status according to BMI-for-age before and after being given nutrition interventions for three weeks. In nutritional status according to body fat percentage, there was a non-significant increase in males ($p = 0.162$) and a significant increase in females ($p = 0.028$). There was no significant difference in athletes' performance before and after nutrition interventions ($p = 0.360$).

Table 4: The effect of nutrition intervention by sports dietitian

Assessment	Mean \pm SD (n = 27)		p
	Before	After	
Nutritional Status			
BMI-for-age (SD)	-0.26 \pm 0.52	-1.23 \pm 0.55	<0.001** ^a
Body Fat Percentage (%)	13.06 \pm 2.22	13.44 \pm 1.70	0.162 ^a
Boys	22.54 \pm 2.25	23.47 \pm 1.91	0.028 ^b
Girls			
Bleep test (mL/kg/min)	46.82 \pm 6.22	46.34 \pm 5.36	0.360 ^a

* $p < 0.05$; ** $p < 0.01$; a = Statistical analysis used was a paired *t* test; b = Statistical analyses used was Wilcoxon signed-rank test

Discussion

Our study found that nutrition interventions by a sports dietitian have a significant effect on nutritional status according to BMI-for-age and female body fat percentage, but not on male body fat percentage and the performance of sepak takraw players in SMANOR Sidoarjo, after getting nutrition intervention for three weeks, including nutrition education, nutrition counseling, and food assistance.

Changes in nutritional status can be attributed to the athlete's knowledge and food consumption. Athletes who have sufficient nutritional knowledge will choose to eat healthy and nutritious foods (11). This nutrition intervention demonstrated that nutrition education only increased athletes' knowledge but did not result in changes in eating behavior, as evidenced by the results of nutrition education session 1, which had no significant effect ($p = 0.338$) on the knowledge of athletes. These findings have an impact on athletes who are unable to apportion food during food assistance activities. Moreover, due to the limited portioning regulations of the food service at SMANOR, athletes could not eat according to the portions on the meal etiquette.

According to Rash et al. (12), nutritional knowledge influences only 5% of food intake decisions. The rest is influenced by the food service system. The food service system designed specifically for athletes must meet several criteria, including meeting the athlete's energy needs while also being balanced with a variety of fruits and vegetables. The menu cycle that should be used is 30 days, with flexible, healthy, and nutritious menu variations that take into account the type of consumer. Food service must also be supported by a comfortable, neat, and clean place (11). Because the food does not meet the energy needs of athletes, the food served is less varied, and there is a 7-day menu cycle, these criteria become the evaluation material for the food service system at SMANOR Sidoarjo.

This study carried out food assistance activities eight times, each time during breakfast. Because the sports dietitian could not directly monitor the athletes' food intake, the risk of the food not meeting the athletes' energy needs increases. Athletes were also known to be bored because the menus served lacked variety. As a result, whether athletes dine in or out of the dormitory, may be influenced by their satisfaction with food service (13). Athletes' diets are typically high in calories, high in fat, low in fiber, and low in nutrient density outside of the dormitory (14). This type of food is detrimental to athletes' health and nutritional status, as evidenced by an increase in body fat percentage in this study (11).

An increase in body fat percentage can be detrimental to an athlete's health and performance. Increased body fat can cause a delay in the process of building muscle mass, reducing an athlete's ability to move (15). Excess body fat also contributes to low oxygen consumption, which causes athletes to become tired quickly and unable to maintain long-duration playing performance (10).

Adolescence, particularly in females, is known to increase fat storage due to hormonal changes during puberty (16). Women, as a result, tend to store more fat than men. A 24-hour recall to determine athletes' nutritional intake was not followed up on in this study, and it was difficult to determine the relationship between body fat percentage and athlete performance. Several studies, however, have discovered that excessive food consumption can increase body fat storage, affecting athletes' body composition and performance (17).

The type, frequency, and intensity of exercise all have an impact on an athlete's performance (18). The high training schedule (twice a day training for six days a week) combined with a heavy workload in school is one of the causes of athletes experiencing a decrease in physical performance. This is also supported by athletes' limited ability to apportion food, which results in inadequate nutritional intake. As a result, athletes become exhausted and demotivated.

Peak athlete performance can be achieved by combining effective training strategies with healthy eating habits. Athletes who consume the recommended amount of nutrients have good nutritional status and a 68.9% effect on performance. This, when combined with an effective training factor, can increase an athlete's performance by up to 72.5% (18). As a result, expert nutrition intervention is critical in assisting athletes to improve their performance.

To determine how much influence the nutrition intervention has on the athlete's performance, the intervention program should be carried out for at least 8-12 weeks. At that point, the body begins to adapt by increasing basal metabolism due to the influence of regular exercise combined with a healthy diet (18). The nutrition intervention in this study was only three weeks long, which may have resulted in subpar results. A sports dietitian must also work with coaches to create effective training strategies. Adequate nutrition and an optimal exercise program can thus result in the best athletic performance (19). More research is needed to determine the best intervention design for athletes and in a broader range of sports.

Strength and Limitation

The strength of this study is that it is the first nutrition intervention by a sports dietitian in Indonesia using adolescent sepak takraw athletes. The results of this study will be used as the basis to support the role of dietitians in the Indonesian sports field. This research uses nutrition education, nutritional counseling, and food assistance which aim to increase athletes' knowledge and practice of implementing eating behaviors. In addition, the participation of athletes is high. Overall, the average participation of sepak takraw athletes from the beginning to the end was 86.96% with the presence of 100% pre-intervention measurements, education 1 at 77.78%, education 2 at 74.07%, nutritional counseling at 88.89%, food assistance at 81.02%, and 100% post-intervention measurement.

This research has several limitations. First, the food assistance intervention could not be implemented optimally because of the limitations of food service regulations. Second, three weeks were not enough to show significant results on the athlete's performance. It takes a minimum of 8-12 weeks to see a significant change in results. The absence of follow-up on the athletes' food intake during the intervention program caused this study to be unable to predict the cause of excessive or reduced food intake which resulted in the results of nutritional status and performance of athletes. In addition, this study did not monitor the athletes' fluid intake, so this study cannot relate how hydration status affects athlete performance.

Conclusion

Nutrition interventions by a sports dietitian have a significant effect on nutritional status according to BMI-for-age and female body fat percentage, but not on male body fat percentage and the performance of sepak takraw players in SMANOR Sidoarjo.

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Conflict of interest

The authors declare that there is no conflict of interest.

Ethical Clearance

Ethics approval was obtained from the Medical and Health Research Ethics Committee of Faculty of Medicine, Public Health, and Nursing Universitas Gadjah Mada, number KE/FK/0100/EC/2021

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