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Prevalence of nutritional alterations in cancer patients in a third level hospital

Prevalencia de alteraciones nutricionales en pacientes con cáncer en un hospital de Tercer Nivel

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ABSTRACT

Introduction: Patients who are diagnosed with cancer are subjected to different nutritional maladies, such as malnutrition, sarcopenia, and cachexia that have prognostic values.

Objective: The aim of the present study is to evaluate the prevalence of nutritional alterations in subjects with cancer.

Methods: The study has a cross-sectional design. Adult volunteers of both sexes were recruited and then underwent medical and nutritional assessments at the ambulatory oncology service. Diagnoses of sarcopenia and cachexia were made according to international criteria.

Results: A total of 119 subjects were recruited, 57.1% were women. The mean age was 55.9 ± 14.2 years, and the mean body mass index was 25.0 ± 4.88 kg/m^2. Of the total population studied, 25.2% had breast cancer, 17.6% gastrointestinal cancer, and 16.8% hematologic cancer and other neoplasms. According to the WHO guidelines for body mass index, 14% of subjects were underweight, 40% had normal weight, 30% were overweight and 16% were obese. The prevalence of sarcopenia was 26.1%; we observed that male volunteers had a higher risk of presenting sarcopenia [OR 13.1 (IC 95% 4.5-37.9, p<0.001)] and 47.6% of those subjects had gastrointestinal cancer [OR 3.3 (IC 95% 1.3-8.9, p<0.05)]. Finally, 12% of all of the subjects were diagnosed with cachexia.

Conclusion: The prevalence of malnutrition, sarcopenia, and cachexia are high in oncological patients treated in the ambulatory service, especially in men and in those diagnosed with gastrointestinal cancer.

KEYWORDS

Cancer risk, cachexia, obesity, breast cancer, malnutrition

RESUMEN

Introducción: Los pacientes diagnosticados con cáncer son susceptibles a diferentes enfermedades nutricionales, como la desnutrición, la sarcopenia y la caquexia, que tienen valores pronósticos.

Objetivo: El objetivo del presente estudio es evaluar la prevalencia de alteraciones nutricionales en sujetos con cáncer.

Métodos: Se realizó un estudio con diseño transversal. Pacientes adultos de ambos sexos fueron seleccionados y luego fueron sometidos a evaluaciones médicas y nutricionales en el servicio de oncología ambulatoria. Se realizó el diagnóstico nutricional, así como el diagnóstico de sarcopenia o caquexia de acuerdo a criterios internacionales. Resultados: Se incluyeron a un total de 119 sujetos, el 57,1% eran mujeres. La edad fue de 55,9 ± 14,2 años, y el índice de masa cor-

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poral (IMC) promedio fue de 25,0 ± 4,88 kg / m^2. De la población total estudiada, el 25,2% tenía cáncer de mama, el 17,6% de cáncer gastrointestinal y el 16,8% de cáncer hematológico y otras neoplasias. De acuerdo a la clasificación de la OMS, el 14% de los sujetos tenían bajo peso, el 40% tenían peso normal, el 30% tenían sobrepeso y el 16% obesidad. La prevalencia de sarcopenia fue del 26,1%. Se observó que los voluntarios masculinos tenían un mayor riesgo de presentar sarcopenia [OR 13,1 (IC 95% 4,5-37,9, p <0,001)] y 47,6% de estos pacientes tenían cáncer gastrointestinal [OR 3,3 (IC 95% 1,3-8,9) p <0,05] Finalmente, el 12% de todos los sujetos fueron diagnosticados con caquexia.

Conclusión: La prevalencia de malnutrición, sarcopenia y caquexia son altas en pacientes oncológicos atendidos en el servicio ambulatorio, especialmente en hombres y en aquellos diagnosticados con cáncer gastrointestinal.

PALABRAS CLAVE

Riesgo de cáncer, caquexia, obesidad, cáncer de mama, desnutrición.

ABBREVIATIONS

BIA: bioelectrical impedance analysis.

BMI: body mass index.

BUN: blood ureic nitrogen.

cm: centimetres.

CPOD: chronic obstructive pulmonary disease.

dl: decilitres.

EWGSOP: European Working Group on Sarcopenia in Oldeder People.

g: grams.

HDL: high density lipoprotein cholesterol.

Kg: kilogram.

LDL: low density lipoprotein cholesterol.

INTRODUCTION

Cancer disease ranks are the top public health problems in occidental countries, representing the second highest cause of death following cardiovascular diseases. Along with the appearance of cancer, many other metabolic and health complications appear, including inflammation, loss of appetite, changes in hormone levels, anemia and severe weight loss[1,2]. Patients who are diagnosed with cancer are subject to different nutritional maladies such as sarcopenia and cachexia that compromise their quality of life during treatment; therefore, the accurate assessment of nutritional status is of the utmost importance.

The term sarcopenia was initially used to describe the decrease of muscular mass related to aging. It is diagnosed by the presence of muscle loss and decreased muscular strength and physical endurance[3]. In addition to sarcopenia, cachexia is characterized by muscular weight loss that may be accompanied by a decrease in fat mass. Cachexia has been associated with cancer and other diseases, such as chronic obstructive pulmonary disease (CPOD), kidney disease and infectious diseases such as HIV. Muscle depletion is highly associated with infectious complications, a longer hospital stays, a longer duration of ventilation, a longer rehabilitation after discharge and mortality[4].

To achieve a more holistic treatment for cancer, special emphasis must be given to cachexia prevention in order to decrease morbidity and mortality and increase the quality of life after diagnosis[1,2]. It has been established that at least 22% of deaths among patients with neoplasia are a result of malnourishment[4]. Therefore, an accurate and prompt assessment of nutritional status is mandatory.

AIM OF THE STUDY

The aim of the present study is to evaluate the prevalence of nutritional alterations in subjects with cancer that are being treated at a third level hospital.

METHODS

The present study is a cross-sectional and descriptive study that occurred at a third level health facility in Mexico City; the study's duration was 12 months (January to December 2015), and it was approved by the ethics committee of Medica Sur Hospital (2015-EXT-20). Adult subjects of both sexes were recruited and evaluated by the nutrition department of the same hospital; they were informed about the procedures and the objectives of the study as well as asked to sign informed consent.

After recruitment, subjects underwent medical and nutritional assessments at the ambulatory oncology service for anthropometric measurements. Height and weight were reported in duplicate according to the Lohman method. Waist and hip circumferences were measured using a Gullik fiberglass measuring tape (SECA 150 cm); results were reported in centimeters (cm); waist circumference measurements were taken at the middle point between the lowest rib and the highest point of the iliac crest, hip circumference was measured at the widest point of the anterior trochanters, as it is established by the WHO[5]. Body composition was evaluated by bioelectrical impedance analysis (BIA) with a in Body equipment after a 12 hour fast. Body mass index was obtained and used to classify a subjects weight status according to the following classification: underweight (BMI <20 kg/m^2), normal weight (BMI 20 a 24.9 kg/m^2), overweight (BMI 25 a 29.9 kg/m^2) and obesity (BMI >30 kg/m^2).

Dietary assessment was performed by using a food frequency questionnaire validated for Mexican population (SNUT). The results for macro- and micronutrients were used for the results reported in this paper.

Diagnosis of sarcopenia was made by applying the European Working Group on Sarcopenia Older Person algorithm (EWGSOP)[6] that includes the evaluations of a) gait speed, b) muscular strength and c) muscle mass.

a) Gait speed was measured in meter/second (m/sec). Each subject was asked to walk at a normal speed through a 6-meter path; the cutoff point used to indicate a slow pace and a decreased ability to walk was <0.8 m/sec, as suggested by the EWGSOP.

b) Muscular strength was established by measuring the grip strength of the non-dominant hand with an analog and digital dynamometer (Smedley III, model T.K.K. 5401 Grip D). Measurements were taken in triplicate, and the mean of the two highest measurements was obtained. During the test, each subject was asked to stand with their arm extended. Afterwards, they were asked to grip their non-dominant hand as strongly as possible. The cutoff point established by the EGWSOP was applied (< 30 kg for men < 20 kg for women) to indicate low muscular strength.

c) The total amount of muscle mass was evaluated as established earlier and then divided by the square of the subject's height. The cutoff points recommended by the EWGSOP were used[7].

d) Diagnosis of cachexia was made with the presence of three of the following criteria*: BMI*< 20 kg/m^2, lower muscular strength than the normal according to dynamometry, decrease in the fat-free mass assessed by BIA, hemoglobin < 12 g/dl and serum albumin < 3.2 g/dl[1].

Statistical Analysis: The distribution of the data was assessed by the Kolmogorov-Smirnov test; the variables that were not normally distributed were log-transformed. Student T-test was used for independent measurements, and ANOVA was adjusted for sex and age. Qualitative data were assessed using a Chi-squared test; for the odds ratio calculation and confidence interval, a logistic regression was applied using the presence of sarcopenia as the dependent variable. The significance value for p was established at <0.05. Data were analyzed using the SPSS software (version 20.00 SPSS Inc. Chicago. IL).

RESULTS

A total of 119 subjects diagnosed with cancer were recruited; 68 (57.1%) were women, and 51 (42.9%) were men. The age mean was 55.9 ± 14.2 years (**Table I**). Of the total population studied, 30 (25.2%) had breast cancer, 21 (17.6%) had gastrointestinal cancer (colon cancer and rectal cancer, gastric cancer, oesophageal cancer, intestinal cancer, cholangiocarcinoma or liver cancer), 20 (16.8%) had haematologic cancer (lymphoma, multiple myeloma, leukaemia), and 14 (11.8%) had gynaecological cancer. Moreover, 10 (8.4%) subjects were diagnosed with pancreatic cancer, 6 (5.0%) with lung cancer, 5 (4.2%) with prostate cancer and 13 (10.9%) patients were diagnosed with other types of neoplasia (head and neck cancer, thymus, renal, melanoma, glioma, leiomyosarcoma, and astrocytoma). Of all patients recruited, 84% were treated with chemotherapy, 3% were treated with radiotherapy and 13% of the population received both treatments.

Table I. Clinical, anthropometric and metabolic characteristics of patients (n=119).

Age, years	55.9 ± 14.2
Weight, kg	67.6 ± 15.5
BMI, kg/m^2	25.0 ± 4.88
Waist circumference, cm	91.5 ± 12.5
Hip circumference, cm	100 ± 10.0
Arm circumference, cm	28.0 ± 6.26
Fat mass, %	21.4 ± 9.57
Lean mas,%	25.0 ± 6.01
Hemoglobin, g/dL	12.8 ± 1.95
Leucocytes, 10^3/mm^3	5.77 ± 2.00
Glucose, mg/dL	106 ± 28.1
BUN, mg/dL	14.8 ± 22.8
Urea, mg/dL	26.4 ± 10.6
Creatinine, mg/dL	0.75 ± 0.22
Triglycerides, mg/dL	164 ± 84.2
Total cholesterol, mg/dL	192 ± 43.8
HDL cholesterol, mg/dL	46.1 ± 13.2
LDL cholesterol, mg/dL	116 ± 35.3
Total protein, mg/dL	6.49 ± 0.69
Albumin, mg/dL	3.75 ± 0.52
Globulin, mg/dL	2.66 ± 0.65
Intake Calories/kg	29.7 ± 15.6
Intake Protein g/kg	1.07 ± 0.58

Data are expressed as mean ± DE.

According to the WHO guidelines, 14% of subjects were underweight, 40% had normal weight, 30% were overweight and 16% were obese. Regarding muscular strength, 64% of patients who were recruited had decreased grip strength.

The prevalence of sarcopenia was 26.1% (31 patients), 23 men (83.9%) and 5 women (16.1%). After evaluating the clinical, anthropometric and biochemical characteristics of the subjects according to the presence of sarcopenia, we observed a lesser BMI, waist circumference, total cholesterol HDL and LDL (p<0.05) in subjects with sarcopenia. Moreover, these subjects also presented a higher serum glucose concentration, a higher blood ureic nitrogen (BUN), urea, creatinine, potassium, globulin and indirect bilirubin (p<0.05, **Table II).**

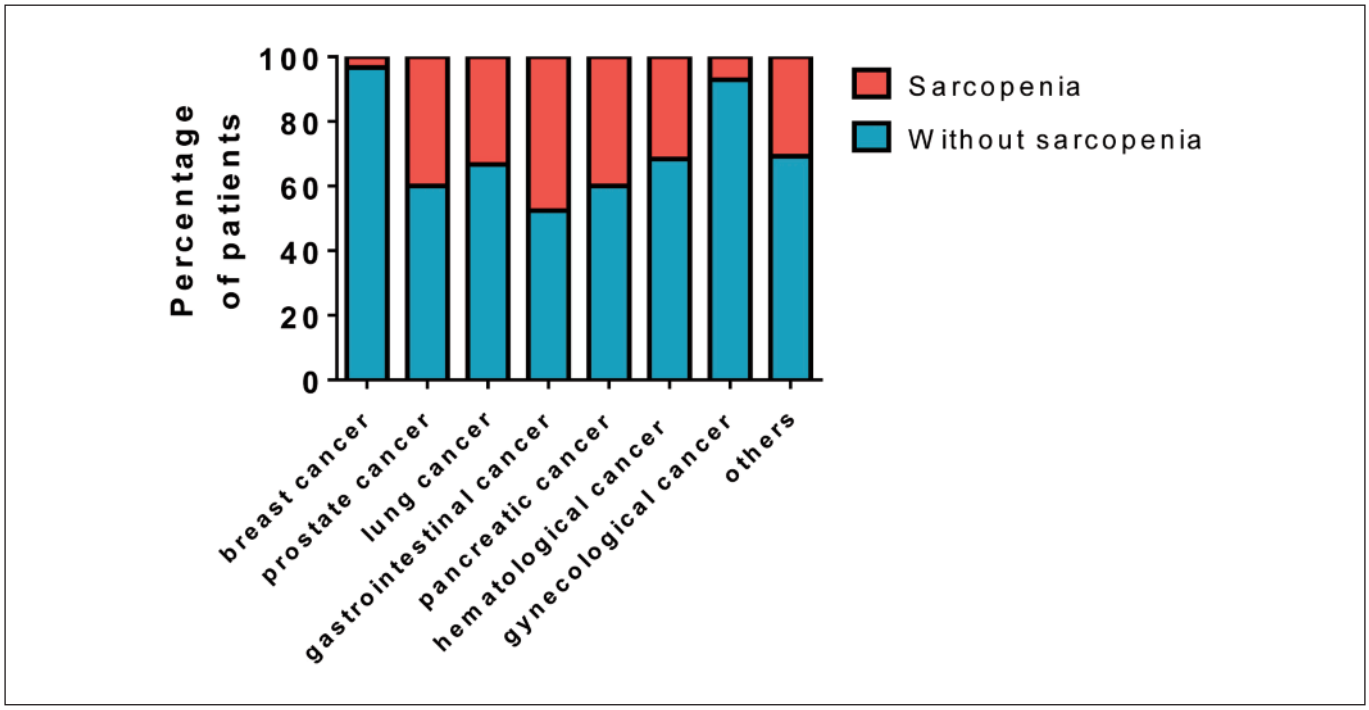
Interestingly, we observed that male patients had a higher risk for presenting sarcopenia [OR 13.1 (IC 95% 4.5-37.9, p<0.001)] according to the type of cancer diagnosed; subjects with gastrointestinal cancer had the highest risk, 47.6% [OR 3.3 (IC 95% 1.3-8.9, p<0.05)], followed by subjects with pancreatic cancer, 40% [OR 2.0 (IC 95% 0.5-7.7, p=NS)], prostate cancer, 40% [OR 1.95 (IC 95% 0.3-12.3, p=NS)], lung cancer, 33.3% [1.5 (IC 95% 0.3-8.3, p=NS)] and haematologic cancer, 31.6% [1.38 (IC 95% 0.48-4.03,

Table II. Clinical, anthropometric and metabolic characteristics of patients with sarcopenia and without sarcopenia with cancer.

Variable	Without sarcopenia N=88	With sarcopenia n =31	p
Age, years	55.7 ± 13.8	56.5 ± 15.7	0.787
Weight, kg	68.0 ± 16.0	66.4 ± 14.1	0.621
BMI, kg/m^2	25.8 ± 4.91	22.9 ± 4.16	0.039
Waist circumference, cm	92.09 ± 12.8	89.8 ± 11.7	0.001
Hip circumference, cm	102 ± 10.2	97.0 ± 8.35	0.365
Arm circumference, cm	27.9 ± 3.64	28.2 ± 10.7	0.158
Fat mass, %	32.5 ± 7.94	26.1 ± 10.5	0.019
Lean mas,%	24.7 ± 6.04	26.0 ± 5.93	0.001
Hemoglobin, g/dL	12.9 ± 1.90	12.7 ± 2.10	0.086
Leucocytes, 10^3/mm^3	5.72 ± 1.92	5.90 ± 2.26	0.763
Glucose, mg/dL	106 ± 28.3	108 ± 28.1	0.011
BUN, mg/dL	11.6 ± 3.97	25.0 ± 10.6	0.038
Urea, mg/dL	24.7 ± 8.59	31.8 ± 14.4	0.039
Creatinine, mg/dL	0.73 ± 0.22	0.82 ± 0.22	0.034
Triglycerides, mg/dL	170 ± 90.6	148 ± 58.5	0.540
Total cholesterol, mg/dL	196 ± 45.4	179 ± 36.8	0.003
HDL cholesterol, mg/dL	46.7 ± 12.9	44.0 ± 14.5	0.012
LDL cholesterol, mg/dL	119 ± 36.7	107 ± 29.6	0.029
Total protein, mg/dL	6.46 ± 0.70	6.58 ± 0.65	0.093
Albumin, mg/dL	3.73 ± 0.56	3.79 ± 0.08	0.205
Globulin, mg/dL	2.62 ± 0.65	2.80 ± 0.67	0.057

Mean ± DE; Statistical analysis by one-way ANOVA adjusted for age and sex.

Figure 1. Prevalence of sarcopenia and type the cancer.



p=NS)]. **Figure 1.** Another variable asked the subjects was the time that they have with cancer diagnosed, given that this could affect the sarcopenia diagnosed, however, no statistical difference was found with this variable.

According to BMI, in the group of underweight subjects, seven patients (41.2%) [OR 2.3 (IC 95% 0.8-6.6, *p*=NS)] had sarcopenia, while 15 subjects with normal weight (31.3%) [(OR 1.6 (IC 95% 0.7-3.6, p=NS)] had the same diagnosis. Likewise, seven subjects with overweight (20%) [OR 0.6 (IC 95% 0.2-1.6, p=NS)] and 2 (10.5%) patients with obesity [OR 0.29 (IC95% 0.1-1.3, *p*=NS)] had the same results (**Figure 2 and 3).**

Figure 2. Body mass index (BMI) and type of cancer.

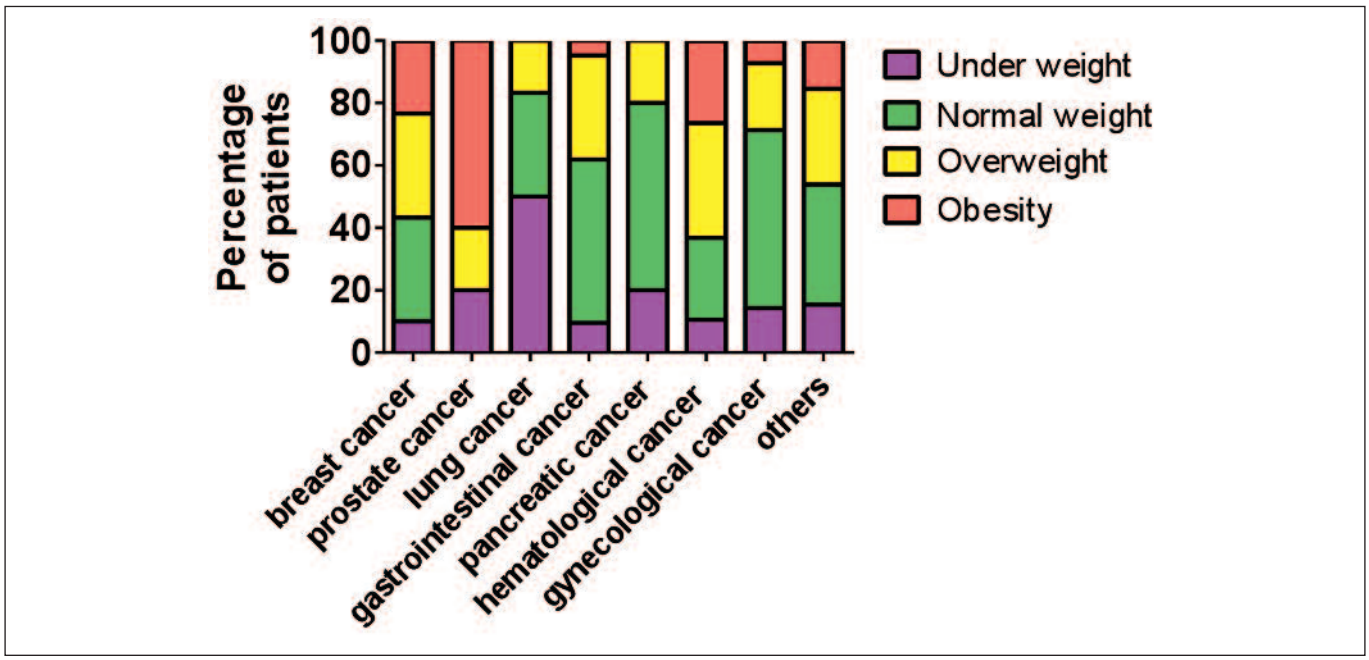
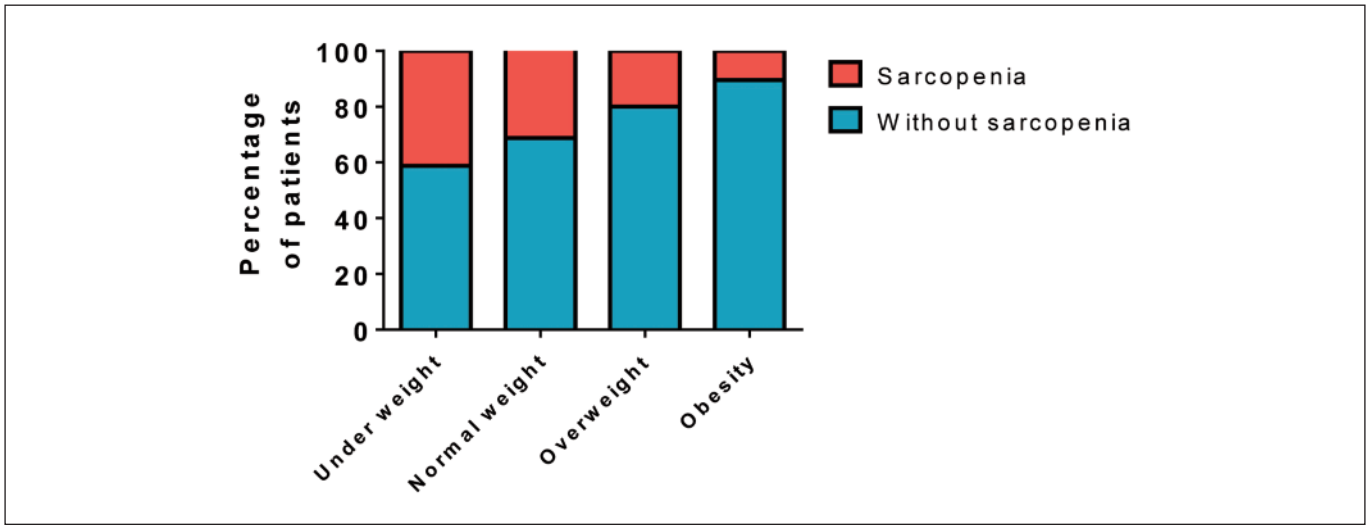


Figure 3. Prevalence of sarcopenia and BMI.



We observed no influence of treatment in the presence of sarcopenia. Finally, 14 patients (12% of total), of which eight were women and six were men, were diagnosed with cachexia. Of these subjects, two were diagnosed with breast cancer, two with gynecological cancer, one with prostate cancer, one with lung cancer, two with gastrointestinal cancer, two with pancreatic cancer, two with hematologic cancer, and two with other types of cancer. Moreover, of these 14 subjects, only seven (50%) had sarcopenia [OR 3.37 (IC95% 1.1-10.6, $p<0.05$)].

DISCUSSION

There are different instruments to identify alterations in the nutritional status of patients with different pathologies. The early detection of subjects at risk for developing malnutrition from the overall patient population is one of the main goals in nutritional care. In the particular case of subjects with cancer, the risk of malnutrition increases because of physiological alterations in response to tumoral metabolism and therapy that contribute to weight loss and specifically to muscle mass loss. The latter has a determinant role in the patient's prognosis because it interferes with the response to treatment and increases complications that may compromise survival and quality of life.

In subjects with any form of cancer, a personalized nutritional assessment that includes constant check-ups and intervention must be designed[8]. However, even though there is extensive evidence of the benefits of such conduct, the health community is still far from achieving goals in this regard. To date, there are still many subjects malnourished utilizing hospital service, and their situation worsens during their hospital stay, which may result from fasting periods, depression, anorexia, etc.

There is a dynamic condition in subjects with cancer that implies the progression of the disease; the movement from pre-cachexia to cachexia that may be modulated by prompt and effective nutritional intervention[1]. Even though these nutritional alterations are mostly undiagnosed and are rarely treated, they constitute an area of opportunity to implement new strategies for their treatment[9].

As we have shown in this study, overweight and obesity (that may also be accompanied with sarcopenia, known as sarcopenic obesity) are increased in oncological patients and may be a result of the fact that obesity itself increases the risk for developing different types of cancer. The presence of obesity has also been shown to decrease the survival rate and increase the recurrence of cancer after treatment[10].

The use of BMI to assess nutritional status has proven to be of lesser utility in subjects with a cancer diagnosis because it does not reflect the risk for cachexia or malnourishment. In multiple studies, the uses of different markers that allow for a holistic evaluation of the nutritional status of the patients have proven to be more efficient in nutritional care. Albumin, as we have shown in our results, was a helpful marker to indicate muscle strength and total mass; however, is important to take into account that the use of albumin has different limitations, such as its half lifetime and its high variation caused by different diseases such as kidney or liver disease. Therefore, it should not be used as a unique marker for nutritional status.

The assessment of a fat-free mass, especially muscle mass may be evaluated with non-invasive methods such as BIA that are usually integrated into the nutritional evaluation. Promising evidence has been generated that suggests that protein catabolism may be reversible, and thus, subjects with sarcopenia or sarcopenic obesity may benefit from different exercises that increase muscle mass accompanied by adequate energy and protein intake[11].

According to other publications, gastrointestinal cancer contributes to a higher risk of malnutrition because it principally alters food intake, digestion, absorption, and excretion. It is of interest that it was the men recruited in this study who had a higher risk of presenting sarcopenia.

The present work has different limitations; one of these is because of its design does not allow further inquiry into the presence of sarcopenia throughout the treatment time. Further research is needed in this matter; however, these preliminary results are of great value to the professional health community that is in direct contact with such patients because it may help improve clinical practice and integrate new indicators, such as the use of muscle loss and strength measurements, into the subject's nutritional and medical evaluation in order to detect malnourishment.

CONCLUSION

In conclusion**,** the prevalence of malnourishment, sarcopenia, and cachexia are high in oncological patients treated in ambulatory service, especially in men and in those diagnosed with gastrointestinal cancer. Frequently used indicators in clinical practice, such as BMI and albumin, are not effective enough to diagnosed nutritional alteration in these type of patients because they may be in normal values even though the subject presents all of the criteria for a sarcopenia diagnosis. The implementation of accessible methods for the routine assessment of nutritional status allows an adequate treatment and prevention of nutritional alterations that may help in limiting the consequences that malnutrition inflicts on cancer patients.

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