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Indicators for the Assessment and Monitoring of Nutritional Changes in Patients with Hematologic Diseases Undergoing Chemotherapy: A Scoping Review

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Abstract

Introduction: Nutritional assessment in patients with hematologic malignancies should be multiparametric, integrating different methods to better identify nutritional risk and facilitate clinical follow-up; however, there is no ideal model for such an assessment.

Methods: A scoping review conducted according to the Joanna Briggs Institute and PRISMA-ScR criteria. Studies involving adults (≥18 years) with hematologic diseases hospitalized for antineoplastic treatment were included. The databases consulted included PubMed, Embase, Scopus, Web of Science, Cochrane Library, LILACS, SciELO, EBSCO, and gray literature. Selection was performed by two independent reviewers.

Results: Thirteen studies involving 911 patients were included. Populations with mixed hematologic diseases predominated (61.5%). The most commonly used methods were anthropometry and laboratory markers such as albumin and CRP (both 92.3%), nutritional screening and handgrip strength (46.2%), and bioelectrical impedance analysis (38.5%). Food intake was assessed primarily using 24-hour recall and food diaries in 61.5% of the studies. There was considerable methodological variability and low standardization among the studies.

Conclusion: Methodological heterogeneity limits the comparability of the studies. The adoption of standardized and more sensitive instruments is recommended.

INTRODUCTION

Hematologic diseases comprise a group of benign and malignant conditions that affect the hematopoietic system, including neoplasms such as leukemias, lymphomas, and multiple myeloma, as well as myelodysplastic syndromes. These conditions require intensive treatments, such as chemotherapy and hematopoietic stem cell transplantation [1]. Patients with hematologic diseases frequently experience treatment-related side effects. These effects directly impact quality of life, nutritional status, and survival. Among the most common symptoms during this period are nausea, vomiting, gastrointestinal disturbances, loss of appetite, and anorexia. Consequently, they may be associated with the development of malnutrition, loss of muscle mass, reduced muscle strength, and metabolic changes that compromise the clinical prognosis. [2, 3, 4].

Evidence regarding tools and indicators capable of adequately identifying nutritional changes in patients with hematologic diseases remains scarce. This limitation becomes even more relevant in the context of chemotherapy treatment. Studies indicate that nutritional assessment in this population is complex and often requires a combination of different methods, as no single indicator reflects the nutritional status of these patients [5, 6]. Furthermore, certain factors can mask these changes, such as intravenous hyperhydration, edema, and anasarca. These conditions can alter body weight and compromise the interpretation of traditional anthropometric indicators; they may also act as confounding factors, making it difficult to obtain reliable measurements of nutritional status [7, 8, 9].

Studies involving cancer patients with solid tumors demonstrate the effectiveness of various nutritional strategies and indicators. These approaches highlight an association between nutritional status, clinical complications, and prognosis during anticancer treatment [10]. However, when it comes to patients with hematologic diseases, the available literature is still relatively limited, with fewer studies specifically investigating nutritional changes, cachexia, or sarcopenia in this population [11]. Although both conditions share similar metabolic characteristics, patients with hematologic malignancies present specific clinical and therapeutic features. Among these characteristics are a hypercatabolic state, a heightened inflammatory response, and intensive treatments related to the pathophysiology of the disease [12, 13].

In this context, this study is motivated by the need to synthesize the available evidence on this topic, as well as to identify gaps in the literature that may guide future research and inform clinical practice.

This scoping review aims to map and synthesize the indicators, methods, and tools used to assess and monitor the nutritional status of adult patients with hematologic diseases. It also seeks to identify how these strategies are applied throughout antineoplastic treatment. The results are expected to contribute to the systematization of the methodological approaches employed to help improve nutritional assessment and monitoring strategies in this population.

METHODOLOGY

This review was conducted in accordance with the methodology proposed by the Joanna Briggs Institute (JBI) and reported in accordance with the PRISMA-ScR guidelines [14, 15]. The methodological protocol was registered on the Open Science Framework (OSF) platform (osf.io/5teu8), where the objectives, the research questionv- “What are the most effective indicators for assessing nutritional changes during hospitalization for the treatment of hematological diseases?” - and the methods used to conduct the review were defined.

The eligibility criteria were established based on the PCC (Population, Concept, and Context) strategy, as shown in the table below.

Table 1
Formulation of the research question

Population	**Onco-hematological patients, aged 18 years or older, undergoing chemotherapy**
Concept	Tools and indicators used to assess nutritional changes in these patients
Context	Hospital treatment

Studies involving hospitalized individuals aged 18 years or older with hematologic diseases that addressed changes in nutritional status during chemotherapy were included. Studies published in any language and without restrictions on methodological design were considered. However, the studies had to present primary data, two or more nutritional assessments conducted during hospitalization, and

availability of the full text. Publications from the gray literature were also included, with no restrictions on the year of publication, considering the relevance and currency of the evidence on the topic. Studies addressing solid tumors or focusing primarily on other clinical conditions were excluded, as were those that did not present clinical outcomes or relevant information related to the participants' nutritional status.

All stages of the review were conducted independently by two reviewers (G.O. and M.S.). Disagreements between the reviewers were resolved by consensus or with the involvement of a third reviewer (EIR), when necessary, to ensure the consistency of the information collected.

Information sources included the electronic databases VHL (Virtual Health Library), PubMed/Medline, LILACS, Cochrane Library, Embase, SciELO (Scientific Electronic Library Online), Scopus, EBSCO, and Web of Science. Additionally, searches for gray literature were conducted using Google Scholar. The reference lists of the included studies were manually reviewed to identify additional publications. The most recent search was conducted on January 10, 2026.

The search strategy was developed systematically, beginning with an exploratory search of the MEDLINE and VHL databases to identify controlled descriptors and free-text terms related to the topic. Based on this initial step, a structured search strategy was developed, combining descriptors and keywords using the Boolean operators AND and OR, with the assistance of the institution's librarian. The searches were individually tailored to each database, taking into account their methodological specificities, and applied to the following sources: PubMed, LILACS/BVS, Embase, Scopus, EBSCO, and SciELO. Additionally, a search of the gray literature was conducted using Google Scholar, as well as a manual search of the reference lists of the included studies to identify potentially relevant additional publications. The complete search strategies used for each database are presented in Table S.1.

The process of selecting evidence sources occurred in two stages. Initially, the studies identified in the databases were exported to the Rayyan® software [16], where duplicates were removed. Next, the titles and abstracts were assessed for eligibility. Subsequently, the full texts of the potentially relevant studies were analyzed to confirm that they met the inclusion criteria.

Data extraction was performed using a standardized form that had been previously tested by the research team. The information extracted was predefined in accordance with the review's objectives and included study identification data, such as authors, year, and country. Information was also collected on methodological characteristics, the study population, context, nutritional assessment methods, main findings, and outcomes. No critical assessment of the methodological quality of the included studies was performed, since this step is not mandatory in scoping reviews and the objective of the study was to map the available evidence on the topic, not to evaluate the effectiveness of interventions.

The results were synthesized descriptively by presenting the data in tables and figures, accompanied by a narrative summary. The results were organized to highlight the main characteristics of the available evidence and the methods used. In addition, knowledge gaps identified in the literature were presented.

RESULTS

Thirteen complete studies that fully met the established inclusion and exclusion criteria were included. The studies identified in the search, as well as the screening and selection stages, are described in Fig. 1. Most of the studies were conducted in Brazil (n = 3), followed by Japan (n = 2) and the Netherlands (n = 2), in addition to single studies conducted in South Korea, Spain, France, Norway, and Poland. (Fig. 2)

The most common methodological design was the longitudinal observational study, identified in eight studies. The sample comprised participants with various hematological diseases, with a predominance of mixed hematological disorders (61.5%). Regarding the treatment profile, a predominance was observed of patients undergoing chemotherapy alone (46.2%), followed by those treated with chemotherapy combined with allogeneic hematopoietic stem cell transplantation (HSCT) (38.5%). Less frequently, combined treatment regimens of chemotherapy and radiation therapy + HSCT, and autologous HSCT (both 7.7%) were observed (Fig. 3). The other general characteristics of the selected studies are summarized in Table 2.

Only six studies conducted formal nutritional screening or assessment procedures. Among the instruments used, the Patient-Reported Global Subjective Assessment (ASG-PPP) was the most common; it was used alone in three studies and combined with the Nutritional Risk Index (NRI) in one study. In addition, one of the studies employed a screening method that had not been validated for the study population.

Monitoring of food intake was reported in eight studies. However, the methods used were quite diverse. The 24-hour recall (24h-R) was the most common method (n = 8), followed by food diary (n = 3). Another strategy was based on estimating daily energy intake by analyzing hospital records of oral intake; consumption was calculated and expressed as a percentage of each patient's estimated energy requirement (n = 1). Another study also estimated daily energy intake by comparing food intake with energy expenditure (n = 1). Direct food weighing (n = 1) and the use of intake percentages (n = 1) were also observed in the studies that assessed food consumption.

Anthropometric assessment was included in almost all studies. Only one study did not use this method. Five studies combined the triad of weight, height, and Body Mass Index (BMI). One study [17] assessed weight, height, BMI, triceps skinfold thickness (TSFT), arm circumference (AC), and arm muscle area/circumference (AMA/AMC). Another study [18], used the same six indicators and additionally included calf circumference (CC). A separate study [19], combined weight with waist circumference and arm muscle circumference (AMC) or calf circumference (CC), whereas only one study [20] monitored patients using weight and thigh circumference. Additionally, bioelectrical impedance analysis (BIA) was used in five studies to provide a more detailed assessment of body composition during treatment.

Functionality was assessed in eight studies using handgrip strength as the method of analysis, either alone or in combination with fatigue tests, the 6-minute walk test, or knee extensor strength (n = 6). One

study used only the fatigue test and another used only the 6-minute walk test, while one of the studies did not specify the method used.

Laboratory assessment was the most common method, used in 12 studies. Serum albumin was measured in all of these studies and was frequently combined with C-reactive protein (CRP) (n = 5) and other inflammatory or nutritional markers.

The specifics of the methods applied in the initial nutritional assessment and at subsequent monitoring time points, as well as the main differences identified in each study, are presented in Table 3.

Significant variation was observed in the frequency of nutritional follow-up among the studies. The most commonly reported minimum interval ranged from 7 to 20 days.

Based on the synthesis of the results, a conceptual model for nutritional assessment and monitoring in hematology patients was developed, bringing together the main tools for nutritional screening, diagnosis, and follow-up described in the literature (Supplementary Fig. 2).

Adapted from Page MJ, McKenzie JE, Bossuyt PM, et al. *The PRISMA 2020 statement: an updated guideline for reporting systematic reviews*. BMJ. 2021;372:n71.

Table 2
General characteristics of the studies

Study (Author, Year)	Country	Sample (N)	Age (mean/median)	Population (Disease)	Treatment
Alves (2024)	Brazil	20	Average age of 40,3 years	Mixed hematology	Chemotherapy + HSCT
Iversen et al. (2010)	Norway	15	Average age of 53,5 years	Multiple Myeloma	Chemotherapy + HSCT
Lee et al. (2021)	South Korea	40	Average age of 47,7 years	Mixed hematology	Sole-modality chemotherapy
Peñalva et al. (2009)	Spain	125	Average age of 51,3 years	Mixed hematology	Sole-modality chemotherapy
Rzepecki et al. (2007)	Poand	54	Median 36 years	Mixed hematology	Chemotherapy + HSCT
Schiavoni (2024)	Brazil	27	Average age of 38,15 years	Mixed hematology	Chemotherapy + HSCT
Schiavoni et al. (2020)	Brazil	32	Average age of 35,3 years	AML	Sole-modality chemotherapy
Takahashi et al. (2024)	Japan	104	Average age of 62,2 years	Mixed hematology	Sole-modality chemotherapy
Takekiyo et al. (2015)	Japan	35	Median 58 years	Mixed hematology	Chemotherapy + HSCT
Tanaka et al. (2017)	Japan	34	Median 51,5 years	Mixed hematology	Chemotherapy + HSCT
Thomaz et al. (2015)	Brazil	56	Average age of 33,7 years	Mixed hematology	Chemotherapy + HSCT
Van Lieshout et al. (2024)	Netherlands	126	Average age of 57,4 years	Leukemia e MDS	Sole-modality chemotherapy
Van Lieshout et al. (2025)	Netherlands	204	Average age of 56,3 years	Leukemia e MDS	Sole-modality chemotherapy

Table 2. Characteristics of the included studies regarding country of publication, sample size, participants' age, population analyzed, and type of treatment used. Abbreviations: HSCT = Hematopoietic Stem Cell Transplantation; AML = Acute Myeloid Leukemia; MDS = Myelodysplastic Syndrome.

Legend: The image displays the location of the 13 studies selected for the scoping review. The icons (pins) indicate the countries of origin, accompanied by text boxes specifying the absolute number of studies (n) conducted in each location: Brazil (n = 4), Japan (n = 3), Netherlands (n = 1), France (n = 1), Spain (n = 1), Poland (n = 1), Norway (n = 1), and South Korea (n = 1). The data demonstrate a concentration of research within the Brazil-Japan axis.

Figure 3. Distribution of diagnoses and therapeutic regimens used in the analyzed studies

Figure A shows the predominance of diagnoses of mixed hematological diseases (n = 8; 61.5%), followed by leukemias (n = 4; 30.8%) and multiple myeloma (n = 1; 7.7%). Figure B details the treatment modalities, especially exclusive ones (n = 6; 46.2%) and chemotherapy specific to allogeneic hematopoietic stem cell transplantation (HSCT) (n = 5; 38.5%). Notes: HSCT: Hematopoietic Stem Cell Transplantation; Chemo: Chemotherapy; Radio: Radiotherapy.

Table 3
Breakdown of Nutritional Assessments: Pre-treatment/Baseline vs. Follow-up

Study (Author, Year)	Initial assessment (T1 – Baseline)	Follow-up assessments (T2, T3, T4...)	Results obtained and differences observed
Alves (2024)	T1 (Pre-treatment): Weight, BMI, NRI, Albumin, CRP, and Adiponectin.	T2 (During treatment): ~20 days after T1. Reassessment of all parameters.	Significant increase in adiponectin at T2 ($p = 0.007$). 100% of patients remained at high nutritional risk according to the NRI, although 60% were eutrophic according to BMI.
Iversen et al. (2010)	T1 (Baseline): Weight, Handgrip Strength, TSF, Biochemistry, and Quality of Life.	T2 through T4: End of chemotherapy, pre-melphalan, and post-melphalan. T5: 6 months later.	Significant reductions in handgrip strength, C-reactive protein (CRP), albumin, and vitamins D and E during treatment.
Lee et al. (2021)	Week 1 (Before treatment): ASG-PPP, Weight, BMI, Mobility, and Biomarkers.	T2 to T4 (Weekly, during treatment): Repeat measurements from Weeks 1, 2, and 3.	Significant weight loss in Weeks 2 and 3 ($p < 0.01$). Decreased mobility and oral intake in Week 3, with elevated levels of the biomarkers GDF-15 and CXCL13.
Peñalva et al. (2009)	T1 (Admission): ASG, NRI, Weight Loss, Intake, Albumin, and Proteins.	T2 (Discharge): Repeat measurements and daily monitoring of actual food intake (weighing of food).	Significant overall weight loss (2.3 kg, $p < 0.001$). Only the group receiving the flavored commercial supplement avoided nutritional deterioration as measured by ASG.
Rzepecki et al. (2007)	T1 (Pre-conditioning): Albumin, Pre-albumin, Transferrin, RBP, CRP, and other proteins.	T2 through T4: Day + 7, Day + 14, and Day + 21 (Post-transplant).	A drastic drop in all serum proteins following conditioning. Pre-albumin on Day + 7 was the best predictor of the need for NPT.
Schiavoni (2024)	T1 (Pre-treatment): Complete anthropometry, BIA/BIVA, handgrip strength, biochemistry, and basal metabolic rate (BMR).	T2 to T4: Infusion day (T2), D + 21 (T3), and D + 100 (T4).	Weight and BMI decreased only in the placebo group (D + 100). Handgrip strength was preserved only in the Whey + Leucine group. A decrease in BMR was observed in the placebo group at T2.
Schiavoni et al. (2020)	T1 (Pre-Treatment): ASG-PPP, 24-hour recall, weight, and BMI.	T2 (During): Reassessment after 3 to 4 weeks of hospitalization.	Deterioration in nutritional status and increased prevalence of malnutrition as measured by the ASG-PPP. Symptoms such as nausea and mucositis associated with reduced food intake.
Takahashi et al.	T1 (Pre-Chemo): Weight, BMI, Albumin, and	T2 (Post-Chemo): ~30 days after the end of	Significant reduction in skeletal muscle mass. Muscle

Study (Author, Year)	Initial assessment (T1 – Baseline)	Follow-up assessments (T2, T3, T4...)	Results obtained and differences observed
(2024)	Muscle Mass (segmental BIA).	the cycle.	loss in the lower extremities (p = 0.040) was the factor that contributed most to worse outcomes.
Takekiyo et al. (2015)	T1 (2 weeks pre-transplant): Weight, BIA, handgrip strength, and 6-minute walk test (6MWT).	T2 (6 weeks post-transplant): Complete reassessment 43 days after the transplant.	Reduction in muscle mass in the trunk (-7.4%) and upper limbs (-5.6%). Significant decline in handgrip strength (-6.7%) and performance on the 6MWT (-5.4%).
Tanaka et al. (2017)	T1 (1 week pre-transplant): Weight, circumferences, strength (manual knee extensor test), 6MWT, and biochemistry.	T2 (Discharge): ~30 days. Intake and biochemistry monitored at 5 time points.	Significant decrease in weight and muscle strength. Post-transplant reduction in albumin and elevation in CRP; low oral caloric intake correlated with muscle weakness.
Thomaz et al. (2015)	T1 (Admission): Weight, PCT, CB, AMB, BMI, and Food Intake.	T2 and T3 (during treatment): Days 15 and 30 of hospitalization.	Energy and protein deficit. Baseline AMB ≤ the 15th percentile was the only isolated predictor of 180-day mortality.
van Lieshout (2024)	T1 (Pre-treatment): ASG-PPP, Weight, BIA, Waist Circumference, AMB, and % Calorie Intake.	T2 (Post-Discharge): 3 to 5 weeks after the chemotherapy cycle.	Significant reduction in weight (-4.1%) and fat-free mass (FFM), while fat mass remained stable. Worsening of the ASG-PPP score.
van Lieshout (2025)	T1 (Pre-treatment): ASG-PPP, Weight, Waist Circumference, CP, BIA, Handgrip Strength, and Biochemistry.	T2 through T4 (during treatment): Continuous weekly monitoring until discharge.	Hospitals with a proactive approach had patients with less weight loss (-4.2% vs. -8.2%) and shorter length of stay (p = 0.009) compared to the observational approach.

Table 3. Detailed description of the nutritional assessments performed, including baseline/pre-treatment evaluation time points, monitoring stages during treatment, and the main outcomes observed throughout follow-up. Abbreviations: AMB = Arm Muscle Area; ASG = Subjective Global Assessment; ASG-PPP = Patient-Generated Subjective Global Assessment; BIA = Bioelectrical Impedance Analysis; BIVA = Bioelectrical Impedance Vector Analysis; BN = Nitrogen Balance; CB = Arm Circumference; CP = Calf Circumference; FFM = Fat-Free Mass; IMC = Body Mass Index; NPT = Total Parenteral Nutrition; NRI = Nutritional Risk Index; PCR = C-Reactive Protein; PCT = Tricipital Skinfold Thickness; Pré-alb = Prealbumin; QdV = Quality of Life; RBP = Retinol Binding Protein; TSF = Tricipital Skinfold; 6MWT = Six-Minute Walk Test.

DISCUSSION

An analysis of the selected studies revealed a higher concentration of scientific output in Brazil, Japan, and the Netherlands. This may be related to the presence of centers of excellence in hematology and transplantation, as well as the high demand for nutritional assessment and monitoring strategies that drive research in this population [21].

The studies focused predominantly on populations with mixed hematologic diseases (61.5%) undergoing intensive regimens, such as chemotherapy alone or in combination with allogeneic HSCT. This geographic and clinical diversity is crucial, as hematologic patients face nutritional challenges distinct from those with solid tumors due to the high chemosensitivity and toxicity of treatments, which induce rapid weight loss and muscle catabolism [11, 22].

As recommended by nutritional therapy guidelines and consensus statements, early screening is essential for identifying risk and preventing malnutrition in these patients [22, 9]. In the studies included in this review, the Patient-Reported Global Assessment (PGR-PPP) was the most commonly used tool. This tool is widely recognized as the gold standard in oncology because it detects not only changes in physical condition but also the impact of symptoms (such as mucositis, loss of appetite, and nausea) on food intake [23]. Additionally, the use of the Nutritional Risk Index (NRI) in hematology studies has gained prominence as a strong predictor of overall survival and recurrence-free mortality, especially in the context of allogeneic HSCT [24]. However, the identification of studies using unvalidated tools highlights the need for methodological standardization to ensure diagnostic accuracy in this specific population [9]. Nevertheless, it is evident that there is still no unanimous consensus on this assessment among healthcare services.

In this context, the absence of the GLIM (Global Leadership Initiative on Malnutrition) criteria in the included studies represents a significant gap and an opportunity for discussions regarding diagnostic standardization at the international level. This is likely due to the time that elapsed between the development of the criteria and the publication dates. It is expected that the incorporation of GLIM into the ICD will expand its use. GLIM combines phenotypic criteria (such as unintentional weight loss and reduced muscle mass) and etiological criteria (reduced intake and severity of disease/inflammation) and demonstrates high agreement with the ASG-PPP and the NRI in surgical and oncology populations [25, 26]. This indicates that malnutrition as defined by GLIM is an independent predictor of survival and longer hospital stays [27, 28, 29]. The difficulty in accurately measuring muscle mass in hospitalized patients and the complexity of integrating these data into simple retrospective or observational studies explain why more traditional and direct tools, such as the ASG-PPP alone, still predominate [29, 30].

Body composition is directly related to malnutrition; in the selected studies, the prevalence of classical anthropometric measures (weight and BMI) was noted in 92.3% of the studies. Regarding the anthropometric assessment of muscle mass, the use of calf circumference (CC) and arm muscle circumference (AMC) offers advantages because they are low-cost methods that are easy to apply at the bedside. However, TC should be interpreted with caution in patients with lower extremity edema [31, 28]. Nevertheless, these parameters are limited because they do not distinguish between body

compartments and are influenced by edema and fluid retention, which are common due to the use of corticosteroids and intensive chemotherapy regimens [23, 27]. In this context, Bioelectrical Impedance Analysis (BIA), particularly through the Phase Angle (PhA), offers a more refined assessment of cellular integrity and hydration status [32, 33]. A reduced PhA correlates with malnutrition even when BMI is within normal ranges, as PhA acts as a superior marker of membrane integrity and cellular mass, capable of identifying deterioration in nutritional status even when weight remains stable due to hyperhydration [34, 27]. Patients with low phase angle (PhA) have a higher risk of 12-month mortality and prolonged hospital stays [35]. For this reason, the combined use of anthropometry (CMB and arm muscle area, AMB) for initial screening and BIA/BIVA for longitudinal monitoring is recommended, as it allows for the early identification of lean mass loss, enabling more effective interventions [36, 37, 33].

On the other hand, it could overcome the limitations of anthropometry in patients with edema and the inaccuracy of BIA in states of extreme hydration, allowing for the measurement of muscle thickness and the identification of fat infiltration (myosteatosis) [28, 30]. The limited use of this tool suggests a technological gap or the need for specialized training of nutrition teams to incorporate this method into highly complex routines. Despite the potential of USG as a promising tool for assessing muscle quantity and quality at the bedside, its absence in the reviewed articles reflects the lack of standardized protocols for onco-hematological patients [38, 39, 40].

In the context of functionality, handgrip strength (measured using a handgrip dynamometer) has established itself as a sensitive functional indicator. It demonstrates significant predictive power for clinical outcomes. Recent evidence indicates that low handgrip strength is common among cancer patients (potentially exceeding 57%) and acts as a robust predictor of severe chemotherapy-induced toxicity, surpassing even BMI; furthermore, patients with low muscle reserve are 2.7 times more likely to experience adverse outcomes and mortality [41, 30].

From the same perspective, the use of the handgrip test proved to be a better marker of nutritional risk than anthropometric indicators alone [29]. The ease of performing dynamometry—which requires only a standardized protocol and a calibrated dynamometer—makes it an indispensable tool and superior to more complex physical performance tests (such as walking speed or a walking test) that may be impractical for bedridden hematology patients or those with motor limitations [25, 29, 30]. The association of muscle strength with GLIM criteria enhances its prognostic value, allowing for the early identification of cancer-related sarcopenia [37]. In hospitalized patients, low muscle strength is also an early indicator of functional decline and is significantly associated with nutritional risk as detected by the NRI and with malnutrition as assessed by the ASG-PPP [35, 36, 41].

A critical point identified was the seventh day (D7) after the start of treatment, when the decline in oral intake results in a marked negative energy balance. This cumulative energy and protein deficit is associated with adverse clinical outcomes, such as weight loss, depletion of muscle mass and strength, worsening functional status, as well as an increased risk of mortality and complications such as graft-versus-host disease (GVHD) in post-transplant patients [42, 43]. Loss of appetite is directly related to

treatment toxicity and systemic inflammation, resulting in reduced energy intake, particularly between the 1st and 3rd days of the chemotherapy cycle [44]. Monitoring food intake is an important preventive indicator for quantifying this deficit. Consequently, reduced food consumption is associated with malnutrition and worse clinical outcomes [43]. Data from the analysis of food consumption demonstrated a progressive deterioration in nutritional intake during critical phases of hematologic treatment. This finding was observed primarily during chemotherapy induction and conditioning for HSCT. Using methods such as the 24-hour recall and food diary, the researchers identified that reduced oral intake is often caused by symptoms of gastrointestinal toxicity, including nausea, loss of appetite, anorexia, and mucositis; these symptoms are prevalent in up to 80% of onco-hematologic patients and constitute key factors in the development of Anorexia-Cachexia Syndrome (ACS) [9]. In contrast, evidence from studies using proactive interventions and oral nutritional supplementation has shown that these are effective strategies for increasing food intake, thereby meeting energy requirements and maintaining nutritional status (12,22). The most commonly used methods in the literature for assessing intake are the 24-Hour Recall (24HR), the Food Diary, and the Food Frequency Questionnaire (FFQ). The 24HR is the most common due to its speed, but it suffers from memory bias (44). To optimize this assessment, the use of subjective scales validated for the Brazilian oncology context—such as the Appetite Assessment Scale (EAA-BR), based on a visual analog scale—allows for rapid identification of anorexia and correlates with actual acceptance of the hospital diet. The EAA has proven to be a useful tool for identifying patients who require immediate pharmacological or nutritional intervention [45]. Care models that incorporate daily monitoring of food intake enable earlier and more effective interventions [46]. In the context of TCTH, maintaining lean body mass through interventions such as protein supplementation and resistance training has demonstrated clinical potential for mitigating severe exercise-induced catabolism [12].

With regard to laboratory testing, this method was used in 92% of the studies and focused on serum albumin. However, recent evidence, including the ASPEN consensus, warns that albumin alone is a marker of inflammation and disease severity, not just of malnutrition [9, 47]. The combination of albumin with C-reactive protein (CRP) was common in the analyzed studies; this strategy aims to distinguish nutritional risk from inflammatory metabolic stress [36]. Rapidly turnovering biochemical markers, such as prealbumin, have also proven useful in guiding decisions regarding the initiation of alternative nutritional therapies, such as total parenteral nutrition (TPN) [9]. Due to its short half-life of approximately 2 days, prealbumin is a more sensitive marker for detecting acute changes compared to albumin [48]. During parenteral nutrition, prealbumin is used to monitor protein-energy intake, allowing for a higher degree of tailoring to patients' needs [9]. However, it is important to interpret these values with caution, and their interpretation should be combined with other markers [49, 50].

This review contributes to the synthesis of evidence regarding nutritional assessment methods used in onco-hematological patients undergoing chemotherapy and hematopoietic stem cell transplantation (HSCT), allowing for the identification of the main tools employed in clinical practice and the existing gaps in the literature. The mapping of published studies revealed significant advances in the use of more

effective tools and highlighted the importance of continuous nutritional monitoring in this patient population.

However, this review has some limitations that should be taken into account. There was considerable methodological heterogeneity among the included studies, particularly regarding the characteristics of the study populations, stages of hematologic treatment, instruments used for nutritional assessment, and outcomes analyzed. This variability hindered not only direct comparisons between studies but also a more in-depth critical analysis of the superiority, complementarity, or applicability of each method in specific clinical contexts. Consequently, although advantages and limitations of the different nutritional assessment tools were identified, the strength of the evidence is still insufficient to establish definitive recommendations on which method should be prioritized at each stage of onco-hematological treatment.

Furthermore, the lack of standardization in the application, interpretation, and description of the methods has limited the comparison of parameters. This aspect is particularly relevant for clinical practice, since nutritional decision-making in a hospital setting depends on the use of tools capable of early identification of changes in nutritional status and prediction of clinical outcomes. The limited use of internationally standardized diagnostic criteria, such as the GLIM criteria, as well as the limited incorporation of more sensitive methods for assessing muscle mass and muscle quality - such as ultrasound and vector bioimpedance - hinder the development of evidence-based care protocols and reduce comparability among services and treatment centers.

Similarly, the predominance of observational and retrospective studies limits the ability to establish causal relationships between nutritional indicators and the observed clinical outcomes. Furthermore, few studies have simultaneously analyzed different methods of nutritional assessment, which limits our understanding of their relative accuracy, prognostic value, and feasibility of implementation in routine hospital practice. Thus, although the results of this review reinforce the importance of multiparametric nutritional assessment, gaps remain regarding the definition of the most effective strategies for monitoring, risk stratification, and longitudinal follow-up of onco-hematological patients.

CONCLUSION

This review demonstrated that the assessment of nutritional status in onco-hematological patients undergoing chemotherapy should be conducted comprehensively and using multiple parameters, simultaneously considering different aspects of changes in nutritional status, with the aim of reducing the risk of bias and diagnostic errors. It is suggested that future studies use a combination of standardized methods and more sensitive indicators to assess patients during treatment, in order to reduce methodological gaps and improve the comparability of findings. It is hoped that this review will contribute to the improvement of nutritional care in onco-hematology and encourage the development of evidence to support more consistent clinical protocols for the nutritional monitoring of this population.

Declarations

CONFLICT OF INTEREST

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Author Contribution

GO, EIR contributed to the work's conception, design, data collection, data interpretation and analysis; MS contributed to the data collection and data interpretation; EIR and AT participated in the critical revision of the article. All authors read and approved the version of the manuscript being submitted. All authors share responsibility for ensuring the manuscript complies with the journal's style requirements and terms of consideration.

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51. STATEMENTS & DECLARATIONS

Figures

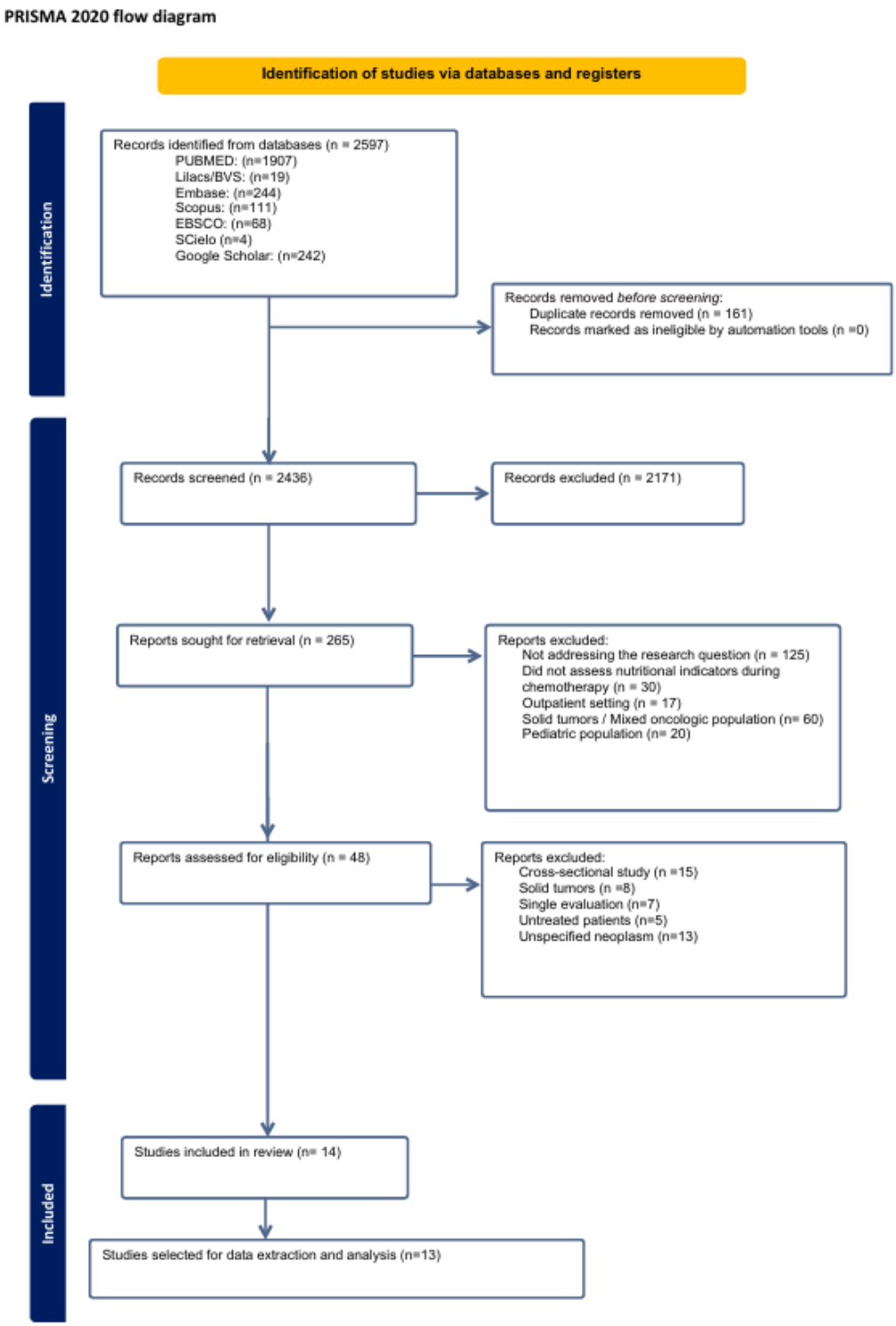


Figure 1

PRISMA-ScR flowchart for the identification, selection, and inclusion of evidence sources.



Figure 2

Global Geographical Distribution of Nutritional Assessment Studies in Hematology

Legend: The image displays the location of the 13 studies selected for the scoping review. The icons (pins) indicate the countries of origin, accompanied by text boxes specifying the absolute number of studies (n) conducted in each location: Brazil (n=4), Japan (n=3), Netherlands (n=1), France (n=1), Spain (n=1), Poland (n=1), Norway (n=1), and South Korea (n=1). The data demonstrate a concentration of research within the Brazil-Japan axis.

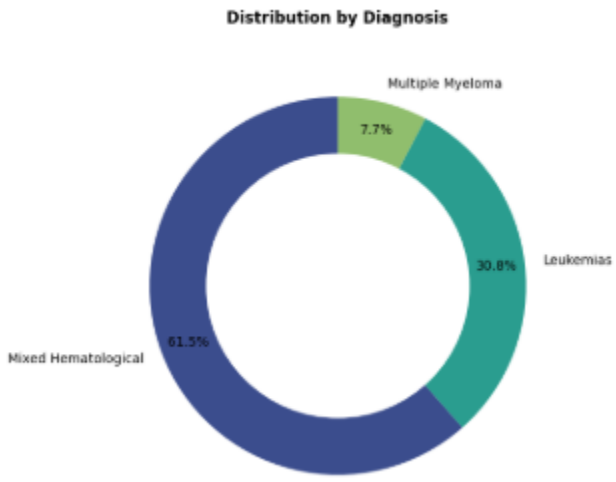


Figure 3

Distribution of diagnoses and therapeutic regimens used in the analyzed studies

Figure 3.A Figure A shows the predominance of diagnoses of mixed hematological diseases (n=8; 61.5%), followed by leukemias (n=4; 30.8%) and multiple myeloma (n=1; 7.7%).

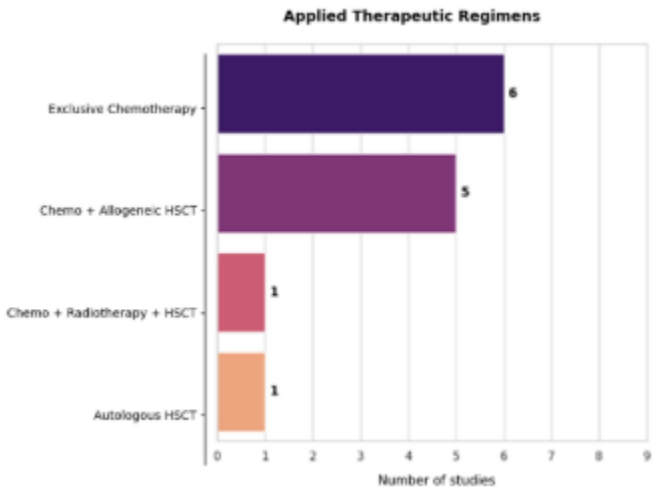


Figure 4

Distribution of diagnoses and therapeutic regimens used in the analyzed studies

Figure 3.B Figure B details the treatment modalities, especially exclusive ones (n=6; 46.2%) and chemotherapy specific to allogeneic hematopoietic stem cell transplantation (HSCT) (n=5; 38.5%). Notes: HSCT: Hematopoietic Stem Cell Transplantation; Chemo: Chemotherapy; Radio: Radiotherapy.

Supplementary Files

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