

PREVALENCE OF MALNUTRITION IN OLDER HOSPITALIZED CANCER PATIENTS: A MULTICENTER AND MULTIREGIONAL STUDY

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Abstract: *Background:* Malnutrition is frequent in older cancer patients, with a prevalence that ranges from 25% to 85%. The aging process is associated with several physiological changes, which may have implications for nutritional status. Screening tools can be useful for identifying malnutrition status among older patients with cancer. *Methods:* A hospital-based multicenter cohort study that included 44 institutions in Brazil. The Mini Nutritional Assessment-Short Form (MNA-SF) was administered to 3061 older hospitalized cancer patients within 48 hours of admission. The Kolmogorov-Smirnov test was used to test the sample distribution, considering sex, age range, calf circumference, body mass index, and MNA-SF score and classification. The categorical data were expressed by frequencies (n) and percentages (%) and compared using the chi-square test or Tukey test. *Results:* According to the results of the MNA-SF, 33.4% of the patients were malnourished, 39.3% were at risk of malnutrition, and 27.3% were classified as having normal nutritional status. Length of hospital stay (in days) was found to be longer for those patients with a poorer nutritional status (malnourished: 7.07±7.58; at risk of malnutrition: 5.45±10.73; normal status: 3.9±5.84; p <0.001). *Conclusions:* The prevalence of malnutrition and nutritional risk is high in older hospitalized cancer patients in all the regions of Brazil and a worse nutritional status is associated with a longer hospital stay. Using a low-cost, effective nutritional screening tool for older cancer patients will enable specialized nutritional interventions and avoid inequities in the quality of cancer care worldwide.

Key words: Geriatrics, malnutrition, cancer, MNA-SF, nutritional screening.

Background

Malnutrition is frequent in elderly cancer patients, with a prevalence that ranges from 25% to 85% (1-7), based on nutritional assessments. Indeed, malnutrition can be considered an independent factor associated with negative clinical outcomes (8). The prevalence of malnutrition amongst cancer patients is higher than it is amongst patients of other chronic diseases. Indeed, almost 20% of cancer patients die because of malnutrition and its complications, rather than the malignancy of the disease itself (6).

The aging process is associated with several physiological changes, which may have implications for nutritional status (9, 10). Screening tools can be useful for identifying malnutrition status among older patients with cancer. The American Society of Parenteral and Enteral Nutrition (ASPEN) (11) and the European Society for Clinical Nutrition and Metabolism (ESPEN) (12) are in agreement that elderly cancer patients should undergo nutritional screening, but there is still no consensus among experts on how best to track the nutritional status of such patients. The Mini Nutritional Assessment (MNA) has been widely used in clinical practice with elderly patients and is recommended by ESPEN (12), the International Association of Geriatrics and Gerontology, and the International Academy of Nutrition and Aging (13).

The multicenter Brazilian Malnutrition Survey (14) was

conducted in 2001, but it was not specific for older cancer patients. It was designed to evaluate the prevalence of malnutrition in hospitalized patients with different diseases and found that 48.1% of the patients were malnourished. A recent multicenter study, the Brazilian Survey of Oncology Nutrition (8), investigated the prevalence of malnutrition in hospitalized cancer patients, finding a 45.3% prevalence of moderate-to-severe malnutrition. However, the prevalence of malnutrition in older cancer patients has not yet been examined in a multicenter study. In view of the above, a Brazilian governmental health institution, Instituto Nacional de Cancer (National Cancer Institute, INCA), carried out a large multicenter study with the objective of evaluating the prevalence of malnutrition and its association with clinical and nutritional variables in older hospitalized cancer patients in Brazil, using the Mini Nutritional Assessment -Short Form (MNA-SF).

Methods

Study design

The Brazilian Survey of the Nutrition of Older Oncology Patients (15) was a prospective multicenter cohort study that included patients of both sexes aged 65 or older who had malignant tumors and were admitted to 44 different public hospitals in Brazil between September and October 2014.

Table 1
 Results of the categorical variables from the MNA-SF

Variable	Category	N	%
Food intake	Severe decrease	636	20.8
	Moderate decrease	975	31.9
	No decrease	1450	47.4
Weight loss	Greater than 3kg	1058	34.6
	Between 1 and 3 kg	531	17.3
	Not known	310	10.1
	No weight loss	1162	38
Mobility	Bed or chair bound	340	11.1
	Able to get out of bed / chair	738	24.1
	Goes out	1983	64.8
Psychological stress	Yes	2321	75.8
	No	740	24.2
Neuropsychological problems	Severe dementia or depression	104	3.4
	Mild dementia	191	6.2
	No psychological problems	2766	90.4
BMI	< 19 kg/m ²	558	18.2
	≥ 19 < 21 kg/m ²	287	9.4
	≥ 21 < 23 kg/m ²	388	12.7
	≥ 23 kg/m ²	1828	59.7
CC	< 31cm	267	8.7
	≥ 31 cm	2794	91.3
MNA-SF	Malnourished	1023	33.4
	At risk of malnutrition	1203	39.3
	Normal status	835	27.3

Patients

The study population consisted of hospitalized cancer patients aged 65 or more. The patients were enrolled within 48h of admission after signing an informed consent form. Patients admitted to intensive care units, in coma, with a mental handicap, or unable to answer the MNA-SF questionnaire were not included in the study.

The project complied with ethical principles and was approved by the Research Ethics Committee of INCA under registration no. 956.512/2015.

Data collection

Nutritionists collected demographic and clinical data from each patient, including their gender, age, weight, height, comorbidities, use of tobacco or alcohol, location of tumor, reason for hospitalization (surgical or clinical), and length of stay (days).

Evaluation of nutritional status

The nutritional assessment was performed using the MNA-SF questionnaire, as validated for use in the Brazilian Portuguese setting (16). The questionnaire was administered within the first 48 h of hospitalization by experienced clinical nutritionists.

To guarantee the quality of the data, the study methodology included the theoretical and practical training of all the clinical nutritionists involved in the study at the 44 participating hospital units. This included training in how to administer the MNA-SF and how to complete a form on an online platform developed specifically for the collection of the study data.

The MNA-SF is designed especially for older people. It contains six questions from the full MNA regarding changes in appetite, weight loss in the last three months, mobility, psychological stress, neuropsychological problems, and additional anthropometric measurements: body mass index (BMI) or calf circumference (CC). Psychological status was determined from medical records (medical diagnosis of

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dementia, depression, and/or Alzheimer's). CC was evaluated with the person seated or lying down with their knee and ankle at a right angle, with the tape placed in a horizontal position at the maximum circumference of the calf (17).

Each question was rated from 0 to 2 or 3, giving a maximum score of 14. MNA-SF has a three-category scoring classification: 14–12 signifying normal nutritional status, 11–8 meaning at risk of malnutrition, and 7–0 identifying malnourishment (18).

Statistical analysis

The Kolmogorov-Smirnov test was used to test sample distribution. Descriptive data analysis was performed using measures of central tendency and dispersion.

The categorical data were expressed as frequencies (n) and percentages (%) and compared using the chi-square test. The numerical data were expressed by the mean \pm standard deviation and compared using one-way ANOVA. Pairwise comparisons of categorical data were done using the chi-square test with a confidence level of 1.7% (descriptive level adjusted for multiple comparisons) and pairwise comparisons of the numerical data were done using the Tukey test, with a confidence level of 5%.

Results

We assessed 3061 cancer patients aged 65 and over who were evaluated prospectively in 44 hospitals in Brazil between September and October 2014; 1722 (56.3%) were male, the mean age was 73.4 (± 6.6 years), and 33.6% of the patients were over 75 years of age. In the total sample, the mean MNA-SF score was 8.9 and the mean BMI was 24.4 (± 4.8 kg). As for the distribution of the MNA-SF score among the patients, 33.4% of the sample had scores of 0–7 points, 39.3% had scores of 8–11 points, and 27.3% had scores of 12–14 points.

According to the MNA-SF classification, 33.4% of the patients in this study were malnourished, 39.3% were at nutritional risk, and 27.3% were classified as being of normal nutritional status. Again, according to the results of the MNA-SF, 20.8% of the patients reported a severe decrease in food intake, 34.6% had weight loss of greater than 3 kg, 11.1% were bed or chair bound, 75.8% were under psychological stress, 3.4% had severe dementia or depression, 18.2% had a BMI of <19 kg/m², and 33.4% had a CC of <31 cm (Table 1).

In the present study, a significantly longer length of stay in hospital was associated with a worse nutritional status. In addition, significantly lower BMIs and CCs were observed among the malnourished patients as compared with those of normal nutritional status and at risk of malnutrition (Table 2).

Table 3 shows the association between nutritional status and socio-demographic and clinical variables. Significant associations were found between both female gender and older age and the occurrence of malnutrition. Hospitalization in the southern region of the country was found to be more associated

with malnutrition, as was hospitalization due to clinical factors. When the location of the tumor was assessed, the ones with the highest association with malnutrition were head and neck, upper gastrointestinal tract, chest, and hematological.

When the individual items from MNA-SF were evaluated (Table 4), they were all found to be significantly associated with nutritional status. Interestingly, despite the fact that malnutrition impairs mobility, the distribution of patients «able to get out» in the malnourished group was close to that of the «bed or chair bound» patients. In addition, the distribution of the data indicates that psychological stress has limited discriminatory power, since psychological stress was found to be frequent, even in the patients whose nutritional status was normal. Conversely, the frequency of severe neuropsychological problems was low, even among malnourished patients; also conferring this item limited power to discriminate nutritional status.

Table 2

Comparisons between nutritional status, length of hospital stay, BMI, and calf circumference

Variable	Malnourished	At Risk of Malnutrition	Normal Status	p value
Length of hospital stay	7.07 \pm 7.58	5.45 \pm 10.73	3.9 \pm 5.84	<0.001
BMI	20.94 \pm 4.35	24.79 \pm 4.34	27.20 \pm 3.85	<0.001
CC	29.41 \pm 3.79	32.51 \pm 3.74	34.42 \pm 3.39	<0.001

One way ANOVA test, Tukey's post-hoc test (5% confidence interval); BMI: body mass index; CC: calf circumference

Discussion

This is the first large-scale multicenter study in Brazil of the nutritional status of older cancer patients. The prevalence of malnutrition amongst 3061 older cancer patients admitted to 44 hospitals in the five regions of Brazil was assessed using MNA-SF. Attention is drawn to the fact that 72.7% of the patients were found to be malnourished or at nutritional risk. The factors found to be associated with malnutrition were: female sex, older age, hospitalization in the southern region of the country, and the presence of hematological tumors or tumors in the head, neck, upper gastrointestinal tract, and chest. Length of stay increased significantly as nutritional status deteriorated, and there was also a significant reduction of BMI and CC among the malnourished patients, compared to the well-nourished patients and the patients at nutritional risk.

In the present study, most of the patients' BMIs were above the malnutrition range. This finding corroborates previous studies of patients with gastric and colorectal cancer (19). Due to kyphosis, a higher healthy weight BMI is acceptable for older adults, with a lower cutoff of 22 or 24 kg/m² typically used to define underweight. However, the presence of edema in a proportion of patients with cancer, especially older

Table 3
Socio-demographic and clinical variables according to MNA-SF classification

Variable	Category	MNA-SF Classification						p value
		Malnourished		At Risk of malnutrition		Normal status		
		N	%	N	%	N	%	
Gender	Male	565	55.2	634	52.7	523	62.6	< 0.0001
	Female	458	44.8	569	47.3	312	37.4	
Age range	≤ 69 years	319	31.2	433	36.0	325	38.9	< 0.0001
	70 to 74 years	302	29.5	369	30.7	294	35.2	
	≥ 75 years	402	39.3	401	33.3	216	25.9	
Region	Northeast	262	25.6	316	26.3	243	29.1	< 0.0001
	Midwest	175	17.1	230	19.1	182	21.8	
	North	2	0.20	3	0.25	2	0.24	
	South	202	19.7	168	14	74	8.9	
	Southeast	382	37.3	486	40.4	334	40	
Location of Tumor	Head and Neck	12022	11.7	94	7.8	75	9	< 0.0001
	UGIT ^a	4	21.9	121	10.1	41	4.9	
	LGIT ^b	117	11.4	192	16.0	106	12.7	
	Chest	88	8.6	45	3.7	16	1.9	
	Gynecological	63	6.2	62	5.2	38	4.6	
	Hematological	74	7.2	46	3.8	28	3.4	
	Urological	148	14.5	279	23.2	256	30.7	
	Other ^c	116	11.3	239	19.9	205	24.6	
	Breast	73	7.1	125	10.4	70	8.4	
	Reason for Hospitalization	Clinical	566	55.3	345	28.7	103	
Surgical	457	44.7	858	71.3	732	87.7		

a. Upper gastrointestinal tract: esophagus, stomach, pancreas, liver, gallbladder, biliary ducts; b. Lower gastrointestinal tract: colon, rectum and anal canal; c. Other: bone, articulation, skin, endocrine, melanoma, rare. The categorical data were expressed as frequencies (n) and percentages (%) and compared by the chi-square test or the Tukey test.

patients, confounds the interpretation of weight status (20). The confounder for using BMI as a simple screening tool is that many patients with cancer who experience malnutrition are also obese (21). In our results, we observed that 21.1% of the total samples were overweight, with prevalence similar to a previous study in older adults with neoplasms (22). Malnourished obese patients have worse outcomes than well-nourished obese patients (23). BMI may not be as effective a screening tool for malnutrition in older patients with cancer with recent weight loss and decreased oral intake (24).

More than half of the patients had a moderate to severe intake reduction and weight loss of more than 1 kg. This finding may be associated with the presence of nutritional impact symptoms. In fact, in a previous study performed by our study group of hospitalized adult patients with cancer in Brazil, we observed that patients who had difficulty swallowing, loss of appetite, and vomiting had the highest odds ratio for malnutrition (8). In a study of patients with advanced cancer, it was observed that dysphagia was the only symptom that was an

independent predictor of survival (25), reinforcing the need for priority management of these symptoms by multidisciplinary teams.

The BMI and CC values showed a significant reduction with the worsening of nutritional status, according to the MNA-SF, which is consistent with a previous study of patients with lung cancer (19). In addition, we observed that the patients classified as malnourished and at nutritional risk had a significantly longer stay in hospital than those who were well nourished. This finding draws attention to the immediate need to perform early nutritional screening in order to prioritize the appropriate nutritional management and thereby help reduce mortality, improve quality of life, and reduce hospital costs, especially in view of the fact that the length of stay of these patients was almost twice that of the well-nourished patients.

Upper gastrointestinal tract, chest, and head tumors were the most associated with malnutrition. These results are in agreement with previous studies (4, 8). However, in the present study of older cancer patients, hematological tumors were also

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Table 4
 Individual items according to MNA-SF classification

Variable	Category	MNA-SF Classification						p value
		Malnourished		At Risk of malnutrition		Normal status		
		N	%	N	%	N	%	
Food intake	Severe decrease	558	54.5	77	6.4	1	0.1	<0.0001
	Moderate decrease	383	37.4	527	43.5	65	7.8	
	No decrease	82	8	599	49.8	769	92.1	
Weight loss	Weight loss greater than 3kg	767	75	291	24.2	0	0	< 0.0001
	Does not know	151	14.8	150	12.5	9	1.1	
	Between 1 and 3 kg	84	8.2	375	31.2	72	8.6	
Mobility	No weight loss	21	2.1	387	32.2	754	90.3	< 0.0001
	Bed or chair bound	295	28.8	44	3.7	1	0.1	
Psychological stress	Able to get out of bed / chair Goes out	431	42.1	276	22.9	31	3.7	< 0.0001
	Yes	297	29.1	883	73.4	803	96.2	
Neuro-psychological problems	No	895	87.5	922	76.6	504	60.4	< 0.0001
	Severe dementia or depression	128	12.5	281	23.4	331	39.6	
BMI	Mild dementia	78	7.6	24	2	2	0.2	< 0.0001
	No psychological problems	144	14.1	46	3.8	1	0.1	
	< 19 kg/m ²	801	78.3	1133	94.2	832	99.6	
CC	≥ 19 < 21 kg/m ²	464	45.4	94	7.8	0	0	< 0.0001
	≥ 21 < 23 kg/m ²	153	15.0	119	9.9	15	1.8	
	≥ 23 kg/m ²	130	12.7	224	18.6	34	4.1	
CC	< 31cm	276	27	766	63.7	786	94.1	< 0.0001
	≥ 31 cm	685	72.6	40	5.36.4	119	15.7	
		258	27.4	707	63.6	640	84.3	

The categorical data were expressed as frequencies (n) and percentages (%) and compared by the chi-square test or the Tukey test. BMI: body mass index; CC: calf circumference.

associated with malnutrition. This finding may be associated with the fact that hematological malignancies are more common amongst older people, since it has been reported that 60% of patients with malignant hemopathies are over 65 (26). Almost half of the patients in the present study were hospitalized for surgical reasons, and it has previously been reported that the MNA is more effective than other nutritional risk screening tools for older surgical patients (22).

A previous Brazilian study demonstrated the validity of the MNA for the nutritional assessment of older Brazilians (22). The MNA-SF is a rapid and accurate way of screening for malnutrition in frail hospitalized older adults. It takes about five minutes to complete and offers a good level of screening accuracy compared with the full MNA (27, 28). Furthermore, it has been demonstrated that in outpatients and older hospital patients, the MNA is predictive of outcomes and cost of care (28).

The strengths of our study are its large sample size-it was conducted at several cancer treatment centers in every

region of Brazil-and its use of MNA-SF, which is a specific tool to evaluate the nutritional status of older people. Aging associated with a greater burden of cancer can make health care challenging in developing regions, such as Latin America (29), where there can be a shortage of adequate resources and infrastructure for geriatric medicine. The main weakness of the study is that it did not collect data on tumor staging, although this is not routinely available in medical records.

In conclusion, the prevalence of malnutrition and nutritional risk is high in older hospitalized cancer patients in all the regions of Brazil. The worst nutritional status was associated with longer hospital stays, lower BMI and CC, female sex, older age, and the presence of hematological tumors and tumors of the head, neck, upper gastrointestinal tract, and chest.

Epidemiological estimates of future cases of cancer demonstrate that the number of older cancer patients will continue to increase in the world. As such, the use of a low-cost. Effective nutritional risk assessment tool for older cancer patients will allow specialized nutritional interventions and help

prevent inequities in the quality of cancer care worldwide.

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Conflicts of Interest: The authors declare that they have no conflict of interest.

Ethical standards: The study complies with the current laws of the country in which it was performed.

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