# Nutritional Interventions And Support Programs For Individuals With Specific Health Conditions

Turki Abdulaziz Alabdulkarim , Tamran Mohammed Hamad Altamran , abdulaziz ibrahim alrasheed , Ghadah Sulaiman Alrumaykhan , Ahmed nasser Alzaidi , Abdullah Mahdi Alzamanan , Abdullah Ahmed salami , Badr. Abdulrahman.Abo goaeed , Abdullah Saad Aldukhi

**Abstract**

This paper examines the deficiencies and potential areas for improvement in the impact of diet on the prevention and reversal of low muscle mass in cancer patients. The main indication of poor nutrition is the significant depletion of muscle mass (MM), which can occur at any stage of the disease and is often accompanied by obesity. The efficacy of nutritional therapies in preventing or treating low muscle mass in cancer patients remains unclear due to the scarcity of research and lack of clinically feasible techniques for assessing body composition. The research designs, inclusion criteria, intervention duration, and selection of nutritional methods have not been ideal, leading to an underestimation of the anabolic effects of dietary treatments. The paper also discusses energy requirements and various interventions to address low muscle mass in cancer patients, including protein intake, branched-chain amino acids, glutamine, carnitine, creatine, fish oil, and vitamin/mineral supplementation. The ultimate goal is to minimize muscle loss during anti-cancer therapy and maximize muscle growth during the recovery process, enhancing general health and prediction, including the ability to withstand therapy and increase survival rates.

**Keywords:** Nutrition intervention, cancer, muscle mass, nutritional methods, diatery treatment.

## 1. Introduction

Cancer is a prevalent and fatal illness that impacts a large number of individuals and is among the primary causes of mortality on a global scale. Optimal nutrition may reduce the intensity of symptoms, enhance overall health throughout the

many stages of cancer, and promote the well-being of cancer survivors. It is a key component of effective cancer therapy.

The main nutritional issue faced by individuals with cancer, which has a significant influence on prognosis, is muscle atrophy, also known as sarcopenia or myopenia. Irrespective of the stage of cancer (ranging from curative to palliative), low muscle mass (MM) is prevalent and serves as a standalone indicator of impaired physical performance, diminished quality of life, surgical complications, cancer advancement, and decreased survival rates3-7. The prevalence of low muscle mass (MM) is more than 50% in persons newly diagnosed with cancer, much higher than the about 15% prevalence in healthy adults of comparable age (median 65 years old). This indicates that low MM plays a role in the development of cancer, either directly or indirectly. In addition, it is worth noting that the prevalence of low muscle mass is not influenced by body weight or fat mass, since it occurs spontaneously in around 10% of patients who are underweight.

Reversing low tumor mutational burden (MM) has the potential to enhance the efficacy of cancer treatment, reduce associated complications, and eventually decrease death rates. Considering the significance of muscle mass (MM) and adipose tissue in cancer outcomes, it is crucial to implement techniques that enhance body composition for effective cancer treatment. Nutrition is a therapy that has the potential to positively impact both MM (muscle mass) and adipose tissue (body fat). In this article, we provide a comprehensive analysis of the existing research in this field, give a summary of nutritional approaches designed to improve MM, and explore methods to address the constraints of dietary treatments.

## 2. Muscle Mass In Cancer

The study of low muscle mass (MM) in cancer has mostly focused on refractory cancer cachexia, a condition that cannot be reversed and does not respond to nutrition therapies. As a result, there is doubt about the effectiveness of nutrition interventions in preventing MM loss. Although both illnesses are linked to muscle loss, poor muscle mass in cancer occurs regardless of weight loss and hence is not related to cachexia. Cachexia is not common in all types of cancer, but loss of muscle mass (MM) may occur more frequently across different types of cancer, even in the presence of weight maintenance

or weight gain. It is important to note that patients without refractory cachexia have the potential for muscle growth and may experience gains in MM. Low MM in cancer can occur at any stage of the disease. Some people mistakenly believe that nutrition is not important once cancer is diagnosed, or that it can even promote tumor growth. However, these beliefs are not supported by scientific evidence.

The inadequate understanding of the influence of dietary treatments on cancer outcomes might also be attributed to the (not limited to) following issues: There is limited use of accurate tools to measure body composition. While body weight and weight loss can be helpful in predicting outcomes, they do not provide information about changes in body composition. In fact, BMI and BMI loss do not consistently relate to immediate clinical outcomes like treatment side effects. The use of advanced measurements of body composition in oncology is relatively new. The first study to assess muscle mass using computerized tomography in cancer was published in 2007. Accurate tools like computerized tomography can not only measure the impact of an intervention on muscle mass, but also detect muscle attenuation, which is a measure of intramuscular fat (the "quality" of the muscle). In addition, individuals with cancer may have elevated levels of skeletal muscle collagen, a protein that is linked to worse chances of survival21. These specific characteristics cannot be identified using basic measurements of body size and shape. Because body composition measures have been traditionally scarce, dietary therapies aimed at reversing MM loss have mostly focused on increasing overall body weight, without a precise assessment of the particular alterations in muscle and adipose tissue compartments.

Various criteria for defining low MM: There is ongoing debate on the specific level of MM at which individuals are diagnosed with 'low MM'. As mentioned in other discussions, the cut-off points for this diagnosis depend on the methodological approach used, as well as the specific population and desired result. Recent research has suggested the use of sex-specific percentiles, averages, and standard deviations for skeletal muscle mass based on healthy adult populations. Nutrition research is allocated a very limited amount of financing, particularly when compared to the funds allocated to pharmaceutical studies. This has had a negative influence on the financial resources available for conducting meticulously planned (and expensive) randomized controlled

trials,27 which in turn affect the recommendations provided in guidelines and possibly undermine the credibility of healthcare experts from various fields.

Without the use of anabolic drugs, it may take many months to fully regain muscle that was lost in a short period of time. Short-term treatments may not be long enough to see changes in muscle growth, as shown by the lack of improvement in muscle mass. In the field of oncology, some individuals may experience a rapid loss of muscle mass, which is particularly significant in cases of metastatic disease. A study reported a decrease of 6.1% in muscle mass over a period of 3 months, with a corresponding weight loss of 1.7 kg in male patients and 1.1 kg in female patients with advanced colorectal cancer. This decrease was statistically significant ($P < 0.001$) and fell within a 95% confidence interval of -8.4 to -3.8. Even in patients with earlier stage cancer, approximately 20% of individuals ($n = 1924$) experienced a muscle mass loss of at least 5.7% over a median period of 14.3 months. On the other hand, regaining muscle mass through behavioral interventions is a much lengthier process. As an example, engaging in 12 months of organized resistance training leads to a gain of less than 1 kilogram of lean mass (a category that includes muscle mass) in individuals who have survived breast cancer. (29,30)

Without the use of anabolic medicine, it may need many months to fully regain muscle that has been lost within a little timeframe. This may be compared to a wildfire situation, when it is more advantageous to preserve rather than rebuild. Thus, it is unlikely that short-term therapies would significantly affect patient prognostication. Multiple cross-sectional studies have demonstrated that patients experience muscle depletion at the time of cancer diagnosis and continue to lose muscle throughout the course of the disease, even when the disease is potentially curable. Therefore, a nutrition intervention that can prevent further muscle wasting or decline in physical function (i.e. no change in muscle mass) can be considered a positive outcome. This is supported by the widely accepted guidelines from the European Society for Clinical Nutrition and Metabolism (ESPEN) regarding nutrition in cancer, which emphasize the importance of maintaining or increasing muscle mass. Additionally, nutrition intervention should be ongoing, with the goal of minimizing muscle mass loss during periods of catabolic circumstances (such as anti-cancer treatment) and maximizing muscle mass growth during recovery. During the therapeutic journey, it is important for nutrition regimens to

adjust to the metabolic and behavioral changes that take place. This historical period is not included in the present scope of inquiry.

The inclusion criteria for many clinical trials have been limited to patients with a short life expectancy. These trials primarily focused on studying the effects of nutrition interventions on muscle loss in the context of cachexia. However, it is important to note that these studies were conducted before we fully understood the limited ability of patients with refractory cachexia to build muscle. Therefore, the inclusion criteria of these trials often exclude patients with refractory cachexia, which prevents the possibility of achieving positive outcomes. While focused dietary management may temporarily enhance protein synthesis in these patients, their limited life expectancy of a few weeks/months would likely prohibit significant improvements in MM and, hence, have little effect on patient prognostication. Consequently, the need for patients in some trials to have a life expectancy of 3 months or less34, 35, which is often associated with refractory cachexia10, hinders the accurate assessment of the actual effects of a dietary intervention.

Insufficient knowledge of optimal dietary methods to promote muscle growth alone and in conjunction with exercise and other supplementary treatments (multimodal approaches). Although multimodal therapies have shown promise in preserving MM in cancer, there is less research on the effectiveness of the individual components of these strategies. Gaining a more comprehensive knowledge of the precise role that individual nutrients play in promoting muscle growth in these patients might pave the way for the creation of targeted nutritional solutions aimed at preventing muscle wasting in cancer patients.

Based on the evidence provided, our knowledge of the most effective nutritional therapies to address decreased muscle mass in cancer is still in its early stages. Considering the significance of nutrition in the field of oncology, it is crucial to provide a detailed overview of the present research landscape in order to develop well-informed research and therapeutic strategies that might effectively reduce muscle mass loss in cancer patients.

## 3. Addressing Nutritional Intervention In Cancer

The nutrients being evaluated for the management of reduced muscle mass in cancer. We conducted a comprehensive search of the PubMed database, including all available material from its creation until April 25, 2019. The search approach included using specific phrases related to dietary intervention, poor muscle mass/sarcopenia, and cancer. Within each component, important words were connected using the 'OR' Boolean function. The findings from the three components were then merged using the 'AND' Boolean function.

## 4. Energy

Assessing the energy needs of cancer patients is a difficult task. It is crucial to ensure that they consume the right amount of energy to prevent weight loss and promote muscle maintenance. This may be achieved by promoting protein synthesis and inhibiting protein breakdown. The relationship between weight loss due to cancer and muscle loss has been recognized for a long time. This is sometimes referred to as 'the skeleton in the closet'. However, the therapeutic consequences of gaining adipose tissue (fat) compared to gaining muscle mass (MM) are different. Muscle is a vital tissue that plays a crucial role in facilitating movement, mobility, balance, posture, and strength. Additionally, it serves as a storage site for amino acids and is responsible for producing myokines. Although adipose tissue remains significant, having excessive adiposity may not provide a survival benefit, particularly in the presence of low muscle mass (MM). Previous studies suggesting a "obesity paradox" in cancer outcomes, where being overweight or obese leads to favorable results, may be attributed to the absence of body composition information and the use of body mass index (BMI), which complicates the relationship between low MM and shorter survival. Therefore, interventions that primarily increase adipose tissue rather than MM may have limited effects on clinical outcomes or on reversing low MM. Accurately determining energy expenditure is a crucial stage in the nutrition care process for understanding energy needs.

## 5. Challenges and strategies to address them in nutrition intervention research

An important and valid topic is whether dietary intervention alone may affect low muscle mass in the absence of concomitant exercise intervention. The potential of diet to compensate for a lack of activity and safeguard against muscle

mass (MM) loss and functional decline in cancer patients remains uncertain. We recognize that, apart from nutrition, the anabolic state of muscle is sustained by physical activity and endocrine variables. It is important to investigate exercise or hormone/drug therapies with dietary measures. Nevertheless, it is crucial to acknowledge that exercise intervention might alter the requirements for nutrients. By deepening our comprehension of dietary requirements and the effects of therapies, we may establish highly targeted and relevant nutrition and exercise interventions for cancer patients with low muscle mass.

Another issue to consider is the practicality and influence of dietary treatments. As stated before, except in cases of refractory cachexia, low muscle mass in cancer patients can be reversed. Therefore, individuals with cancer can experience muscle growth when provided with nutritional support. It is important to conduct feasibility studies on patients who do not have cachexia in order to determine the number of eligible patients, the success of recruitment, the willingness of participants to be randomly assigned, the characteristics of the outcome measure, and the rates of follow-up and adherence, among other factors. These studies should include a long enough follow-up period to detect differences in muscle mass or survival.

It is important to consider the influence of cancer-related and treatment symptoms on the efficacy of dietary intervention. Working with cancer patients presents nutritional issues, such as the potential development of anorexia or cachexia due to therapy or tumor advancement. To address this issue, one possible solution is to enroll patients at the time of their diagnosis, which often aligns with the early stages of the disease's progression. Conducting evaluations throughout treatment cycles, when symptoms are less intense (for example, at least 2 weeks after each cycle), may also be beneficial. Nevertheless, some kinds of cancer may cause persistent or unmanageable symptoms that disrupt nutrition, making it difficult to consume food orally and potentially undermining the effectiveness of oral nutrition interventions.

## 6. Summary

Malnutrition is a common and often overlooked illness in cancer patients. It may be missed when using metrics like weight, BMI, and weight loss, which can affect how patients

are categorized by risk. Preventing and treating it is crucial due to its significant impact on predicting outcomes. Nutrition has a crucial role in sustaining sufficient muscle mass (MM) before and after the progression of cancer (Figure 3). However, there is a need for focused dietary therapies with strong research methodologies to address the issue of reduced muscle mass in cancer patients. These treatments should be given at an earlier stage of the illness when there is a greater opportunity for growth and improvement. Additional research in this field has the potential to directly influence the way medical professionals treat patients and enhance the quality of cancer treatment.

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