Bone mineral density and body composition among athletes: Lightweight versus heavyweight sports

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BONE MINERAL DENSITY AND BODY COMPOSITION AMONG ATHLETES: LIGHTWEIGHT VERSUS HEAVYWEIGHT SPORTS

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Objectives: Energy restriction and weight loss techniques are associated with adverse effects on bone mineral density (BMD) whilst participation in sports is known to be beneficial for skeletal health. However, it is not entirely clear the skeletal health status in lightweight sports where participants often use weight management techniques to attain relatively low mass. Therefore, the aim of this study is to evaluate the differences in BMD and body composition among athletes engaged in weight restricted and non-weight restricted sports.

Methods: A total of 177 athletes (18 runners, 28 rugby players, 84 rowers and 47 ballet dancers) were recruited. BMD and body composition was assessed by Dual-energy X-ray absorptiometry (DXA), utilising either the GE Lunar iDXA or the GE Lunar Prodigy. Participants were categorised into two groups according to their sport characteristics: lightweight (sports where a categorical weight restriction is applied or where low mass is deemed advantageous, e.g., lightweight rowers, ballet, long distance running) and heavyweight (sports with no weight restrictions, e.g., rugby, heavyweight rowing and sprinters). Means with standard deviations (±SD) were calculated for each measurement in males and females, separately. Student t-test was used to determine mean differences between weight groups.

Results: Eighty-two males (45.1% lightweight) and ninety-five females (53.7% lightweight), median (IQR) age: 22.9 (20.7-26.8) years, were analysed. In heavyweight males, BMD was significantly higher in lumbar spine (1.326 ± 0.158) and body without head (1.267 ± 0.111) compared with lightweights (1.248 ± 0.147) and 1.164 ± 0.093, respectively) at $p<0.05$. Significant differences were also found between female heavyweight and lightweight participants at the same measured sites ($p<0.05$). There was no significant difference for BMD at the femoral neck and total hip between weight classes. Heavyweight athletes had significantly higher body mass index, lean mass and fat mass compared to their lightweight counterparts ($p<0.05$).

Conclusions: The present findings suggest that weight classification in sports may be an important determinant of bone health. Further research will bring together collaborative groups to create a comprehensive view on the effects of sport weight-restriction on BMD and body composition.

Table 1. Bone mineral density information according to gender and weight group (n=177)

	Male		Female	
	Heavy-weight (n=45)	Light-weight (n=37)	Heavy-weight (n=44)	Light-weight (n=51)
Spine (L1-L4) BMD (SD)	**1.326 (0.158)**	**1.248 (0.147)***	**1.263 (0.149)**	**1.198 (0.156)***
Femoral-Neck[1] BMD (SD)	1.228 (0.171)	1.209 (0.151)	1.129 (0.109)	1.092 (0.131)
Total Hip[1] BMD (SD)	1.224 (0.149)	1.196 (0.130)	1.149 (0.120)	1.095 (0.159)
Whole Body[2] BMD (SD)	**1.267 (0.111)**	**1.164 (0.093)****	**1.097 (0.085)**	**1.052 (0.083)***

Values are mean (SD).
BMD measured in g/cm^2
SD Standard Deviation
[1] Left side only
[2] Whole body minus head

Significant values are highlighted in bold:
*** p < 0.05, **p < 0.001**

Note: 5 lightweight male and female did not have data available for BMD at total hip, 7 and 5 lightweight male and female, respectively, did not have data available for BMD at whole body.