NUTRISCORE and functional capacity assessment in cancer outpatients

Uso del NutriScore y evaluación de la capacidad funcional en los pacientes oncológicos ambulatorios

Uso do NutriScore e avaliação da capacidade funcional em pacientes oncológicos ambulatoriais

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Abstract

Background: Malnutrition (MN) is frequently observed in cancer patients and is associated with a decrease in their functional capacity. NutriScore is a specific tool used to measure the risk of MN in cancer outpatients.

Objective: To determine the nutritional risk and functional capacity of patients attending the Oncology Outpatient Unit at the Center for Medical Education and Clinical Research "Norberto Quirno" (CEMIC).

Methods: In this study, a descriptive, observational, cross-sectional, and prospective design with non-probabilistic sampling was implemented. Both NutriScore and ECOG scale were used. The presence of symptoms related to food intake and food restrictions were assessed. The mean, standard deviation, absolute frequency, and relative frequency were calculated. The association between variables was determined using the Pearson's Chi-squared test.

Results: A total of 200 patients were included in the study. The risk of MN was found to be 7 %. According to the body mass index (BMI), 36.5 % were overweight. Functional status was preserved in 90.5 %. Among the participants, 62 % had symptoms related to food intake, with anorexia and constipation being the most frequently reported. Additionally, 33 % of patients eliminated certain foods from their diet, with dairy products and gluten being

Resumen

Introducción: la malnutrición es frecuente en pacientes con cáncer y se relaciona con una disminución de su capacidad funcional. El NutriScore es una herramienta específica para medir el riesgo de desnutrición en los pacientes oncológicos ambulatorios.

Objetivo: conocer el riesgo nutricional y la capacidad funcional de los pacientes que asisten al hospital de día de oncología del Centro de Educación Médica e Investigaciones Clínicas "Norberto Quirno" (CEMIC).

Materiales y métodos: estudio descriptivo, observacional, transversal y prospectivo. Muestreo no probabilístico. Se realizó el NutriScore y la escala ECOG. Se indagó acerca de la presencia de los síntomas relacionados con la ingesta alimentaria y la restricción de los alimentos. Se calculó la media, el desvío estándar y la frecuencia absoluta y relativa, según corresponda. La asociación entre las variables se estableció según Chi cuadrado.

Resultados: se incluyeron un total de 200 pacientes. El 7 % presentó riesgo de desnutrición y el 36,5 % tuvo exceso de peso, según el índice de masa corporal (IMC). El estado funcional se encontró conservado en el 90,5 %. El 62 % presentó síntomas gastrointestinales, siendo los más frecuentes la anorexia y la constipación. El 33 % eliminó algún alimento de su ingesta, siendo los más frecuentes los lácteos y los

Resumo

Introdução: a má nutrição é comum em pacientes com câncer e está relacionada à diminuição de sua capacidade funcional. O NUTRISCORE é uma ferramenta específica para medir o risco de desnutrição em pacientes oncológicos ambulatoriais.

Objetivo: conhecer o risco nutricional e a capacidade funcional dos pacientes atendidos no Hospital de Día de Oncología do Centro de Educação Médica e Investigaciones Clínicas "Norberto Quirno" (CEMIC).

Materiais e métodos: estudo descritivo, observacional, transversal e prospectivo. Amostragem não probabilística. Foi realizado o NUTRISCORE e a escala ECOG. Foi indagada a presença de sintomas relacionados à ingestão alimentar e à restrição alimentar. Foram calculadas a Média, o desvio padrão, a frequência absoluta e relativa conforme corresponda. A associação entre as variáveis foi estabelecida de acordo com o Qui quadrado.

Resultados: um total de 200 pacientes foram incluídos. O 7 % apresentou risco de desnutrição e o 36,5 % teve excesso de peso, de acordo com o IMC. O estado funcional foi preservado em 90,5 %. O 62 % apresentaram sintomas gastrointestinais, sendo os mais frequentes anorexia e constipação. O 33 % eliminaram algum alimento de sua ingestão, sendo os mais frequentes os laticínios e os alimentos com glúten. O risco nutricional foi significati-

the most common exclusions. Nutritional risk was significantly associated with the type of tumor (*p* value 0.002), treatment setting (*p* value 0.015), and specific treatment (*p* value 0.032). **Conclusion**: The risk of MN assessed by NutriScore was lower than that reported in the literature and was not associated with functional capacity.

Keywords: NutriScore; ECOG; Nutritional assessment; Cancer patient.

alimentos con gluten. El riesgo nutricional se asoció significativamente con el tipo de tumor (*p* = 0,002), de terapia (*p* = 0,015) y de tratamiento (*p* = 0,032). **Conclusiones:** el riesgo de desnutrición en los pacientes, según el NutriScore, resultó menor del descrito por la bibliografía y no se asoció con la capacidad funcional.

Palabras clave: NutriScore, ECOG, evaluación nutricional, paciente oncológico.

vamente associado ao tipo de tumor (*p* = 0,002), tipo de terapia (*p* = 0,015) e tipo de tratamento (*p* = 0,032). **Conclusões:** o risco de desnutrição nos pacientes segundo o NUTRISCORE foi menor do que o descrito na literatura e não esteve associado à capacidade funcional.

Palavras-chave: NutriScore, ECOG, avaliação nutricional, paciente oncológico.

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INTRODUCTION

Malnutrition (MN) affects cancer patients, with a prevalence ranging from 30 % to 90 %[1, 2]. The causes of MN include altered metabolic state, which varies according to the type of tumor, its stage and the oncological treatment received[3, 4]. The European Society for Clinical Nutrition and Metabolism (ESPEN) recommends the assessment of nutritional risk in outpatient settings using validated nutritional screening tools[3, 4]. In 2017, Arribas *et al.*, validated the use of NutriScore for cancer patients[5]. This screening tool is simple, quick, and effective for the management of outpatients[6-8].

Cancer patients at nutritional risk should undergo a comprehensive nutritional evaluation. The gold standard tool is the Patient-Generated Subjective Global Assessment (PG-SGA)[9], which proved to be similar to its conventional version. The PG-SGA has been used to validate the NutriScore, with a strong concordance between both tools[5, 10].

On the other hand, certain types of cancer, such as breast cancer, have exhibited a high prevalence of obesity, which has been associated with poorer outcomes and accelerated disease progression[11-14]. According to Rocculi *et al.*, the prevalence of excess weight in an oncology outpatient setting in Buenos Aires was 60.7 % (36.6 % overweight and 38.4 % obesity)[15].

Cytotoxic therapy often induces symptoms like nausea, vomiting, poor appetite, dry mouth, and alterations in taste or smell perception, with implications on the quality of life. The impact of these symptoms has been extensively studied in tumors affecting the gastrointes-tinal tract, such as head and neck cancer. However, the specific symptoms affecting the dietary intake of breast cancer patients are not well-defined[11, 16, 17].

The decline in nutritional status often occurs simultaneously with muscle mass (MM) depletion, particularly in the elderly[12, 13]. This leads to physical dysfunction, increased risk of surgical complications, disease progression, higher levels of toxicity, diminished quality of life, and lower survival rates[14, 18-20]. In this regard, the ECOG performance scale has been widely validated to measure functional capacity in cancer patients[9, 14]. Cessot A. *et al.*, demonstrated that 61 % of patients with MN presented altered functionality with an ECOG score of 2-3[21]. In turn, Bozzetti *et al.*, reported 20 % of physical dysfunction in 1453 outpatients included in their study[22].

The exclusion of certain foods during cancer treatment has not been extensively researched. Sullivan *et al.*, who studied 1073 cancer survivors from 20 hospitals in Ireland, reported that 31.7 % of them avoided specific foods during their cancer treatment. The most frequently eliminated items included alcohol, sugar, dairy products, gluten, and meat[23].

The present study aims to describe the nutritional status, changes in weight, functional capacity, the presence of gastrointestinal symptoms, and the elimination of usual food groups in cancer patients attending a day hospital. It also aims to analyze the association between nutritional risk according to the NutriScore tool and factors such as tumor site, oncological treatment, body mass index (BMI), functional capacity, and the presence of gastrointestinal symptoms.

MATERIALS AND METHODS

This study has a prospective, descriptive, observational, and cross-sectional design. Its population included male and female patients aged 18 years or older, diagnosed with solid or hematological tumors, who attended the Oncology Outpatient Unit at CEMIC between March and July 2021. Patients who were receiving investigational drugs or had difficulty comprehending the purpose or questions of the study, or individuals who declined to participate were excluded. Moreover, when any of the tools herein used could not be applied, data was excluded from the analysis.

A non-probabilistic convenience sampling method was used[24]. Data were consecutively collected from all patients attending the Oncology Outpatient Unit during the nutritionists' visits. A sample size of 139 patients was estimated to achieve a 95 % significance level with a ± 5 % precision. The sample size was calculated using the OpenEpi statistical program, considering 10 % risk of MN with 5 % variability[25]. This prevalence was estimated through a pilot study conducted at the same center (n = 50). The sample size calculated achieved a precision of 3.5 with a prevalence of MN risk of 7 %.

The characterization variables were: Gender, age, body mass index (BMI) which was categorized according to the cut-off points recommended by the World Health Organization (WHO) and Lipschitz criteria for individuals aged 65 years or older[26, 27]; malignant neoplasm site according to the International Classification of Diseases, 10th revision (ICD-10)[28]; tumor stage categorized as localized, regional, or disseminated (LRD) based on the extent of tumor[29]; treatment scenario classified as neoadjuvant, adjuvant, advanced first-line, or advanced subsequent lines; and oncological treatment categorized as chemotherapy, immunotherapy or hormone therapy.

The following variables were analyzed:

- Nutritional risk: No MN risk (< 5 points), MN risk (≥ 5 points). Categorized based on the NutriScore screening[5].
- Nutritional diagnosis: A (well-nourished), B (moderately malnourished), C (severely malnourished). Categorized based on (PG-SGA)[30].
- Functional capacity: 0 to 1 point, 2 to 3 points, 4 points. Categorized based on the ECOG scale[31].
- Weight changes over the last three months. Categorized as: No change in weight, weight gain, involuntary weight loss less than 5 %, involuntary weight loss greater than or equal to 5 %[32].
- Presence of any symptom affecting food intake in the last 15 days: Yes/No. Considered affirmative in the presence of at least one symptom (nausea, vomiting, anorexia, loss of appetite, diarrhea, constipation, dysphagia, dysgeusia, aversion to smells, gastroesophageal reflux, xerostomia, or oral infection)[30].
- Elimination of foods or food groups: Yes/No. Considered positive when patients reported elimination diets due to their oncological diagnosis and described the food or food group eliminated (dairy, sugar, meat, wheat, oat, barley, and rye).

This study adheres to the World Medical Association Declaration of Helsinki; Act 3301, Ministry of Health of the Government of the City of Buenos Aires; Resolution 1480/2011, Argentine Ministry of Health, and all the legislation and regulations issued by CEMIC Ethics Committee. The research was approved by this Ethics Committee, and each participant was asked to consent prior to their participation in the study.

Trained nutritionists collected data from both primary sources of information (patients and/or caregivers) and secondary sources (electronic medical records). The OMRON® HBF-510LA, which has a precision of 100 g and a capacity of 0 to 150 kg, was used –when feasible– to obtain the current weight. Otherwise, this data was reported by the individual, their caregiver, or eventually estimated by the interviewer. Height and weight of the previous three months were reported by the patient or their caregiver.

The collected data were recorded in a proprietary database and analyzed using VCC Stat Beta 3.0 Beta® and Stata 11.0® statistical software. For descriptive analysis of quantitative variables, the mean and standard deviations were calculated, and for qualitative variables, absolute and relative frequencies were estimated with their 95 % confidence intervals (CI). The association between nutritional risk and the different characteristics was assessed using the Pearson's Chi-squared test (χ^2) or Fisher's exact test, as appropriate. A significance level of $p < 0.05$ was considered.

RESULTS

The study included a sample of 200 patients, with a median age of 60 years (interquartile range: 47-70), ranging from 18 to 87 years. Among the participants,

71 % (95 % CI: 64.1-77) were female, while the remaining 29 % (95 % CI: 22.9-35.9) were male. In terms of BMI classification, 12.5 % (95 % CI: 8.4-18) were categorized as underweight, 51 % (95 % CI: 43.8-58) as normal weight, and 36.5 % as excess weight [22.5 % (95 % CI: 17-29) overweight and 14 % (95 % CI: 9.6-19.7) obese].

The most common locations for neoplasms were the breast, accounting for 32 %, and the respiratory and intrathoracic organs, accounting for 19.5 %. This was followed by genital organs and hematological tumors (Table 1).

Table 1. Sample characteristics (n = 200)

Tumor site	n	%	CI
Breast	64	32	25.7-39
Respiratory and intrathoracic organs	39	19.5	14.4-25.8
Genital organs	31	15.5	10.9-21.4
Hematologic	25	12.5	8.4-18
Digestive organs	21	10.5	6.7-15.8
Urinary tract	11	5.5	2.9-9.9
Head and neck	5	2.5	0.8-9.2
Others	4	2	0.5-58
Otros	11	5.5	2.9-9.9

CI: confidence interval; n: number of patients.

Regarding disease progression, those patients with available medical records (N = 158), 81.6 % (95 % CI: 75.61-87.68) were categorized as Stages III and IV, while 18.4 % (95 % CI: 12.32-24.39) were classified as Stages I and II.

In terms of treatment scenario (N = 181), 63 % (IC 95 % 56-70) of the patients were classified as "neoadjuvant or adjuvant", 24.3 % (IC 95 % 18,1-30,6) "first-line", and 12.7 % (IC 95 % 7,9-17,6) "late-line".

A total of 92 % (IC 95 % 88,2-95,8) of the patients received chemotherapy as part of their treatment: 71,2 % (IC 95 % 64,7-77,7) received exclusively chemotherapy, 19,6 % (IC 95 % 13,8-25,3) in combination with hormone therapy or immunotherapy and 9,2 % (IC 95 % 5,1-13,4) received it with concurrent radiotherapy. The remaining 8 % (IC 95 % 4,2-11,8) received only immunotherapy or hormone therapy.

According to the NutriScore tool, 7 % (95 % CI: 4-11.7) of the sample were at risk of MN. Among the 14 patients at risk, 57 % (95 % CI: 26.1-83.1) were categorized as moderately mal-nourished, while 43 % (95 % CI: 16.8-73.9) were categorized as severely malnourished based on the PG-SGA classification. None of the patients at risk of MN were categorized as well-nourished.

Regarding the association between nutritional risk, assessed by NutriScore and the different characteristics, a significant correlation was observed between treatment scenario (n = 181; $p = 0.006$) and oncological treatment (n = 200; $p = 0.037$). Furthermore, a positive association was observed between tumor site and nutritional risk ($p = 0.019$). A higher percentage of MN risk was observed in patients with tumors located in the digestive organs (28.7%) and hematological tumors (21.43%) (Table 2). No significant differences were found between nutritional risk and tumor stage.

Half of the sample, 50 % (95 % CI: 42.9-57.1), exhibited weight variations in the last three months. Among them, 22 % (95 % CI: 16.6-28.5) experienced weight gain, while 28.5 % (95 % CI: 22.5-35.4) presented involuntary weight loss. Significant weight loss (greater than 5 %) was observed in 14 % of the patients (95 % CI: 9.6-19.8), and was consistently associated with nutritional risk ($p = 0.000$). Conversely, BMI categorization based on age was not associated with nutritional risk ($p = 0.427$) (Table 3).

Functional capacity was classified as ECOG 0-1 in 90.5 % of the patients (95 % CI: 85.2-94.1), while the remaining 9.5 % (95 % CI: 5.9-14.8) were categorized as ECOG 2-3. None of the patients were classified as ECOG 4. There was a significant association between functional capacity and tumor site ($p = 0.003$), but no association was found between functional capacity and risk of MN, as assessed by NutriScore ($p = 0,394$) (Table 3).

We found that 62 % of the patients (95 % CI: 54.8-68.6) experienced some treatment-related symptoms. The most commonly reported were constipation and anorexia, both at a rate of 26.5 % (95 % CI: 20.6-33.3), followed by nausea and diarrhea at 16 % (95 % CI: 11.3-22). The presence of any gastrointestinal symptom was not significantly associated with nutritional risk ($p = 0.058$). However, when analyzed separately using the Chi-squared test, significant associations were found between the presence of anorexia ($p = 0.000$), vomiting ($p = 0.001$), dysphagia ($p = 0.000$), dysgeusia ($p = 0.000$), and food aversion ($p = 0.008$).

The exclusion of a particular food or food group as a result of the disease diagnosis was reported by 33 % of

the patients (95 % CI: 26.6-40). Among them, elimination of dairy products was the most frequently reported (31,3 %; IC 95 % 19,9-42,6), followed by gluten, meat, and sugar in similar proportions (23,5 %; IC 95 % 13,1-33,8) (Table 4).

DISCUSSION

Multiple studies have shown the adverse effects of MN on cancer patients, leading to decreased treatment tolerance and effectiveness, as well as diminished quality of life and survival rates[3,16]. The main objective of this study was to describe the nutritional status, functional capacity, gastrointestinal symptoms, and food exclusions in cancer patients attending a day hospital. Additionally, the study aimed to analyze the association between nutritional risk according to NutriScore in relation to tumor site, oncological treatment, BMI, functional capacity, and the presence of gastrointestinal symptoms.

Table 2. Association of nutritional risk and tumor site (n = 200)

Tumor site	NutriScore < 5 points			NutriScore ≥ 5 points		
	n	%	CI	n	%	CI
Head and neck	3	1.61	0.33-5.9	1	7.14	0.2-34
Digestive organs	17	9.14	5.5-14.4	4	28.57	8.3-61.4
Urinary tract	4	2.15	0.6-6.3	1	7.14	0.2-34
Genital organs	30	16.13	11.3-22.3	1	7.14	0.2-34
Breast	64	34.4	27.7-41-7	0	0	0-23
Respiratory and intrathoracic organs	37	19.89	14.5-26.5	2	14.29	1.8-43.8
Hematologic	22	11.8	7.7-17.5	3	21.43	4.6-50.8
Others	9	4.8	1.7-13.6	2	14.29	1.8-43.8

CI: confidence interval; n: number of patients.

Table 3. Association between nutritional risk and characterization variables

		NUTRIC SCORE		P
		Risk of malnutrition	No risk of malnutrition	
Tumor stage n = 158	I and II	30	1	0.306
	III and IV	116	11	
Treatment scenario n = 200	Neoadjuvant or adjuvant	109	5	0.006
	Advanced first-line	38	6	
	Advanced subsequent line	21	2	
Oncological treatment n = 200	Chemotherapy	121	10	0.037
	Chemotherapy and radiotherapy	12	5	
	Chemotherapy and immunotherapy or hormone therapy	36	0	
	Immunotherapy or hormone therapy	14	2	
ECOG scale n = 194	0-1	166	12	0.394
	2-3	14	2	

ECOG: Eastern Cooperative Oncology Group; NUTRIC: Nutrition Risk in the Critically ill.

Table 4. Elimination of foods or food groups (n = 46)

Food	n	%	CI
Dairy products	20	31.3	19.9-42.6
Gluten	15	23.4	13.1-33.8
Sugar	15	23.4	13.1-33.8
Meat	14	21.9	11.8-32

CI: confidence interval; n: number of patients.

Among the main findings, the prevalence of overweight (22.5 %) and obesity (14 %) was lower compared to the data previously reported by Rocculi *et al.*, who did not consider age-specific BMI classification[15]. Additionally, 36 % of the study population had excess weight, and even 22 % of the sample experienced weight gain in the previous months. Interestingly, this population would greatly benefit from nutritional recommendations before, during, and after their cancer treatment, given the increased risk of comorbidities, such as cardiovascular diseases and diabetes[3, 19].

Regarding the prevalence of MN in cancer outpatients, this study revealed a rate of 7 %, which is significantly lower than that reported in the literature, ranging from 30 % to 90 %[2, 4, 9]. This finding could be associated with the high proportion of breast cancer patients (32 %) with no risk of MN, according to NutriScore (0 %). On the other hand, the lower prevalence of tumors in the digestive organs (10.5 %) was associated with a higher percentage of MN (28.5 %).

The prevalence of MN risk was higher when compared to Kang *et al.* (7% versus 2.9%). The difference could be attributed to variations in tumor sites, considering that Kang *et al.* included leukemia patients, who represented 19.6% of their population, and none showed nutritional risk[17].

The low prevalence of nutritional risk could be biased since data collection was carried out during chemotherapy infusion and failed to detect variations in symptomatology and food intake occurring afterwards[11, 23, 33].

Functional capacity was found to be limited in 9.5 % of the patients, as opposed to the high rates (29 %) described by Cessot A. *et al*[21]. According to the ECOG, this difference is observed since functionality is significantly associated with the tumor site ($p = 0.003$), whose prevalence varied in each study. However, no disparities in functionality were found based on the risk of MN ($p = 0.524$). On the contrary, Bozzetti *et*

al.,[22] reported an association between functionality and body composition[10].

The nutritional screening tool used in this study includes specific variables related to oncological disease, which makes it a promising method. However, its low sensitivity is considered the main limitation of the study[17]. In a multicenter study, Kang J. *et al.*, recently reported significantly lower sensitivity values compared to those described by Arribas *et al.*, (6.3 % vs. 97.3 %)[17].

One could have opted for one of the main tools recommended by the ESPEN[4] and ESMO[3, 9, 34] guidelines. Despite this, the present study used the NutriScore since its variables are specifically related to the oncological disease, such as tumor location and treatment. Additionally, the tool has demonstrated high specificity (96 %-97 %)[5, 17], which was confirmed in this study, where 100% of patients detected at nutritional risk were subsequently diagnosed, through the VGS-GP, with some degree of MN[5, 17]. The tool was also selected for its simplicity and rapid use. Another limitation was the use of medical records to collect data such as oncological treatment and disease stage. When analyzing the results, the distribution of tumor sites should be considered since it may have influenced the study outcomes[3, 9, 34].

As a result of the lack of information on food and nutrition during cancer treatment, patients resort to unqualified and unreliable sources, such as non-healthcare endorsed media. This is potentially dangerous for their nutritional status[23, 35]. In the study sample, the prevalence of eliminating certain foods or food groups was similar (33 %) to that described by Sullivan Es *et al.*, (31.7 %). This might, in some way, reflect the growing use of complementary and alternative medicine, which warrants deeper exploration in future research[23, 35].

The side effects of chemotherapy have a significant impact on patients' quality of life. More than half of the study patients (62 %) presented at least one symptom that could directly affect their food intake. This raises concerns about the assumption that all cancer patients would benefit from individualized nutritional care to effectively manage their symptoms[22].

In accordance to the aforementioned, future research should focus on the need for a specific tool for cancer patients. It should be sensitive enough to allow the early detection of those patients that would benefit from comprehensive and personalized diet interventions. Additionally, it should be closely associated with functional capacity. Thus, it could improve both patients' nutritional status and their overall quality of life.

KEY POINTS

- Outpatients should undergo a nutritional risk assessment using a validated screening tool, such as NutriScore, to ensure comprehensive care.
- Nutritional status deterioration often leads to muscle mass depletion.
- The Eastern Cooperative Oncology Group (ECOG) scale is extensively validated for the study of functional capacity among cancer patients.
- The ECOG scale is significantly associated with the location of the tumor.

CONCLUSION

These findings demonstrate that, according to the NutriScore tool, the risk of MN in cancer outpatients varies depending on the site of the tumor. Additionally, a significant association was found between nutritional risk, the type of oncological treatment received, and the tumor site. Patients at risk of MN were more likely to experience decreased functional capacity.

Conflict of interest

The authors declare no conflicts of interest.

Statement of authorship

Manuscript authors: O. Capelli, P. Navarro, J. Adaglio. Authorship statement: O. Capelli, P. Navarro and J. Adaglio equally contributed to the conception and design of data collection, analysis, and interpretation. P. Navarro and O. Capelli drafted the manuscript. All authors reviewed the manuscript, agreed to be fully responsible for the integrity and accuracy of the work, and read and approved the final manuscript.

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