



RESEARCH PAPER

Safe Practices of Supplements Use as a Protective Factor for Menstrual Symptoms: Insight from Varsity Female Athletes

¹Sahar Fatima, ²Dr. Asif Ali and ³Muhammad Afaq

1. BS Physical Education & Sports Sciences, Government College University Lahore, Punjab, Pakistan.
2. Associate Professor, Department of Physical Education & Sports Sciences, Government College University Lahore, Punjab, Pakistan.
3. M.Phil. Scholar, Department of Physical Education & Sports Sciences, Government College University Lahore, Punjab, Pakistan

Corresponding Author: asif.ali@gcu.edu.pk

ABSTRACT

The study examined the role of supplementation knowledge, attitudes and practices in relation to the menstrual symptoms among the elite female university athletes. By using a cross-sectional design, data was collected from 116 athletes age ranges from 18 to 25 years from 5 different universities in Lahore. The questionnaire utilized were composed of demographics section, the menstrual symptoms questionnaire (MSQ) and the knowledge, attitude and practice (KEP) scale. Regression analysis revealed that while the overall models predict the spasmodic and congestive dysmenorrhea were significant ($p < .001$), only supplementation practices were significant predictor. Higher practices scores were associated with the reduced severity of the spasmodic dysmenorrhea and lower severity of congestive dysmenorrhea whereas knowledge and attitudes showed no significant association. These finding highlighted that the consistent and safe supplementation practices rather than awareness or perception alone serve as a protective factor against the menstrual symptoms among the female athletes. This stressed the necessity for behavior focused interventions and the professional guidance to promote the evidence-based supplementation practices that can support both menstrual health and the athletic performance in the female athletes.

KEYWORDS Supplementation Practices, Menstrual Symptoms, Female Athletes, Dysmenorrhea

Introduction

Menstrual problems are among of a most common gynaecological concern that is faced by a woman of reproductive age, which includes “amenorrhea, dysmenorrhea, delayed menarche, oligomenorrhea, and menorrhagia” (Attia et al., 2023; Pogodina et al., 2022). Such problems are more particularly seen and prevalent among the females of young age especially those in the university age range of 18 to 25 years which is a period when reproductive and hormonal functions are still stabilizing (Kahal et al., 2024). Female athletes are at even the greater risk as they do intense physical training, low energy availability and the composition of the body factors that have been linked with the irregularities in the cycle and menstrual dysfunction (Grabia et al., 2024). Several studies across different disciplines of sports showed a wide range of variation in the prevalence of menstrual disorders ranging from 0% to 61% depending upon the type of sport and diagnostic criteria that is been used (Gimunova et al., 2022). For example, in the UK, about 30% of athletes reported irregular menstrual Cycles, whereas 68% of the sample reported dysmenorrhea and 31% reported menorrhagia (Bruinvels et al., 2021). Similarly, a study conducted in USA among the female athletes of the university found that 47% of the athlete’s experience irregularities in menstrual Cycles by including primary amenorrhea, oligomenorrhea and secondary amenorrhea along with dysmenorrhea being reported commonly in otherwise regular Cycles (Cheng et al., 2021). Sum of all, these studies

highlighted that menstrual problems are prevalent among university aged female athletes however their frequency and severity vary by the sports type, the age and a load of training (De Souza et al., 2019).

Such kind of menstrual problems can have a significant consequence across physical psychological and social domain which affects both the general population and the athletic population (Odongo et al., 2023; Pogodina et al., 2022). Physically, menstrual dysfunction such as amenorrhea is linked to reduce bone mineral density and it increases the risk of osteoporosis and fractures particularly among the young woman where the estrogen deficiencies can impair the peak bone mass formation (Behary & Comminos, 2022; Indirli et al., 2022). In addition, there were many other conditions such as fatigue, metabolic disorder, altered cardiovascular roles and impaired glucose metabolism that are being associated with chronic menstrual irregularities among women (Kochhar & Ghosh, 2022; van Iersel et al., 2016). Psychologically, dysmenorrhea and irregularities in menstrual Cycles are correlated with the conditions like elevated anxiety, depression, mood instability, poor sleep quality, loneliness and overall reduced quality of life (Kochhar & Ghosh, 2022; Odongo et al., 2023; Sundari et al., 2022). Socially and academically, the menstrual irregularities including the menstrual pain and heavy bleeding can interfere towards poor academic concentration and poor social participation among the university students which will ultimately turns into the poor psychological health (Alsaleem, 2018). Among athletes these issues further effect the training capacity, its recovery period, consistency in performance and increase risk of injuries especially when combined with the low energy availability (Mountjoy et al., 2018). So therefore, among the university female athletes, the menstrual irregularities and problems may result in poor bone health, higher psychological distress and a compromised academic as well as athletic performance.

Nutritional supplementations are seen as potential means to lower some of the menstrual problems in young adults when used properly and appropriately under the supervision of a medical professional (Brown et al., 2023). Female athletes frequently use the supplements such as multi-vitamins, calcium, vitamin D protein and iron with the prevalence that ranges from 40% to 90% depending upon the nature of sports and the level of competition (Langan-Evans et al., 2024). Significantly, the supplementation that have been prescribed after the proper assessment has shown to yield measurable benefits in the previous studies. For example, a study demonstrated that vitamin D supplementation reduces the severity of pain and menstrual blood loss in the women with dysmenorrhea (Amzajerdi et al., 2023) whereas iron supplementation helps to improve the aerobic capacity, mood and the fatigue among female athletes with iron deficiency (Safa et al., 2024). Moreover, the female athletic triad which shows less energy presences, menstrual dysfunction and minimum gemstones or iron ore density of bone emphasizes the interconnected nature of the nutrition and the reproductive health (Grabia et al., 2024). By addressing the deficiencies of Iron and vitamin D and combining it with optimizing caloric intake can used to improve the menstrual regularity, bone health and athletic recovery (Amzajerdi et al., 2023; Muthukumar et al., 2025). In case of self prescription and unsupervised use of supplements, health risks which underscore the importance of proper consultation with the doctors and sports dietitians (Pengelly et al., 2025). For university female athletes, safe and guided supplementation can thus provide a crucial kind of strategy for preventing or elevating the menstrual irregularities and dysfunction.

Despite of growing recognition of these issues, there remains a research gap as the studies have focus on athletes by leaving less attention to the university athletes including young adults who face unique pressures from academics along with limited medical supervision and varying the level of training intensity. Moreover, menstrual irregularities and supplementation practices have been studied independently each. However, the prior studies have frequently assessed the awareness or perception of supplementation but has paid less attention to whether the behaviors related to engage in the safe supplementation practices can offer measured protection again menstrual symptoms. This is particularly

very important in the regions like Pakistan who are in the developing state where athletes may have less access to qualified nutritionist and gynaecologist and they might face the unsupervised use of supplements. Addressing this gap is very critical for promoting the menstrual health athletic population along with the academics.

Therefore, the current study seeks to investigate the association among the supplementation practices and the menstrual symptoms in university level elite female athletes and provide proper evidence to inform targeted interventions and the health education strategies.

Literature Review

Menstrual irregularities are seen as a prevalent concern among the female athletes particularly among those female athletes who engage in high intensity training and endurance Sports. Gimunova et al. (2022) demonstrated that the menstrual disturbance such as oligomenorrhea and amenorrhea are highly widespread among the female athletes with the prevalence rates of about 0 to 61% depending upon the type of sports and methodology. This variability reflects the influence of energy availability, training load and the sports specific pressures among these population. By complementing these findings, Nabeyama et al. (2023) reported that the iron deficient but known anaemic status is common among the university athletes which might exhibit the menstrual problems and negatively affect the athletic performance of the athlete. Together these studies highlighted that the both menstrual dysfunction and nutritional deficiencies are pressing the health concerns in the university level female athletes that are almost younger adults and this underscore the need for more targeted research on the prevalence and the management strategies within this group.

The consequences of such issues are not only limited to the performance outcomes but these are also extended to health and well-being. For example, Amzajerdi et al. (2023) found that the vitamin D supplementation can significantly reduce this severity of primary dysmenorrhea and lowered analgesic use among young women demonstrating that nutritional intervention can directly mitigate the menstrual pain. Similarly, Safa et al. (2024) revealed that short term iron supplementation can improve the aerobic capacity among the female players by suggesting that the correcting micronutrient deficiencies not only reduces the menstrual related fatigue but also enhance the overall performance in their Sports. These studies emphasized that the menstrual dysfunction and their associated physical symptoms can be addressed through a carefully tailored strategies of supplementation and provide the practical solution for athletes that are struggling with both performance limitations and the menstrual discomfort.

Safe supplementation practices are particularly relevant to the framework of female athlete Triad that in compasses the minimum energy accessibility, menstrual dysfunction and disabled bone health. Grabia et al. (2024) contended that the nutritional management including the supplementation play core role to prevent and treat the Triad related symptoms and maintaining the long-term health. Supporting this another study conducted by Šmid et al. (2024) showed that the oral iron supplementation can affectively improve iron status in the physical active adults with the performance benefits most evident in the Iron deficient individuals. The studies demonstrate that how physician supervised the supplementation can address the deficiencies linked to menstrual problems while it reducing the risks associated with the unsupervised use of supplements.

Recent evidences also suggest that the advances in the supplementation strategies may also improve the efficacy and compliance. Such as a study conducted by Sandroni et al. (2022) found that combining the symbiotic supplementation with iron therapy can improve the absorption and ferritin levels more than iron alone in the female athletes, which offer a novel approach to correcting the deficiencies with the fewer side effects. Similarly, Pengelly

et al. (2025) concluded that the iron supplementation based on laboratory confirmed deficiency can reliably improve the endurance performance and the overall health outcomes of the female adults. These studies not only validate the importance of supplementation in the mitigating menstrual and performance problems but also shown the need for the evidence-based studies. And despite of such findings few studies have clearly examined the relationship among the supplement use and the menstrual outcomes in the university level female athletes and leave a critical gap that the current study will examine.

Materials and Methods

Study design

This study has a quantitative cross-sectional study design, which facilitates collecting data at a certain point from participants while allowing them to consider an easy way of surveying to collect data from both athletes who take supplements or who do not take supplements while being university athletes.

Sample and population

This study included 120 female university athletes aged in between 18 to 25, selected from different departments across 5 universities of Lahore and all of them were national or international level athletes. A purposive sampling technique was used for data collection. Out of 150 elite female athletes from these universities, we successfully took data of only 120 because some of them had scheduling conflicts that prevented them from participating few were uninterested in the study and chose not to respond and some were unavailable. Out of 120, 4 cases were deleted for data normality and 116 were examined. The participants in the study had to be university students enrolled in a four-year BS program, actively part of the university's sports team competing at inter-university, national, or international levels.

Instrument

Data was collected using a questionnaire consisting of the three sections first section was demographic second section was MSQ to assess menstrual problems and third section was KAP to assess supplementation use.

Demographic

The demographic section consists of 15 items including the name of university, age, study program, semester, department, study year, receiving any scholarship, which scholarship, playing experience, which sports, highest level of participation, highest achievement in sports, injury experience, menstrual status and supplement intake status.

Menstrual symptom questionnaire (MSQ)

MSQ, a scale created by Chesney and Tasto (1975), to measure menstrual irregularities. It is composed of 25 questions and is considered a reliable and valid tool to assess menstrual problems in females. The participants require responses ranging from 1 (never) to 5 (always). It has two domains: one is spasmodic dysmenorrhea and other is congestive dysmenorrhea and scoring for each is different also higher scores for spasmodic domain refers to severity while lower scores in congestive domain refers to severity.

Knowledge, Attitude, and Practice (KAP)

KAP scale used to assess the supplementation practices, knowledge and attitude, which was developed by Elshoryi et al. (2023). This scale consists of three subdivisions

which are knowledge, having 6 items attitude having 4 items and practice having 4 items, where participants have to select one of three options yes no or do not know for all of them scored as 1, 0 and 0. Higher scores refer to good knowledge, positive attitude and low-risk and vice versa.

Tool permission

The MSQ and KAP are available on Google scholar and other online sources. To request for a copy of questionnaire and to get permission of these tools a mail was sent to their authors. After they granted permission to use these tools, the questionnaire used was made consisting of demographic section at first then MSQ and KAP at the end.

Data collection

To gather data for this study, participants filled out a self-administered questionnaire. Prior to study, everyone was told that participation was completely voluntary and that their responses would be kept private. The data would be used just for research work and would not share with any third party. Participants were reassured that taking part in the study wouldn't affect them in any way. Before starting, they were encouraged to ask any questions if anything was unclear. The researcher was there to help and make sure everyone understood the questions. Participants were given 20-25 minutes to fill out the questionnaire during in-person meeting.

Data analysis

For data analysis, presenting tools for effective data processing and different statistical analyses, SPSS version 27.0.1 was used, a most common used statistical software. Simple linear regression analysis was applied to data. For prevalence descriptive analysis was done and for association multiple linear regression was applied.

Results and Discussion

Table 1
Summary of ANOVA for regression predicting Spasmodic Dysmenorrhea in Female university athletes

model	variables	Sum of square	df	Mean square	F	P
1	Regression	932.668	3	310.889	12.809	.000
	Residual	2718.367	112	24.271		
	Total	3651.034	115			

Dependent Variable: Spasmodic dysmenorrhea, Predictors: Constant, Practice Global Score, Attitude Global Score, Knowledge Global Score

This table shows the ANOVA results for the regression model predicting spasmodic dysmenorrhea among university female athletes. It suggests that the model was statistically significant ($F= 12.809, P=.000$) with the predictor's knowledge, attitude and practice, when combined, have significant variance proportion with spasmodic dysmenorrhoea which means collectively these independent variables have strong impact to the prediction of spasmodic dysmenorrhea among female university athletes.

Table 2
Simple linear Regression predicting Spasmodic dysmenorrhea in Female university athletes

Model	Variables	B	Std. error	β	t	P
	Constant	40.036	1.458		27.456	.000
	Knowledge	-.057	.424	-.014	-.134	.894
	Attitude	-.290	.499	-.058	-.581	.562
	Practice	-2.097	.491	-.463	-4.271	.000

Note: B= un-standardized error, β = beta, P=significant

Simple linear regression showed that practice score of supplementations ($B=-2.097$, $\beta=-.463$, $t=-4.271$, $P=.000$) was found as significant negative predictor with spasmodic dysmenorrhea, indicated that higher the scores of practices of supplements mean low values of spasmodic dysmenorrhea which leads to less severity. While knowledge factor of supplementation ($B=-0.057$, $\beta = -0.014$, $t= -0.134$, $p = 0.894$) and attitude factor of supplementation ($B= -0.290$, $\beta = -0.058$, $t= -0.581$, $p = 0.562$) did not significantly predict spasmodic dysmenorrhoea. It indicates that participants got high scores, which means low symptoms for spasmodic dysmenorrhea.

Table 3
Summary of ANOVA predicting Congestive Dysmenorrhea in Female university athletes

model	variables	Sum of square	df	Mean square	F	P
1	Regression	887.711	3	295.904	11.705	.000
	Residual	2831.289	112	25.279		
	Total	3719.000	115			

Dependent Variable: Congestive dysmenorrhea, Predictors: Constant, Practice Global Score, Attitude Global Score, Knowledge Global Score

This presents the ANOVA results for the regression model predicting congestive dysmenorrhoea among university female athletes. These results showed statistical significance ($F=11.705$, $P=.000$) of the model, which indicates that these predictors, knowledge, attitude and practice together accounted for significant variance in congestive dysmenorrhoea. Collectively these independent variables have meaningfully contributed to the prediction of congestive dysmenorrhoea.

Table 4
Simple linear Regression predicting congestive Dysmenorrhea in Female university athletes

Model	Variables	B	Std. error	β	t	P
	Constant	30.039	1.488		20.185	.000
	Knowledge	.094	.432	.023	.218	.828
	Attitude	.727	.509	.145	1.429	.156
	Practice	1.737	.501	.380	3.466	.001

Note: B= un-standardized error, β = beta, P=significant

Simple linear regression showed that practice score of supplementations was found as a significant positive predictor ($B=1.737$, $\beta=.380$, $t=3.466$, $P=.001$) congestive dysmenorrhea indicated that higher the score of practice of supplements means high values for congestive dysmenorrhea that leads to less severe symptoms. In contrast, knowledge factor of supplementation ($B=.094$, $\beta=.0432$, $t=.218$, $P=.828$) and attitude factor of supplementation ($B=.727$, $\beta= .145$, $t=1.429$, $P=.156$) were not found significant predictor with congestive dysmenorrhoea. It indicates participants got higher scores which leads to less severe symptoms for congestive dysmenorrhea.

Discussion

The present study examined the association among the supplementation (knowledge, attitudes and practices) with the menstrual problems, especially spasmodic and congestive dysmenorrhea among elite female university athletes. Our research demonstrated that while the overall regression models predict both of the menstrual issues including spasmodic and congestive dysmenorrhea were statistically significant, only the supplementation practices was immersed as an independent predictor. So, the higher practices scores were associated with the lower severity of this spasmodic dysmenorrhea

while they were also significant and related meaningfully to lower severity in congestive dysmenorrhea. In contrast, the supplementation knowledge and the attitudes were not the significant predictors of the menstrual symptoms. These results highlighted the actual behavioral engagement in the supplementation that plays a decisive role in reducing the menstrual discomfort and irregularity among athletes.

These findings are linked to prior studies emphasizing the role of self and supervised supplementation in addressing the menstrual health problems. Amzajerdi et al. (2023) found that the vitamin D supplementation significantly reduced the dysmenorrhea severity and decrease the dependence on analgesics among young women which suggest that the supplementation can directly elevate or reduce the menstrual pain. Same as, another study conducted by Safa et al. (2024) found that the iron supplementation among the female handball players improved the aerobic capacity and reduce the fatigue which is often worsened during menstruation. The finding of our study extended these evidences by showing that the safe supplementation practices might not only improve the overall health and the performance but also directly protect against the menstrual symptom's severity among the university levels elite athletes.

Further evidences highlighted the protective effect of the supplementation that can also be understood within the broader framework of the term female athletic Triad and RED-S. These board frameworks mainly identify the menstrual dysfunction as a key component of the energy imbalance which may be combined by the insufficient nutrient intake as Grabia et al. (2024) noted that the inadequate nutritional intake and the low energy availability are the key drivers for the menstrual dysfunction among the female athletes whereas the safe supplementation can help to mitigate these risks. In addition, Nabeyama et al. (2023) detected that the deficiencies in the micronutrients such as iron and vitamin D are strongly linked with the irregularities in the menstrual Cycles and these can be corrected through the targeted supplementation. So, These findings underscore that while the journal knowledge of the supplementation is very important as it is the translation of this knowledge into safe supervised practice that yield tangible benefits for the menstrual health which is also linked with out result.

Conclusion

In sum, the current study demonstrated that the safe supplementation practices as a protective factor against the menstrual symptoms among the university's elite female athletes. Unlike knowledge and the attitudes, it is the consistent practice of supplementation that significantly reduces or lower this severity of spasmodic and congestive dysmenorrhea. These findings emphasized the importance of spreading the awareness into supervised and evidence-based practices of supplementation to safeguard the menstrual health and support the athletic performance.

Implications

From a practical viewpoint, the findings of our study suggested that the Sports plans should be prioritise behavior focus strategies over the knowledge-based interventions alone. The athlete's education movements must be coupled with the personalized supervised supplementation plan that address the individual nutritional deficiencies. Sports coaches, dietitians and the sports Physicians should cooperate and ensure that the female athletes should receive the evidence-based supplementation guidance which not only reduces the severity of the menstrual irregularities and the symptoms but also supports them in the overall athletic performance and well-being.

Future Recommendations

The future research should be built on these findings by employing the other research designs including the longitudinal or experimental designs to explore the Casual pathways between the supplementation practices and the menstrual outcomes. The studies should also focus on identifying the most of the effective types and the doses of the supplements, for example: iron, vitamin D, calcium and Omega 3 fatty acids that directly elevate or mitigate the menstrual symptoms among the female athletes. Moreover, the studies in future can be expanded in the diverse athletic population such as recreational and professional athletes of one sport.

References

- Alsaleem, M. A. (2018). Dysmenorrhea, associated symptoms, and management among students at King Khalid University, Saudi Arabia: An exploratory study. *Journal of family medicine and primary care*, 7(4), 769-774.
- Amzajerdi, A., Keshavarz, M., Ghorbali, E., Pezaro, S., & Sarvi, F. (2023). The effect of vitamin D on the severity of dysmenorrhea and menstrual blood loss: a randomized clinical trial. *BMC women's health*, 23(1), 138.
- Attia, G. M., Alharbi, O. A., & Aljohani, R. M. (2023). The impact of irregular menstruation on health: a review of the literature. *Cureus*, 15(11).
- Behary, P., & Comminos, A. N. (2022). Bone perspectives in functional hypothalamic amenorrhoea: an update and future avenues. *Frontiers in Endocrinology*, 13, 923791.
- Brown, N., Martin, D., Waldron, M., Bruinvels, G., Farrant, L., & Fairchild, R. (2023). Nutritional practices to manage menstrual cycle related symptoms: a systematic review. *Nutrition research reviews*, 1-24.
- Bruinvels, G., Goldsmith, E., Blagrove, R., Simpkin, A., Lewis, N., Morton, K., Suppiah, A., Rogers, J. P., Ackerman, K. E., & Newell, J. (2021). Prevalence and frequency of menstrual cycle symptoms are associated with availability to train and compete: a study of 6812 exercising women recruited using the Strava exercise app. *British journal of sports medicine*, 55(8), 438-443.
- Cheng, J., Santiago, K. A., Abutalib, Z., Temme, K. E., Hulme, A., Goolsby, M. A., Esopenko, C. L., & Casey, E. K. (2021). Menstrual irregularity, hormonal contraceptive use, and bone stress injuries in collegiate female athletes in the United States. *Pm&r*, 13(11), 1207-1215.
- Chesney, M. A., & Tasto, D. L. (1975). The development of the menstrual symptom questionnaire. *Behaviour Research and therapy*, 13(4), 237-244.
- De Souza, M. J., Koltun, K. J., & Williams, N. I. (2019). The role of energy availability in reproductive function in the female athlete triad and extension of its effects to men: an initial working model of a similar syndrome in male athletes. *Sports Medicine*, 49(Suppl 2), 125-137.
- Elsahoryi, N. A., Odeh, M. M., Jadayil, S. A., McGrattan, A. M., Hammad, F. J., Al-Maseimi, O. D., & Alzoubi, K. H. (2023). Prevalence of dietary supplement use and knowledge, attitudes, practice (KAP) and associated factors in student population: A cross-sectional study. *Heliyon*, 9(4).
- Gimunova, M., Paulinyova, A., Bernacikova, M., & Paludo, A. C. (2022). The prevalence of menstrual cycle disorders in female athletes from different sports disciplines: a rapid review. *International journal of environmental research and public health*, 19(21), 14243.
- Grabia, M., Perkowski, J., Socha, K., & Markiewicz-Żukowska, R. (2024). Female athlete triad and relative energy deficiency in sport (REDs): nutritional management. *Nutrients*, 16(3), 359.
- Indirli, R., Lanzi, V., Mantovani, G., Arosio, M., & Ferrante, E. (2022). Bone health in functional hypothalamic amenorrhea: What the endocrinologist needs to know. *Frontiers in Endocrinology*, 13, 946695.

- Kahal, F., Alshayeb, S., Torbey, A., Al Helwani, O., Kadri, S., Helwani, A., Al-Habal, S., Moufti, M., Johari, M., & Al Darra, A. (2024). The prevalence of menstrual disorders and their association with psychological stress in Syrian students enrolled at health-related schools: A cross-sectional study. *International Journal of Gynecology & Obstetrics*, 164(3), 1086-1093.
- Kochhar, S., & Ghosh, S. (2022). Impact of menstruation on physical and mental health of young adolescent girls. *International Journal of Health Sciences*(II), 6693-6713.
- Langan-Evans, C., Hearn, M. A., McQuilliam, S., Burke, L. M., Stellingwerff, T., Elliott-Sale, K. J., & Morton, J. P. (2024). Hormonal contraceptive use, menstrual cycle characteristics and training/nutrition related profiles of elite, sub-elite and amateur athletes and exercisers: one size is unlikely to fit all. *International Journal of Sports Science & Coaching*, 19(1), 113-128.
- Mountjoy, M., Sundgot-Borgen, J., Burke, L., Ackerman, K. E., Blauwet, C., Constantini, N., Lebrun, C., Lundy, B., Melin, A., & Meyer, N. (2018). International Olympic Committee (IOC) consensus statement on relative energy deficiency in sport (RED-S): 2018 update. *International journal of sport nutrition and exercise metabolism*, 28(4), 316-331.
- Muthukumar, D., Bin Jumah, J. A., Shanmugam, R., & Kamaraj, C. (2025). From Sunshine to Wellness: Understanding Vitamin D Impact on Menstrual Health. *Advances in Public Health*, 2025(1), 5296320.
- Nabeyama, T., Suzuki, Y., Saito, H., Yamamoto, K., Sakane, M., Sasaki, Y., Shindo, H., Takita, M., & Kami, M. (2023). Prevalence of iron-deficient but non-anemic university athletes in Japan: an observational cohort study. *Journal of the International Society of Sports Nutrition*, 20(1), 2284948.
- Odongo, E., Byamugisha, J., Ajeani, J., & Mukisa, J. (2023). Prevalence and effects of menstrual disorders on quality of life of female undergraduate students in Makerere University College of health sciences, a cross sectional survey. *BMC women's health*, 23(1), 152.
- Pengelly, M., Pumpa, K., Pyne, D. B., & Etxebarria, N. (2025). Iron deficiency, supplementation, and sports performance in female athletes: A systematic review. *Journal of sport and health science*, 14, 101009.
- Pogodina, A., Dolgikh, O., Astakhova, T., Klimkina, J., Khramova, E., & Rychkova, L. (2022). Health-related quality of life and menstrual problems in adolescents. *Journal of paediatrics and child health*, 58(6), 1028-1032.
- Safa, G., Hemmatinifar, M., Nemati, J., Imanian, B., & Suzuki, K. (2024). Effect of Off-Season Iron Supplementation on Aerobic Capacity of Female Handball Player: A Randomized, Double-Blinded, Placebo-Controlled Study. *Current Developments in Nutrition*, 8(6), 103767.
- Sandroni, A., House, E., Howard, L., & DellaValle, D. M. (2022). Synbiotic supplementation improves response to iron supplementation in female athletes during training. *Journal of Dietary Supplements*, 19(3), 366-380.
- Šmid, A. N., Golja, P., Hadžić, V., Abazović, E., Drole, K., & Paravlic, A. H. (2024). Effects of oral iron supplementation on blood iron status in athletes: a systematic review, meta-analysis and meta-regression of randomized controlled trials. *Sports Medicine*, 54(5), 1231-1247.

- Sundari, T., George, A. J., & Sinu, E. (2022). Psychosocial problems of adolescent girls during menstruation. *Journal of mental health education*, 3(2), 47.
- van Iersel, K. C., Kiesner, J., Pastore, M., & Scholte, R. H. (2016). The impact of menstrual cycle-related physical symptoms on daily activities and psychological wellness among adolescent girls. *Journal of Adolescence*, 49, 81-90.