

(REVIEW ARTICLE)



## The importance of nutrition in protecting the elderly from COVID-19

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### Abstract

The coronavirus (COVID-19), which emerged in the province of Wuhan in China in December 2019, is a pandemic that threatens all humanity. In this pandemic, so far elderly people appear to be the most vulnerable group. Adequate and balanced nutrition is required for the immune system of the body to fight against any diseases. Covid-19 has a direct correlation with nutrition habits, especially in elderly people. Therefore, the purpose of this study was to examine the relationship between the risk of COVID-19 and nutrition in elderly individuals.

**Keywords:** COVID-19; Elderly nutrition; Immune system; Malnutrition; Nutritional habits; SARS-CoV-2

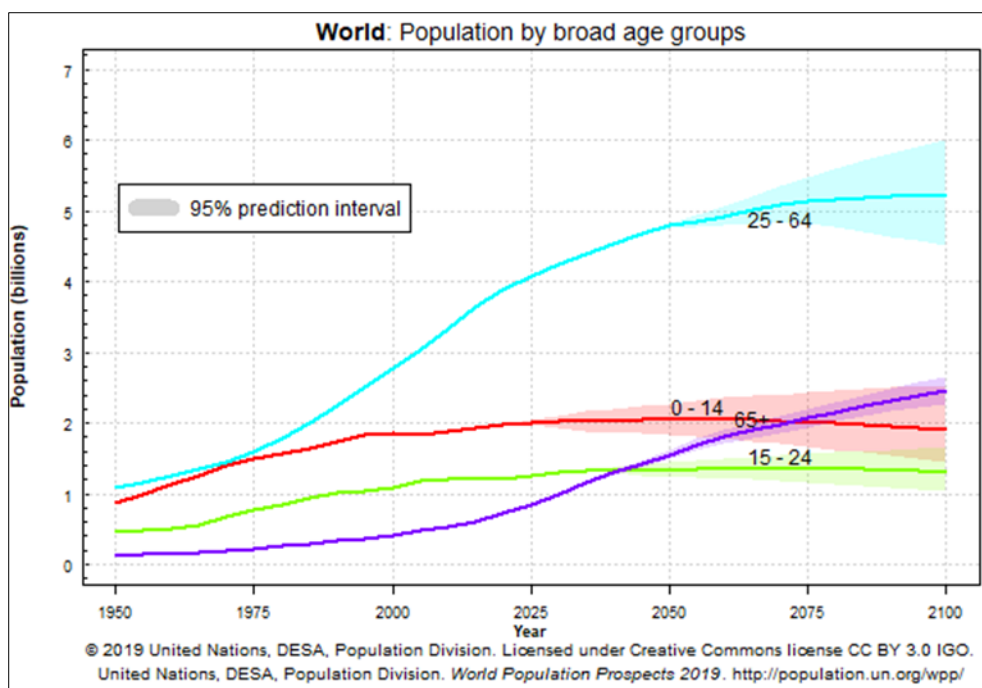
### 1. Introduction

Aging is the changes that occur in the structure and functions of the body over time. It cannot be prevented, however, it can be partially slowed. At a biological level, aging is a consequence of a wide range of molecular and cellular destruction that transpires during a lifetime. In addition, this leads to a gradual decrease in physical and mental capacity, an increasing risk of disease, and eventually death [41]. The old age limit can vary by country due to various reasons such as working conditions and social life standards. However, in most countries the old age limit is verified by the retirement age. In Turkey, the population aged 65 and above is considered as the elderly population according to the Turkish Statistical Institute. There is an increase in the number and rate of elderly individuals in almost all countries around the world [42]. The elderly population in Turkey is growing steadily and the rate is higher than that of the young population [32]. Furthermore, the global population aged 65 and above, which is determined as the elderly population, was 703 million in 2019. The proportion of the elderly population in the total population is estimated to double to 1.5 billion in 2050 [33].

The population ratio of different age status is shown in Figure 1. As can be seen from the figure, the ratio of the 0-14 age group declines steadily by the year 2100. Moreover, a slight and stable increase is observed for the 25-64 age group. In addition, the same prediction can be seen for the 15-24 age group. However, for the 65 and above age group, there is a significant increase in the population ratio [34].

Due to the increase in the elderly population, there may be various problems related to old age. In addition to environmental conditions these problems depend on the physical, mental and economic conditions of elderly people. Elderly people get sick more often, and can suffer from chronic diseases or other problems. Moreover, elderly individuals experience social adaptation problems in society. The social adaptation of the elderly, their level of relations with society, their family and environment are different from each other [17]. In addition to the conditions listed above, elderly people can also have nutritional problems that depend on various factors.

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**Figure 1** Population ratio by age group between 1950-2100

As in every stage of life, adequate and balanced nutrition is extremely important when aging. Proper nutrition of the elderly benefits both themselves and public health. Adequate and healthy nutrition in old age is necessary for protecting and improving health, maintaining a positive mind set and being emotionally balanced, preventing and treating diseases, increasing life expectancy and quality, and ensuring an energetic, happy and independent life [27]. It is very important to protect the body from diseases and to increase the quality and continuity of life. Many factors such as physical, socioeconomic and psychological reasons, chronic diseases and drug-food combinations can affect the nutritional level, aging process and quality of life [14].

## 2. The causes of inadequate nutrition in elderly people

The first factor in the cause of the inadequate nutrition of elderly people is body changes that occur as a result of old age and affect adequate nutrition. Body composition changes with the loss of both fat and muscle tissue, and malnutrition. In general, body fat increases until the age of 75 years and then decreases or remains stable [12]. As humans age, their mobility and hormones decrease, metabolism slows down, body muscle tissue decreases and adipose tissue increases. In addition, the amount of calcium in the bones decreases during this stage. Therefore, the bones of elderly people can damage more easily and their healing process can take longer. Osteoporosis occurs with age and increases with the presence of risk factors including insufficient vitamin D and calcium intake, and inadequate physical activity [1]. In addition, the weakening in bones and muscles can cause changes such as shrinking in height, the emergence of a hunchback, increased risk of bone fracture and tooth loss.

The second factor in the cause of the inadequate nutrition of elderly people is their change in appetite, which leads to them not getting the sufficient energy from their diet. Insufficient appetite is the main cause of malnutrition and is mediated by different factors [12]. Changes in the digestive system, hormonal changes, illness, pain, changes in the sense of smell, taste and vision, and decreased energy requirements are physiological changes that occur with age that can affect appetite [26].

The third factor in the cause of the inadequate nutrition of elderly people is that problems such as difficulties in chewing, swallowing and digesting foods occur, which cause energy intake to slow down [36]. Reduction in the strength of the tongue and throat can result in incomplete or ineffective swallowing, which causes food to get stuck in the throat and constrict the airway. Hence, these issues affect the sufficient intake of foods and nutrition into the body [14].

The fourth factor is psychological, socioeconomic and cultural causes. In addition to the physiological changes that occur in the bodies of elderly individuals, various changes also occur in their lifestyle. Being alone, losing partners, a sedentary

lifestyle, financial difficulties and trouble in performing daily life activities can be given as examples to such changes. Depression, which is common in the elderly, can also be one of the reasons for poor nutrition.

The last factor is changes in the digestive system. Indigestion in the elderly, the feeling of satiety due to the slowing down of the digestive system, decreased gastric and intestinal movements, saliva and stomach acid secretion, enzyme production, delayed gastric emptying and decreased absorption of nutrients from the small intestine cause digestive difficulties and nutritional disorders [27; 36]. Such issue can cause gastrointestinal infections and reduce the absorption of certain nutrients including calcium, iron, folate, vitamin B12 and zinc. The changes that occur in the gastrointestinal system during the aging process and the inefficiency of the gastrointestinal system cause elderly individuals to become more susceptible to nutritional deficiencies [27].

When the factors listed are examined, it can be seen that there are several basic points that should be taken seriously regarding nutrition in old age. A decrease in the ability to taste and smell, which can affect food intake, and deterioration in tooth and eye health can occur with old age [12]. Zinc deficiency, dental prosthesis problems, oral hygiene problems and medications used can also play a role in reducing the sense of taste. This decrease in the ability to taste and smell can cause malnutrition in individuals [2]. Elderly people can become unable to distinguish deteriorated, rotten or spoiled food and drink due to the decrease in their focusing capacity [12]. Approximately 50% of elderly individuals have difficulty in distinguishing the foods they taste without seeing them. Therefore, food must be prepared and cooked well, and stored correctly. This decrease in the abilities of taste and smell can cause malnutrition in individuals [2].

The consumption of saturated and trans fats in the diet of the elderly people should be reduced as much as possible. Increasing the consumption of such foods increase blood cholesterol levels, which is a risk factor for cardiovascular diseases. On the other hand, Omega 3 fats, which are present in most fish and seafood, protect cardiovascular health by reducing blood fats and plaque accumulation in the vessels in old age, and also prevent inflammation in the joints by preventing fat accumulation in the abdominal area and protect from obesity [1].

Adequate calcium intake in the body plays an important role in reducing bone mineral loss and maintaining bone health. Therefore, elderly people are recommended to consume foods with a high calcium content such as milk, yogurt and cheese. Calcium is important in preventing and reducing chronic diseases such as osteoporosis, colon cancer and hypertension [29].

In general, elderly people prefer salty and sugary foods more because of their sensory loss. However, they should reduce the amount of such foods in their diets [38]. In addition, insufficient fluid intake and increased fluid loss are significant issues that are common among elderly people and can lead to dehydration. If not avoided by the excessive consumption of water and other liquid foods dehydration can cause serious health problems [29]. Elderly people must consume an adequate amount of water and other fluids and drink at least 2 liters of water a day [2]. In addition, elderly people should avoid alcohol and smoking. Furthermore, the ideal body weight of elderly people should be monitored at regular intervals. Sudden weight loss can be a sign of malnutrition or cancer [14].

Elderly people, just like those in other age groups, require fundamental food group namely meat and dairy products, vegetables and fruits, bread, cereals. These foods should be consumed in the appropriate amounts [29]. Nutritional diversity should be ensured by increasing the number of meals and choosing a range of foods from the different food groups for different meals [1]. The lack of food diversity can result in some nutrients to be deficient [1]. A single type of food alone cannot provide all the necessary nutrients for the body such as proteins, fats, carbohydrates, water, fibers, vitamins and minerals [16]. Therefore, each meal must contain foods from the four main food groups: meat and its derivatives, milk and dairy products, vegetables and fruits, and cereals. The essential sources of carbohydrates, proteins, fiber and micronutrients are cereals. In recent years, there has been an increase in the scientific evidence showing that cereals contain a lot of components that promote health, such as antioxidants and dietary fibers. Dietary fiber, for example, has been reported to effectively lower serum LDL cholesterol levels and protect against cardiovascular disease, type 2 diabetes mellitus, and cancer [4]. Elderly people should consume approximately 400 grams of fruits and vegetables a day [16].

## **2.1. Water and Other Liquids**

Liquid intake is highly important for elderly people. Liquid loss from the body increases with age due to the thinning of the skin. This leads to the increase in the risk of dehydration as a result of the decrease in the ability of the kidneys to concentrate urine and the sensitivity of the thirst center. As a result of the decrease in the level of the antidiuretic hormone (ADH) with age, edema can develop due to sodium retention in the body with water. In addition, inactivity,

dementia, high blood pressure, chronic diseases such as heart and kidney diseases increase the development of dehydration and electrolyte imbalances [29].

## 2.2. Carbohydrates

In nutrition 55-60% of daily energy is provided from carbohydrates. It is important to meet the carbohydrate requirement from complex carbohydrates as carbohydrate tolerance decreases with aging. With the intake of complex carbohydrates, vitamin, mineral, and fiber intake are also provided to the body [2]. In elderly people the intake of simple sugars should be reduced, while the consumption of cereal products should be increased, and foods with a low glycemic index should be preferred. Simple sugars only provide energy, however, foods containing complex carbohydrates (grains, legumes, potato, etc.) provide protein, vitamins, minerals, and fiber required for body functions in addition to energy [29].

## 2.3. Proteins

With aging, growth in human's stops, and muscle functions and muscle mass decrease. Proteins are required for the functioning of the body, protecting muscle mass and tissues, and strengthening the immune system [31]. The amount of protein that is best to preserve lean tissue mass and tissue functions in elderly people is not exactly known. The presence of sufficient protein in the diets of elderly people is significant in preventing conditions that can cause changes in calcium metabolism in old age such as osteoporosis and bone fractures [5].

Protein requirement is affected by age, physical activity, medication use, dietary protein intake and health status [2]. It is important that elderly people get their protein from vegetable or animal sources. Proteins obtained from plant foods have low amino acid content and low digestibility. Thus, the rate of digestion of animal-derived proteins in the body is higher than vegetable-derived proteins. Some researchers have indicated that the need for essential amino acids increases with old age [29]. Although the protein amount does not change, its quality is desired to be high [3].

## 2.4. Lipids

In elderly individuals, a maximum of 30% of daily energy intake should be provided from fat [2]. The surplus of lipids containing saturated fatty acids in the diets of elderly people can increase serum cholesterol levels and result in cardiovascular and cerebrovascular illnesses [15; 38]. Fats in the diet are effective in the absorption of fat-soluble vitamins namely vitamins A, D, E and K. The ratio of fatty acids in nutritional elements is as important as the total amount of fat in a sufficient and balanced diet. As fatty acids are not synthesized in the body, they should be taken as supplements. The intake of omega-3 fatty acids in the diet is essential for the prevention of heart disease and the protection of retinal and brain health [7]. In addition, olive oil is important in the nutrition of the elderly people as it contains polyphenols, which are powerful antioxidants.

## 2.5. Vitamins

With aging, the body's requirements for some vitamins alter. Vitamin D, vitamin B12, vitamin C, vitamin A, vitamin B6, Thiamine (vitamin B1), vitamin E, and folic acid deficiencies are particularly more common in the elderly [31]. In a study that examined the diets of elderly individuals with complaints of abdominal pain, indigestion, anorexia, back pain, and low productivity it was determined that these individuals were deficient of vitamin A, riboflavin, thiamine, niacin, vitamin B12, folic acid, vitamin C, iron, magnesium and protein [35]. Elderly people are at high risk of vitamin D deficiency. There are various reasons for this such as the inability to sufficiently benefit from direct sunlight, decrease in vitamin D synthesis through ultraviolet rays in the skin, decrease in the absorption of vitamin D and its conversion into active form due to reduction in kidney functions [29]. Vitamin E is the key lipid-soluble nutrient in the antioxidant protection mechanism of cells and is obtained exclusively from nutrition. As a result of its antioxidant function, it has several significant roles within the body. Vitamin E has been shown to be effective against numerous potential disorders and illnesses, including cancer, aging, arthritis and cataracts, all of which have been related to oxidation [28]. Low folate (vitamin B9) intake is associated with anemia, dementia, irritability, depression and decreased memory function. The requirement of vitamin B6 increases in elderly individuals. According to metabolic studies, elderly individuals are recommended to take 2.5 mg of vitamin B6 per day [10].

## 2.6. Minerals

The most well-known mineral deficiencies in elderly people are calcium, phosphorus, iron, iodine, selenium, zinc and magnesium [9]. With age a decrease in calcium absorption occurs, which is possibly due to the change in the vitamin D metabolism. In addition, inadequate and unbalanced nutrition, smoking, and drinking alcohol can disrupt the absorption of calcium and other minerals in the bones. The high rate of sodium acquired from processed foods and coffee

accelerates mineral loss from the bones. The increase in inactivity with age also increases the risk of osteoporosis by accelerating the passage of calcium from the bones to the blood. In other words, the body's requirement for calcium can also vary with the nutritional status of the individual. For example, the calcium requirements of individuals who have a diet rich in sodium and protein increase. Inadequate intake of vitamin D increases bone loss and causes osteoporosis [2].

### **2.7. Fiber**

Although dietary fiber is not considered a nutrient, it is an important dietary component due to its positive effects on gastrointestinal functions. Dietary fiber consists of water-soluble and water-insoluble fiber. Water-soluble fibers lower cholesterol and regulate blood glucose. In addition, they reduce the risk of diabetes, cancer, and coronary heart disease and have therapeutic properties on the elderly [2]. On the other hand, water-insoluble fibers prevent constipation and are essential in regulating intestinal activities in elderly people. They also reduce the risk of colon cancer [29]. However, it should be noted that a higher fiber diet can reduce the absorption of various nutrients.

### **2.8. Probiotics**

According to the WHO, probiotics are microorganisms that positively affect health when taken into the body in enough quantities. The easiest and most affordable method to prevent health problems caused by aging is the regulation of nutrition [39]. Therefore, the intake of foods containing probiotic and prebiotic foods specific to elderly people can be effective in maintaining and improving health.

### **2.9. Energy**

The requirement of energy decreases in the elderly due to the decrease in basal metabolic rate, changes in body composition and decreases in physical activity [29]. Determining the correct energy requirement is very important in maintaining the ideal body weight in elderly individuals. Therefore, it is recommended that elderly people should spend 30-35 kcal/day energy per kilogram in order to maintain their ideal body weight, assuming they are at a minimum physical activity level [2].

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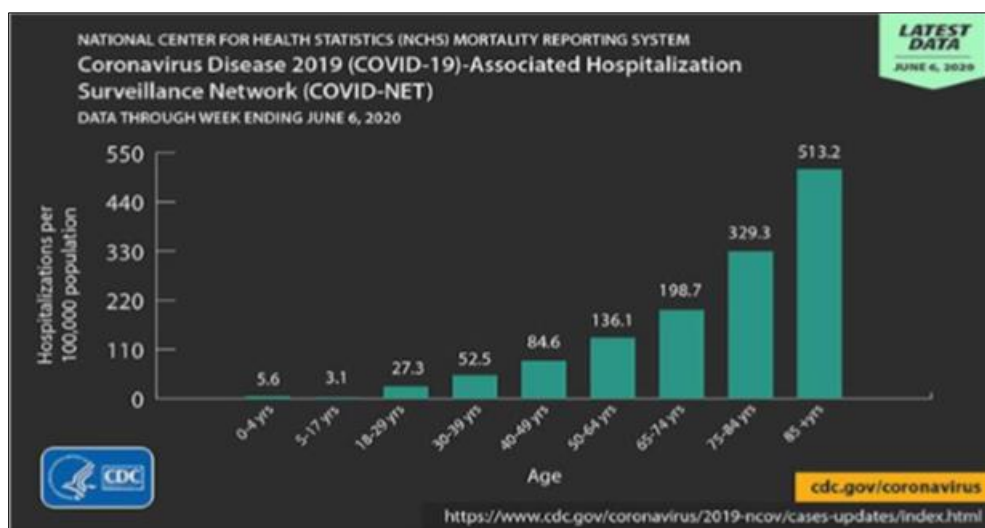
## **3. Coronavirus (Covid-19) and Elderly Populations**

Sars-CoV-2, an infectious disease caused by a newly discovered coronavirus and is an acute respiratory infection (RTI). It manifests itself as pneumonia in humans. This disease was first detected in a group of patients with symptoms of pneumonia [30] in Wuhan, the largest city in China's Hubei province, in late 2019 [11; 18]. It was initially referred to as 2019 nCoV, but later renamed COVID-19 by the WHO and declared as a pandemic in March 2020 [40]. Coronaviruses are a large family of viruses that can cause illness in both animals and humans. Several coronaviruses are known to cause respiratory infections, ranging from the common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS) in humans. COVID-19 is spread by the inhalation of droplets scattered by infected individuals when they cough and sneeze. People can be also infected by touching their face, eyes, nose or mouth without washing their hands after touching surfaces contaminated with respiratory particles. COVID-19 usually emerges as a fever, cough, and shortness of breath and progresses into an acute syndrome of respiratory distress, lung consolidation, kidney failure, multiple organ failure and finally death [25].

The knowledge gained so far regarding COVID-19 has shown that some people are more at risk of getting sick and developing severe symptoms than others [43]. The incidence and outcome of COVID-19 primarily depends on the age of the individual [22]. The disease usually affects people aged 60 and above [43]. Adults over 65 years are responsible for 80% of hospitalizations and are 23 times more likely to die than those under 65 [22]. While 80% of the cases have mild symptoms, 20% are treated in hospital conditions [43]. According to Chinese data, the rates of hospitalization with a diagnosis of COVID-19 increase with age and are 1% for those aged between 20-29 years, 4% for those aged between 50-59 years, and 18% for those over 80 years old [37]. Of the 10 deaths associated with COVID-19 reported in the US, eight were reported to be adults age 65 and above [24]. Figure 2 presents the hospitalizations per 100.000 population versus age. As can be seen from the figure, as age increased the number of hospitalized by Covid-19 increased as well.

In general, those over the age of 80 are severely affected by the virus. Elderly individuals with underlying medical conditions such as cardiovascular disease, diabetes, hypertension, chronic respiratory disease and cancer are more likely to develop serious illness. On the other hand, in cases of nutritional deficiencies, the proliferation of immune cells slows down and the body's resistance to infections decreases. As a result of the deficiencies in the immune system in that occur with old age, the incidence of upper respiratory tract infections and other infectious diseases, cancer and deaths increase [29]. Immune functions decrease with age, and both humoral and cellular immunity are greatly affected.

These changes reduce the body's ability to fight infections in elderly people. The need for energy, protein and micronutrients increases in people diagnosed with the disease and those hospitalized due to high fever or respiratory distress. During hospitalization, it is important to monitor and evaluate the nutritional status of the patients to prevent their conditions from getting worse [23].



**Figure 2** Hospitalizations per 100.000 population vs. age [24]

It is well known that the elderly are more likely to have nutrient deficiencies and weak immune systems. Essentially, this increases the risk of getting COVID-19, thus, adequate nutrition is essential. Vitamin and mineral deficiencies have also been observed in elderly COVID-19 patients in high-risk groups, increasing the risk of morbidity and mortality [30]. As vitamins A, C, D and E, selenium, and zinc are important micronutrients in fighting infections, a variety of foods are recommended to improve and build the immune system of elderly people [6]. Vitamin C reinforces the immune system and increases resistance to infection. In addition, it is believed that vitamin C inhibits the production of cytokine storms caused by COVID-19 [13]. These micronutrients are lower in the elderly due to the lack of an adequate and balanced diet. For example, many elderly people are less exposed to sunlight, thus they are at risk of vitamin D deficiency [6]. The risk of acute respiratory infections is reduced by vitamin D. Therefore, elderly individuals with vitamin D deficiency are more vulnerable to contract Covid-19. According to a study conducted in Switzerland, patients with positive Covid-19 test results had significantly lower plasma 25-hydroxy vitamin D concentrations than those who had negative results [8]. One study found that the serum vitamin D levels of COVID-19 patients were significantly lower than healthy individuals (150 people matched by age/gender). In another study, severe vitamin D deficiency (with a limit of 10 ng / dl) was observed in 7.3% of the control group and 24.0% of the patients in the COVID-19 group [11]. Furthermore, other studies have found that individuals with dark skin are prone to vitamin D deficiency and therefore severe COVID-19 infection [21]. Vitamin D deficiency may be one of the many factors that play a role in determining the outcome of COVID-19 patients. Clinical trials investigating vitamin D supplements in COVID-19 patients are still ongoing [19]. Recent studies have shown that nutritional supplements can play a supporting role in COVID-19 patients. Several studies have reported that the administration of higher than recommended daily doses of nutrients such as vitamins D, C, E, zinc, and omega-3 fatty acids can have a beneficial effect and potentially reduce the SARS-CoV-2 viral load and hospital stay. These nutrients have antioxidant and immunomodulatory effects, and their deficiency can cause immune dysfunction and increase susceptibility to pathological infection [30, 20]

#### 4. Conclusion

This study concluded that, it is highly essential to maintain an adequate and healthy diet when getting older in order to prevent malnutrition and various diseases. Elderly people should be careful about their eating habits and diet, which must include proteins, carbohydrates, lipids, vitamins, minerals, fibers and water. In addition, to decrease the many dangers related to health, elderly individuals should carry out various light physical activities, such as walking, to improve their physical and mental health, and immune system. In general, older individuals are more likely to catch viruses and bacteria and suffer more severely compared to young people. This case is even more serious in the elderly who have insufficient nutrition and unbalanced diets. For example, today the recently emerged covid-19 virus is a dangerous threat that particularly affects elderly people who have nutritional deficiencies and weak immune systems.

Therefore, the elderly population must take care of their nutritional habits and physical activities to keep their immune system strong.

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## Compliance with ethical standards

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### *Disclosure of conflict of interest*

Authors have declared that no competing interests.

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