Original Research

Gender Differences in Factors Associated with Nutritional Status of Older Medical Patients

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Key words: under-nutrition, older people, nutritional status, MNA

Objectives: To evaluate gender differences in nutritional risk of older people admitted to an acute-care general medical department, and identify gender-specific risk factors.

Design: Cross-sectional study. Setting: Internal Medicine Department in an acute care, university-affiliated hospital in southern Israel.

Subjects: 204 cognitively intact patients aged 65 and over, admitted during a 12-month period to a general medical department. Measures of outcome: Evaluation included demographic and clinical data consisting of the sum of medical conditions and of prescribed medications, evaluation of nutritional status, cognitive status, depression assessment and functional ability. Statistical analyses were conducted to evaluate the gender specific risk factors for under-nutrition.

Results: 32.5% of the men and 48.1% of the women admitted to an internal medicine department were at risk for under-nutrition. Those at nutritional risk had a higher rate of depression, lower cognitive and physical ability, poorer reported health status and more diagnosed diseases. Nutritional risk for men was associated with higher depression score, longer hospitalization, and poor appetite. For women, nutritional risk was associated with lower functional status and more diagnosed diseases. In a multivariate analysis, being a female increased the risk of under-nutrition by 3.3 fold.

Conclusion: Risk of under-nutrition is prevalent among older in-patients and is gender-related. Female inpatients are at markedly increased risk for under-nutrition. The mechanism of the gender discrepancy in factors related to nutritional deterioration is complex and poorly understood.

INTRODUCTION

Inadequate nutrition in older adults is a major, often unrecognized, problem. The reported prevalence rates of compromised nutritional status in the elderly vary widely, depending on the examined population and the diagnostic criteria used [1,2], with a high rate of under-detection of impaired nutritional status [1]. This has been reported in 1% to 15% of community-dwelling, ambulatory elderly [1,3,4], in 20%–60% of hospitalized older persons [3–6], and in 25%–65% of institutionalized elderly patients [4,7]. The risk of malnutrition is higher than the prevalence of actual malnourishment reported [7,8]. Under-nutrition adversely affects both lifespan and quality of life in community-dwelling older people [9–12], and is a critical determinant of outcomes among aging in-patients: it influences the outcome of the hospitalization [12,13] and correlates with morbidity [14–16] and mortality [17–19] in this population. In Israel, nutritional assessment of institutionalized [20,21] and home-dwelling [22,23] elderly has been performed, but data about the nutritional status of older acute-care patients are sparse [24]. Studies conducted in the Negev, the southern part of Israel, were limited to elderly living in the community [23] and focused on the eating habits of this population [23,24] without particular attention to gender-specific differences. The present study evaluated the prevalence of nutritional risk in older people recently admitted to an acute-care general medicine department, and evaluated gender differences in factors associated with nutritional risk in this population. The associations between nutritional status and health, chronic use of medications and parameters of mental (mood and cognitive) and physical functioning were ascertained.

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METHODS

204 patients aged 65 and over, admitted to an internal medicine department at the Soroka University Medical Center, a 1000-bed university-affiliated acute-care hospital in the south of Israel, during a 12-month period (July 2000–June 2001) were recruited. In order to create a representative sample of elderly patients, the first 15 elderly patients, admitted each month, who were willing to participate were recruited. Inclusion criteria were age (65 or older) and sufficient cognitive ability to take part in the study. Exclusion criteria included neoplastic disease, inability to be interviewed or unwillingness to give informed consent. The criteria for inclusion were stringent as future nutritional intervention that required communication and cognitive skills was planned.

A multidimensional evaluation was performed using a standard protocol including a structured interview, data from the medical record and relevant physical examination findings. The interview was performed within 48 hours of admission by a single, trained interviewer and included demographic information, cognitive, affective and functional evaluation, and assessment of somatic health and of the nutritional status.

Demographic variables, including sex, age, marital status, country of origin, years since immigrating to Israel, when relevant, education, and living arrangements, were obtained from the hospital admission form and from the patient, and confirmed through an interview with caregivers.

Clinical data were obtained from the medical history gathered directly from the patients and family members and from careful review of the patients' charts. A modified list of the most frequent medical conditions among hospitalized elderly patients [25] was used to determine co-morbidity. Prescribed medications were recorded from the charts. In addition, we used a self-assessed health evaluation as a measure of health, using a scale of 1 to 5 [25]. These scores were dichotomized with values 1 and 2 recorded as "poor" and values of 3–5 considered "good" health status. Due to the lack of "gold standard" measurement for nutritional risk among the elderly [26] we used 3 recommended tools:

1. Total lymphocyte count (TLC), fasting serum albumin, transferrin and total cholesterol values were determined during the first 24 hours after admission as part of the routine medical assessment, and values <1800, <3.5 g/dl, <200 mg/dl and <165 mg/dl respectively, used as indicators of nutritional risk [27,28]. If one indicator was below the level of nutritional risk the patient was scored as "at nutritional risk."

2. Mini Nutritional Assessment (MNA) [26], a simple, validated screening tool for nutritional risk in elderly persons, which distinguishes between adequate nutritional status (MNA >24), protein-calorie malnutrition (MNA <17) and patients at nutritional risk (MNA between 17 and 23.5). We also used the 2 parts of the questionnaire separately: The screening part includes 6 questions to valuate changes in appetite, changes in weight and mobility, BMI, psychological stress and neuropsychological problems. For this part a score ≥ 12 is considered normal and a score <11 is an indicator for possible risk. The assessment part includes 12 additional questions with maximum score of 16.

3. Nutrition Risk Index (NRI) includes a list of nutritional and health problems that may put the subject at nutritional risk. These include 16 questions regarding swallowing and chewing, constipation etc. Participants responding positively to more than four questions were considered at nutritional risk [30]. Cognitive status was assessed using the Folstein Mini Mental State Examination (MMSE) [31]. Patients with a total score of 23 and below were excluded from the study because of their limited ability to understand, cooperate and communicate verbally during the interview. Depressive symptoms were assessed using the GDS (Geriatric Depression Screening Scale) [32].

Functional status was assessed using the modified Barthel Index [33], based on basic activities of daily living (ADL).

The protocol was approved by the hospital Helsinki committee. Informed, signed consent was obtained from all participants.

Statistical analyses were conducted using SPSS for Windows version 11. Baseline characteristics were recorded and a comparison between males and females was conducted using t-tests for continuous variables. The prevalence of different indicators for under-nutrition was compared between males and females using χ^2. Comparison between characteristics of under-nourished and well-nourished patients was conducted using ANOVA with age as a covariate in the analyses. Multivariate analysis was conducted using a logistic regression model in which nutritional risk was used as the dependent variable. Variables in the model included depression score of over 5 (median), a cognitive function score >27 (median), physical functioning score <96 (median), gender (0 = male, 1 = females), age and number of diagnosed diseases. Appetite was categorized as "good" or "poor," and was included in the model. Two sided p-values are presented in all cases.

RESULTS

A total of 204 patients, 123 men age 73.3 years on average and 81 women age 74.5 years on average participated in the study. Baseline characteristics of the study population by gender are shown in Table 1. Men had a significantly higher level of education, their BMI was lower, and a higher percent of them were married as compared with the women. There was no difference by gender in the mean years since immigration to Israel, number of diagnosed diseases, number of prescribed medications and duration of hospitalization. Examination of functional variables revealed statistically significant differences between genders. Women suffered from more functional disability, having a lower mobility status than men. When compared to men, women had a higher score for depression, a

Table 1. Characteristics of the Study Population by Gender

Variable (Mean ± SD) or %	Men n = 123 (60.3%)	Women n = 81 (39.7%)	Total n = 204
Age	73.3 ± 5.4	74.5 ± 5.8	73.8 ± 5.6
Education*	11.2 ± 4.9	9.7 ± 5.2	10.5 ± 5.1
Country of Origin			
Israel	3 (2.4%)	0	3 (1.5%)
Africa/Asia	29 (23.6%)	15 (18.5%)	44 (21.6%)
Europe/America	91 (74%)	66 (81.5%)	157 (77%)
Years since immigration	26.0 ± 22.3	27.0 ± 24.0	26.4 ± 23.2
BMI (Mean ± SD)*	27.3 ± 4.0	30.7 ± 7.0	28.7 ± 5.6
Living alone (%)	19 (15.4%)	23 (28.4%)	2 (20.6%)
Family status (%)*			
Married	95 (77.2%)	38 (49%)	133 (65.1%)
Widowed	24 (19.6%)	35 (42.2%)	59 (28.9%)
Other	4 (3.2%)	10 (12%)	14 (6.8%)
Poor subjective health status*	52 (25.5%)	54 (26.5%)	106 (52%)
Number of diagnosed diseases	4.2 ± 1.8	4.0 ± 1.8	4.2 ± 1.8
Number of medications	5.1 ± 2.6	5.2 ± 2.5	5.2 ± 2.6
Length of stay	8.4 ± 4.1	8.6 ± 4.6	8.3 ± 4.6
Functional status: Total Barthel Index*	98.1 ± 5.2	93.6 ± 14	96.1 ± 9.9
Mobility*	42.1 ± 9.5	36.2 ± 13.8	39.8 ± 11.7
Continence	23.5 ± 3.3	23.1 ± 3.6	23.3 ± 3.4
Depression (GDS)*	5.7 ± 6.1	8.5 ± 6.6	6.8 ± 6.4
Cognitive function (MMSE)*	27.6 ± 3.4	26.5 ± 4.2	27.6 ± 3.0

* $p < 0.05$.

lower score on cognitive function evaluation, and worse subjective health status.

The most prevalent medical conditions upon admission included heart disease (70%), cardiac arrhythmia (29%), acute disease of the gastrointestinal system (19%) and acute pulmonary disease (17%). The prevalence of hypertension, dyslipidemia and diabetes mellitus was 63%, 38% and 34% respectively. Fig. 1 depicts the most prevalent medical conditions by gender. Men had a higher prevalence of heart disease while women had significantly higher prevalence of hypertension. As shown in Table 2, 38.7% of the study population were at nutritional risk, with MNA score <23.5. Only 2 patients scored <17 in the MNA, we thus used the single criteria of MNA <23.5 to determine nutritional risk. The prevalence of under-nutrition risk, based on the MNA, was higher for women as compared with men (48.1% vs. 32.5% respectively). The main difference stems from a difference in the assessment part of the MNA. When using the NRI, the prevalence of nutritional risk was 50.6% among women and 36.6% among men. Women also had a tendency for higher prevalence of hypoalbuminemia, although it did not reach statistical significance. The prevalence

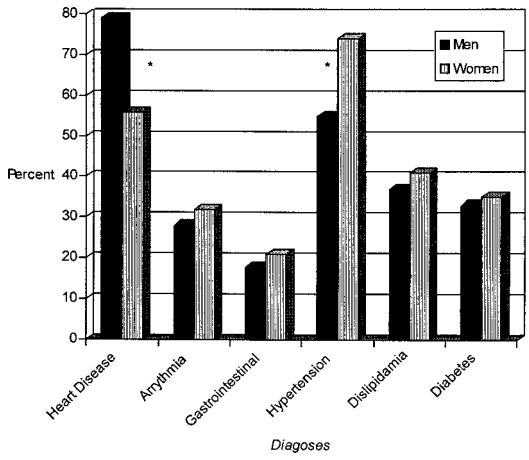

Fig. 1. The prevalence of the main diagnoses [25] by gender.

Table 2. The Prevalence of Under-nutrition According to the MNA, NRI and Laboratory Indices by Gender

Variable	Men n = 123	Women n = 81	Total n = 204
"At risk" by MNA** (MNA 17–24)	40 (32.5%)	39 (48.1%)	79 (38.7%)
Screening score (Mean ± SD) (p = 0.57)	12.2 ± 1.8	11.7 ± 1.9	12.0 ± 1.9
Assessment score (Mean ± SD)**	12.7 ± 1.5	12.0 ± 1.3	12.4 ± 1.4
NRI (At nutritional risk >4 positive answers)*	45 (36.6%)	41 (50.6%)	86 (42.2%)
BMI (Mean ± SD)*	27.3 ± 4.0	30.8 ± 7.1	28.7 ± 5.7
Albumin <3.5 g/dl	33 (26.8%)	27 (33.3%)	60 (29.4%)
TLC <1800	51 (41.5%)	33 (40.7%)	84 (41.2%)
Cholesterol <165 mg/dl*	30 (24.4%)	8 (9.9%)	38 (18.6%)
At least one indicator*	46 (37.4%)	46 (56.8%)	92 (45%)

* $p < 0.05$.
** $p < 0.001$.

of serum cholesterol levels lower than 165 mg/dl was significantly higher among men. When any single abnormal clinical measurement was used as an indicator for nutritional risk, the prevalence was significantly higher for women (56.8% for women, as compared with 37.4% for men).

We also analyzed our data to look for differences in nutritional status by country of birth and gender; no difference in nutritional status was detected. As summarized in Table 3, factors for nutritional risk differed by gender. Nutritional risk for men was associated with higher GDS depression score, length of hospitalization, and poor appetite. For women, nutritional risk was associated with lower functional status and more diagnosed diseases.

When the independent effect of individual health status variables on nutritional risk was evaluated in a multivariate model (Table 4), being a female increased the risk of under-nutrition by 3.3 fold. Age <75, good reported appetite and functional status with score >96 were protective (OR + 0.37, OR = 0.3 and OR = 0.26 respectively).

Table 3. Gender Differences in Factors Associated with Nutritional Risk as Measured by at Least 1 Impaired Clinical Measurement, Adjusted for Age

Variable	Normal status	Nutritional risk	*p* value
Functional status (Total Barthel Index)			
Males	98.7 ± 4.0	97.3 ± 6.5	0.14
Females	97.0 ± 7.8	90.9 ± 17.0	0.025
Depression (GDS)			
Males	5.0 ± 6.0	6.4 ± 6.2	0.04
Females	8.0 ± 7.4	8.8 ± 5.9	0.60
Cognitive function (MMSE)			
Males	27.8 ± 3.4	27.2 ± 3.4	0.38
Females	27.1 ± 3.8	26.1 ± 4.6	0.46
No. of medications			
Males	5.2 ± 2.5	5.0 ± 2.7	0.65
Females	5.1 ± 2.6	5.3 ± 2.5	0.80
No. of diagnosed diseases			
Males	4.2 ± 1.9	4.3 ± 1.8	0.8
Females	3.5 ± 2.0	4.7 ± 1.5	0.003
Days of hospitalization			
Males	8.0 ± 9.0	12.8 ± 9.0	0.04
Females	12.0 ± 10.5	9.5 ± 9.4	0.60
Poor appetite (%)			
Males	11.7	29.4	0.01
Females	28.6	45.6	0.06

Table 4. A Logistic Regression Model to Predict Nutritional Risk with Health Status Variables as the Independent Variables in the Model

Variable	OR	*p* value	95% CI
Depression score (GDS) >5	1.1	0.90	0.35–3.3
Cognitive function score (MMSE) >27	1.0	0.93	0.3–2.8
Functional status (Barthel index) <96	0.26	0.027	0.08–0.85
Sex (Being a female)	3.3	0.028	1.2–9.4
Age <75	0.37	0.049	0.13–0.99
Good appetite	0.3	0.048	0.1–0.99
Over 4 diagnosed diseases	1.1	0.85	0.4–3.5

DISCUSSION

In our study 38.7% of older patients were at nutritional risk on admission to a medical ward, as measured by an MNA score of 17–23.5. The risk of under-nutrition was more prevalent among women (48.1%) than men (32.5%). Being a woman increased the risk of under-nutrition by more then 3 fold. These findings are in contrast with previous publications reporting similar prevalence rates in elderly men and women [34,35] or higher rates in men [36].

Israel is a multiethnic country with ongoing waves of immigration from various countries. When studying adult under-nutrition in developing countries [37], it has been shown that, although under-nutrition rates are generally similar in men and women, gender differences do exist sometimes in specific ethnic communities. In our group we did not show any difference in nutritional status by country of birth. This lack of difference may be explained in part by the relatively homogenous characteristic of our group in which over 70% of men and over 80% of women were from European origin.

Gender may also be related to differences in food choices and in energy and nutrient intake [38]. In addition, higher rates of depression and widowhood, and lower subjective health status, which are all known risk factors for nutritional deterioration [39], were found in the women studied.

Depression is the most common cause of unintentional weight loss and under-nutrition in older adults [1,40] and indeed among our males group, higher depression scores were shown in the "at nutritional risk" group. Among our female participants higher depression rates were shown in both nutritional status groups with no difference between them. These high rates may be partly explained by data concerning social resources. Over 42% of the women were widowed and over 28% were living alone, as compared with 19.6% and 15.4%, respectively, for men (Table 1). Living alone and social isolation, especially when combined with recent bereavement or poor social support, have been shown in previous studies to be major risk factors for malnutrition [39,41]. A possible explanation for the lack of significant difference in depression score between the nutritional status groups in women is the high background prevalence of under-nutrition among our women. Given such high background prevalence, the relative contribution of depression to under-nutrition may be smaller then in men.

Nutritional risk is related to functional status [42,43]. Gender differences in functional ability have been documented previously, indicating higher prevalence of impaired mobility among older women [44]. Our results indicate lower mobility among patients at nutritional risk. Women had lower functional

status along with a higher prevalence of nutritional risk. When individual components of the Barthel Index were compared, men scored better than women for mobility (Table 1). The lower mobility of women in our study could contribute to the higher rates of nutritional risk seen. An increased tendency to poor physical performance and decreased dietary intake has already been described in older, homebound women [45]. In addition, gender difference in self-reported functional limitation has also been described [46] and although its mechanism is poorly understood, it may interrelate with the nutritional status.

Relation between the physical health, use of medications and nutritional risk have been shown in previous studies [1,47,48]. We found an association between nutritional risk and morbidity as determined by the sum of medical conditions among women only. These findings are in accordance with previous reports showing an increased nutritional risk among women reporting a poor health status [47,48]. It is important to note that after further adjustment for different functional status measurements no relations were shown between nutritional and health status. Nutritional risk in our study was more prevalent among women, in spite of higher prevalence of hypocholesterolemia, an indicator for nutritional risk [49,50], among men. The complex inter-relationship between cholesterol level, morbidity, mortality and gender, has been extensively studied, showing that many factors apart from the nutritional status, such as the burden of underlying diseases [49], selective survival [51], and physiologic-metabolic and hormonal changes [51] may explain the gender discrepancy seen here.

As indicated in Table 3 the distribution of nutritional risk factors by gender was different. For example, men at nutritional risk exhibited a higher rate of depression, had poorer appetite and longer hospitalization period as compared with females. The gender differences in risk for malnutrition may be explained by social factors [52] and hormonal differences as inferred from animal and human studies [53,54]. It is difficult to interpret the meaning of these findings at this point, and further studies may shed light on these intriguing gender differences in future. Our study suffered from several limitations. The study examined a selected population of elderly patients; the severely ill and cognitively impaired patients were excluded from the study due to the need for verbal communication for the interview. Thus, inferences regarding an unselected population of elderly inpatients cannot be conclusively drawn, but imply an even greater risk in cognitively impaired elders. The sum of concomitant conditions was used in the study as a basic measure of co-morbidity without evaluation of the severity of the individual diseases [55]. Both the number and severity of medical conditions are determinants of health [56]; however evaluation of the severity of disease was beyond the scope of the present study. Further longitudinal studies that include more detailed medical assessment are required.

Due to the cross-sectional design of the study, we could not assess the gender-related under-nutrition risk on differential morbidity, mortality and health-services utilization, therefore we cannot assess the impact of these gender differences on health outcomes and costs. Further, more extensive studies are needed.

CONCLUSIONS

The results of the present study indicate a high prevalence of under-nutrition among elderly medical in-patients in southern Israel. Our findings underscore the multi-factorial origin of this important condition and the effect of gender on the factors associated with nutritional risk. The mechanism underlying the gender discrepancy in factors related to nutritional deterioration is not yet clear. Further research is needed to evaluate the contribution of the different factors. These findings raise the question of whether policies aimed at reducing under-nutrition, including policies aimed at improving health status, should be gender-specific.

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