**World Nutrition Journal |eISSN 2580-7013**

CASE REPORT

# The impact of nutritional therapy in malnourished patient with tongue squamous cell carcinoma undergoing chemoradiation: A case report

Debtia Rahmah[1], Diana Sunardi[1,2], Nurul Ratna Mutu Manikam[1,2]

1. *Department of Nutrition, Faculty of Medicine, Universitas Indonesia, Indonesia*
2. *Division of Clinical Nutrition Cipto Mangunkusumo Hospital, Jakarta, Indonesia*

Received 11 December 2025
Accepted 31 March 2026
Published 31 August 2026

Link to DOI:
10.25220/WNJ.V10.i1.0001

**Citation:** Rahmah D, Sunardi D, Manikam NRM. The impact of nutritional therapy in malnourished patient with tongue squamous cell carcinoma undergoing chemoradiation: a case report. World Nutrition Journal.2026 August 31,10(i1): 1-10.



## Abstract

**Background**: Malnutrition affects 30%-50% of patients with head and neck carcinoma. It is associated with reduced survival, increased risk of complications, treatment interruption, and higher treatment-related toxicity.

**Objective:** This case aim to discuss about nutritional therapy in tongue carcinoma patient with malnourished and cachexia undergoing chemoradiotherapy.

**Case:** A 52-year-old man with squamous cell carcinoma of the tongue presented with clinically severe malnutrition and cachexia. Imaging revealed a solid mass involving the entire tongue and extending to the floor of the mouth, resulting in dysphagia. He undergo locoregional Intensity-Modulated Radiation Therapy (IMRT) 70/56 Gy in 35 fractions in concomitant with chemotherapy. Nutritional management involves enteral feeding with a gradual increase in energy intake from 40 kcal/kg body weight (BW) to 63 kcal/kg BW and protein from 2 to 3 g/kg BW. The patient received daily micronutrient supplementation consisting of 1 tablet of vitamin B complex three times daily, vitamin C 50 mg twice daily, zinc 20 mg twice daily, folic acid 500 mcg once daily. He also given 1 gram eicosapentaenoic acid (EPA). After one month, the patient demonstrated a weight gain of 1.8 kg (4.3%), increased handgrip strength, and functional capacity. Body composition analysis demonstrated increase in fat-free mass index (FFMI) from 15.2 to 15.8 kg/m$^2$, skeletal muscle index (SMI) from 5.6% to 5.9%, and fat mass from 5.3% to 5.6%.

**Conclusion:** Adequate energy and high protein intake along with micronutrients and EPA supplementation may help prevent deterioration of nutritional status, increase body weight, preserve muscle mass, and improve functional capacity in cancer patient undergoing chemoradiotherapy.

**Keywords:** tongue carcinoma, malnutrition, nutritional therapy, cachexia, chemoradiotherapy

***Corresponding author:***
Debtia Rahmah
Department of Nutrition, Faculty of Medicine, Universitas Indonesia, Indonesia
debtia_r@yahoo.com

## Introduction

Patients with head and neck cancer (HNC) undergoing chemoradiation are at risk for developing malnutrition due to reduced oral intake, treatment-related side effect, and tumor-induce hypermetabolism. Malnutrition adversely affects morbidity, quality of life, healing rate, treatment tolerance, and survival, highlighting the importance of early nutritional risk screening and comprehensive nutritional management.[1,2] Nutritional therapy constitutes an integral component of supportive care.[3]

Although malnutrition is highly prevalent in this population, reports detailing individualized nutritional strategies for patient with severe malnutrition complicated by cachexia undergoing chemoradiotherapy are scarce. This gap is clinically significant, as concurrent chemoradiotherapy can further compromise oral intake, amplifies systemic inflammation, and accelerate muscle loss. In this case, enteral nutritional therapy with a progressive increase in calorie and high protein target, combined with micronutrients and EPA supplementation was prescribed to prevent further weight loss, preserve muscle mass, and support functional capacity.

This case report aims to describe the implementation and clinical outcomes of an individualized nutritional therapy approach in a severely malnourished patient and cachexia with tongue carcinoma undergoing chemoradiotherapy, and to contribute practical insight into optimizing nutrition management in similar case.

## Case Report

A 52-year-old man was diagnosed with squamous cell carcinoma of the tongue. The patient presented with dysphagia, jaw pain and trismus. Nutritional intake was provided by enteral nutrition through nasogastric tube (NGT), consisting of blenderized food and milk. The patient is neither nauseous nor vomiting. He passes stool once daily. Stool color is yellow with solid consistency. The patient experienced unintentional weight loss of 10.2 kg (19.6%) over the preceding six months. His body mass index (BMI) was 16.1 kg/m$^2$. However, the patient's nutritional status is classified as severely malnourished based on the Global Leadership Initiative on Malnutrition (GLIM) criteria for malnutrition dan cancer cachexia.

Computed tomography (CT) scan revealed a solid mass involving the entire tongue, predominantly on the right side. The lesion extended to the base of the tongue and infiltrated both intrinsic and extrinsic muscles, involving the masticator space (partially the medial pterygoid and masseter muscles) up to the right carotid space, involving the right palatine tonsil, right submandibular salivary gland, extending to the subcutaneous tissue of the right submandibular region with ulceration and intralesion air component. The mass reaches the base of the mouth and expands, narrowing the oropharyngeal cavity, especially on the right side. The mass measured approximately 7.4 x 7.2 x 9.5 cm with an estimated depth of invasion of 5 cm. No evidence of bone destruction or encasement of the internal carotid artery was identified. Multiple enlarged lymph nodes appear rounded in the neck region at levels Ia and Ib bilaterally and containing calcification components. The patient undergoing locoregional intensity-modulated radiotherapy with a total planned dose of 70/56 Gy in 35 fractions over five days per week, concomitant with cisplatin chemotherapy. At the first examination at clinical nutrition outpatient clinic, the patient had completed the third of 35 radiation fractions. Laboratory evaluation revealed anemia and leukocytosis while electrolyte levels, kidney function marker, and liver

function marker were within normal limits. The second visit occurred two weeks later, following hospitalization due to tounge bleeding. At that time, he had completed the 12th of 35 radiation fractions and third cycle of chemotherapy. The third visit took place one week later, at which point he had completed the 18th of 35 radiation fractions. At the fourth visit, one week after the third , he completed the 23th of 35 radiation fractions.

Enteral nutrition was intensified to meet requirement needs. Total caloric intake was increased from 40 to 63 kcal/kg body weight and protein intake was escalated from 2 to 3 g/kg. The protein formulation provided 16.8 - 28.1 g of branched-chain amino acids daily. The patient received daily micronutrients supplementation consisting of 1 tablet of vitamin B complex three times daily, vitamin C 50 mg twice daily, zinc 20 mg twice daily, folic acid 500 mcg. Additionally, the patient also prescribed 1 g of EPA supplementation daily.

**Table 1.** Nutritional prescription

| Visit | Prescription | Description |
|---|---|---|
| I | Energy 1700 kcal (40 kcal/kgBW), protein 84 g (2 g/kgBW, 20%, N;NPC = 1:101), fat 50 g (27%), carbohydrates 183 g (53%) | The blenderized meal consisted of 2 servings of rice, 6 servings of low-fat animal protein, 4 servings of plant-based protein, 1 serving of vegetables, 3 servings of fruit, 4.5 servings of oil, 3 egg whites, and high-protein oral nutritional supplement (ONS) administered at 4 scoops once daily. |
| II | Energy 1900 kcal (44 kcal/kg body weight), protein 100 g (2.3 g/kg body weight, 21%, N:NPC = 1:91), fat 53 g (26%), carbohydrates 240 g (53%) | The blenderized meal consisted of 1.5 servings of rice, 4 servings of low-fat animal protein, 1 serving of plant-based protein, 1 serving of vegetables, 3 servings of oil, 2 servings of fruit, and high-protein ONS administered at 5 scoops three times daily. |
| III | Energy 2300 kcal (53 kcal/kg body weight), protein 114 g (2.7 g/kg body weight, 20%, N:NPC = 1:100), fat 79 g (31%), carbohydrates 267 g (49%) | The blenderized meal consisted of 2 servings of rice, 3 servings of low-fat animal protein, 2 servings of moderate-fat animal protein, 2 servings of plant-based protein, 1 serving of vegetables, 6 servings of oil, 2 servings of fruit, and high-protein ONS administered at 5 scoops three times daily. |
| IV | Energy 2700 kcal (63 kcal/kg body weight), protein 124 g (2.8 g/kg body weight, 18%, N:NPC = 1:112), fat 94 g (31%), carbohydrates 331 g (51%) | The blenderized meal consisted of 3 servings of potatoes, 4 servings of low-fat animal protein, 1 serving of medium-fat animal protein, 3 servings of plant-based protein, 2 servings of vegetables, 9 servings of olive oil, 3 servings of fruit, and high protein ONS administered at 5 scoops three times daily. |

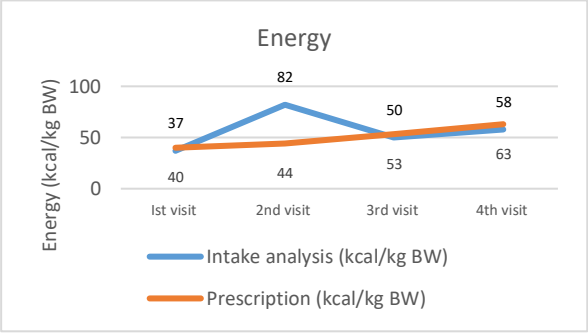


**Figure 1**. Energy intake

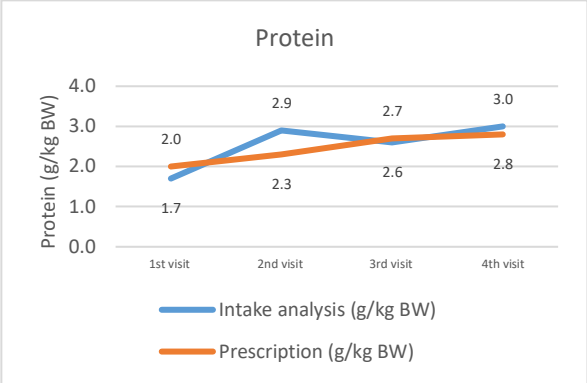


**Figure 2.** Protein intake

After one month of optimized nutritional management, the patient demonstrated clinical improvement, including a weight gain of 1.8 kg (4.3%), increased handgrip strength, and enhanced functional capacity. The Karnofsky Performance Scale score improved by 20 points, from 70 to 90. Body composition analysis using the Omron body composition monitor HBF-375® bioelectrical impedance analysis device showed an increase in FFMI (15.2 to 15.8 kg/m$^2$), SMI (5.6% to 5.87%), and fat mass (5.3% to 5.6%).

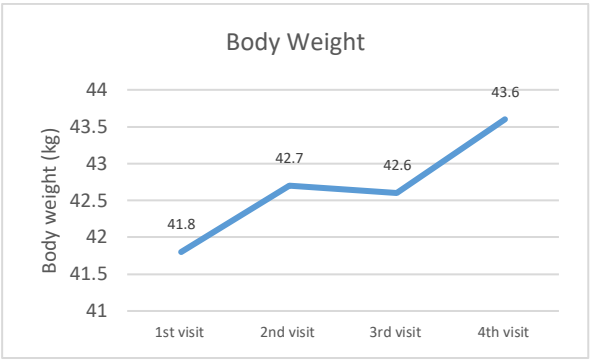


**Figure 3.** Body weight monitoring

**Table 2**. Body composition

| Parameter | Baseline after 3rd radiation therapy (1st visit) | | After 23rd radiation therapy, 3rd chemotherapy (4th visit) | |
|---|---|---|---|---|
| | **Result** | **Interpretation** | **Result** | **Interpretation** |
| Fat mass | 5.3% | Low | 5.6% | Low |
| Visceral fat | 0.5% | Normal | 1 | Normal |
| Subcutaneous fat | N/A | N/A | N/A | N/A |
| Sceletal muscle mass | 34.8% | Normal | 34.9% | Normal |
| *Free fat mass index* (FFMI) | 15.2 | Low | 15.8 | Low |
| *Skeletal mass index* (SMI) | 5.6 | Low | 5.87 | Low |

**Table 3.** Functional capacity

| Visit | Karnofsky performance scale score | Handgrip strength | |
|---|---|---|---|
| | | Right hand | Left hand |
| 1st visit | 70 | 20.6 (low) | 20 (low) |
| 2nd visit | 70 | 18.8 (low) | 18 (low) |
| 3rd visit | 90 | 21.4 (low) | 19.3 (low) |
| 4th visit | 90 | 22.2 (low) | 20.6 (low) |

## Discussion

This case highlights the importance of nutritional management in preventing deterioration of nutritional status in patient with tounge carcinoma patient undergoing chemoradiotherapy. One study reported that the risk of malnutrition in HNC patients increase from 11.9% before therapy to 49.4% following radiotherapy or chemoradiotherapy.[4] Several factors contribute to significant weight loss in this population, including tumor location, inflammation, metabolic alteration, and treatment-related adverse effects. Tumors in head and neck region can impair oral intake due to difficulty chewing, dysphagia, and pain. In addition, inflammatory responses and metabolic changes can further increase energy expenditure and promote catabolism, leading to energy deficit. Side effect of radiotherapy and chemotherapy such as mucositis, pain, nausea, vomiting, and fatigue further limit oral intake that exacerbate weight loss.[5] In this case, the patient experienced dysphagia due to squamous cell carcinoma of the tongue which infiltrated the entire glossus extended to the floor of the mouth, and narrowed the oropharyngeal cavity. The tumor location made adequate oral intake unattainable, while metabolic stress elevated energy requirement. Evaluation using the GLIM criteria indicated clinically severe malnutrition.

Since the tumor mass was unresectable, the patient undergo radiation therapy which uses ionizing radiation to induce DNA strand breaks. DNA damage lead to cell death or loss of proliferative capacity. The therapeutic target of radiation therapy is to reduce the number of cancer cells while preserving as many healthy cells as possible. However, normal tissues may also be damage depending on the dose and area of exposure.[6] Platinum-based chemotherapeutic agent, such as cisplatin, exert their effects by binding to purine bases and inducing DNA strand damage in cancer cells. This process inhibits cell division, ultimately leading to cell apoptosis. The adverse effects of chemotherapy include nausea, vomiting, loss of taste, anorexia, bone-marrow suppression, organ toxicity, and loss of muscle mass. Cisplatin may contribute to muscle mass reduction by promoting proteolysis, decreasing muscle protein synthesis, and inducing systemic inflammation.[7]

Alteration in protein metabolism, characterized by a net protein breakdown and increased oxidation of branched-chain amino acids (BCAAs), play a significant role in the development of cancer cachexia. The breakdown of host protein is partially driven by tumor-secreted factors and inflammatory cytokines produced by the host. Nutritional management in patients with cancer cachexia is intended to mitigate the negative energy balance and reduce net protein breakdown without stimulating tumor growth or adversely interfering with anticancer therapy. To promote anabolic processes, adequate caloric intake and appropriate nutrient composition are essential.[8]

Nutritional therapy is required to ensure adequate nutrient intake and optimize clinical outcomes in patients undergoing chemoradiotherapy, including improve treatment

tolerance, reduce treatment interruptions, decreased treatment-related toxicities, improved nutritional status, functional capacity, quality of life and overall survival.[9] The patient's basal energy expenditure (BEE) was estimated using the Harris-Benedict predictive equation, yielding a value of 1,100 kcal. Energy intake was targeted at twice the basal energy requirement to promote weight gain. Energy provision was gradually increased according to the patient's clinical condition. The European Society for Clinical Nutrition and Metabolism (ESPEN) recommends an energy target 25-30 kcal/kg/day and protein at >1 g/kg. When feasible, protein provision up to 1.5 g/kg/day is suggested for cancer patient.[10] In cases of cancer cachexia, protein intake of 1.2-2 g/kg body weight may be administered to overcome anabolic resistance.[11] Another guideline, the United Kingdom National Multidisciplinary Guideline, recommends aiming for energy and protein intakes of at least 30 kcal/kg/day and 1.2 g protein/kg/day in head and neck cancer patients receiving radiotherapy or chemoradiotherapy.[3]

A prospective observational study by Valle et al.,[12] evaluated the effect of higher energy consumption than recommended by ESPEN. A mean daily energy intake of 35±10 kcal/kg maintain stable body weight during and after chemoradiotherapy in patients with head and neck cancer.[12] Another case report indicated that prescribing a daily energy intake of 38-54 kcal/kgBW, protein 2.2-2.5 g/kg for breast cancer patient with severe malnutrition and cachexia also yielded positive outcome. In that case, energy target was calculated using the Harris–Benedict equation with the stress factor of 2.0, considering that the patient's severely malnourished status. After three weeks of monitoring, the patient demostrated improvements in body weight, muscle mass, and handgrip strength.[13] In the present case, energy provision was initiated at 40 kcal/kg BW, as the patient's dietary intake had already reached 37 kcal/kgBW but malnutrition persisted. Follow-up assessments during subsequent visits revealed no clinical symptoms of refeeding syndrome. The prescribed energy was gradually increased to promote weight gain and improve nutritional status. Protein was prescribed at 2-2.8 g/kg BW per day, but intake analysis showed patient consumption reached 3 g/kg BW per day. Follow-up laboratory evaluations demonstrated patient's serum urea and creatinine levels remained within normal limit, indicating preserved renal function and good tolerance to the high-protein regimen.

One study showed higher protein intake, adequate energy intake and body weight stability were associated with an increased likelihood of maintaining skeletal muscle mass in cancer patient undergoig chemoradiotherapy or immunotherapy. In univariate analysis, protein intake demonstrated the strongest association with muscle mass preservation, followed by energy intake and percentage change in body weight.[12]

In the present case, the patient was prescribed high-protein diet. High protein diet promotes muscle anabolism in cancer patients by stimulating muscle protein synthesis and providing essential amino acids to support lean tissue accretion and overall energy intake. Protein intake should be derived from both animal and plant sources. Protein from animal sources has a higher biological value, but protein from plant sources is also important because it is not only a source of protein, but also includes essential amino acids and has other nutrients at the same time.[15,16] Branched-chain amino acids particularly leucine play a role in muscle protein synthesis. Foods rich in BCAAs consumed by patients included chicken eggs, chicken breast, and dairy products. The amount of leucine protein consumed by the patient was 4.8 g/day from ONS. Branched-chain amino acids may activate the mammalian target of rapamycin (mTOR) pathway and modulate inflammation, thereby decrease proteolysis and promoting protein synthesis

in skeletal muscle.[8] Low muscle mass is associated with decreased physical functional capacity, diminished quality of life, increased risk of treatment-related toxicity, and shorter survival.[17]

In the present case, the patient was prescribed EPA 1,240 mg/day, obtained from ONS and omega-3 fish oil capsules supplementation. The proposed anticancer effects of omega-3 polyunsaturated fatty acids (PUFAs) are attributed to changes in the fatty acid composition of cell membranes phospholipids of tumor cells, leading to alteration in membrane structure, fluidity and associated signaling pathways. Additionally, studies have demonstrated the immunomodulatory effects of omega-3 PUFAs. Limited evidence demonstrated reduction in polymorphonuclear concentration, C-reactive protein (CRP) and interleukin-6.[18] In this present case, follow-up laboratory examinations showed a reduction in leucocyte toward the normal reference range.

However, studies on EPA supplementation have reported inconsistent findings. A randomized controlled trial study in patients with head and neck squamous cell carcinoma found no benefit of EPA supplementation on body weight or muscle mass.[19] Conversely, a meta-analysis demonstrated that omega-3 supplementation significantly increased body weight in cancer patients with cachexia, particularly in spesific subgroup of patient with a baseline weight ≤60 kg and age ≥67 years.[20] Another systematic review reported high-protein, n-3 PUFA–enriched ONS supplementation in adult cancer patient receiving chemo(radio)therapy has been shown to significantly increase body weight compared with isocaloric controls (+1.89 kg; 95% CI 0.51–3.27; P = 0.02). In addition, these interventions were associated with attenuation of lean body mass loss and improvements in selected quality-of-life domains. These findings suggest that combining high protein intake with n-3 PUFA supplementation may help support muscle anabolism and mitigate the adverse effects of cancer-related malnutrition. While the underlying mechanisms are not directly assessed in these trials, the observed benefits are consistent with the proposed roles of protein in stimulating muscle protein synthesis and of n-3 PUFAs in modulating systemic inflammation.[21]

In line with this finding, the ESPEN guideline recommends the use of fish oil and omega-3 fatty acids in cancer patients undergoing chemotherapy who are at risk of weight loss or malnutrition, with a weak strength of recommendation, to improve appetite, lean body mass, and body weight.[10] Although omega-3 PUFAs demonstrate promising adjunctive potential in cancer therapy, further studies are warranted.

In the present case, patient was prescribed micronutrients including 1 tablet of vitamin B complex supplementation three times daily, folic acid 500 mcg daily, vitamin C 50 mg twice daily, and zinc 20 mg twice daily. The prescribed doses were in accordance with the Indonesian Recommended Dietary Allowances (RDA).[22] According to ESPEN recommendations, micronutrient supplementation should follow RDA and high-dose micronutrient supplementation is not advised in the absence of deficiency.[10]

B vitamins are essential for maintaining cellular functions and metabolic processes. The B complex supplement received by the patient consisted of vitamin B1 (2 mg), vitamin B2 (2 mg), nicotinamide (vitamin B3, 20 mg), calcium pantothenate (vitamin B5, 10 mg) and vitamin B6 (2 mg). Vitamin B1 is particularly significant for aerobic metabolism. Its active form, thiamine pyrophosphate (TPP), acts as a primary cofactor for pyruvate dehydrogenase that involve in gluconeogenesis. Thiamin also inhibite pyruvate dehydrogenase kinase (PDK). This inhibition maintains pyruvate dehydrogenase (PDH) activity and has been shown to decrease tumor cell proliferation

and glycolytic activity. Thiamine also directly contributes to ribose synthesis that require for DNA/RNA synthesis.[23]

Vitamin B2 or riboflavin plays a critical role in in antioxidant system as cofactor enzyme glutathione reductase. Study show riboflavin may mitigate cisplatin's toxic effects by reducing the inflammatory response and replenishing antioxidant enzymes and cellular reductants. Vitamin B3 is essential for generating coenzymes such as nicotinamide adenine dinucleotides (NAD) and NADPH which involved in several metabolic processes such as glycolysis, the Krebs Cycle, oxidative phosphorylation, and the hexose monophosphate shunt. NAD+ serves as a substrate for key enzymes like sirtuin 1 (SIRT1) and poly ADP-ribose polymerase 1 (PARP1). Poly ADP-ribose polilymerase 1 plays a role in DNA repair and apoptosis, while SIRT1 is associated with the regulation of gene expression, proliferation, differentiation, carcinogenesis and immune response.[23,24]

Pantothenate is a precursor to coenzyme A (CoA). CoA is then utilized as a fundamental coenzyme in numerous metabolic processes. Vitamin B6 plays a role in many biochemical reactions within the body, immune response, also modulates apoptosis by regulating oxidative stress, redox balance, and epigenetic alterations. Thus, pyridoxine deficiency could promote DNA damage and tumorigenesis.[23]

Folic acid (vitamin B9) play role in one-carbon metabolism which essential to DNA, RNA and protein methylation. Folate also have a role in converting deoxyuridine monophosphate (dUMP) to deoxythymidine monophosphate (dTMP), which is essential for DNA synthesis and repair. Folate deficiency can cause DNA strand breaks and an aberrant gene expression.[23]

Vitamin C has been suggested to confer radioprotective properties through the scavenging of reactive oxygen species (ROS) generated by ionizing radiation, thereby mitigating oxidatif DNA damage in normal tissue. Conversely, at high doses, vitamin C may potentiate radiation-induced cytotoxicity in tumor cells via pro-oxidant mechanism.[25]

Zinc involves in various cellular processes including act as enzyme cofactor, involve in cell proliferation and apoptosis, antioxidant activity. Zinc supplementation may decrease oxidative stress biomarkers and inflammatory cytokines. Regarding effect zinc to radiotherapy toxicities, some report documented zinc decreases mucosities but a systematic review also showed that supplementation of zinc did not significantly decrease adverse effect i.e weight loss, changes in taste, nausea, nor alleviate radiotoxicity.[26]

## Limitation

This case has several limitations. This is a single-case study with a short follow-up period, lacks biochemical markers, and absence of control.

## Conclusion

Adequate energy and high protein intake along with micronutrients and EPA supplementation may help prevent deterioration of nutritional status, increase body weight, preserve skeletal muscle mass, and improve functional capacity in cancer patient undergoing chemoradiotherapy.

## Conflict of interest

The authors declared no conflict of interest regarding this article.

## Ethic Statement

Written informed consent was obtained from the participant prior to data collection.

## Open Access



## Author Contributions

DR: Conceptualization, data acquisition, drafting the manuscript; DS and NRMM: Supervision, critical revision of the manuscript, interpretation of data, and final approval of the version to be published.

## References

1. Bao X, Liu F, Lin J, Chen L, Chen F, Wang J. Nutritional assessment and prognosis of oral cancer patients: a large-scale prospective study. BMC Cancer. 2020;1–8.
2. Findlay M, White K, Brown C, Bauer JD. Nutritional status and skeletal muscle status in patients with head and neck cancer: Impact on outcomes. J Cachexia Sarcopenia Muscle. 2021;(6):2187–9.
3. Talwar B, Donnelly R, Skelly R, Donaldson M. Nutritional management in head and neck cancer: United Kingdom National Multidisciplinary Guidelines. J Laryngol Otol. 2016;130(Suppl.S2):1-9.
4. Liu W, Gao L, Huang X, Luo J, Zhang S, Wang K, et al. Pretreatment nutritional risk as a prognostic factor in head and neck cancer patients receiving radiotherapy or chemoradiotherapy. Asia Pac J Clin Nutr. 2019;(2):1–7.
5. Muthanandam S, Muthu J. Understanding cachexia in head and neck cancer. Asia Pac J Oncol Nurs. 2021;8(5):527-38.
6. Setyawan A, Djakaria HM. Efek dasar radiasi pada jaringan. Radioterapi & onkologi Indonesia. 2014;25–33.
7. Huang KC, Chiang YF, Ali M, Hsia SM. Cisplatin-Induced Muscle Wasting and Atrophy: Molecular Mechanism and Potential Therapeutic Interventions. J Cachexia Sarcopenia Muscle. 2025;16(3):1-18.
8. van de Worp WRPH, Schols AMWJ, Theys J, Helvoort AV, Langen RCJ. Nutritional Interventions in Cancer Cachexia: Evidence and Perspectives from Experimental Models. Front Nutr. 2020;(7):1–16.
9. James S, Oppermann A, Schotz KM, Minotti MM, Rao GG, Kleckner IR, et al. Nutritional counseling during chemotherapy treatment: a systematic review of feasibility, safety, and efficacy. Curr Oncol. 2025;32(1):1–41.

10. Muscaritoli M, Arends J, Bachmann P, Baracos V, Barthelemy N, Bertz H, et al. ESPEN practical guideline: Clinical Nutrition in cancer. Clinical Nutrition. 2021;40(5):2898–913.
11. Arends J, Bachmann P, Baracos V, Barthelemy N, Bertz H, Bozzetti F, et al. ESPEN guidelines on nutrition in cancer patients. Clinical Nutrition. 2017:11-48.
12. Valle SD, Colatruglio S, La Vela V, Tagliabue E, Mariani L, Gavazzi C. Nutritional intervention in head and neck cancer patients during chemo-radiotherapy. Nutrition. 2018;(51):95–7.
13. Putri GN, Manikam NRM, Andayani DE, Trismiyanti, Halim L. Successful nutritional therapy at home for a patient with invasive breast carcinoma: A case report. Asia Pac J Oncol Nurs. 2023;(10):1–5.
14. Tobberup R, Rasmussen HH, Holst M, Jensen NA, Falkmer UG, Bogsted M, et al. Exploring the dietary protein intake and skeletal muscle during first-line anti-neoplastic treatment in patients with non-small cell lung cancer. Clin Nutr ESPEN. 2019;1–7.
15. Ajomiwe N, Boland M, Phongthai S, Bagiyal M, Singh J, Kaur L. Protein nutrition: understanding structure, digestibility, and bioavailability for optimal health. Foods. 2024;13(11):1–15.
16. Sarathy SP, Ravikumar H, Nanjan P, Alagesan N, Chua BL. Plant-based protein: a multi-nutritional sustainable alternative to animal foods and their structure, functions, and relationship: a review. Int J Biol Macromol. 321(3).
17. Van Zanten ARH, Deutz NE, Prso AML, Prado CM, Schooneman MG, Soeters MR, et al. Shaping the future of muscle health: a clinical nutrition perspective and research agenda. Clinical Nutrition. 2026:1-18.
18. Munhoz J, Mazurak V, Field CJ. Perspective: implications of docosahexaenoic acid and eicosapentaenoic acid supplementation on the immune system during cancer chemotherapy: perspectives from current clinical evidence. Advance in Nutrition. 2025;(16):1–11.
19. Arribas L, Hurtos L, Esteve A, Peiro I, Tampan ARG, Choulli M, et al. Nutritional impact of eicosapentaenoic acid supplementation (EPA) in patients with locally advanced head and neck cancer: a double-blind placebo-controlled randomized trial. Nutr J. 2025;24(140):1-13.
20. Hosseini F, Hemmati A, Takabi FS, Naeini F, Bidar SS. A dose–response meta-analysis of randomized clinical trials investigating the effects of omega-3 supplementation on body weight in patients with cancer cachexia. Clin Nutr ESPEN. 2024;378–86.
21. Schueren MAEDVD, Laviano A, Blanchard H, Jourdan M, Arends J, Baracos VE. Systematic review and meta-analysis of the evidence for oral nutritional intervention on nutritional and clinical outcomes during chemo(radio)therapy: current evidence and guidance for design of future trials. Ann Oncol. 2018;29(5):1141–53.
22. Menteri Kesehatan Republik Indonesia. Peraturan menteri kesehatan Republik Indonesia nomor 28 tahun 2019 tentang angka kecukupan gizi yang dianjurkan untuk masyarakat indonesia. 2019:1-34.
23. Frost Z, Bakhit S, Amaefuna CN, Powers RV, Ramana KV. Recent advances on the role of B vitamins in cancer prevention and progression. Int J Mol Sci. 2025;26(5):1–34.
24. Yousafzai NA, Jin H, Ullah M, Wang X. Recent advances of SIRT1 and implications in chemotherapeutics resistance in cancer. Am J Cancer. 2021;11(11):5233–48.
25. Islam MM, Sultana N, Liu C, Mao A, Katsube T, Wang B. Impact of dietary ingredients on radioprotection and radiosensitization: a comprehensive review. Annals of Medicine. 2024;56:1-23.
26. Woldeselassie M, Tamene A. Therapeutic controversies over use of antioxidant supplements during cancer treatment: a scoping review. Front Nutr. 2024;(11):1–15.