South African black female student athletes are at risk of the female athlete triad

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Abstract

Introduction

The female athlete triad (Triad) was first described in 1992 and more recently an energy deficit has been identified as the main contributing factor towards the sub-clinical conditions (i.e. reduced energy availability with/without disordered eating behavior, menstrual dysfunction, and low bone mass) and the clinical endpoints (i.e. low energy availability without eating disorders, functional hypothalamic amenorrhea, and osteoporosis) of the Triad.¹ Currently our knowledge no published data are available on the prevalence of the Triad among black South African athletes and the prevalence of the components of the Triad among minority groups worldwide is sparse. Furthermore, it is known that eating disorders and the risk of fractures are increasing within the black South African population due to westernization² which increases the risk of the Triad among black South African athletes.

Aim

The primary aim of this study was to determine the prevalence of the components of the Triad amongst South African female University students. A secondary aim was to compare white and black female students to identify any possible ethnic differences in the components of the Triad.

Methods

Black and white female volunteer student athletes (n=123) and non-athletes (n=78) were recruited from the North-West University, Vaal University of Technology and Tswane University of Technology to take part in this descriptive, cross-sectional study. The study was approved by the Ethics Committee of the North-West University. Subjects could participate in the study after written informed consent was obtained. Exclusion criteria included use of corticosteroids or hormone replacement therapy during the past 6 months, pregnancy or lactating, and any known bone disease. On test day subjects reported to the laboratory for measurements and completion of disordered eating behavior questionnaires. Measurements included: (1) body weight and height, (2) body composition and bone mineral density measured with dual energy X-ray absorptiometry (Hologic Discovery W, APEX system software version 2.3.1). The remaining questionnaires were completed online using SurveyMonkey® and had to be submitted within 7 days after test day.

A 5 day weighed dietary record and ActiWear® monitor determined energy balance and availability. Eating disorder inventory-3 (EDI-3) drive for thinness and body dissatisfaction subscales as well as the EDI-3 referral form and Cognitive dietary restraint subscale of the Three-factor eating questionnaire identified disordered eating behavior; menstrual function was assessed with a self-reported questionnaire.

Statistical Analysis

Data were analyzed using IBM SPSS statistics (Version 20). Normally distributed data is presented as means and standard deviations and not-normally distributed data as medians and interquartile ranges. Categorical data were analyzed with cross-tabulations and are expressed as percentage. Differences between groups were analyzed with Chi-square (χ²) analyses for categorical data; Mann-Whitney U-tests and Kruskal-Wallis ANOVA for non-parametric variables; and t-tests as well as ANOVA with post hoc Tukey for parametric variables. When EDI-3 subscales, TFEQ-CDR, and BMD were compared between groups, data was adjusted for BMI. Significance was set at P<0.05.

Results and Discussion

In Table 1 subject characteristics and body composition measurements are compared between all the groups. Black and white athletes had lower body fat percentage and higher bone mineral density at all sites before and after adjusting for body mass index compared to controls.

Table 1. Subject characteristics and body composition by all groups

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>Athletes (n=123)</th>
<th>Controls (n=78)</th>
<th>White Athlete (n=74)</th>
<th>Black Athlete (n=49)</th>
<th>White Control (n=43)</th>
<th>Black Control (n=30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Women</td>
<td>Men</td>
<td>Women</td>
<td>Men</td>
<td>Women</td>
<td>Men</td>
</tr>
<tr>
<td>Age (yr)</td>
<td>20.5±4.9</td>
<td>21.3±4.7</td>
<td>20.4±5.3</td>
<td>21.1±4.9</td>
<td>20.8±4.9</td>
<td>21.0±4.7</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>161±7.7</td>
<td>181.5±6.9</td>
<td>161.5±7.2</td>
<td>181.7±6.9</td>
<td>161.5±7.2</td>
<td>181.6±6.9</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>66.0±5.9</td>
<td>76.4±10.7</td>
<td>66.0±5.9</td>
<td>76.4±10.7</td>
<td>66.0±5.9</td>
<td>76.4±10.7</td>
</tr>
<tr>
<td>Body fat percentage (%)</td>
<td>25.3±5.9</td>
<td>31.5±6.5</td>
<td>24.4±5.3</td>
<td>30.4±6.9</td>
<td>24.4±5.3</td>
<td>31.4±6.7</td>
</tr>
<tr>
<td>Bone BMC (g/cm²)</td>
<td>0.944 (0.888;1.118)</td>
<td>0.960 (0.918;1.040)</td>
<td>0.941</td>
<td>0.960 (0.918;1.040)</td>
<td>0.941</td>
<td>0.960 (0.918;1.040)</td>
</tr>
<tr>
<td>Femoral neck BMC (g/cm²)</td>
<td>0.996 (0.939;1.050)</td>
<td>0.995 (0.948;1.047)</td>
<td>0.996 (0.939;1.050)</td>
<td>0.995 (0.948;1.047)</td>
<td>0.996 (0.939;1.050)</td>
<td>0.995 (0.948;1.047)</td>
</tr>
<tr>
<td>Spine BMC (g/cm²)</td>
<td>0.993 (0.939;1.050)</td>
<td>0.972 (0.923;1.017)</td>
<td>0.993 (0.939;1.050)</td>
<td>0.972 (0.923;1.017)</td>
<td>0.993 (0.939;1.050)</td>
<td>0.972 (0.923;1.017)</td>
</tr>
</tbody>
</table>

Note: *Bone mineral density: Significantly different between controls and athlete, p<0.001; a differs significantly from b (p=0.05); c differs significantly from d (p<0.01); and d differs from e (p=0.001) between white and black athletes and control groups.

In Figure 1 pathogenic weight control measures are shown. Black and white athletes had a similar prevalence. Black athletes had a low prevalence of bulimia-type behavior and athletes used more exercise to control weight. Athletes had a low energy availability than controls (Figure 2).

Conclusion:

Black athletes are also at risk for the components of the Triad, with almost 50% having at least one component and 76% having one or more components collectively.

Summary and Conclusion

The main results were:

1. The most prevalent component of the Triad among black athletes was a low energy availability and/or a risk for disordered eating behavior.
2. Black athletes had a low prevalence (8%) of “low BMD for age” and none were at risk for osteoporosis.
3. Some (10%) black athletes were identified with all three of the Triad components.

Statistical Analysis

Pathological weight control measures and compliance scores p<0.05 & p<0.001

Figure 1. Pathogenic weight control measures

Figure 2. Energy availability of all subjects

Figure 3. Percentage subjects scoring above the EDI-Body dissatisfaction cut-off

Figure 4. Prevalence of the Triad components

Acknowledgements

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References


**Note:** The document contains tables and figures that are not visible in the text format. The tables and figures are essential for understanding the full context of the research findings.