Nutrición Hospitalaria

Nutr Hosp. 2014;29(4):907-912
ISSN 0212-1611 • CODEN NUHOEQ
S.V.R. 318

Original / *Cáncer*

Dietary intake and nutritional status in cancer patients: comparing adults and older adults

Henyse Gómez Valiente da Silva, Camila Fonseca de Andrade and Annie Seixas Bello Moreira

Universidade do Estado de Rio de Janeiro-UERJ. Brazil.

Abstract

Objective: **Evaluate the nutrient intake and nutritional status of food in cancer patients admitted to a university hospital, with comparison of adult and older adult age category**

Methods: **Cross-sectional study. This study involved cancer patients admitted to a hospital in 2010. Dietary habits were collected using a Brazilian food frequency questionnaire. Participants were divided in two groups: adults or older adults and in 4-cancer category: hematologic, lung, gastrointestinal and others. Body Mass Index evaluated nutritional status.**

Results: **A total of 86 patients with a mean age of 56.5 years, with 55% males and 42% older adults were evaluated. The older adult category had a higher frequency of being underweight (24.4% *vs* 16.3%, p < 0.01) and a lower frequency of being overweight (7% vs. 15.1%, p < 0.01) than adults. Both, adult and older adults had a high frequency of smoking, alcohol consumption and physical inactivity. The older adults had lower consumption of calories, intake of iron and folic acid. Inadequacy of vitamin intake was observed in both groups; respectively, 52%, 43%, 95%, 76% and 88% for Vitamin A, C, D, E and folic acid. The older adults had a higher folic acid and calcium inadequacy than the adults (97% *vs* 82%, p <0.01; 88% *vs* 72%, p < 0.01). There was no association of micronutrient intake with cancer, nor with nutritional status.**

Conclusion: **The food intake, macro and micronutrients ingestion is insufficient among cancer individuals. Food intake of older adults was inferior, when compared to the adult category. There was a high prevalence of BMI excess in the adult group and a worst nutritional status in the older adult category.**

(*Nutr Hosp.* 2014;29:907-912)

DOI:10.3305/nh.2014.29.4.7131

Key words: *Diet. Cancer. Lifestyle habits. Nutritional status. Older adults.*

Correspondence: Henyse Gomes Valente da Silva.
Universidade do Estado de Rio de Janeiro-UERJ.
Brazil.
E-mail: henyse@uol.com.br

Recibido: 12-XI-2013.
Aceptado: 18-XII-2013.

INGESTA DIETÉTICA Y ESTADO NUTRICIONAL EN PACIENTES CON CÁNCER: COMPARACIÓN ENTRE ADULTOS Y ADULTOS MAYORES

Resumen

Objetivo: **Evaluar la ingesta de nutrientes y el estado nutricional de los alimentos en pacientes con cáncer ingresados en un hospital universitario, comparando por categoría de edad entre adulto y adulto mayor.**

Métodos: **Estudio transversal. Este estudio incluía pacientes cancerosos ingresados en un hospital en 2010. Se recogieron los hábitos dietéticos mediante un cuestionario brasileño de frecuencia de alimentos. Se dividieron los participantes en dos grupos: adultos y adultos mayores y en 4 categorías de cáncer: hematológico, pulmonar, gastrointestinal y otros. El estado nutricional se evaluó con el índice de masa corporal.**

Resultados: **Se evaluó a un total de 86 pacientes con una edad promedio de 56,5 años, siendo el 55 % varones y el 42 % adultos mayores. La categoría de adultos mayores tenía con mayor frecuencia peso bajo (24,4 % frente a 16,3 %, p < 0,01) y una menor frecuencia de sobrepeso (7 % frente a 15,1 %, p < 0,01) que los adultos. En ambos grupos había una frecuencia elevada de fumadores, consumo de alcohol e inactividad física. Los adultos mayores tenían un menor consumo de calorías, ingesta de hierro y ácido fólico. Se observó una ingesta inadecuada de vitaminas en ambos grupos; respectivamente, 52 %, 43 %, 95 %, 76 % y 88 % para las vitaminas A, C, D, E y el ácido fólico. Los adultos mayores tenían más ingesta inadecuada de ácido fólico y calcio que los adultos (97 % frente a 82 %, p < 0,01; 88 % frente a 72 %, p < 0,01). No hubo una asociación entre la ingesta de micronutrientes con el cáncer ni con el estado nutritivo.**

Conclusión: **La ingesta de alimentos y de macro y micronutrientes es insuficiente en los individuos con cáncer. La ingesta de alimentos en adultos mayores fue menor en comparación con los adultos. Hubo una prevalencia elevada de IMC excesivo en el grupo de adultos y un peor estado nutricional en la categoría de adultos mayores.**

(*Nutr Hosp.* 2014;29:907-912)

DOI:10.3305/nh.2014.29.4.7131

Palabras clave: *Dieta. Cáncer. Hábitos de vida. Estado nutricional. Adultos mayores.*

Introduction

The etiology of cancer is multifactorial. Factors involved include the dietary habits and its composition, age and nutritional status. Diet can have both, positive or negative carcinogenic effects on some types of cancer[1].

Current evidence suggests that high consumption of red meat and protein are associated with increased colorectal cancer[2,3]. Factors, associated with a lower cancer incidence, were high intake of fish, fruit, vegetables and whole grains[4-6]. Factors regarding adequate consumption of vitamin D and dietary fiber are not as well established with lower risks of cancer[7,8].

Age is another risk factor. Average age of cancer is 65 years or older and median age of most common adult tumors is 70 years[9,10]. The scientists are studying the basic molecular and cellular processes of aging on the mechanisms of tumor development and growth, but, currently, has not been completely defined.

Nutritional status is also an important factor in the cancer growth and development. Malnutrition and obesity have distinct implications, with the potential of a negative prognosis in cancer[11-13]. In the older adults, this problem is aggravated since malnutrition is found to be a common problem at hospital admissions depending on the methods used and the disease, itself.[14]

The objective of this study was to analyze the food intake and consumption of macro and micronutrients, as well as nutritional status, in an inpatient cancer group, comparing adults and older adults.

Methodology

This cross-sectional study included in patients with different cancer diagnosis, independent of disease length. Patients were admitted to a university hospital in Rio de Janeiro, Brazil, during the second semester of 2010. All patients were evaluated according to dietary habits and nutritional status, within the first 48 hours of admission. The inclusion criteria were patients >20 years of age, both genders, with a diagnosis of cancer. Age > 60 year was considered old adult. The exclusion criteria was pregnancy and lactation. The hospital's Research Ethics Committee (Protocol 1754/08) approved this criteria.

Dietary Assessment

This assessment was based on a semi-quantitative, interviewer-administered food frequency questionnaire (FFQ) with 82 food items[15,16]. The results were described according to qualitative and quantitative food groups, and intake of macro and micronutrients. The DIET PRO software version 4.011 was used for diet analysis[17].

This survey evaluated total energy intake, consumption of carbohydrates, proteins and lipids (saturated, polyunsaturated and monounsaturated fats). In addition to cholesterol, vitamins A, C, D, E, fiber, iron, calcium and folic acid were also analyzed.

The food groups were analyzed and compared with the Adapted Food Pyramid for the Brazilian population[18], dividing consumption by food groups and average quantities of consumption per group.

Consumption was also dichotomized into adequate/inadequate. Adequate groups were three to five servings' fruit (400 g), four to five servings' vegetables (150-200 g), three portions (400-600 g) of milk and dairy products, one to two servings (100-200 g) meat and eggs.

The Dietary Reference Intake[19] was used to evaluate intake of micronutrients in relation to age and sex. In relation to vitamins, levels less than 625 or 500 mcg for Vitamin A, and 75 mg or 60 mg for Vitamin C, respectively, for men and women were considered low. Vitamin D, E and folic acid was considered low in both sexes if levels were lower than 10 mcg, 12 mcg and 320 mcg, respectively. Regarding minerals, calcium intake was defined as lower if levels were less than 1,000 mg to 1300mg for adults and older adults;

Iron levels were considered low if level was less than 5 mg to 6 mg for men and women, respectively, and Selenium consumption level was less than 45 mcg.

Other data related to lifestyle risk, such as physical activity, smoking and alcohol consumption was also collected and analyzed. Patients were considered sedentary if they exercised less than 30 minutes a week. Regarding smoking, patients were classified as smokers or non-smokers; and alcoholism was characterized as frequent alcohol consumption or not at all, according to self-declaration.

Nutritional Assessment

Weight and height were determined with a mechanic scale (Fillizola®) with maximum capacity being 150 kg and accuracy of 0.1 kg. Based on this data calculated the Body Mass Index (BMI), dividing the weight by the square of the height (kg/m^2) and nutritional status was classified according to the World Health Organization criteria (WHO, 1998)[20] Adult criteria was as follows: BMI (kg/m^2) < 18.5 = Underweight; 18.5 ≤ BMI ≤ 24.9 = Normal; 25 ≤ BMI ≤ 29.9 = Overweight; BMI ≥ 30 = Obesity. For older adult BMI Lipschitz[21] was used: BMI ≤ 22 = Under-nutrition; 22 < BMI < 27 = Normal; BMI ≥ 27= Overweight.

Statistical Analysis

Descriptive analysis used average values, standard error and standard frequency. The Kolmogorov-Smirnov test used to assess normality. For variables with normal distribution, the Student t test was used. Variables without normal distribution used the Mann

Whitney test to compare older adults and adults. Quantitative variables were transformed into dichotomous variables (normal or below the recommendation) and the chi-square test was used to assess differences in relation to inadequate micronutrient adults and older adults. The software used was SPSS13 version 21.0. p value < 0.05 considered significant.

Results

Inpatients evaluated equaled 86 (39 woman and 47 men), with the mean age of 56.5 y, 42% were older adults. Regarding gender, 55% (n = 47) were male. The most common type of cancer was hematologic (23.3%), followed by lung (22.1%), gastrointestinal tract (25.6%) and other types (i.e. prostate and breast). Table I shows the characteristics of cancer patients, stratified by age: adults and older adults.

Table II characterizes the lifestyle risk, gender and type of tumor in the older adults and the adults with cancer. Although, there was no difference between the two age groups, a high smoking frequency (41%), alcohol consumption (29%) and physical inactivity (41%) was found in, both, adult and older adult categories.

In relation to the recommendations of the food pyramid, 70% resulted in an insufficient intake of fruits (average intake: 345 ± 317 g) and 64% of vegetables (average intake of 160 ± 130.2 g). Regarding the consumption of milk and dairy products, 84% consumed lower than the recommended amount of 400-600 ml. No difference was found in food intake insufficiencies between adult and older adults.

Regarding the macronutrient and fiber, both age groups consumed normal carbohydrate proportion (55.6%), protein (18%) and fat (27%), but there was an important inadequacy of fat composition, especially monounsaturated (6.5%) and polyunsaturated (4%) (table III), was identified. The adult group consumed a higher caloric intake than the older adults did (p = 0.023). More than 50% consumed less fiber than the recommended 30 g/day, with the mean ingestion being 20 g/day. More severe cases were identified among the older adults. (p = 0.054)

A comparison of micronutrients and mineral ingestion between adults and older adults is identified in table IV. Iron was the only mineral significantly less consumed by older adults than by adults (13.8 ± 1.6 *vs* 19.1 ± 1.4, p = 0.014).

When evaluating the dietary recommendation, both categories consumed less than the suggested amount. A minimal number of patients attained the vitamin D recommendation. No significant difference between the two groups was noticed, with the exception being, the consumption of folate and calcium was less in the older adult group. Folate (91.5% older adults inadequacy × 72% adult inadequacy, p = 0.024) and calcium (88% older adults inadequacy × 72% adult inadequacy, p = 0.049).

Table I
Characteristics of the cancer patients: differences between adults and older adults

Characteristics	*Adults Means ± SD*	*Older adults Means ± SD*	*p*
Age (year)	45.5 ± 1.6	71.9 ± 1.2	0.001
Weight (kg)	59.8 ± 12.2	58.2 ± 16.3	0.661
Height (m)	1.7 ± 0.1	1.6 ± 0.1	0.004
BMI (kg/m^2)	21.5 ± 0.6	22.1 ± 0.8	0.538

BMI = Body mass index, SD = Standard Deviation, p = T test.

Table II
Differences in the prevalence of male gender, tumor type, physical inactivity, smoking and alcohol habits, according to age category

Characteristics	*Adults % (n)*	*Older adults % (n)*	*p*
Male	58 (29)	50 (18)	0.303
Tumor type			
Hematologic	30 (15)	14 (5)	0.333
Lung	18 (15)	28 (10)	
Gastrointestinal	24 (12)	28 (10)	
Other	28 (14)	30 (11)	
Physical inactivity	21 (42)	14 (38)	0.772
Smoking	19 (38)	16 (44)	0.548
Alcohol habits	15 (30)	10 (28)	0.823

n = patient number. Chi-square test.

Table III
Macronutrient intake: differences between adult and older adults

Macronutrients	*Adults Means ± SD*	*Older adults Means ± SD*	*p*
Energy intake (kcal)	2379.7 ± 160.6	1855.1 ± 145.5	**.023**
Carbohydrate (% energy)	54.3 ± 1.4	53.2 ± 1.6	.603
Protein (% energy)	18 ± 0.7	20.6 ± 1.2	.070
Fat (% energy)	27.8 ± 1.1	26.3 ± 1.3	.393
Saturated Fat (g)	7.4 ± 0.5	6.5 ± 0.5	.202
Monounsaturated Fat (g)	6.5 ± 0.7	5.9 ± 0.6	.586
Polyunsaturated Fat (g)	4.1 ± 0.5	3.6 ± 0.4	.475
Cholesterol (mg)	273.9 ± 35.9	198.7 ± 18.8	.067
Fiber (g/d)	23.0 ± 2.6	16.9 ± 1.7	**.054**

SD = Standard Deviation. p = *T* test.

The inadequacies of micronutrient intake was not associated with either cancer types or nutritional status (data not shown).

Regarding nutritional status, 32% have normal BMI, 40.7% underweight and 22.1% overweight. BMI did not differ from adults to older adult patients (table I), as indicated in figure 1, the older adults had a higher frequency of lower weight than in the adult group (58.3 % *vs* 28%, p = 0.018).

Table IV
Macronutrient intake: differences between adult and older adults

Macronutrients	*Adults Means ± SD*	*Older adults Means ± SD*	*p*
Vitamin A (UI)	1076.6 ± 158.6	1021.0 ± 207.5	0.668
Vitamin C (mg)	392.1 ± 92.9	207.8 ± 43.3	0.840
Vitamin D (UI)	2.2 ± 0.42	11.6 ± 7.1	0.703
Vitamin E (UI)	13.0 ± 1.77	9.2 ± 1.4	0.122
Folic acid (mcg)	233.9 ± 27.9	164.0 ± 18.4	0.237
Selenium (mcg)	107.9 ± 13.6	80.5 ± 10.2	0.349
Iron (mg)	19.1 ± 1.6	13.8 ± 1.4	**0.014**
Calcium (mg)	741.9 ± 73.5	643.3 ± 72.9	0.381

SD = Standard Deviation, p = *T* test.

When stratifying the population, according to the types of cancer (hematologic, lung and gastrointestinal tract), there was no difference in nutritional status. However, in patients diagnosed with hematological cancer, a higher BMI (23.51 ± 4.3 kg/m^2) was found than in those with lung cancer (19.78 ± 3.47 kg/m^2, p = 0.012).

Discussion

Food intake and nutrition have different meanings. The meal involves social, emotional and economics aspects. It is known that food intake has several errors, not only in Brazil, but worldwide[20,22]. These errors lead to several chronic diseases, including cancer[23], with an increased prevalence in older adults[24,25].

Age is another concern. A transition from independence to disability, noticed in older adults, modified body composition and impaired physical activity resulted in weight loss, decrease in food intake and nutritional change[26]. This study concluded there was a high male and older adult prevalence, as previously presented by Azevedo CD[27] and Ulsenheimer A[28].

The most prevalent cancer was hematological, pulmonary and gastrointestinal, different from a Brazilian study conducted by INCA that defined skin, prostate and breast cancer as the most prevalent. This difference was justified by the source of patients, as it evaluated in a tertiary university hospital, involving serious cases.

Analysis of the food consumption indicated a low percentage of milk and dairy product intake, lower than the dietary recommendation (DRI). The association between low milk intake and colorectal, prostate and bladder cancer has already been demonstrated[29-31].

Vogtmann E et al[32] studied 60.000 men, from ages 40 to 74, and identified an inverse relation between fruit intake and colon cancer. Epplein M et al[33], confirmed the protective effect of fruit in cancer prevention, described the same association. Vegetable consumption seemed to reduce IGF-1 levels because they are richness in micronutrients, such as vitamins, therefore, reducing cancer risk[34]. A low consumption of fruit and vegetable was identified.

Meat intake was elevated, while a lower consumption of fish was observed. Steffen A et al[35] has already observed a higher intake of processed meat is positively associated with upper digestive tract, as well as Norat T et al[36], verifying this association in colon cancer. Other authors have made the same observation[23,37]. All these statistics discount the Mediterranean diet, that has been known to establish protection against several diseases, including cancer[4,38]. The diet of fruits, vegetables, olive oil and fishes emphasized in the Mediterranean diet. It is important to observe that what is chosen in our alimentation can define our life quality and health. The older adults made the same mistakes in selecting their diet intake as the adult category.

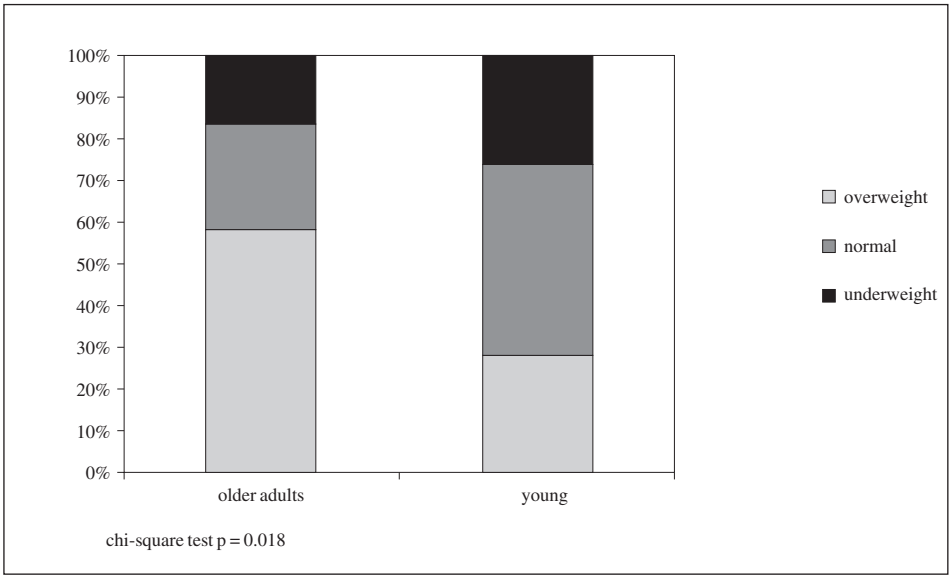

Fig. 1.—Stratification of participants according to BMI classification: overweight, normal or obesity, comparing adults and old adults.

Dietary composition was also inadequate in both groups, with older adults being inferior to the adult category, consuming fewer calories, carbohydrates and lipids. The imbalance was observed in both macro and micronutrients. Carbohydrates and lipids were adequately consumed according to dietary recommendation, although, the lipids composition was not. A high consumption of saturated lipids and low level of polyunsaturated lipids was observed. The Mediterranean diet emphasizes olive oil, rich in monounsaturated lipids, as a tumor protectant factor regulating the oncogenesis[38,39].

There was a high protein intake based on DRI, justified by the high meat intake. Ali A et al[40], demonstrated that a high protein intake allied to higher consumption of carbohydrate are associated with increased risk of Non-Hodgkin's Lymphoma, whereas a significantly reduced risk was observed with higher intake of vegetables.

Epidemiological and clinical studies demonstrate that a recommended intake of dietary fiber and whole grain is inversely related to obesity, type two diabetes, cardiovascular disease and cancer[41-43]. Although most studies demonstrate this association, no evidence of an inverse association between fiber and cancer in any subgroup defined by age was found. Hutter CM[44] et al found no association, either.

Additional studies did not confirm the link. A prospective study of 16,448 U.S. men found no association between the dietary intake of total cereal or vegetable fiber and colorectal adenomas, although, a slight reduction in risk was observed with increased fruit fiber intake.[7] we attempted to justify this difference by the lower fiber consumption, according to DRI.

Some micronutrients were poorly consumed, specifically, vitamin A, C, D and E. Several studies exhibited a protective effect of some vitamins in the carcinogenesis[45-47]. IN a review study, Welsh J et al[48] demonstrated that Vitamin D supplementation reduced colon, prostate and breast cancer.

Calcium intake was, also, deficient in both groups. Nevertheless, the older adult diet was lacking more minerals than the adult group. Azevedo DC et al[27] established the wrong pattern, identifying a low calcium intake among cancer patients. Galas A et al[49] confirmed the effect of high doses of dietary calcium against the risk of colon cancer depended on the level of dietary fiber, suggesting a modified modification effect of calcium and fiber on the carcinogenesis.

Comparing folate intake in the two age categories, our observation found the older adult consumption was lower than adult group, although, both groups consumed an insufficient amount. According to Carraro S et al[34] a folate-rich diet could have the effect of lowering circulating IGF-1 levels in older adult women and, consequently, reducing rates of some cancer types and reducing all causes of mortality.

Evaluating nutritional status based on Body Mass index, although cancer leads to a high metabolism, we determined a high percentage of overweight/obesity patients. This can be justified by the epidemic of obesity, not only in Brazil, but worldwide. Similar results reported in additional studies[27,50].

Evaluating the influence of age in the anthropometric data, older adults have a lower weight than adults, as well as, lower body mass index excess. Older adults have an inferior nutritional status than adults. Many reasons for malnutrition exist in the older adults, leading to sarcopenia and cachexia. The prevalence of protein-energy malnutrition increases with age and the number of comorbidities[10,51].

Associating BMI and cancer category, no difference in the nutritional status in the three cancer types (hematological, pulmonary or digestive) was found. However, hematological disease was associated with higher BMI than pulmonary, in both groups. Uehara C et al[52] have demonstrated similar results. Other studies have shown different results, associating malnutrition with hematological disease[53].

Limitations were found in our study since we had no verification of longevity of the disease or weight loss data, in addition to having a small convenience sample.

Conclusions

Food intake and consumption of macro and micronutrients was inadequate in this population.

Comparing adults with older adults, the older adult category had a lower intake than the former, as well as, an inferior nutritional status.

In our study, association among diet and cancer types was not identified.

References

1. Gonzalez CA, Riboli E. Diet and cancer prevention: contributions from the European Prospective Investigation into Cancer and Nutrition (EPIC) study. *Eur J Cancer* 2010; 46 (14): 2555-62.
2. Vargas AJ, Thompson PA. Diet and nutrient factors in colorectal cancer risk. *Nutr Clin Pract* 2012; 27 (5): 613-23.
3. Richman EL. Intakes of meat, fish, poultry, and eggs and risk of prostate cancer progression1. *Am J Clin Nutr* 2010; 91(3): 712–21.
4. La Vecchia C et al. Nutrition and health: epidemiology of diet, cancer and cardiovascular disease in Italy. *Nutr Metab Cardiovasc Dis* 2001; 11 (4):10-5.
5. Vogtmann E et al. Fruit and vegetable intake and the risk of colorectal cancer: results from the Shanghai Men's Health Study. Cancer Causes Control 2013. [Epub ahead of print]
6. Bosetti C et al. The role of Mediterranean diet on the risk of pancreatic cancer. *Br J Cancer* 2013; 109 (5): 1360-6.
7. Platz EA, Giovannucci E, Rimm EB, Rockett HR, Stampfer MJ et al. Dietary fiber and distal colorectal adenoma in men. *Cancer Epidemiol Biomarkers Prev* 1997; 6 (9): 661-70.
8. Welsh J et al. Cellular and molecular effects of vitamin D on carcinogenesis. *Arch Biochem Biophys* 2012; 523 (1): 107-14.
9. Jensen GL, et al. Screening for hospitalization and nutritional risks among community-dwelling older persons. *Am J Clin Nutr* 2001; 74: 201-5.
10. Azad N, et al. Nutrition survey in an elderly population following admission to a tertiary care hospital. *Can Med Assoc J* 1999; 161: 511-5.

11. Dias do Prado C, Alvares Duarte Bonini Campos J. Nutritional status of patients with gastrointestinal cancer receiving care in a public hospital; 2010-2011. *Nutr Hosp* 2013 Mar-Apr; 28 (2): 405-11.
12. Valenzuela-Landaeta K, Rojas P, Basfi-fer K. Nutritional assessment for cancer patient. *Nutr Hosp* 2012; 27 (2): 516-23.
13. Ramos Chaves M, Boléo-Tomé C, Monteiro-Grillo, Camilo M, Ravasco P. The diversity of nutritional status in cancer: new insights. *Oncologist* 2010; 15 (5): 523-30.
14. Reyes JG, Zuniga AS, Cruz MG. Prevalence of hypo nutrition in the elderly at admission to the hospital. *Nutr Hosp* 2007; 22 (6): 702-9.
15. Willett WC. Food-frequency methods. In: Willett WC, editor. Nutritional Epidemiology. 2nd. New York: Oxford University Press; 1998. pp. 74-100.
16. Ribeiro AC, Sávio KEO, Rodrigues MLCF, Costa THM, Schimitz BAS. Validation of a food frequency questionnaire for the adult population. *Rev Nutr* 2006; 19 (5): 553-62.
17. www.dietpro.com.br. 19/05/2004.
18. Philippi ST, Latterza AR, Cruz ATR, Ribeiro LC. Pirâmide alimentar adaptada: guia para escolha dos alimentos. *Rev. Nutr* 1999; 12 (1): 65-80.
19. Available from: http://iom.edu/Activities/Nutrition/SummaryDRIs. Institute of Medicine Dietary Reference Intakes. National Academy Press. Washington, DC: 1997.
20. World Health Organization (WHO). Obesity: preventing and managing the Global Epidemic: Report of a WHO Consultation on Obesity. Geneva, Switzerland: WHO, 1998.
21. Lipschitz DA. Screening for nutritional status in the elderly. *Prim Care* 1994; 22: 55-67.
22. Salomon JA, et al. Healthy life expectancy for 187 countries, 1990-2010: a systematic analysis for the Global Burden Disease Study 2010. L*ancet* 2012; 380 (9859): 2144-62.
23. Rolão A, Monteiro-Grillo I, Camilo ME, Ravasco P. What is the nutrition and lifestyle profile in oncology patient? Cross-sectional study]. *Acta Med Port* 201; 24 (Supl.) 2: 113-22.
24. Ward BW, Schiller JS. Prevalence of multiple chronic conditions among US adults: estimates from the National Health Interview Survey, 2010. *Prev Chronic Dis*. 2013; 10:E65. doi: 10.5888/pcd10.120203.
25. Purim O, Gordon N, Brenner B. Cancer of the colon and rectum: potential effects of sex-age interactions on incidence and outcome. *Med Sci Monit* 2013 20; 19: 203-9
26. Inzitari M, et al. Nutrition in the age-related disablement process. *J Nutr Health Aging* 2011; 15 (8): 599-604.
27. Azevedo CD, Bosco SMD. Perfil nutricional, dietético e qualidade de vida de pacientes em tratamento quimioterápico. *Conscientiae saúde* 2011; 10 (1): 23-30.
28. Ulsenheimer A, Silva ACP, Fortuna FV. Perfil nutricional de pacientes com câncer segundo diferentes indicadores de avaliação. Rev Bras Nutr *Clín* 2007; 22 (4): 292-7.
29. Lampe JW. Dairy products and cancer. *J Am Coll Nutr* 2011 out; 30 (5): 464S-70S.
30. Li F et al. Milk and dairy consumption and risk of bladder cancer: a meta-analysis. *Urology* 2011; 78 (6): 1298-305.
31. Aune D et al. Dairy products and colorectal cancer risk: a systematic review and meta-analysis of cohort studies. *Ann Oncol* 2012; 23 (1): 37-45.
32. Vogtmann E, Xiang YB, Li HL, Levitan EB, Yang G et al. Fruit and vegetable intake and the risk of colorectal cancer: results from the Shanghai Men's Health Study. *Cancer Causes Control* 2013; 24 (11): 1935-45
33. Epplein M et al. Fruit and vegetable consumption and risk of distal gastric cancer in the Shanghai Women's and Men's Health studies. *Am J Epidemiol* 2010 15; 172 (4): 397-406.
34. Carraro S et al. Association between dietary folate intake and serum insulin-like growth factor-1 levels in healthy old women. *Growth Hormone IGF Res*. 2013.
35. Steffen A et al. Meat and heme iron intake and risk of squamous cell carcinoma of the upper aero-digestive tract in the European Prospective Investigation into Cancer and Nutrition (EPIC). *Cancer Epidemiol Biomarkers Prev* 2012; 21 (12): 2138-48.
36. Norat T, Bingham S. Meat, fish, and colorectal cancer risk: the European Prospective Investigation into cancer and nutrition. *J Natl Cancer Inst* 2005; 97 (12): 906-16.
37. Daniel CR et al. Prospective investigation of poultry and fish intake in relation to cancer risk. *Cancer Prev Res (Phila)* 2011; 4 (11): 1903-11.
38. Fernández E, Gallus S, La Vecchia C. Nutrition and cancer risk: an overview. *J Br Menopause Soc* 2006; 12 (4): 139-42.
39. Stephenson JÁ, Al-Taan O, Arshad A, Morgan B, Metcalfe MS, Dennilson AR. The multifaceted effects of omega-3 polyunsaturated Fatty acids on the hallmarks of cancer. *J Lipids* 2013; 2013: 261247.
40. Ali A et al. Dietary and Lifestyle Factors and Risk of Non-Hodgkin's Lymphoma in Oman. *Asian Pac J Cancer Prev* 2013; 14 (2): 841-8.
41. Kaczmarczyk MM, Miller MJ, Freund GG. The health benefits of dietary fiber: beyond the usual suspects of type 2 diabetes mellitus, cardiovascular disease and colon cancer. *Metabolism* 2012; 61 (8): 1058-66.
42. Lattimer JM, Haub MD. Effects of dietary fiber and its components on metabolic health. *Nutrients* 2010; 2 (12): 1266-89.
43. Russnes KM et al. Total antioxidant intake in relation to prostate cancer incidence in the health professionals follow up study. *Int J Cancer* 2013; 19. [Epub ahead of print].
44. Hutter CM et al. Characterization of gene-environment interactions for colorectal cancer susceptibility loci. *Cancer Res*. 2012; 72 (8): 2036-44.
45. Xu X et al. Dietary intake of vitamins A, C, and E and the risk of colorectal adenoma: a meta-analysis of observational studies. *Eur J Cancer Prev* 2013; 22 (6): 529-39.
46. Bassett JK et al. Dietary intake of B vitamins, methionine, and colorectal cancer risk. *Nutr Cancer* 2013; 65 (5): 659-67.
47. Gnagnarella P et al. Nutrient intake and nutrient patterns and risk of lung cancer among heavy smokers: results from the COSMOS screening study with annual low-dose CT. *Eur J Epidemiol* 2013; 28 (6): 503-11.
48. Welsh J. Cellular and molecular effects of vitamin D on carcinogenesis. *Arch Biochem Biophys* 2012 Jul 1; 523 (1): 107-14.
49. Galas A, Augustyniak M, Sochacka-Tatara E. Does dietary calcium interact with dietary fiber against colorectal cancer? A case-control study in Central Europe. *Nutr J* 2013; 12 (1): 134.
50. Tarlovsky VF, Salmean GG. Situacion nutricional en pacientes oncologicos internados en un hospital público de la ciudad de Mexico. *Rev Cubana Med* 2008; 47 (2): 1-12.
51. Agarwal E, Miller M, Yaxley A, Isenring E. Malnutrition in the elderly: A narrative review. *Maturitas* 2013. [Epub ahead of print].
52. Uehara C, Santoro Il, Jamnik S. Câncer de pulmão: comparação entre os sexos. *J Pneumologia* 2000; 26 (6): 286-90.
53. Baltazar Luna E et al. Nutritional status in patients first hospital admissions service hematology National Cancer Institute. *Nutr Hosp* 2013; 28 (4): 1259-65.