Effect of Running and Swimming on Bone Mineral Density Throughout the Lifespan

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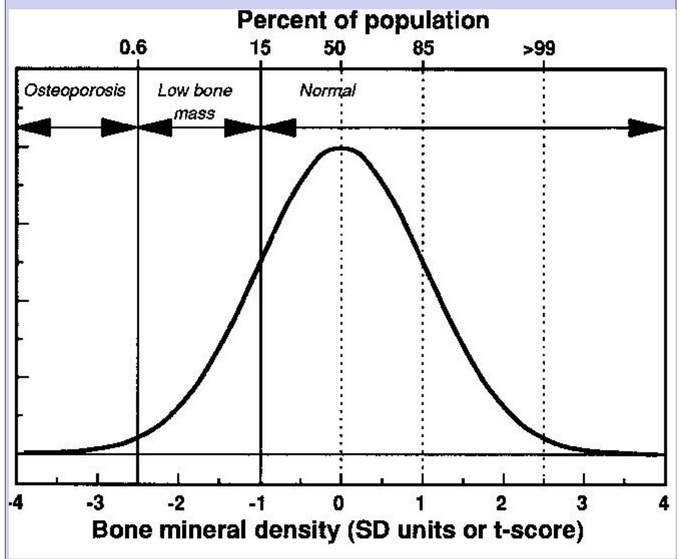
Introduction

- Deterioration of bone density and quality is of serious concern due to the high incidence of fracture in older individuals. As people age and their level of physical activity decreases, too much bone re-absorption occurs in relation to formation, resulting in overall loss of bone mass and structural integrity.[1]
- Bone mineral density (BMD) is used as an indirect indicator of risk of osteoporosis and bone fracture.[2] Both swimming and running have been found to have a positive effect on BMD.[3-5]
- A comparison of the effects of swimming and running on BMD in humans has not been performed.



Objectives

- This study will contribute to determining if participation in running or swimming differently affects BMD in young athletes as well as mature adults.
- These findings could highlight the importance of maximizing BMD by early adulthood before if begins to decline, beginning in the third decade of life.
- Findings may also provide evidence to determine if mechanical loading of the bone must entail ground reaction forces as a stimulus to obtain peak BMD in order to guide the prescription of mode of exercise in older individuals at risk for diminished BMD.

Methods

- This study included 54 total participants total, with 12 runners under age 30, 18 runners over age 30, 11 swimmers under age 30, and 13 swimmers over age 30.
- After each participant was screened based on inclusion and exclusion criteria to determine eligibility to participate, a consent form was reviewed and signed.
- Researchers used the GE Achilles Ultrasonometer, a qualitative ultrasound sonometer (QUS), to measure BMD of the heel of each qualified participant.
- QUS has been shown to significantly predict vertebral fractures with an odds ratio reported as 1.94 with a 95% confidence interval when compared to DEXA, the gold standard for measurement of BMD.[6]

Results

- No statistically significant difference (alpha = 0.05) in BMD existed between swimmers and runners in the young adult or mature adult groups (P = 0.618).
- A T-test did not establish a statistically significant difference (alpha = 0.05) in BMD for gender (P – 0.525), regardless of sports.
- A one-way ANOVA did not produce statistical significance for any of the following factors: hours of activity (swimming or running) per week (P = 0.424), distance of activity (swimming or running) per week (P = 0.347), age (P = 0.327), height (P – 0.672), and history of participation in sport (swimming or running) (P – 0.219).
- Athlete weight was the only variable that correlated with a statistically significant difference in T-score (P = 0.0007). (Table 1)

Table 1. ANOVA: Age/Sport vs.T-score

	Sum of Squares	dF	Mean Square	F	Significance
Between Groups	2.389	3	0.796	0.599	0.618
Within Groups	69.077	52	1.328		
Total	71.466	55			

Data Analysis

- Data were analyzed using Statistical Package for the Social Sciences (SPSS) software
- ANOVA tests were run for all factors with multiple comparisons
- A T-test was run for the factor with a binary factor

Discussion

- This correlational study found no significant difference in BMD existed between swimmers and runners across the lifespan.
- No beneficial nor deleterious effects of either activity can be established in relation to BMD, which may help support that gravity and ground reaction forces such as those found during running and other land-based exercise activities may not play a vital role in the maintenance of BMD. Solely the forces placed on bone by the contracting muscle, as seen in swimming where the buoyancy of water negates any gravitational or ground reaction forces, are adequate to create the necessary stress to support Wolff's law to maintain BMD.
- Based on our literature review and results from our own study, there is currently no evidence available to refute swimming as an adequate alternative form of exercise for individuals who may not be able to tolerate the ground reaction forces involved in running and other land-based activities.
- Limitations to this study include the relatively small sample size which decreases the statistical power and ability to generalize findings to the general population, inability to determine degree of causality due to the study's correlational nature, and the unique characteristics of the mature population who participates in these activities acting as a confounding variable.

Conclusions

- No correlation between mode of activity and BMD can be established at this time.
- Athlete weight was the only variable that correlated with a statistically significant difference in T-score
- No evidence exists to support running as a superior activity to swimming to maintain BMD in the young or mature populations.

References: See Handout with Reference List