Poor nutritional status is now well established as a major negative prognostic indicator in older persons (1-3). Weight loss in persons over 60 years of age approximately doubles the chances of dying, regardless of the persons body mass index (4-7). There are 6 major causes of weight loss, namely: Sarcopenia, anorexia, malabsorption, hypermetabolism, cachexia and dehydration (8). Cachexia is most commonly associated with excess cytokines and has both muscle and fat loss, together with low albumin and anemia (9-12). Elevated cytokines, especially tumor necrosis factor-alpha receptor, is associated with poor response to treatment (13-16). Of the causes of weight loss, only sarcopenia should not be considered to be true malnutrition, but rather is a loss of muscle mass often replaced by fat mass (17-19). Over the last 20 years, there has been important advances in our ability to diagnose malnutrition, predominantly because of the large body of work exploring the use of the Mini Nutritional Assessment (MNA)(20-23). Despite this, persons with malnutrition are still poorly recognized by physicians (24).

Screening Tests

Besides the MNA a number of screening tests for malnutrition have been validated. The Nutritional Screening Index was the first of these and while well constructed, it proved to be nonspecific (24, 25). SCREEN is a Canadian instrument with good test-retest and inter-rater reliability (26, 27). It correlates with the dietitian nutritional risk rating. It has a sensitivity of 84% and specificity of 62%. The Appetite, Hunger and Sensory Perception Questionnaire (AHSP) has good internal consistency (0.71 to 0.76) but performs poorly in non healthy elderly (28).

The Malnutrition Universal Screening Tool (MUST) is a simple tool using just three items – body mass index (BMI), weight loss and acute disease effect (29, 30). It predicts mortality and length of stay (31). In hospital both it and the MNA predicted persons at high risk of admission, but weight loss during hospitalization was more predictive.

SCALES was developed to recognize cachexia (25). It consists of sadness, low cholesterol, low albumin, weight loss, eating problems and shopping/food preparation problems. The subjective global assessment was developed for younger persons in hospital and validated for those with gastrointestinal disorders. Dietary intake has reported energy intakes of 10 to 45% lower than measured intakes (25). Food diaries perform slightly better.

The anorexia of aging is closely correlated with poor outcomes in older persons (32-36). Anorexia is a complex behavior representing the interaction of a variety of neurotransmitters that are easily perturbed by a variety of factors (37-40). For these reasons, we developed the simplified nutrition assessment questionnaire (SNAQ) (41). This predicts future weight loss in community and nursing home persons. It has an 81.3% sensitivity and a 76.4% specificity to predict weight loss.

Numerous anthropomorphic parameters can be used to detect nutritional changes (Table I). While serum proteins have been widely used to measure nutrition, the fact that they are dramatically lowered by cytokine activity (inflammation) makes their utility as nutritional markers at best questionable (42) (Table II).

### Table 1
**Anthropometric Parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight change</td>
<td>Half-life</td>
</tr>
<tr>
<td>BMI</td>
<td>Age</td>
</tr>
<tr>
<td>Arm span</td>
<td>Others</td>
</tr>
<tr>
<td>Mid-arm or Calf Circumference</td>
<td></td>
</tr>
<tr>
<td>Triceps skinfold</td>
<td></td>
</tr>
<tr>
<td>MAMC and MAMA</td>
<td></td>
</tr>
<tr>
<td>Waist Circumference</td>
<td></td>
</tr>
<tr>
<td>Bioelectrical impedance</td>
<td></td>
</tr>
<tr>
<td>Dual photon absorptiometry (DEXA)</td>
<td></td>
</tr>
<tr>
<td>CT/MRI</td>
<td></td>
</tr>
<tr>
<td>Ultrasound</td>
<td></td>
</tr>
<tr>
<td>Underwater weighing</td>
<td></td>
</tr>
<tr>
<td>Stable isotopes</td>
<td></td>
</tr>
</tbody>
</table>

BMI=Body Mass Index; MAMC=Mid-Arm Muscle Circumference; MAMA=Mid-Arm Muscle Area

### Table 2
**Serum Proteins**

<table>
<thead>
<tr>
<th>Protein</th>
<th>Half-life</th>
<th>Age</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albumin</td>
<td>18 d</td>
<td>? decrease</td>
<td>Posture, Cytokines</td>
</tr>
<tr>
<td>Prealbumin (Transhthyretin)</td>
<td>2 d</td>
<td>none</td>
<td>Cytokines</td>
</tr>
<tr>
<td>Transferrin</td>
<td>9 d</td>
<td>decrease</td>
<td>Fe, Cytokines</td>
</tr>
<tr>
<td>RBP</td>
<td>12 h</td>
<td>m f</td>
<td>Cytokines, Zinc, Vitamin A</td>
</tr>
<tr>
<td>IGF-1</td>
<td>2-4 h</td>
<td>decrease</td>
<td>Cytokines</td>
</tr>
<tr>
<td>Fibronectin</td>
<td>4 h</td>
<td>?</td>
<td>Cytokines</td>
</tr>
</tbody>
</table>

RBP = Retinol Binding Protein; IGF-1 = Insulin Growth Factor-1; d=days; h=hours; m=male; f=female; Fe=Iron; Cytokines=Cytokines
ASSESSMENT OF MALNUTRITION IN OLDER PERSONS: A FOCUS ON THE MINI NUTRITIONAL ASSESSMENT

Mini Nutritional Assessment

The MNA was developed by Vellas and Guigoz in 1989 and has subsequently become the best validated and most widely utilized nutritional assessment tool (43-45). Scores between 17 and 23 are considered at risk and those less than 17 represent protein energy malnutrition. A major advantage is it requires no laboratory testing.

Numerous studies from around the world continue to appear using the MNA (46-53). The prevalence of either malnutrition or risk for malnutrition is particularly high in persons undergoing acute rehabilitation (54). The level of true malnutrition in older persons depends on the setting studied. In the community, values of malnutrition run from as low as 0.7% to 5.8%. A recent review found that in 4507 persons studied with an average age of 82.3 years the MNA identified 46.2% of older persons as being at risk for malnutrition (55). In nursing homes 13.8% were malnourished and in hospitals 38.7%. In a population with early dementia 5% were malnourished and 32% at risk (56).

As with a low BMI, the MNA is predictive of mortality (57, 58). Nurses appear to be the most appropriate persons to do the MNA assessment (59).

In an attempt to improve the rate of screening a short form of the MNA was developed and validated (56). As determining the BMI in older persons is often difficult, a new revised form of the MNA-SF was developed, showing that calf circumference can replace BMI (60).

When the MNA identifies persons at risk, they are often also identified as frail (61-64). This is not surprising as the components of the MNA-SF that are key components of frailty include weight loss, low food intake, and strength (represented by mobility and when used calf circumference). For this reason, all persons who score as nutrition at risk should be worked up for frailty. If frail, an exercise regimen should be added to their treatment (65).

The MNA identifies persons at risk, they are often also identified as frail (61-64). This is not surprising as the components of the MNA-SF that are key components of frailty include weight loss, low food intake, and strength (represented by mobility and when used calf circumference). For this reason, all persons who score as nutrition at risk should be worked up for frailty. If frail, an exercise regimen should be added to their treatment (65-67). A number of components of the MNA long form (J to O) are very helpful in identifying persons whose problem is predominantly nutritional.

Other Screening Tests

Persons with depression are at very high risk for developing malnutrition (68-76). For this reason all persons who screen positive with the MNA should be also screened with either the geriatric depression scale or the Cornell Depression Scale for persons with dementia. This is particularly important for men living alone (77).

In addition, all persons at risk for malnutrition should be assessed for cognitive problems (78-80). Nutritional support is important in persons with Alzheimer’s disease and may improve cognition (81).

All older persons who are not receiving at least 1000 IU of vitamin D a day should have their 25(OH) vitamin D level measured (82-86). Low vitamin D levels are related to sarcopenia, falls, hip fracture, heart disease and increased mortality. The 25(OH) vitamin D level should be at least 70nmol/L (30ng/ml).

Conclusion

All older persons should be screened for malnutrition or being at risk for malnutrition. The MNA is the best validated and most widely utilized screening test for malnutrition in older persons. When persons are recognized to be malnourished or at risk for malnutrition, they should be carefully evaluated for reversible causes using an instrument such as the MEALS-ON-WHEELS mnemonic (Table III). Treatment algorithms such as the ones developed for nursing homes can then be implemented (87). If supplements are to be used, they should be given between meals (88-91). Nutrition is a central factor in improving function and quality of life in older persons.

Table 3
Causes of Weight Loss

<table>
<thead>
<tr>
<th>Causes of Weight Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medications</td>
</tr>
<tr>
<td>Emotional (depression)</td>
</tr>
<tr>
<td>Alcoholism, anorexia tardive, abuse (elder)</td>
</tr>
<tr>
<td>Late life paranoia</td>
</tr>
<tr>
<td>Swallowing problems</td>
</tr>
<tr>
<td>Oral problems</td>
</tr>
<tr>
<td>Nosocomial infections, no money (poverty)</td>
</tr>
<tr>
<td>Wandering/dementia</td>
</tr>
<tr>
<td>Hypothyroidism, hypercalcemia, hypoadrenalism</td>
</tr>
<tr>
<td>Enteric problems (malabsorption)</td>
</tr>
<tr>
<td>Eating problems (eg. Tremor)</td>
</tr>
<tr>
<td>Low salt, low cholesterol diet</td>
</tr>
<tr>
<td>Shopping and meal preparation problems, Stones (cholecytisitis)</td>
</tr>
</tbody>
</table>

References


ASSESSMENT OF MALNUTRITION IN OLDER PERSONS: A FOCUS ON THE MINI NUTRITIONAL ASSESSMENT