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RELATIVE ENERGY DEFICIENCY IN SPORT (RED-S): ADULT FEMALE CLUB-LEVEL SWIMMERS

Sports Science

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ABSTRACT

Background: Relative Energy Deficiency in Sport (RED-S) occurs when there is an imbalance between energy intake and expenditure, impacting athletes' health and performance. The Low Energy Availability in Females Questionnaire (LEAF-Q) is a widely used validated screening tool for RED-S in athletes, assessing early symptoms of energy deficiency in women with 90% specificity and 78% sensitivity, making it easy and inexpensive to implement. **Aim And Objectives:** The study aims to evaluate the prevalence of RED-S among adult female club-level swimmers using the LEAF-Q. It aims to identify the proportion of swimmers at risk, assess symptoms, and analyse the relationship between body composition and RED-S risk. The study also aims to identify differences in RED-S risk among different age groups. **Methods:** A survey-based cross-sectional study was conducted on 118 adult female club-level swimmers from Mumbai. Participants completed the LEAF-Q, with additional data collected on age, body composition (BMI), and related symptoms. **Results:** More than half of the swimmers (58.47%) are at risk of RED-S. A total of 69 swimmers are classified as at risk of RED-S, with 97.46% reporting symptoms linked to injury risk. Menstrual irregularities affect 43.22%, while 38.14% report gastrointestinal issues. A negative correlation is observed between BMI and LEAF-Q scores, indicating a higher risk with normal body composition. **Conclusion:** The study concludes that a significant proportion of adult female club-level swimmers are at risk of RED-S these findings emphasize the need for increased awareness and preventive strategies to address RED-S in female swimmers.

KEYWORDS

Relative Energy Deficiency in Sport (RED-S), Low Energy Availability (LEA), Low Energy Availability in Females Questionnaire (LEAF-Q), Body Mass Index (BMI).

INTRODUCTION:

The importance of proper fueling for sport has been emphasised as a cornerstone of athletic health and performance for decades. In 1992, the American College of Sports Medicine (ACSM) introduced the Female Athlete Triad, describing disordered eating (DE), amenorrhea, and osteoporosis in physically active women.[1-2] Over time, the ACSM revised this model to reflect a continuum, where athletes could experience low energy availability (EA), functional hypothalamic amenorrhea, and osteoporosis at any point along the spectrum.[3] Research identified low EA as the key driver of the Triad, affecting physiological functions like growth, muscle recovery, and homeostasis.[3-4] In 2014, The IOC introduced RED-S in 2014, a condition resulting from inadequate energy intake for sports, affecting metabolic rate, menstrual function, bone health, immunity, and cardiovascular health.[5] The IOC updated its definition of RED-S in 2018 to highlight that it can arise from insufficient calorie intake and high energy demands in sports.[6] The 2023 IOC consensus further emphasized the harmful effects of RED-S, including decreased energy metabolism, increased injury risk, impaired recovery, and reduced athletic performance, along with psychological effects like anxiety, depression, and poor concentration both in and out of the sport.[7] In summary, RED-S is a complex syndrome that significantly affects both the physical and mental health of athletes. Among club-level adult female swimmers, who display remarkable determination and athleticism, RED-S presents a hidden challenge. Swimming is unique for its aquatic environment, from reaction speed to proper joint movement while also requiring higher energy due to the resistance of water.[8]. This study investigates the presence of RED-S among adult female club-level swimmers using the LEAF-Q. LEAF-Q has a 90% specificity and 78% sensitivity in identifying RED-S.[9] The LEAF-Q is easy and inexpensive to implement, making it the most widely used validated screening tool for determining the risk of LEA. [10]

Aim: To assess the prevalence of RED-S amongst adult female club-level swimmers using the LEAF-Q.

Objectives:

1. To identify the percentage of adult female club-level swimmers who are at risk of RED-S based on LEAF-Q scores.
2. To identify the percentage of adult female club-level swimmers reporting menstrual disturbances, injuries, and gastrointestinal disturbances based on their LEAF-Q scores.
3. To analyse the relationship between body composition (BMI) and LEAF-Q scores.
4. To identify the difference in RED-S risk among swimmers in different age group (18-25, 25-30, 30-35,35-40

MATERIALS & METHODOLOGY:

This cross-sectional survey-based study was conducted to assess RED-S prevalence among adult female swimmers in Mumbai. Ethical approval was obtained from the Institutional Ethics Committee at D.Y. Patil School of Physiotherapy. Participants met inclusion criteria and were informed about the study's purpose. Data was collected using the 25-item LEAF-Q tool, demographic data, and a score of 8 or higher indicates low energy availability.

Inclusion Criteria:

1. Female swimmers aged 18-40 years.
2. At least one year of consistent club level swimming experience.
3. Minimum 5 hours of weekly swimming training.
4. Informed consent required.

Exclusion Criteria:

1. Pregnant or breastfeeding female swimmers.
2. Current hormonal birth control users.

RESULTS:

Among the 118 swimmers who participated in this study, all were females. The swimmers mean age was 25.47 ± 5.96 years. The maximum participation of 59.32% was from the age group of 18–25 years. The mean body mass index of swimmers was 20.66 ± 4.76 kg/m^2.

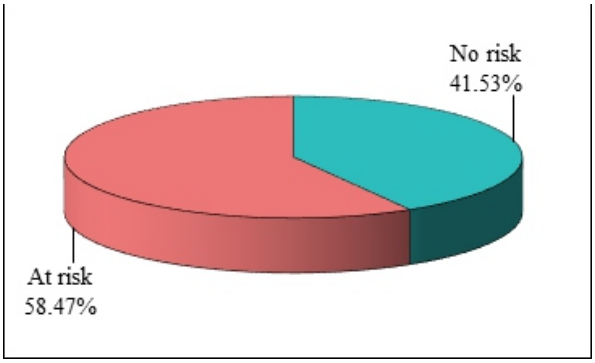

Figure 1: Prevalence of RED-S based on their LEAF-Q scores

Interference:

Based on LEAF-Q scores [≥ 8 are at risk of RED-S], more than half of the swimmers (58.47%) were at risk of RED-S.

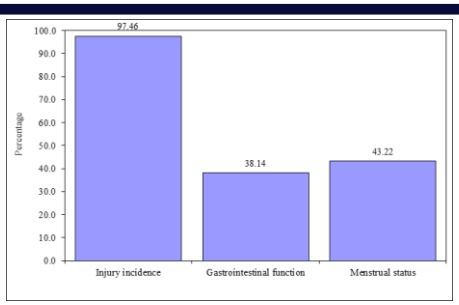

Figure 2: Prevalence of RED-S Injury incidence, Gastrointestinal function and Menstrual status

Inference:
The study revealed that 97.46% of swimmers experienced injury-related symptoms, while 38.14% experienced gastrointestinal disturbances and 43.22% experienced menstrual disturbances.

Table 1: Association of BMI groups with prevalence of RED-S based on their LEAF-Q scores

RED-S	Under weight	%	Normal	%	Overweight	%	Total	x^2	p-value
No risk	22	44.90	19	38.78	8	16.33	49	0.4010	0.8180
At risk	27	39.13	30	43.48	12	17.39	69		
Total	49	41.53	49	41.53	20	16.95	118		

Inference:
A chi-square value of 0.4010 with a p-value of 0.8180 shows no significant relationship between BMI and RED-S prevalence in individuals, with 44.90% underweight, 38.78% normal, and 16.33% overweight at no risk, and 39.13%, 43.48%, and 17.39% at risk, based on LEAF-Q scores.

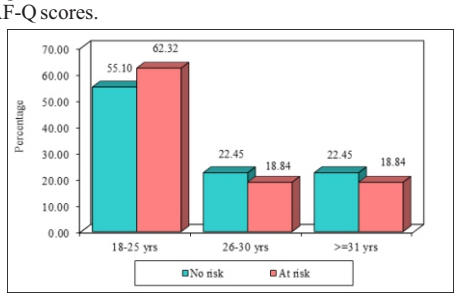

Figure 3: Association between age groups with prevalence of RED-S based on their LEAF-Q scores

Inference:
Swimmers aged 18-25 had the highest risk, with 62.32% at risk. In contrast, 18.84% of swimmers aged 26-30 and 31+ were at risk.

DISCUSSION:

To the best of our knowledge, this is the first study to specifically investigate the prevalence of RED-S risk among adult female club-level swimmers using the LEAF-Q. Swimming is an endurance-based sport with high training volumes and potential nutritional challenges, making swimmers particularly vulnerable to energy deficiencies. Our findings revealed a concerning prevalence of RED-S risk, with over half of the participants (58.47%) falling into the risk category. These findings are consistent with previous studies among national to world class middle/long-distance runners and race walkers (52.8%) [11], European cross-country athletes (64.3%) [12], and pre-professional, professional, and advanced amateur level dancers from 27countries (54.2%) [13], National Athletes in Malaysia (67.2%) [57], recreational exercisers (44.9%) [14]. However, different studies used different methodologies to estimate the prevalence of LEA and RED-S since there is no gold standard method of measurement [6]. The study aimed to determine the frequency of symptoms associated with RED-S, 97.46% of swimmers at risk experienced injury symptoms, primarily in their shoulders, knees, and neck due to repetitive and high-intensity training. Gastrointestinal disturbances were common such as bloating and gaseous abdomen after extended training hours, affecting 38.14% of swimmers, while 43.22% experienced menstrual disturbances ranging from missed menses to inconsistent cycles often associated with changes in training intensity. The study highlights the complex effects of RED-S on swimmers, highlighting health issues beyond performance. It emphasizes the importance of maintaining proper nutrition and energy levels for female swimmers' health, longevity, and athletic careers. The study found a complex relationship between body composition and RED-S risk, with the highest LEAF-Q scores found in swimmers within normal weight range. This contradicts the belief that RED-S is solely for underweight athletes and emphasizes the importance of screening for RED-S risk across all BMI categories. The study also analysed the risk of RED-S among swimmers aged 18-25, 25-30, 30-35, and 35-40. It found that RED-S affects older swimmers as well. The study emphasizes the significance of energy balance in athletes' careers, highlighting the need for age-specific interventions and management strategies to prevent and manage RED-S, a condition affecting athletes' performance and overall health.

CONCLUSION:

The study highlights the importance of early detection strategies for RED-S risk in club-level swimmers, emphasizing the need for education and early intervention to prevent long-term health consequences.

Future Scope:

1. The study can be conducted on larger population.
2. Can be correlated between training variables.

REFERENCES:

1. Yeager, K. K., Agostini, R., Nattiv, A., & Drinkwater, B. (1993). The female athlete triad: disordered eating, amenorrhea, osteoporosis. Medicine & Science in Sports & Exercise.
2. Otis, C. L. (1997). American College of Sports Medicine position stand. The female athlete triad. Med Sci Sports Exerc, 29(5), 1669-1671.
3. Stand, P. (2007). The female athlete triad. Med Sci Sports Exerc, 39(10), 1867-82.
4. De Souza, M. J., Nattiv, A., Joy, E., Misra, M., Williams, N. I., Mallinson, R. J., ... & Panel, E. (2014). 2014 female athlete triad coalition consensus statement on treatment and return to play of the female athlete triad: 1st International Conference held in San Francisco, California, May 2012 and 2nd International Conference held in Indianapolis, Indiana, May 2013. British journal of sports medicine, 48(4), 289-289.
5. Mountjoy, M., Sundgot-Borgen, J., Burke, L., Carter, S., Constantini, N., Lebrun, C., ... & Ljungqvist, A. (2014). The IOC consensus statement: beyond the female athlete triad—relative energy deficiency in sport (RED-S). British journal of sports medicine, 48(7), 491-497.
6. Mountjoy, M., Sundgot-Borgen, J., Burke, L., Ackerman, K. E., Blauwet, C., Constantini, N., ... & Budgett, R. (2018). International Olympic Committee (IOC) consensus statement on relative energy deficiency in sport (RED-S): 2018 update. International journal of sport nutrition and exercise metabolism, 28(4), 316-331.
7. Mountjoy, M., Ackerman, K. E., Bailey, D. M., Burke, L. M., Constantini, N., Hackney, A. C., ... & Erdener, U. (2023). 2023 International Olympic Committee's (IOC) consensus statement on relative energy deficiency in sport (REDs). British journal of sports medicine, 57(17), 1073-1097.
8. Knechtle, B., Dalamitros, A. A., Barbosa, T. M., Sousa, C. V., Rosemann, T., & Nikolaidis, P. T. (2020). Sex differences in swimming disciplines—can women outperform men in swimming?. International journal of environmental research and public health, 17(10), 3651.
9. Rogers, M. A., Drew, M. K., Appaneal, R., Lovell, G., Lundy, B., Hughes, D., ... & Burke, L. M. (2021). The utility of the low energy availability in females questionnaire to detect markers consistent with low energy availability-related conditions in a mixed-sport cohort. International journal of sport nutrition and exercise metabolism, 31(5), 427-437.
10. Melin, A., Tornberg, Å. B., Skouby, S., Faber, J., Ritz, C., Sjödin, A., & Sundgot-Borgen, J. (2014). The LEAF questionnaire: a screening tool for the identification of female athletes at risk for the female athlete triad. British journal of sports medicine, 48(7), 540-545.
11. Heikura, I. A., Uusitalo, A. L., Stellingwerff, T., Bergland, D., Mero, A. A., & Burke, L. M. (2018). Low energy availability is difficult to assess but outcomes have large impact on bone injury rates in elite distance athletes. International journal of sport nutrition and exercise metabolism, 28(4), 403-411.
12. Jesus, F., Castela, I., Silva, A. M., Branco, P. A., & Sousa, M. (2021). Risk of low energy availability among female and male elite runners competing at the 26th European cross-country championships. Nutrients, 13(3), 873.
13. Keay, N., Overseas, A., & Francis, G. (2020). Indicators and correlates of low energy availability in male and female dancers. BMJ open sport & exercise medicine, 6(1), e000906.
14. Marzuki, M. I. H., Mohamad, M. I., Chai, W. J., Farah, N. M., Safii, N. S., Jasme, J. K., & Jamil, N. A. (2023). Prevalence of relative energy deficiency in sport (RED-S) among national athletes in Malaysia. Nutrients, 15(7), 1697.