

BACKGROUND

The Female Athlete Triad (FAT) is a syndrome involving the interplay between low energy availability, menstrual dysfunction and altered bone mineral density. Endurance runners are at increased risk due to high energy demands from their training regimen and the potential desires for leanness to improve performance. Worldwide female participation in ultra-endurance events may place athletes at risk for the FAT. The 89km Comrades Marathon requires consistent weekly training distances of 80 - 200 km during the 6 months preceding the event, thereby placing these athletes at risk for low energy availability and its health consequences. Treatment of the triad is complex and difficult due to psychological and performance-related aspects; therefore prevention should be prioritised and requires the education of athletes and coaches which is sorely lacking. The objectives of this study were to establish triad knowledge, occurrence of disordered eating, and triad risk amongst participants of the Comrades Marathon event.

METHODS

A survey utilizing the LEAF (Low Energy Availability in Females) and FAST (Female Athlete Screening Tool) questionnaires were conducted on female participants in order to determine their risk. Seven questions pertaining to the triad were asked to determine their knowledge. Athletes were requested to complete an anonymous questionnaire after written informed consent was obtained. Statistical analyses included correlations and cross-tabulations to evaluate associations.

RESULTS

Knowledge of the triad was poor with 92.5% of participants not having heard of the triad before. Of the 306 athletes included in the study 44.1% were found to be at risk for the FAT. One third of participants demonstrated disordered eating behaviours. There is a significant association between athletes at risk for the triad according to the LEAF questionnaire and those with disordered eating ($\chi^2(1) = 8.411$; $p=0.014$). Statistically, more athletes in the group with clinical and sub-clinical eating disorders were at risk for the triad.

Table 1: Knowledge of the female athlete triad amongst female participants in the 2014 Comrades Marathon

| Question | Frequency | Percentage (%) |
|---|-----------|----------------|
| Familiarity with triad | 23 | 7.5 |
| No previous knowledge | 283 | 92.5 |
| Source of knowledge: | | |
| Sports magazine/Running book/Internet/Race Expo | 9 | 2.95 |
| University/school/coach | 14 | 4.55 |
| Not Applicable | 283 | 92.5 |
| Ability to name components: | | |
| Unable to name any | 286 | 93.5 |
| Of the 20 participants able to name components: | | |
| Able to name only one | 6 | 2.0 |
| Able to name two | 7 | 2.2 |
| Able to name all three | 3 | 1.0 |
| Incorrect | 4 | 1.3 |

Self-assessed risk for the triad:

Only 2.3% of participants thought they were at risk for the triad. The overwhelming majority (83.3%) were uncertain whether they were at risk and 14.4% believed they were not. (Table 1)

Table 2: Number of female athletes with disordered eating according to FAST questionnaire results

| | Frequency | % | Mean | SD |
|-----------------------------|-----------|------|--------|------|
| No eating disorder | 208 | 68.0 | 61.79 | 9.59 |
| Subclinical eating disorder | 82 | 26.8 | 82.70 | 4.68 |
| Clinical eating disorder | 16 | 5.2 | 100.13 | 6.04 |

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According to the FAST questionnaire almost a third of participants were at risk for low energy availability related to their eating behaviours. (Table 2) The majority of participants believed that their weight was related to their running performance with 60.5% expecting performance improvements with weight reduction and 67.4% worrying that weight gain would impair their performance. Restrictive eating behaviours were reported by nearly half of participants with 47.7% controlling fat and calorie intake and 44.5% limiting carbohydrate intake.

Table 3: Summary of bivariate correlations

| Variables | Pearson Coefficient | p for H ₀ : $\rho=0$ |
|-------------------------------------|---------------------|---------------------------------|
| LEAF Score and Comrades performance | -0.159 | 0.029 |
| FAST score and LEAF Score | 0.244 | <0.001 |
| FAST Score and weight | 0.198 | 0.001 |
| FAST Score and BMI | 0.186 | 0.001 |

Higher LEAF scores had a weak negative correlation with faster race performance, while higher FAST scores correlated positively with LEAF scores and with both weight and BMI. (Table 3)

Table 4: Cross-tabulation of FAST and LEAF score categories

| FAST Score category: | | Not at risk for Triad according to LEAF Score | At risk for Triad according to LEAF Score | Total |
|-----------------------------|----------------|---|---|----------------------|
| No eating disorder | Count | 125 | 83 | 208 (68% of 306) |
| | Expected Count | 116.2 | 91.8 | |
| | Column% | 73.1% | 61.5% | |
| Subclinical eating disorder | Count | 42 | 40 | 82 (26.8% of 306) |
| | Expected Count | 45.8 | 36.2 | |
| | Column % | 24.6% | 29.6% | |
| Clinical eating disorder | Count | 4 | 12 | 16 (5.2% of 306) |
| | Expected Count | 8.9 | 7.1 | |
| | Column % | 2.3% | 8.9% | |

The cross-tabulation of the FAST and LEAF categories (Table 4) demonstrates more athletes at risk for the triad in the groups with clinical and sub-clinical eating disorders than expected under the null hypothesis of no association (count vs. expected count).

DISCUSSION

A disturbingly small percentage (7.5%) of participants knew about the triad. The majority (80%) of these were international runners from Europe, USA or Australia. If knowledge of the triad is so poor amongst this group of athletes it is unlikely they have adequate nutritional knowledge to prevent inadvertent energy deficiency. The majority of these athletes demonstrate a subclinical eating disorder with only 5.2% meeting clinical eating disorder criteria, which is only marginally higher than general population rates (2-4%). Nearly 45% of participants reported carbohydrate restriction. This is likely due to proposed benefits of improved body composition and performance without adequate input from a dietician, placing them at greater risk for calorie deficits. LEAF questionnaire scores classified 44.1% of participants at risk for the triad and a correlation was seen between faster race performance and higher triad risk. Screening and educational interventions are the most effective preventative strategy amongst endurance athletes. Education should include health care professionals managing athlete injuries/illnesses, club coaches, family and friends of athletes.

CONCLUSIONS

Only 7.5 % of the female Comrades Marathon runners knew about the triad despite 44.1% being at high risk for the triad. Therefore education and regular screening programmes targeting these athletes are overdue. Postmenopausal athletes are at particularly high risk for large losses in bone mass if they experience chronic energy deficiency and hence require special focus.

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