

## NUTRITION STRATEGY FOR PATIENTS UNDER CONDITIONS OF THE CORONAVIRUS INFECTION PANDEMIC (SARS-COV-2)

A.V. Turusheva

The North-Western State Medical University named after I.I. Mechnikov, Saint Petersburg, Russia

In this review, we discuss about nutritional status and the role of diet and lifestyle in patients with SARS-COV-2 infection. This review speculates the importance of nutrition as a mitigation strategy to support immune function amid the coronavirus pandemic, identifying food groups and key nutrients of importance that may affect the outcomes of respiratory infections.

**Keywords:** coronavirus infection; nutrition; COVID-19; SARS-CoV-2.

## ОСОБЕННОСТИ ПИТАНИЯ ПАЦИЕНТОВ В УСЛОВИЯХ ПАНДЕМИИ КОРОНАВИРУСНОЙ ИНФЕКЦИИ (SARS-COV-2)

А.В. Турушева

Федеральное государственное бюджетное образовательное учреждение высшего образования «Северо-Западный государственный медицинский университет имени И.И. Мечникова» Министерства здравоохранения Российской Федерации, Санкт-Петербург

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В статье представлены рекомендуемые методы оценки нутритивного статуса в условиях пандемии коронавирусной инфекции. Рассмотрена роль различных паттернов пищевого поведения и пищевых групп в качестве стратегии снижения выраженности «цитокинового шторма» и синдрома гиперкоагуляции, наблюдаемых при инфекции SARS-COV-2.

**Ключевые слова:** коронавирусная инфекция; питание; COVID19; SARS-CoV-2.

### Introduction

If we imagine the human body as a besieged fortress, we will see that its cells and organs perform various functions peculiar to people. These include protecting and repairing walls, treating the wounded and sick people, raising offspring, and distributing food. In this analogy, the immune system plays the role of an army in our body. Equally, in the fight against a coronavirus infection (as in a real war), the body must decide when to fight, and what weapons are better to use. An incompetent immune response will lead to a rapid spread of infection in the body. Conversely, an over-competent one leads to the development of a “cytokine storm,” which damages one’s own tissues even to death.

The combat readiness of the immune system of the human body (as well as the real army), directly depends on adequate supply, which can also have a modulating effect on its work. From recent studies, different eating behavior patterns can have a multidirectional effect on

the state of immune response and the level of chronic inflammation in the body [1–6].

Thus, nutrition plays an important role in the general state of human health, its functional status, and immune response. Both malnutrition (characterized by a decrease in lean body mass, insufficient admission of certain macro- and microelements) and excessive admission of various food substances leads to increased body weight and obesity, affect the body’s susceptibility to bacterial and viral infections, and the risk of complications and failures [1–14].

### Tactics of examination and correction of nutrition of patients with coronavirus infection

#### I. Assessment of nutritional status [6].

1. The probability of developing malnutrition should be assessed for all patients especially those at risk to be infected by the coronavirus infection which includes all patients

*Comparative characteristic scales for the assessment of nutritional status*

Name of the scale	Parameters		Points	Points
Universal screening method for assessing nutritional deficiencies	Body mass index, kg/m <sup>2</sup>	18.5–20	1	0 — low risk of developing malnutrition; 1–2 — moderate risk of developing malnutrition; ≥2 — high risk of developing malnutrition
		≤18.5	2	
	Weight loss for the last 3–6 months	5–10%	1	
		≥10%	2	
Actual or expected lack of nutrition	>5 дней	2		
A brief rating scale of a nutritional evaluation	Has food consumption decreased over the past 3 months due to loss of appetite, digestive problems, chewing, or swallowing?	Significant reduction in food consumption	0	12–14 points — normal nutritional status; 8–11 points — risk of malnutrition; 0–7 points — insufficient nutrition
		Moderate reduction in consumption	1	
		There is no reduction in food consumption	2	
	Weight loss in the last 3 months	Has	0	
		Does not know	1	
		From 1 to 3 kg	2	
		No mass loss	3	
	Mobility	Recumbent or uses a wheelchair	0	
		Able to get out of bed / chair, but does not leave the room	1	
		Leave the room	2	
	Have you experienced psychological stress or acute illness in the last 3 months?	Yes	0	
		No	1	
	Neuropsychological problems	Severe dementia or depression	0	
		Moderate dementia	1	
		No	2	
	Body mass index, kg/m <sup>2</sup>	Less than 19	0	
		From 19 to 21	1	
		From 21 to 23	2	
		23 or more	3	

aged 65 years and older, persons with chronic diseases of the cardiovascular, bronchopulmonary system, systemic connective tissue diseases, chronic kidney disease, cancer, liver cirrhosis, immunodeficiency conditions, inflammatory bowel diseases [6].

To assess the risk of developing malnutrition and its diagnosis in outpatient practice, it is recommended to use the following scales (see the table). Firstly, universal screening method for assessing nutritional deficiencies (the MUST scale from the English Nutrition Universal Screening Tool), created for screening and evaluating nutritional status in the general population. In addition, a short nutrition assessment scale (MNA — from the English Mini

Nutritional Assessment), designed specifically for patients aged 65 years and older.

2. Furthermore, aged patients with identified malnutrition or risk of malnutrition should be a thorough evaluation to identify additional factors of malnutrition such as depression, cognitive status, physical functioning, and level of independence from others. For this purpose, you can use the “14D” rule [7]. This rule includes dementia, depression, dental prostheses with missing teeth and xerostomia, dysphagia, decompensation of chronic diseases, long-term use of medications and polypharmacy, motor disorders, dysfunction of the endocrine system (hyperthyroidism, hypercortisolism, hypercalcaemia), dyspepsia, decreased appetite, and other

diseases of the gastrointestinal tract, sensory deficit (reduced vision, taste and smell), diet (Hypo-cholesterol, salt-free, lactose-free.), de-socialization with loss of independence (needs outside help), nursing home or hospital stay, money, and socio-economic factors.

3. Patients with identified nutritional deficiencies or risks of their development should be given additional nutritional recommendations [6].

4. In addition, overweight and obese patients are also at risk of developing failure and death from coronavirus infection, and therefore should also receive additional recommendations for dietary correction [5, 6].

5. Decreased taste and smell of varying intensity (one of the main symptoms of coronavirus infection), also significantly affects the risk of developing malnutrition and eating stale foods, especially in the elderly age [14].

## II. Advice on nutrition.

1. The daily caloric content of a diet should be 28–30 kcal/kg of body weight per day, depending on the severity of the patient's condition. Protein should be 1–1.5 g/kg of body weight per day. In the absence of signs of respiratory failure, the ratio of fat and carbohydrates in the diet should be 30/70, and in the presence of signs of respiratory failure, it should be 50/50.

2. Comparison of various patterns of eating behavior showed that following a Mediterranean diet rich in seafood, fresh vegetables, fruits, whole grains with a high content of monounsaturated fats (olive oil, nuts) helps to reduce the severity of the “cytokine storm” and hypercoagulation syndrome, observed in the complicated course of a coronavirus infection [6]. On the contrary, following the western model of eating behavior, which is characterized by eating foods rich in refined carbohydrates, sugar and saturated fats, increases the risk of failure and complications during the current pandemic [6].

3. In adding/sipping mixes to the diet, their caloric content should be at least 400 kcal/day, including 30 g or more of protein per day [6].

4. For patients with malnutrition, vitamin complexes containing vitamins A, E, D, B<sub>6</sub>, and B<sub>12</sub>, omega-3, zinc, selenium and iron can be prescribed [6].

5. According to a systematic review published in July 2019, eating four or more portions of vegetables and fruits per day associated with

a decrease in inflammatory markers in the body such C-reactive protein, interleukin-6 (IL-6) and adhesion factors [1, 2]. In addition, diets high in fiber contribute of short-chain fatty acids in the gut (especially butyrate), which also controls the intestinal immune response by increasing the production of transforming growth factor- $\beta$  and reducing pro-inflammatory cytokines such as IL-6, IL-17 [2]. Vegetables and fruits contain a large amount of flavonoids, with a modulating effect on the body's immune response. For example, blueberry anthocyanins reduce the level of transcription factor NF- $\kappa$ B in the blood, which plays a key role in the development of a “cytokine storm” in coronavirus infection [3, 4].

6. Eating 2–4 servings of fish per week is associated with a reduced risk of developing cardiovascular diseases, certain forms of cancer, the level of chronic inflammation in the body, and the risk of blood clots [5]. However, data on the association of fish oil consumption, as well as omega-3 polyunsaturated fatty acids (eicosapentaenoic and docosahexaenoic acids) with the development of infectious diseases are not clear. From our study, in small doses (500 mg/day), omega-3 polyunsaturated fatty acids reduce the risk of infections caused by *Streptococcus*, *Staphylococcus* and *Escherichia coli*. At the same time, taking omega-3 polyunsaturated fatty acids at a dose of 1000–4000 mg per day leads to a decrease in the body's immune response against diseases such as tuberculosis, salmonellosis, herpes, and flu [5].

7. Furthermore, adding foods rich in plant fiber to the diet of mice increased their survival rate in influenza by increasing the synthesis of short-chain fatty acids in the intestine. However, there are currently no clear recommendations for fiber consumption during the current pandemic due to possible gastrointestinal damage [5].

8. Taking a minimum of 200 mg of vitamin C per day reduces the duration of clinical aspects of an acute respiratory viral infection by an average of 8% of adults and 14% of children [8].

9. Again, a recent meta-analysis of 25 randomized controlled studies involving 11,000 patients demonstrated a reduction in the incidence of acute respiratory viral infection due to vitamin D supplementation [9]. In addition, according to recent studies, vitamin D consumption also reduces both the risk of developing and

the severity of complications of SARS-CoV-2 infection [10].

10. In addition, vitamin E has an immunostimulating and powerful antioxidant effect [11]. In numerous studies on animals and humans, it has been shown that vitamin E deficiency leads to a disbalance of humoral and cellular immunity [11]. In this regard, vitamin E was recommended in patients with coronavirus infection [5].

11. Vitamin B<sub>6</sub> participates in more than 100 different processes in the body. These processes include protein metabolism and regulating immune function [5].

12. Zinc is crucial for the development of immune cells and is an important cofactor for many enzyme systems in the body [12]. According to several controlled studies, zinc supplementation is associated with a significant re-

duction in the incidence of acute respiratory viral infection and pneumonia in aged and senium patients [5]. In addition, that taking zinc at a dose of 30–50 mg/day can reduce the replication rate of SARS-CoV-2 and the flu virus [13].

13. According to research data, copper deficiency was associated with a decrease in the immune response and an increase in the frequency of infections [5]. With a balanced diet, copper deficiency is rare, but it can be observed after pneumonia. The inclusion of copper supplements in the treatment regimen for SARS-CoV-2 infection remains controversial [5].

### Conclusion

All coronavirus infection patients nutritional status and given recommendations for dietary correction.

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#### *Information about the authors*

*Anna V. Turusheva* — PhD, Associated Professor of the Department of Family Medicine. North-Western State Medical University named after I.I. Mechnikov, Saint Petersburg, Russia. <https://orcid.org/0000-0003-3347-0984>. SPIN-code: 9658-8074. E-mail: [anna.turusheva@gmail.com](mailto:anna.turusheva@gmail.com).

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#### *Информация об авторах*

*Анна Владимировна Турушева* — канд. мед. наук, доцент кафедры семейной медицины. ФГБОУ ВО «Северо-Западный государственный медицинский университет имени И.И. Мечникова» Минздрава России, Санкт-Петербург. <https://orcid.org/0000-0003-3347-0984>. SPIN-код: 9658-8074. E-mail: [anna.turusheva@gmail.com](mailto:anna.turusheva@gmail.com).