



Analysis of female athlete triad (fat) components: energy and nutritional intake of papuan female athletes

Analysis komponen female athlete triad (fat): energi dan asupan zat gizi atlet putri papua

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ABSTRACT

Female Athlete Triad (FAT) disrupts the health and performance of female athletes both in training and competition, leading to a decline in achievements. The purpose of this research was to analyze one of the components of the FAT namely energy availability in Papuan female athletes. This research is an observational study with a Mixed Methods approach, involving a total sample of 55 female Papua athletes in Jayapura, Papua. Energy and nutrient intake were conducted by collecting data on the energy and nutrient intake of Papuan female athletes through interview, 3x24 hour recalls and questionnaires. The demographic data of FAT risk factors collected include age, weight, height, injury history, and sports. The components of energy availability collected include eating disorders. Energy intake data were processed using the Nutrisurvey dietary intake data processing software. The data were then compared with the recommended adequacy and energy requirements for athletes. The average energy intake achievement in athletes was found to be 87% (2273.76 cal). The average carbohydrate intake was 288.14grs (77%). The average protein intake was 88.68grs (93.34%), while the average fat intake was 86.71grs (98%). Mostly athletes have fulfilled their energy and nutritional intake.

Key words: fat; energy availability; nutrition; female athletes; papuan; indigenous papuans

Female Athlete Triad (FAT) mengganggu kesehatan dan performa atlet putri baik dalam latihan maupun bertanding sehingga berdampak pada menurunnya prestasi. Tujuan dari penelitian ini adalah untuk menganalisis salah satu komponen FAT yaitu ketersediaan energi pada atlet putri Papua. Penelitian ini merupakan penelitian observasional dengan pendekatan Mixed Methods, yang melibatkan total sampel 55 atlet putri Papua di Jayapura, Papua. Asupan energi dan gizi dilakukan dengan mengumpulkan data asupan energi dan gizi atlet putri Papua melalui interview, recall 3x24 jam dan kuesioner. Data demografi faktor risiko FAT yang dikumpulkan meliputi usia, berat badan, tinggi badan, riwayat cedera, dan cabang olahraga. Komponen ketersediaan energi yang dikumpulkan yaitu gangguan makan. Data asupan energi diolah menggunakan software pengolah data asupan makanan Nutrisurvey. Data tersebut kemudian dibandingkan dengan rekomendasi kecukupan dan kebutuhan energi atlet. Rata-rata capaian asupan energi pada atlet sebesar 87% (2273,76 kal). Rata-rata asupan karbohidrat adalah 288,14gr (77%). Rata-rata asupan protein sebesar 88,68gr (93.34%), sedangkan rata-rata asupan lemak sebesar 86,71gr (98%). Sebagian besar atlet sudah tercukupi asupan energi dan nutrisinya.

Key words: fat; ketersediaan energi; nutrisi; atlet putri; papua; orang asli papua

ARTICLE INFORMATION

Article History:

Accepted : 15 November 2024

Approved : 22 December 2024

Available online December 2024

Doi: <http://dx.doi.org/10.20527/multilateral.v23i4.21682>

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INTRODUCTION

One of the strategies for developing human resources in Papua is through sports. The geographical ecology of Papua with its beaches, valleys, lakes, hills,

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and archipelagos has shaped the natural talents of Papuan children. Sports are like gift for the Indigenous Papuans (OAP), their identity and self-esteem (Ita, 2017). With its unique and rich natural environment, Papuan children are accustomed to physical activities, which help develop their physical strength (Ita, 2017). This means that sports have truly become an inseparable part of the lives of the Papuan. History records that Papua is a treasure trove of athletes, with many Papuan athletes achieving success at the national and international levels in their outstanding sports of football, athletics, and rowing.

This natural talent is also found in Papuan women. This is evident from the achievements of OAP female athletes, such as Stevani Ibo, Ona Antryni Paays, and the Papua Galanita Team, who have successfully made history for Papua and Indonesia by winning gold medals in PON XX and the 2022 SEA Games. The potential and achievements of Papua's female athletes are beyond doubt, but along their journey, female athletes are vulnerable to complex nutritional and health issues due to intense training and sports, known as the Female Athlete Triad (FAT) (Daily & Stumbo, 2018; Cardozo & Gluck, 2021). FAT is a syndrome characterized by energy availability disorders, menstrual function disorders, and decreased bone density (Daily & Stumbo, 2018; Statuta et al., 2019).

One of the components of FAT is low energy availability. A major factor influencing the occurrence of energy availability disorders is the low food intake due to eating disorders such as anorexia and bulimia nervosa (Skorseth et al., 2020). The insufficient food intake of female athletes also triggers iron deficiency, which is generally accompanied by anemia. Anemia negatively impacts muscle function and maximum work capacity (Petkus et al., 2017). Furthermore, anemia adversely affects the reproductive function of athletes, which in turn will impact the quality of the fetus and the child born. Low energy availability affects the production of reproductive hormones, specifically lutein, which triggers ovulation and, in the long term, can lead to amenorrhea and osteoporosis (Petkus et al., 2017).

Athletes need sufficient energy intake to meet their high metabolic demands during training and competition. Adequate energy and nutrient intake, according to the needs, age, and activities of athletes, is very important to consider. Low energy availability becomes a window for sustained FAT impact. Eating behavior deviations are a consequence of efforts to achieve and maintain an ideal body shape and weight through dangerously strict diets. Low energy availability is closely related to iron deficiency. Iron deficiency conditions lead to a hypometabolic state associated with low energy status, which in turn causes low energy intake, ultimately resulting in low energy availability (Petkus et al., 2017).

Globally, FAT is often found in active adolescent girls with a prevalence of 40-60% (Daily & Stumbo, 2018; Sherwood, 2015). FAT has a significant impact

on female athletes; this syndrome disrupts training and leads to suboptimal performance, resulting in a decline in achievements (Coelho et al., 2021). Handling FAT is not easy, complex, and requires special attention from the collaboration of athletes with related sports sciences such as doctors, nurses, nutritionists, coaches, and psychologists through a personal approach and early intervention (Gastrich et al., 2020; Cardozo & Gluck, 2021; De Souza et al., 2017).

FAT is a serious issue among female athletes, but it is not widely known or recognized (Desai & Prajal, 2020). Research in 2022 was conducted by researchers to begin examining FAT in Papuan female athletes more closely. The researchers found that Papuan adolescent female athletes had limited knowledge about FAT (Sinaga et al., 2023). Subsequently, in 2023, the researchers identified FAT in Papuan female athletes and found that the signs and symptoms of FAT included menstrual disturbances (86.84%), heavy training (68.42%), and fatigue (65.79%) (Sinaga et al., 2023). The researchers also found that 23.68% of the samples had irregular eating patterns (Sinaga et al., 2023). However, FAT research is still limited and has not yet involved many samples with OAP characteristics (Melanesian). Therefore, this study analyzed the energy and nutrient intake of female Papuan athletes.

It is essential to monitor calorie intake and ensure that athletes receive adequate nutrition. The component of energy availability is important to consider because it is a window for the sustainable impact of FAT. If not addressed, FAT will become an obstacle to achieving the targets of sports training programs that incur significant costs and hinder the development of Papua's highly potential human resources. Therefore, this research is important to be conducted as an initial step for prevention, early detection, handling, and ongoing research on FAT in Papua. Furthermore, it serves as a recommendation to be considered in the planning of achievement coaching programs for female athletes in Papua, specifically OAP.

METHODS

Participants

The population in this study consists of female athletes Papua, accounting for 55 athletes.

Study design

The type of this research is observational research with a Mixed Methods Research approach (quantitative + qualitative). This method is applied to obtain information on the energy and nutrient intake of female athletes from Papua. The research will be conducted in the City of Jayapura, Papua. The quantitative method will be more dominant compared to the qualitative method (Putra,

2017). Data on the energy intake and nutrients of Papuan female athletes were gathered by interviews, three 24-hour recalls, and the completion of the Food Frequency Questionnaire (FFQ) in order to analyze energy availability. The Food Frequency Questionnaire (FFQ) will take ten to fifteen minutes to complete. The FFQ is a widely used, legitimate, and trustworthy tool for gathering information on food intake. Age, height, weight, and sports are the demographic information on FAT risk variables that was gathered. The Nutrisurvey data processing software used to process the intake data. Subsequently, we compared the data to the recommended daily intake to determine sufficiency.

Statistical analysis

Both qualitative and quantitative analysis methods were used to process the data gathered from the interviews and three 24-hour recalls of female athletes from Papua. The quantitative information on nutrients and energy intake had been processed using the Nutrisurvey program. SPSS version 28 was used for descriptive statistics and univariate analysis.

FINDINGS AND DISCUSSIONS

Findings

Firstly, we collected respondent’s characteristics data as described below.

Table 1. Characteristics of the respondents

Characteristics of the respondents	(n = 55)		Mean±SD	Total	Percentage (%)
	Min.	Max.			
Age	12	29	21.27±3.89		
Weight			60.51±11.12		
Height			163.93±8.78		
Sports					
Football				23	41.81
Athletics				3	5.45
Cricket				2	3.64
Rowing				2	3.64
Basketball				4	7.27
Volleyball				5	9.09
Archery				1	1.82
Badminton				4	7.27
Hockey				1	1.82
Weightlifting				3	5.45
Soccer				5	9.09
Diving				1	1.82
Total				55	100

The average age, sport, height, and body weight of the 55 athletes who participated are displayed in the table above. As of right now, the respondents’

average age is 21.27 ± 3.89 , with the youngest being 12 and the oldest being 29. The sample's average height was 163.93 cm with a standard deviation of 8.78 and its average weight was 60.51 with a standard deviation of 11.12. Football players (41.81%) make up the majority of the sample when compared to sportsmen in other sports.

Energy availability component

Table 2. Energy availability components

Components	Total	Percentage (%)
Eating disorder		
Yes	2	3.64
No	53	96.36
Eating Frequency		
Yes	48	87.27
No	7	12.72
Restricted Diet		
Yes	3	5.45
No	52	94.54
Weight Control		
Yes	21	38.18
No	33	60
Fasting Habit		
Yes	3	5.45
No	52	94.54
Limiting intake of certain nutrients		
Yes	3	5.45
No	52	94.54

Approximately 96.36% of athletes do not suffer from eating problems, whereas 87.27% of athletes eat three main meals and one snack each day. Five and a half percent of athletes adhere to a rigid diet. Sports-related weight control was observed in 38.18% of athletes, 5.45% of whom reported fasting, and 5.45% of whom restricted specific food intakes.

Energy and Nutrition Intake

Table 3. Energy and Nutrition Intake

Components	Total	Carbohydrate (gr)	Protein (gr)	Fat (gr)
Energy intake	2273.76	288.14	88.68	86.71
average				
Percentage of fulfilment	87%	77%	93.34%	98%
Energy expenditure	1708.21			
Fat Free Mass	39.59			

Table 3 shows the average energy intake was 2273.76 calories. The average carbohydrate intake was 288.14, the protein intake was 88.68, and the average fat intake was 86.71. The percentage of fulfilment respectively was 87%, 77%, 93.34% and 98%. The average energy expenditure obtained was 1708.21 kcal and the fat-free mass was 39.59.

Related FAT components

The related FAT components for which data were also collected in this study are injury history and menstrual disorders, presented as follows.

Table 4. Related FAT Components

Subject Characteristic	Total	Percentage (%)
Injury		
Yes	20	36.36
No	35	63.64
Menstrual disorder		
Yes	2	3.64
No	51	92.73
Total	55	100

According to Table 4, 3.64% of the athletes had menstruation disorders, and 36.36% of the FAT-related components had injuries.

Discussion

This study found that the energy intake of Papuan female athletes was 2273.76 calories, with an average carbohydrate intake of 288.14 grams, a protein intake of 88.68 grams, and a fat intake of 86.71 grams. The percentage of fulfilment respectively was 87%, 77%, 93.34% and 98%. The average energy expenditure was 1708.21 calories, and the fat-free mass was 39.59. Our study findings will be discussed below.

The result shows most athletes (87%) met their energy intake by fulfilling 77%, 93.34% and 98% for carbohydrate, protein and fat intake respectively. Fulfilled energy and nutritional intake has an impact on athlete performance. Carbohydrates are the main energy source that is essential for athlete performance, while protein plays an important role in muscle recovery. Healthy fats also function as a source of reserve energy, especially in endurance sports (Daulay & Siregar, 2024).

On the other hand, the finding indicates that 3.64% of the population suffers from eating problems highlights a significant public health concern that warrants attention and intervention. This prevalence suggests that a notable segment of the community is grappling with issues that can have profound physical and psychological effects. Factors contributing to these eating problems may include societal pressures, mental health conditions, and inadequate access

to nutritional education (Calheiros, 2024). Addressing this issue requires a multifaceted approach, involving increased awareness, better support systems, and accessible resources to promote healthy eating habits and mental well-being. By recognizing and addressing these challenges, we can work towards reducing the incidence of eating disorders and improving overall health outcomes in the affected population (Irandoust et al., 2024).

The finding that 5.5% of athletes adhere to a rigid diet underscores a noteworthy trend in sports nutrition that may have implications for both performance and health. While strict dietary regimens can be beneficial for optimizing athletic performance and achieving specific goals, this rigidity may also lead to potential risks, including nutrient deficiencies and disordered eating patterns (Dai et al, 2024). Athletes may feel pressured to conform to stringent dietary standards to enhance their competitive edge, which can impact their mental and physical well-being. It is essential for coaches, nutritionists, and sports organizations to promote balanced eating practices that support athletic performance while prioritizing overall health. Encouraging flexibility in dietary habits can help mitigate the risks associated with rigid dieting and foster a more sustainable approach to nutrition in athletics.

We found that 38.18% of athletes engage in sports-related weight control strategies. This reveals a common yet concerning practice within the athletic community. Among these, 5.45% reported using fasting as a method, while another 5.45% restricted specific food intakes, indicating a trend toward extreme dietary behaviors that could negatively impact both performance and health. Such practices may stem from pressures to meet weight categories or aesthetic standards in certain sports, potentially leading to unhealthy relationships with food and body image (Jordan, 2024). It is crucial for coaches and sports organizations to promote healthier weight management strategies that focus on balanced nutrition and overall well-being, rather than short-term, restrictive measures. Educating athletes about the potential risks associated with extreme dieting can help foster a more positive and sustainable approach to weight control in sports (Martin-Rodriguez et al., 2024).

The analysis of energy intake and expenditure among athletes reveals an average energy intake of 2,273.76 calories, with macronutrient distribution showing an average carbohydrate intake of 288.14 grams, protein intake of 88.68 grams, and fat intake of 86.71 grams. Notably, the average energy expenditure was significantly lower at 1,708.21 calories, suggesting that many athletes may be consuming more energy than they are expending. This discrepancy raises concerns about potential weight gain or challenges in achieving optimal body composition, particularly for those with a fat-free mass of 39.59 kg. It underscores the importance of individualized nutrition plans that align energy intake with expenditure to support performance goals while

maintaining overall health. Additionally, this data highlights the need for athletes to be educated on appropriate macronutrient ratios to ensure they meet their specific energy demands without compromising their training outcomes.

The finding that 3.64% of athletes experience menstrual disorders highlights a critical area of concern within the athletic population, as such conditions can significantly impact both physical health and performance. Menstrual irregularities are often linked to energy imbalance, stress, and inadequate nutrition, which are common issues among athletes (Witkoś et al., 2024). Furthermore, the observation that 36.36% of those with fat-related components sustained injuries indicates a potential relationship between body composition and injury risk. This suggests that athletes who may be overly focused on maintaining low body fat could be inadvertently compromising their physical resilience (Forelli et al., 2024). Besides, these findings underscore the need for a holistic approach to athlete care, emphasizing proper nutrition, regular health monitoring, and education on the importance of maintaining a healthy body composition to support both menstrual health and injury prevention.

Athletes need to be supervised and guided in light of the energy availability component data, which includes average energy intake, energy expenditure, and fat-free mass. One possible course of action is to educate young female athletes from Papua about FAT and their energy requirements. It is crucial to carry out additional study that looks at bone density and uses a larger sample.

CONCLUSION

In general, it can be concluded that an average energy intake of female athletes was 2273.76 calories, with an average carbohydrate intake of 288.14 grams, a protein intake of 88.68 grams, and a fat intake of 86.71 grams. The percentage of fulfilment respectively was 87%, 77%, 93.34% and 98%. The average energy expenditure is 1708.21 calories, and the fat-free mass is 39.59.

ACKNOWLEDGMENTS

We would like to thank you the research and community service institution of Cenderawasih University for the financial support with contract number 315/UN20.2.1/PG/2024.

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