

Risk Assessment of Female Athlete Triad in Beninese Para-Athletes

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Abstract—Objective: This study evaluated the risks of disorders related to the Female Athlete Triad among female para-athletes in Benin.

Methods: This was a cross-sectional study including 25 participants enrolled in para-sport clubs. The Low Energy Availability in Females Questionnaire (LEAF-Q) was used to assess Triad-related disorders, and the SCOFF-Q was used to analyze disordered eating behaviors.

Results: 40% of participants from the Lions Handisport club and 66.67% from the Warriors club had not menstruated for the preceding 2 to 3 months. Within the clubs, significant proportions of para-athletes admitted to a loss of control over their eating, with rates reaching 66.67% in the Warriors club. Furthermore, 50% of participants from the Buffle club reported self-induced vomiting. The data also showed varying levels of injury-related absences, with participants from the Buffle club being the most affected.

Conclusion: Disorders related to the Female Athlete Triad are a significant concern among female para-athletes in Benin.

Index Terms—Female Athlete Triad, Para-athletics, Menstrual Dysfunction, Benin

I. INTRODUCTION

The Female Athlete Triad, a syndrome defined and recognized by the American College of Sports Medicine (ACSM), describes the complex pathological interrelationship between three clinical components: low energy availability (with or without an eating disorder), menstrual dysfunction, and decreased bone mineral density (BMD) [1], [2]. It is now universally accepted that low energy availability (LEA) constitutes the central etiological factor—the driving force that triggers this cascade of physiological dysregulations. This state of chronic energy deficit, where caloric intake is insufficient to cover the needs for both basic bodily functions and training expenditure, disrupts the hypothalamic-pituitary-gonadal axis, leading to the suppression of essential reproductive and metabolic hormones [3].

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The clinical manifestations of this Triad are diverse and interconnected. LEA can stem from clinically diagnosed eating disorders (EDs), characterized by restrictive or purgative behaviors [4], but also from unintentional energy deficits. The resulting menstrual dysfunction covers a broad spectrum, ranging from oligomenorrhea (irregular cycles) to secondary amenorrhea (the absence of menstruation for three consecutive months or more), which is a major clinical marker of hormonal suppression [5]. Finally, the decrease in BMD is a direct consequence of the LEA-induced hypoestrogenism. Estrogen deficiency disrupts the balance of bone remodeling, favoring resorption over formation, which leads to an alteration of bone microarchitecture and significantly increases the risk of stress fractures, thereby compromising the athlete's career and long-term health [6], [7].

Studies have shown a high prevalence of LEA in female athletes, with rates ranging from 11% to 67%, depending on the sport and time of season [8]. One study of female collegiate soccer players found a 67% prevalence of LEA [9]. Another study reported that 60% of recreational female runners were classified as “at risk” for LEA [10]. These figures illustrate the scale of the problem and have justified the development of screening and prevention strategies in many countries.

In stark contrast, data concerning female para-athletes remain extremely scarce, creating a significant knowledge gap. Yet, this population is subject to unique physiological and psychological stressors that could potentially increase their vulnerability to the Triad. Energy demands can differ and are sometimes higher depending on the type of disability,

and pressures related to body image and functional classification may exacerbate the risk of EDs. A few pioneering exploratory studies have begun to investigate this area. Research conducted on elite wheelchair basketball players and other elite para-athletes has identified concerning signals, notably a high prevalence of menstrual cycle disorders (up to 46.2%) and bone stress injuries [11], [12]. It is crucial to emphasize that these disorders are not only counterproductive to athletic performance but can also lead to severe negative long-term health consequences, including an increased risk of premature osteoporosis and fertility issues [13].

The African context, and more specifically that of Benin, represents an almost complete blind spot in the research on this topic. Local socioeconomic and cultural factors are likely to influence the expression and impact of the Triad differently. Potentially limited access to specialized sports nutrition, often rudimentary training conditions, sociocultural norms regarding body image, and reduced access to specialized medical monitoring are all variables that could modulate the risks. It is therefore imperative, from both a public health and a sports medicine perspective, to assess the prevalence of disorders associated with this syndrome within this specific, vulnerable, and underserved population. The present study constitutes a fundamental step, aiming to conduct the first risk assessment of the Female Athlete Triad in female para-athletes in Benin.

II. METHODS

The present study was conducted using a cross-sectional approach in four para-sport clubs in Benin. This research, carried out by the Deficiencies, Adapted Physical Activities and Rehabilitation Research Unit (UR-DAPAR) of the Laboratory of Motor Skills, Performance and Health in Athletes (LaMoP2S) at the National Institute of Youth, Physical Education and Sport (INJEPS), University of Abomey-Calavi (UAC), is of particular importance in its field.

A cross-sectional study was conducted with Beninese para-athletes. Following an awareness campaign and after obtaining authorizations from the clubs, volunteer participants who met the inclusion criteria were recruited.

Two validated questionnaires were administered. The risk related to the Female Athlete Triad was assessed using the Low Energy Availability in Females (LEAF-Q) [14], a 25-item instrument that evaluates injuries, as well as gastrointestinal and reproductive function. Disordered eating behaviors were screened for using the SCOFF-Q [15], [16], a five-question tool.

The collected data were entered into Excel and then analyzed with SPSS software (version 27). The analysis was based on descriptive statistics (frequencies, percentages, means, and standard deviations).

III. RESULTS

Of the 34 para-athletes initially approached, 25 were included in the final analysis. The distribution of participants by club is detailed in Fig 1.

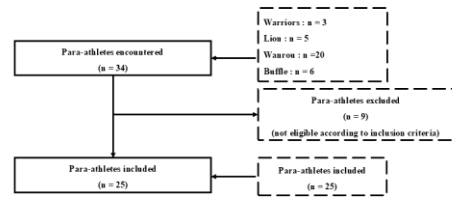


Figure 1: Flow diagram of participant inclusion

The mean age of the cohort was 36.12 years, and the mean BMI was 25.15 kg/m². The specific anthropometric characteristics for each club (Lions, Warriors, Buffle, Wanrou) are presented in Table I.

Table I: Anthropometric data of participants

Club	Age (years) Mean ± SD	Height (m) Mean ± SD	Body Weight (kg) Mean ± SD	BMI (kg/m ²) Mean ± SD
LION	38.40 ± 38.40	1.52 ± 0.06	53.40 ± 4.16	23.25 ± 3.10
WARRIORS	22.00 ± 2.65	1.68 ± 0.11	78.00 ± 45.74	27.40 ± 15.23
BUFFLE	34.33 ± 6.35	1.55 ± 0.15	58.83 ± 7.22	25.20 ± 5.55
WANROU	39.91 ± 5.17	1.55 ± 0.07	60.72 ± 8.56	25.38 ± 4.51
TOTAL	36.12 ± 7.59	1.56 ± 0.10	60.88 ± 16.37	25.15 ± 6.10

A high prevalence of menstrual disorders was observed in our cohort. Recent amenorrhea (absence of menstruation for 2-3 months) was reported by 40% of athletes in the Lion club and 66.7% in the Warriors club. Longer-term amenorrhea (≥6 months) was noted in 18.2% of participants in the Wanrou club. Furthermore, a history of secondary amenorrhea (three consecutive missed periods) was reported by 20% of athletes in the Lion club, 33.3% in the Buffle club, and 36.4% in the Wanrou club (Table II).

Table II: Menstrual function

	LION	WARR	BUFF	WANR
	N (%)	N (%)	N (%)	N (%)
Last menstrual period				
2-3 months ago,	2 (40)	2 (66.70)	1 (16.70)	1 (9.10)
6 months ago, or more	00	00	00	2 (18.20)
NA	3 (60)	1 (30.30)	5 (83.30)	8 (72.70)
Periods absent for 3 months				
Yes, it has happened	1 (20)	00	2 (33.33)	4 (36.40)
No, never	4 (80)	3 (100)	4 (66.70)	7 (64.60)
Menstrual changes				
I bleed less	00	00	1 (33.33)	1 (100)
I bleed for fewer days	1 (50)	00	1 (33.33)	00
My periods stop	00	00	1 (33.33)	00
NA	1 (50)	00	00	00

WARR: WARRIORS BUFF: BUFFLE WAN: WANROU
N: Frequency %: Percentage NA: Not Applicable

The risk assessment for the Triad using the LEAF-Q revealed a notable prevalence of disorders within the cohort. The risk of menstrual dysfunction was particularly high, affecting up to 66.7% of participants in some clubs. Similarly, a significant proportion of athletes was identified as being at risk for gastrointestinal dysfunction. Regarding the overall risk of low energy availability, it was detected in 33.3% of athletes in the Warriors club, 16.7% in the Buffle club, and 9.1% in the Wanrou club (Table III).

Table III: Participants at risk and not at risk (Percentages) for Triad disorders

	Injuries		GIF		MF		FDE	
	R	PR	R	PR	R	PR	R	PR
LION	20	80	80	20	60	40	0	100
WAR	33,33	66,67	66,67	33,33	66,67	33,33	33,33	27,28
BUF	66,67	33,33	83,33	16,67	66,67	33,33	16,67	64,63
WAN	27,28	72,72	72,72	27,28	33,33	66,67	9,10	90,90

WAR: WARRIORS BUF: BUFFLE WAN: WANROU
GIF: Gastrointestinal Function MF: Menstrual Function R: Risk PR: Not At-Risk

The SCOFF-Q questionnaire highlighted an alarming prevalence of at-risk eating behaviors. Loss of control over eating was frequent, reaching 66.7% in the Warriors club. Other significant behaviors were reported, such as self-induced vomiting (50% in the Buffle club) and body image distortion (54.5% in the Wanrou club) (Table IV).

Table IV: Positive and negative responses (Frequencies and Percentages) to the SCOFF-Q questionnaire

		SV	LCA	WL	BDI	FLI
LION	YES	00	2 (40)	1 (20)	1 (20)	00
	NO	5 (100)	3 (60)	4 (80)	4 (80)	5 (100)
WAR	YES	00	2 (66.67)	2 (66.67)	1 (33.33)	2 (66.67)
	NO	3 (100)	1 (33.33)	1 (33.33)	2 (66.67)	1 (33.33)
BUF	YES	3 (50)	2 (33.33)	2 (33.33)	2 (33.33)	1 (16.67)
	NO	3 (50)	4 (66.67)	4 (66.67)	4 (66.67)	5 (83.33)
WAN	YES	3 (27.27)	4 (36.36)	4 (36.36)	6 (54.54)	2 (18.18)
	NO	8 (72.73)	7 (63.64)	7 (63.64)	5 (45.46)	9 (81.82)

WAR: WARRIORS BUF: BUFFLE WAN: WANROU
SV: Self-induced Vomiting LCA: Loss of Control over eating
WL: Weight Loss BDI: Body Distortion Image FLI: Food's High Impact on Life

The overall screening identified a very high proportion of participants at risk for eating disorders (ED). The risk rates varied significantly between clubs, ranging from 20% in the Lions club to 100% in the Warriors club (Table V

Table V: Participants at risk and not at risk for eating disorders

	At Risk	Not at Risk
	<i>N (%)</i>	<i>N (%)</i>
LION	1 (20)	4 (80)
WARRIORS	3 (100)	00
BUFFLE	3 (50)	3 (50)
WANROU	8 (72.72)	3 (27.28)

N: Frequency %: Percentage

IV. DISCUSSION

The anthropometric characteristics of our cohort, with a mean age of 36.1 years and a mean BMI of 25.1 kg/m², are broadly comparable to those reported by Wiltkos et al. (2023) and Pritchett (2021) in studies on elite para-athletes [14], [17]. This mature population is not, however, exempt from the pressures related to performance and body image. As noted by José et al. (2020), even younger athletes are under pressure, while Meghan et al. (2023) have shown that athletes with a higher BMI face specific challenge, increasing the risk of maladaptive eating behaviors [18], [9].

The most striking result of our study is the alarming prevalence of risk factors for the Triad. The SCOFF-Q assessment revealed that more than half of the participants are at risk for eating disorders (ED), a rate similar to that found by Larrinaga et al. (2024) [19]. Our data suggest that the detected low energy availability is primarily due to these behaviors, notably loss of control over eating, a behavior whose cyclical nature was highlighted by Benowitz-Fredericks et al. (2012) [20]. These risks are compounded by practices such as self-induced vomiting, reported by 50% of athletes in one club, and body image distortion, underscoring the urgency of early intervention, as recommended by the American Psychiatric Association [21].

It is important to note that few athletes present all three components of the Triad simultaneously, an observation already made by Wiltkos et al. (2023), but many are affected by at least one of the disorders [14]. Our study highlighted a high prevalence of menstrual dysfunction, with recent amenorrhea (2-3 months) reported by up to 66.7% of athletes in one club. This result is a well-known clinical marker, as confirmed by the study of Carmichael et al. (2021), which established a link between high-level sport and irregular menstrual cycles [22], [23]. Similarly, the gastrointestinal disorders we observed are likely related to inadequate nutrition and stress, two factors that Hughes (2021) and Martinez et al. (2023) have shown to negatively impact performance [24], [25], [26].

Finally, the high frequency of training absences due to injuries may be directly linked to the other components of the Triad. As reported in a study by Gimunová et al. (2024), athletes with disordered eating behaviors exhibit a higher

incidence of injuries [23]. This situation can be exacerbated by overtraining, a well-known risk factor identified by Leppänen et al. (2014) [27], and by inadequate recovery practices, creating a vicious cycle that affects both physical and mental health [28].

This study provides the first data on the risks of the Female Athlete Triad among female para-athletes in Benin. Our results demonstrate that disordered eating behaviors, menstrual dysfunction, and injuries are prevalent and interconnected problems. A multidisciplinary approach, involving nutritional, medical, and psychological support, is essential to preserve the health and optimize the performance of this underserved population.

V. CONCLUSION

This study provides unprecedented evidence of a high and concerning prevalence of risk factors associated with the Female Athlete Triad among female para-athletes in Benin. The main contribution of this work is to highlight a public health issue that has been largely invisible in the context of para-sport in West Africa. Our results suggest that disordered eating behaviors, identified at alarming rates within our cohort, constitute the primary driver of this syndrome, leading to a cascade of physiological consequences, notably a high prevalence of menstrual dysfunction and likely contributing to the significant frequency of reported injuries.

It is crucial to understand that, although few athletes present all three components of the Triad simultaneously, the presence of just one of these disorders is sufficient to impair health and performance. The gap between the identified risks and the lack of adapted management structures is a major source of concern.

In light of these findings, concrete and targeted actions are essential. Firstly, it is imperative to implement education and awareness programs aimed not only at the athletes but also at their support staff (coaches, club managers) to deconstruct myths related to weight and nutrition. Secondly, systematic and early screening for disordered eating behaviors and menstrual irregularities should be integrated into the medical monitoring of these athletes. Finally, management must be multidisciplinary, involving physicians, nutritionists, and sport psychologists, to provide comprehensive support.

This cross-sectional study opens the way for future research. Longitudinal studies are needed to better understand the evolution of these disorders over time. It would also be relevant to conduct interventional studies to evaluate the effectiveness of prevention programs adapted to the socio-cultural context of Benin. The health and well-being of para-athletes should not be compromised in the name of athletic performance; it is our collective responsibility to establish the structures to protect them.

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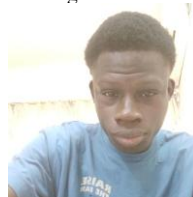
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