

Female Athlete Mental Fitness Scale (FAMFS): Preliminary Validation and Standardization of an Outcome Measure for Mental Health Assessment of Female Athletes of India

Janvhi Singh¹, Dharmita Yogeshwar², Niketa Ahirwar³, Anshul Garhpale⁴, Manisha⁵, Irish Jain⁶, Vipin Kumar Chandraker⁷, Arpit Kulshreshtha⁸

¹Department of Physiotherapy, Associate Professor, LNCT Vidyapeeth university, Indore, MP, India,

Email- janvhisinh13@gmail.com, ORCID- 0000-0003-3588-8049

²Department of Physiotherapy, Assistant Professor, Nims College of PT & OT, Nims University, Jaipur, Rajasthan, India., Email- yogidharmita@gmail.com, ORCID- 0000-0001-8847-4857

³Department of Physiotherapy, Professor, LNCT Vidyapeeth University, Indore, MP, India,

Email- niketaahirwar27@gmail.com

⁴Department of Physiotherapy, Associate Professor, Sri Aurobindo Institute of Allied Health and Paramedical Sciences, Indore, MP, India., Email- ansh1215@gmail.com

⁵Department of Physiotherapy (SAHS), Assistant professor, GNA university Phagwara, Punjab, India, Email- vermarajputmanisha@gmail.com, ORCID- 0009-0000-2916-3784

⁶Assistant Professor, Department of Physiotherapy, Assistant Professor LNCT Vidyapeeth university, Indore, MP, India, Email- irishjain05@gmail.com

⁷Department of Physiotherapy, Principal, Apollo College of Physiotherapy, Durg, C.G., India, Email- vipinchandraker05@gmail.com

⁸School of Physical Education and Sport, Assistant Professor, GNA University, Phagwara, Punjab, India, Email- arpitkulshreshtha4522@gmail.com, ORCID- 0009-0004-5496-905X

Correspondence author Janvhi Singh, Department of Physiotherapy, Associate Professor, LNCT Vidyapeeth University, Indore, India

Email- janvhisinh13@gmail.com, ORCID- 0000-0003-3588-8049

Abstract-

Background: Mental health plays a significant role in athletic performance and overall well-being. Female athletes are particularly vulnerable to psychological and physiological challenges such as anxiety, depression, sleep disturbances, eating-related concerns, and menstrual health issues. However, limited multidimensional assessment tools are available specifically for female athletes in the Indian population.

Objective: To develop and evaluate the reliability of the Female Athlete Mental Fitness Scale (FAMFS), a multidimensional outcome measure designed to assess mental health-related factors among female athletes.

Methods: This instrumental cross-sectional study included 120 female athletes aged 14–40 years who had participated in sports activities for at least two years. The FAMFS was developed through literature review and domain identification focusing on five components: anxiety, depression, sleep quality, eating disorders, and menstrual health. The scale consisted of items rated on a 4-point Likert scale. Reliability analysis was performed using Cronbach's alpha and intraclass correlation coefficient (ICC).

Results: The FAMFS demonstrated acceptable internal consistency with satisfactory reliability values. The multidimensional structure of the scale enabled comprehensive assessment of psychological and physiological factors influencing female athletes. The findings support the potential usefulness of FAMFS as a screening and assessment tool for mental fitness among female athletes.

Conclusion: The Female Athlete Mental Fitness Scale (FAMFS) is a promising multidimensional tool for assessing mental health-related concerns in female athletes. The scale may help clinicians, physiotherapists, coaches, and sports professionals identify psychological and behavioral factors affecting athlete well-being and performance. Further studies with larger sample sizes and advanced psychometric evaluation are recommended to strengthen its validity and clinical applicability.

Keywords: Female athletes, mental health, anxiety, depression, sleep quality, eating disorders, menstrual health, scale development, FAMFS.

INTRODUCTION- There is increasing attention on the mental health of athletes, as highlighted by the International Olympic Committee's (IOC) Consensus Statement on mental health in elite athletes.^[1] Mental fitness in female athletes is a multidimensional concept influenced not only by psychological factors such as anxiety and depression, but also by behavioral and physiological components including sleep quality, eating behavior, and menstrual health. These domains are closely interconnected and collectively influence athletic performance, emotional wellbeing, recovery, and overall health status.^[2] Therefore, assessment of mental fitness in female athletes requires a comprehensive and multidimensional approach rather than evaluation of isolated psychological symptoms alone. While self-reported data from elite athletes suggests that the prevalence rates of mental health symptoms—such as anxiety, depression, and sleep disorders—are similar to those of the general population,^[3] athletes face unique sports-related stressors not typically encountered by others. These include vulnerability to serious or chronic injuries, performance-related setbacks, scrutiny from popular and social media, and the possibility of early or unplanned career termination.^[1] these challenges often coincide with the peak age for the onset of mental health disorders,^[4] potentially heightening athletes' vulnerability to psychological distress and mental health symptoms.

In the general population, studies have shown that females experience higher rates of anxiety and depression compared to males. For example, research by Altemus et al. revealed that females are approximately twice as likely as males to suffer from these psychological disorders.^[5] Similarly, when examining the athletic population as a whole, consistently high rates of anxiety and depression have been observed. A 2018 literature review by Wolanin et al. reported that the prevalence of depression in athletes ranged from 15.6% to 21%,^[6] the study also identified several athlete-specific risk factors for anxiety and depression, including performance expectations, overtraining, sports-related injuries, and involuntary career termination, eating disorder and menstrual health.

Despite the elevated risk of psychological distress among athletes, there is a notable shortage of well-validated, athlete-specific screening tools designed to aid in the early detection of elite athletes experiencing mental health challenges. Such tools could play a crucial role in enabling earlier intervention during the development of mental health symptoms. To address this gap, Rice et al.^[7] developed the multidimensional Athlete Psychological Strain Questionnaire (APSQ), which was modeled on the widely used and validated Kessler 10 (K-10).^[8]

Several outcome measures are used to assess the mental health of female athletes, including the Generalized Anxiety Disorder-7 (GAD-7), Female Athlete Screening Tool (FAST), Patient Health Questionnaire-9 (PHQ-9), and Beck Depression Inventory (BDI). However, these tools have limited components, questions, and domains, highlighting the need for a more comprehensive outcome measure tailored to the Indian population. To address this gap, the present outcome measure was developed based on the International Classification of Functioning, Disability and Health (ICF) model. As female athlete age, they may face a variety of issues related to anxiety, depression, menstrual health, sleep quality, and eating disorders, all of which need to be considered from the perspective of their sport. Given the importance of mental health, it is essential to assess the health behaviors of the female population comprehensively. However, existing outcome measures fail to address all necessary components. Therefore, the newly developed outcome measure aims to evaluate the mental health of female athletes in a more holistic manner.

Poor quality of life, reduced academic and work performance, disrupted social relationships, intense hopelessness, dysfunctional eating habits, negative religious coping, substance abuse (including alcohol and drugs) as maladaptive coping mechanisms, and suicide are frequently reported consequences of these conditions.^[9, 10, 11] As such, early identification and effective management of depression and anxiety in young athletes are critical to preventing serious morbidities. Among individuals under the age of 20, depression and anxiety are moderately co-morbid as clinical diagnoses of emotional disorders.^[12, 13] Furthermore, in youths diagnosed with at least one emotional disorder, depression and anxiety as symptoms are more distinct and influenced by multiple factors compared to mental health-free youth, where such symptoms are explained by a single factor.^[13]

Considering the mental health is necessary to assess the health behavior of female athletic population of INDIA but the existing outcome measures are not covering all the necessary components which needs to be addressed. So, the present outcome measure was developed to evaluate the mental health of female athletes.

The aims of this study were to:

1. Explore the sensitivity/specificity of the FAMFS female elite athletes with regard to their scores.
2. "Assess the internal consistency and reliability of the FAMFS among female athletes."

MATERIALS AND METHODS

1. **Study Design-** This instrumental study adopted a cross-sectional design and utilized a convenience sampling technique. The sample size was calculated using an electronic calculator (Soper, 2023), considering the number of observed and latent variables, an expected effect size ($\lambda = 0.10$), a significance level ($\alpha = 0.05$), and a statistical power of 0.90. Based on these parameters, a minimum of 120 participants was required. The study included female athletes aged between 14 and 40 years ($M = 20.31$, $SD = 3.8$), who had been engaged in sports activities for at least the past two years. Participants not meeting the age criteria or lacking a background in sports were excluded. The primary instrument used was the Female Athlete Mental Fitness Scale (FAMFS), a structured, self-reported measure developed to assess five key components of mental health: anxiety, depression, sleep quality, eating disorders, and menstrual health. The scale employed a four-point Likert response format to ensure nuanced reporting. Ethical approval was granted by the Ethics Committee, and the study followed the Helsinki Declaration guidelines. Informed consent was obtained from all participants, ensuring voluntary participation and confidentiality. Data were collected in person, and the scale's reliability was assessed using Cronbach's alpha.

2. **Instruments-** Female Athlete Mental Fitness Scale (FAMFS) The development of the Female Athlete Mental Fitness Scale (FAMFS) followed a structured process, incorporating patient-reported criteria designed to assess the mental health of female athletes. These criteria were categorized into five key components: (1) Anxiety, (2) Depression, (3) Sleep quality, (4) Eating Disorder, (5) Menstrual Health. To ensure a comprehensive assessment of athletes' mental health, the FAMFS items are presented in a Likert scale format. This scale offers four response options, ranging from "Did not apply to me at all" to "Applied to me very much or most of the time." This structure enables a precise and detailed reflection of female athletes' mental well-being, its impact on their performance, and the importance of personalization in studying this phenomenon.
3. **Expert Validation-** The items of the Female Athlete Mental Fitness Scale (FAMFS) were generated after an extensive review of existing literature and previously published mental health and athlete-related outcome measures. The preliminary draft of the scale was designed to assess five major domains affecting female athletes, including anxiety, depression, sleep quality, eating disorders, and menstrual health. For content validation and refinement, the draft scale was reviewed by a panel of seven experts, including five experts from the field of physiotherapy and two experts from the mental health field, each having more than eight years of clinical and academic experience. The experts evaluated the items for clarity, relevance, comprehensiveness, language appropriateness, and domain suitability. Based on their recommendations and feedback, necessary modifications were made to improve the overall structure and content of the scale before final administration.
4. **Procedure-** Assuming that the prevalence of mental health was at 10%^[13], a minimum sample of 120 participants. The sample size was calculated based on the prevalence of mental health disorder as it is the most common and significant public health with serious clinical impact compared to anxiety. This study adhered to strict ethical standards, ensuring integrity, transparency, and respect for human dignity to uphold the authenticity and accuracy of the findings. The research protocol was reviewed and approved by the Ethics Committee. In compliance with the Helsinki Agreement guidelines, all participants were thoroughly informed about the study's purpose and objectives. The informed consent process followed all relevant legal regulations while demonstrating our commitment to respecting participants' autonomy and their right to decide on their involvement. Data collection was conducted in person, with clear emphasis on the voluntary nature of participation and strict measures to ensure anonymity. Scale reliability was assessed through Cronbach's alpha coefficient.

Statistical analysis

Data were analyzed using SPSS version 26.0 (IBM Corp., Released 2019. IBM SPSS Statistics for Windows, Version 26.0, Armonk, NY: IBM Corp.). Results are presented as mean $\pm$ standard deviation (SD). Correlation coefficient was checked.

Result

Total 120 female elite athletes participated in the study. We used a convenience sampling technique participants ranged in age from 14 to 40 years (M = 20.31, SD = 3.8).

Table1

Cronbach's Alpha	Cronbach's Alpha Based on Standardize	N of Items
.745	.765	121

ICC and Cronbach's alpha (α) is showing good reliability of 0.745 and 0.765. The mean score of outcome measure was checked after one week for test-retest reliability and both components are showing significant reliability of FAMFS scale with mean value of 2.294. As shown in Table 1 & 2.

Table 2- Summary Item Statistics

	Mean	Minimum	Maximum	Range	Max/Min	Variance
Item Mean	5.104	2.294	308.765	306.471	134.590	774.826

Item Variance	5.862	.214	679.579	679.365	3177.033	3813.984
Inter- Item Variance	.138	1.086	8.727	9.813	8.039	.637
Iter- Item Correlation	.186	.478	1.000	1.478	2.092	.189

Scale Statistics

Mean	Variance	Std. Deviation	No. of Items
617.53	2718.317	52.137	120

Table 3- ANOVA with Tukey's Test for Nonadditivity

	Sum of Square	df	Mean Square	F	Sig
Between People	741.359	33	22.465	-	
Between Items	3161288.653	120	26344.072	4603.031	.000
Nonadditivity	21869.499	1	21869.499	108992.731	.000
Within people Residual Balance	794.377	3959	.201	-	
Total	22663.876	3960	5.723	-	
Total	3183952.529	4080	780.381	-	
Total	3184693.888	4113	774.300	-	

Grand Mean = 5.10

a. Tukey's estimate of power to which observations must be raised to achieve additivity = 5.204E-005.

Tukey's test of additivity assessed if the factor variables are additively related to the expected value of the response variable as seen in Table 3. In our case the test for non-additivity was statistically significant, the data are no additive because Mean Square was 774.300 and estimate power to non-additive.

Table 4- Intraclass Correlation Coefficient

	Intra class Correlation	95% confidence Interval		F Test with true value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single measure	.024	.013	.046	3.925	33	39690	.000
Average measure	.745	.607	.853	3.925	33	39690	.000

Reliability

Test-retest reliability was assessed using the intraclass correlation coefficient (ICC) with an absolute-agreement approach. The average-measures ICC was 0.745 (95% CI: 0.607–0.853; $p < 0.001$), indicating good test-retest reliability of the FAMFS. These findings suggest that the scale demonstrated satisfactory stability across repeated administrations.

DISCUSSION-

Findings from this representative sample of elite female athletes support the validity, reliability, and factor structure of the FAMFS. As a concise, five-factor screening tool, the FAMFS could serve as a valuable component within a broader assessment framework for evaluating athlete performance and wellbeing. The findings support the preliminary reliability and applicability of the FAMFS among female athletes. To confirm the dimensionality of the

FAMFS, an independent sample using confirmatory factor analysis (CFA) is required. Nevertheless, these findings are significant, as FAMFS items specifically address domains relevant to athletes. One potential advantage of using the FAMFS in athletic populations is that athletes may perceive its items as less intrusive compared to general psychological distress measures, while still offering critical insights into athlete mental health and adjustment.

Anxiety and depression rates are notably higher among females and athletes in general. Given this trend, it is unsurprising that female athletes report higher rates of these mental health conditions compared to their male counterparts. A systematic review and meta-analysis by Rice et al. found that female athletes were significantly more likely to experience anxiety than male athletes ($P < 0.001$).^[14]

Similarly, Yang et al. reported that female collegiate student-athletes had 1.32 times greater odds of experiencing depression than male athletes.^[15] Further supporting these findings, Weber et al. (2018) also found that female athletes faced a higher likelihood of anxiety and depression. Interestingly, Weber et al. noted no significant correlation between age and mental health conditions, highlighting that even young athletes—such as middle school students—are at risk for these issues, which are often associated with older individuals. Overall, athletes are predisposed to anxiety and depression, with female athletes facing a greater risk, regardless of age.^[16]

Within the female athlete population, those who participate in individual sports are at the highest risk of anxiety and depression.^[16, 17] Research consistently indicates that team sports provide a protective effect against these mental health challenges. Being part of a team offers built-in social support, helping athletes navigate training difficulties, competition stress, and setbacks. Additionally, team membership has been shown to enhance injury recovery.^[18] In a 2000 review, Junge et al. emphasized the buffering effect of social support networks, which help athletes cope with and recover from injuries. Particularly in injury recovery, having a supportive team can be a critical factor in both physical rehabilitation and emotional well-being.^[19]

Future research should focus on longitudinal studies to examine how psychosocial health influences the performance of elite female athletes over time. Additionally, expanding research across diverse populations and cultural contexts is essential to better understand the impact of sleep quality, eating habits, and menstrual health on athletic performance. Investigating the long-term effects of this dependency on mental health and well-being, as well as developing effective interventions to mitigate negative mental health outcomes, should be key priorities. These collective efforts will help foster a future where mental well-being and athletic excellence coexist in balance, benefiting both athletes and society.

There is a strong link between mental health and athletic performance, making it essential to raise awareness among athletes. These dynamics highlight the importance of mental well-being, where early detection should be seen as a complement to human abilities rather than a substitute. In this regard, organizations and professionals should focus not only on assessment but also on relaxation techniques, mindfulness practices, and emotional resilience training to help athletes maintain a healthy lifestyle.

From a theoretical perspective, these findings challenge traditional theories of human-technology interaction, emphasizing the need for an integrated framework that combines psychology, sleep quality, menstrual health, and eating disorders to address the growing impact of mental health on daily life. Additionally, deeper research is needed in fields like educational psychology to explore how mental health dependency influences cognitive and emotional development, particularly among athletes. Educators should be trained to balance mental well-being with teaching strategies that foster independence and self-management skills. At the organizational level, policies should be developed to regulate the assessment and management of psychosocial health, with a focus on preventing dependency and promoting mental well-being. Educational institutions should implement awareness programs, provide self-assessment tools, and conduct regular mental health evaluations for athletes experiencing prolonged performance struggles, and offer counseling services to support athletes facing mental health challenges.

Future research should prioritize examining the scale's convergent and divergent validity, particularly during critical risk periods such as injury phases or transitions out of competitive sport. Additionally, studies should investigate predictive links between physical factors (e.g., acute injuries) and neuropsychological outcomes like concussions, which play a role in athlete mental health (Rice et al., 2018). Other unique psychosocial pressures, such as social media abuse, also warrant exploration. Ideally, this research would incorporate baseline (pre-season) assessments along with periodic follow-ups to facilitate early detection and ongoing monitoring of changes over time. Furthermore, as most participants in this study were not in their primary competitive season during data collection, future studies should consider the influence of seasonal timing on athlete mental health.

Limitations- Future versions of the scale may incorporate additional menstrual health domains such as menstrual irregularities, amenorrhea, and RED-S-related symptoms specific to female athletes.

Conclusion-

The study of female athlete mental health is rapidly evolving, with athlete-centered models of care being developed and implemented. [20, 21, 22]. As clinical and research focus in this area expands, the demand for brief, targeted, and athlete-specific assessment tools will increase. The FAMFS represents a significant advancement in measuring psychological strain and the absence of well-being in elite female athletes. Its use could facilitate early identification of mental health concerns, enabling timely support and ultimately enhancing the well-being of this population.

Author contribution- J.S, D.Y, AG participated in forming the scale, VC, NA, IJ, M, AK participated in writing the paper.

Conflict of interest- We don't have conflict of interest

Data availability statement- We confirm that the data supporting the findings of the study will be shared upon the reasonable request.

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