Nutrition in the Elderly

Malnutrition in the elderly: Epidemiology and consequences

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Module 36.1

CONTENTS

– Prevalence of malnutrition in elderly subjects in
  • the community
  • nursing homes
  • hospitals
– Consequences of malnutrition in the elderly
– Micronutrient deficiency
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Prevalence of malnutrition in the community

- **EURONUT-SENECA STUDY (19 towns, 12 countries)**
  - **I** (1988 - 1989) 2600 subjects, aged 70-75 years
    - **BMI ≤ 20**: 4 % (men) - 5 % (women)
    - **Albumin < 35 g/L**: 2 % of subjects
  - **II** (1993 - 1994) 1221 subjects aged 75-80 years
    - **Weight loss**
      - > 3 kg: 47 % (men) - 43 % (women)
      - > 5 kg: 16 % (men) - 16 % (women)
    - **BMI ≤ 20**: 3 % (men) - 6 % (women)
    - **Albumin < 35 g/L**: 2.2 % of subjects
      » Euronut-Seneca Eur J Clin Nutr 1996
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Prevalence of malnutrition in nursing homes

<table>
<thead>
<tr>
<th>Reference</th>
<th>N</th>
<th>Tool</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sayoun 1988</td>
<td>260</td>
<td>A, Bio, Fl</td>
<td>19 %</td>
</tr>
<tr>
<td>Larsson 1990</td>
<td>435</td>
<td></td>
<td>29 %</td>
</tr>
<tr>
<td>Compan 1999</td>
<td></td>
<td></td>
<td>25 %</td>
</tr>
<tr>
<td>Saletti 2000</td>
<td></td>
<td></td>
<td>30 %</td>
</tr>
<tr>
<td>Crogan 2003</td>
<td>311</td>
<td>BMI</td>
<td>39 %</td>
</tr>
<tr>
<td>Margretts 2003</td>
<td>1368</td>
<td>A</td>
<td>21 %</td>
</tr>
<tr>
<td>Suominen 2005</td>
<td>2114</td>
<td>MNA</td>
<td>29 %</td>
</tr>
</tbody>
</table>


20-40 %
The Helsinki Nutrition Study of Older People

MNA registration of ~80% of institutionalized old people in Helsinki

<10% are well nourished

Soini et al. JNHA 2006;10:495-99
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Prevalence of malnutrition in the hospital

<table>
<thead>
<tr>
<th>Reference</th>
<th>N</th>
<th>Tool</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constans 1992</td>
<td>324</td>
<td>A, Bio</td>
<td>30 (M) - 40 (F) %</td>
</tr>
<tr>
<td>Mowé 1994</td>
<td>311</td>
<td>A, Bio, F</td>
<td>10 %</td>
</tr>
<tr>
<td>Gazotti 2000</td>
<td></td>
<td></td>
<td>21 %</td>
</tr>
<tr>
<td>Thomas 2002</td>
<td></td>
<td></td>
<td>18-53-29 %</td>
</tr>
<tr>
<td>Pablo 2003</td>
<td>60</td>
<td>SGA, NRI, A, Bio</td>
<td>63-90-58 %</td>
</tr>
<tr>
<td>Paillaud 2004</td>
<td>97</td>
<td>A</td>
<td>32 %</td>
</tr>
<tr>
<td>Stratton 2006</td>
<td>60</td>
<td>MUST</td>
<td>58 %</td>
</tr>
</tbody>
</table>

Prevalence of undernutrition according to MNA classification in an international perspective

24 datasets pooled, 12 countries, 4507 subjects, mean age 83 y

Undernutrition in Swedish old adults

Extract from ~30 prevalence studies
Malnutrition in UK costs in excess of £7.3 billion per year

UK costs for obesity = £3.5 billion per year

Long-term care
£2.6 billion

Community

Other

Hospital

£3.8 billion

Elia M BAPEN report 2005
BMI and mortality in a prospective cohort of US adults

- 1 million Americans
- >55 y
- 15 y follow-up
- ~250,000 died

Calle et al NEJM 1999
Body mass index - function and survival in old age

- ~13,000 >65 y
- 7 y follow-up
- Optimal function at BMI ~25
- Best survival at BMI ~25-30

Poor eating in hospital ⇒ higher risk
3200 patients age 78–103 y (4th age quartile)

Energy intake by Swedish hospital patients

• >1000 patients at Uppsala University Hospital, ~65 y
• 24 h food registration
• Energy need: 30 kcal/kg/d (>70: 25 kcal/kg/d)
• Median intake 50-75 % of needs
• ½ received <75% of energy needs
• 20% received <50% of energy needs

Wegener S. Pers comm.
Weight as predictor of COPD mortality

400 COPD-patients, >65 y
4 y f-up

- BMI
- Age
- PaO2
- PaCO2, FEV1, sex

Cardiac cachexia - mortality

- Definition: >6% weight loss last 6 mo
- Prevalence: 12-15% (NYHA II-IV)
- Incidence: 10%/y

1929 CHF pat (60 y), NYHA II 60%, RCT (ACEi vs. C), 35 mo, 39% died

Hazard ratio (95% CI) for †
- Weight loss >6%: 2.1 (1.7-2.5)
- NYHA III: 1.9 (1.4-2.5)
- LVEF <25%: 1.5 (1.3-1.7)

Anker et al. Lancet 2003;361:1077-83
“Geriatric cachexia” - 1-year survival decreases with lower weight (BMI)

- 400 patients (81 y)
- Independent predictors of mortality within 1 y
  - Body mass index
  - Gender
  - Function (ADL)
  - Age, Diagnosis

Major negative effects of undernutrition

- Immunodeficiency – infections
- Muscle wasting – sarcopenia
- Depressed mood - QoL↓
Nutritional immune deficiency
MAIDS - malnutrition associated immune deficiency syndrome

Cell-mediated immunity ↓
- T-lymphocytopenia
- CD4/CD8 ratio ↓

Humoral immunity ↓
- Vaccination ↓

Granulocyte dysfunction
- Chemotaxis ↓
- Oxygen radical production ↓

Infections
Granulocyte dysfunction in starvation

Reduced bactericidal effect in PMN from malnourished

Reduced superoxide generation in PMN from malnourished


Mental effects of starvation

- Depression
- Apathy
- Irritability
- Social withdrawal

34 young men, 1500 kcal/day 6 mon, lost 25% of body weight

Keys A. The Biology of Human Starvation 1950
Macro/micro nutrient deficiencies probably related to brain function

- Tryptophane $\rightarrow$ serotonin $\leftarrow$
- omega-3 fatty acids $\leftarrow$
  - Membrane functions, gene regulation, eicosanoid production
- Vit B12/folate $\rightarrow$ homocystein $\leftarrow$
- Thiamin (B1) $\leftarrow$
- Iron $\leftarrow$
The Japanese Centenarian Study

- 1907 100-year-olds, 10% were independent, i.e. preserved ADL, intact cognition & high social status

Variables Linked to Successful Aging

- Good vision
- **Protein intake↑**
- No falls
- Regular training
- No alcohol
- Good chewing ability
- Regular sleep
- Male

Ozaki JAGS 2007
Gait Speed and Survival in Older Adults

- Pooled analyses of 9 cohorts; 34500 community-dwelling old adults, 74 y, 60% w
- Follow-up 6-21 years, 17500 deaths
- HR for death was 0.88 (95%CI 0.87-0.90) per 0.1 m/s faster gait

**Figure 2.** Predicted Median Life Expectancy by Age and Gait Speed

Studenski et al. JAMA 2011;305:50-58
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Micronutrient deficiency

• Community: Euronut-SENECA study
  – Blood status
    • Low vitamin B12: 2.7 - 7.3 %
    • Low folic acid: 0 - 0.3 %
    • Low vitamin B6: 5.7 - 23 %
    • Low vitamin E: 0.6 - 1.1 %
    • Low vitamin D: 36 - 47 %
  – Dietary intake
    • 24% of men and 47% of women had low dietary intakes of at least one of the following micronutrients:
      – calcium, iron, retinol, ß-carotene, thiamine, pyridoxine or vitamin C
Vitamin D Receptors

Montero-Odasso et al, Mol Aspects Med 2005;26
Vitamin D and Sarcopenia

Prevalence of grip strength loss (defined as loss >40%, study sample n = 1,008) and appendicular muscle mass loss (defined as loss >3%, study sample n = 331) during 3-yr follow-up according to categories of baseline serum 25-OHD concentration. P value of $\chi^2$ test.

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Fracture consequences of malnutrition

- 6754 women, ~6 years follow-up
- **weight loss** increased the risk of fracture of the proximal femur, pelvis and proximal humerus
- age adjusted RR per 10% decrease in weight \( RR = 1.68 \) [95 % CI 1.17 – 2.41]

- Adjustment for age, cigarette smoking, physical activity, estrogen use, medical conditions, health status, body weight, femoral neck bone mass, and rate of change in calcaneal bone mass

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**Pressure sore consequences of malnutrition**

<table>
<thead>
<tr>
<th>Risk factors for pressure sores</th>
<th>Low albumin</th>
<th>Low food intake</th>
<th>Weight BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berlowitz 1989</td>
<td>+</td>
<td></td>
<td></td>
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<tr>
<td>Ek 1991</td>
<td>+</td>
<td>+</td>
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<tr>
<td>Bergström 1992</td>
<td>+</td>
<td>+</td>
<td>+</td>
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<tr>
<td>Inman 1993</td>
<td>+</td>
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<tr>
<td>Eachempati 2001</td>
<td></td>
<td>+</td>
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<tr>
<td>Reed 2003</td>
<td>+</td>
<td></td>
<td></td>
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<tr>
<td>Horn 2004</td>
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<td>+</td>
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Malnutrition in the elderly: Epidemiology and Consequences

- KEY MESSAGES - 1
  The prevalence of protein – energy malnutrition is
  - relatively low in community-dwelling elderly (~1 to 5%)
  - more common in nursing homes (~ up to 35%)
  - frequent in hospitalised elderly patients (~ up to 50%)
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Malnutrition in the elderly: Epidemiology and Consequences

• KEY MESSAGES - 2
• Protein energy malnutrition is associated with an increased cost and risk of
  – death
  – nosocomial infections
  – sarcopenia
  – hip fractures
  – pressure ulcer development
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• KEY MESSAGES-3
  Elderly subjects are at risk of micronutrient deficiency, e.g.
  – low calcium intake and low vitamin D status that increase the risk of osteoporosis
Prevalence of PEM during the stroke trajectory

- Axelson et al. 1988
- Unosson et al. 1994
- Davalos et al. 1996
- Finestone et al. 1995
- Kumlien & Axelson 2002
- Westergren et al. 2001
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Infectious consequences

<table>
<thead>
<tr>
<th>Reference</th>
<th>Risk factors for nosocomial infections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harkness 1990</td>
<td>Dependent feeding, weight loss</td>
</tr>
<tr>
<td>McClave 1992</td>
<td>hypoalbuminemia</td>
</tr>
<tr>
<td>Potter 1995</td>
<td>BMI, CAMA</td>
</tr>
<tr>
<td>Rothan-Tondeur 2003</td>
<td>BMI, hypoalbuminemia</td>
</tr>
<tr>
<td>Paillaud 2005</td>
<td>Hypoalbuminemia, low energy intake</td>
</tr>
</tbody>
</table>

*BMI*: body mass index, *CAMA*: corrected arm muscle area
Health ABC Study

Adjusted lean mass (LM) loss (3 years)
by quintile of energy-adjusted total protein intake (n=2066)

Houston DK et al, Am J Clin Nutr 2008; 87: 150-155
Vitamin D deficiency and physical performance

Bischoff-Ferrari HA et al., Am J Clin Nutr 2004;80:752-8
Depression and cognitive decline in rural old people in Bangladesh

- 457 >60 y (69±7), 75% w
- 26/62% PEM/at risk by MNA
- Low MNA score predicted
  - Depression (self-reported)
  - general cognitive decline
    - Bangla-Adapted MMSE
  - Reduced handling of “speed of information”

Ferdous et al. Publ Health Nutr 2009
Ferdous et al. J Am Ger Soc 2010