Association between dietary intake and resistance exercise with change in body composition and physical function among elderly

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CONFLICT OF INTEREST DISCLOSURE

I have no potential conflict of interest to report

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Discussion of Off-Label, Investigational, or Experimental Drug Use:
None

This study does not necessary reflect the views of the sponsors.
Body composition is an important factor in the development of disease.

- Lean body mass
- Fat mass
- Distribution

Underlying mechanisms

- Inadequate food intake
- Inactivity
- Altered endocrine function
- Inflammation

Aging is associated with changes in body composition.

References:
IceProQualita study

• The overall aim was to increase knowledge on physical activity and nutrition among older adults and to investigate how these factors possibly modify body composition, muscle strength, physical function and other health parameters

• Research question
  – to characterize participants who did not respond to the resistance training with regards to lean body mass.

Study overview

Baseline
(n=237)

- Measurements;
- Questionnaires;
- Nutrient intake

Intervention
(12 weeks)

Six training groups of 20 – 30 participants in each group from October 2008 to December 2009

Endpoint
n=213 → 12% dropout

- Measurements;
- Questionnaires;
- Nutrient intake

Follow-up
n=149 → 30% dropout

6-, 12- & 18 months after endpoint

June 2010
Methods

Baseline (n=237) -> Endpoint (n=213)

• Measurements;
  – Blood sample
  – Anthropometry
    • BMI
    • Waist
  – Body composition
    • DXA
  – Physical function
    • 6MWD
    • TUG
  – Muscle strength
    • Quadriceps strength

• Questionnaires;
  – Demographic status
  – Health & medication
  – MMSE
  – HRQL
  – Physical activity

• Nutrient intake;
  • 3 day weighed food diary
  • FFQ
Methods

• Resistance exercise for 12 weeks
  – 3 times /week
    • 10-15 min. warm-up
    • 10 resistant exercise in equipment
      – 3 sets, 6-8 repetitions
      » 60% of 1-RM first week, 75-80% of 1-RM second week
      » Load ↑ 5-10% /week
    • 10-15 min. stretching exercise
  – Supervised

• Double blind intervention with 3 different isocaloric supplement
  – Milk protein
  – Whey protein
  – Carbohydrate
  
<table>
<thead>
<tr>
<th></th>
<th>20 g protein /serving</th>
<th>40 g CHO /serving</th>
<th>176 kcal/serving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whey protein</td>
<td>236</td>
<td>83</td>
<td>75</td>
</tr>
<tr>
<td>Milk protein</td>
<td>75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>78</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Analyzed at endpoint:
- Milk protein: 66
- Whey protein: 67
- Control: 75
Participants

- Recruited by advertisements in the Reykjavik area
- Inclusion criteria
  - Community dwelling adults
  - 65 years and older
  - Apparently healthy
  - MMSE score > 19 points
## Characteristics of the participants

<table>
<thead>
<tr>
<th></th>
<th>All (n=237)</th>
<th>Male (n=99)</th>
<th>Female (n =138)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong></td>
<td>73.6 ± 5.7</td>
<td>74.6 ± 5.9</td>
<td>72.9 ± 5.5</td>
</tr>
<tr>
<td><strong>BMI [kg/m²]</strong></td>
<td>28.8 ± 4.8</td>
<td>29.6 ± 4.6</td>
<td>28.2 ± 4.9</td>
</tr>
<tr>
<td><strong>Medication [count]</strong></td>
<td>2.1 ± 1.5</td>
<td>2.3 ± 1.4</td>
<td>1.9 ± 1.6</td>
</tr>
<tr>
<td><strong>HRQL (t-score)</strong></td>
<td>54.9 ± 6.1</td>
<td>54.8 ± 6.2</td>
<td>54.9 ± 6.1</td>
</tr>
<tr>
<td><strong>MMSE (points)</strong></td>
<td>27.5 ± 2.1</td>
<td>27.1 ± 2.1</td>
<td>27.8 ± 2.0</td>
</tr>
<tr>
<td><strong>PA [kcal/week]</strong></td>
<td>2093 ± 2116</td>
<td>2303 ± 2375</td>
<td>1944 ± 1907</td>
</tr>
</tbody>
</table>

Mean ± SD
Dietary intake

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>endpoint</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>±</td>
<td>SD</td>
</tr>
<tr>
<td><strong>Energy (kcal)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sugar</td>
<td>1594</td>
<td>±</td>
<td>436</td>
</tr>
<tr>
<td>whey</td>
<td>1724</td>
<td>±</td>
<td>529</td>
</tr>
<tr>
<td>milk</td>
<td>1721</td>
<td>±</td>
<td>468</td>
</tr>
<tr>
<td><strong>Protein (g/d)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sugar</td>
<td>76</td>
<td>±</td>
<td>25</td>
</tr>
<tr>
<td>whey</td>
<td>81</td>
<td>±</td>
<td>26</td>
</tr>
<tr>
<td>milk</td>
<td>76</td>
<td>±</td>
<td>23</td>
</tr>
<tr>
<td><strong>Protein (kg/BW/d)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sugar</td>
<td>0.89</td>
<td>±</td>
<td>0.23</td>
</tr>
<tr>
<td>whey</td>
<td>0.95</td>
<td>±</td>
<td>0.22</td>
</tr>
<tr>
<td>milk</td>
<td>0.97</td>
<td>±</td>
<td>0.28</td>
</tr>
</tbody>
</table>

Supplementation did neither affect total energy- nor protein intake.
Anthropometrical changes after the intervention

Changes in ASM are around 2/3 of total LM changes
BUT - 19% did not gain LM

17.6% for women
21.7% for men

P = 0.587
### Characteristics of LM losers (n= 42) and gainers (n= 169)

<table>
<thead>
<tr>
<th>Category</th>
<th>Mean  ± SD</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong></td>
<td>losers 73.0 ± 6.1</td>
<td>0.906</td>
</tr>
<tr>
<td></td>
<td>gainers 73.1 ± 5.4</td>
<td></td>
</tr>
<tr>
<td><strong>BMI (kg/m²)</strong></td>
<td>losers 29.1 ± 5.7</td>
<td>0.626</td>
</tr>
<tr>
<td></td>
<td>gainers 28.7 ± 5.5</td>
<td></td>
</tr>
<tr>
<td><strong>Lean mass (kg)</strong></td>
<td>losers 48.3 ± 9.9</td>
<td>0.920</td>
</tr>
<tr>
<td></td>
<td>gainers 48.2 ± 9.8</td>
<td></td>
</tr>
<tr>
<td><strong>Fat mass (kg)</strong></td>
<td>losers 32.3 ± 11.0</td>
<td>0.546</td>
</tr>
<tr>
<td></td>
<td>gainers 31.3 ± 9.2</td>
<td></td>
</tr>
<tr>
<td><strong>Quadriceps strength (N)</strong></td>
<td>losers 444 ± 111</td>
<td>0.145</td>
</tr>
<tr>
<td></td>
<td>gainers 475 ± 125</td>
<td></td>
</tr>
<tr>
<td><strong>6MWD (m)</strong></td>
<td>losers 442 ± 71</td>
<td>0.094</td>
</tr>
<tr>
<td></td>
<td>gainers 464 ± 75</td>
<td></td>
</tr>
<tr>
<td><strong>TUG (sec)</strong></td>
<td>losers 8.0 ± 1.5</td>
<td>0.331</td>
</tr>
<tr>
<td></td>
<td>gainers 7.7 ± 2.0</td>
<td></td>
</tr>
<tr>
<td><strong>Attendance (%)</strong></td>
<td>losers 89.4 ± 9.2</td>
<td>0.149</td>
</tr>
<tr>
<td></td>
<td>gainers 91.6 ± 8.5</td>
<td></td>
</tr>
<tr>
<td><strong>MMSE</strong></td>
<td>losers 27.1 ± 2.4</td>
<td>0.080</td>
</tr>
<tr>
<td></td>
<td>gainers 27.7 ± 1.9</td>
<td></td>
</tr>
<tr>
<td><strong>QoL</strong></td>
<td>losers 53.4 ± 6.2</td>
<td>0.054</td>
</tr>
<tr>
<td></td>
<td>gainers 55.5 ± 6.2</td>
<td></td>
</tr>
<tr>
<td><strong>Number of drugs</strong></td>
<td>losers 2.2 ± 1.5</td>
<td>0.510</td>
</tr>
<tr>
<td></td>
<td>gainers 2.0 ± 1.5</td>
<td></td>
</tr>
<tr>
<td><strong>exercise in minutes/week</strong></td>
<td>losers 366 ± 357</td>
<td>0.906</td>
</tr>
<tr>
<td></td>
<td>gainers 350 ± 248</td>
<td></td>
</tr>
<tr>
<td><strong>Energy intake (kcal/d)</strong></td>
<td>losers 1551 ± 394</td>
<td>0.046</td>
</tr>
<tr>
<td></td>
<td>gainers 1724 ± 490</td>
<td></td>
</tr>
<tr>
<td><strong>Protein intake (g/kg BW/d)</strong></td>
<td>losers 0.9 ± 0.2</td>
<td>0.009</td>
</tr>
<tr>
<td></td>
<td>gainers 1.0 ± 0.3</td>
<td></td>
</tr>
</tbody>
</table>
Independent for statistical models, protein intake (g/kg BW) remains a significant predictor of gaining ASM with an OR mostly between 7 and 9.
Improvement in physical function

<table>
<thead>
<tr>
<th>Measure</th>
<th>Losers</th>
<th>Gainers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quadriceps strength (N)</td>
<td>56</td>
<td>52</td>
</tr>
<tr>
<td>Grip strength (lb)</td>
<td>2.7</td>
<td>3.1</td>
</tr>
<tr>
<td>6MWD (m)</td>
<td>33</td>
<td>34</td>
</tr>
<tr>
<td>TUG (sec)</td>
<td>0.7</td>
<td>0.6</td>
</tr>
</tbody>
</table>

No significant differences between losers and gainers.
Conclusion

• In elderly community-living a 12 week resistance exercise program increase lean body mass, muscle strength and physical function.

• There is no added benefit from post-exercise ingestion of 20 g of protein beyond what is achieved by ingesting isocaloric carbohydrates.

Conclusion

• According to our results, dietary intake predicts whether you lose or gain ASM.
• Loss in ASM does not translate into poorer function after 12 weeks.
  – Long term consequences?
• Physical activity is an important factor in healthy aging, however without proper dietary intake it could be questionable
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