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Authors: Teodoro J. Oscanoa, Edwin Cieza-Macedo, Maryam Pourhassan, Roman Romero-Ortuno

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Frequency of malnutrition in older adults according to different types of cancer

Teodoro J. Oscanoa[1, 2, 3 0000-0001-9379-4767], Edwin C. Cieza[1, 2, 3 0000-0002-8766-1412], Maryam Pourhassan[4 0000-0002-5486-0765], Roman Romero-Ortuno[5, 6 0000-0002-3882-7447]

[1] *Universidad Nacional Mayor de San Marcos, Facultad de Medicina, Lima, Peru*

[2] *Universidad de San Martín de Porres, Facultad de Medicina Humana, Lima, Peru*

[3] *Geriatric Department, Almenara Hospital, ESSALUD, Lima, Peru.*

[4] *Department of Geriatric Medicine, Marien Hospital Herne, Ruhr-Universität Bochum, Herne, Germany*

[5] *Discipline of Medical Gerontology, School of Medicine, Trinity College Dublin, Dublin, Ireland*

[6] *Global Brain Health Institute, Trinity College Dublin, Dublin, Ireland*

Introduction. The severity and prevalence of cancer-related malnutrition vary among different cancer types. This study assessed malnutrition frequency in older adults (≥60 years) based on specific cancer types.

Material and methods. An observational, retrospective, case-control study reviewed electronic reports, with (cases) and without cancer (controls) patients. Malnutrition was defined using the Mini Nutritional Assessment Short Form (MNA-SF).

Results. Malnutrition prevalence was 31.5% in cases and 13.2% in controls ($p < 0.001$), with an odds ratio (OR) of 3.0; 95% CI: 2.0–4.5; $p < 0.001$. The highest malnutrition risk was associated with pancreatic cancer (OR: 47.2), followed by head and neck (OR: 18.2), esophagus and stomach (OR: 15.9), lung (OR: 13.3), bile ducts (OR: 18.2), and colorectal (OR: 4.2) cancers ($p < 0.001$).

Conclusions. The prevalence of malnutrition varies by cancer type, with pancreatic, head and neck, esophagus and stomach and lung cancers showing the highest risk.

Key words: malnutrition, neoplasms, geriatric oncology, aged patients, elderly patients, cancer

Introduction

Malnutrition, a state arising from disruptions in nutrient balance and inflammatory activity, can manifest acutely, subacutely, or chronically. Such imbalances lead to changes in body composition and an overall functional decline [1]. Malnutrition can be categorized into three types based on its etiology: starvation-related malnutrition (as seen in conditions like anorexia nervosa), chronic disease-related malnutrition (commonly associated with conditions such as cancer and rheumatoid arthritis), and acute disease or injury-related malnutrition (often observed in severe infections and burns) [2]. In recent European research, it was highlighted that older adults, specifically those over 65, face concerning rates of malnutrition: 28% in hospital settings, 17.5% in residential care, and 8.5% in community settings are at high risk [3]. In contrast a Peruvian study demonstrated even more alarming rates, indicating that up to 60% of hospitalized older adults (aged over 60) were malnourished [4].

For cancer patients, the battle against malnutrition is particularly challenging. Disease-related shifts in nutritional and metabolic statuses often give rise to malnutrition, as well as conditions like sarcopenia and cachexia, both of which can significantly impact survival [5]. Cancer-related malnutrition is a progressive process often leading to sarcopenia, which involves the loss of skeletal muscle mass, often accompanied by a reduction in adipose tissue. Sarcopenia is characterized by low muscle strength and reduced muscle mass, resulting in decreased physical strength and function, ultimately affecting the patient's overall quality of life [6]. Cancer cachexia is currently understood as a multifactorial host-phagocytic syndrome, marked by a continuous decline in skeletal muscle mass, sometimes accompanied by loss of fat tissue [7]. Between 15% to 45% of patients exhibit involuntary weight loss at the time of cancer diagnosis, with an estimated 40% to 80% at risk of developing malnutrition as their illness progresses [8]. On the other hand, a recent meta-analytic study in older adults with cancer found that malnutrition is associated with an increase in risk of mortality from all causes [9].

The prevalence of malnutrition in older adult patients with cancer has been calculated to be 41.9% [10]. Key risk factors contributing to malnutrition in this population include the type of tumor, adverse reactions linked to cancer treatments, cachexia, and age-related anorexia [10]. Despite the various factors associated with malnutrition in cancer patients, it has been observed that specific cancer types carry a higher risk of malnutrition and cachexia compared to others [11]. For instance, lung and pancreatic neoplasms are more frequently associated with wasting syndrome [12]. Recognizing this differential risk, our research aims to provide a comparative

analysis, exploring the relationship between various cancer types and their associated malnutrition risks in older adults.

Material and methods

Setting

The present study employed a retrospective, observational, case-control design and was conducted at the Day Hospital of the Geriatric Department at Almenara Hospital, a reference hospital in Lima, Peru. The study involved the review of Comprehensive Geriatric Assessment (CGA) reports of older patients (≥60 years), both outpatient and hospitalized, conducted from January 2018 to April 2022. Patients diagnosed with cancer were categorized as cases, while those without cancer were referred to as controls. The inclusion criteria for the review of electronic medical records were as follows: participants had to have a diagnosis of cancer (except for controls) and complete CGA reports, which included a nutritional evaluation using the Mini Nutritional Assessment short version (MNA-SF). Patients in both the case and control groups were excluded if their nutritional evaluation did not use MNA-SF (e.g., relying solely on Body Mass Index).

Comprehensive geriatric assessment

Comprehensive geriatric assessment (CGA) was conducted by two trained geriatricians who assessed various domains, including function and mobility, nutritional status, cognition, mood, social environment, and comorbidities. Evaluation of basic activities of daily living (ADL) and instrumental activities of daily living (IADL) was performed using the Barthel index [13] and the Lawton index [14], respectively. Comorbidity evaluation utilized the Charlson index [15]. In defining depressive syndrome, the DSM IV criteria were applied [16]. Cognitive assessment was carried out with the Mini-Mental State Examination (MMSE) Spanish version [17], and social assessment was conducted using the Gijon social family assessment scale [18].

Clinical identification of malnutrition

The Mini Nutritional Assessment short version (MNA-SF) was employed for nutritional risk identification. MNA-SF comprises six questions with a maximum score of 14, classifying patients as

normal (12–14 points), at risk of malnutrition (8–11), or malnourished (<8). The latter category was used in the present study for malnutrition identification. MNA-SF has demonstrated good inter-observer reliability, with sensitivity and specificity values of 89% and 82%, respectively [19].

Statistical analysis

In both cases and controls, the distribution of patients was determined based on demographic factors (age and sex) and clinical data (nutritional status, cognitive impairment, comorbidity, frailty, and function status). Comparative descriptive statistical analysis was performed between the case and control groups, including variables such as median, mean (when normally distributed), standard deviation, median, and range for continuous variables, and relative frequency for categorical variables. To compare cases and controls, we utilized the difference in means or frequencies, as appropriate.

To calculate the risk (odds ratio) of malnutrition associated with specific cancer types, cases with a particular cancer type were compared with the risk in the control group without cancer. The chi-square association test was employed to analyze the data. For tabular comparisons, 2 x 2 tables were constructed, comparing patients with or without malnutrition to those with a specific type of cancer (e.g., pancreatic cancer) and patients without cancer. Statistically significant differences were considered when $p < 0.001$.

Ethical considerations

This study received approval from the Research Ethics Committee of Hospital Nacional Guillermo Almenara Irigoyen in Lima, Peru (letter 80-CIEI-OIyD-GRPA-ESSALUD-2023, March 27, 2023). Stringent measures were implemented to safeguard patient information and ensure their privacy. Informed consent was obtained from all subjects.

Results

During the study period a total of 1,224 comprehensive geriatric assessments (CGAs) were conducted at the Day Hospital of the Geriatrics Department at Almenara Hospital in Lima, Peru. Of these, 643 patients were considered for our analysis based on the presence of complete data, primarily the application of MNA-SF for malnutrition classification. Patients utilizing other metrics like Body Mass Index (BMI) for malnutrition were excluded, leading to the omission of 581 patients.

The age distribution was 77.5 ± 7.5 years for cases and 79.8 ± 7.4 years for controls ($p < 0.001$). Malnutrition was significantly more prevalent among cases at 31.4% compared to 13.2% in controls ($p < 0.001$). Other significant variances between cases and controls encompassed factors such as BMI, age, Charlson Comorbidity Index, and the frequency of depression (all $p < 0.001$). Comprehensive data comparisons are detailed in table I and figure 1.The ten most frequent neoplasms included colorectal (20.3%), esophagus and stomach (18.4%), prostate (9.6%), hematologic malignancies (lymphoma and leukemia) (10.5%), prostate (9.6%), breast (7.1%), skin (7.1%), gynecologic cancers (cervix, endometrium, ovary) (6.8%), lung (5.9%), pancreas (5.1%), and bile ducts (4.2%) – see table II. Malnutrition frequency in older adults according to different cancer types are presented in table II. Our review identified the ten most prevalent neoplasms as follows:

- colorectal (20.3%),
- esophagus and stomach (18.4%),
- prostate (9.6%),
- hematologic malignancies encompassing lymphoma and leukemia (10.5%),
- breast (7.1%),
- skin (7.1%),
- gynecologic cancers which include cervix, endometrium, and ovary (6.8%),
- lung (5.9%),
- pancreas (5.1%),
- bile ducts (4.2%).

Notably, certain types of neoplasms were especially associated with malnutrition, including pancreas (OR: 47.2; 95% CI: 6.0–372.4; $p < 0.001$), head and neck (OR: 18.2; 95% CI: 2.1–160.1; $p < 0.001$), esophagus and stomach (OR: 15.9; 95% CI: 6.8–37.1; $p < 0.001$), lung (OR: 13.3; 95% CI:

3.5–50.2; p < 0.001), bile ducts (OR: 18.2; 95% CI: 2.1–160.1, p < 0.001), and colorectal (OR: 4.2; 95% CI: 2.1–8.6, p < 0.001) – see table II and figure 2.

Discussion

The findings of our study underscore the diverse risk of malnutrition in older adults depending on the specific neoplasia. Notably, certain neoplasms, including pancreatic, head and neck, esophagus and stomach, lung, bile duct, and colorectal cancers, were predominantly linked with malnutrition. In contrast, the frequency of malnutrition was relatively low in cases of prostate, breast, and skin neoplasms. Muscaritoli et al. conducted a study to assess the prevalence of malnutrition in outpatient cancer patients during their initial medical oncology visit. They utilized the Mini Nutritional Assessment (MNA), and the mean age of the patients was 62.7 years [20]. Their findings revealed the order of malnutrition frequency in cancer patients as follows:

- gastroesophageal (40.2%),
- pancreatic (33.7%),
- head and neck (23.8%),
- respiratory (20.9%),
- genitourinary (15.8%),
- unknown primary (14.3%),
- colorectal (13.4%) [20].

Other studies have been conducted on older adults to explore the relationship between types of cancer and malnutrition. However, these studies did not use the MNA as the operational definition of malnutrition. Nonetheless, their results align with our study, indicating that pancreatic, head and neck, and lung cancers are the most frequently associated with malnutrition [21–23]. In line with our findings, Muscaritoli et al. highlighted a similar trend in the prevalence of malnutrition among outpatient cancer patients (mean age 62.7 years), using the Mini Nutritional Assessment (MNA) for evaluation. Their analysis pinpointed varying frequencies of malnutrition across cancer types, with gastroesophageal cancers leading at 40.2%, followed by pancreatic (33.7%), head and neck (23.8%), respiratory (20.9%), genitourinary (15.8%), cancers of unknown origin (14.3%), and colorectal (13.4%). Other research, although not exclusively employing MNA, have mirrored our

observations, consistently indicating that pancreatic, head and neck, and lung cancers are intrinsically associated with malnutrition.

Nicholson et al. investigated the association between unexpected weight loss and cancer. They identified that the most closely associated neoplasms were pancreatic cancer, cancer of unknown primary, gastroesophageal cancer, lymphoma, hepatobiliary cancer, lung cancer, bowel cancer, and renal-tract cancer [24]. Similarly, our findings resonate with the low prevalence of malnutrition in certain cancers, specifically prostate and breast, echoing established research outcomes.

One of the key factors contributing to variations in the risk of malnutrition among different types of cancer may be linked to the varying likelihood of developing cachexia. Cachexia emerges as a consequence of tumor-induced activation of inflammatory pathways, which subsequently initiates a wasting response characterized by symptoms such as anorexia, disrupted metabolism, and involuntary loss of both lean muscle and fat mass [11]. Presently, there is ongoing debate regarding whether cancer cachexia should be classified as a nutritional disorder or as a systemic inflammatory syndrome. The available evidence lends support to the idea of cachexia as a "disease-related inflammation accompanied by malnutrition" [25].

Pancreatic cancer is notably linked with involuntary weight loss and malnutrition, with around 71% of patients presenting with cachexia upon diagnosis. [26]. Cachexia in pancreatic cancer is driven by an inflammatory process with significant catabolic effects. Studies indicate that pancreatic tumors secrete an array of cytokines, such as interleukin-1 (IL-1), IL-6, IL-8, and tumor necrosis factor alpha (TNF-alpha). Notably, TNF-alpha stands out for its robust role in advancing cachexia, spurring processes like lipolysis, proteolysis, insulin resistance, and muscular deterioration [27]. In pancreatic cancer, another contributing factor to malnutrition is anorexia and decreased appetite, which is mediated by IL-1. This interleukin triggers the release of serotonin, which, in turn, contributes to the constant activation of POMC/CART (cocaine- and amphetamine-regulated transcript) neurons [27]. Additionally, malnutrition in pancreatic cancer can be attributed to mechanical factors that disrupt nutrient absorption. These factors include external compression caused by the tumor or its surgical removal, resulting in anatomical changes that lead to pain and symptoms affecting eating and nutrient absorption (such as fatigue, dysphagia, gastroparesis, constipation, and pancreatic insufficiency). Tumor growth can also cause intestinal obstruction by infiltrating or compressing the duodenum or stomach, which clinically manifests as nausea and

vomiting [28]. Adverse reactions to chemotherapy and radiotherapy further contribute to malnutrition, presenting as symptoms like nausea, vomiting, anorexia, and abdominal pain.

Another cancer type that frequently leads to significant malnutrition is lung cancer. The mechanisms of cachexia in lung cancer appear to be similar to those in pancreatic cancer, particularly involving an inflammatory process and its catabolic effects. However, in lung cancer, the inflammatory process intensifies and may be exacerbated by comorbidities associated with lung cancer, such as chronic obstructive pulmonary disease (COPD) and idiopathic interstitial pneumonia, which can also contribute to cachexia [29].

Some limitations to the present study should be discussed. We employed a retrospective case-control design, focusing on CGA reports. The inclusion criteria were restricted to patients with comprehensive reports, particularly those assessed using the MNA-SF, irrespective of their cancer status. A significant gap in our data was the absence of details about the cancer stage, even though the study included patients across various metastatic stages. Information about ongoing chemotherapy or surgical procedures at the time of the CGA was also missing. Nevertheless, our research sheds light on the varying prevalence of malnutrition among different cancer types in comparison to control subjects.

Furthermore, the adoption of the MNA-SF for nutritional evaluation poses an additional limitation, potentially making our findings less aligned with studies employing alternative assessment methods. To illustrate, a recent meta-analysis delving into the heightened mortality risk associated with malnutrition in cancer patients covered ten studies; only one utilized the MNA-SF, while five leveraged the MNA. This underscores the diverse methodologies present in current research literature.

Conclusions

In conclusion, the prevalence of malnutrition in older adults with cancer varied depending on the specific type of cancer. Neoplasms most strongly associated with malnutrition included pancreatic, head and neck, esophagus and stomach, lung, bile duct, and colorectal cancers. In contrast, prostate, breast, and skin neoplasms exhibited a lower frequency of malnutrition. These findings underscore the importance of tailored nutritional assessment and support strategies for older cancer patients, taking into account the specific cancer type and its associated risk factors.

Article information and declarations

Author contributions

Teodoro J. Oscanoa – conceptualization, writing – original draft preparation, writing – review and editing.
Edwin C. Cieza – data curation, formal analysis, writing – review and editing.
Maryam Pourhassan – data curation, formal analysis.
Roman Romero-Ortuno – writing – original draft preparation, writing – review and editing.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restriction.

Ethics statement

This study was approved by the Research Ethics Committee of Almenara Hospital in Lima, Peru (letter 80-CIEI-OIyD-GRPA-ESSALUD-2023, March 27, 2023). The necessary strategies were implemented to maintain the privacy of patient information.

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Conflict of interst

None declared.

Teodoro J. Oscanoa PhdD

Universidad de San Martín de Porres

Facultad de Medicina Humana

Av. Alameda del Corregidor 1502

La Molina 15024 Lima, Perú

e-mail: tjoscanoae@gmail.com

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Table I. Patient characteristics

Variables	**Cases (patients with cancer (n = 354)**	**Controls (patients without cancer) (n = 289)**	**p value**
mean age (years) (SD)	77.5 (7.5)	79.8 (7.4)	< 0.001
male sex (%)	185 (52.3%)	130 (45.0%)	NS
female sex (%)	169 (47.7%)	159 (55.0%)	NS
The Mini Nutritional Assessment Short Form (MNA-SF)			
mean total MNA-SF (SD)	9.2 (3.1)	10.8 (2.8)	<0.001
MNA-SF: 12–14 points: Normal (%)	96 (27.1%)	138 (47.8%)	<0.001
MNA-SF: 8–11 points: at risk (%)	147 (41.5%)	113 (39.0%)	NS
MNA-SF: 0–7 points: malnourished (%)	111 (31.4%)	38 (13.2%)	<0.001
mean BMI (kg/m^2) (SD)	24.5 (4.2)	25.5 (5.1)	<0.001
mean Charlson Comorbidity Index (SD)	3.2 (1.9)	1.9 (1.2)	<0.001
median (IQR) Barthel Index for Activities of Daily Living	95% (85–100)	95% (85–100)	–
mean Lawton Instrumental Activities of Daily Living Scale (SD)	5.1 (2.3)	4.6 (2.5)	NS
depression by DSM IV criteria (%)	64 (18.5%)	81 (29.2%)	<0.001
Gijon Social Family assessment scale >14 points: social problem (%)	5 (1.4%)	10 (3.5%)	NS
median (IQR) MMSE score (SD)	26 (IQR: 21–28)	24 (IQR: 24–27)	–

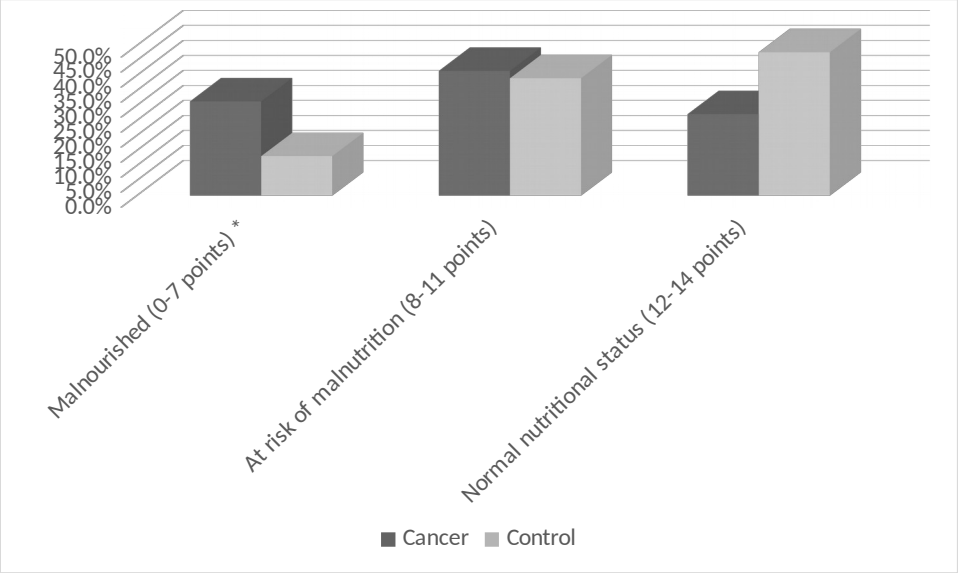
NS – not significant; SD – standard deviation; MNA-SF – Mini Nutritional Assessment Short Form; BMI – body mass index; MMSE – Mini Mental State Examination; IQR – interquartile range

Table II. Malnutrition frequency in older adults according to different cancer types

Tumor site	**Total patients cancer (n = 354)**		**Mini Nutritional Assessment Short Form (MNA-SF)**						**Odds ratio (MNA-SF: <8 cancer *vs.* control <8)**	**p value**
			Normal nutritional status (12–14 points), n = 96 (27%)		**At risk of malnutrition (8–11 points), n = 147 (42%)**		**Malnourished (<8 points), n = 111 (31%)**			
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**		
colorectal	72	20.3	19	26.4	31	43.1	22	30.6	4.21 (2.07–8.56)	0.0001
esophagus and stomach	65	18.4	8	12.3	29	44.6	28	43.1	15.89 (6.81–37.09)	< 0.0001
hematological (non-Hodgkin lymphoma, leukemia)	37	10.5	11	29.7	16	43.2	10	27.1	3.30 (1.30–8.36)	0.0117
prostate	34	9.6	15	44.1	12	35.3	7	20.6	1.70 (0.65–4.45)	0.2846
breast	25	7.1	11	44.0	13	52.0	1	4.0	0.33 (0.04–2.64)	0.2960
skin	25	7.1	14	56.0	10	40.0	1	4.0	0.26 (0.03–2.04)	0.1993
gynecologic cancer (cervix, endometrium, ovary)	24	6.8	11	45.8	9	37.5	4	16.7	1.32 (0.40–4.38)	0.6495
lung	21	5.9	3	14.3	7	33.3	11	52.4	13.32 (3.54–50.16)	0.0001
pancreas	18	5.1	1	5.6	4	22.2	13	72.2	47.21 (5.99–372.43)	0.0003
bile ducts	15	4.2	1	6.7	10	66.7	5	33.3	18.16 (2.06–160.13)	0.0090
urologic (kidney, bladder)	10	2.8	2	20.0	4	40.0	4	40.0	7.26 (1.28–41.17)	0.0251
head and neck	8	2.3	1	12.5	2	25.0	5	33.3	18.16 (2.06–160.13)	0.0090
liver	3	0.8	1	33.3	1	33.3	1	33.3	3.63 (0.22–59.42)	0.3658
other/unknown primary sites	5	1.4								
two tumor sites	8	2.3	4	50.0	1	12.5	3	37.5	2.72	0.2021

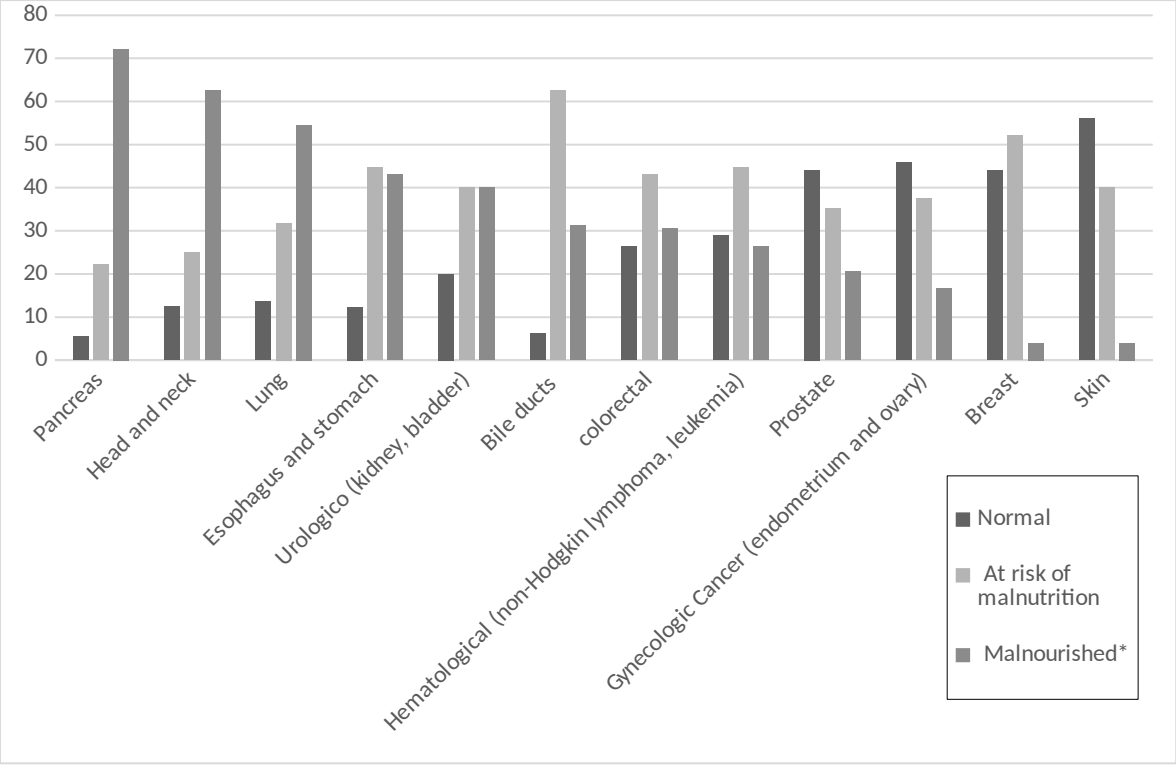
									(0.58–12.70)	
metastatic tumor	63	17. 8	1 7	27.0	25	39.7	21	33.3	4.49 (2.16–9.34)	0.0001

Figure 1. Frequency of malnutrition in older patients with or without cancer



* – according to the Mini Nutritional Assessment Short Form (MNA-SF)

Figure 2. Malnutrition frequency in older adults according to different cancer types



* – according to the Mini Nutritional Assessment Short Form (MNA-SF)