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Bone mineral density and body composition in high-performing cricket players; an exploratory study

A thesis presented in partial fulfilment of the requirements for the degree of

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Abstract

Background/Aim: Cricket is a popular sport both in New Zealand, and internationally. Cricketers have a high prevalence of stress fractures, which may in part be linked to bone mineral density. However, little research exists investigating bone health in this group. The primary aim of this study was to investigate determinants of bone mineral density (BMD) in a group of high-performing cricketers. Secondary aims included measuring musculoskeletal differences in the dominant versus non-dominant arm, and monitoring pre and postseason body composition.

Methods: Healthy male (n=27) and female (n=11) cricketers aged 16-33y were recruited. BMD was measured using DXA, and body composition was measured pre and post-season using bioelectrical impedance analysis (BIA). Food frequency questionnaires (FFQ’s) and a lifestyle & health questionnaire were completed. Determinants of BMD were tested using hierarchical multiple regression analysis. A dependent samples t-test was used to determine differences between dominant and non-dominant arms and changes in body composition over the season.

Results: Skeletal muscle mass was a significant predictor of BMD and accounted for 31, 18, and 38 percent of BMD variation at the hip, spine, and total body, respectively. Age and calcium intake did not predict BMD at any site. BMD and lean mass were significantly greater (p<0.05) in the dominant arms of both males (+0.056g/cm² and +308.4g) and females (+0.078g/cm² and +254.2g). A 0.8kg reduction in post-season skeletal muscle mass was found in females (p<0.05), with no differences found in males.

Conclusions: Skeletal muscle was the strongest predictor of BMD in this group, while age and calcium intake showed no effect. Significant differences in BMD and lean mass were observed between dominant and non-dominant arms. Skeletal muscle in males remained unchanged from beginning to end of season, and was reduced in females. Training methods in this group should target development and maintenance of muscle mass in order to optimise BMD.
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To my fellow researcher Shelley McDonald, thank you for all of your hard work during the recruiting and data collection process, and assistance throughout the entire journey.

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## Table of contents

Abstract................................................................................................................................. I
Acknowledgements............................................................................................................... II
List of tables......................................................................................................................... VI
List of appendices.............................................................................................................. VII
List of abbreviations......................................................................................................... VIII
Contributions to research................................................................................................. IX

**Chapter 1: Introduction**...................................................................................................... 1
1.1 Background.................................................................................................................... 1
1.2 Purpose of this study...................................................................................................... 3
1.3 Aim.................................................................................................................................. 3
1.4 Objectives....................................................................................................................... 3
1.5 Thesis structure.............................................................................................................. 4

**Chapter 2: Literature review**............................................................................................ 5
2.1 Determinants of bone mineral density........................................................................ 5
  2.1.1 Background............................................................................................................... 5
  2.1.2 Calcium...................................................................................................................... 6
  2.1.3 Vitamin D.................................................................................................................... 8
  2.1.4 Protein........................................................................................................................ 10
  2.1.5 Fruit and vegetables.................................................................................................. 12
  2.1.6 Potassium.................................................................................................................. 13
  2.1.7 Vitamin K................................................................................................................... 14
  2.1.8 Other micronutrients............................................................................................... 16
  2.1.9 Calorie restriction and disordered eating................................................................. 16
  2.1.10 Physical activity...................................................................................................... 17
  2.1.11 Smoking/tobacco use.............................................................................................. 19
  2.1.12 Alcohol.................................................................................................................... 20
  2.1.13 Ethnicity.................................................................................................................... 21
2.1.14 Body composition

2.2 Differences in composition between dominant and non-dominant arms in athletes

2.3 Body composition and BMD in cricketers

2.4 Summary

Chapter 3: Methods

3.1 Participants and recruitment

3.2 Ethical approval

3.3 Research design and phases of data collection

3.3.1 Initial phase

3.3.2 Follow-up phase

3.3.3 Injury questionnaire

3.4 Dietary analysis

3.5 Statistical analyses

Chapter 4: Results

4.1 Participant characteristics

4.2 Body composition and bone mineral density

4.3 Lifestyle factors

4.4 Dietary intake

4.5 Determinants of bone mineral density (BMD)

4.6 Composition of dominant versus non-dominant arms

4.7 Changes in body composition over the season

Chapter 5: Discussion

5.1 Summary of key findings

5.2 Determinants of bone mineral density - Skeletal muscle mass

5.3 Nutritional considerations - calcium

5.4 Age as a predictor of bone mineral density

5.5 Other considerations when assessing stress fracture risk
5.6 Composition of dominant versus non-dominant arms..........................................................48
5.7 Changes in body composition throughout the season.........................................................50
5.8 Gender differences in BMD between males and females..................................................52

Chapter 6: Conclusion.............................................................................................................53
6.1 Strengths and limitations of this study...........................................................................53
6.2 Recommendations for future research..........................................................................55
6.3 Concluding summary......................................................................................................55

References.............................................................................................................................57
Appendices..........................................................................................................................76
List of tables

Table 1.1: Contributions to this study...........................................................................................................IX
Table 4.1: Participant characteristics...........................................................................................................33
Table 4.2: Bone mineral density and body composition..............................................................................34
Table 4.3: Lifestyle and health factors including injury.................................................................................36
Table 4.4: Daily consumption of food groups compared to guidelines.........................................................37
Table 4.5: Multiple regression analysis to determine factors associated with total BMD in male cricketers........................................................................................................................................38
Table 4.6: Multiple regression analysis to determine factors associated with BMD at the spine in male cricketers........................................................................................................................................39
Table 4.7: Multiple regression analysis to determine factors associated with BMD at the hip in male cricketers........................................................................................................................................39
Table 4.8: Composition of dominant versus non-dominant arms.................................................................40
Table 4.9: Female changes in body composition............................................................................................41
Table 4.10: Male changes in body composition............................................................................................42
List of appendices

Appendix A: *Athlete diet index* ................................................................. 76
Appendix B: *Questions from Food frequency questionnaire (FFQ)* .......... 89
Appendix C: *Calcium content of foods using foodworks 8* ...................... 91
Appendix D: *Lifestyle and health questionnaire* ........................................ 92
Appendix E: *Injury questionnaire* ............................................................ 101
Appendix F: *Standard operating procedure for BIA* ................................... 104
Appendix G: *Standard operating procedure for DXA* ............................... 106
List of abbreviations

BIA: Bioelectrical Impedance Analysis
BMC: Bone Mineral Content
BMD: Bone Mineral Density
BMI: Body Mass Index
Cm: Centimetre
CSA: Cross-sectional area
DXA: Dual X-ray Absorptiometry
FFM: Fat Free Mass
FFQ: Food Frequency Questionnaire
GFR: Glomerular filtration rate
IGF-I: Insulin-Like Growth Factor-I
IU: International units
Kg: Kilogram
Mcg: Micrograms
Mg/dL: milligrams per decilitre
Nmol/L: Nanomol per litre
UcOC: Under-Carboxylated Osteocalcin
UVB: Ultraviolet B
NASA: National Aeronautics and Space Administration
RDI: Recommended Dietary Intake
SD: Standard Deviation
SMM: Skeletal muscle mass
P: p-value (statistical analysis)
PTH: Parathyroid hormone
UL: Tolerable Upper Intake level
μg: Microgram
## Contributions to research

<table>
<thead>
<tr>
<th>Researchers</th>
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