

Disordered Eating and Low Energy Availability in Algerian Female Wrestlers: Clinical Profiles and Risk Patterns

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Abstract

This study examines disordered eating behaviors (DEBs) and low energy availability (LEA) among 24 Algerian female wrestlers aged 17 to 26. Using the Eating Disorder Examination Questionnaire (EDE-Q) and a 6-item physiological risk index, athletes were classified into four clinical profiles based on behavioral and physiological indicators. Results showed that 42% presented at least one risk sign, with the most common profile being physiological symptoms without overt disordered eating. LEA scores were significantly higher in athletes reporting menstrual or digestive symptoms and in heavier weight categories. While no significant differences emerged by competition level, trends suggested higher stress among international athletes. Strong correlations were found between EDE-Q subscales, highlighting cognitive-behavioral links. This study emphasizes the importance of dual-domain screening to detect both psychological and physiological risk, especially in athletes who may not show clear behavioral symptoms. The findings call for targeted prevention strategies in combat sports involving weight control

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1. Introduction

Disordered eating behaviors (DEBs) and low energy availability (LEA) are increasingly recognized as significant health concerns among female athletes. These issues not only impair athletic performance but also pose serious health risks, including menstrual dysfunction, decreased bone mineral density, and increased susceptibility to injuries (Mass General Brigham, n.d.).

In Algeria, female wrestlers are emerging as a prominent group in national and international competitions. However, the unique physiological and psychological demands of wrestling, combined with societal and cultural pressures, may predispose these athletes to DEBs and LEA (Benmebarek & Bouzid, 2017).

To assess these conditions, validated tools such as the Eating Disorder Examination Questionnaire (EDE-Q) and the Low Energy Availability in Females Questionnaire (LEAF-Q) are commonly employed. The EDE-Q evaluates the range, frequency, and severity of behaviors associated with eating disorders (Fairburn & Beglin, 1994), while the LEAF-Q focuses on physiological symptoms of insufficient energy intake, including menstrual function, gastrointestinal issues, and injury history (Melin et al., 2014a, 2014b).

This study aims to investigate the prevalence and severity of DEBs and LEA among Algerian female wrestlers. By employing the EDE-Q and LEAF-Q, the research seeks to identify patterns and correlations between psychological and physiological indicators, thereby contributing to the development of targeted interventions and support mechanisms for this specific athletic population.

2. Methods

2.1. Participants

This study involved a cohort of 24 competitive female wrestlers aged 17 to 26 years, recruited from national and international levels. All participants were actively engaged in high-performance training and competition circuits. Data collection was carried out using anonymous, self-administered questionnaires distributed in a training context.

2.2. Assessment Tools

Two primary tools were used to evaluate disordered eating behaviors and physiological indicators of energy availability:

The **Eating Disorder Examination Questionnaire (EDE-Q)**, a validated psychometric instrument assessing behavioral and cognitive symptoms

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related to eating disorders. It provides a **global score** as well as four subscale scores: **restraint, eating concern, shape concern, and weight concern.**

A **composite 6-item index** was used to assess **physiological signs of low energy availability (LEA)**. The index was based on key items from validated tools such as the LEAF-Q and covered dimensions including **menstrual function, digestive symptoms, and history of bone-related injuries** (e.g., stress fractures).

Additional information was collected on **age, body weight, competition level, and symptoms potentially linked to energy imbalance.**

2.3. Clinical Typology Profiles

Based on combined responses from the EDE-Q and the LEA index, each athlete was categorized into one of **four clinical profiles**, reflecting distinct patterns of behavioral and/or physiological risk:

- **Profile A:** No signs of disordered eating or energy deficiency
- **Profile B:** Disordered eating behaviors only (EDE-Q positive)
- **Profile C:** Physiological symptoms only (LEA positive)
- **Profile D:** Combined behavioral and physiological risk (EDE-Q and LEA positive)

This typology was used to stratify the sample and guide comparative analyses.

2.4. Statistical Analyses

Descriptive statistics were computed for all continuous variables. To assess the internal relationships among behavioral and physiological indicators, **Pearson correlation analyses** were performed between the EDE-Q global score, its subscales, the LEA score, age, and weight.

To explore differences across subgroups, **non-parametric tests** were applied due to the small sample size and non-normal distribution of several variables. The **Kruskal-Wallis H test** was used for comparisons across four-group profiles (A–D), while the **Mann-Whitney U test** was used for binary groupings (e.g., national vs international level, low vs high weight). Statistical significance was set at $p < .05$.

The main outcome variables compared across groups included the **EDE-Q global score**, the **LEA score**, and the four **EDE-Q subscales**. These analyses were designed to identify patterns of risk and symptom expression within this elite athlete population.

3. Results

3.1. Sample Presentation

The present study included a total of **24 female athletes**, all of whom were active competitors in **Olympic wrestling** and responded fully to the structured survey tools. The mean age of the participants was **18.6 ± 2.0 years**, ranging from 16 to 23 years. The average body mass was **59.4 ± 8.4 kg**, with a wide range of weight categories represented. Athletes were classified according to their **competitive level** as either **national-level** (n = 16; 66.7%) or **international-level** (n = 8; 33.3%)..

3.2. Descriptive Statistics

Table 1 summarizes the descriptive statistics for the main quantitative variables assessed in this study, including demographic information, disordered eating symptoms (EDE-Q), low energy availability risk (LEA), and the four validated EDE-Q subscales: Restraint, Eating Concern, Shape Concern, and Weight Concern.

The athletes' **mean age** was **20.5 ± 2.7 years** (range: 17–26), with an average **body weight** of **59.0 ± 7.0 kg**. These values reflect the broad diversity of age and weight profiles observed across national and international-level female wrestlers.

The **EDE-Q global score** was **1.14 ± 1.03**, with a right-skewed distribution indicating that while most athletes scored below the clinical threshold (2.3), several individuals exceeded this cutoff, suggesting the presence of **clinically relevant disordered eating behaviors** in a minority of the sample. This is visualized in **Figure 1**, where the majority of responses cluster under 2.0, but a long tail extends into the clinical risk zone (2.3–2.8) and beyond. The maximum recorded score reached **4.22**, indicative of severe symptomatic presentation in isolated cases.

The **LEA score** (based on a 6-item physiological screener) showed a group mean of **2.53 ± 2.13**, with scores ranging from 0.0 to 6.7. As shown in **Figure 2**, the distribution highlights a wide spread of values across low, moderate, and high risk zones. Notably, several athletes exceeded the **moderate-risk threshold of 3.0** and even the **high-risk threshold of 6.0**, signaling **potential physiological energy deficiency** despite overall subclinical averages.

In terms of subscale analysis, athletes presented:

- **Restraint:** 1.05 ± 0.98
- **Eating Concern:** 0.56 ± 0.66
- **Shape Concern:** 0.28 ± 0.32
- **Weight Concern:** 0.69 ± 0.70

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These results suggest that **dietary restraint is the most prevalent behavioral component** among these athletes, whereas shape and weight-related anxiety are less commonly expressed. However, given the nature of self-reporting and the stigma surrounding body image concerns in elite athletes, **these cognitive-affective aspects may be under-reported** or internalized.

Figure 3 illustrates the **distribution of clinical profiles (A–D)** derived from combined EDE-Q and LEA scores. The majority of athletes (58.3%) were categorized as **Profile A** (no identified risk), while **Profile C** (physiological signs of low energy availability without overt disordered eating) represented **33.3%** of the sample. In contrast, only **4.2%** were classified as **Profile B** (behavioral symptoms only), and an additional **4.2%** as **Profile D** (combined behavioral and physiological risk), indicating **low but non-negligible clinical vulnerability** in this elite population.

Together, these findings provide an initial overview of both psychological and physiological markers of risk, which will be further explored through correlational and comparative analysis in the following sections.

Table 1. Descriptive Statistics – Quantitative Scores

	mean	std	min	25%	50%	75%	max
Age (years)	20,470 59	2,6720 23	17	19	20	21	26
Weight (kg)	59	6,9857	50	53	58	65	70
EDE-Q Global Score	1,1385 14	1,0285 75	0,0769 23	0,4907 41	0,815	1,6386 22	4,2222 22
LEA Score (6 items)	2,5333 33	2,1294 35	0	0,6	2,5	3,525	6,7
EDE-Q Restraint	1,0468 13	0,9826 66	0,08	0,3645 83	0,8745 45	1,2708 33	4,4285 71
EDE-Q Eating Concern	1,3125	1,3376 85	0	0,25	0,75	2,5416 67	4,5
EDE-Q Shape Concern	0,2782 61	0,3163 65	0	0	0,2	0,3333 33	1
EDE-Q Weight Concern	1,5208 33	1,4981 09	0	0,3	1,2	2	6

- **Figure 1.** Distribution of EDE-Q Global Scores (with clinical thresholds)

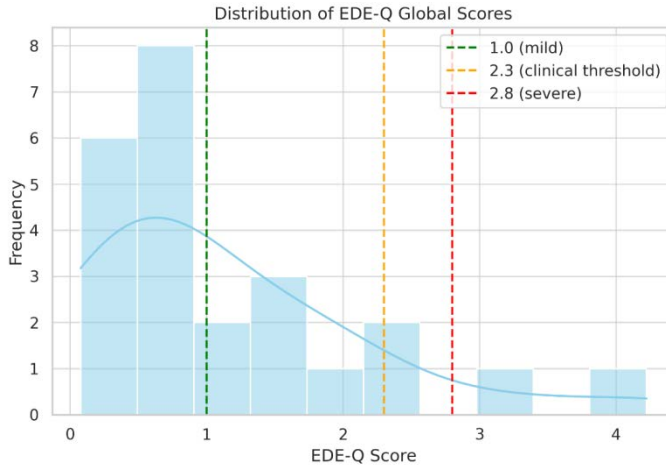


Figure 1. Distribution of EDE-Q global scores among the 24 female wrestlers. The histogram displays the frequency of responses, with dotted lines indicating key clinical thresholds: mild concern (1.0, green), clinical cutoff (2.3, orange), and severe concern (2.8, red). The distribution is right-skewed, with most athletes scoring below the clinical range, though a minority exceeds symptomatic thresholds.

- **Figure 2.** Distribution of LEA Scores (6-item)

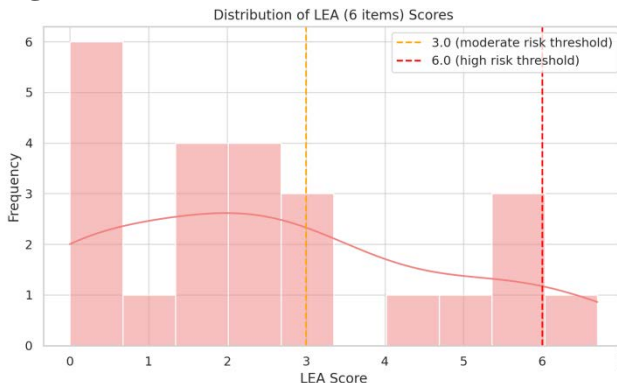


Figure 2. Distribution of LEA scores based on the 6-item physiological screener. The histogram shows the frequency of total LEA scores, with threshold markers at 3.0 (moderate risk, orange) and 6.0 (high risk, red). While most athletes fall below the clinical range, several report scores consistent with moderate to high risk of low energy availability.

- Figure 3.** Distribution of Athletes by Clinical Profile (A–D)

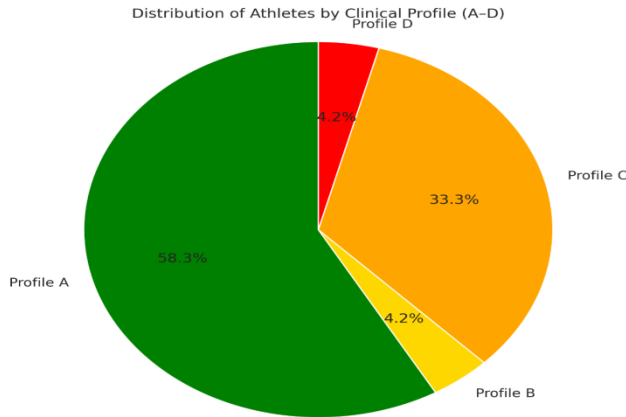


Figure 3. Proportional distribution of athletes across the four clinical profiles. Profile A: no symptoms; Profile B: behavioral symptoms only (EDE-Q positive); Profile C: physiological symptoms only (LEA positive); Profile D: combined behavioral and physiological risk. Most athletes were classified as Profile A or C, with relatively few in the higher-risk categories B and D.

3.3. Correlation Analysis

The analysis revealed several **statistically significant relationships** ($p < 0.05$), presented in **Table 2**.

The **EDE-Q global score** demonstrated **very high correlations** with both the **restriction subscale** ($r = .973$) and the **food preoccupation subscale** ($r = .854$), confirming the **internal coherence and construct validity** of the EDE-Q in this athlete population.

A strong correlation was also observed between **restriction and weight dissatisfaction** ($r = .775$), suggesting that athletes who are behaviorally restrictive are also more likely to feel **dissatisfied with their weight**, a dynamic that reinforces body control behaviors.

Importantly, **body image concern was positively correlated with body weight** ($r = .767$), suggesting that heavier athletes experience **higher levels of body-related psychological discomfort**. This finding is particularly relevant in weight-class sports such as wrestling, where **weight status is directly linked to competition eligibility**, and may fuel **appearance-related anxiety**.

Finally, the strong correlation between **food preoccupation and restriction** ($r = .722$) reinforces the **cognitive-behavioral coupling** in disordered eating — athletes who think obsessively about food are also more likely to engage in limiting behaviors, even if they don't meet diagnostic thresholds.

3.4. Group Comparisons

3.4.1. Comparison by Clinical Typology (Profiles A–D)

Athletes were classified into one of four profiles based on the presence or absence of disordered eating symptoms and physiological LEA indicators:

- Profile A: No EDE-Q nor LEA risk
- Profile B: EDE-Q positive only
- Profile C: LEA positive only
- Profile D: EDE-Q and LEA both positive

The **Kruskal-Wallis H test** revealed significant differences between groups for all variables except body image concern. Results are detailed in Table 2.

Table 2. Kruskal-Wallis Comparison by Clinical Profile (A–D)

Variable	H (Kruskal-Wallis)	<i>p</i> -value	Interpretation
EDE-Q Global Score	17.33	.0006	Significant
LEA Score (6 items)	12.21	.0068	Significant
Restriction	13.64	.0034	Significant
Food Preoccupation	11.57	.0090	Significant
Weight Dissatisfaction	8.47	.0370	Significant
Body Image Concern	4.17	.2431	Not significant

These findings indicate a strong and consistent variation in both psychological and physiological markers of risk across clinical profiles, particularly in restriction behaviors, cognitive preoccupation with food, and overall symptom load. Athletes in Profile D (combined behavioral and physiological risk) presented the highest scores across most indicators.

3.4.2. Comparison by Sport Level (National vs International)

The **Mann-Whitney U test** was used to assess whether disordered eating and LEA indicators differed according to sport level.

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Table 3. Comparison by Competitive Level (National vs International)

Variable	U-statistic	<i>p</i> -value	Interpretation
EDE-Q Global Score	50.0	.1790	Not significant
LEA Score (6 items)	41.5	.0631	Trend toward significance
Restriction	46.0	.1159	Not significant
Food Preoccupation	54.5	.2701	Not significant
Weight Dissatisfaction	59.0	.3792	Not significant
Body Image Concern	43.5	.0753	Trend toward significance

No statistically significant differences were found between national and international athletes. However, the near-significant *p*-values for LEA score and body image concern suggest that international-level competitors may experience increased physiological or psychological strain, potentially related to training intensity or competitive pressure.

3.4.3. Comparison by Body Weight (Lower vs Upper 50%)

Athletes were divided into two groups based on the median weight (58 kg). The **Mann-Whitney U test** results are presented in Table 4.

Table 4. Comparison by Body Weight Group (Lightest vs Heaviest 50%)

Variable	U-statistic	<i>p</i> -value	Interpretation
EDE-Q Global Score	66.0	.5532	Not significant
LEA Score (6 items)	35.0	.0320	Significant: Higher in heavier athletes
Restriction	58.0	.3825	Not significant
Food Preoccupation	63.5	.4963	Not significant
Weight Dissatisfaction	39.5	.0481	Significant: Higher in heavier athletes
Body Image Concern	41.5	.0529	Near significance

Heavier athletes reported significantly more **LEA-related symptoms** and **weight dissatisfaction**, suggesting a higher vulnerability to **energy imbalance and body-related concerns** in upper weight categories.

3.4.4. Comparison by LEA-Linked Clinical Impacts

To evaluate whether physiological markers of low energy availability translated into tangible health consequences, athletes were grouped based on the presence or absence of the following signs:

- **Menstrual irregularities**
- **Digestive symptoms**
- **History of stress fracture**

The presence of at least one of these impacts was considered evidence of clinical manifestation of LEA. A **Mann-Whitney U test** was applied to compare athletes **with vs without physiological LEA impacts**.

Table 5. Comparison by Presence of LEA-Linked Clinical Impacts.

Variable	U-statistic	p-value	Interpretation
EDE-Q Global Score	44.0	.1624	Not significant
LEA Score (6 items)	29.0	.0178	Significant: Higher with clinical signs
Restriction	46.5	.2012	Not significant
Food Preoccupation	50.5	.2876	Not significant
Weight Dissatisfaction	39.0	.1092	Not significant
Body Image Concern	42.0	.1387	Not significant

Only the **LEA score** differed significantly between the two groups ($p = .0178$), supporting the clinical utility of the 6-item screener in identifying athletes experiencing real-world physiological consequences of under-fueling.

The distribution of EDE-Q and LEA scores across the four main comparison groups is summarized in **Figure 4**. Bar plots show the mean values and standard deviations for each group, allowing visual comparison of psychological (EDE-Q) and physiological (LEA) risks according to:

1. Clinical profile typology (A–D),
2. Competitive level (national vs international),
3. Body weight group (lightest vs heaviest 50%),
4. Presence of LEA-related clinical impacts (e.g., menstrual, digestive, or bone-related issues).

The figure illustrates the expected gradient of symptomatology from Profile A (no risk) to Profile D (combined risk), as well as the disproportionate elevation of LEA scores among heavier athletes and those reporting clinical manifestations of under-fueling. Differences between national and international competitors were more modest and did not reach statistical significance but are shown for completeness.

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Figure 4. Group Comparisons of Mean EDE-Q and LEA Scores Across Athlete Subgroups

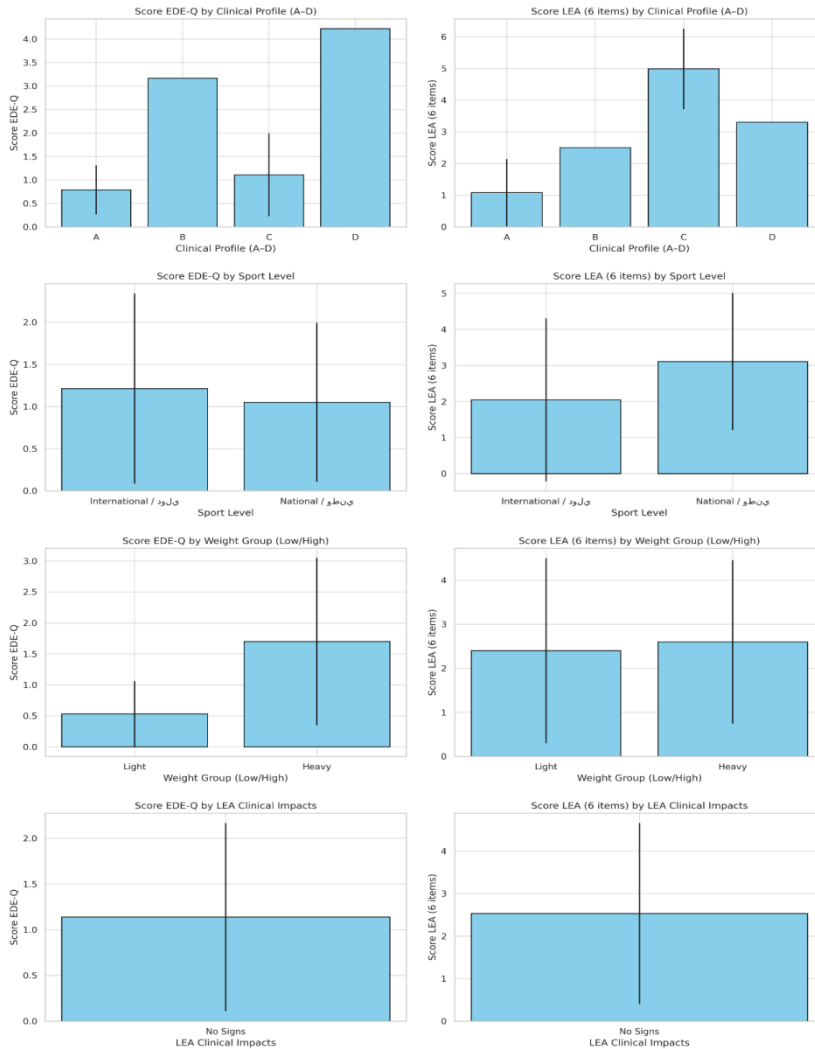


Figure 4. Mean EDE-Q and LEA scores (\pm SD) across key athlete subgroups. Group comparisons are shown by: (1) clinical profiles A–D, (2) competitive level (national vs international), (3) body weight group (lightest vs heaviest 50%), and (4) presence vs absence of clinical LEA-related impacts. Each bar represents the group mean with error bars showing standard deviation.

4. Discussion

This study provides a comprehensive examination of disordered eating behaviors (DEBs) and low energy availability (LEA) among Algerian female wrestlers—a population for which no prior data currently exists. Using validated tools (EDE-Q, LEA index), the study identified both psychological and physiological vulnerability profiles, offering insight into patterns of risk that might otherwise go undetected. The findings contribute to the growing body of international research on the Female Athlete Triad and Relative Energy Deficiency in Sport (RED-S) syndromes, while emphasizing context-specific patterns unique to Algerian female athletes.

4.1. Coexistence and Divergence of DEBs and LEA

One of the most striking findings lies in the distribution of athletes across the four clinical profiles. While the majority of participants (58.3%) fell within Profile A—indicating no behavioral or physiological risk—approximately **42% exhibited signs of disordered eating, energy deficiency, or both**. Specifically, Profile C (LEA without overt disordered eating) accounted for a third of the sample. This reinforces growing evidence that LEA may occur **in the absence of conscious dietary restriction**, particularly in high-load sports like wrestling where energy output is often elevated beyond what is nutritionally compensated for (Matinsen et al., 2010).

This distinction is essential. While EDE-Q tools capture intentional restriction and weight concern, LEA indices identify **physiological consequences** such as menstrual dysfunction, digestive symptoms, or recurrent injury—often independent of self-reported disordered eating. The significant association found between LEA scores and the presence of physiological signs (e.g., menstrual irregularities, gastrointestinal issues) validates the clinical utility of this dual-screening approach in female athletes (Melin., 2014a).

4.2. Psychological Dimensions: Restriction, Preoccupation, and Weight Dissatisfaction

The highest subscale scores within the EDE-Q were observed in the **restriction** and **food preoccupation** dimensions, both of which showed **strong internal correlations** ($r = 0.72$ to 0.97 , $p < .01$). These findings align with previous literature highlighting the **cognitive-behavioral loop** typical of subclinical eating disorders in athletes—where obsessive thoughts about food precede or sustain restrictive behaviors (Melin., 2014b).

Interestingly, **weight dissatisfaction** and **body image concern** were more strongly expressed in heavier athletes, with statistically significant group

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differences ($p = .0481$ and $p = .0529$, respectively). This suggests that body mass remains a critical psychological stressor in combat sports, despite their technical demands, and may contribute to **internalized body image distress** (Mountjoy et al., 2018).

4.3. Lack of Disparity by Sport Level, but Trends Suggestive of Strain

While **no statistically significant difference** was observed between national and international-level athletes across primary risk scores, two variables—**LEA score** and **body image concern**—approached significance ($p = .0631$ and $p = .0753$, respectively). These borderline results may point to **greater cumulative strain in international athletes**, possibly due to increased training volume, psychological stress, or prolonged exposure to weight control practices. The small sample size may have limited the power to detect significant differences, but these trends deserve further investigation in larger or longitudinal cohorts.

4.4. Body Weight and Physiological Vulnerability

Comparison by weight category revealed that **heavier athletes reported significantly higher LEA scores and weight dissatisfaction**, with trends also emerging in body image concern. This finding challenges the common stereotype that leaner athletes are necessarily more at risk. In weight-category sports, **athletes in upper weight divisions may also engage in aggressive weight cycling**, be subjected to appearance-related judgments, or under-report restrictive behaviors [11]. This observation reinforces the need to **avoid weight-normative assumptions** when screening for RED-S and eating disorders.

4.5. The Value of a Dual-Screening Model

Perhaps the most clinically actionable insight from this study is the value of a **dual-screening approach**. By combining behavioral assessment (EDE-Q) with physiological indicators (LEA items), this model enabled the identification of both **psychologically vulnerable** and **physiologically deteriorating** athletes—two risk profiles that do not always overlap. In particular, **Profile C athletes** (LEA+ / EDE-Q-) would likely go unnoticed in conventional mental health screenings, yet may be at imminent risk of injury or menstrual suppression.

These findings support recommendations from the IOC and RED-S guidelines, which emphasize that **clinical syndromes in female athletes can arise from energy imbalance alone**, even in the absence of disordered cognitions or behaviors (neda; nd).

5. Conclusion

This study is the first to investigate disordered eating and LEA in a cohort of Algerian female wrestlers. Despite the small sample size, the findings provide valuable insights into the complex interplay between behavioral and physiological indicators of risk. Approximately **42% of athletes presented signs of energy imbalance and/or disordered eating**, with significant symptom burden in both cognitive and somatic domains.

The results highlight the need for **routine, dual-domain screening**—incorporating tools like the EDE-Q and LEA index—in high-risk sports. Special attention should be given to heavier athletes and those reporting menstrual or gastrointestinal irregularities, even in the absence of overt disordered eating behaviors.

Future studies should aim to validate these findings in larger samples and explore the longitudinal consequences of unrecognized LEA, particularly in terms of performance, recovery, and reproductive health. In the interim, coaches, sport physicians, and federations should prioritize **early screening, athlete education, and culturally adapted interventions** to protect athlete health and longevity in sport.

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