

The 'Mini Nutritional Assessment' (MNA) and the 'Determine Your Nutritional Health' Checklist (NSI Checklist) as predictors of morbidity and mortality in an elderly Danish population

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The purpose of the present study was to evaluate the capacity of the 'Determine Your Nutritional Health' Checklist (NSI Checklist) and the 'Mini Nutritional Assessment' (MNA) methods to predict nutrition-related health problems. Data were from the Danish part of the 'Survey in Europe of Nutrition in the Elderly, a Concerted Action' (SENECA) baseline survey from 1988, and the follow-up study from 1993. Based on the baseline survey thirty-nine (19.3%) of the subjects were classified at high nutritional risk, 103 (51%) were considered at moderate nutritional risk and sixty (29.7%) were within the 'good' range according to the criteria in the NSI Checklist. With the MNA, 171 subjects were classified according to their nutritional risk into a well-nourished group, comprising 78.4%, and a group who were at risk of undernutrition, comprising 21.6% at baseline. A total of 115 subjects participated in the follow-up study. The mortality rate and the prevalence of various morbidity indicators were compared between the different risk groups. The analysis showed that subjects with a high MNA score (≥ 24) had significantly lower mortality (rate ratio estimate: 0.35; 95% CI 0.18, 0.66) compared with subjects with a low MNA score (≤ 23.5). In contrast, the NSI Checklist score was not a significant predictor of mortality (rate ratio estimate: 1.45; 95% CI 0.78, 2.71). The sixteen Danes judged to be at high nutritional risk by the NSI Checklist in 1988, had more acute diseases ($P < 0.001$) than the rest of the participants, between 1988 and 1993. No significant differences were found in the participation rates, hospitalization rates, physician visits, need of help or weight loss between the groups. The thirteen Danes judged to be at risk of undernutrition in 1988 by the MNA, had a lower participation rate ($P < 0.01$) and higher occurrence of acute disease ($P < 0.05$), need of help ($P < 0.05$), and weight loss ($P < 0.001$) than the well-nourished group, between 1988 and 1993. No significant differences were found in hospitalization rates and physician visits between the two groups. In conclusion, the results indicate that modified versions of the NSI Checklist and the MNA are capable of identifying a group of 70–75-year-old subjects with increased risk of certain nutrition-related health problems. Further, an MNA score ≤ 23.5 predicts mortality in a Danish population.

Screening: Elderly: Nutritional assessment

The elderly population is particularly prone to inadequate nutritional status because of factors such as age-related physiological and social changes, occurrence of chronic diseases, use of medications, and decreased mobility (Morley, 1995). The undernutrition may not be easy to recognize or distinguish from changes resulting from the ageing process itself, and, if undetected, could result in more rapid deterioration of health and early death. Efforts are, therefore, directed to the understanding, evaluation and

detection of the different factors that influence the nutritional status of elderly people (Sahyoun *et al.* 1997).

The 'Determine Your Nutritional Health' Checklist (NSI Checklist) was developed as part of the US Nutrition Screening Initiative, a collaborative effort between the American Dietetic Association, the American Academy of Family Physicians and the National Council on the Ageing (Barocas *et al.* 1995). This self-administered awareness tool may need a follow-up by professionals for further

Abbreviations: MNA, 'Mini Nutritional Assessment'; NSI Checklist, 'Determine Your Nutritional Health' Checklist; SENECA, 'Survey in Europe of Nutrition in the Elderly, a Concerted Action'.

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nutritional and health assessments (Barrocas *et al.* 1995). The NSI Checklist includes ten yes/no items, which are given different weights, associated with the nutritional well-being of older people. It is not meant to be a clinical diagnostic tool but should predict overall perceived health, and identify persons whose estimated nutrient intakes fall below the recommended dietary allowances. However, few studies have validated the NSI Checklist (Posner *et al.* 1993; Coulston *et al.* 1996; Sahyoun *et al.* 1997), and only one has examined its predictive capacity in relation to mortality (Sahyoun *et al.* 1997). In this study the authors found that the cumulative score of the NSI Checklist was a weak predictor of mortality (Sahyoun *et al.* 1997).

Another tool for application in nutritional screening is the 'Mini Nutritional Assessment' (MNA) developed in France (Guigoz *et al.* 1994). MNA was developed to evaluate the risk of undernutrition, and to identify those who could benefit from early intervention. It is composed of eighteen simple and rapid-to-measure items encompassing anthropometry, dietary assessment, clinical global assessment and subjective self-perception of health and nutritional status, and requires a professional to complete. Validation tests have been done using the opinion of two expert physicians (clinical status) as gold standard. The MNA has been found capable of identifying undernourished persons (Guigoz *et al.* 1994). However, as for the NSI Checklist, its predictive capacity has never been thoroughly assessed.

This is now possible by means of information obtained from the 'Survey in Europe of Nutrition in the Elderly, a Concerted Action' (SENECA) study. In 1988, data on dietary intake, lifestyle and health were collected from 2600 Europeans, including a group of Danes, born between 1913 and 1918. In 1993 half the cohort participated in the follow-up study. However the SENECA data do not supply information to answer all the questions in the NSI Checklist and the MNA, hence, some approximations have to be made.

Thus, the present study was undertaken to evaluate the capacity of modified versions of both nutritional screening tools to predict mortality and several nutrition-related health problems, by means of data from the Danish part of the SENECA survey and follow-up study.

Methods

Subjects

A total of 202 Danes (101 women; 101 men) participated in the baseline survey in 1988. Five years later, in 1993, thirty-one of them were dead, three could not be reached and fifty-three refused to take part again. However, thirty-two of the refusers agreed to answer a non-respondent's questionnaire. Thus, a total of 115 subjects (fifty-eight women; fifty-seven men) participated in the follow-up study, and 147 subjects (eighty-one women; sixty-six men) who answered the non-respondent's questionnaire were included (van't Hof & Burema, 1996).

In 1988 and again in 1993 all subjects were visited three times at home. At the first visit data were collected, via a personal interview, on living situation, activities of daily living, social network, diet habits, use of medicines, health

and presence of acute or chronic diseases. In addition to this, subjects were carefully instructed to record all foods eaten in estimated household measures for three consecutive days, including one weekend day. At the second visit, 4–5 d later, subjects were interviewed about their habitual food intake, whereupon the dietary intake over the last 2 weeks was checked using a list of food items. Common household measures and weights of foods eaten frequently were measured to quantify the portion sizes more accurately (de Groot *et al.* 1996b; van't Hof & Burema, 1996). The food consumption data were encoded on standardized forms, and the average daily intakes of energy and nutrients were calculated using the computerized Danish nutrient data bank (Osler & Schroll, 1991; de Groot *et al.* 1996b). At the same visit, body weight and height, and upper arm, hip and waist circumference were measured according to standardized procedures. BMI was calculated by dividing weight (kg) by height (m) squared (Osler & Schroll, 1991). Data from the first two visits were gathered by specially trained registered dietitians. The third visit was used for blood sampling (Osler & Schroll, 1991).

In 1993, the 'non-responders' questionnaire contained questions about hospitalization, or receipt of home help or 'meals on wheels' in the preceding 5 years. The questionnaire did not gather information about change of weight, presence of acute disease or visits to physicians (de Groot *et al.* 1996b).

The vital status of the subjects was followed until 1 July 1995, by using the unique person identification number in the national Central Person Register. The observation time for each subject was the time from the initial examination (1988–9) until 1 July 1995, or until death (n 52).

'Determine Your Nutritional Health' Checklist

Each of the ten items of the NSI Checklist is weighted with a numerical score. The cumulative score can range between 0 and 21. Subjects with a score of ≥ 6 are considered to be at high nutritional risk. A score of 3–5 indicates moderate nutritional risk, whereas a score of 0–2 is classified as 'good'. To answer the NSI Checklist questions by information derived from the SENECA baseline study some assumptions had to be made:

Question 1 ('yes' score = 2): 'I have an illness or condition that made me change the kind and/or amount of food that I eat', was mirrored by SENECA questions on the inclusion or exclusion of foods for health reasons.

Question 2 ('yes' score = 3): 'I eat fewer than two meals per day', could not be answered by SENECA questions, and, therefore, all the subjects were given a 'no' score.

Question 3 ('yes' score = 2): 'I eat few fruits or vegetables or milk products'. The subjects were given score 2 if they used < 150 g fruit and vegetables or < 150 g milk products per day.

Question 4 ('yes' score = 2): 'I have three or more drinks of beer, liquor or wine almost every day'. Similar information could be derived from SENECA's dietary history.

Question 5 ('yes' score = 2): 'I have tooth or mouth problems that make it hard for me to eat' is comparable to the SENECA question which asked subjects if they had problems chewing.

Question 6 ('yes' score = 4): 'I do not always have enough money to buy the food I need'. SENECA participants were given score 4 if they always/often found it difficult to budget their food.

Question 7 ('yes' score = 1): 'I eat alone most of the time', could not be answered by the SENECA questions, and, therefore, all were given a 'no' score.

Question 8 ('yes' score = 1): 'I take three or more different prescribed or over-the-counter drugs a day'. SENECA collected detailed information on the frequency and type of drugs used.

Question 9 ('yes' score = 2): 'Without wanting to, I have lost or gained 10 pounds in the last 6 months', could not be answered from the SENECA questions, and, therefore, all the subjects were given a 'no' score.

Question 10 ('yes' score = 2): 'I am not always physically able to shop, cook and/or feed myself'. Negative replies to SENECA questions: 'are you able to carry a heavy thing, e.g. a shopping bag of 5 kg for a hundred metres', 'are you able to cook a meal on your own', or 'are you able to feed yourself' resulted in score 2.

Mini Nutritional Assessment

The MNA includes eighteen items and assigns points on nutritional adequacy. The maximum score is 30 points with cut-off values at 24 points (≥ 24 : well nourished) and at 17 points (17–23·5: at risk of undernutrition, < 17 : undernourished). Seven of the questions in the MNA could be answered directly from the information obtained in the SENECA study (de Groot & van Staveren, 1988). This was the case for items 1 (BMI), 2 (mid-arm circumference), 5 (living independently), 6 (number of medications used), 8 (mobility), 16 (ability to eat without assistance) and 18 (self-perceived health).

The results from the dietary history were used to score items 12 (consumption of milk products, eggs, meat and fish), 13 (consumption of fruit and vegetables) and 15 (fluid intake). Average daily intakes of > 25 g cheese, > 150 g milk or milk products, > 15 g egg, > 80 g meat and > 100 g fish (item 12), and daily intakes of > 200 g fruit or > 100 g vegetables or a total intake of fruits and vegetables of more than 150 g (item 13) were considered to be sufficient, and resulted in the maximum number of points (= 1). The content of a glass was set to be 150 ml (item 15).

Item 7 (suffering from psychological stress or acute disease) was answered from information about the subject's own view of their present health. Item 14 (decline of food intake over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties) was answered by combining questions regarding chewing and digestive problems. All subjects obtained the maximum number of points (= 2) for item 9 (neuropsychological problems), since that was one of the exclusion criteria in the SENECA baseline study (de Groot & van Staveren, 1988).

Five of the questions could not be answered by the SENECA survey. This was the case for items 3 (calf circumference), 10 (pressure sores or skin ulcers) and 11 (number of full meals daily) where subjects were given the maximum number of points (= 1), and the items 4 (weight

loss during the last 3 months) and 17 (nutritional problem), where 1 point was given corresponding to the answer 'does not know'.

Statistical analyses

With the use of the Statistical Analysis Systems statistical software package, version 6.11 (SAS Institute, Inc., Cary, NC, USA), cumulative scores were calculated for both checklists, by means of the data from the SENECA baseline survey of 1988. Based on the pre-set cut-off values subjects were classified in nutritional risk categories according to either score. Information about height, weight and age was used to assess the individual BMR and the minimum level of dietary energy intake (Sandström *et al.* 1996). The weight data were used to calculate each subject's protein requirement (World Health Organization, 1985). The capacity of the NSI Checklist and the MNA to predict nutrition-related health problems was assessed by comparing the different risk categories with regard to degree of weight loss, need of help and morbidity experienced in the 5-year period between the baseline survey and follow-up study and with regard to mortality from baseline to 1 July 1995.

Chi squared (χ^2) tests with Yates correction were used for the statistical analysis. Two-sided *P* values < 0.05 were considered significant.

The mortality data were analysed using Cox's proportional hazards regression. For the MNA and the NSI Checklist respectively, a Cox model was developed that controlled for age at enrolment (in years), sex (0 = males, 1 = females), and smoking status (0 = current smoker, 1 = ex-smoker, 2 = non-smoker) and evaluated the cumulative scores as predictors of the hazard of death.

Results

'Determine Your Nutritional Health' Checklist

All the subjects from the Danish part of the SENECA study (*n* 202) could be scored by means of the NSI Checklist. The scoring showed that thirty-nine (19%) of the subjects were classified at high nutritional risk, 103 (51%) were considered at moderate nutritional risk, and sixty (30%) were within the 'good' range in 1988.

When separating the subjects into a moderate/low-nutritional-risk group (0–5 points) and a high-nutritional-risk group (≥ 6 points), and comparing the presence of different conditions known to influence the nutritional status of elderly people, the only significant differences between the groups were the frequency of subjects who rested more than 1 h during the day ($P < 0.001$), and suffered from a chronic disease ($P < 0.05$) (Table 1).

The number of deaths was not significantly higher in the high-nutritional-risk group than in the moderate/low-nutritional-risk group, and the NSI Checklist score was not a significant predictor of mortality in the Cox model (rate ratio estimate: 1.45; 95% CI 0.78, 2.71).

Sixteen of the 115 subjects, who participated in the follow-up study in 1993, were estimated to be at high nutritional risk in 1988. In the 6 months preceding the follow-up study, a significantly larger part of this high-risk

Table 1. Characteristics of the Danish participants in the 'Survey in Europe of Nutrition in the Elderly, a Concerted Action' (SENECA) study of 1988 (Subjects are classified in nutritional risk categories by means of the 'Determine Your Nutritional Health' (NSI) Checklist (score ≥ 6 : high nutritional risk, score 0–5: 'good'/moderate nutritional risk) and the 'Mini Nutritional Assessment' (MNA) (17–23.5 points: at risk of undernutrition, ≥ 24 points: well-nourished))

	NSI Checklist			MNA		
	Score ≥ 6 (n 39)	Score 0–5 (n 163)	P	17–23.5 points (n 37)	≥ 24 points (n 134)	P
Energy intake $< 1.4 \times \text{BMR}$ (%) [*]	27	39	NS	41	38	NS
Protein intake $< \text{RDA}$ (%) [†]	25	27	NS	27	30	NS
Chronic disease (%)	87	68	< 0.05	84	67	NS
Visits (%) [‡]	15	13	NS	16	12	NS
Living alone (%)	36	42	NS	32	40	NS
Rest/sleep > 1 h during the day (%)	46	11	< 0.001	43	11	< 0.001
Special diet (%) [§]	–	–	–	19	14	NS
No close friends (%)	39	29	NS	41	25	NS
Dead (%)	36	23	NS	49	17	< 0.01

RDA, recommended dietary allowance.

^{*} The factor 1.4 represents the lowest plausible physical activity level (Sandström *et al.* 1996).

[†] 0.8 g/kg body weight (World Health Organization, 1985).

[‡] Never/less than once monthly.

[§] Special diet was one of the questions (= 1) in the NSI Checklist, hence it was not relevant to compare the prevalence in the two groups.

group than the moderate/low-nutritional-risk group, had suffered from acute disease ($P < 0.001$). However, no significant differences were found between the two groups in the participation rates, hospitalization rates, physician (i.e. general practitioner and specialist) visits, need of help, and weight loss (Table 2).

Inclusion of subjects who answered the non-responders' questionnaire increased the number in the high-risk group to twenty-five in the follow-up study. Among these twenty-five subjects the need for help (e.g. home care and 'meals on wheels') was significantly higher (41.7 v. 25.8%, $\chi^2 = 4.13$, $P < 0.05$) than in the moderate/low-nutritional-risk group. Still, the hospitalization rates did not differ between groups (27.3 v. 26.6%, $\chi^2 = 0.04$; results not shown).

'Mini Nutritional Assessment'

Thirty-one of the 202 Danish participants had data missing regarding height, weight and mid-arm circumference. Therefore, only 171 persons (84.7%) could be scored

according to the criteria in the MNA. The instrument identified thirty-seven (21.6%) subjects at risk of undernutrition and 134 (78.4%) well-nourished subjects. No one was considered undernourished in 1988 according to the MNA.

When comparing the frequency of nutrition-related conditions in, respectively, the well-nourished group (≥ 24 points) and in the group at risk of undernutrition (≤ 23.5 points), the only significant difference was in the proportion of subjects who rested for more than 1 h during the day (Table 1).

The prevalence of mortality was higher in the 'at risk' group ($P < 0.01$). The Cox regression analysis showed that subjects with a high MNA score (≥ 24) had significantly lower mortality (rate ratio: 0.35; 95% CI 0.18, 0.66) compared with subjects with a low score (≤ 23.5). Also, the prevalence of chronic disease tended to be higher in the 'at risk' group ($0.05 < P < 0.1$).

Thirteen of the 115 subjects who participated in the follow-up study in 1993 belonged to the group judged to

Table 2. Characteristics of the Danish participants in the 'Survey in Europe of Nutrition in the Elderly, a Concerted Action' (SENECA) follow-up study of 1993, who in 1988 were classified in different risk categories by means of the 'Determine Your Nutritional Health' (NSI) Checklist (score ≥ 6 : high nutritional risk, score 0–5: 'good'/low nutritional risk) and the 'Mini Nutritional Assessment' (MNA) (17–23.5 points: at risk of undernutrition, ≥ 24 points: well-nourished)

	NSI Checklist			MNA		
	Score ≥ 6 (n 16)	Score 0–5 (n 99)	P	17–23.5 points (n 13)	≥ 24 points (n 102)	P
Participation (%)	64	74	NS	54	81	< 0.01
Acute disease (%) [*]	39	26	< 0.001	42	23	< 0.05
Need of help (%) [†]	33	18	NS	15	6	< 0.05
Hospitalization (%) [‡]	25	26	NS	50	23	NS
Physician visits (%) [§]	69	70	NS	79	68	NS
Weight loss > 5 (%)	21	18	NS	58	12	< 0.001

^{*} In the preceding 6 months had suffered from colds, coughing, respiratory trouble or fever, or had been bound to bed during more than 3 d due to an infectious disease.

[†] In the period 1991–3 received home care for the household for medical reasons, received 'meals on wheels' or received help from social worker.

[‡] During the last 2 years.

[§] Physician; general practitioner or specialist. Visited during the last 2 years.

be at risk of undernutrition in 1988. Compared with the well-nourished group, significantly more in the 'at risk' group had died or did not want to participate in the follow-up study ($P < 0.01$). Significantly more subjects considered at risk of undernutrition in 1988 had up to 1993 received home care, 'meals on wheels', etc. ($P < 0.05$), suffered from acute disease ($P < 0.05$) or experienced weight loss of more than 5% ($P < 0.001$) compared with the well-nourished group (Table 2). No significant differences could be found among the two groups in relation to physician (i.e. general practitioner and specialist) visits or hospitalization rates. However, the latter was close to being significant ($0.05 < P < 0.1$).

Inclusion of subjects who answered the non-responders' questionnaire increased the number of persons belonging to the 'at risk' group to twenty in the 1993 follow-up study. Among these twenty persons the need of help (home care, 'meals on wheels', etc.) was significantly higher (23.0 v. 7.0%, $\chi^2 = 15.8$, $P < 0.001$) than in the well-nourished group. In addition, the 'at risk' group had a higher rate of hospitalization (47.4 v. 22.7%, $\chi^2 = 3.88$, $P < 0.05$; results not shown).

'Determine Your Nutritional Health' Checklist and 'Mini Nutritional Assessment'

Only a very small proportion (about 7%) of the subjects had had a bone fracture, a stroke or a myocardial infarction between 1988 and 1993. Likewise, only a few (about 4%) suffered from malignancy. Hence, it was not possible to determine whether the frequency of these events was different in the 'at risk' and well-nourished groups.

Discussion

In this study using data from the SENECA baseline and follow-up studies we found that modified versions of the NSI Checklist and the MNA could identify 70–75-year-old Danes at risk of certain nutrition-related health problems. Further, the analysis showed that the MNA could predict mortality in a Danish population.

By examining the cohort in 1993 we found significantly more instances of acute disease in the two 'at risk' groups. Protein–energy undernutrition in older persons will result in immune dysfunction and an increased risk of infections (Morley, 1995). Another consequence of undernutrition is an increased risk of hospitalization (Mowé *et al.* 1994). Correspondingly, follow-up data showed an increase in the hospitalization rate among the twenty subjects judged to be at nutritional risk in 1988 by means of the MNA. A similar increase could not be found in the 'at risk' group identified in 1988 by means of the NSI Checklist.

There was a lower participation rate in the 1993 study among the Danes judged to be at nutritional risk in 1988 by means of both the NSI Checklist and the MNA. However, only with the MNA was the difference significant. An obvious explanation was the lower mortality found among the subjects with a high MNA score (≥ 24).

Reduced physical activity is a consequence of undernutrition (World Health Organization, 1985). As an indicator for reduced activity we used the information obtained in

the SENECA baseline study regarding how many hours the subjects rested and/or slept during the day. This study found that the groups with increased nutritional risk by both the NSI Checklist and the MNA had a significantly higher ($P < 0.001$) prevalence of subjects who rested for more than 1 h during the day.

Most of the questions or items in the NSI Checklist and the MNA could be answered by the information obtained in the SENECA baseline survey. However, this was not possible for three of the questions in the NSI Checklist and five of the items in the MNA. With regard to two of the items in the MNA (weight loss during the last 3 months and nutritional problem perceived by the subject) we used the answer 'do not know' to calculate scores. For the other three MNA items (calf circumference, pressure sores or skin ulcers, and number of complete meals daily) the subjects were scored the maximum number of points. Thus, it was assumed that all the subjects ate more than two meals per day, an assumption that was based on the result of the follow-up study, which showed that only one of the Danish subjects had less than four meals per day (Schlettwein-Gsell & Barclay, 1996). Since the prevalence of pressure sores in Denmark is very low, 43 per 100 000 (Sørensen *et al.* 1997), it was also assumed that none of the participants suffered from these.

With regard to question 2 in the NSI Checklist ('I eat fewer than two meals per day'), all the subjects were given a 'no' score, based on the assumption mentioned earlier. In contrast to the MNA, the NSI Checklist does not give the option to answer 'do not know'. Instead we chose to give all the subjects a 'no' score to question 9 ('10 pounds lost or gained in the last 6 months'). However, from the follow-up study it is known that 17% of the men and 16% of the women had lost more than 5 kg in the period between the two studies (de Groot *et al.* 1996a). We also decided to make the assumption that no one was eating alone, in spite of the fact that 27% of the males and 53% of the females who participated in the baseline study were living alone (Schlettwein-Gsell *et al.* 1991), because a longitudinal study has shown that 30% of the Danish women living alone had their evening meal outside the home at least three times weekly (Schlettwein-Gsell & Barclay, 1996).

The assumptions may have caused misclassification of some of the participants. However, our results obtained by the MNA agree with those reported by others (Guigoz *et al.* 1994) who found that the MNA categorized < 1% of a group of healthy, community-dwelling elderly people as undernourished, whereas 18% were classified as borderline nourished, and 80% were classified as well-nourished.

This and other studies have shown a high prevalence of elderly people being at risk for poor nutritional status based on the NSI Checklist (range: 48–98%) (Posner *et al.* 1993; Coulston *et al.* 1996; Miller *et al.* 1996; Sahyoun *et al.* 1997). Unfortunately, comparison between studies is not possible, first because different population groups were included, e.g. recipients of 'meals on wheels' programmes (Coulston *et al.* 1996), and inner-city-dwelling black Americans (Miller *et al.* 1996). Second, it is not certain whether the NSI Checklist scoring system applies to European populations. The NSI Checklist items and their scores have been adapted based on a checklist analysis with a

representative sample of non-institutionalized persons aged 70 years and older in New England, USA (Posner *et al.* 1993). In this, the culturally defined meaning of several questions may well have influenced the final item content and scores of the NSI Checklist. This might also explain the poorer performance of the NSI Checklist in predicting mortality in a European population, compared with the MNA.

Another reason for the apparent superiority of the MNA could be that the SENECA data did not match the NSI Checklist questions to the same degree as they did the MNA questions. However, our results are supported by the findings of an earlier validation study, which, although the authors used different grouping of the individuals, found that the cumulative score of the NSI Checklist was only a weak predictor of mortality in a healthy American population (Sahyoun *et al.* 1997).

The participants in the SENECA study had an average weight loss of about 0.5 % per year in the period between the two studies (de Groot *et al.* 1996a). These findings are supported by others (World Health Organization, 1995). The degrees and rates of weight loss that should prompt concern and investigation, and the significance and extent of the weight-loss problem in community-dwelling elderly populations remain poorly characterized. Recently, a review has suggested that a weight loss of more than 1 % per year is abnormal (Beck & Ovesen, 1998) and made us choose the cut-off value of 5 %. The results showed that a significantly higher percentage of the group at risk of undernutrition by the MNA, had lost 5 % or more in weight. However, there was no difference in the number of persons in the two NSI Checklist groups, who in 1993 had lost > 5 % of their weight in 1988.

In conclusion, although our results are based on a small group of subjects, they indicate that modified versions of the MNA and the NSI Checklist are capable of identifying a group of 70–75-year-old Danes, who in the long term have an increased risk of developing nutrition-related health problems. Besides this, an MNA score ≤ 23.5 predicts increased mortality in a Danish population.

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