KEY POINTS

- Patients with cancer may present disorders secondary to the underlying disease, such as malnutrition, sarcopenia, and cachexia, as a result of the exacerbation of systemic inflammation (high C-reactive protein, neutrophil–lymphocyte ratio, and/or pro-inflammatory cytokines).
- The protein recommendation for cancer patients is greater than 1.0–1.5 g/kg of body weight/day; in patients diagnosed with malnutrition, the use of the upper limit is indicated, consisting of 65% of protein of animal origin.
- In relation to amino acids, there is some positive and negative evidence to recommend supplementation. Although leucine is an avenue for new studies, there is no clinical evidence if this amino acid attenuates muscle wasting in sarcopenia or cachectic patients. However, randomized clinical trials should be conducted to comprehend the effects of supplementation.
- Creatine supplementation to clinically treat cancer patients requires caution as evidence has demonstrated controversial findings on cancer metastasis.
- Arginine has an immunomodulatory function, so studies suggest that this nutrient can be supplemented at all stages of cancer treatment as a protein source.
- Glutamine supplementation can be considered well tolerated for cancer patients, particularly in ameliorating mucositis.

system cells are determinants for the development of symptoms of cancer [5]. Enhanced inflammatory responses intervened by pro-inflammatory cytokines, such as interleukin-1 (IL-1) and tumor necrosis factor-alpha (TNF-α), increase the expression of muscle atrophy-specific protein ligases (E3), including atrogin-1/MAFbx and muscle ring finger-1 (MURF-1) impairing the molecular pathways of muscle protein synthesis [6,7].

Furthermore, with this exacerbated inflammatory condition, ubiquitin–proteasome activation may occur from the target protein pathway of rapamycin in mammals (mTORC1), causing protein degradation of myocytes [7,8]. Together, there is a decrease in protein synthesis and the installation of a hypermetabolic state, thus favoring a catabolic state in the cancer patient, further intensifying muscle depletion [3,8].

Another parallel and dependent mechanism to this condition is that physiologically, the hypothalamus is responsible for controlling food intake and energy expenditure. In summary, with the activation of the inflammatory condition triggered by cytokines, the body develops adeptly by suppressing appetite by inverting the secretion of neuropeptides (activating anorexigenic and inhibiting orexigenic) [5].

The result of hypercatabolism caused by intense inflammatory activity associated with decreased food intake can lead patients to insufficient protein–energy reserves, leading to malnutrition, sarcopenia, and cachexia [5]. In addition to these conditions, we still have several factors that present greater risks for developing the associated disorders mentioned above, such as advanced types of cancer, including head and neck, lung, gastrointestinal tract, liver, and pancreas; side effects of oncological treatments (chemotherapy, surgery, and radiotherapy) causing cytotoxic damage to tumor cells; and the presence of early satiety, changes in smell or taste, dysphagia, and odynophagia [3,5,8].

Therefore, it is common to find in these patients a marked loss of muscle or muscle atrophy, a decrease in food intake, especially proteins and essential amino acids for muscle synthesis, a reduced functional capacity, and a reduced quality of life [2]; thus leading to an increased risk of morbidity and mortality for these cancer patients. This highlights the importance of protein synthesis and maintenance of muscle mass with a focus on energy intake, quality, and quantity of proteins and essential amino acids [5].

THERAPEUTIC CONDUCT FOR PROTEINS IN CANCER

Poor food intake and consequent nutritional loss often occur in cancer patients, thus leading to negative clinical results. Therefore, nutritional therapy, especially when performed early, is part of the support for these patients, whose objective is to maintain quality of life and greater tolerance to cancer treatment [4▪▪,5,9,10,11▪▪].

Current and international consensus on nutrition with an oncological focus has established the important role of nutritional therapy in cancer patients [4▪▪]. These documents describe objectives and targets for macronutrient intake. The protein recommendation described in these guidelines for these patients is greater than 1.0–1.5 g/kg of weight/day, and for patients already diagnosed with malnutrition, sarcopenia, and cachexia secondary to cancer, the recommendation is the maximum limit (1.5 g/ kg of weight/day) [4▪▪].

In a recent narrative review, Laviano [11▪▪] concluded that the ideal protein recommendation is the same as previously mentioned for patients with digestive cancer. In addition, patients at risk or diagnosed with malnutrition should be prescribed