

RESEARCH STUDY

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The Examination of the Knowledge Level of Young Papuan Female Athletes about Female Athletes Triad (FAT)

Gambaran Pengetahuan Atlet Remaja Putri Papua mengenai Female Athletes Triad (FAT)

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ABSTRACT

Background: Female Athletes Triad (FAT) is a syndrome characterized by impaired energy availability, menstrual dysfunction, and low bone density. FAT might interfere with the health and performance of young female athletes in training and competition, which causes a decrease in achievement. Research on FAT is still limited in Indonesia, especially on indigenous Papuans.

Objectives: To obtain a description of young Papuan female athletes' knowledge of FAT, including the three main components of FAT: danger, impacts, and risk factors for FAT.

Methods: The total sample was 61 young female athletes with a convenience sampling technique. The survey method used a questionnaire consisting of questions related to athlete characteristics (age, ethnicity, training duration, and sports) and eight questions about FAT knowledge; it includes the three main components of FAT (osteoporosis, menstrual disorders, eating disorders), dangers and impacts, and the risk factors (age and physical activity).

Results: Young Papua female athletes (80.33%) lacked knowledge about FAT. Most athletes (80.33%) had never heard of FAT. Most of the sample failed to identify FAT's three main components and risk factors correctly. Only five athletes (8.20%) correctly answered questions about fracture occurrence. Only six athletes (9.84%) could identify FAT components entirely and correctly, and about 11 (18.30%) answered correctly regarding the risk of excessive physical activity in athletes. Finally, only 23 athletes (37.70%) correctly answered questions about age.

Conclusions: Young female Papuan athletes lack knowledge about the FAT components and risk factors.

INTRODUCTION

In recent years, several factors have been found to significantly contribute to the history of sport in Indonesia, including the surge in Indonesian female athletes participating in various sporting activities. This situation marked a significant shift from when women's involvement in sports was limited. Currently, the number of female athletes engaging in sports has increased¹, fostering an environment where both males and females have the same potential to excel in national and international events. This positive change resulted in a viral trend of "celebrity athletes," thus leading to the perception that being an athlete is a promising career choice. In 2021, Indonesian female athletes gained well-deserved recognition for their impressive achievements. A touching moment during the 2020 Tokyo Olympic

Games was when Greysia Polii and Apriyani Rahayu proudly raised the flag of Indonesia, symbolizing their success and dedication to the respective sports they were engaged in.

Recently, the president of Indonesia approved Papua as a sports province in the country. This was primarily because of the successful hosting of the area's 20th National Sports Week (PON XX Papua 2021). Papua was successful as an organizer and in terms of sports achievement. The province ranked 4th in the championship, securing an impressive medal tally of 93 gold, 66 silver, and 102 bronze medals². This triumph was a historic moment for the region with around 923 Papuan athletes, including 387 female athletes, specifically indigenous Papuan female athletes^{2,3}.

The recognition of Papua as a sports province showcases its significant progress, even though the area is undeveloped in Indonesia. The area has abundant natural resources, featuring unique landscapes with beaches, valleys, lakes, and hills. Furthermore, intertwined with nature, the Papuan lifestyle promotes physical activity and fosters physical strength and the natural talent for sports among its people⁴. The geographical and ecological aspects of the area have undoubtedly contributed to nurturing the innate sports talents of its indigenous, making sports an integral part of their lives. Accordingly, it is evident that the successful PON XX Papua further accelerated the development of sports potential in the region³.

This region has a rich heritage of producing remarkable athletes, as evidenced by historical records. These athletes have consistently achieved notable success at both national and international levels, particularly in football, athletics, and rowing⁴. Additionally, it is imperative to cultivate sports talent from an early age by leveraging sports sciences, including medicine, physiology, nutrition, biomechanics, psychology, coaching, and research⁵ to facilitate optimal development. Regardless of the potential and achievements of female athletes, they usually face unique challenges. These challenges include complex nutritional and health issues arising from excessive exercise, commonly known as Female Athletes Triad (FAT)^{6,7}.

FAT is characterized by impaired energy availability, menstrual dysfunction, and decreased bone density^{6,8}. Globally, the syndrome is often found in active adolescent girls with a prevalence rate of 40-60%^{6,9}. Desai & Prajal (2020) discovered that 49.5% of female athletes in India were not aware of the syndrome¹⁰. Although data on FAT in Indonesia remains limited, several research reports reported tendencies ranging from 1.1% to 11.54% in the high category and >11.54% in the very high category^{11,12}. Understanding that research on Papuan female athletes is still limited is expedient. Most of this research focused primarily on general aspects such as physical and psychological conditions^{13,14}, personality traits¹⁵, the mentality of the athletes¹⁶, psychological profile¹⁷, and anxiety and aggressiveness¹⁸. Therefore, information regarding young female athletes is unavailable.

Given its significant impact on female athletes, the syndrome can impede training and performance, leading to a decrease of approximately 9.8% in different competitive individuals. Managing FAT is a complex task requiring the collaboration of the athletes with various sports sciences professionals, such as doctors, nurses, nutritionists, coaches, and psychologists, through personalized approaches and early treatment^{6,19,20,21}. This syndrome, if not addressed, will hamper sports coaching programs that demand substantial investments and potentially hinder the development of natural athletic talent in Papuan. Therefore, this research aims to obtain a comprehensive description of the knowledge level of young Papuan female athletes regarding FAT. It serves as a crucial initial step for preventing, detecting, and treating FAT in Papua. Furthermore, the results can

contribute valuable insights to address research gaps and aid in planning achievement development programs for the athletes, specifically those belonging to the indigenous community.

METHODS

This observational research was conducted using a cross-sectional survey design in Jayapura City, Papua. Furthermore, it involved a total sample size of 61 young Papuan female athletes selected from the Student Sports Education and Training Center of Papua Province (PPLP) and various sports clubs. The athletes were selected from a diverse range of games, such as hockey, outdoor volley, football, basketball, tennis, cycling, rowing, weightlifting, and athletics, as well as martial sports such as judo, martial arts, wrestling, boxing, karate, and taekwondo. As mentioned earlier, a convenience sampling technique was used to select the participants from the two locations where most young female athletes trained. Data were collected using a questionnaire adapted from research conducted by Jafar (2021). The questionnaire comprised eight questions that focused primarily on assessing the knowledge level of the athletes about the three main components of FAT (osteoporosis, menstrual disorders, and eating disorders), its impacts, and the associated risk factors²² (intensive physical activity, age, and stress fracture). To determine the knowledge category of each participant, this research employed the classification method proposed by Budiman and Riyanto (2013). Using this method, the data on the knowledge level obtained were divided into two categories, namely "good knowledge" and "lack of knowledge". "Good knowledge" was assigned when the total score exceeded the median, while "lack category" was designated when the score was less than or equal to the median. Furthermore, the data related to the athletes' knowledge was analyzed using descriptive statistics with univariate analysis. In this situation, the SPSS program was used to determine the mean, standard deviation, and frequency. The categorical data were then presented in the form of frequency and proportion. It is crucial to note that this research has been approved by the Health Research Ethics Committee at the Health Polytechnic of Jayapura with Ethical Clearance number 125/KEPK-J/VII/2022.

RESULTS AND DISCUSSION

This research comprised 61 young Papuan female athletes actively training at various sports clubs in Jayapura City and PPLP in Papua Province. Data collection for the research was carried out over a period spanning from August 3 to September 30, 2022. Accordingly, the collected data underwent descriptive analysis to provide comprehensive insights, and the detailed results are presented below.

Characteristics of Subjects

The research samples comprised young female athletes who were part of PPLP in Papua Province. The samples' characteristics include age, ethnicity, training duration, and sports, as shown in Table 1.

Table 1. Characteristics of Subjects

Characteristics of Subject	Mean±SD	Frequency (n)	Percentage (%)
Age	14.74±1.84		
Ethnicity			
Papuan		53	86.89
Non-Papuan		8	13.11
Training Duration			
< 1 year		31	50.82
1 year		15	24.59
2 years		6	9.84
> 3 years		9	14.75
Sports			
Hockey		9	14.75
Tennis Court		4	6.56
Outdoor Volley		1	1.64
Judo		2	3.28
Athletics		12	19.67
Martial arts		4	6.56
Football		1	1.64
Cycling		2	3.28
Rowing		5	8.20
Wrestling		1	1.64
Boxing		4	6.56
Basketball		6	9.84
Karate		3	4.92
Weightlifting		2	3.28
Taekwondo		3	4.92
Total		61	100

Table 1 shows a comprehensive overview of each respondent's average age, ethnicity, and length of practice. It also presents the distribution of sports among a total of 61 athletes. The average age of respondents was 14.74±1.84 years old, with the youngest being ten and the oldest 20 years old. Regarding ethnicity and training duration, approximately 86.89% of the athletes were Papuan, while 50.82% had trained for less than one year. Only nine athletes had undergone training for three or more years. Furthermore, when examining the distribution of sports among the samples, the athletes

involved in athletics held the highest percentage (19.67%).

Description of Knowledge of FAT

The knowledge assessment on FAT consisted of 3 main components: the associated dangers, impacts, and risk factors. In this situation, participants were asked eight questions, each with a dichotomous response format of “yes” or “no” and “true” or “false”. Table 2 presents the detailed questions included in the knowledge assessment.

Table 2. Knowledge on FAT

Question Topics	Response	Total	Percentage (%)
Have you ever heard about FAT	Yes	12	19.67
	No	49	80.33
Bone fractures occur in FAT	True	5	8.20
	False	56	91.80
FAT is a serious health problem	True	40	65.57
	False	21	32.79
Women over 25 were not at risk of FAT	True	23	37.70
	False	38	62.30
FAT remained after not becoming an athlete	True	42	68.85
	False	19	31.15
Eating disorders occur in FAT	True	46	75.41
	False	15	24.59
High-risk athlete group developing FAT	True	11	18.03
	False	50	81.97
Component FAT are osteoporosis, menstrual disorders, eating disorder	True	6	9.84
	False	54	88.52
Total		61	100

Abbreviation:

FAT = Female Athletes Triad

Table 2 presents the knowledge assessment results regarding FAT among young Papuan female athletes. The results showed that approximately 80.33% of participants were unaware of the syndrome. Following this, only 8.20% correctly acknowledged that bone fracture is an occurrence associated with FAT. Regarding the dangers posed, about 65.57% of the athletes agreed that the syndrome is dangerous and a serious problem, acknowledging its potential implications on health and performance. It was also observed that approximately 62.30% of the athletes believed that women over 25 years were not at risk of FAT, and 68.85% stated that the syndrome persists even after an infected person stops being an athlete. Furthermore, 75.41% answered correctly that eating disorders are part of this condition, indicating a better understanding of this aspect. Apart

from the results, it is crucial to note that most respondents provided incorrect answers about the high-risk group (81.97%) and the main components of FAT (88.52%), highlighting the need for improved knowledge in these areas.

FAT Knowledge Category

The knowledge score for each participant was determined by assigning points based on their responses to the eight questions related to FAT. For each correct answer, a certain number of points were allocated, and all the obtained points from every question were summed up. After calculating the total score for each participant, the scores were categorized into two main groups, namely "good knowledge" and "lack of knowledge".

Table 3. FAT Knowledge Category

Knowledge of the Athletes	Total	Percentages (%)
Good	12	19.67
Lack	49	80.33
Total	61	100

The table above shows that approximately 80.33% of the athletes lacked knowledge about FAT, while only 19.67% indicated accurate knowledge of the subject matter. This research aimed to examine the knowledge level of Papuan female athletes concerning FAT. Accordingly, the obtained results showed that most participants lacked awareness and understanding of the syndrome, with more than half indicating total unawareness, highlighting a significant knowledge gap.

Specific aspects of FAT were examined, and the following results were obtained. First, only 8.20% of the athletes correctly answered questions related to fracture occurrence in FAT, and merely 9.84% could accurately identify all three syndrome components. Furthermore, 18.30% of the participants recognized the risk associated with high physical activity in athletes, and only 37.70% could correctly answer questions related to age and its relation to FAT.

Regarding sample characteristics, this research involved predominantly (86.89%) indigenous Papuan athletes with an athletic background. The average age of the participants was 14.74 years old, and they mostly had a training duration of less than one year. FAT is characterized by three interrelated conditions, namely menstrual disorders, eating disorders, and osteoporosis. It is crucial to understand that several risk factors are associated with various syndrome components, including the type of exercise, psycho-social problems, dietary and nutritional issues, body image, and training regimen, as described in multiple evidence-based reviews of medical history²³. Accordingly, research in other regions showed that elite female athletes in Pakistan had a high risk of experiencing eating disorders^{18,21}, and endurance athletes aged 18 to 38 years were reported to experience the totality of the syndrome²³.

Female athletes across various sports and levels of competition are at risk of FAT syndrome, with those

engaging in endurance sports having the highest risk. Aesthetics sports athletes, particularly those focusing on leanness, are also prone to FAT due to concerns about shape and weight. This leads to abnormal eating habits and potential deviations in eating behavior, resulting in decreased bone mass and an increased risk of bone fracture. While the role of ethnicity and race in contributing to the occurrence of FAT is still debated, previous research showed that low energy availability was found both in African-black and African-American athletes²⁴. Moreover, Caucasian athletes have been found to have a higher risk of menstrual dysfunction and energy deficiency²⁵.

The results showed that the majority of female athletes lacked knowledge about FAT, and this was consistent with previous research showing poor knowledge among athletes and coaches^{26,27,28}. General knowledge about nutrition among athletes, coaches, and sports specialists had also been reported to be inadequate^{29,30} possibly due to the limited access to research-based nutrition information, specifically when licensed sports nutritionists were not available as part of the sports science team. The athletes must have a good understanding of FAT components as this will enable early recognition of the syndrome and foster the immediate action of appropriate prevention measures³¹.

The results also showed that a significant portion of the athletes, approximately 80.33%, were unaware of FAT. Additionally, most participants failed to identify the main component of FAT and the associated risk factors. The results align with previous research conducted among sports students^{28,31} and athletes^{26,22,32}, indicating limited awareness of FAT-related aspects. While the majority of the respondents correctly recognized the dangers of FAT and the presence of eating disorders, it is expedient to understand that inadequate nutritional knowledge and understanding of good eating habits and

nutrient benefits could lead to intelligence and productivity issues. Research conducted by Nugroho & Purwanto (2020) on sports students also highlighted a notable risk of experiencing the syndrome and a lack of knowledge and information^{33,34}.

The global prevalence of FAT syndrome in female athletes was reported to be relatively high, ranging from 40 to 60%. This prevalence could be attributed to the lack of knowledge about FAT, as observed from the research on female swimmers in KwaZulu-Natal²⁷. The research also found that athletes in various sports had limited access to appropriate healthcare choices, pinpointing the necessity to initiate further evaluation and preventive measures to address metabolic progression and decline associated with FAT⁶. According to Lawrence Green's theory, knowledge is one of the perceived factors that can be targeted to deal with health problems related to health behavior³⁴. Therefore, interventions aimed at improving sports nutrition knowledge and behavior in female endurance athletes with relative energy deficiency in sports have shown positive results³⁵. Previous research showed that collaboration with policymakers in health education or dissemination was beneficial in increasing health knowledge and awareness while minimizing the consequences of the syndrome³⁶.

Eating disorders are closely related to health behavior, and they can manifest in the form of anorexia and bulimia nervosa³⁷. Combat sports athletes, in particular, have a higher risk of developing FAT due to severe weight-cutting behaviors³⁸. Various research showed that female athletes often struggle to meet their nutritional and energy needs both from macronutrients and micronutrients, and this has led to health problems related to low energy availability and poor performance (EA)¹⁹. It is crucial to understand that adequate nutrition is vital for adolescent growth and optimal performance in sports^{39,40}. FAT is dangerous, and each of its components has significant health implications, among which are morbidity and mortality³⁸. Moreover, nutritional knowledge among athletes is crucial as it influences food selection, eating frequency, habits, and body weight control, ultimately affecting physical condition, fitness, and optimal performance⁴¹.

FAT has an impact not only on sports performance but also on daily life activities and mental health. The collected data underwent descriptive analysis to provide comprehensive insights. The detailed results are presented below. Additionally, FAT can have a detrimental impact on the mental health of the athletes, leading to stress and pressure from coaches and their social environment during training and competition. This situation also has the potential to affect their dietary intake⁴². The consequences of the syndrome include eating disorder patterns, mental health-related conditions, osteoporosis⁴³, and potential effects on future pregnancy⁴⁴.

CONCLUSIONS

In conclusion, the results showed that young Papuan female athletes had a significant lack of knowledge regarding FAT, with the majority unaware of its existence. Moreover, many of the athletes failed to accurately identify the components of the syndrome and

its associated risk factors. To address this issue and promote early prevention and management of FAT, it was crucial to implement educational initiatives targeted at young Papuan female athletes, coaches, and parents. To gain further insights and advance knowledge in the area, it was recommended that future research should be conducted using a larger sample. They can also explore additional aspects, such as signs and symptoms of FAT in athletes, variables related to physical activities, and anthropometric data.

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Conflict of Interest and Funding Disclosure

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REFERENCES

1. Jeanes, R. *et al.* Gender Relations, Gender Equity, and Community Sports Spaces. <https://doi.org/10.1177/0193723520962955> **45**, 545–567 (2020).
2. REFLEKSI PON XX DAN PEPARNAS XVI PAPUA. *Refleksi PON XX dan Peparناس XVI Papua* 135–141 (2021) doi:10.31219/OSF.IO/UQ7M3.
3. Guntero, T. S. *et al.* PON XX Papua: Bagaimana persepsi masyarakat terhadap dampak yang ditimbulkan? *Jorpres (Jurnal Olahraga Prestasi)* **18**, 29–39 (2022).
4. Ita, S. Pemetaan Olahraga Unggulan Papua Berbasis Wilayah Adat. *Altius: Jurnal Ilmu Olahraga dan Kesehatan* **6**, (2017).
5. Rohendi, A. & Rustiawan, D. H. Kebutuhan Sport Science Pada Bidang Olahraga Prestasi. *JOURNAL RESPECS* **2**, 30–45 (2020).
6. Daily, J. P. & Stumbo, J. R. Female Athlete Triad. *Primary Care - Clinics in Office Practice* **45**, 615–624 (2018).
7. Cardozo, E. & Gluck, A. *The Female Athlete. Essential Sports Medicine* (Springer, Cham, 2021). doi:10.1007/978-3-030-64316-4_20.
8. Statuta, S. M., Wood, C. L. & Rollins, L. K. Common Medical Concerns of the Female Athlete. *Primary Care - Clinics in Office Practice* **47**, 65–85 (2020).
9. Human Physiology: From Cells to Systems. *Cengage Learning*, 1–912 Preprint at (2015).
10. Desai, M., Prajal, R. & Intern, B. Awareness of the Female Athlete Triad in Female Athletes. *Journal of Exercise Science & Physiotherapy* **16**, 1 (2020).
11. Pratama, K. W. & Rismayanthi, C. Identifikasi Female Athlete Triad (FAT) Pada Atlet Persatuan Angkat Besi, Berat, Dan Binaraga Seluruh Indonesia (PABBSI) DIY. *MEDIKORA* **11**, (2013).
12. Corlesa, G. J. Hubungan Jenis Olahraga dengan Stratifikasi Risiko Female Athlete Triad pada Atlet Remaja Perempuan di Pusat Pendidikan dan Latihan X = Associations Between Type of Sports and Female Athlete Triad Risk Stratification in

- Adolescent Female Athletes at Educa. (Universitas Indonesia, 2019).
13. Putra, M. F. P. & Ita, S. Gambaran kapasitas fisik atlet Papua: Kajian menuju PON XX Papua. *Jurnal Keolahragaan* **7**, 135–145 (2019).
 14. Guntoro, T. S., Muhammad, J. & Iy Qomarrullah, R.'. Faktor kemampuan fisik dan psikologis penunjang keterampilan atlet elit sepakbola Propinsi Papua. *Jurnal SPORTIF: Jurnal Penelitian Pembelajaran* **6**, 390–406 (2020).
 15. Guntoro, T. S., Kurdi, K. & Putra, M. F. P. Karakter kepribadian atlet Papua: kajian menuju POPNAS ke-XV. *Jurnal SPORTIF: Jurnal Penelitian Pembelajaran* **6**, 40–58 (2020).
 16. Sutoro, S., Setyo Guntoro, T., Fariz, M. & Putra, P. Mental atlet Papua: Bagaimana karakteristik psikologis atlet atletik? *Jurnal Keolahragaan* **8**, 63–76 (2020).
 17. Dongoran, M. F., Kalalo, C. N. & Syamsudin. Profil Psikologis Atlet Pekan Olahraga Nasional (PON) Papua Menuju PON XX Tahun 2020. *Journal Sport Area* **5**, 13–21 (2020).
 18. Fadli Dongoran, M., Lewar, E., Yuli Satria, G. & Ibrahim. Analisis tingkat kecemasan dan agresivitas atlet olahraga beladiri pon papua. *Journal Of Sport Education (JOPE)* **3**, 113–126 (2021).
 19. Gastrich, M. D., Quick, V., Bachmann, G. & Moriarty, A. M. D. Nutritional Risks Among Female Athletes. *J Womens Health* **29**, 693–702 (2020).
 20. De Souza, M. J., Koltun, K. J., Etter, C. V. & Southmayd, E. A. Current Status of the Female Athlete Triad: Update and Future Directions. *Curr Osteoporos Rep* **15**, 577–587 (2017).
 21. Syed, J. et al. Prevalence of Risk Factors of the Female Athlete Triad among Young Elite Athletes of Pakistan. *Int J Sports Phys Ther* **17**, 210 (2022).
 22. Jafar, F. & Yk, M. Knowledge and Attitude Towards Female Athlete Triad among University Female Athletes. *Annals Medicine Health Science and Research* **11**, 1-8 (2021).
 23. Melin, A. et al. The LEAF questionnaire: a screening tool for the identification of female athletes at risk for the female athlete triad. *Br J Sports Med* **48**, 540–545 (2014).
 24. Tosi, M., Maslyanskaya, S., Dodson, N. A. & Coupey, S. M. The Female Athlete Triad: A Comparison of Knowledge and Risk in Adolescent and Young Adult Figure Skaters, Dancers, and Runners. *J Pediatr Adolesc Gynecol* **32**, 165–169 (2019).
 25. Mountjoy, M. et al. The IOC consensus statement: beyond the Female Athlete Triad—Relative Energy Deficiency in Sport (RED-S). *Br J Sports Med* **48**, 491–497 (2014).
 26. Brown, K. N., Wengreen, H. J. & Beals, K. A. Knowledge of the Female Athlete Triad, and Prevalence of Triad Risk Factors among Female High School Athletes and their Coaches. *J Pediatr Adolesc Gynecol* **27**, 278–282 (2014).
 27. Seals, E. An Exploration Into The Knowledge, Understanding And Management Of The Female Athlete Triad And The Triad Risk Factors Among Elite Swimmers In Kwazulu-Natal (KZN). 1–78 Preprint at (2022).
 28. Pantano, K. J. Knowledge, Attitude, and Skill of High School Coaches with Regard to the Female Athlete Triad. *J Pediatr Adolesc Gynecol* **30**, 540–545 (2017).
 29. Lodge, M. T., Ackerman, K. E. & Garay, J. Knowledge of the Female Athlete Triad and Relative Energy Deficiency in Sport Among Female Cross-Country Athletes and Support Staff. *J Athl Train* **57**, 385–392 (2022).
 30. Beaudry, A. G. et al. Female Athlete Triad Recognition and Knowledge of Collegiate Cross-Country Coaches. *Journal of Women's Sports Medicine* **2**, 112–124 (2022).
 31. Kumari, R. & Bhalla, S. Female athlete triad syndrome and physical Education: Causes, components & treatment. ~ 113 ~ *International Journal of Physical Education, Sports and Health* **9**, 113–115 (2022).
 32. Cameron, J. Preparing for the Game, Eating for Life: A Review of the Female Athlete Triad and Nutrition Deficiencies Amongst High Level Athletes. *Honors Senior Theses/Projects* (2021).
 33. Adelina Elsa Damayanti. Hubungan Citra Tubuh, Aktivitas Fisik, Dan Pengetahuan Gizi Seimbang Dengan Status Gizi Remaja Putri. (Universitas Airlangga, 2016).
 34. Nugroho, A. S. & Purwanto, B. Gambaran Risiko Terjadinya Gangguan Female Athlete Triad Syndrome pada Mahasiswi Olahraga. *JOSSAE (Journal of Sport Science and Education)* **5**, 104–115 (2020).
 35. Al Daccache, M. & Bardus, M. PRECEDE-PROCEED Model. *The Palgrave Encyclopedia of Social Marketing* **4**, 1–4 (2022) doi:10.1007/978-3-030-14449-4_143-1.
 36. Fahrenholtz, I. L. et al. Effects of a 16-Week Digital Intervention on Sports Nutrition Knowledge and Behavior in Female Endurance Athletes with Risk of Relative Energy Deficiency in Sport (REDs). *Nutrients* **2023**, Vol. 15, Page 1082 **15**, 1082 (2023).
 37. Williams, N. I., Koltun, K. J., Strock, N. C. A. & De Souza, M. J. Female athlete triad and relative energy deficiency in sport: A focus on scientific rigor. *Exerc Sport Sci Rev* **47**, 197–205 (2019).
 38. İnce Yenilmez, M. & İnce Palamutoğlu, M. Critical thoughts and insights on the female athlete triad: Precedents, existing challenges and prospects. *Journal of Management Information and Decision Sciences* **23**, 324–331 (2020).
 39. Purcell, L. Sport nutrition for young athletes. *Paediatr Child Health* **18**, 200–202 (2013).
 40. Arimbi, A., Rahman, A. & Saharullah, S. Pengaturan nutrisi tepat bagi atlet. *Seminar Nasional Pengabdian Kepada Masyarakat* **2018**, (2018).
 41. Faizal, A. & Kusuma, F. Gambaran Faktor - Faktor Penyebab Masalah Berat Badan (Overweight) Atlet Pencak Silat Pada Masa Kompetisi. *Jurnal*

- Ilmiah Sport Coaching and Education* **3**, 65–78 (2019).
42. Oliveira, T. A. P. De, Oliveira, G. L. De, Valentin-Silva, J. R., Dantas, E. H. M. & Filho, J. F. Female athlete triad in high performance sports: Implications from performance and women health. *Journal of Physical Education and Sport* **18**, 2428–2439 (2018).
43. Chamberlain, R. The Female Athlete Triad: Recommendations for Management. *Am Fam Physician* **97**, 499–502 (2018).
44. Brown, K. A., Dewoolkar, A. V., Baker, N. & Dodich, C. The female athlete triad: special considerations for adolescent female athletes. *Transl Pediatr* **6**, 144 (2017).