

Protein Adequacy versus Nutritional Status of Adult Oncology Patients in Intensive Care Unit

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Adequação Proteica versus Estado Nutricional de Pacientes Oncológicos Adultos em Unidade de Terapia Intensiva Protein Adequado contra el Estado Nutricional de Pacientes Adultos en Oncología en la Unidad de Cuidados Intensivos

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Abstract

Introduction: Adequate nutrition can reduce complications, length of hospital stay, and improve patient outcomes. **Objective:** To evaluate the adequacy of the protein prescription in enteral nutritional therapy for cancer patients and to compare the protein nutritional prescription with the specific recommendations available for oncology, according to the current literature. **Method:** This is a retrospective quantitative study. The data of the research were obtained through the map of daily use by the Nutritionist. **Results:** 54% of the patients were women and 46% were men. 41% of women had breast cancer and 21% of men had lung cancer. The nutritional risk score 3 was prevalent in adults and the elderly, of both sexes. Eutrophic adults accounted for 64% and undernourished elderly 50%. The average protein requirement for eutrophic adults was 1.5 g ptn/kg; for malnourished 2.1 g ptn/kg; for overweight 1.4 g ptn/kg and for the obese 1.8 g ptn/kg. For malnutrition in the elderly, the mean protein requirement was 1.4 g ptn/kg, for eutrophic 1.5 g ptn/kg and for obese 1.5 g ptn/kg. No evaluated result presented statistical significance. **Conclusion:** The malignancy of the underlying disease, age and the presence of nutritional risk suggest greater need to increase the amount of nutritional supply. It highlights the need to use protein modules to adjust nutritional prescription, especially to obese patients.

Key words: Enteral Nutrition, Neoplasms, Nutritional Status, Dietary Proteins.

Resumo

Introdução: A nutrição adequada pode reduzir as complicações, o tempo de internação hospitalar e melhorar os desfechos clínicos dos pacientes. **Objetivo:** Avaliar a adequação da prescrição proteica na terapia nutricional enteral para pacientes oncológicos e comparar a prescrição nutricional proteica com as recomendações específicas disponíveis para oncologia, segundo a literatura atual. **Método:** Trata-se de um estudo quantitativo retrospectivo. Os dados da pesquisa foram obtidos por meio do mapa de uso diário pela nutricionista. **Resultados:** 54% dos pacientes eram mulheres, 41% das mulheres tinham câncer de mama e 21% dos homens, câncer de pulmão. Pelo NRS 2002, o escore de risco nutricional 3 foi prevalente em adultos e idosos de ambos os sexos. Adultos eutróficos representaram 64% e idosos desnutridos, 50%. A exigência proteica média para adultos eutróficos foi de 1,5 g ptn/kg; para desnutridos, 2,1 g ptn/kg; para sobrepeso, 1,4 g ptn/kg; e para o obesos, 1,8 g ptn/kg. Para a desnutrição em idosos, a exigência proteica média foi de 1,4 g ptn/kg; para eutróficos, 1,5 g ptn/kg; e para obesos, 1,5 g ptn/kg. Nenhum resultado avaliado apresentou significância estatística. **Conclusão:** A malignidade da doença de base, a idade e a presença do risco nutricional sugerem maior necessidade de incrementar o quantitativo de aporte nutricional. Evidencia-se também a necessidade da utilização de módulos de proteína para adequar a prescrição nutricional principalmente aos pacientes obesos.

Palavras-chave: Nutrição Enteral, Neoplasias, Estado Nutricional, Proteínas na Dieta.

Resumen

Introducción: La nutrición adecuada puede reducir las complicaciones, el tiempo de internación hospitalaria y mejorar los resultados clínicos de los pacientes. **Objetivo:** Evaluar la adecuación de la prescripción proteica en la terapia nutricional enteral para pacientes oncológicos y comparar la prescripción nutricional proteica con las recomendaciones específicas disponibles para oncología, según la literatura actual. **Método:** Se trata de un estudio cuantitativo retrospectivo. Los datos de la encuesta fueron obtenidos a través del mapa de uso diario por la Nutricionista. **Resultados:** 54% de los pacientes eran mujeres y el 46% eran hombres. El 41% de las mujeres tenían cáncer de mama y el 21% de los hombres de cáncer de pulmón. La puntuación de riesgo nutricional 3 fue prevalente en adultos y ancianos, de ambos sexos. Los adultos eutróficos representaron el 64% y los ancianos desnutridos 50%. La exigencia proteica media para adultos eutróficos fue de 1,5 g ptn/kg; desnutridos 2,1 g ptn/kg; sobrepeso 1,4 g ptn/kg y el obesos 1,8 g ptn/kg. Para la desnutrición en ancianos, la exigencia proteica media fue de 1,4 g ptn/kg, eutróficos 1,5 g ptn/kg y para obesos 1,5 g ptn/kg. Ningún resultado evaluado presenta significancia estadística. **Conclusión:** La malignidad de la enfermedad subyacente, la edad y la presencia de riesgo nutricional sugieren mayor necesidad de incrementar el cuantitativo de suministro nutricional. Se evidencia también la necesidad de la utilización de módulos de proteína para adecuar la prescripción nutricional, principalmente en los pacientes obesos.

Palabras clave: Nutrición Enteral, Neoplasias, Estado Nutricional, Proteínas de la Dieta.

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INTRODUCTION

Cancer is a non-transmissible chronic disease characterized by the abnormal and disordered growth of cells. The development of cancer is the result of innumerable mechanisms that provoke successive mutations in the genetic materials of the cells because it is related to environmental and/or individuals' intrinsic risk factors¹.

For 2018-2019 in Brazil, it is estimated the occurrence of 600 thousand new cases for each year. These previews reflect the profile of a country that has prostate, lung, female breast, colon and rectum cancer as the most incident, however, it still has high rates of cervix, stomach and esophageal cancer².

It is known that different types of cancer interfere in many ways in the nutritional status, in the prognosis of the disease and length of hospital stay, which may be associated to the nutritional risk, especially for these patients³.

Cancer promotes modifications of the nutritional status resulting from the stress caused by the disease, and from the chemotherapy and radiotherapy these patients undergo⁴.

One frequent complication and extremely relevant in patients with advance stage malignant neoplasm is the anorexia-cachexia syndrome characterized by intense intake of lean mass and adipose tissue, progressive and involuntary weight loss, anemia, hypoalbuminemia, asthenia and negative nitrogenate balance⁵.

From 50 to 80% of the patients with cancer have cachexia, it diminishes the quality of life, leading to a progressive functional impact and is associated to high mortality⁶⁻⁸.

The most common metabolic modifications analyzed of cancer-associated cachexia are the total rates of organic recycling of proteins and synthesis rates and muscular protein catabolism. The muscular tissue creates nearly 50% of the recycling of body proteins in normal conditions. However, this recycling of body proteins is higher in oncologic patients with weight loss because of the priority to liver synthesis of acute phase proteins^{9,10}.

The proteolysis-inducing factor is a protein that acts directly through the activation of the ubiquitin-proteasome system in the muscular cells, it is a key element for the protein deterioration present in cancer-associated cachexia and it is a dependent system of energy that acts in the protein hydrolysis in different physiologic and physiopathological conditions¹¹.

The greater the severity of the oncologic disease associated to comorbidities and malnutrition, the worse are the clinical outcomes seen in these patients in Intensive Care Unit (ICU)¹².

A proper nutrition can diminish the complications as the risk of infections, dehiscence of anastomosis and mortality, length of hospital stay, and favorably impact the patient's outcome as well as minimize hospital costs¹³.

For the identification of higher or lower nutritional risk through nutritional screening, the aim is to plan the patient's nutritional care. The *Nutritional Risk Screening* (NRS) 2002 is a tool utilized to screen nutritional risk and it is recommended by the *European Society for Clinical Nutrition and Metabolism* (Espen)¹⁴.

This study is relevant because emphasizes to health care providers the importance of proper enteral nutrition therapy (ENT) prescription for the adjustment of the protein supply to patients in Intensive Care Unit (ICU).

The objective of this research is to assess the suitability of the ENT prescription of the oncologic patients and describe the most prevalent type of cancer within the ICU, evaluate the nutritional status of the oncologic patients, verify the classification of nutritional risk of these patients in the first 24 hours in ICU and compare the protein nutritional prescription with the specific available recommendations for oncology according to the current literature.

METHOD

It is a retrospective, quantitative approach observational study. It was developed in a private hospital in Rio de Janeiro in two mixed ICU's. The research data were obtained from the analysis of the nutritionist daily map and the daily follow up notes of the ENT from March to December 2017. The Institutional Review Board (IRB) of "Hospital Copa Dor", CAAE 86354418.0.0000.5249 approved the research on April 2018 and the number of the report is 2.591.744.

After the analysis of the data, it was conducted a bibliographic revision in the databases *Lilacs*, *Medline*, *SciELO*, and scientific books about Nutrition and Medicine.

The inclusion criteria utilized in the study were: patients in ICU > 18 years old with diagnosis of cancer at the admission to the hospital, in use of exclusive ENT for more than 72 hours. The exclusion criteria were: at the admission, the patient is healthy, disease-free, the patients that die in until 72 hours after the admission to the ICU, the patients who initiated ENT during the admission to ICU and in ENT associated to oral diet and/or parenteral nutrition (PN).

The sample consisted of 41 patients categorized per age range (adults and elderly from 60 years old), gender, primary location of the cancer and nutritional risk score (characterized by NRS 2002).

The nutritional status was classified according to the World Health Organization (WHO) for adults and elderly and the Body Mass Index (BMI) was calculated through the formula (weight ÷ height² in meters). It was utilized the knee height as the height estimate (KH), (men = [64.19 – (0.04 x age) + (2.02 x KH in cm)] and women = 84.88 – (0.24 x age) + (1.83 x KH in cm)]. The estimated weight (EW) was calculated through the formula (CA x 2.31) + (CC x 1.50) – 50.10, for men and (CA x 1.63) + (CC x 1.43) – 37.46, for women where CA is the circumference of the arm and CP is the circumference of the calf⁵.

The patients did not have edema and the anthropometric measures were done in the right side of the body. For the obese, the weight was adjusted with the formula (ideal weight – current weight) x 0.25 + current weight¹⁶.

The adequacy of the protein supply was evaluated through the total grams of the protein of the enteral diet divided by the patient weight (gram of protein /kg weight/day).

The data were compiled in a specific spreadsheet containing the initials of the patients, age, gender, location of the cancer, nutritional risk score, estimated weight, estimated height, BMI, commercial brand of the enteral diet utilized and total grams of the enteral diet divided by the patient weight (gram of protein/ kg weight/day). Later, the data were treated with the Microsoft Office Excel 2013. The information were analyzed by the mean and standard deviation, *t student* test, analysis of variance (Anova) and chi-square test according to the data collected.

RESULTS

It were evaluated the data of the 41 patients, being 73% (n=30) elderly. Of the total, 54% (n=22) were females, (27% (n=6) adults (49.7±5.5 years) and 73% (n=16) elderly (85±5.9 years) and 46% (n=19) males (74% (n=14), elderly (78.7±10 years) and 26% (n=5) adults (46.7±8.8 years). According to the location of the tumor and gender of the patients, it was observed that, of the women, 41.5% (n=9) had breast cancer, 18% (n=4), brain tumor, 9% (n=2), pancreas, 9% (n=2) in the lungs, 9% (n=2) in the oral cavity, 4.5% (n=1) in the ovary, 4.5% (n=1) in the thyroid and 4.5% (n=1), multiple myeloma (Table 1).

Among men, 21% (n=4) had lung cancer, 15% (n=3) in the intestine, 11% (n=2), prostate, 11% (n=2), stomach, 11% (n=2), pancreas, 11% (n=2), oral cavity, 5% (n=1) in the mandible, 5% (n=1), brain, 5% (n=1), kidneys and 5% (n=1) had skin epidermoid cancer (Table 1). Either men or women, the incidence of the different type of tumor did not present significant statistical differences when analyzed by Anova, with $p > 0.05$. Most likely because of the reduced number of cases, when analyzed and compared in a stratified manner.

According to NRS, the nutritional risk was demonstrated in 97.5% of the patients (n=40), being 100% (n=11) in adults and 97% (n=30) in elderly, without significant difference among the groups per chi-square, $p = 0.54$. Of the total of the patients, the women, 95% (n=21) and the men, 100% (n=19), had nutritional risk (χ^2 , $p = 0.34$) (Table 2).

Table 1. Prevalence of cancer for both genders in adults and elderly

Location of the Tumor	Adults (n=11)				Elderly (n=30)			
	Men ^a		Women ^a		Men ^a		Women ^a	
	n	%	n	%	n	%	n	%
Brain tumor	0	0	2	10	1	5.3	2	10
Breast	0	0	2	10	0	0	7	32
Ovary	0	0	1	4.5	0	0	0	0
Multiple myeloma	0	0	1	4.5	0	0	0	0
Pancreas	1	5.3	0	0	1	5.3	2	4.5
Oral cavity	0	0	0	0	2	10.5	2	10
Thyroid	0	0	0	0	0	0	1	4.5
Lung	2	10.5	0	0	2	10.5	2	10
Intestine	1	5.3	0	0	2	10.5	0	0
Stomach	1	5.3	0	0	1	5.3	0	0
Prostate	0	0	0	0	2	10.5	0	0
Kidney	0	0	0	0	1	5.3	0	0
Mandible	0	0	0	0	1	5.3	0	0
Epidermoid cancer	0	0	0	0	1	5.3	0	0
Total of cases	5	26	6	27	14	74	16	73

Captions: n = number of patients; ^a = $p > 0.05$ (Anova).

Table 2. Prevalence of nutritional risk in adults and elderly of both genders

Score NRS	Adults (n=11) ^b				Elderly (n=30) ^b			
	Men		Women		Men		Women	
	n	%	n	%	n	%	n	%
Score 2	0	0	0	0	0	0	1	5
Score 3	1	5	4	18	4	21	4	18
Score 4	1	5	1	5	4	21	5	22
Score 5	2	11	1	5	3	16	4	18
Score 6	1	5	0	0	2	11	1	5
Score 7	0	0	0	0	1	5	1	5
Total of cases	5	26	6	27	14	74	16	73

Captions: NRS = nutritional risk score (<3 no risk / ≥3 with risk, the greater the score, worse is the nutritional risk); n = number of patients; b = p>0.05 (chi-square).

By the BMI, the eutrophic patients represented 44% (n=18) of the sample, while the malnourished represented 39% (n = 16), followed by 5% (n=2) of overweight and 12% (n=5) of obesity (Table 3). In the analyzes of the prevalence of different nutritional risk score according to NRS 2002, either adults or elderly as in relation to the nutritional status stratified in eutrophic, malnutrition and overweight/obesity, by the test chi-square, there were no significant statistical differences with p>0.05.

Table 3. Distribution of the nutritional status according to the Body Mass Index in adults and elderly

BMI	Total ^b		Adults (n=11)		Elderly (n=30)	
	n	%	n	%	n	%
Eutrophic	18	44	7	64	11	37
Malnutrition	17	41	2	18	15	50
Overweight	1	3	1	9	-	-
Obesity	5	12	1	9	4	13

Captions: BMI = Body Mass Index; n = number of patients; b = p>0.05 (chi-square).

The average prescription of the total protein for adult patients was 1.66±0.39g ptn/kg of weight and, for elderly patients, 1.5±0.21g ptn/kg of weight. The average protein prescribed for malnourished patients was 1.44±0.31g ptn/kg of weight, for the eutrophic, it was 1.57±0.27g ptn/kg of weight, for the obese, it was 1.52±0.25g ptn/kg of weight and for the only patient with overweight, it was 1.4g ptn/kg of weight.

When it was evaluated the protein prescription in the group of adult and elderly patients by the BMI, the prescribed average for eutrophic adults was 1.55±0.39g ptn/kg, for the malnourished, it was 2.1±0.28g ptn/kg, for overweight, it was 1.4g ptn/kg and for the obese, 1.8g ptn/kg. For the malnourished elderly, it was 1.4±0.22g ptn/kg, for the eutrophic, 1.57±0.17g ptn/kg and for the obese, it was 1.5±0.25g ptn/kg (Table 4).

Table 4. Grams of protein prescribed according to the Body Mass Index for adults and elderly

Nutritional status per BMI	Adults (n=11)		Elderly (n=30)	
	n	g ptn/kg (mean/SD) ^c	n	g ptn/kg (mean/SD) ^c
Eutrophic	7	1.55 + 0.39	11	1.57 + 0.17
Malnutrition	2	2.1 + 0.28	15	1.4 + 0.22
Overweight	1	1.4	-	-
Obesity	1	1.8	4	1.5 + 0.25

Captions: BMI = Body Mass Index; n = number of patients; g ptn/kg = prescribed gram of protein per kg; SD = standard deviation; c = p>0.05 (t of student).

When comparing grams of protein according to BMI in adults and elderly and within each nutritional status range, with the application of test t of *student*, the quantitative differences observed were not statistically significant, basically because of the reduced number of cases in each stratified group with p>0.05.

The total of the patients receiving the prescription of protein quantity in kg/weight following the scientific literature for adults was 100% (n=30), without significant statistic difference, chi-square, p=0.09.

DISCUSSION

The present study identified that 54% of the patients were female and 46%, males with prevalence of elderly. As described by Soares et al.¹⁷, the incidence of cancer increases considerably with age, most likely because, while aging, there is an accumulation of risk factors for some specific types of cancer associated to the tendency of reduced efficacy of mechanisms of cellular rejuvenation in the elderly.

Of the sample studied, the higher frequency of tumors encountered was in the lungs for males and in the breast for females, consistent with the data of "Instituto Nacional de Câncer José Alencar Gomes da Silva (INCA)²⁸", where it is affirmed that, for males, lung cancer is more prevalent and for females, breast cancer prevails.

Lung cancer is the second most common for males in Brazil and the first in the world since 1985, either for incidence or for mortality, with an estimate of 18,740 new cases in 2018¹⁸. In 90% of the cases diagnosed, lung cancer is associated to tobacco by-products. Highly lethal, the total accumulated mean survival in 5 years, ranges between 13% and 21% in developed countries and between 7% and 10%, in the countries in development. In the end of the 20th century, lung cancer became one the main causes of avoidable deaths¹⁸.

Still, according to INCA¹⁹, breast cancer is the most common type for females in Brazil and in the world, after the non-melanoma skin, responsible for about 28% of new cases at each year, with an estimate of 59,700 new cases in Brazil in 2018. Relatively rare before 35 years, above this age, its incidence grows progressively, especially after 50 years old. Statistics indicate increase of its incidence both in developed or in development countries.

Score 3 was the most predominant grade encountered, which is a corroboration of the fact that NRS 2002 is based in the severity of the disease and in the age adjusted for patients older than 70 years, in addition to weight loss, food intake and BMI²⁰.

In the sample studied the nutritional status most prevalent was eutrophy (44%), followed by malnourishment (39%). According to a Ferreira et al.²¹ study, malnourishment is a frequent complication in patients with cancer, associated to diminishing response to specific antineoplastic treatment, deterioration of the quality of life, major risk of infections, extension of length hospital stay and morbimortality. It is common to see malnourishment in hospitalized individuals, it is three-fold more frequent in patients with cancer, in comparison to those who do not have this diagnosis, which suggests that the disease, *per se*, causes damages in the nutritional status during hospitalization²¹.

The gram of protein prescribed for senior patients was within the recommendations suggested by INCA²² for oncologic patients: without stress: from 1.0 to 1.2 g ptn/kg of current/day weight (maintenance), minor stress: from 1.2 to 1.5 g ptn/kg of current/day weight (acute or chronic disease) and moderate or severe stress: from 1.5 to 2.0 g ptn/kg of current/day weight (severe disease, or aggression and malnourishment).

Among adult patients, 91% were supplied with prescribed grams of protein within INCA recommendations²²: 1.5 to 2.0 g ptn/kg of current weight/day. In this group of adult patients, the obese (n=1; 9%) had protein prescription below the references (>2.0 g/kg/day of ideal weight for individuals with BMI between 30 and 40 kg/m² and ≥ 2.5 g/kg of ideal weight for BMI > 40 kg/m²) according to the guidelines of *American Society for Parenteral and Enteral Nutrition* (Aspen)²³, probably because of the absence of nutritional module to be utilized in the unit.

The present study has limitations, this needs to be highlighted, in relation to the weight utilized for nutritional calculations, since the estimated weight is subjective and, consequently, the variable BMI is underestimated as well (estimated weight and height). It is recommended that the weight utilized for the calculations of nutritional therapy is, whenever possible, the current weight (measured by the scale). Furthermore, the utilization of the nutritional module of the protein is determinant for the proper supply of full protein intake in obese.

CONCLUSION

The results of this study reinforce the importance of the evaluation and nutritional follow up in clinical practice, as well as the adequacy of protein intake per kg of current weight according to the nutritional status and the severity of the baseline disease. The malignancy of the disease, the age and the presence of nutritional risk suggest a more consistent necessity of increasing the amount of nutritional intake in order to lessen this comorbidity in the progression of the treatment. It is clear also the need to utilize protein modules to adjust the nutritional prescription mainly in obese patients and the nutritional screening NRS 2002, plus a subsequent new screening at regular time intervals to verify the variation of nutritional risk scores as support to the adequacy of nutritional conducts.

CONTRIBUTIONS

Gradzielle Polito Villardo, Nara Lucia Andrade Lopes Segadilha and Eduardo Eiras Moreira da Rocha contributed equally to the conception and design of the research, to the analysis and interpretation of the data, to the wording and critical review of the manuscript with intellectual input and final approval of the version for publication.

DECLARATION OF CONFLICT OF INTERESTS

There are no conflict of interests to declare.

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