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The Influence of Nutritional Knowledge on Nutritional Status and Physical Performance in Young Female Athletes

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Abstract. The excellent level of nutritional knowledge for female younger athletes is one of the strategies to enhance achievement and to improve the satisfaction level on body image. Therefore, this research aimed at revealing nutritional knowledge, eating behavior, nutritional status and physical performance on female younger athletes involving samples of 129 young female athletes with the age range of 12-19 years old from 27 sports branches. The data collection was conducted using survey and measurement methods. The survey was carried out to explore the nutritional knowledge, eating behavior, and body image. Nutritional status was measured using body mass index measurement, while the physical performance was measured using maximum oxygen volume (VO_2 max) and Balke test. Based on the research results, the level of nutritional knowledge of the most critical nutritional element of 70% of the samples was carbohydrate, and 64% of them was protein; 5% of the samples had undernutrition status; 5% of the samples had overnutrition status; 50% of the samples had poor eating behavior; 6% of the samples had bad eating behavior; 77% of the samples were not satisfied with the body image; and their average of VO_2 max was 35 mL/kgBW/minute. Based on the research results, it can be concluded that on average, young female athletes experience multiple nutritional problems, poor eating behavior, and have self-conflicts related to body image and performance as poor-category athletes.

Keywords: Young female athlete, nutritional status, body image, nutritional knowledge, eating behavior

1. Introduction

The level of nutritional knowledge for young female athletes is one of the causes of the increase in unhealthy diet trend and bad eating behavior [1], meanwhile, athletes are demanded to have achievements [2], with an ideal, proportional, athletic body shape, and excellent and satisfying body image [3]. However, the demand becomes a pressure instead, which impacts eating behavior disorder [4], self-induced vomiting, which increases the risk of unsatisfaction on body image [5]. The data

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showed that more than 50% of young female athletes were unsatisfied with their body images with the feeling of anxiety on their body size and body weight [6]. Not only this will impact on physical performance and sports achievement, but also on nutritional status, health [7], psychology, social, physical function, and cognitive ability [8].

The unsatisfaction with their body image [9], the feeling of overweight, fat, and obsession with becoming thinner are required by sports branches [10]; besides, they also want to look like their idol figure [11]. The conclusion from the research by Nadira Malik showed that more than 66% of the young female athletes perceived that they were overweight and more than 40% of them wanted to lose their weight and become thinner [10]. In the long term, it can be the cause of the delay in sexual maturity [12], anemia, menstrual disorder [13] low self-esteem, stressful feeling, and even can lead to depression [14], stress, anxious, and social phobia [15].

Young female athletes have the longing to enhance their achievement which becomes the demands of sports branch, and also always want to look good, slim, and have an ideal body image [16]. This demand requires adequate nutritional knowledge to balance out between the demand for appearance and sports achievement [17]. Thus, the athletes' level of nutritional knowledge is an imperative factor to fulfill the demands [18]. Nutritional knowledge is often associated with healthy eating behavior and diet [19]. Therefore, an excellent level of nutritional knowledge is crucial to give the comprehension on a healthy diet, healthy body weight, excellent growth, and imposing appearance, as well as good physical performance and health [20]. Therefore, this research aimed to reveal the level of nutritional knowledge, body image, eating behavior, and nutritional status as well as the physical performance of female young athletes. These research results are expected to minimize eating disorder, enhance the satisfaction on body image, nutritional status, health and achievement of young female athletes.

2. Methods

This research is an analytical descriptive study appraising young female athletes in KONI Malang city consisting of samples from 27 achievement sports branches which have female athletes. The variables used in this research were nutritional status, nutritional knowledge, eating behavior, body image, and physical performance. The exploration of information related to eating behavior, nutritional knowledge, body image was performed using questionnaires, while nutritional status and physical performance were conducted using tests. Nutritional status was measured using Body Mass Index (BMI), while physical performance with VO_2 max was measured using the Balke test. The data analysis was performed using descriptive statistic test, and Confirmatory Factor Analysis test.

3. Results and Discussion

The characteristics of the samples based on age and anthropometrics are presented in Table 1.

Table 1. The anthropometric data of the subjects

Variable	Average
Age	15 years old
Body Weight	47.82 kg
Body Height	154.84 cm
Upper arm circumference	28.15 cm
Lower arm circumference	24.40 cm
triceps skin-fold thickness	17.47 mm
Percentage of body fat	25%

Based on the research results, the average BMI was 19.86 kg/M^2, which belonged to the normal category of BMI [21] (Table 1). This case is significantly required in adolescent, which is a growth period since it involves an appropriate diet to support ideal growth [22]. The development of information technology in giving information on western food and culture inspires adolescent females to have a lightweight and slim body shape. Eventually, this case will influence their eating behavior

and impacts on their nutritional status and growth and development [23]. The research results showed that there are multiple nutritional problems in young female athletes (Table 2).

Table 2. Athletes' Nutritional Status

Category of Nutritional Status	Percentage (%)
Normal	89
Over	5
Under	6

The research conducted by Nikolaidis also exposed the same features which were not 100% of the athletes had normal nutrition since abnormal nutritional status still existed [21]. The multiple nutritional problems were likely caused by the factors of eating behavior, internal and external demand from sports branches which demand the athletes to look slim and lightweight as well as lacking nutritional knowledge [23]. Besides that, the obsession with having a lightweight and slim body and having over-anxiety on body weight cause eating disorder such as irregular eating behavior and unhealthy diet, this case will influence the nutritional status [24]. An excellent nutritional status is essential, not only for physical performance but also for growth and development, health, and having impacts on psychological aspect and body image satisfaction [25]; besides that, the optimal performance can be attained in the sports branch that is participated, [26]. Abnormal nutritional status can cause various physical disorders such as anemia, menstrual disorders, or osteoporosis [27]. Sports affects the improvement of body functions including the function of heart, respiration, neuromuscular, and digestion system, and then workout needs to be reinforced by an excellent nutritional status; if not, then it will cause organ dysfunctions even increase the risks of diseases [28]. This case can occur if the level of nutritional knowledge is excellent which is illustrated in the proper nutritional knowledge [21].

Balancing the nutritional intake for energy balance is crucial to prevent energy deficiency or excess. Energy deficiency can cause stunting, delayed puberty, menstrual dysfunction, muscle mass loss, and injury or pain; on the other hand, energy excess can cause overweight and obesity [26]. In the adolescent period, an excellent nutritional status is crucially needed to enhance the growth and development, secondary sec characteristics, nerve-cell growth, and young female athletes have a higher risk compared to the male athletes [29]. An excellent nutritional station in high-intensity sport also have risks in the occurrence of menstrual disorder [30]. Therefore, nutritional status has a significant role in achieving an optimal sport performance [28]. This case needs an adequate nutritional knowledge so that athletes have a healthy diet habit, balance-nutrition eating pattern, as the requirement for athletes to always perform well, facing sport training, sport competition [31]. It is likely that athletes will experience a deficiency in energy, fluid, and even muscle damage. Accordingly, a proper, healthy, and balanced diet is highly necessary to refill the energy supply and prevent dehydration and muscle damage [32]. These phenomena will occur if athletes have adequate nutrition diversity [33]. The research results show that the level of nutritional knowledge related to the nutritional element diversity is still limited (Table 3).

Table 3. Nutritional knowledge

Nutritional Elements	Percentage (%)
Protein	64
Carbohydrate	70
Fat	40
Vitamin	61

Based on Table 3, the most important nutritional element to achieve an ideal appearance besides carbohydrate is protein, then vitamin. As a matter of fact, the vitamin is considered to be able to increase physical performance which is always consumed before the match. Previous research also

reported that 46% of athletes used the vitamin-contained supplement and 30% used protein or substitutional food [34]. The habit was caused by the lack of adequate nutritional knowledge [35]. Adequate nutritional knowledge is an essential supplement for all kinds of physical fitness programs and proper nutrition so that the athletes' physical performance improve [28]. Consequently, young athletes need to have nutritional knowledge and learn about the kinds of foods that are good for energy supply, when to eat, what to eat pre- and post-sport, having proper knowledge of balance diet for energy supply that is adequate for the physical growth and performance [26].

The good nutritional knowledge is pivotal for young female athletes to select healthy nutrition and diet according to their needs [28]. Consequently, an excellent nutritional knowledge will contribute to healthy diet intake, particularly calorie regulation, nutritional element diversity, the increase in fruit and vegetable consumption, as well as healthy diet arrangement according to the sports branches [36]. Many factors influencing eating behavior in young female athletes make it distinctive from other groups [37]. The research results showed that the eating behavior of young female athletes had not illustrated a good eating behavior, which is not based on the needs but wants as displayed in Table 4.

Table 4. Young female athletes' eating behavior

Eating frequency/day				**Food Quantity**			**Eating behavior**			**Beverage**		
1 (%)	2 (%)	3 (%)	4 (%)	Additional portion (%)	Dessert (%)	Snacking (%)	Side dish (%)	Vegetable (%)	Fruit (%)	Isotonic (%)	Milk (%)	Coffee (%)
6	32	42	19	40	52	57	64	39	21	6	29	12

The description shows that young female athletes' eating behavior has not illustrated a good nutritional knowledge and athlete nutritional needs including the needs of both micro and macro nutritional elements, while the nutritional element is vital for young athletes for physical performance during the sports, and also optimal growth and development [26]. The fluid needs are relatively better; based on the research results, 100% of the samples use mineral water as their primary beverage which they consume before, during, and after sports, 29% of the samples drink milk before the sports. Based on the eating behavior, it is possibly inadequate because the samples need extra calorie needs in the growing and developing [38] and for a fast growth [39]. This phenomenon occurred possibly related to the level of nutritional knowledge [28] and independence in food selection [34], as well as the independence to select food which is not based on the needed nutritional needs [38]. However, this case does not only impact on physical performance but also nutritional status, and its health [34]; it has risks on the emergence of chronical diseases [38]. Eating behavior correlates with the level of nutritional knowledge, and the research results showed that nutritional knowledge is a dominant factor influencing eating behavior and nutritional status of young female athletes with $\beta = 0.740$. The level of nutritional knowledge will impact on eating behavior and attitude [40].

Eating behavior is also influenced by the anxiety of gaining weight while adolescent females are demanded internally to look slim and lightweight [23], although they have been slim and lightweight. On the other hand, adolescent males tend to expect to have an athletic and muscular body, both of which influence eating behavior and also will cause eating disorders [41]. The nutritional knowledge factor formed by parents, trainers, environment, and peers has a significant impact on behavior, the perception of food, and even can create a perception on the unsatisfaction of body image [42]. Such a perception creates a change in the eating behavior even eating disorder for athletes, moreover with the demand and pressure of sports which needs to perform agile, nimble, slim, then it will cause eating disorders such as anorexia which also causes an unsatisfaction feeling on their body image [43].

The problem of unsatisfaction on the body image changes the weight and appearance, that frequently occur in young female athletes [44]. This case is considered as the results of the internationalization of social pressure and sports which becomes the moderator causing eating disorder among athletes [43], and it is already on the worrying level [42]. The research results showed that 82%

of young female athletes felt unsatisfied with their body image and only 18% of the athletes felt satisfied (Table 5). The unsatisfaction on the body image is a significantly risky factor on the eating disorder such as bulimia, a cause of psychological problems such as low self-esteem and depression which will influence the physical and psychological health [37].

Table 5. The perception of body image on young female athletes

Perceptions of Body Image	Percentage (%)
Satisfied	18
Not yet satisfied	37
Dissatisfied	32
Neutral	13

During the adolescent period, particularly in a female group, body image becomes the major concern and the peak of unsatisfaction on the body image occurs in the early adolescent period, signified with the feelings of anxiety and worries on their body, which eventually influences eating behavior [45]. The research results proved that body image was a dominant factor influencing eating behavior with a score of 0.21 (0.000 (S). Based on Confirmatory Factor Analysis, the factor influencing the eating behavior is nutritional knowledge $\beta = 0.11$ and body image of $\beta = 0.31$. Athletes were demanded to always perform optimally with high physical performance to achieve an optimal weight [31]. This case becomes a significantly complex problem; young female athletes need a specific nutritional intake to support nutritional status, their growth and development; on the other hand, the unsatisfaction on their body image causes the feeling of being fat [23]. The unsatisfaction on the body image tends to encourage to conduct a tight diet and modify eating behavior [42]; their mind and feeling tend to be negative on the body, feeling the difference of sizes that they feel and the ideal condition, [46]. Therefore, a positive perception of the body image is required to regulate eating nutritional food successfully and as an essential part to support the growth and development [47].

The unsatisfaction on body image is always related to eating disorders, unhealthy eating, feeling fat, and a tendency of losing weight, even though having an ideal body [32]. This behavior will impact on the nutritional status, which will then impact on the menstrual cycle and bone problems [48] and also on the physical and physiological abilities as well as physical fitness [32]. The research results proved that unsatisfaction on body image impacted on the physical performance of young female athletes (Table 6).

Table 6. Category of Physical Performance

Category of physical performance (VO_2 max)	Percentage (%)
Superior	13
Excellent	6
Good	31
Fair	41
Poor	9

Based on the research results (Table 6), the measured level of physical performance, VO_2 max showed 41% ak was in the poor category and the very poor category was 9%. Based on the category, it can be seen in Graphic 1.

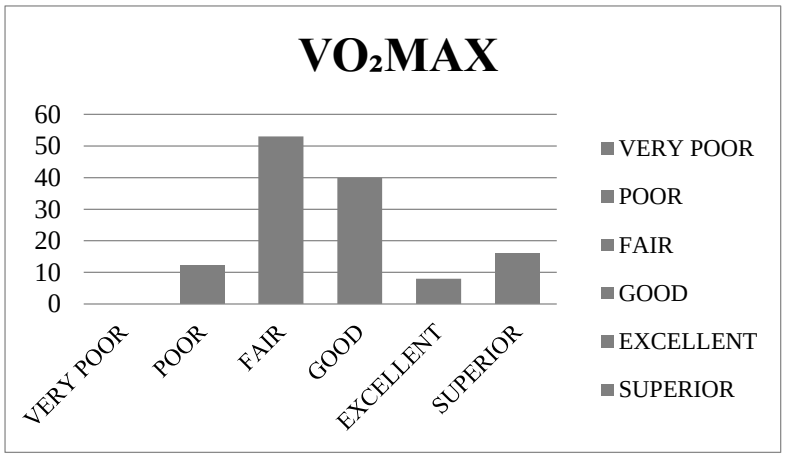

Figure 1. Category of VO_2 max in female young athlete samples

The athletes' physical performance is illustrated in VO_2 max besides influenced by nutritional status and the feeling of unsatisfaction on body image [49]. This case is shown in the research conducted by Nikolaidis who revealed that an athlete who has normal nutritional status tends to have an excellent physical condition, on the other hand, an athlete who has a poor nutritional status tends to have a poor physical condition. In the research, there was a measurement of VO_2max of adolescents who have a normal and abnormal nutritional status; the adolescents who had a normal nutritional status had VO_2max of 48.2 mL/kg/minute, furthermore, in the abnormal nutritional status the measurement showed VO_2max of 41.6 mL/kg/minute, while for female group with normal nutritional status, the measurement showed 39.6 mL/kg/minute and in the abnormal nutritional status, the measurement was 35.9 mL/kg/minute [21].

4. Conclusion

Based on the research results, it can be concluded that 90% of the young female athletes had normal nutritional status and 10% of them had abnormal nutritional status, then based on eating behavior only 42% of the young female athletes who had the habit of eating three times a day. Meanwhile, from the aspect of nutritional knowledge, they did not understand the level of diversity in nutritional elements needed for the athletes. Related to body image, 82% of the athletes were not satisfied with their body image, and this case impacted on their physical performance; only 50% of them who had a good and excellent physical performance, however, was not appropriate with the minimum needs required by sports branches. Therefore, it is recommended to improve nutritional knowledge, improve eating behavior to be better according to the nutritional needs of sports branches and training demand, as well as enhance the body image, so the physical condition improves. Accordingly, athletes should do a proper diet, healthy diet, and diet which can support the nutritional needs of sports branches, with nutritional element diversity.

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