

Injury Associated with Higher Prevalence of Psychological Distress and Depressive Symptoms Among South African Female Athletes: Findings from the Female Athlete Lifestyle and Mental Health Evaluation I (FLAME I) study

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Abstract

Background

Female athletes may be at greater risk of experiencing mental health symptoms than their male counterparts due to unique biological, psychological, and sport-related stressors. In South Africa, however, there is limited evidence regarding the mental health status of female athletes. The aim of the study was to estimate the prevalence of mental health symptoms among South African female athletes by level of participation (elite vs amateur) and sport type (team vs individual), and to identify demographic and sport-related risk indicators associated with these symptoms.

Methods

A cross-sectional study was conducted using an online questionnaire. A total of 376 athletes participated. The survey assessed symptoms of psychological distress, anxiety, depression, disordered eating, sleep disturbance and alcohol misuse, as well as demographic and sport-related characteristics.

Results

Disordered eating had the highest prevalence (75%), followed by psychological distress (67%) and sleep disturbances (45%). Lower prevalence rates were observed for alcohol misuse (36%), anxiety (27%), and depression (25%). One-third (33%) of participants reported no symptoms of psychological distress. Previous injury was identified as a risk indicator for psychological distress and depression, while younger age and studying were associated with increased anxiety symptoms.

Conclusions

Mental health symptoms are common among South African female athletes, with particularly high rates of disordered eating and psychological distress. Injury history, younger age, and academic commitments may increase vulnerability to certain symptoms. These findings highlight the need for targeted mental health screening, prevention strategies, and support services tailored to the needs of female athletes across different sporting contexts.

1. Backgrounds

2.1 Introduction

Mental health symptoms (MHS), defined as “any adverse thought, feeling, behaviour and/or psychosomatic symptom that might lead to subjective distress or functional impairments in daily life, work and/or sport” [1], have been a growing public health concern since the COVID-19 pandemic, among the general population . Previous studies have indicated that elite athletes also experience MHS, such as symptoms of depression and anxiety, at rates comparable to or even higher than those of the general population [2, 3]. Participating in sports offers numerous physical and psychological benefits. However, it can also introduce stressors and pressures

that can significantly impact an athlete's mental health [4]. Females in the general population have been shown to experience depressive, anxiety and disordered eating (DE) symptoms at a higher rate than males; this also holds true for the athletic population [5].

2.2 Prevalence rates of MHS in female athletes

Current international literature indicates that female athletes may be at an elevated risk of experiencing MHS compared to their male counterparts. One study [6] found that 20% of females exhibited at least one type of psychopathology, in contrast to 15% of men. Another study [7] reported a lifetime prevalence of MHS at 58% among female athletes, compared to 42% among males. A systematic review [8] demonstrated significantly higher anxiety symptoms in female athletes. Furthermore, studies on American collegiate athletes [9] and German elite female footballers [10] indicated a higher prevalence of depressive symptoms among female athletes than males. Female athletes also encounter specific stressors related to their gender, such as gender-based violence (GBV), sexual harassment, pay disparities, under-representation in the media, and challenges related to family planning and motherhood, which can exacerbate MHS [11].

2.3 The effect of MHS on athletes

Mental health symptoms (MHS) can severely affect athletes, including potential negative consequences for their athletic performance [12]. Symptoms such as difficulty concentrating, difficulty sleeping, loss of appetite, fatigue, and low motivation may be misinterpreted as physical overtraining or other medical conditions [13]. These symptoms can affect physical performance and decision-making during competitions. This misinterpretation may lead to prolonged MHS and to the development of a disorder that affects multiple aspects of the athlete's life, including overall well-being and performance [13]. Early recognition and intervention of depressive symptoms result in more favourable prognosis and outcomes [14].

2.4 The research gap in the African female athlete

There is currently no research exploring the prevalence of MHS among female athletes in South Africa. This is noteworthy given the concerning state of mental health in the South African general population [15]. Previous studies suggest that one in six South Africans suffers from probable symptoms of anxiety, depression, or substance use disorders [16]. The most identified risk factors for anxiety and depression in South African females include socioeconomic (low-income households) and psychological (adverse childhood events) factors [16]. Poverty and violence exposure are critical factors associated with anxiety symptoms in South African females, including female athletes [11]. Overall, the prevalence of probable depression in South Africa ranges from 14.7% to 38.8%. Among South African females, the prevalence of probable depression is 26.7%, while the prevalence of probable anxiety is 18.3% [16]. While our research focuses on female athletes, it is crucial to recognise that they are not immune to the factors affecting the general female population. To the author's knowledge, this study is the first of its kind in South Africa to investigate the prevalence of MHS among elite and amateur female athletes participating in team and individual sport. This will help ascertain the current mental health burden in the female athlete population and help future studies develop screening and treatment strategies.

2. Methods

2.1 Aim

The primary aim of this study was to estimate the prevalence of MHS among South African female athletes by level of participation (elite vs amateur) and by sport type (team vs individual). The secondary aim was to investigate demographic and sport-related risk indicators associated with the presence of MHS, including participation level and sport type.

2.2 Study design

This study employed an observational, cross-sectional design using an online survey, employing convenience sampling.

2.3 Participants

The population consisted of elite and amateur female athletes participating in team or individual sport in South Africa. Elite athletes were defined as those who competed at the National level in their sport or played in the first division of a provincial league [17]. Amateur athletes participate in club sports or Division Two leagues and lower [17]. The eligibility criteria included female athletes aged 18 years or older who participated in team or individual sport and could read and comprehend English.

2.4 Sample size

To estimate the prevalence of MHS, assuming a 95% confidence level, a 5% margin of error, and a maximum variability of 50% [18], the required sample size was estimated at 384 athletes. The sample size was increased by 10% to account for potential non-response and adjusted for a design effect

($D = 1.2$), resulting in a target sample size of 460 athletes.

2.5 Data collection tools

The questionnaire consisted of two parts: Part A included questions related to age categories, employment status, area of living (Suburban, Township, rural area), type of sport (team or individual), years of participation, level of competition (club, provincial and national/international), training hours, and any time-loss injuries in the last four weeks.

Part B consisted of the Sports Mental Health Assessment Tool-1 (SMHAT-1), a screening tool developed by the International Olympic Committee Mental Health Working Group to identify athletes at risk for MHS and disorders [19]. The SMHAT-1 is typically administered in a stepwise manner, beginning with the Athlete Psychological Strain Questionnaire (APSQ) [20], which has a defined cut-off score (≥ 17) to determine progression to further screening. However, in our study, all participants were asked to complete all components of the SMHAT-1, irrespective of APSQ score. This approach was adopted due to concerns regarding the cross-cultural applicability and validity of the APSQ cut-off threshold in this population [21]. As such, Step 2 screening was not contingent on APSQ scores and all participants completed the following instruments: the (1) Generalized Anxiety Disorder-7 (GAD-7); (2) Patient Health Questionnaire-9 (PHQ9); (3) Athlete Sleep Screening Questionnaire (ASSQ); (4) Alcohol Use Disorders Identification Test Consumption (AUDIT-C); (5) Cutting Down, Annoyance by Criticism, Guilty Feeling, and Eye-openers Adapted to Include Drugs (CAGE-AID); and (6) Brief Eating Disorder in Athletes Questionnaire (BEDA-Q). This approach allowed for comprehensive symptom surveillance across multiple domains and minimised the risk of false negatives.

The APSQ was used to screen for psychological distress [20], and the GAD-7 measures symptoms of anxiety [22]. Depressive symptoms were assessed using the PHQ-9 [23]. The ASSQ assessed for sleep disturbances and was validated in athletes [24]. The AUDIT-C was used to screen for alcohol misuse [25]. The CAGE-AID assessed drug(s) misuse in the previous three months [26]. The BEDA-Q was used to assess the presence of DE and has been validated in athletes [27]. The validity and reliability of all screening tools are presented in Supplementary Table 1. Athletes who scored above the predefined threshold on the screening tools and consented to provide an email address were referred for further assessment. Regardless of the screening outcome, all participants were provided with information on how to access mental health support if needed.

2.6 Procedure

The questionnaire was programmed using Qualtrics (Qualtrics International Inc., United States of America). Information about the study was shared with coaches and managers of sporting unions, who were requested to distribute the survey to their athletes via email. Participation was anonymous, and electronic consent was obtained prior to the survey beginning. Although the protocol anticipated recruitment through sporting organisations using a clustered approach, participant recruitment ultimately relied on convenience and snowball sampling through sporting organisations and athlete networks. Athletes were asked to complete it online within one week. This study was not incentivised. To achieve high coverage and to reach athletes of as many performance levels and sports as possible, the study was promoted, and the online questionnaire was distributed via online platforms, including social media accounts. This allowed athletes who were eligible to participate but not affiliated with an organisation to participate in the study. The study was open for six months from January 2025 to July 2025. Periodic reminders were sent to sporting organisations and coaches every two months, and the survey was shared on social media platforms four times.

2.7 Statistical analysis

All consenting athletes who completed the survey were used for the analysis. The athlete's questionnaire data were exported into a Microsoft Excel spreadsheet (Microsoft Excel, 2016) and analysed using the SAS v9.4 statistical software (Cary, NC). Descriptive analyses (mean, SD, frequency, and percentages) were performed for all variables included in the study. MHS were grouped according to the SMHAT-1 tool under categories for symptoms of (1) distress (APSQ), (2) anxiety (GAD), (3) depression (PHQ9), (4) sleep disturbances (ASSQ), (5) alcohol misuse (AUDIT-C), and (6) DE (BEDA-Q). Participants were classified as screening positive for a given MHS if their score met or exceeded the recommended threshold for that screening instrument as specified in the SMHAT-1. Drug misuse prevalence was < 5% and therefore excluded due to insufficient cell counts. Prevalence was calculated as the proportion of athletes who screened positive for a given MHS relative to the total number of participants who completed that category. Generalised linear models with a Poisson distribution and log link were used to examine associations between each MHS construct and demographic and sport-related variables, including age, employment, area of residence, sport type, level of participation, training history, and years of participation. Variables significantly associated with each mental health symptom in the univariate analyses were subsequently entered into multiple regression models. Multiple regression analyses were only performed for outcomes with two or more significant univariate predictors. Prevalence ratios (PR) were reported as the measure of association with 95% confidence intervals (CIs), and p-values were reported as measures of association.

2.8 Ethics

Ethical approval

was obtained from the Faculty of Health Sciences Research Ethics Committee at the University of Pretoria. All personal information collected during this study, including participants' email addresses, was kept strictly confidential. This study followed the principles outlined in the Declaration of Helsinki (2024). Participants were informed that they could withdraw from the study at any time without suffering any repercussions.

3. Results

3.1 Participants

A total of 376 female athletes consented to participate in the study, with most (58%) being amateur and 42% elite. Table 1 presents the demographic, training, and injury history variables for all participants and each subgroup. Most participants competed in team sport (57%), with 43% participating in individual sport.

Table 1
Demographics and sport-related variables overall and by sport type and level of participation.

Characteristic	Sport type		Level of participation		Overall
	Individual n (%)	Team n (%)	Amateur n (%)	Elite (n%)	n (%)
N (%)	163 (43.4)	213 (56.7)	219 (58.2)	157 (41.8)	376 (100)
Age range					
18–24 years	34 (20.9)	136 (63.9)	78 (35.6)	92 (58.6)	170 (45.2)
25–34 years	46 (28.2)	58 (27.2)	59 (26.9)	45 (28.7)	104 (27.7)
> 34 years	83 (50.9)	19 (8.9)	82 (37.5)	20 (12.7)	102 (27.1)
Employment					
Yes	136 (83.4)	65 (30.5)	154 (70.3)	47 (29.9)	201 (53.4)
No	7 (4.3)	50 (23.5)	15 (6.9)	42 (26.8)	57 (15.2)
Studying	20 (12.3)	98 (46.0)	50 (22.8)	68 (43.3)	118 (31.4)
Area of residence					
City	60 (36.8)	65 (30.5)	71 (32.4)	54 (34.4)	125 (33.2)
Rural and Township †	8 (4.9)	46 (21.6)	27 (12.3)	27 (17.2)	54 (14.4)
Suburban	95 (58.3)	102 (47.9)	121 (55.3)	76 (48.4)	197 (52.4)
Training hours per week					
0–6 hours	58 (35.6)	101 (47.4)	114 (52.0)	45 (28.7)	159 (42.3)
> 7 hours	105 (64.4)	112 (52.6)	105 (48.0)	112 (71.3)	217 (57.7)
Number of years playing the sport (experience)					
0–6 years	72 (44.2)	55 (25.8)	98 (44.8)	29 (18.5)	127 (33.8)
> 6 years	91 (55.8)	158 (74.2)	121 (55.2)	128 (81.5)	249 (66.2)
Injured during the past four weeks					
No	135 (82.8)	161 (75.6)	175 (79.9)	121 (77.1)	296 (78.7)
†: An underdeveloped, usually (but not only) urban, residential area that during Apartheid was reserved for non-whites (Africans, Coloureds and Indians) who lived near or worked in areas that were designated 'white only'					

Characteristic	Sport type		Level of participation		Overall
	Individual	Team	Amateur	Elite	n (%)
	n (%)	n (%)	n (%)	(n%)	
Yes	28 (17.2)	52 (24.4)	44 (20.1)	36 (22.9)	80 (21.3)
†: An underdeveloped, usually (but not only) urban, residential area that during Apartheid was reserved for non-whites (Africans, Coloureds and Indians) who lived near or worked in areas that were designated 'white only'					

The highest proportion of team sport athletes in this sample was observed in the 18–24 age group (64%). Team athletes were mainly unemployed or studying (69%), lived in a suburb (48%), had been playing sport for more than 6 years (74%), and had been training for more than 7 hours per week (64%). Whereas individual sport athletes were most represented in the > 34 age group (51%), were employed (83%), lived in a suburb (58%), had been playing sport for more than 6 years (56%), with an equal proportion training for < 6 hours (47%) or more than 7 hours (53%).

The highest proportion of elite athletes was observed in the 18–24 age group (59%). These athletes most commonly were studying (43%), lived in suburban areas (48%), had participated in their sport for more than 6 years (82%), and trained for more than 7 hours per week (71%). In contrast, amateur athletes in this sample were more represented in the > 34 age group (38%), were predominantly employed (70%), lived in suburban areas (55%), had been playing their sport for more than 6 years (55%), and were more likely to train for 0–6 hours per week (52%).

Overall, 80 (21%) of athletes reported an injury sustained in the past 4 weeks. The proportions were similar in all four subgroups: individual sport (17.2%), amateur (20.1%), elite (22.9%) and team sport (24.2%).

Table 2

Univariate prevalence of mental health symptoms overall and by sport type and level of participation

Mental health symptom	Overall	Sport type		Level of participation			
	Overall	Individual	Team	PR	Amateur	Elite	PR
		Prevalence (95%CI)	Prevalence (95%CI)	(95% CI) *p-value	Prevalence (%CI)		(95% CI) Prevalence (%CI)
Any symptom	342 (91%)	144 (88%)	198 (93%)	N/A	199 (91%)	143 (91%)	N/A
Distress (APSQ ≥ 17)	67.0 (59.2–75.8)	63.8 (52.7–77.3)	69.5 (59.1–81.6)	1.1 (0.9–1.4)	63.5 (53.8–75.0)	72.0 (59.9–86.6)	1.1 (0.9–1.5)
Anxiety (GAD-7 ≥ 10)	27.3 (22.5–33.2)	20.3 (14.3–28.6)	32.7 (25.8–41.5)	1.6 (1.1–2.5) 0.02*	24.4 (18.6–32.0)	31.4 (23.6–41.6)	1.3 (0.9–1.9)
Depression (PHQ-9 ≥ 10)	25.4 (20.6–31.1)	20.7 (14.6–29.2)	28.9 (22.4–37.3)	1.4 (0.9–2.2)	25.1 (19.2–32.9)	25.7 (18.7–35.3)	1.0 (0.7–1.6)
Alcohol misuse (AUDIT-C ≥ 3)	35.9 (30.2–42.8)	38.7 (29.9–50.0)	33.9 (26.7–42.9)	0.8 (0.6–1.2)	39.1 (31.5–48.7)	31.3 (23.3–41.9)	0.8 (0.6–1.2)
Disordered eating (BEDA-Q ≥ 4)	75.0 (66.5–84.6)	72.2 (59.8–87.0)	77.1 (65.9–90.3)	0.9 (0.7–1.2)	77.9 (66.8–90.9)	70.8 (58.3–86.0)	0.9 (0.7–1.2)
Sleep disturbances (ASSQ ≥ 8)	44.5 (38.1–52.0)	45.1 (35.6–57.1)	44.1 (35.9–54.2)	1.0 (0.7–1.3)	44.5 (36.3–54.5)	44.6 (35.0–56.8)	1.0 (0.7–1.4)

Individual sport athletes and amateur athletes were used as the reference group (PR = 1.00). *: $p < 0.05$. N/A: Not applicable. Prevalence estimates were calculated using the number of participants who completed each screening instrument.

3.2 Prevalence of Mental Health Symptoms (MHS)

Overall, DE was the symptom cluster with the highest prevalence above the established screening thresholds (75%), followed by psychological distress (67%) and sleep disturbances (45%). Only 33% of all participants reported symptoms of psychological distress below the screening cut-off. Symptoms of alcohol misuse (36%), anxiety (27%) and depression (25%) were reported at a lower prevalence. Table 2 presents the prevalence of MHS by sport type and level of participation.

A total of 70% of team sport athletes and 64% of individual sport athletes experienced psychological distress. Disordered eating was highly prevalent among team sport (77%) and individual sport athletes (72%). Distress was reported by 70% of team sport and 64% of individual sport athletes. Sleep disturbances were reported in 44% of team sport and 45% of individual sport athletes. Anxiety symptoms were present in 33% of the team sport athletes and 21% of individual sport athletes. Team sport athletes had demonstrated a higher prevalence of symptoms of anxiety than individual sport athletes (PR: 1.61; 95%CI: 1.06–2.46; $p = 0.0255$). No other significant differences are reported between individual and team athletes.

Regarding participation level, no significant differences were observed between amateur and elite athletes. In this sample, distress was more prevalent among elite athletes (72%) compared to amateurs (64%). Disordered eating (DE) was highly prevalent in both groups, particularly among amateur athletes (78%) compared to elite athletes (71%). Anxiety symptoms were more prevalent in elite athletes (31%) than in amateur athletes (24%). Depressive symptoms were equal across both groups and consistent with the overall rate of 25%.

3.3 Participant characteristics and MHS

Younger athletes aged 18–24 exhibited a significantly higher prevalence of anxiety (PR: 2.6; 95% CI: 1.4–4.6; $p = 0.001$) and depression symptoms (PR: 1.8; 95% CI: 1.1–3.1; $p = 0.030$), but a significantly lower prevalence of alcohol misuse (PR: 0.64; 95% CI: 0.42–0.97; $p = 0.040$) when compared to the > 34 age category (Table 3).

Athletes who were studying exhibited a significantly higher prevalence of anxiety symptoms (PR: 2.04; 95% CI: 1.03–4.07; $p = 0.040$) compared to the employed athletes. Injury history in the past four weeks was also significantly associated with a higher prevalence of symptoms for distress (PR: 1.34; 95% CI: 1.01–1.77; $p = 0.045$) and depression (PR: 2.02; 95% CI: 1.31–3.11; $p = 0.001$) compared to those without injury.

No significant associations were observed for area of residence, training hours per week, or years playing sport across all MHS constructs.

Age category and sport type were significantly associated with anxiety symptoms in the univariate analyses and were therefore entered into a multiple regression model. After adjustment, the association between sport type and anxiety was no longer significant, whereas age remained significantly associated with anxiety. Athletes aged > 34 years had a lower prevalence of anxiety symptoms compared with those aged 18–24 years. No other mental health outcomes had more than one significant univariate risk indicator; therefore, no final multiple regression models were presented.

Table 3
MHS Prevalence (95% CI) by demographic and sport-related risk indicators

Independent Variable	Category	Distress (%, 95% CI) (p-value)	Anxiety (%, 95% CI) (p-value)	Depression (%, 95% CI) (p-value)	Alcohol Misuse (%, 95% CI) (p-value)	Disordered eating (%, 95% CI) (p-value)	Sleep disturbances (%, 95% CI) (p-value)
Age group (years)	18–24 (Ref†)	74.7 (62.8–88.9)	35.8 (27.7–46.3)	32.1 (24.3–42.3)	27.9 (20.7–37.7)	75.8 (63.2–91.0)	44.9 (35.5–56.7)
	25–34	62.5 (49.0–79.7) (0.24)	27.2 (18.8–39.4) (0.23)	22.6 (15.0–33.9) (0.16)	40.4 (29.6–55.1) (0.09)	82.0 (66.0–100.0) (0.59)	36.6 (26.5–50.6) (0.32)
	> 34	58.8 (45.7–75.8) (0.13)	13.9 (8.2–23.4) (0.001) *	22.6 (15.0–33.9) (0.03) *	43.9 (32.5–59.2) (0.04) *	66.7 (52.4–84.9) (0.40)	52.0 (39.6–68.2) (0.42)
Employment	Employed (Ref)	63.7 (53.6–75.7)	24.2 (18.3–32.2)	23.6 (17.7–31.5)	41.3 (33.1–51.5)	73.3 (62.1–86.5)	44.6 (36.1–55.1)
	Unemployed	50.9 (35.4–73.2) (0.28)	18.2 (9.8–33.8)	16.7 (8.7–32.0) (0.34)	28.3 (17.1–47.0) (0.18)	75.0 (54.8–100.0) (0.9)	35.2 (22.4–55.2) (0.35)
	Studying	80.5 (65.8–98.4) (0.08)	37.2 (27.5–50.3) (0.04) *	32.7 (23.6–45.4) (0.14)	30.3 (21.5–42.6) (0.14)	78.0 (63.1–96.5) (0.65)	49.1 (37.6–64.1) (0.58)
Area of residence	Suburban (Ref)	68.0 (57.4–80.6)	27.6 (21.1–36.1)	27.9 (21.3–36.5)	41.9 (33.5–52.3)	71.9 (60.7–85.2)	46.3 (37.5–57.1)
	City	70.4 (57.1–86.8) (0.80)	32.3 (23.6–44.1) (0.46)	23.9 (16.5–34.7) (0.51)	31.0 (22.4–43.0) (0.14)	78.6 (64.1–96.5) (0.51)	42.7 (32.4–56.4) (0.65)
	Rural and Township	55.6 (38.8–79.5) (0.32)	15.1 (7.6–30.2) (0.11)	19.2 (10.4–35.7) (0.28)	25.5 (14.8–43.9) (0.10)	78.0 (57.0–100.0) (0.65)	42.3 (27.9–64.3) (0.71)

Ref† is the reference category

Values are presented as prevalence (%) with 95% confidence intervals. P-values are derived from univariate regression models. Statistically significant associations are indicated by * (p < 0.05)

Independent Variable	Category	Distress (%, 95% CI) (p-value)	Anxiety (%, 95% CI) (p-value)	Depression (%, 95% CI) (p-value)	Alcohol Misuse (%, 95% CI) (p-value)	Disordered eating (%, 95% CI) (p-value)	Sleep disturbances (%, 95% CI) (p-value)
Training hours/week	0–6 (Ref)	62.3 (51.1–75.8)	30.1 (22.6–40.1)	30.9 (23.2–41.2)	42.0 (32.8–53.8)	79.5 (66.5–95.0)	43.4 (34.1–55.3)
	> 7	70.5 (60.2–82.6) (0.34)	25.2 (19.3–33.0) (0.38)	21.3 (15.8–28.6) (0.07)	31.3 (24.5–40.1) (0.10)	71.6 (60.9–84.4) (0.40)	45.4 (37.0–55.6) (0.79)
Years playing sport	0–6 years (Ref)	65.4 (52.7–81.0)	22.0 (15.0–32.0)	23.3 (16.1–33.8)	37.1 (27.5–50.0)	79.0 (64.5–96.7)	40.3 (30.4–53.5)
	> 6	67.9 (58.4–78.9) (0.78)	30.0 (23.9–37.8) (0.16)	26.4 (20.6–33.7) (0.59)	35.3 (28.5–43.8) (0.80)	73.0 (62.8–84.8) (0.54)	46.6 (38.7–56.2) (0.40)
Injury history (past four weeks)	No (Ref)	62.5 (54.1–72.2)	24.6 (19.5–31.0)	20.9 (16.2–26.9)	35.4 (29.0–43.1)	72.9 (63.5–83.7)	43.4 (36.4–51.9)
	Yes	83.8 (65.9–100.0) (0.04) *	37.7 (26.2–54.2) (0.053)	42.1 (29.8–59.5) (0.001) *	37.8 (26.1–54.8) (0.75)	82.7 (64.5–100.0) (0.39)	48.7 (35.3–67.2) (0.54)
Ref† is the reference category							
Values are presented as prevalence (%) with 95% confidence intervals. P-values are derived from univariate regression models. Statistically significant associations are indicated by * (p < 0.05)							

4. Discussion

This is among the first studies to examine MHS among female athletes in South Africa, focusing on both prevalence and contributing factors. Our research reveals that this cohort experiences a substantial level of psychological distress (67%) and DE (75%). Injury status, studying, and certain age categories were identified as significant risk indicators for developing MHS in the South African female athlete population. Given the cross-sectional design, these variables should be interpreted as correlates or risk indicators rather than causal predictors. These findings will help emphasise the need for strengthening the mental health care system caring for South African female athletes, guide mental health literacy interventions, and inform the development of targeted screening and management strategies for this population.

4.1 Comparison to the general population

Psychological distress affects 22% of the general female population in South Africa [28], yet our study indicates a substantially higher prevalence among female athletes, with 67% reporting distress symptoms. This discrepancy may be partially attributed to the different assessment tools used: while Zungu et al. employed the Kessler 10-item Psychological Distress Scale (K-10), our study utilised the Athlete Psychological Strain Questionnaire (APSQ), which is based on the K-10 and demonstrates superior internal consistency in athletic populations [29]. Other factors contributing to higher levels of distress in the athlete population than in the general population could include the added pressures of dual careers, financial concerns, and the pressure to perform [30]. Regarding depression, approximately 26% of the general female population is likely to be experiencing symptoms of probable depression when they are screened [16], a figure closely mirrored in our athlete cohort, where 25% reported depressive symptoms.

4.2 Comparison to other athletic populations

Psychological distress was reported in 70% of South African female elite athletes. Although the prevalence was slightly higher than that observed among amateur athletes, the difference was not statistically significant. Consequently, participation level could not be confirmed as a risk indicator for psychological distress in this cohort, despite the additional performance and competition-related demands often associated with elite sport [31]. Furthermore, 75% of the elite athletes in this study screened positive for DE symptoms. The very high prevalence of disordered eating symptoms should be interpreted cautiously. Although the BEDA-Q is athlete-specific, its performance and optimal cut-off may vary across cultural and sporting contexts. The high proportion screening positive may reflect a substantial symptom burden but may also indicate the need for further validation of the tool in South African female athletes. It may also be attributed to sporting environments emphasising body composition, which may normalise restrictive eating behaviours. Aesthetic and weight-sensitive sports often emphasise specific body image ideals, which can increase pressure on athletes to maintain a particular physique and, in turn, heighten the risk of DE Symptoms [32]. The prevalence observed in this cohort was higher than that reported among Portuguese elite female athletes (18%) [33] and English and Scottish elite female footballers (11%) [34]. Amateur athletes in our cohort demonstrated a high prevalence of psychological distress (64%) and DE (78%). This may reflect the burden of training alongside financial and time pressures, and comparatively limited access to structured mental health and sports nutrition support, which can delay early identification and intervention. In addition, amateur environments may include strong body image and performance pressures without evidence-based guidance, increasing vulnerability to restrictive or compensatory eating behaviours.

4.3 Individual and team athletes

While team athletes in this sample had reported non-significant differences in prevalence of psychological distress (70% vs. 64%), depression (29% vs. 21%), and DE (77% vs. 72%) compared to individual athletes, symptoms of anxiety were significantly different (33% vs. 20%). Team athletes were, in fact, 1.6 times (95% CI: 1.1–2.5) more likely to report anxiety symptoms compared to individual athletes ($p = 0.02$). This finding contradicts previous studies suggesting that individual athletes are more prone to MHS [35]. The prevalence of anxiety and depressive symptoms surpasses that observed in German female team athletes, who demonstrated depressive symptoms ranging from 14.1% to 16.6% and anxiety symptoms ranging from 1.4% to 6.9% [36] when using the GAD-7. This disparity may suggest that South African team athletes are at an elevated risk of developing MHS, especially anxiety. Potential contributing factors include a lack of mental health literacy, inadequate coping skills, and a history of trauma or adverse life events [16]. In addition, team sport

environments may involve frequent social comparison and interpersonal conflicts, and athletes may experience reduced autonomy and limited control over outcomes compared to individual sport [37], which can exacerbate anxiety symptoms.

4.4 Risk indicators

This study found that younger athletes (18–24 years old) were at a higher risk of developing symptoms of anxiety and depression when compared to athletes above 34 years old. Importantly, these findings suggest that early adulthood may represent a vulnerable phase in a female athlete's career. This may be due to younger athletes transitioning into elite sport, developing their identity, or balancing study and athletic performance [38]. Younger athletes are also most likely to be student-athletes, and Moore et al. found that there was a high prevalence of anxiety, depression, and substance use among student-athletes [39]. These athletes often navigate major psychosocial, academic, and financial stressors while establishing themselves within a competitive sporting environment. Reporting an injury in the four weeks preceding completing the survey was associated with a higher prevalence of psychological distress and depressive symptoms. However, the cross-sectional design does not allow determination of whether injury preceded, followed, or co-occurred with these symptoms. This observation aligns with numerous studies indicating that injuries can precipitate MHS [40]. This finding underscores the intricate relationship between physical injury and psychological well-being in athletes. Injuries lead to physical limitations, a loss of athletic identity, isolation from teammates and coaches, and anxiety regarding future performance and recovery. Furthermore, injuries can disrupt an athlete's routine, jeopardise career progression, and impose financial burdens, all of which may contribute to the development of MHS.

5. Limitations

Limitations include a cross-sectional design that cannot distinguish between transient and persistent symptoms, as we did not follow up with the athletes. Another limitation was the use of self-reported questionnaires, which are subject to recall and response bias and may alter participants' true responses, thereby affecting the true prevalence. The achieved sample size was 18% smaller than the target sample, potentially reducing statistical power to detect group differences and affecting the precision of prevalence estimates. Furthermore, the use of convenience sampling through online survey distribution via email and social media may have introduced self-selection and volunteer bias. Athletes with an interest in or previous experiences with mental health symptoms may have been more likely to participate, potentially affecting the representativeness of the sample and influencing prevalence estimates. In addition, the sample may not be fully representative of the broader athlete population, limiting the generalisability of the study findings. These limitations mean that findings should be interpreted with caution.

6. Recommendations

These findings highlight the need to integrate routine mental health screenings and support within elite and amateur sporting environments across both team and individual sports. Screenings should be athlete-centred and conducted periodically throughout the season (pre-season, after injury, post-season, and during end-of-career discussions), utilising a validated tool with an established cut-off threshold to facilitate appropriate clinical decision-making and referral by healthcare professionals. To maximise the effectiveness of screening

programmes, mental health literacy initiatives should be offered to athletes at the start of the season and after every screening. This would help them understand why these screenings are needed and would help to address the stigma towards mental health. Increasing mental health literacy among athletes, coaches, and support staff may facilitate earlier identification of MHS. At the organisational level, sporting bodies, particularly those operating in elite sport, should consider integrating sport-specific mental health professionals, such as sports psychologists or psychiatrists, within their medical and high-performance teams. In amateur sporting settings, where resources may be limited, establishing formal referral pathways to external clinical psychologists and community mental health services is essential to ensure that athletes who screen positive receive timely and appropriate care. Sporting organisations and national federations should invest in low-cost or subsidised mental health resources for amateur clubs, as amateur athletes are just as vulnerable to MHS as elite athletes, yet often lack the same infrastructure and support. Given the high reported prevalence of psychological distress and the presence of gender-specific risk factors for female athletes, like GBV and stressors related to family planning and motherhood, sporting federations should develop protocols for returning to sport post-pregnancy and offer social and psychological support for athletes who have experienced GBV. The high prevalence of DE in this cohort of female athletes underscores the need for evidence-based, gender-specific nutritional support, including access to sports nutritionists who can promote healthy eating behaviours and challenge the normalisation of restrictive dietary practices within sporting environments. As student-athletes may be at risk of developing MHS, universities and sporting bodies should collaborate to provide dual-career support to help athletes manage the psychosocial and financial stressors of balancing academics and sport. Future research should prioritise longitudinal study designs to follow the progression and resolution of these symptoms in athletes.

7. Conclusion

To our knowledge, this is the first study to investigate mental health symptoms among South African female athletes. The high prevalence of psychological distress and disordered eating observed across sporting levels and disciplines in this sample is consistent with growing international evidence that female athletes are vulnerable to mental health concerns, while providing novel data from a previously underrepresented population. Our findings suggest that younger athletes may be particularly vulnerable to anxiety and depressive symptoms, while the higher prevalence of anxiety observed among team sport athletes contrasts with previous studies reporting greater vulnerability among individual sport athletes, highlighting the need to consider contextual and population-specific factors when interpreting mental health risk. The finding in this study regarding injury as a risk factor for MHS is consistent with multiple prior studies. Our study highlights the importance of integrating routine mental health screening into athlete healthcare to enable early identification of athletes experiencing psychological distress and facilitate timely access to appropriate support. Structured mental health promotion strategies, including education, stigma reduction, and multidisciplinary care pathways, should be considered alongside screening to foster athlete wellbeing and optimise both health and sporting performance. Future longitudinal research is needed to better understand the factors contributing to mental health symptoms in South African female athletes and to evaluate the effectiveness of targeted interventions across different sporting contexts and stages of athletic development.

Declarations

Ethics approval and consent to participate

The University of Pretoria Faculty of Health Sciences Research Ethics Committee approved the study. This study followed the principles outlined in the Declaration of Helsinki (2024). The researchers obtained informed consent from participants before starting the questionnaire. Participation was anonymous, and participants were informed they could withdraw from the study at any time without repercussions.

Consent to publish declaration

Not applicable.

Data availability

The data supporting the findings of this study are not publicly available due to ethical and privacy considerations related to participant confidentiality. De-identified data may be made available from the corresponding author upon reasonable request, subject to approval by the relevant ethics committee.

Conflict of interest

Dhavina Naidoo, James Burger, Pieter Boer, Esme Jordaan, Dina Christa Janse van Rensburg, Vincent Gouttebarga and Candice MacMillan have no conflicts of interest that are directly relevant to the content of this article.

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Authorship

Dhavina Naidoo, D.C. Janse van Rensburg, and Candice Macmillan conceptualised and designed the study. All authors contributed to the development of the methodology, data analysis and interpretation, and drafting and critical revision of the manuscript. All authors reviewed and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

Clinical trial number

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