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Abnormal uterine bleeding and associated factors: a cross-sectional study in high-performance Peruvian athletes

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ABSTRACT

Background Abnormal uterine bleeding (AUB) is a problem that affects women and can cause outcomes such as anaemia, affecting women's quality of life. In high-performance athletes, this problem can be further exacerbated by intense physical activity, strict nutritional regimens and physical stress.

Hypothesis There are factors that increase the risk of occurrence of AUB in high-performance Peruvian athletes.

Study design Cross-sectional study.

Level of evidence Level 4.

Methods We applied an online questionnaire with questions to identify AUB according to the International Federation of Gynecology and Obstetrics criteria, demographic characteristics, sport practised and evaluation of the risk of an eating disorder using the Eating Attitudes Test questionnaire. We used a generalised linear model to identify factors associated with AUB.

Results We evaluated 101 participants whose mean age was 22.3±4.3 years. The body mass index had a mean of 22.6±2.4 kg/m². From the total of athletes, 68.3% (95% CI 58.6% to 76.7%) presented AUB. The bivariate analysis showed that the type of sport and the duration of the sporting activity were associated (p<0.05) with AUB, with AUB frequencies of 76.5% observed in athletes who practised anaerobic sports. The multivariate analysis did not report factors significantly associated with AUB.

Conclusion We found a high frequency of AUB in high-performance Peruvian athletes, especially in those who practice anaerobic and resistance sports.

Clinical relevance High-performance female athletes health must be evaluated periodically, and immediate actions are taken to control and treat AUB.

WHAT IS ALREADY KNOWN ON THIS TOPIC
⇒ Abnormal uterine bleeding (AUB) is a health problem and is a major cause of anaemia and poor quality of life globally among women, even in athletes' ones.

WHAT THIS STUDY ADDS
⇒ The alteration in athletic practice, training regimes and monitoring in Peruvian high-performance athletes is associated with high frequency of AUB.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY
⇒ AUB can decrease sports performance, and even partial and permanent desertion of the athlete.

⇒ It is important to improve medical evaluation actions in female athletes.

INTRODUCTION

Women's participation in highly competitive sporting events has increased in recent decades, and at the International Olympic Games level, it has been recorded that 45% of the participants are women.[1] Reaching a high competitive level requires extreme physical and mental preparation.[2] The demand on the female athletes' physiology can cause irregularities due to the demanding exercise programmes and eating regimes required to reach highly competitive levels.[3] Among the most frequent alterations reported are decreased bone mass, fatigue, anxiety, eating disorders and menstrual disorders with abnormal uterine bleeding (AUB).[4 5]

AUB is characterised by irregularity in the menstrual cycle, frequency, duration, volume and flow outside of pregnancy.[6] The prevalence of AUB in general population ranges between 5% and 35.6% depending on age, occupation and origin,[7] and it is considered a reason for gynaecological consultation in 75% of adolescents.[8] In female athletes, an incidence between 16% and 61% of menstrual disorders with AUB is recorded.[9] The frequency of AUB is higher in more demanding sports,[10] and AUB has even been identified in athletes aged 11 years, with a prevalence of 28%.[11] On the other hand, the prevalence of AUB presents significant differences (p<0.05) between adolescents and young athletes, with 39% of young athletes presenting AUB compared with 6% in non-athletic women.[12]

Although it is evident that menstruation disorders are a common problem in elite athletes,[13] there is limited information on AUB in Latin American countries such as Peru, where social and cultural gaps are significantly different between men and women.[14] Therefore, our study aimed to determine the prevalence of AUB in high-performance Peruvian athletes and identify the associated factors. Our study contributes to the improvement of primary prevention strategies in a population that requires careful medical follow-up to improve their sports performance, well-being, health and quality of life.

METHODS

Design and participants

We designed a cross-sectional study and evaluated high-performance Peruvian athletes representing the Peruvian sports delegation in national and international events. The Peruvian Sports Institute (IPD, in Spanish: Instituto Peruano del Deporte) grants the qualification as a high-performance athlete, as established in Peruvian Law No. 30 994. According to the list of high-performance athletes referred to by the IPD, during the year 2021, 872 people were registered. Our study sample comprised 101 high-performance female athletes who reside in Lima, the capital from Peru, and have participated in national and international competitions during the last 3 years.

Since the IPD provided no nominal list, information was obtained through the sports federations in Lima, and the snowball sampling strategy was used. Preliminary information was obtained from the 2020–2021 statistical compendia and bulletins reported by the IPD.[15] Subsequently, we recruited the athletes residing in Lima, Peru who have competed in different national federations and participated in the 2020 Olympic Games until the sample size was reached. We encourage participants to contact other athletes to participate in the study.

We recruit high-performance female athletes between 18 and 40 years residing in Lima, Peru. We do not consider underage athletes with chronic pathology, family history with metabolic diseases, pregnancy, perimenopause, presenting any physical disability, use of oral hormonal contraceptives in the last 2 months or having a personal history of abortion, cancer or surgical interventions attached to the reproductive system. Nine participants who were under 18 years of age were excluded.

Techniques and instruments

Due to the COVID-19 health emergency declared in Peru, we applied a virtual questionnaire developed in Google Forms, which contains questions distributed in demographic and anthropometric aspects related to the sport practised, eating disorders and AUB. Expert judgement validated the questionnaire. Similarly, we conducted a pilot test on 25 female athletes to refine the terminology and questions in the questionnaire.

The AUB was evaluated through the application of a questionnaire designed by the Delphi RAND technique approved by the International Federation of Gynecology and Obstetrics (FIGO).[16] Its dimensions are divided into frequency, duration, regularity, volume, presence or absence of intermenstrual bleeding and unscheduled bleeding (in those women receiving progestin with or without oestrogen), parameters that evaluate the presence of normal and abnormal symptoms of uterine bleeding in women's reproductive years.[17] The Delphi RAND method allowed terms to be harmonised and abnormalities to be classified, considering that it is a flexible 75th percentile design to facilitate searches, educate and apply in the clinic.[18] The questionnaire's validity was studied by epidemiologists, gynaecologists and other experts worldwide between 2012 and 2017 at different conferences and teleconferences, where they applied a series of questionnaires using the modified Delphi technique.[16] The Delphi technique is considered one of the general methods of prospective and structuring questionnaires. It is widely used in health sciences research, considering that it stands out for its iterative, anonymous process, controlled feedback and providing group statistics to clarify and validate the information provided.[19] The structure of the questionnaire is observed in online supplemental material 1.

Eating disorders were assessed using the Eating Attitudes Test (EAT-26) questionnaire. It is an instrument that evaluates the risks of eating disorders in the female population.[20] We used the Spanish version which was validated in 136 students from the private university of Medellín. Cronbach's alpha was 92.1%, thus validating its reliability. The receiver operating characteristic analysis finalised the best cut-off value of 11 or more points due to its best sensitivity of 100% and specificity of 85.6%. This point indicates that a person with a score of 11 or more is at risk of eating disorders with a 97.3% probability.[21] The content of the EAT-26 is shown in online supplemental material 2.

The type of sport was classified into anaerobic (weight-lifting), resistance (swimming, cycling and running) and aesthetic (rhythmic gymnastics and synchronised swimming) categories. The characteristics of the sport practised included the measurement of physical fitness within its frequency and duration, as recommended by IPD,[22] to evaluate the female health of athletes. We also obtained information on age, height, weight and menarche.

Statistical analysis

The characteristics of the participants were presented using descriptive statistics. The presence of AUB was presented in relative frequency and with its 95% CI. Likewise, the AUB was compared for each independent variable using the Pearson's χ^2 test, and we considered a p value <0.05 as a significant difference. Factors associated with AUB were identified using a generalised linear model with the Poisson family and a log link function. Variable selection was based on epidemiological criteria and a diagram acyclic graph analysis. We calculated the prevalence ratio as a measure of association and its 95%

Table 1 Descriptive characteristics of the participants (n=101)

Characteristic	N (%)	95% CI
Age (years)	22.3±4.3	
Height (cm)	160.6±7.3	
Weight (kg)	58.4±7.2	
BMI (kg/m^2)	22.6±2.4	
Age at onset of menarche (years)	12.6±1.5	
Type of sport		
Aesthetic	12 (11.9)	6.8 to 19.9
Resistance	38 (37.6)	28.6 to 47.6
Anaerobic	51 (50.5)	40.7 to 60.2
Practice frequency per week		
3–5 days	21 (20.8)	13.9 to 29.9
6–7 days	80 (79.2)	70.1 to 86.1
Duration of time training		
<1 hour	3 (3.0)	0.9 to 8.9
1–2 hours	25 (24.7)	17.2 to 34.2
>2 hours	73 (72.3)	62.7 to 80.2
Eating disorder		
Low risk of TAC	57 (56.4)	46.5 to 65.9
High risk of TAC	44 (43.6)	34.1 to 53.5

BMI, body mass index; TAC, trastorn of alimentary conduct.

Table 2 Abnormal uterine bleeding and characteristics of menstruation in the participants

Characteristic of menstruation	N (%)	95% CI
Menstrual bleeding		
Normal	66 (65.4)	56.5 to 75.0
Abnormal	35 (34.6)	25.0 to 43.5
Bleeding volume		
Normal	70 (69.3)	59.5 to 77.6
Light	5 (4.9)	20.5 to 11.5
Heavy	26 (25.8)	18.1 to 35.3
Flow duration		
<8 days	95 (94.1)	87.3 to 97.3
From 8 days to more	6 (5.9)	2.6 to 12.7
Intermenstrual bleeding		
No	65 (64.4)	54.4 to 73.2
Yes	36 (35.6)	26.8 to 45.5
Regularity		
From 7 to 9 days of variation/cycle	83 (82.2)	73.3 to 88.5
From 10 to more days of variation/cycle	18 (17.8)	11.5 to 26.6
Frequency of menstrual bleeding		
<24 days	80 (79.2)	70.1 to 86.1
24–38 days	11 (10.9)	6.1 to 18.7
>38 days	8 (7.9)	4.0 to 15.2
Does not bleed	2 (2.0)	0.5 to 7.7
Abnormal uterine bleeding		
Absence	32 (31.7)	23.3 to 41.5
Presence	69 (68.3)	58.6 to 76.7

CI in a bivariate and multivariate model. The calculations were performed in the Stata V.17.0 (StataCorp, College Station, Texas, USA, April 2021).

RESULTS

We enrolled 110 athletes, of which we excluded 9 minors. The participants had a mean age of 22.3 years, and 85.2% had a body mass index (BMI) <25.0 kg/m^2. According to the characteristics of the sport, 50.5% of athletes performed anaerobic sports and practised frequently daily at an intensity greater than two continuous hours. We found that 43.6% of all athletes were at high risk for eating disorders (table 1).

Although 65.4% reported normal menstrual bleeding, 68.3% (95% CI 58.6% to 76.7%) of the participants experienced AUB. Of the parameters defining AUB, the two with the highest frequency of alteration were the presence of intermenstrual bleeding and the volume of bleeding (table 2).

The type of sport practised by the participants was significantly associated with the presence of AUB (p<0.005), and we observed that among athletes with AUB, the highest frequency occurs in those who practice anaerobic sports (76.5%), followed by those who practice resistance sports (71.0%). The time training was also associated with AUB (p<0.05), and a higher frequency of AUB was recorded in those who practised sports activity for more than two continuous hours (table 3).

The generalised linear model analysis did not show variables associated with AUB, either in the bivariate or multivariate model (table 4).

DISCUSSION

AUB is a problem in women of childbearing age, especially in those with intense physical activity, obesity, nutritional and hormonal disorders, among others.[23] We found that 68.3% had AUB, which was more common among athletes who practised anaerobic and resistance sports, as well as those who engaged in continuous time training for >60 min/day. This high frequency can be explained from the metabolic and endocrine point of view. It is known that athletes had high physical activity, low BMI[24] and, combined with low-calorie dietary regimens, could induce functional changes in the hypothalamus and the synthesis of leptins,[25] which are associated with an increase in delayed menarche and increased AUB.[26] We found that 85.2% of those evaluated had a BMI <25.0 kg/m^2. The participants are characterised by having high

Table 3 Factors associated with abnormal uterine bleeding in bivariate analysis

Characteristic	Abnormal uterine bleeding, n (%)		P value
	Absence	Presence	
Age (years)	22.0 (19.0–24.5)	21.0 (19.0–24.0)	0.857*
Height (cm)	160.0 (156.5–163.0)	160.0 (156.0–164.0)	0.410*
Weight (kg)	56.0 (52.5–59.5)	58.0 (54.0–62.0)	0.067*
BMI (kg/m^2)	22.0 (20.3–23.5)	22.8 (21.1–24.2)	0.106*
Age at onset of menarche (years)	13.0 (12.0–13.0)	13.0 (11.0–14.0)	0.855*
Type of sport			0.002†
Aesthetic	9 (75.0)	3 (25.0)	
Resistance	11 (29.0)	27 (71.0)	
Anaerobic	12 (23.5)	39 (76.5)	
Practice frequency per week			0.384†
3–5 days	5 (23.8)	16 (76.2)	
6–7 days	27 (33.8)	53 (66.2)	
Duration of time training			0.035†
<1 hour	3 (100.0)	0 (0.0)	
1–2 hours	7 (28.0)	18 (72.0)	
>2 hours	22 (30.1)	51 (69.9)	
Eating disorder			0.403†
Low risk of TAC	20 (35.1)	37 (64.9)	
High risk of TAC	12 (27.3)	32 (72.7)	

*Mann-Whitney U non-parametric test.
†Pearson's χ^2 test.

physical activity and controlled diets, so the confluence of these factors can exacerbate the occurrence of AUB.

It is also known that exercise and regular aerobic physical activity are associated with better regulation of insulin in women, whose receptors are expressed in the ovary and, therefore, can influence the menstrual cycle[27]; therefore, it could be beneficial in the prevention and control of AUB.[28] However, excessive physical activity is among the risk factors for AUB.[23] In women who practice resistance and anaerobic sports, we found

Table 4 Factors associated with abnormal uterine bleeding in multivariate analysis

Characteristic	Bivariate model*			Multivariate model		
	PR	95% CI	P value	PR	95% CI	P value
Age (years)	1.00	0.94 to 1.05	0.935	1.00	0.94 to 1.06	0.961
BMI (kg/m^2)	1.04	0.95 to 1.14	0.371	1.03	0.93 to 1.13	0.628
Age at onset of menarche (years)	1.00	0.86 to 1.17	0.999	1.00	0.85 to 1.17	0.974
Type of sport						
Aesthetic	Reference			Reference		
Resistance	2.84	0.86 to 9.37	0.086	3.03	0.90 to 10.16	0.073
Anaerobic	3.06	0.95 to 9.90	0.062	3.13	0.94 to 10.36	0.062
Practice frequency per week						
3–5 days	Reference			Reference		
6–7 days	0.87	0.50 to 1.52	0.624	0.82	0.47 to 1.44	0.489
Eating disorder						
Low risk of TAC	Reference			Reference		
High risk of TAC	1.12	0.70 to 1.80	0.638	1.19	0.73 to 1.94	0.487

*Generalised linear model with the Poisson family and a log link function.
BMI, body mass index; PR, prevalence ratio.

the highest frequencies of AUB, with 71.0% and 76.5%, respectively in each group. However, no significant association was found between the sport practised and the presence of AUB. A recent study presented an opposite case that found an association between very active women and AUB (OR 0.90; 95% CI 0.82 to 0.98),[29] so physical activity could play an essential role in preventing AUB. These discrepant results compared with ours should be addressed in longitudinal designs that involve a larger sample size.

Regarding diet and eating behaviour, despite not having found a significant relationship with the presence of AUB in the athletes evaluated, we did observe a higher frequency of AUB (72.7%) in women with a high risk of the eating disorder compared with those at low risk (64.9%). Low risk eating behaviours characterised by consuming grains, fruits, vegetables, seafood and nuts, among others, are associated with a lower frequency of menstrual disorders.[30]

AUB leads to many health problems, the most significant being the presence of massive haemorrhage, and it also becomes the most important cause of anaemia in women.[31] The presence of anxiety, depression and obsessive-compulsive disorder has also been reported in women with AUB,[32] and they may represent factors associated with AUB. Perhaps one of the aspects most affected in women who suffer from AUB is the quality of life, representing millions of direct and indirect economic expenses annually.[33 34] As can be seen, this pathology has negative implications on women's overall health, and there is a risk of absenteeism and sports desertion.[35]

The most important limitation is that the data were obtained subjectively through self-report. We did not perform a gynaecological examination supported by diagnostic imaging or histopathology aimed at identifying pathologies that cause AUB. FIGO identifies these pathologies as follows: of structural origin such as polyp, adenomyosis, leiomyoma (uterine fibroids), malignant neoplasia, coagulopathy, ovulatory dysfunction, endometrium, iatrogenic and not otherwise classified.[16] However, it has been shown that between 20% and 35% of women with AUB present with polyps and adenomyosis.[36 37] We also did not consider the vaccination status of athletes, and recently, research has indicated AUB as a possible side effect of COVID-19 vaccination.[38 39] Despite the limitations, our findings are relevant, especially given the scarcity of evidence on AUB in highly competitive athletes on a global scale.[13 40] Likewise, we have included essential variables that explain the occurrence of AUB and are consistent with previous findings.

Finally, it is vital to explore the interactions between potential factors associated with AUB and use biomarkers with better sensitivity and specificity that allow addressing the problem of AUB more comprehensively.[41] The health of highly competitive athletes must be evaluated periodically.

CONCLUSION

Seven out of 10 high-performance Peruvian athletes experience AUB, making it one of the most prevalent health issues in this risk group. We have found that AUB is more frequent in those who practice anaerobic (76.5%) and resistance (71.0%) sports. Our results show the highest AUB frequency reported to date compared with other studies that show AUB frequencies <61%. Likewise, it is the first study that addresses the problem of AUB in athletes in Latin America, and serves as a reference for future studies. Regarding eating disorders, we have not found a significant association, even though previous studies indicate it as an important determinant. However, we observed a high frequency of risk for eating disorders, the interaction of which with other unassessed factors could play an essential role in explaining AUB. Finally, we can emphasise the importance of strengthening programmes for the timely detection of AUB, and implementing preventive measures to control and mitigate its occurrence.

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