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Prevalence, Severity, and Psychosocial Determinants of Relative Energy Deficiency in Sport (REDs) Among Female Collegiate Athletes in Lahore, Pakistan

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ABSTRACT
Background: Relative Energy Deficiency in Sport (REDs) is a syndrome of multiple systems that is caused by chronic low energy availability (LEA). The prevalence of REDs and the psychosocial factors were not studied among female collegiate athletes in Pakistan. **Objectives:** To evaluate the prevalence of risk of REDs, the psychopathology of eating disorders, the availability of energy, the status of menstrual function and to determine independent factors predicting risk of REDs. **Methods:** This was a quantitative cross-sectional study of 92 female collegiate athletes (21.4±2.1 years) from five universities of Lahore. The Low Energy Availability in Females Questionnaire (LEAF-Q ≥ 8 = at risk), EDE-Q 6.0, and FHAM (structured questionnaire) were used to assess REDs risk, energy availability (EA), and menstrual function, respectively. **Results:** REDs risk prevalence was 54.3% (n = 50/92; 95% CI: 43.8–64.4%). The sport with the highest sport-specific prevalence was gymnastics (70.0%) followed by athletics (61.1%). The overall global mean was 2.18 ± 0.91 with 40.2% of these scores being above the clinical cut-off point of 2.3. The average EA was 33.8 ± 9.4 kcal/kg FFM/day (range: 14.2 – 56.8) and 39.1% were deemed to be in the critically low energy expenditure brackets (< 30 kcal/kg FFM/day), approximately following a normal distribution. A higher proportion of participants (38.0%) had irregular periods with this proportion being significantly higher in the athlete at risk group ($\chi^2(1) = 21.84$, $p < 0.001$). Logistic regression analyses revealed that EA (OR = 0.84), EDE-Q global score (OR = 3.84), menstrual irregularity (OR = 4.17), and aesthetic/endurance sport type (OR = 2.63) were independent significant factors (all $p \leq 0.027$; Nagelkerke $R^2 = 0.61$). **Conclusion:** Female college students are at risk and have clinically significant prevalence of REDs in Lahore, Pakistan. The major risk determinants are eating disorder psychopathology, low energy availability, menstrual dysfunction and

sport type.

Keywords: REDs, low energy availability, LEAF-Q, EDE-Q, female athletes, Pakistan, eating disorders, menstrual dysfunction, collegiate sports.

INTRODUCTION

Relative Energy Deficiency in Sport (REDs) is a clinical syndrome of multi-system physiological and psychological impairment that is a result of chronic low energy availability (LEA). REDs were initially developed as an extension of the Female Athlete Triad in 2014 by the International Olympic Committee (IOC) and involve at least 9 systems, such as reproductive, skeletal, metabolism, cardiovascular, immunological, hematological, gastrointestinal and neurocognitive functions (Mountjoy et al., 2014; 2023). The 2023 IOC consensus statement, informed by more than 170 research publications pertaining to LEA, categorizes LEA along a continuum of adaptable to problematic, following on the understanding that in a cascade, a chronic or severe LEA results in multi-system impairment (Mountjoy et al., 2023).

Energy Intake − Exercise Energy Expenditure, divided by Fat-Free Mass is the expression used to define LEA, which is energy expenditure above what is used for exercise, per kg of fat-free mass per day. A critical low EA threshold is <30 kcal/kg FFM/day, leading to a reduction in reproductive hormone levels, reduction in bone mineral density (BMD) accrual, metabolic down regulation and impaired immunity (Burke et al., 2018). The systematic review and meta-analysis reported a prevalence of LEA of 44.2% in female athletes and a prevalence for risk for REDs ranged between 22% and 58% in different populations (Moore et al., 2024; Mountjoy et al., 2023).

These physiological changes of chronic LEA have wide-reaching implications, and involve multiple endocrine pathways with a spectrum of interdependent dysfunctions that make up the REDs spectrum. Chronic LEA is linked to a reproductive spectrum that includes reduced pulsatile gonadotropin-releasing hormone (GnRH) secretion from the hypothalamus which leads to a decrease in downstream luteinizing hormone (LH) and follicle-stimulating hormone (FSH) secretion, a decrease in ovarian production of estrogen, and functional hypothalamic amenorrhea (FHA) (De Souza et al., 2019; Wong et al., 2025). Meanwhile, the low levels of insulin like growth factor-1 (IGF-1) that occur with LEA also contribute to poor formation of bone, and the increase in cortisol and decrease in leptin contribute to increased bone resorption rates all of which lead to a decrease in bone mineral density that is not fully restored once menstrual function returns (Melin et al., 2024).

Besides their effect on reproductive and skeletal systems, other consequences of REDs involve reduced hematological parameters (serum ferritin and hemoglobin); diminished cardiovascular efficiency; gastrointestinal motility and impaired neurocognitive performance (reaction time, mood regulation, and executive function) (Mountjoy et al., 2023). The multi-systemic nature of this impairment underscores the need for the absence of any single clinical metric being adopted for prevalence screening and the development of validated multi-instrument approaches to prevalence screening such as the LEAF-Q, EDE-Q and energy availability calculation (currently consensus Mountjoy et al., 2023).

The risk profile of the female collegiate athlete for REDs is unique with respect to her non-athletic peers and also the elite professional athletes (structural, psychological, and nutritional). In most countries like Pakistan, collegiate sports are not supported by a sports medicine and dietetics infrastructure found in professional or national sports; athletes are expected to complete full academic requirements, thus requiring similar training loads to

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semi-professional sports with no target energy intake and recovery nutrition to guide them (Jagim et al., 2022).

The collegiate years are a critical period where one is more vulnerable to issues of identity and body image and where sport culture, through peer comparisons and coaching feedback on body shape and appearance, as well as sport-specific beauty ideals (Roux et al., 2024), can heighten this focus. As for nutrition, collegiate athletes often have logistical challenges to getting enough energy with limited access to the canteen during training hours; financial limitations to the quality of foods available; and time poverty between academics and training sports that can lead to unintentional LEA, regardless of disordered eating cognitions (Logue et al., 2020). Logue et al. (2020) estimated that as many as 44% of LEA in female collegiate athletes might be unintentional, which supports integration of Behavioural and structural factors associated with energy intake in collegiate athletes in REDs risk assessment.

Data supporting that eating disorder psychopathology is a primary psychosocial risk factor for LEA and REDs in female athletes is gradually increasing. Higher scores on valid eating disorder questionnaires (e.g., EDE-Q) correspond with less energy available, a greater prevalence of menstrual dysfunction, and higher scores on the LEAF-Q in cross-sectional and longitudinal studies of athletes (Logue et al., 2020; Witkoš et al., 2024). The mechanism of action is cognitive dietary restraint (Burke et al., 2018): Athletes with more eating psychopathology factors perform an intentional energy restriction to achieve weight and/or body composition goals which results in the reduction of energy available for energy expenditure during training. Importantly, clinical level eating disorder psychopathology (EDE-Q global score > 2.3) is not a requirement for the risk of REDs, as sub clinical levels of eating disorder restraint and weight preoccupation are sufficient to cause significant amounts of energy deficit if training is sufficiently high (Sundgot-Borgen & Torstveit, 2004). Thus, the importance of identifying the psychosocial risk factors of REDs is not only an academic issue; the rapid and cost-effective identification of eating disorder psychopathology by means of self-report allows for the use of the EDE-Q as a screening instrument in a resource-limited university setting as a first-line approach. College women athletes is a known high-risk population.

Academic demands, competitive training and sociocultural factors related to body weight converge to form a setting for the insidious emergence of LEA (Jagim et al., 2022). Although women collegiate sports have expanded significantly in Pakistan since the Sports Drive of Kamyab Jawan 2021, there still is much work that needs to be done, including family level monitoring of dietary behaviors, sports nutrition facilities, and health monitoring at collegiate level for REDs (Laar et al., 2022; Fatima et al., 2023). Only a single previous close study (Syed et al., 2022) identified 50% risk for disordered eating and 24% prevalence of menstrual irregularity, but did not assess energy availability, and examined national-camp athletes, not collegiate athletes. Relevant, validated RED screening tools have undergone tremendous improvements in their capacity to conduct prevalence studies at the population level. Melin et al. (2015) developed and validated the LEAF-Q in Norwegian elite endurance athletes (sensitivity 78%, specificity 90%) which is the first questionnaire specifically created to identify female athletes at risk of LE-related health consequences. It is a valid tool for other sport modalities and competitive levels (collegiate and recreational) as demonstrated by Witkoš et al., (2024) and Logue et al., (2020).

Eating Disorder Examination-Questionnaire (EDE-Q; Fairburn and Beglin, 1994) is a structured self-report instrument that was validated and developed from the Eating Disorder Examination (EDE) interview, which assesses eating disorder psychopathology in four dimensions directly related to the psychosocial determinants of LEA: dietary restraint, eating concern, weight concern, and shape concern. When used in combination with a 3-day food recall for energy availability, these instruments provide convergent and triangulated evidence for the risk of REDs which is more rigorous than either instrument alone (Burke et al., 2018; Mountjoy et al., 2023). LEAF-Q/EDE-Q previously have been validated internationally and widely used in the prevalence studies of European and North American countries, however, have never been used in female collegiate players in Pakistan, which is a gap in global evidence of REDs.

Methods and Materials

Study Design

A quantitative cross-sectional survey design was used in this study to identify the prevalence, severity and psychosocial determinants of REDs in collegiate female athletes in Lahore, Pakistan. All the data were gathered from one structured session, thus minimizing the burden on the participants and providing adequate data to meet all the research objectives.

Population of the study

Target population of the study Female collegiate athletes aged 17 to 25 years old, enrolled and actively participating in competitive sports in Lahore, Pakistan were included in the population of this study. The participants were selected from five Universities namely University of the Punjab, Lahore College for Women University, University of Lahore, Kinnaird College for Women and Forman Christian College.

Sample and Sample Size

Purposive sampling with snowball recruitment was used in collecting the sample while the size of the sample was determined by the L.R. Gay formula.

Instruments and instrumentation

The following five instruments were used to collect these data: (1) The Low Energy Availability in Females Questionnaire (LEAF-Q) created by Melin et al. to identify the risk of having REDs; (2) the Eating Disorder Examination Questionnaire (EDE-Q 6.0) created by Fairburn and Beglin to evaluate eating disorder psychopathology; (3) a 3-day food diary analyzed by the Ainsworth et al. Compendium of Physical Activities MET values to calculate energy availability; (4) anthropometric and body composition measurements, including height, weight, and fat-free mass (FFM) analyzed by bioelectrical impedance analysis (Tanita BC-601); and (5) the Female Health and Menstrual History Questionnaire (FHAM) created by Nattiv et al. to assess menstrual function.

Ethical Consideration

The ethical approval was given by the department of sports sciences and physical education, University of Lahore, Punjab, Pakistan. All participants signed a written informed consent before them taking part in the data collection.

Mode of data Collection

Data were personally collected by the researcher in private rooms in each institution in the absence of coaches or peers to reduce bias.

Statistical Analysis

Collected data was statistically analyzed by using Statistical Package for Social Sciences (SPSS, Version 26) with the following appropriate statistical tests (independent-samples t-test, Chi-square (χ^2) test, binary logistic regression (enter method) and Hosmer – Lemeshow test).

Results

Table 1. Participant characteristics (Mean ± SD) for the full sample and stratified by LEAF-Q risk classification. At Risk = LEAF-Q ≥ 8; Not at Risk = LEAF-Q < 8.

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Variable	Total (N=92)	At Risk (n=50)	Not at Risk (n=42)
Age (years)	21.4 ± 2.1	21.1 ± 2.0	21.8 ± 2.2
Height (cm)	163.2 ± 4.9	162.8 ± 4.7	163.7 ± 5.2
Body mass (kg)	59.1 ± 6.3	57.4 ± 5.8	61.1 ± 6.4
BMI (kg/m²)	22.1 ± 2.2	20.8 ± 2.18	23.6 ± 1.94
Fat-free mass (kg)	45.8 ± 4.3	44.9 ± 4.1	46.9 ± 4.5
Training hours/week	12.8 ± 2.7	13.2 ± 2.8	12.3 ± 2.6

Table 1 describes that ninety-two female collegiate athletes completed all instruments. The mean age was 21.4 ± 2.1 years, the mean BMI was 22.1 ± 2.2 kg/m², and the mean weekly training hours were 12.8 ± 2.7. At-risk athletes demonstrated significantly lower BMI (20.8 ± 2.18 vs. 23.6 ± 1.94 kg/m²; $t(90) = 6.88$, $p < 0.001$). There was no group difference in the number of training hours ($t(90) = 1.63$, $p > 0.05$). Table 1 displays the characteristics of the participants.

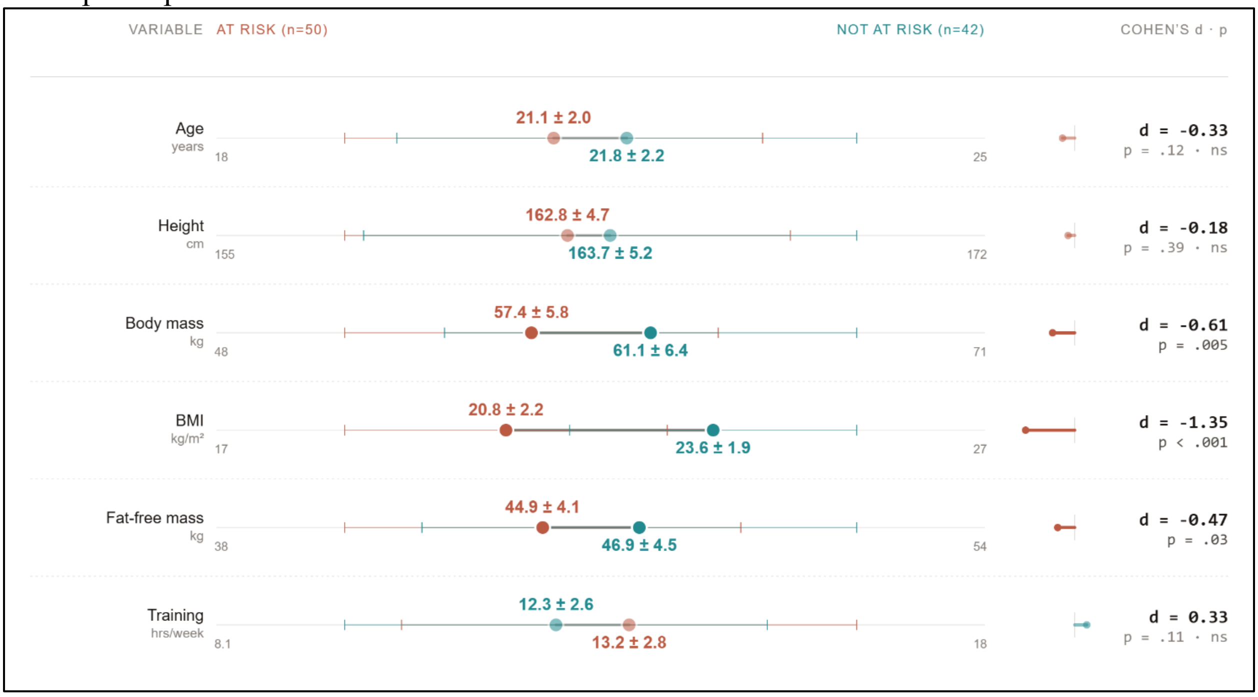

Figure 1. *Dumbbell plot of group means by variable. Dots = At Risk / Not at Risk means; thin red/teal whiskers = ±SD; central grey segment = inter-group gap. The right column shows Cohen's d (pooled SD) on a ±1.6 mini-axis with the Welch's t-test p-value. Non-significant rows are dimmed.*

Table 2. REDs risk prevalence (LEAF-Q ≥ 8) and LEAF-Q mean scores stratified by sport discipline. Overall, 95% Wilson CI: 43.8% – 64.4%.

Sport	Type	n	At Risk n	Prevalence (%)	LEAF-Q Mean ± SD
Volleyball	Team	22	10	45.5	7.41 ± 3.92
Athletics	Endurance/Aesthetic	18	11	61.1	9.33 ± 4.18
Cricket	Team	16	6	37.5	6.88 ± 3.64

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Sport	Type	n	At Risk n	Prevalence (%)	LEAF-Q Mean ± SD
Badminton	Racket	14	7	50.0	8.07 ± 4.01
Football	Team	12	5	41.7	7.25 ± 3.77
Gymnastics	Aesthetic	10	7	70.0	11.60 ± 3.89
TOTAL	Mixed	92	50	54.3% (95% CI: 43.8–64.4%)	8.14 ± 4.22

Table 2 shows that the REDs' risk prevalence was 54.3% (n = 50/92; 95% CI: 43.8–64.4%). The mean LEAF-Q total was 8.14 ± 4.22 across the full sample: 11.92 ± 3.14 in at-risk and 3.71 ± 2.08 in not-at-risk athletes ($t(90) = 12.84$, $p < 0.001$). The sport-specific prevalence ranged from 37.5% (cricket) to 70.0% (gymnastics; Table 2). Logistic regression analysis showed that aesthetic/endurance sport type was 2.63 times more likely to be associated with the risk of REDs than team sports (OR = 2.63, 95% CI: 1.12–6.17, $p = 0.027$).

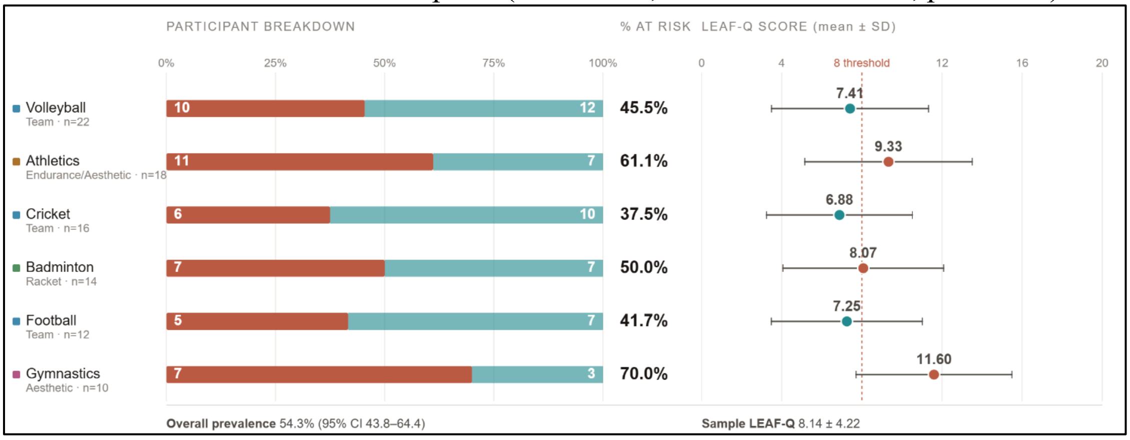

Figure 2. *Sport-stratified REDs risk. Left panel: proportion of athletes classified at risk (LEAF-Q ≥ 8) by sport. Right panel: LEAF-Q score (mean ± SD); dashed line marks the risk threshold. Sport-type tag color shown beside each label.*

Table 3. Key outcome variables by LEAF-Q risk classification. All p-values from independent-samples t-tests (continuous variables) or chi-square tests (categorical variables).

Outcome Variable	At Risk (n=50)	Not at Risk (n=42)	p
LEAF-Q total score (Mean ± SD)	11.92 ± 3.14	3.71 ± 2.08	< 0.001
EDE-Q global score (Mean ± SD)	2.87 ± 0.69	1.38 ± 0.57	< 0.001
EDE-Q above clinical threshold (%)	72.0%	2.4%	< 0.001
Energy availability (kcal/kg FFM/day)	26.4 ± 5.2	42.6 ± 6.8	< 0.001
Critically low EA (< 30) n (%)	36 (72.0%)	0 (0.0%)	< 0.001
Menstrual irregularity n (%)	30 (60.0%)	5 (11.9%)	< 0.001

Table 3 presents the EDE-Q scores, energy availability, and menstrual status across different risk groups. Significant differences were observed between the groups for all variables ($p < 0.001$).

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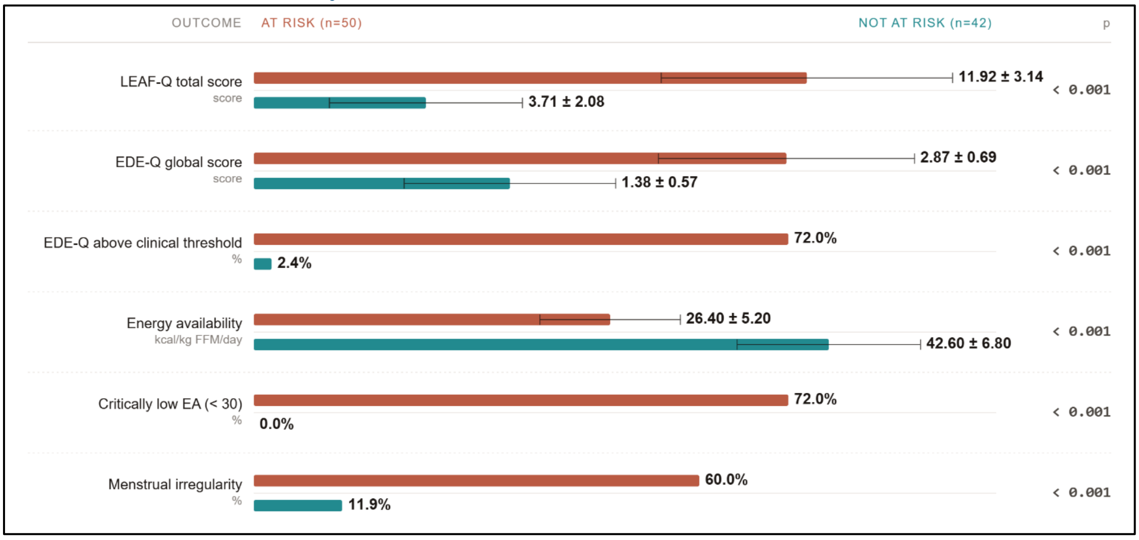

Figure 3. *Group means (continuous outcomes show ±SD whiskers) and prevalences (%) for six key outcomes. All between-group differences significant (Welch's t or χ^2). Note that lower energy availability indicates worse status; for all other rows, lower is better.*

Subscale analysis of the EDE-Q revealed significant differences between groups in each of the four subscales (Restraint, Eating Concern, Weight Concern, and Shape Concern; all $p < 0.001$). The largest absolute difference was found for the Restraint subscale (3.08 ± 0.81 vs. 1.24 ± 0.68), which is congruent with the notion that eating disorder psychopathology is mainly related to decreased energy intake through dietary restraint.

Of 92 participants, 57 (62.0%) were eumenorrheic, 22 (23.9%) oligomenorrheic, and 13 (14.1%) amenorrhoeic. Sixty percent of at-risk athletes had menstrual irregularity (oligomenorrhoea and amenorrhea combined) compared with 11.9% of not-at-risk athletes ($\chi^2(1) = 21.84$, $p < 0.001$; $\varphi = 0.44$, medium-to-large effect). Energy availability distribution: 39.1% critically low (< 30 kcal/kg FFM/day), 41.3% reduced (30–44.9 kcal/kg FFM/day), 19.6% optimal (≥ 45 kcal/kg FFM/day). The distribution of the EA was close to normal (Shapiro-Wilk W = 0.97, p = 0.09). Critically low EA participants were all at risk on LEAF-Q, indicating strong convergent validity between EA and LEAF-Q.

Table 4. *Binary logistic regression predicting REDs risk (LEAF-Q ≥ 8) from six independent predictors (N = 92). OR = odds ratio. Reference category for sport type: team sports. The reduced 4-predictor sensitivity model is reported in Supplementary Material.*

Predictor	OR	95% CI	Wald χ^2	p
Energy availability (kcal/kg FFM/day)	0.84	0.79–0.90	25.31	< 0.001
EDE-Q global score	3.84	2.21–6.67	18.42	< 0.001
Menstrual irregularity (vs. regular)	4.17	1.88–9.25	11.63	0.001
Aesthetic/endurance sport (vs. team)	2.63	1.12–6.17	4.91	0.027
BMI (kg/m²)	0.91	0.79–1.05	1.72	0.190

Predictor	OR	95% CI	Wald χ²	p
Weekly training hours	1.08	0.96–1.22	1.63	0.201
Nagelkerke R² = 0.61 | Hosmer-Lemeshow χ²(8) = 6.43, p = 0.599 | Classification accuracy = 81.5% | Note: 6-predictor enter model; reduced 4-predictor model (significant predictors only) produced equivalent fit (Nagelkerke R² = 0.59; see Supplementary Material)				

Table 4 presents the binary logistic regression model. The model demonstrated good fit (Hosmer-Lemeshow $\chi^2(8) = 6.43$, $p = 0.599$; Nagelkerke $R^2 = 0.61$; classification accuracy = 81.5%). Of these, 4 were statistically significant. Energy availability was the best predictor (OR = 0.84): a 1 kcal/kg FFM/day increase in EA lowered the odds of REDs by 16%. The global score of EDE-Q (OR = 3.84), the aesthetic/endurance sport type (OR = 2.63), and menstrual irregularity (OR = 4.17) were all significant. Notably, BMI and weekly training hours were not significant (OR = 0.91, $p = 0.190$; OR = 1.08, $p = 0.201$, respectively); these non-significant findings are discussed in Section 4.

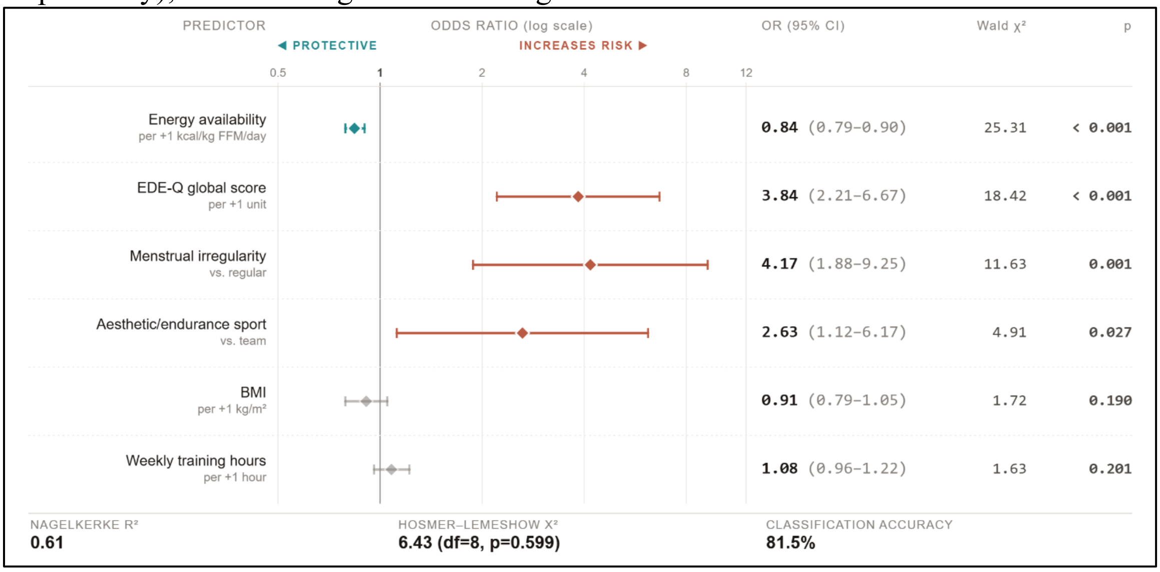

Figure 4. *Forest plot of adjusted odds ratios for six predictors of REDs risk. Diamonds = point estimates; whiskers = 95% CI; horizontal axis is logarithmic. Energy availability and EDE-Q global score show the largest reliable effects; BMI and weekly training hours are non-significant in the adjusted model.*

4. Discussion

This is the first time study on the prevalence of risks associated with REDs in collegiate female athletes in Pakistan was carried out and was an empirical study. The overall prevalence of 54.3% (95% CI: 43.8–64.4%) falls at the higher end of international ranges of prevalence in collegiate athletes as reported by Logue et al. (2020) (47.3% in collegiate athletes in Ireland), Melin et al. (2015) (47% in elite endurance athletes in Norway), and for LEAF in Pakistanis collegiate athletes as reported by Moore et al. (2024) (pooled prevalence of 44.2% internationally), demonstrating the applicability of the LEAF-Q as a screening tool for this context.

The prevalence trend is similar to that found internationally and is sport-stratified. The prevalence was highest for gymnastics (70.0%) and athletics (61.1%), as expected, due to

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the high-risk profile of aesthetic and endurance sports with incentives to body leanness or lightness (Sundgot-Borgen & Torstveit, 2004; Roux et al., 2024). Logistic regression analysis revealed that the kind of the sport (aesthetic/endurance sport type) was an independent predictor (OR = 2.63, $p = 0.027$). In addition, there was a high prevalence in team sports (45.5% across volleyball, 41.7% across football and 37.5% across cricket) which is also reported by Dasa et al. (2024) and suggests that the screening of REDs should not be restricted to aesthetic sports disciplines.

The association of the EDE-Q global score with REDs risk (OR = 3.84, $p < 0.001$) corroborates the known psychosocial pathway from disordered eating cognitions to dietary restraint to LEA (Burke et al., 2018; Logue et al., 2020). Forty per cent, 40.2%, of the total sample (not only those who were classified as at risk of developing ED) scored above the EDE-Q clinical cut-off score of 2.3 suggests that the psychopathology of eating disorders should be considered a population-level concern among female collegiate athletes in Lahore. This finding is particularly pertinent in the social and cultural context of Pakistan where risk mechanisms have not been described in the literature, mostly of Western origin, so far published. The absence of body weight and eating behavior monitoring in the family level in Pakistan results in the development of a chronic environment of internalized pressures of body weight beyond the sport level demands.

Even female sport participants of Pakistani universities have to face the chronic stress of family disapproval and body commentary that affect self-perception and eating habits of the athletes (Laar et al. 2022) without taking into account the sport specific factors and peer influence. To the sport specific body image issues, there is also a second layer of cognitive restriction imposed by the cultural ideals of femininity and the social comparison processes within social media seen in women in South Asia as a whole (Rao et al., 2015).

The third mechanism which is very unique to this sample of Pakistani athletes is Ramadan fasting: a pattern of periodic acute energy restriction which is a culturally accepted phenomenon, but interaction with athletic training load and the LEA pathway to REDs has not been systematically investigated to date. Recurring LEA in within-day energy as assessed by dietary recall and LEAF-Q can happen in athletes who are training throughout Ramadan and fasting from sunrise to sunset. These sociocultural processes (family surveillance, cultural appearance pressures, religious dietary observance) may explain or at least contribute to accounts of the levels of eating disorder psychopathology and risk for REDs reported above and beyond sport-type risk profiles for eating disorders, at least in this sample.

Menstrual irregularity was determined to be 38.0% for the whole sample; 60.0% of the at-risk athletes and 11.9% of the not-at-risk athletes were determined to be irregular, consistent with the well-established LEA-to-FHA pathway (Wong et al., 2025) and confirming Hypothesis 4. The prevalence of amenorrhea in the study population is clinically significant at 14.1% for age 17-25 years when bone mineral density is increasing most quickly. By this developmental phase, FHA will impact the skeleton for the rest of life, and some of these effects may not be completely corrected even when menstruation is restored (Melin et al., 2024; Wong et al., 2025). Menstrual irregularity was the most powerful predictor in the logistic regression model (OR = 4.17), highlighting the importance of this easily-collected, low cost clinical tool for screening for REDs when biomarkers are not available and tested.

The mean EA of 33.8 ± 9.4 kcal/kg FFM/day and the proportion of athletes in the critically low category (39.1%) suggests that LEA is not subclinical but severe in this population with 36 athletes below the threshold of 30 kcal/kg FFM/day, which correlates with measurable reproductive and skeletal damage (Burke et al., 2018; Mountjoy et al., 2023).

Convergent evidence for all three instruments (LEAF-Q, EA, and menstrual status) for all athletes in the critical low EA category was also LEAF-Q at risk, which strengthened support for the multi-instrument approach and the internal consistency of the model of the REDs framework in this context.

The adjusted logistic regression model indicated that BMI (OR = .91, P = .190) and the number of weekly training hours (OR = 1.08, P = .201) were not significant, and hence did not merit the inference that they were. As in clinical practice, BMI was usually assumed to be a good indicator of nutritional risk; however, after adjusting for EA and EDE-Q, BMI was not significantly associated with nutritional risk, a fact that is supported by the principle that the risk of REDs is more related to energy intake behaviors than just body size (Burke et al., 2018). In normal BMI or above athletes, restricting their diet can lead to extreme energy deficiency especially if they are not consuming adequate energy to support energy needs during training. Similarly, the training hours were non-significant, similarly to Jagim et al. (2022) that indicated disordered eating cognitions and nutrition knowledge deficits were the two most important modifiable factors related to LEA in collegiate athletes. With no changes in body composition or training volume found in the null findings, the focus in clinical practice moves from monitoring body composition and training volume towards dietary behavior and eating disorder screening as primary areas to focus on for REDs risk identification.

Conclusions

The prevalence of REDs among female collegiate athletes was 54.3% (95% CI: 43.8-64.4%) in this study, which is in the upper limit of international estimates and the first empirical evidence of the prevalence of REDs in female collegiate athletes of Pakistan. Energy availability, eating disorder psychopathology, menstrual irregularity, and sport type were the four main non-body composition and workload independent predictors of REDs risk, suggesting a focus on dietary behavior and psychological screening instead of body composition and hours of training. The combination of Pakistani specific psychosocial mechanisms, family level body surveillance, cultural appearance pressures and Ramadan fasting may contribute to an increased risk of REDs, above and beyond that predicted by the sport-type profiles, highlighting the need for culturally tailored approaches to prevention. University sports departments are invited to try out annual LEAF-Q screening, create a referral network to sports medicine and dietetics, and incorporate sports nutrition training based on Pakistani lifestyles into athlete welfare programs until its replication in larger multi-city samples.

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