The female athlete triad profile of elite Kenyan runners and its future health implications

Author: Y. Goodwin

ABSTRACT

The female athlete triad (FAT or the TRIAD) is a complex syndrome arising from associations among the trio of energy availability (EA), menstrual function (MF) and bone mineral density (BMD) along their respective continuums from health to disease state. It has been recognized that women whose energy intake (EI) does not meet the energy requirements for physiological functions subsequent to participation in exercise and physical activity could have low EA. In the TRIAD, low EA, an initiator in menstrual dysfunction (MD) and concomitant hypoestrogenism, indirectly results in low BMD. Therefore, the purpose of this study was to: (i) establish the status of EA, MF and BMD among elite Kenyan female athletes and non-athletes, (ii) explore associations between EA and MF in elite Kenyan female athletes and non-athletes, (iii) determine the relationships of EA and MF to BMD in elite Kenyan female athletes and non-athletes, and (iv) to determine the profile of the female athlete triad in elite Kenyan distance athletes and in non-athletes. Measurements of EA, MF and BMD were undertaken in 39 female participants (Middle distance athletes =12, Long distance athletes=13, Non-athletes=14). Energy intake minus exercise energy expenditure (EEE) and the remnant normalized to fat free mass (FFM) determined EA. Energy availability was determined through weight of all food and liquid consumed over three consecutive days. Exercise energy expenditure was determined after isolating and deducting energy expended in exercise or physical activity above lifestyle level from the total energy expenditure output as measured by Actigraph GT3X+. Fat free mass and BMD were assessed using dual energy x-ray absorptiometry (DXA). A nine-month daily temperature-menstrual diary was used to evaluate menstrual status. In addition, since psychological eating behaviour practice (EBP) contributes to low EA, the Eating Disorder Examination Questionnaire (EDE-Q) was used to determine presence of such practice among the participants and their relationship to EA. Overall, EA below 45 kcal.kgFFM-1.d-1 was found in 61.53% of the participants (athletes=28.07±11.45kcal.kgFFM-1.d-1, non-athletes=56.97±21.38kcal.kgFMM-1.d-1). The ANOVA showed that there was a significant difference (p<0.001) in EA among the long and middle distance runners and non-athletes; and the Tukey‘s HSD revealed that the source of the difference were the non-athletes. Results of the EDE-Q showed almost negligible presence of psychopathological eating behaviour practice among the Kenyan participants. None of the TRIAD components showed significant relationship with EBP. Results of MF showed that whereas none of the athletes presented with amenorrhea, oligomenorrhea was present among 40% athletes and 14.3% non-athletes, and amenorrhea vii

among 14.3% non-athletes. However, there was no significant difference between athletes and non-athletes in MF. Low BMD was seen in 76% of the athletes and among 86% of the non-athletes. The analysis did not show significant difference in BMD *Z*-scores between athletes and non-athletes. The analysis did not show any significant association between EA and MF among the participants. The only significant relation of EA to any BMD dimension measured was between EA and total BMD in the long distance runners (r=0.560; p=.046). Significant relationship (*rho*=0.497; p=.001) was found between MF and BMD *Z*-scores among the athletes with middle distance highlighting the relationship further (*rho*=0.632; p=.027). Overall, the binary logistic regression revealed that MF did not predict BMD (OR=4.07, 95% CI, 0.8-20.7, p=.091). Overall, 10% of the participants (athletes=4, long distance athletes =3, middle distance athletes=1, non-athletes=0) showed simultaneous presence of all three components of the TRIAD. The independent sample t-test showed a significant difference (t=5.860; p=<.001) in the prevalence of the TRIAD between athletes and non-athletes.

Keywords: Energy availability, menstrual function, bone mineral density, exercise energy expenditure.