Muscular Function and Strength Predictions Using DXA in Collegiate Athletes

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Introduction
- Introduction Lean body mass (LBM) and function are well-known predictors of overall health and quality of life and have played an integral part in athletic and medical research.
- Isokinetic dynamometry is widely regarded as the gold standard for assessing muscle strength.
- Methods of determining LBM, appendicular lean mass (ALM) or skeletal muscle mass (SMM) include DXA, bioelectrical impedance, 3D optical anthropometry and recently, a novel method of isotopic-labeled D3-Cr (1).
- Few studies reported the association of D3-Cr derived SMM and its relationship with muscle function and strength and no study has investigated the associations within an athletic population.

Objective
- To compare different methods of determining body composition measures and their predictive ability to muscle strength in an athletic population. We hypothesize that DXA’s body composition measures will provide better predictive capability in determining strength output for all measures of strength over D3-Cr and demographics.

Methods
- This analysis was part of the Da Kine study, a healthy cohort (Male N=40, female N=40) or multi-ethnic/ multi-racial collegiate and intramural athletes.
- The determination of SMM by D3-Cr involved each subject ingesting a single 60 mg dose of D3-Cr three days before testing; all issues will consume an ad libitum diet during this period. The processing time of D3-Cr and DXA are outlined in Figure 1.
- LBM and ALM were measured on a DXA Hologic Discovery/A system, Apex version 4.5 (Hologic Inc., Marlborough, MA).
- As shown in Figure 2, knee and trunk extension and flexion were measured using an isokinetic dynamometer (Humac NORM, Computer Sports Medicine, Stoughton, MA, USA).

Statistic
- Stepwise linear regression determined which demographic and DXA variables to operate within the model.
- A p-value <0.10 was included in the testing model and had a p-value of 0.05 to stay in the model.
- Results are reported as adjusted R² and root mean square error (RMSE) in Nm.
- All statistical calculations were performed using SAS 9.4

Results
- Results of the participants demographics and mean distributions are shown in Table 1, with significant differences found in all measures by sex

Table 1 – Descriptive Characteristics of 67 athletes

<table>
<thead>
<tr>
<th>Variables</th>
<th>Units</th>
<th>Male (n=33)</th>
<th>Female (n=34)</th>
<th>p value</th>
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</thead>
<tbody>
<tr>
<td>Weight</td>
<td>kg</td>
<td>80.99</td>
<td>63.92</td>
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<tr>
<td>Height</td>
<td>cm</td>
<td>179.32</td>
<td>167.78</td>
<td>&lt;.0001</td>
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<td>Age</td>
<td>years</td>
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<td>21.91</td>
<td>0.0435</td>
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<td>BMI</td>
<td>kg/m²</td>
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<td>22.62</td>
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<td>D³-Cr</td>
<td>kg</td>
<td>40.99</td>
<td>24.84</td>
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<tr>
<td>Lean Body Mass</td>
<td>kg</td>
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<td>49.70</td>
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<tr>
<td>ALM</td>
<td>kg</td>
<td>33.23</td>
<td>22.34</td>
<td>&lt;.0001</td>
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<tr>
<td>Leg Extension</td>
<td>Nm</td>
<td>134.85</td>
<td>95.00</td>
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<tr>
<td>Leg Flexion</td>
<td>Nm</td>
<td>70.82</td>
<td>48.21</td>
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<tr>
<td>Trunk Extension</td>
<td>Nm</td>
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<td>94.18</td>
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<tr>
<td>Trunk Flexion</td>
<td>Nm</td>
<td>272.94</td>
<td>172.88</td>
<td>&lt;.0001</td>
</tr>
</tbody>
</table>

• Leg Extension: For males, LBM was the most highly predictive (R²=0.28, RMSE=28.37), and ALM in females (R²=0.38, RMSE=21.22).
• Leg Flexion: For males, LBM was the most highly predictive (R²=0.25, RMSE=15.96), and ALM in females (R²=0.42, RMSE=10.87)
• Trunk Extension: For males, LBM was the most highly predictive (R²=0.46, RMSE=44.62), and ALM in females (R²=0.69, RMSE=21.21)
• Trunk Flexion: For males, LBM was the most highly predictive (R²=0.17, RMSE=85.6), and ALM in females (R²=0.56, RMSE=35.7)
• All measures of LMB performed the best when predicting muscular strength in males, and measures of ALM was best in females.
• All measures of D3-Cr to strength performed better than demographic variables alone, but did not our perform DXA variables

Conclusion
- Conclusion DXA’s standard body composition output variables produce a more reliable measure of muscular strength and function over the use of D3-Cr or demographic variables in an athletic population.

Acknowledgments: We gratefully acknowledge En Liu and Nisa Kelly for subject recruitment and implementation of the study protocol

Funding: Hologic, Inc. Marlborough, MA, USA

Reference(s)