Malnutrition in the elderly: different determinants warrant different approaches

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Because whatever we do in terms of preventive lifestyle changes, there will still be malnourished elderly patients to feed…
Conceputal hierarchy of nutritional disorders

Nutritional disorder

Mal/undernutrition
- Starvation-related underweight
  - BMI <18.5
- Cachexia/disease-related malnutrition
  - Disease
  - BMI <20 or Weight loss
  - FFM↓

Micronutrient abnormalities
- Sarcopenia
  - FFM↓
  - Gait speed↓ or Handgrip↓
- Frailty
  - Weight loss
  - Weakness
  - Exhaustion
  - Slowness
  - Low phys act

Overnutrition
- Overweight
  - BMI 25-30
- Obesity
  - BMI >30
  - FM↑

ESPEN Initiative for Diagnostic Criteria for Undernutrition
Malnutrition in the elderly

Diagnostic criteria for malnutrition

Step 1. Risk screening by a validated instrument, e.g. NRS2002, MUST, MNA(-SF), etc., i.e. BMI, Weight loss, Reduced food intake, Disease severity

Step 2. Diagnosis

- **BMI <18.5 kg/m²**

Alternative diagnostic trajectory

- **Weight loss >10% (indefinite time)/>5% last 3 mo** combined with either
  - **BMI <20 (if <70 years)/<22 (if >70 y)**
  - **FFMI <15 and 17 kg/m² in women and men, respectively**

ESPEN Initiative for Diagnostic Criteria for Undernutrition
Consequences of undernutrition

- Delayed and impaired wound healing
- Infections
- Osteoporosis
- Mortality
- Reduced quality of life
- Increased dependence, institutionalization, length of hospital stay, costs
<table>
<thead>
<tr>
<th>Factor</th>
<th>Possible causes</th>
</tr>
</thead>
</table>
| Psychological, social, and environmental                              | Social isolation  
Grieving  
Financial difficulties  
Ill-treatment  
Hospitalisation  
Change in lifestyle: Admission to an institution                       |
| Oral and dental disorders                                             | Mastication disorders  
Poor dental hygiene  
Poorly fitting dentures  
Dryness of the mouth  
Oropharyngeal candidiasis  
Dysguesia                                                              |
| Swallowing disorders                                                  | Ear, nose, and throat diseases  
Vascular or neurodegenerative disease                                    |
| Psychiatric disorders                                                 | Depressive syndromes  
Behavioural disorders                                                      |
| Dementia                                                              | Alzheimer's disease  
Other types of dementia                                                      |
| Other neurological disorders                                          | Delirium syndrome  
Disorders of consciousness  
Parkinsonism                                                              |
| Long-term drug treatment                                              | Polymedication  
Medication causing dryness of the mouth, dysguesia, gastrointestinal disorders, anorexia, drowsiness etc.  
Long-term corticosteroid therapy                                       |
| Any acute disorder or decompensation of a chronic disease            | Pain  
Infectious disease  
Fracture causing a disability  
Surgical procedure  
Severe constipation  
Pressure sores                                                            |
| Dependency for daily activities                                       | Eating impairment  
Mobility impairment                                                          |
| Restrictive diets                                                     | Salt-free  
Slimming  
Diabetic  
Cholesterol-lowering  
Long-term residue-free diets                                             |
Malnutrition and geriatric syndromes

<table>
<thead>
<tr>
<th>Geriatric syndromes</th>
<th>Normal MNA score (n = 232)</th>
<th>MNA score ≤ 23, (n = 181)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual disturbances</td>
<td>154 (66%)</td>
<td>110 (61%)</td>
<td>NS</td>
</tr>
<tr>
<td>Hearing loss</td>
<td>105 (45%)</td>
<td>82 (45%)</td>
<td>NS</td>
</tr>
<tr>
<td>Urinary incontinence</td>
<td>75 (32%)</td>
<td>72 (40%)</td>
<td>NS</td>
</tr>
<tr>
<td>Fecal incontinence</td>
<td>2 (1%)</td>
<td>16 (9%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Falls</td>
<td>72 (31%)</td>
<td>77 (43%)</td>
<td>0.018</td>
</tr>
<tr>
<td>Insomnia</td>
<td>51 (22%)</td>
<td>69 (38%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Psychosis</td>
<td>2 (1%)</td>
<td>8 (4%)</td>
<td>0.025</td>
</tr>
<tr>
<td>Dementia</td>
<td>46 (20%)</td>
<td>77 (43%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Depression</td>
<td>75 (32%)</td>
<td>110 (61%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Delirium</td>
<td>1 (1%)</td>
<td>8 (4%)</td>
<td>0.012</td>
</tr>
<tr>
<td>Neurological disorders</td>
<td>57 (25%)</td>
<td>89 (49%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Dizziness</td>
<td>30 (13%)</td>
<td>44 (24%)</td>
<td>0.004</td>
</tr>
<tr>
<td>Need for a caregiver</td>
<td>12 (6%)</td>
<td>62 (34%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Diabetes</td>
<td>65 (28%)</td>
<td>45 (24%)</td>
<td>NS</td>
</tr>
</tbody>
</table>

Saka et al. Clin Nutr
Energy intake with age

Average decrease in oral intake between 20 and 80
- 1321 kcal/d in men
- 629 kcal/d in women

NHANES 1999 –
Anorexia of ageing

- Smell
- Taste
- Fat Mass
- Leptin
- Testosterone
- Opioids
- NPY
- Nitric oxide
- Vagus
- TNFα
- Cholecystokinin

Adaptive Relaxation
Antral stretch occurs earlier
grelin
Decreased rate of gastric emptying

Decreased Food Intake
male > female

Morley et al. Pharm Biochem Behavior
Body weight after energy restriction

Variations in weight (kg)

-3 -2 -1 0 1 2

D20 D29 D41 D77 Max weight

Restriction Ad libitum

Young
Elderly

Roberts et al. JAMA
Food intake in the 10 days following restriction

Roberts et al. JAMA
Delayed gastric emptying of the solid component of a test meal

Clarkston et al. Am J Physiol
Total plasma ghrelin in young and old

Snack

P < 0.01 vs. * Young, † Well-nourished

Well-nourished young
Malnourished young
Well-nourished elderly
Malnourished elderly

Schneider et al. Clin Nutr
Hunger VAS

Snack

P < 0.01 vs. † Well-nourished

Well-nourished young
Malnourished young
Well-nourished elderly
Malnourished elderly

Schneider et al. Clin Nutr
Solitude and Nutrition above age 70 - The SOLINUT - Study

- **Participants**
  - 150 persons above age 70 living alone in France
  - Mean age 80.8 years

- **Results**
  - 42.6 % oral intake < 25 kcal/kg body weight per day
  - 21.3 % overt undernutrition
  - 44 % too weak to carry a shopping bag (weight 5 kg)
  - 32 % no shared meals with friends or relatives
Body composition in young and elderly malnourished patients

Schneider et al. Clin Nutr
Nutritional Support Strategy

- Apart from situations contra-indicating oral feeding, nutritional support should, as a priority, be initiated by providing dietary advice and/or fortified foods (grade C).
- Oral nutritional supplementation may be given if these supportive measures are ineffective or from onset in patients with severe malnutrition (grade C).
- Enteral nutrition may be attempted if it is impossible to achieve adequate oral nutritional support.
- Parenteral nutrition is restricted to the following three situations: severe anatomical or functional malabsorption syndromes, acute or chronic bowel obstruction, failure of well-conducted enteral nutrition.

Raynaud-Simon et al. Clin Nutr
Recommendations for protein intake

PROT-AGE recommendations for protein levels in geriatric patients with specific acute or chronic diseases

- The amount of additional dietary protein or supplemental protein needed depends on the disease, its severity, the patient’s nutritional status prior to disease, as well as the disease impact on the patient’s nutritional status.
- Most older adults who have an acute or chronic disease need more dietary protein (ie, 1.2–1.5 g/kg BW/d); people with severe illness or injury or with marked malnutrition may need as much as 2.0 g/kg BW/d.
- Older people with severe kidney disease (ie, estimated glomerular filtration rate [GFR] < 30 mL/min/1.73m²) who are not on dialysis are an exception to the high-protein rule; these individuals need to limit protein intake.
Food fortification

- Oil
- Cream, sour cream
- Butter, eggs
- Milk, cheese, skimmed milk powder
- Sugar
- Commercial CHO/protein powder or liquids
- Protein-enriched pasta, couscous

Aims to increase the energy and protein density of the diet
Other interventions on meals

- Between-meal snacks
- Compliance with preferences
- Modified pureed food
- Decentralized food portioning
- Verbal prompting
- Provision of feeding assistance
- Individualized care
- Improvement of environment
## Optimal BMI after age 65

<table>
<thead>
<tr>
<th>Source, y/Study</th>
<th>Weight</th>
<th>Type</th>
<th>Range (Referent Group)</th>
<th>Optimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calle et al, 1999/Cancer Prevention Study II</td>
<td>Self-reported</td>
<td>Categorized, 10 levels</td>
<td>&lt;20.5 to ≥35 (23.5 to 24.9)</td>
<td>65-74 y: 20.5 to 23.4; ≥75 y: 23.5 to 24.9</td>
</tr>
<tr>
<td>Kalmijn et al, 1999/Honolulu Heart Program</td>
<td>Measured</td>
<td>Categorized, 5 levels</td>
<td>≤20.7 to 39.3 (≤20.7)</td>
<td>Not given</td>
</tr>
<tr>
<td>Diehr et al, 1998/Cardiovascular Health Study</td>
<td>Measured</td>
<td>Categorized, 9 levels, tested continuous</td>
<td>≤20 to &gt;34 (&gt;20 to ≤34)</td>
<td>Women: 26 to 28; men: 30 to 32</td>
</tr>
<tr>
<td>Stevens et al, 1998/American Cancer Society Cancer Prevention Study</td>
<td>Self-reported</td>
<td>Categorized, 7 levels, tested continuous</td>
<td>&lt;19 to ≥32 (19.0 to 21.9)</td>
<td>65-74 y: not given; ≥75 y: 27.4 to 28.5</td>
</tr>
<tr>
<td>Menotti et al, 1996/Finland, Italy, Netherlands Elderly Study</td>
<td>Measured</td>
<td>Continuous</td>
<td>. . .</td>
<td>65-74 y: 29.4; ≥75 y: 30.7</td>
</tr>
<tr>
<td>Losonczy et al, 1995/Established Populations for Epidemiologic Studies of the Elderly</td>
<td>Self-reported</td>
<td>Categorized, 5 levels</td>
<td>≤21 to ≥29.2 (men: 24.4 to 26.2; women: 23.7 to 25.8)</td>
<td>Not given</td>
</tr>
<tr>
<td>Rimm et al, 1995/Health Professionals Follow-up Study</td>
<td>Self-reported</td>
<td>Categorized, 5 levels</td>
<td>&lt;23.0 to ≥33.0 (&lt;23.0)</td>
<td>29 to 32.9</td>
</tr>
<tr>
<td>Seeman et al, 1993/Established Populations for Epidemiologic Studies of the Elderly, New Haven Cohort</td>
<td>Self-reported</td>
<td>Categorized, 3 levels</td>
<td>≤23 to ≥28 (≤23)</td>
<td>Coronary heart disease mortality: ≥28; myocardial infarction incidence: men, ≥23 and women, ≥28</td>
</tr>
<tr>
<td>Cournion-Huntley et al, 1991/National Health and Nutrition Examination Survey I, Epidemiologic Follow-up Study</td>
<td>Measured</td>
<td>Categorized, 5 levels, percentiles</td>
<td>&lt;20.5 to &gt;34.4 (40th to 59th percentiles)</td>
<td>Black women: 28.82 to 34.37; black men: 22.95 to 25.58; white women: 24.37 to 26.95; white men: 26.39 to 29.30</td>
</tr>
<tr>
<td>Rissanen et al, 1991/Finland</td>
<td>Measured</td>
<td>Categorized, 5 levels</td>
<td>≤22.7 to 47.4 (65 to 74 y: 24.1 to 26.4; ≥75 y: 22.8 to 25.2)</td>
<td>27 to 31</td>
</tr>
<tr>
<td>Rissanen et al, 1989/Finland</td>
<td>Measured</td>
<td>Categorized, 7 levels</td>
<td>&lt;19.0 to ≥34.0 (22.0 to 24.9)</td>
<td>≥75 y: 28 to 31</td>
</tr>
<tr>
<td>Tayback et al, 1990/National Health and Nutrition Examination Survey I, Epidemiologic Follow-up Study</td>
<td>Measured</td>
<td>Categorized, 3 levels</td>
<td>&lt;22.0 to &gt;30.0 (22.0 to 30.0)</td>
<td>26.5 to 27</td>
</tr>
<tr>
<td>Harris et al, 1988/Framingham Heart Study</td>
<td>Measured</td>
<td>Categorized, 4 levels, percentiles</td>
<td>&lt;23.0 to ≥28.7 (men, 23.0 to 25.2; women, 24.2 to 26.1)</td>
<td>Not given</td>
</tr>
</tbody>
</table>
Restrictive diets and undernutrition

RR for MNA-SF® <12 = 3.6, 95%CI=1.8-7.2, P<0.001

Protein and energy supplementation in elderly people at risk from malnutrition

*Mortality by nutrition status*

- 42 reports / 8031 randomized subjects
- 21% reduction in mortality when only undernourished subjects included
- Mean weight gain 2.2% [1.8-2.5]

Milne *et al.* Cochrane DSR
Meta-Analysis: Protein and Energy Supplementation in Older People

*Percent Weight Gain*

- Hospital 14 trials
- Long term-care 8 trials
- Home 16 trials

- 1.0%
- 1.4%
- 1.8%
- 2.2%
- 2.6%
- 3.0%
- 2.5%
- 2.3%

*Milne et al. Cochrane DSR*
Net improvement of nutritional parameters during cyclic EN in young and elderly malnourished patients

- **Body weight**
  - D15: <65 years (P<0.01) vs ≥65 years (NS), D28: <65 years (P<0.001) vs ≥65 years (NS)
  - D15 vs D28: <65 years (P<0.05) vs ≥65 years (NS)

- **Serum transferrin**
  - D15: <65 years (P<0.05) vs ≥65 years (NS), D28: <65 years (NS) vs ≥65 years (P<0.05)

- **Serum transthyretin**
  - D15: <65 years (NS) vs ≥65 years (P<0.05), D28: <65 years (NS) vs ≥65 years (P<0.05)

- **Serum albumin**
  - D15: <65 years (NS) vs ≥65 years (P<0.01), D28: <65 years (P<0.001) vs ≥65 years (NS)

Hébuterne et al. JAMA
Estimation of energy excess for the gain of 1 kg in young and elderly malnourished patients

Hébuterne et al. Personal
Combined effects of exercise and nutritional supplements in frail institutionalized elderly subjects

Fiatricone et al. N Engl J Med
A better feeding efficiency?

- 24 elderly inpatients > 70 yr-old
- Total enteral nutrition
- 2 isoE and isoN diets (900 kcal/d)
- 12-week refeeding
  - *L. johnsonii* La1
  - Nothing

In the LC1 group compared to the control group:

- Higher increase of albumin levels (34.3 ± 3.2 to 35.8 ± 2.5 vs. 33.9 ± 3.6 to 35.0 ± 3.2 g/L) (P<.01)
- Higher reduction of the % of days with infections
- No change in faecal microbiota between groups

Fukushima *et al*. Br J Nutr 2007
## Concrete research/innovation actions: prevention

<table>
<thead>
<tr>
<th>Home setting</th>
<th>Screening for malnutrition in patients with chronic diseases, geriatric syndromes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domotics</td>
<td></td>
</tr>
<tr>
<td>Social structure</td>
<td></td>
</tr>
</tbody>
</table>

| No restriction                |                                                                                   |
| Pleasure                      |                                                                                   |
| BMI threshold                 |                                                                                   |
| Protein intake                |                                                                                   |
| Restrictive diets             |                                                                                   |
| Functional food?              |                                                                                   |

| Oral care                     |                                                                                   |
| Dentistry                     |                                                                                   |
| Lubricants                    |                                                                                   |
| Textured food                 |                                                                                   |
Concrete research/innovation actions: treatment

- Enriched food
  - Protein and energy
  - Adapted textures

- Age-specific formulas
  - RDA
  - Anti-inflammaging
  - Anabolic

- Adjuvants to artificial nutrition
  - Specific amino acids?
  - Physical exercise
  - Probiotics

- Hormonal treatment
  - SARMs
  - Ghrelin analogues