

CORRELATION OF ISOKINETIC KNEE AND TRUNK MUSCULAR STRENGTH WITH BONE MINERAL CONTENT IN FEMALE SOCCER PLAYERS

Michele Forgiarini Saccol, Natália Cristina Oliveira, Ana Lúcia de Sá Pinto, Rosa Maria Rodrigues Pereira*, Lílian Takayama*, Júlia Maria D'Andrea Greve** and Fernanda Rodrigues Lima

*Divisão de Reumatologia (Laboratório de Metabolismo Ósseo) and **Instituto de Ortopedia e Traumatologia (Laboratório de Estudos do Movimento Humano), Faculdade de Medicina da Universidade de São Paulo, Brazil

KEY WORDS: bone mineral content, muscle strength, soccer.

INTRODUCTION: Soccer is an effective load activity to increase bone mineral content. It remains unknown if this activity induces strength alterations in knee and trunk concomitant with bone in female players. The aim of this study was to assess the possible correlation between knee and trunk muscle strength and bone values in female junior soccer players.

METHOD: Twenty-two consecutive females soccer players with at least 15 h.wk⁻¹ of training during the previous year were compared with 20 females not engaged in regular exercise, except for school physical education. Bone mineral density (BMD) and bone mineral content (BMC) were measured in lumbar spine, femoral neck and total femur of dominant hip, dominant leg and whole body by dual-energy X-ray absorptiometry. Fat mass and lean mass were also determined using whole body scan (DXA, Hologic Discovery, USA). Isokinetic muscle measurements were performed using the Biodex System 3 dynamometer (Biodex Medical Systems Inc, USA) with 5 repetitions at 60°/s at concentric and eccentric modes for the variables peak torque (PT), total work (TW) and set total work (STW). Statistical analysis was performed using Student *t*-test and Pearson's correlation.

RESULTS: The two groups were alike regarding age, height, weight, body mass index or calcium intake ($p > 0.05$). Female soccer players had higher percentage of lean body mass (72.45 ± 3.52 vs 66.75 ± 5.45 , $p < 0.001$) and lower percentage of body fat (23.7 ± 3.67 vs 29.94 ± 5.75 , $p < 0.001$) compared to controls. For bone mineral values, the athletes demonstrated in all sites evaluated, significantly higher BMD and BMC compared to control group. Dominant knee concentric and eccentric strength were also significantly higher for soccer group (concentric extension PT 150.46 ± 31.08 vs 129.47 ± 21.72 , $p = 0.016$; eccentric extension PT 127.21 ± 27.15 vs 104.85 ± 25.46 , $p = 0.009$). Related to trunk strength, only concentric mode had higher performance in the soccer group (concentric extension PT 214.23 ± 52.24 vs 146.12 ± 49.72 , $p < 0.001$). All knee strength extension variables demonstrated positive correlation to BMC of leg, femoral neck and total femur of dominant hip ($0.46 < r < 0.70$). This correlation was also found for flexion knee strength, but only with PT variable ($0.42 < r < 0.64$). On trunk evaluation, only flexors strength performance were correlated with BMC of total trunk at variables TW ($r = 0.525$) e STW ($r = 0.513$).

DISCUSSION: The majority of investigations in female athletes involve knee muscle strength and BMD. To our knowledge, only Helge & Kanstrup (2002) evaluated the same relationship of our study and found in female elite gymnasts that BMD was strongly correlated to knee and trunk muscle strength.

CONCLUSION: These findings of positive correlation between muscle strength and bone mineral values in a specific site reinforces that there is a direct role of muscle function on the accretion of the regional bone mineral mass.

REFERENCES:

Helge, E.W. & Kanstrup, I. (2002). Bone density in female elite gymnasts: impact of muscle strength and sex hormones. *Medicine and Science in Sports Exercise*, 34, 174-80.