

# Nutritional Support in Patients with Colorectal Cancer: State of Knowledge and Perspectives

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**Abstract:** Many cancer patients have a nutritional risk. Nutritional support therapy plays an important role in cancer treatment, especially for the patients with digestive system cancer. Nutritional support therapy for tumor patients should be based on the specific saturations. For example, types of tumors, degree of differentiation, and nutritional status of the patients need to be evaluated in detail, and then propose the specific implementation approach. For the colorectal cancer patients with promising treatment prospects, nutritional support should be standardized and make every effort to improve the safety and effectiveness of treatment. This article reviews the research progress on nutritional support therapy for colorectal cancer patients thereby promoting the standardized development of nutritional support therapy and better guiding the clinical nutritional support practice. In addition, this paper discussed the feasibility of a combination of nutritional and exercise interventions to efficiently improve muscle and strength, physical function, nutritional status, fatigue, and quality of life in colorectal cancer patients. Establishing a standard process for nutritional support should become an interdisciplinary task. Standard procedures and quality control should also be specified to ensure the effectiveness of nutritional therapy. The current knowledge, and perspectives of application of nutritional support in patients with colorectal cancer in this paper could provide a good reference for the future research of cancer diagnosis and treatment.

**Keywords:** Nutritional Support, Colorectal Cancer, Cancer treatment, Oral nutrition supplements, Artificial feeding, Exercise intervention.

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## 1. Introduction

Nowadays, cancer is becoming the second largest cause of death all over the world. According to the statistic data, there were 19.3 million cases of cancer and 10 million cancer deaths in 2020 [1]. The incidence rate of malignant tumors was 2.8583/100,000 in China in 2015. This number will increase significantly in the next few decades. It will be increased to 22 million by 2030. There are approximately 1.93 million colorectal cancer cases diagnosed and 0.94 million cases death in 2020 [2]. Therefore, recovery and treatment of cancer patients is a very important research topic. The National Health Commission of the People's Republic of China pointed out that cancer screening tests and improve cancer treatment are the main measures to prevent and treat cancer in the "China's cancer prevention and treatment three-year action plan"[3].

Compared with other patients, colorectal cancer patients have a higher proportion of malnutrition. There are many reasons including anorexia, cachexia, dysphagia, inflammation and digestive dysfunction of digestive tract mucosa caused by chemotherapy and radiation therapy, short-term postoperative inflammatory bowel obstruction, long-term mechanical obstruction, intra-abdominal tumor metastasis, gastrointestinal fistula, multiple organ dysfunction syndrome (such as heart, liver, kidney), and other factors that cause nutritional depletion[4]. Figure 1 shows nutritional support for different complications caused by cancer treatment. Malnutrition can lead to increased mortality in patients with malignant tumors, and significantly reduce the patient's tolerance to surgical trauma and antitumor therapy. Therefore, nutritional support therapy is important to

improve the comprehensive tumor treatment effect, thereby improving the quality of life and long-term survival rate of the cancer patients.

Epidemiological studies have shown that the incidence of malnutrition in patients with malignant tumors of the digestive system is the highest among patients with malignant tumors [5]. It is about 20% of patients die directly from malnutrition. Malnutrition will have a negative impact on disease treatment and the quality of life of patients, and it is extremely unfavorable for prognosis. Therefore, the nutritional status of patients with malignant tumors of the digestive system should be given a special attention. Evidence shows that providing nutritional support to patients with malignant tumors of the digestive system can effectively improve the prognosis and reduce hospital length of stay. Nutrition recommendation and management should be included into the entire process of cancer therapy. However, there are still many difficulties in clinical practice due to population heterogeneity, nutritional assessment, and support methods.

The current point of view is that both the long-term survival of the colorectal cancer patients and maintenance of the quality of life and nutritional status are important during the cancer treatment process. Although the positive effect of nutritional support in the cancer treatment process is limited, nutritional support is an indispensable measurement in the patient-centered cancer treatment planning. This article reviews the nutritional support methods and current problems for colorectal cancer patients to provide reference for clinical work. The purpose of this study is to: 1) discuss the current nutritional support therapy method of patients with colorectal cancer; 2) discuss the potential strategy and future visions of nutritional support therapy for colorectal cancer patients.

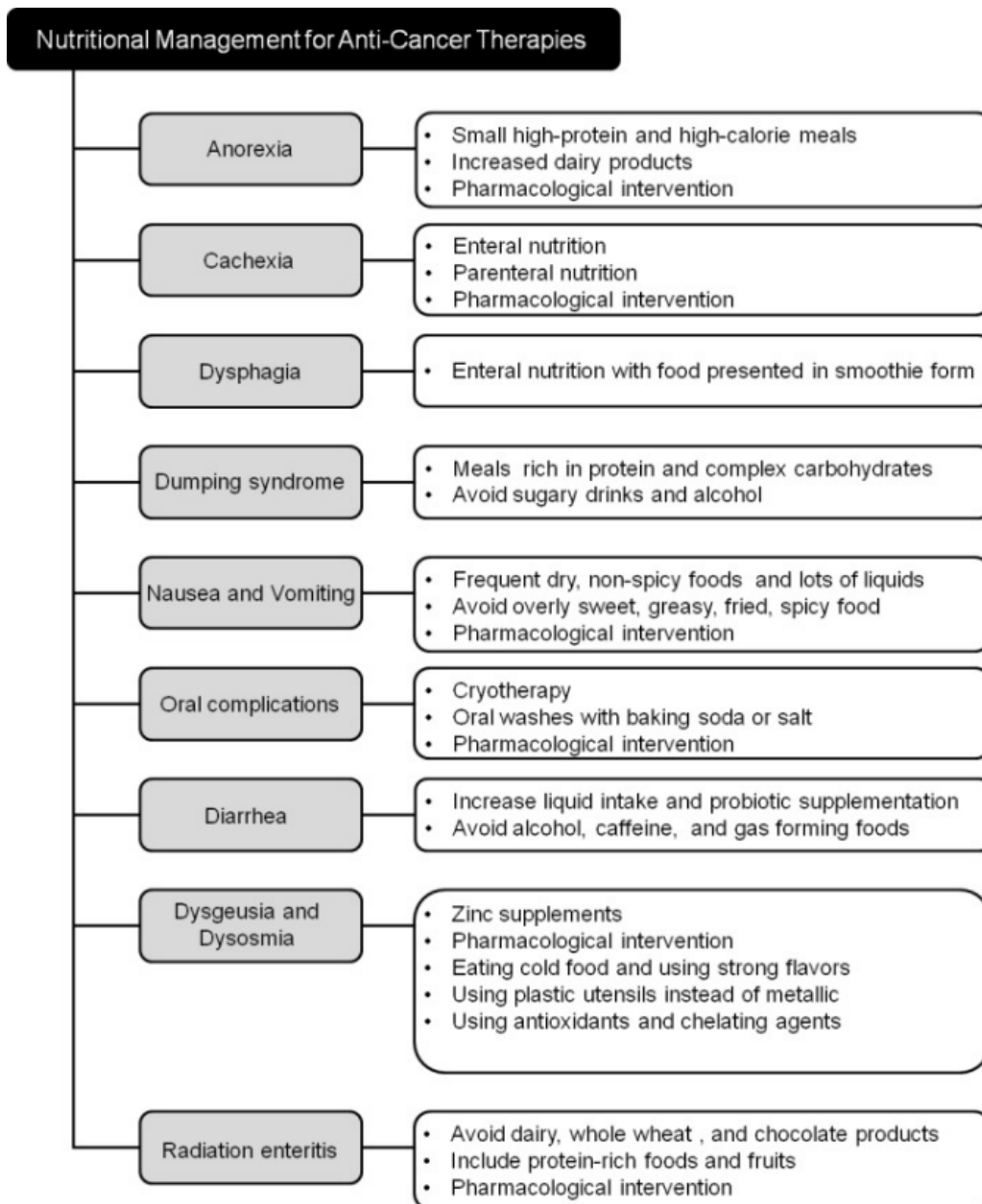


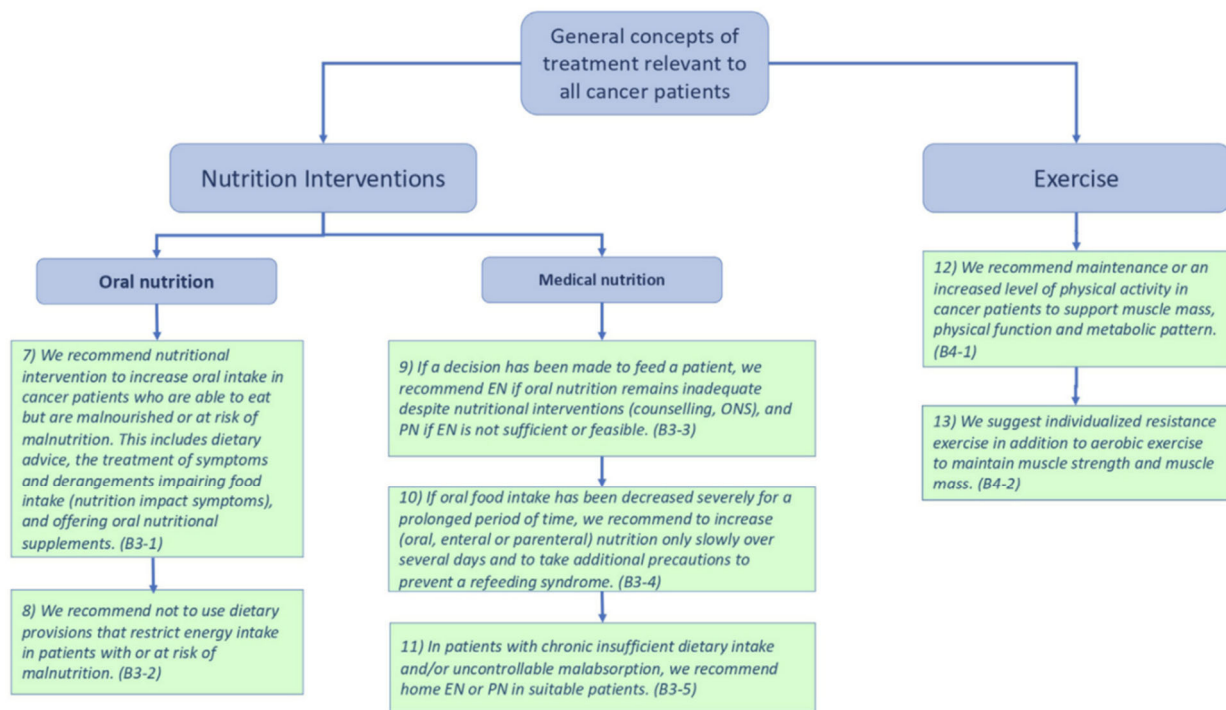
Figure 1. Nutritional support for different complications caused by cancer treatment

## 2. Nutritional Support Therapy of Patients with Colorectal Cancer

### 2.1. Nutritional Support for Cancer Patients

According to the guidelines on nutrition in cancer patients issued by the European Society for Clinical Nutrition and Metabolism (ESPEN) in 2017, nutritional support therapy for

patients with malignant tumors of the digestive system include oral nutrition supplements (ONS), artificial feeding, exercise intervention, pharmacological nutrients, and drug treatment [6]. Figure 2 shows the general concepts of treatment relevant to all cancer patients proposed by the European Society for Clinical Nutrition and Metabolism[7]. Due to the different physical conditions, disease severity, and digestive tract functions, individual therapy should be implemented in clinical work.



**Figure 2.** Concepts of treatment relevant to all cancer patients proposed by the European Society for Clinical Nutrition and Metabolism

## 2.2. Oral Nutrition Supplements (ONS)

ONS is usually for the patients at risk of malnutrition, who can eat by mouth and have basically intact gastrointestinal function. ONS is including standard milk feeds, milk feeds suitable for diabetes, concentrated milk feeds, and juice-based feeds[8]. They are mainly ready-to-drink liquid or powdered formulas with nutrients such as protein, and vitamins in clinical practice. Standard milk feeds have good taste and are suitable for oral administration. They are suitable for most patients with malignant tumors of the digestive system. However, special nutritional preparations such as diabetic patients are required to control their blood sugar. The mechanism is to increase the energy supply ratio of fat or control the slow release of carbohydrates. Concentrated milk feeds are not as good in taste as the standard milk feeds. The taste needs to be improved to meet patients' requirements. The dosage of ONS depends on different situations, and there is no specific ratio and supplementary amount, which needs to be adjusted according to the patient's condition and nutritional status.

## 2.3. Artificial Feeding

Artificial feeding refers to providing nutrients through enteral circuit (enteral nutrition) or parenteral infusion (parenteral nutrition) [9]. Enteral nutrition refers to inputting of nutrition through nasogastric tube, nasoenteric tube, gastrostomy, jejunostomy, etc. Parenteral nutrition refers to the provision of nutrients through intravenous routes. When the colorectal cancer patient cannot eat orally and receive tube feeding or has severe intestinal, peritoneal, and other diseases, the nutritional status can be maintained through parenteral nutrition. The main reasons for the reduction of food intake in colorectal cancer patients include anorexia, oral ulcers, nausea, vomiting, side effects of drugs. After treatment, the patient's oral food intake is insufficient (less than 60% of the demand), and artificial feeding needs to be implemented in a timely and reasonable manner to stabilize the nutritional

status. When the gastrointestinal tract function is normal and tolerated, it is better to choose the enteral nutrition to conduct nutritional support. When the energy provided by enteral nutrition is insufficient to meet the patient's needs, the parenteral nutrition route is selected.

## 2.4. Exercise Intervention

Colorectal cancer patients with malignant tumors of the digestive system often experience reduced exercise, which is not conducive to their recovery. Especially for patients with advanced cancer, the effects of drugs and nutrients are limited, and exercise training is needed to improve malnutrition. Exercise and physical activity can induce mitochondrial protein expression, regulate inflammatory mediators, improve sex hormone secretion, and promote nutrient storage, which can improve body function. A combination of nutritional and exercise interventions can have a synergistic effect which can effectively improve muscle and strength, physical function, nutritional status, fatigue, and quality of life in patients with malignant tumors. In addition to the common daily activities and aerobic exercise, resistance exercise is also beneficial to patients with malignant tumors, especially for improving muscle strength. In order to reduce the risk of muscle atrophy, patients should be encouraged to walk every day and exercise regularly, and exercise for more than 150 minutes per week.

## 3. Conclusion

Current research shows that all colorectal cancer patients diagnosed of the digestive system should be screened for nutritional risk. For the patients with malignant tumors of the digestive system with nutritional risk, nutritional counseling, oral nutritional supplements, artificial feeding, and exercise intervention are recommended. Maintaining or gaining muscle mass is the focus of nutritional support goals. Studies have shown that increased protein intake can promote the synthesis and metabolism of muscle protein in patients.

Medical staff should conduct nutritional assessment on patients with malignant tumors of the digestive system as soon as possible. The nutritional support team needs to provide individualized guidance to patients according to factors such as the patient's individual situation, tolerance and subjective wishes, thereby selecting the most effective nutritional support measures.

Although diet and exercise interventions have been proven to be effective and feasible for most colorectal cancer patients, they have not been widely used as standards. Therefore, establishing a standard process for nutritional support should become an interdisciplinary task. Standard procedures and quality control should also be specified to ensure the effectiveness of nutritional therapy. In addition, different healthcare facilities are required to provide to implement nutritional assessments, nutritional treatment, and monitoring and feedback. The literature on nutritional treatment timing, ONS dosage, and nutrition combined with exercise is still in its infancy. Therefore, high-quality research in this area is urgently needed to better guide practice.

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