



ORIGINAL ARTICLE

Nutritional Status and Associated Factors in Older Patients with Prostate Cancer: A Cross-Sectional Study in Two Brazilian Cities

Grazielle Marques Rodrigues* and Inês Echenique Mattos

Department of Epidemiology and Quantitative Methods in Health, National School of Public Health, Oswaldo Cruz Foundation, Brazil

*Corresponding author: Grazielle Marques Rodrigues, National School of Public Health/Oswaldo Cruz Foundation, Rua Leopoldo Bulhões, 1480/room 817b, Manguinhos, Zip Code: 21041-210, Rio de Janeiro, Brazil



Abstract

Background: Given the heterogeneity of the overall health status of older patient with cancer, it is recommended to conduct a multidimensional geriatric assessment (MGA) before the establishment of the treatment protocol. Nutritional status is an important part of this assessment, as it is associated to poor health outcomes in older adults with cancer. This study aims to identify factors associated with nutritional status in older adults with prostate cancer.

Methods: Cross-sectional study of 538 older adults aged 60 or more, with incident prostate cancer before the beginning of the treatment at hospitals of Brazil's Unified Health System. Nutritional status was evaluated with the Mini-Nutritional Assessment Short-Form version. Socio-demographic and clinical variables, besides some dimensions of the MGA (functionality, comorbidity and emotional condition) were evaluated. We estimated the prevalence of subjects at risk of malnutrition or malnourished and analysed the associations between nutritional status and the independent variables using prevalence ratios and Poisson's regression with statistical significance for p value ≤ 0.05 .

Results: The mean age of the individuals was 69.11 ± 6.43 years and 27.1% were at risk of malnutrition or malnourished. Presence of depressive symptoms (PR 1.78; 95% CI 1.27-2.50), functional dependence in Basic Activities of Daily Living (PR 1.40; 95% CI 1.01-1.94) and age (PR 1.02; 95% CI 1.00-1.04) were independent factors associated with nutritional status.

Conclusion: The high prevalence of patients at risk of malnutrition or malnourished and the association with functional dependence, presence of depressive symptoms and age point the importance to assessment the nutritional status in this population.

Keywords

Nutritional status, Prostate cancer, Aged

Introduction

Older adults currently constitute a major part of the world's population and it is estimated that in 2050 they will number around two billion [1]. In Brazil, population ageing occurred rapidly [2] and the Brazilian Institute of Geography and Statistics [3] indicated that individuals aged 65 years and more will represent 21.8% of the country population in the year 2050. Age is an important risk factor for cancer [4-6] and high frequencies of new cancer cases in older adults are expected in Brazil in the years to come, due to this age shift.

Prostate neoplasia is the most frequently diagnosed tumor in men in the world excluding non-melanoma skin cancer [7]. For 2018, were estimated more than one million cases of prostate cancer worldwide [8]. In the same year, for Europe, prostate cancers corresponding 21.8% of the total of primary sites [9]. Similar data were reported in the United States in 2019, where 174,650 new cases of this tumor are estimated (20% of all malignancies diagnosed in men) [10]. In Brazil, for the biennium 2018-2019, are expected 68,220 new cases of this tumor, corresponding a risk of 66.12 new cases/100,000 men [11]. It is important to note that incidence and mortality increase markedly after 50 years [12].

Population ageing leads to a high incidence of cancer in older adults, increasing the demand of oncological care for these individuals [13,14]. Older adults constitute a heterogeneous population in relation to overall health, and therefore individuals of the same age may display different health conditions and so, respond differently to cancer treatment [15-17]. For this reason, it is recommended to conduct a multidimensional geriatric assessment (MGA) before the establishment of the treatment protocol. The evaluation of nutritional status is an important part of this assessment [15,18,19] because it allows early intervention in patients at risk of malnutrition or malnourished, reducing days of hospitalization, the development of infections, toxicity during chemotherapy and increased survival [20-23].

Paillaud, et al. [22] studied patients 70 or more years old, before starting treatment for different types of solid tumours, including prostate cancer and reported that 41.0% were at risk of malnutrition and 13.2% malnourished. Already, Aaldriks, et al. [14] observed that 33.0% of the older adults were considered at risk of malnutrition or malnourished.

Despite the above findings, there are still few international studies evaluating the nutritional status and its associated factors before the beginning of prostate cancer treatment. As for Brazil, no articles were found on this subject.

Thus, the present study aims to estimate the prevalence of nutritional status and analyse its associated factors in older patients with incident prostate cancer, before the therapeutic decision in Campo Grande and Rio de Janeiro municipalities in Brazil.

Methods

The present study used data from the research project "Multidimensional Geriatric Assessment in the elderly with prostate cancer: feasibility and potential impact on survival" with funding from the National Counsel of Research (Grant PDTSP/FIOCRUZ) and was approved by the Research Ethics Committee of the National School of Public Health of the Oswaldo Cruz Foundation (CAEE04383912.1.3001.5253).

Study design

This is a cross-sectional study developed in two Brazilian municipalities, Campo Grande and Rio de Janeiro. From April 2012 to June 2014, consecutive cases of prostate cancer that met the inclusion criteria were recruited from urology outpatient clinics of eight hospitals of the Brazilian National Health System in the cities of Campo Grande and Rio de Janeiro. Trained research assistants, who were standardized as to data collection procedures, interviewed the patients applying a structured questionnaire, which included sociodemographic and clinical variables, besides some dimensions of the MGA. Complementary data was collected in the pa-

tient's medical records by the researchers.

Study population

Eligibility criteria consisted of individuals aged 60 years and older with a histopathological diagnosis of prostate cancer and not having initiated treatment. Prevalent cases, patients who had started any oncological treatment for prostate cancer or with cancer at other sites, cases not confirmed after immunohistochemical study and patients without conditions to answer the items of the questionnaire were excluded.

Assessment measuring

The outcome variable was the nutritional status, evaluated with the Mini-Nutritional Assessment Short-Form version (MNA-SF), which consists of a subset of six items. The MNA-SF score varies from zero to 14 points [24,25]. This instrument is specific for the evaluation of older adults, allows the detection of individuals at risk of malnutrition and has high sensitivity and specificity [24,25]. The instrument was translated to Portuguese and validated for the Brazilian population [26,27]. Subjects were classified into three categories, based on the score obtained: normal nutritional status (14-12 points), at risk of malnutrition (11-8 points) and malnourished (7-0 points) [25]. For purposes of analysis, this variable was later dichotomized into normal nutritional status and at risk of malnutrition or malnourished.

Like possible exposure variables we analyzed sociodemographic (age, family income, marital status and education level), clinical (Gleason score and Body Mass Index) variables, and other dimensions of elderly health (functionality in Basic Activities of Daily Living, functionality in Instrumental Activities of Daily Living, comorbidity and emotional condition).

Functionality in Basic Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL) were assessed, respectively, through the Katz [28] and the Lawton [29] scales, both translated to Portuguese and validated for the Brazilian population [30,31]. For the two scales, we considered as dependence those individuals who were unable to perform unaided one or more of the activities assessed. Comorbidity was assessed with the Cumulative Illness Rating Scale-Geriatric (CIRS-G) [32]. Comorbidity was classified by total score, which is the sum of scores obtained in each system or organ affected, reflecting the severity of the diseases. This variable was categorised into three strata: no/mild comorbidity (0-2 points), moderate comorbidity (3-8 points) and severe comorbidity (> 8 points) [33]. For the multiple analysis, we combined the moderate and severe comorbidity in one stratum, the other being no/mild comorbidity.

We investigated emotional condition with the 15-item Geriatric Depression Scale (GDS-15), translated to Portuguese and validated for Brazilian older adults

[34,35]. By adding the scores obtained on each item, participants were classified into three strata: No depressive symptoms (0-5 scores), mild depressive symptoms (6-9 scores) and severe depressive symptoms (10-15 scores). For the multiple analysis, we dichotomized this variable in without depressive symptoms and with mild/severe depressive symptoms.

Statistical analysis

The characteristics of the study population were described by measures of central tendency and dispersion for continuous variables and by frequency distributions for categorical variables. We estimated prevalence and prevalence ratios (PR) by strata of the independent variables in order to test the presence of associations with nutritional status for individuals classified as at risk of malnutrition or malnourished and tested the statistical significance for a p value ≤ 0.05 .

We performed a Poisson regression statistical modeling to control possible confounding variables, using the stepwise method for inclusion of independent variables. The covariates that showed associations with statistical significance for a p value ≤ 0.05 and had theoretical relevance in relation to nutritional status were included in the model. The criterion for retention in the model was statistical significance for a p value ≤ 0.05 and 95% confidence interval (CI).

Statistical data was performed with SPSS 22.0 and STATA, version 10.0 (StataCorp LP) for Windows.

Results

We recruited 639 older adults subjects, of which 15.8% (N = 101) were excluded after medical history review, histopathological report and immunohistochemical study. Of these, 66.5% (N = 67) had no malignant neoplasia, 26.7% (N = 27) were prevalent cases and 6.9% (N = 7) had other malignancies.

The study population consisted of 538 Older patients, whose mean age was 69.11 ± 6.43 (60-88) years, with a median of 68.00 years, mean weight of 74.64 ± 11.88 kg (42 kg-129 kg) and an average Body Mass Index of 25.99 ± 3.91 kg/m². The MNA-SF identified 72.9% (N = 376) with normal nutritional status, 23.4% (N = 121) at risk of malnutrition and 3.7% (N = 19) malnourished (Table 1).

The majority of the individuals were married or lived with a partner, had a median family income of 3.12 ± 2.77 (0.12-36.87) minimum wages (minimum wage was approximately 332 dollars) and low education level. On the Gleason score, all patients, except one, had a tumour classified as intermediate and high risk (Table 1).

Most participants were independence in Basic Activities of Daily Living and in Instrumental Activities of Daily Living. Mean total comorbidity score was 4.98 ± 3.05 (0-18), with the largest proportion of participants with

Table 1: Characteristics of older adults with incident prostate cancer before the beginning of the treatment, Brazil (N = 538).

Variables		N	%
Age group	60-69 years	327	60.8
	70-79 years	166	30.9
	80 or more years	45	8.4
Marital status	Married/Living with partner	402	74.7
	Divorced or separated	48	8.9
	Widowed	47	8.7
Education level*	Single	41	7.6
	Illiterate	74	13.8
	Incomplete elementary school	257	47.9
	Complete elementary school	81	15.1
	Complete secondary school	83	15.5
	Graduate	41	7.6
Gleason score*	Low risk	1	0.2
	Intermediate risk	410	79.8
	High risk	103	20
Nutrition status*	Normal nutritional status	376	72.9
	At risk of malnutrition	121	23.4
	Malnourished	19	3.7
Functionality in ADL	Functional independence	449	83.5
	Functional dependence	89	16.5
Functionality in IADL*	Functional independence	388	72.3
	Functional dependence	149	27.7
Emotional condition*	No depressive symptoms	476	89.6
	Mild depressive symptoms	46	8.7
	Severe depressive symptoms	9	1.7
Comorbidity	No/mild comorbidity	117	21.7
	Moderate comorbidity	355	66
	Severe comorbidity	66	12.3

*Differences between absolute numbers are due to missing values.

moderate comorbidity. In relation to emotional condition, the GDS-15 mean score was 2.70 ± 2.18 (0-13) and the majority of older adults showed no depressive symptoms.

Based on the pre-established criteria, only age (continuous), marital status, functionality in ADL or IADL and emotional condition were included in the multiple model (Table 2). After analysis, the independent variables associated with being at risk of malnutrition or malnourished were functionality in Basic Activities of Daily Living (functional dependence), emotional condition (mild/se-

Table 2: Prevalence's and crude prevalence ratios (PR) for nutritional status (at risk of malnutrition or malnourished) in older adults with incident prostate cancer before the beginning of the treatment, Brazil (N = 538).

Variables	At risk of malnutrition or malnourished N (%)	Crude PR (95% CI)	p-value
Age (continuous)		1.04 (1.01-1.07)	0.003
Marital status			
Married/Living with partner	95 (67.9)	1	
Divorced or separated/single/widowed	45 (32.1)	1.42 (1.06-1.90)	0.023
Education Level			
Illiterate/Incomplete elementary school	85 (61.2)	1	
Others	54 (38.8)	1.00 (0.74-1.33)	0.986
Functionality in ADL			
Functional independence	108 (77.1)	1	
Functional dependence	32 (22.9)	1.59 (1.16-2.18)	0.006
Functionality in IADL			
Functional independence	81 (57.9)	1	
Functional dependence	59 (42.1)	1.94 (1.48-2.55)	< 0.001
Emotional condition			
No depressive symptoms	113 (82.5)	1	
Mild/Severe depressive symptoms	24 (17.5)	1.91 (1.37-2.67)	< 0.001
Comorbidity			
No/Mild comorbidity	23 (16.4)	1	
Moderate/Severe comorbidity	117 (83.6)	1.44 (0.97-2.14)	0.058

Table 3: Poisson multiple regression model for nutritional status (at risk of malnutrition or malnourished) in older adults with incident prostate cancer before the beginning of the treatment, Brazil (N = 538).

Variables	Adjusted Prevalence Ratios (95% CI)
Emotional condition (mild/severe depressive symptoms)	1.78 (1.27-2.50)
Functionality in ADL (functional dependence)	1.40 (1.01-1.94)
Age (continuous)	1.02 (1.00-1.04)

vere depressive symptoms) and age (continuous) (Table 3).

Discussion

In this study, functional dependence in Basic Activities of Daily Living, presence of mild/severe depressive symptoms and age were independent risk factors for being at risk of malnutrition or malnourished in older patients with incident prostate cancer before the beginning of the treatment.

The aging process may foster alterations in older adults nutritional status by different mechanisms, including loss of muscle mass [36,37]. In France, in a study of individuals of both sexes and mean age 61.90 years with head and neck cancer diagnosis, before the start of oncological treatment, it was observed an association between malnourishment and age 65 years or more (OR 2.07; 95% CI 0.96-4.4) [38]. Although lacking statistical significance, age seems to have contributed to malnourishment, given that the sample comprised individuals from various different age strata.

The association between functional dependence in

Basic Activities of Daily Living and being at risk of malnutrition or malnourished may be connected with limitations on participants' ability to prepare meals and feed themselves without depending on others [39]. Amaral, et al. [40] conducted a multicentre study in Portugal to examine the association between functionality and nutritional status, using the Nutritional Risk Screening and the Katz scale. Functional dependence in ADL showed an association with being at risk of malnutrition (OR 2.60; 95% CI 1.95-3.46) among patients completely dependence. Nonetheless, despite the methodological differences, these findings corroborate the association between dependence in ADL and nutritional status.

As regards to the association with emotional condition, it is possible that patients with depressive symptoms tend to reduce their food intake and, as a result, lose weight [41]. In Lithuania, in a study of 40 older adults with advanced prostate cancer, assessed by the Mini-Nutritional Assessment (MNA) and the 15-item Geriatric Depression Scale, it was observed an inverse correlation between nutritional status and depressive symptoms, i.e., low MNA score/high GDS-15 score (r

0.46; $p < 0.01$) [42]. In France, Paillaud, et al. [22] studied patients 70 or more years old, before starting treatment for different types of solid tumours, including prostate cancer. Nutritional status was assessed by the MNA and emotional condition, by the GDS-15. In multiple analysis, having depressive symptoms was associated with being at risk of malnutrition or being malnourished. Although using different methodologies, these results reinforce the findings of the present study.

In the present study, 23.4% (N = 121) patients were at risk of malnutrition and 3.7% (N = 19) were malnourished. We recruited individuals with a recent diagnosis of prostate cancer and were evaluated before the beginning of cancer treatment. Even so, more than a quarter of the population already presented alterations in their nutritional status.

Decoster, et al. [43] studied patients of 70 or more years, with different types of cancer, at two hospitals in Belgium, and found that 63.7% were at risk of malnutrition or malnourished at time of diagnosis. Terret, et al. [44] studied individuals of 65 or more years with a diagnosis of advanced-stage prostate cancer at oncological centres in France. Nutritional status was assessed with the MNA, 45.0% of the patients were at risk of malnutrition, and 20% were malnourished. Toliusiene & Lesauskaite [42] recruited individuals with 65 or more years old, hospitalised with stage-III prostate cancer and in treatment with radiotherapy at a cancer hospital in Lithuania, and nutritional status was assessed with the MNA. Fifty percent of the patients were at risk of malnutrition and 10.0% were considered malnourished. These studies examined the nutritional status of patients with cancer using the MNA or MNA-SF and their samples comprised only patients with advanced-stage disease or already in treatment, which explains the higher prevalence of nutritional problems.

In Brazil, the most relevant study of nutrition in older patients with cancer is the *Luso-Brazilian Survey of Oncologic Nutrition of the Elderly* [45]. This study evaluated the nutritional status in the first 48 hours of hospitalization using MNA-SF in patients with 65 and more years of both sexes. It was shown that 39.8% of the older adults were at risk of malnutrition and 33.2% were malnourished. However, the high prevalence of malnourished individuals could be explained by the inclusion of patients with different cancer stages.

Nutritional status is associated with increased toxicity during treatment, longer hospitalizations, presence of fatigue and lower survival rates [20,23,46]. In addition, nutritional deficits can trigger cancer cachexia, an abnormality associated with anorexia, skeletal muscle atrophy, loss of adipose tissue and anemia [47,48].

In Italy, Basso, et al. [49] studied patients with 70 or more years, with different types of cancer, before starting chemotherapy. They assessed the same dimensions and the same instruments we used in the present

study and reported 27.4% of participants with functional dependence, 16.2% with depressive symptoms and a mean comorbidity score of 4 (0-8). Except for comorbidity, which returned a mean similar to that found in the present study, they found high percentages of alterations in the other dimensions, which could be explained, in part, by the high mean age (75 years) of participants and by the inclusion of patients with metastatic cancer.

This study has limitations, particularly because of its cross-sectional design. In this type of study, exposure and outcome are ascertained at the same time, making it difficult to assess for potential causal associations. Other limitations include the low prevalence of participants over 70 years of age, which hinders comparisons with the international literature, and the use of self-reported instruments to measure health dimensions. Although research assistants were trained in order to standardize application of the instruments, the possibility of information bias cannot be disregarded.

On the other hand, this study has strengths, among them, a subject that was little explored in studies in the area of geriatric oncology, the adequate sample size for the conducted analyzes and its originality. Up to the present moment, we could not identify a study that evaluated the nutritional status of older adults with cancer before the beginning of cancer treatment in Brazil.

The findings point to older adults with a good overall health, considering the low percentage of deficits in the domains of the multidimensional geriatric assessment. However, we pointed out a relevant percentage of individuals at risk of malnutrition or malnourished. This percentage could be high among those with functional dependence and/or depressive symptoms and increases with each year of increase in age. These findings reinforce the relevance of an early nutritional assessment of older adults with prostate cancer, especially those with advanced age, presenting depressive symptoms or functional dependence.

Conclusion

This study is the first to analyze factors associated with nutritional status in older patients with cancer in Brazil. During data collection, it was observed that few hospitals conduct a multidisciplinary assessment before the beginning of cancer treatment.

Due to the aging of the Brazilian population, an increment in the number of new cancer cases in older adults is expected. Health services will need to be prepared to provide quality and individualized care with a multidisciplinary team, thus avoiding adverse outcomes such as hospitalizations, toxicity and death during treatment.

For future studies to bring more contributions on this topic, the development of longitudinal studies that evaluate nutritional status is needed in order to

estimate its association with unfavorable events during oncological treatment and to evaluate the role other dimensions of health on them.

Acknowledgements

We would like to thank all the staff, research assistants and urology outpatient clinics of eight hospitals of the Brazilian National Health System in the cities of Campo Grande and Rio de Janeiro, for their help in completing this study. This work was supported by Clinical Research Network in Public Health/Oswaldo Cruz Foundation and National Research Council (CNPq/PDTSP-FI-OCRUZ).

Disclosure and Conflicts of Interest

The authors have no conflicts of interest to disclose.

Sources of Support

This work was supported by Clinical Research Network in Public Health/Oswaldo Cruz Foundation and National Research Council (CNPq/PDTSP-FIOCRUZ).

Statement of Equal Authors' Contribution

Study concept and design: IE Mattos.

Data acquisition: GM Rodrigues.

Quality control of data and algorithms: GM Rodrigues and IE Mattos.

Data analysis and interpretation: GM Rodrigues and IE Mattos.

Statistical analysis: GM Rodrigues and IE Mattos.

Manuscript preparation: GM Rodrigues and IE Mattos.

Manuscript editing, review and final approval: IE Mattos and GM Rodrigues.

References

- (2014) World Health Organization. Global Health and Ageing.
- Veras RP (2012) International experiences and trends in health care models for the elderly. *Ciênc Saúde Colet* 17: 231-238.
- (2018) Projeções da população: Brasil e Unidades da Federação: Revisão 2018. (2nd edn), Instituto Brasileiro De Geografia E Estatística-IBGE. 40.
- Balducci L (2003) New paradigms for treating elderly patients with cancer: The comprehensive geriatric assessment and guidelines for supportive care. *J Support Oncol* 2: 30-37.
- Misra D, Seo PH, Cohen HJ (2004) Aging and Cancer. *Clin Adv Hematol Oncol* 2: 457-265.
- Kartal M, Tezcan S, Canda T (2013) Diagnosis, treatment characteristics, and survival of women with breast cancer aged 65 and above: A hospital-based retrospective study. *BMC Womens Health* 13: 34.
- Jemal A, Bray F, Center MM, Ferlay J, Ward E, et al. (2011) Global Cancer Statistics. *Cancer J Clin* 61: 60-69.
- (2018) Globocan. Tables by cancer.
- Ferlay J, Colombet M, Soerjomataram I, Dyba T, Randi G, et al. (2018) Cancer incidence and mortality patterns in Europe: Estimates for 40 countries and 25 major cancers in 2018. *Eur J Cancer* 103: 356-387.
- Siegel RL, Miller KD, Jemal A (2019) Cancer Statistics. *CA Cancer J Clin* 69: 7-34.
- (2017) Estimativa 2018: Incidência de câncer no Brasil. Ministério da saúde, Instituto Nacional de Câncer José Alencar Gomes da Silva, Rio de Janeiro.
- Noone AM, Howlader N, Krapcho M, Miller D, Brest A, et al. (2018) SEER Cancer Statistics Review (CSR) 1975-2015. Bethesda.
- Kellen E, Bulens P, Deckx L, Schouten H, Van Dijk M, et al. (2010) Identifying an accurate pre-screening tool in geriatric oncology. *Crit Rev Oncol Hematol* 75: 243-248.
- Aaldriks AA, Maartense E, Cessie SLE, Giltay EJ, Verlaan HA, et al. (2011) Predictive value of geriatric assessment for patients older than 70 years, treated with chemotherapy. *Crit Rev Oncol Hematol* 79: 205-212.
- Puts MT, Hardt J, Monette J, Girre V, Springall E, et al. (2012) Use of geriatric assessment for older adults in the oncology setting: A systematic review. *J Natl Cancer Inst* 104: 1133-1163.
- Wildes TM, Ruwe AP, Fournier C, Gao F, Carson KR, et al. (2013) Geriatric assessment is associated with completion of chemotherapy, toxicity, and survival in older adults with cancer. *J Geriatr Oncol* 4: 227-234.
- Handforth C, Burkinshaw R, Freeman J, Brown JE, Snowden JA, et al. (2019) Comprehensive geriatric assessment and decision-making in older men with incurable but manageable (chronic) cancer. *Support Care Cancer* 27: 1755-1763.
- Lichtman SM (2003) Guidelines for the treatment of elderly cancer patients. *Cancer Control* 10: 445-453.
- Balducci L, Colloca G, Cesari M, Gambassi G (2010) Assessment and treatment of elderly patients with cancer. *Surg Oncol* 19: 117-123.
- Extermann M, Wedding U (2012) Comorbidity and geriatric assessment for older patients with hematologic malignancies: A review of the evidence. *J Geriatr Oncol* 3: 49-57.
- Duval PA, Vargas BL, Fripp JC, Arrieira ICO, Lazzeri B, et al. (2010) Cancer cachexia in oncology patients hospitalized in an interdisciplinary home care program. *Rev Bras Cancerol* 56: 207-212.
- Paillaud E, Liou E, Laurent M, Thuaut AL, Vincent H, et al. (2014) Geriatric syndromes increased the nutritional risk in elderly cancer patients independently from tumour site and metastatic status. The ELCAPA-05 cohort study. *Clin Nutr* 33: 330-335.
- Boulahssass R, Gonfrier S, Ferrero JM, Sanchez M, Mari V, et al. (2018) Predicting early death in older adults with cancer. *Eur J Cancer* 100: 65-74.
- Vellas B, Villars H, Abellan G, Soto ME, Rolland Y, et al. (2006) Overview of the MNA®-Its history and challenges. *J Nutr Health Aging* 10: 456-463.
- Rubenstein LZ, Harker JO, Salva A, Guigoz Y, Vellas B (2001) Screening for undernutrition in geriatric practice: Developing the short-form mini nutritional assessment (MNA-SF). *J Gerontol A Biol Sci Med Sci* 56: 366-372.

26. Delacorte RR, Moriguti JC, Matos FD, Pfrimer K, Marchinil JS, et al. (2004) Mini-nutritional assessment score and the risk for undernutrition in free-living older persons. *J Nutr Health Aging* 8: 531-534.
27. Ferreira LS, Nascimento LF, Marucci MF (2008) Use of the mini nutritional assessment tool in elderly people from long-term institutions of southeast of Brazil. *J Nutr Health Aging* 12: 213-217.
28. Katz S, Downs TD, Cash HR, Grotz RC (1970) Progress in development of index of ADL. *Gerontologist* 10: 20-30.
29. Lawton MP, Moss M, Fulcomer M, Kleban MH (1982) A research and service oriented multilevel assessment instrument. *J Gerontol* 37: 91-99.
30. Lino VTS, Pereira SEM, Camacho LAB, Filho STR, Buksman S (2008) Adaptação transcultural da escala de independência em atividades da vida diária (Escala de katz). *Cad Saúde Pública* 24: 103-112.
31. Santos RL, Virtuoso Júnior JS (2008) Confiabilidade da versão brasileira da escala de atividades instrumentais da vida diária. *Rev Bras Prom Saúde* 21: 290-296.
32. Miller MD, Paradis CF, Houck PR, Mazumdar S, Stack JA, et al. (1992) Rating chronic medical illness burden in geropsychiatric practice and research: Application of the cumulative illness rating scale. *Psychiatr Res* 41: 237-248.
33. Rodríguez MAZ, Pavón JG, Fernández PS, Salinas AF, Guzmán LM, et al. (2012) Fiabilidad interobservador de los 4 índices de comorbilidad más utilizadas em pacientes ancianos. *Rev Esp Geriatr Gerontol* 47: 67-70.
34. Yesavage JA, Brink TL, Rose TL, Lum O, Huang V, et al. (1982) Development and validation of a geriatric depression screening scale: A preliminary report. *J Psychiatr Res* 1982-1983 17: 37-49.
35. Almeida OP, Almeida SA (1999) Confiabilidade da versão brasileira da escala de depressão em geriatria (GDS) versão reduzida. *Arq Neuropsiquiatr* 57(2-B): 421-426.
36. Vandewoude M (2010) Nutritional assessment in geriatric cancer patients. *Support Care Cancer* 18: 51-56.
37. Bozzetti F (2011) Nutritional aspects of the cancer/aging interface. *J Geriatr Oncol* 2: 177-186.
38. Lescut N, Personeni E, Desmarets M, Puyraveau M, Hamlaoui R, et al. (2013) Evaluation of a predictive score of undernutrition in irradiated patients for cancer of the upper aerodigestive tract: A retrospective study in 127 patients. *Cancer Radiother* 17: 649-655.
39. Abd-Al-Atty MF, Abou-Hashem RMA, Abd-Elaziz KM (2012) Functional capacity of recently hospitalized elderly in relation to nutritional status. *Eur Geriatr Med* 3: 356-359.
40. Amaral TF, Matos LC, Teixeira MA, Tavares MM, Álvares L, et al. (2010) Undernutrition and associated factors among hospitalized patients. *Clin Nutr* 29: 580-585.
41. Ulger Z, Halil M, Kalan I, Yavuz BB, Cankurtaran M, et al. (2010) Comprehensive assessment of malnutrition risk and related factors in a large group of community-dwelling older adults. 29: 507-511.
42. Toliusiene J, Lesauskaite V (2004) The nutritional status of older men with advanced prostate cancer and factors affecting it. *Support Care Cancer* 12: 716-719.
43. Decoster L, Kenis C, Puyvelde K, Flamaing J, Conings G, et al. (2013) The influence of clinical assessment (including age) and geriatric assessment on treatment decisions in older patients with cancer. *J Geriatr Oncol* 4: 235-241.
44. Terret C, Albrand G, Droz JP (2004) Geriatric assessment in elderly patients with prostate cancer. *Clin Prostate Cancer* 2: 236-240.
45. Taís Facina (2015) Inquérito luso-brasileiro de nutrição oncológica do idoso: Um estudo multicêntrico *Revista Brasileira de Cancerologia* 61: 287-288.
46. Esau PJ, Gittemeier EM, Opoku-Acheampong AB, Rollins KS, Baumfalk DR, et al. (2017) Prostate cancer reduces endurance exercise capacity in association with reductions in cardiac and skeletal muscle mass in the rat. *Am J Cancer Res* 7: 2566-2576.
47. Hong S, Jeong IG, You D, Lee JL, Hong JH, et al. (2013) Safety of megestrol acetate in palliating anorexia-cachexia syndrome in patients with castration-resistant prostate cancer. *J Korean Med Sci* 28: 687-692.
48. Mochamat, Cuhls H, Marinova M, Kaasa S, Stieber C, et al. (2017) A systematic review on the role of vitamins, minerals, proteins, and other supplements for the treatment of cachexia in cancer: A European Palliative Care Research Centre cachexia Project. *J Cachexia Sarcopenia Muscle* 8: 25-39.
49. Basso U, Tonti S, Bassi C, Brunello A, Pasetto LM, et al. (2008) Management of frail and not-frail elderly cancer patients in a hospital-based geriatric oncology program. *Crit Rev Oncol Hematol* 66: 163-170.