



# Analyzing the Difference in Bone Strength Between Aquatic and Land-Based Athletes

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## INTRODUCTION

Previous research has shown a positive correlation between Body Mass Index and Bone Mineral Content (Lloyd JT et al.). Additionally, aquatic athletes “present lower bone mineral density” than higher impact sports (Gomez-Bruton et al.).

Based on these conclusions, I am expanding on this research by using alternative metrics of bone and muscle strength (lean mass (LM) and bone mineral content (BMC)) to compare aquatic and land-based sports.

The goal of this study is to strengthen those previous conclusions made and to pinpoint methods to improve bone strength in athletes.

## METHODOLOGY

### Data

- Provided by the Dual-energy Absorptiometry body composition scans conducted by UM including the Swim, Dive, Gymnastics, and Track & Field teams.
- Includes athlete LM and BMC in different regions of their bodies

### Methods

Step 1) Compute the percentage of body weight made up by BMC in aquatic and land-based athletes

Step 2) Determine if there is a statistically significant relationship between LM and BMC and between weight and BMC by computing Pearson’s Correlation Coefficient.

## RESULTS AND ANALYSIS

- Fig. 1 shows that BMC makes up a higher percentage of land athletes’ weights (~4.27%) than for aquatic athletes (~3.89%) and Fig. 2 shows the disparities in BMC—the BMC averages and upper quartiles trend higher in land sports than in aquatic sports.
- This indicates that BMC is much lower in aquatic athletes and that they may be at higher risk of bone related injuries.

Fig. 1: % of Body Weight that is BMC

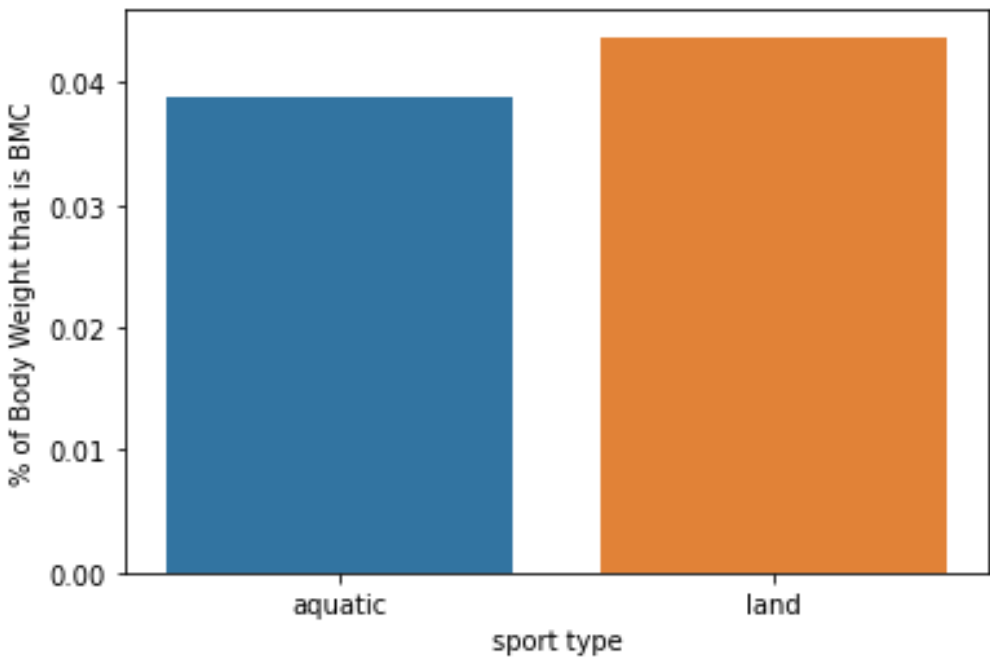
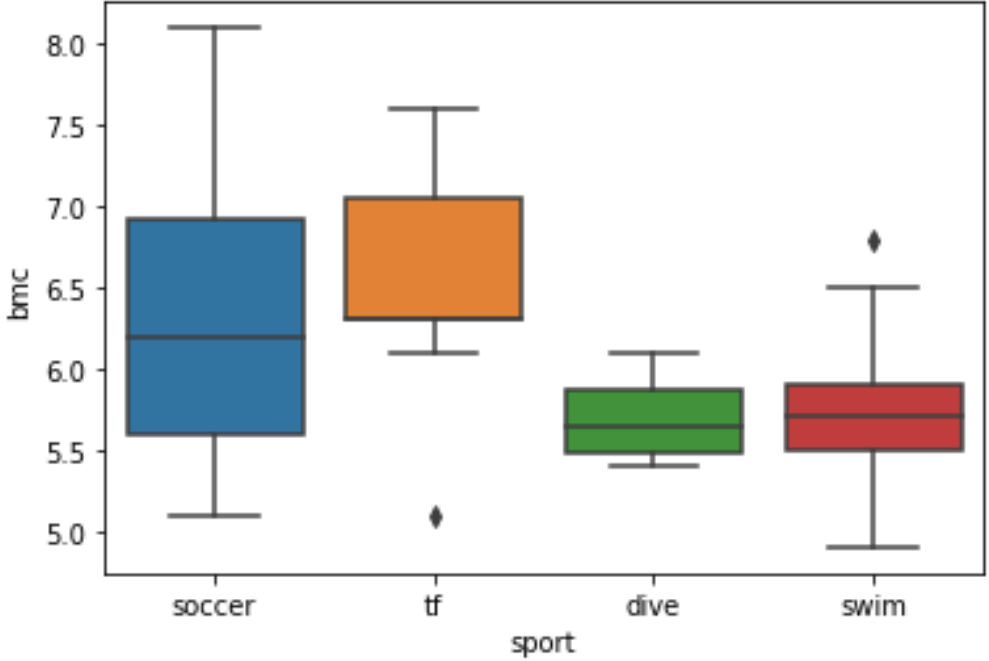


Fig. 2: BMC Distribution Across Sports



### How can Aquatic Athletes Improve their BMC?

To answer this, I explored the relationship between LM and BMC and between body weight and BMC to determine if athletes can improve their BMC through physical training.

### Findings:

- Fig. 3 and 4 show that the correlation between LM and BMC and between BMC and weight are both statistically significant for land athletes but not aquatic athletes, meaning aquatic athletes are less capable of altering BMC through these metrics.

Fig. 3: Correlation Coef. Between LM & BMC

LM & BMC Correlation Coefficient	
Sport Type	
land sports	0.845638
water sports	0.580665

Fig. 4: BMC Distribution Across Sports

BMC & Weight Correlation Coefficient	
Sport Type	
land sports	0.808574
water sports	0.562995

This led me to researching nutritional solutions to improve BMC in athletes.

## NUTRITIONAL SOLUTIONS

### Supplements to diet:

- “vitamin D, calcium, magnesium, silicon, vitamin K, and boron” (Price et. al.)

### Low energy availability (LEA):

- “long-term LEA negatively impacts bone health”
- Athletes need adequate caloric intake to support their BMC levels. This is managed through
  - “an adequate protein intake” (Heikura et. al.)
  - “sufficient calories are consumed to support training” (Logue et. al.).

## CONCLUSIONS

- BMC in aquatic athletes trends lower in aquatic athletes than in land-based athletes, indicating weaker overall bone strength
- Relationships between BMC and other body metrics do not have a strong enough correlation to recommend altering BMC through physical activity
- Aquatic athletes should consider various dietary/nutritional supplements to increase their bone strength and decrease risk of bone related injury

## REFERENCES

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