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# THE RELATIONSHIP BETWEEN NUTRITIONAL KNOWLEDGE RELATED TO IMMUNITY AND HISTORY OF COVID-19 ILLNESS AND VITAMIN C INTAKE IN WOMEN OF FERTILIZING AGE IN BOJONEGORO

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## ABSTRACT

**Background:** Coronavirus Disease is an infectious disease caused by the SARS Cov-2 virus. Someone who has a history of COVID-19 illness complains of several ongoing symptoms and even experiences substantial organ dysfunction after being exposed toSARS-Cov-2 infection. Vitamin C contributes to maintaining immunity by supporting various cellular functions of the innate and adaptive immune systems. This study aims to determine the relationship between nutritional knowledge and history of COVID-19 illness with vitamin C intake.
**Method**: This type of study used a cross-sectional design. The population used was women of childbearing age (WUS) with a sample of 88 respondents using simple random sampling technique. The research was conducted in April 2023. The instruments used were a questionnaire and the SQ-FFQ form. Then the data analysis test used was the chi-square test.
**Result**: The results showed that there was a relationship between nutritional knowledge and a history of COVID-19 illness and intake of vitamin C with p values <0.000 and <0.008 with odds ratios of 10,633.
**Conclusion:** Knowledge of nutrition can shape behavior and create actions that determine a person's nutritional intake. In a history of COVID-19 illness, post-COVID-19 symptoms can cause chronic inflammation which will spread to other tissues and the bloodstream so that vitamin C has a role as an electron donor so that immune cells are protected from damage by free radicals.

**Keywords:** COVID-19, Nutritional Knowledge, Vitamin C

## INTRODUCTION

Coronavirus Disease is an infectious disease caused by the Severe Acute Respiratory Syndrome Corona Virus-2 (SARS Cov-2). The disease caused by Coronavirus Disease attacks the respiratory tract and is characterized by symptoms such as fever, cough and shortness of breath. The serious symptoms caused by Coronavirus Disease are pneumonia, acute respiratory syndrome, kidney failure, and even death (Ministry of Health of the Republic of Indonesia, 2020). It is very important to emphasize a vigilant attitude in facing the COVID-19 pandemic to the public to prevent being infected with this virus. The main key in preventing COVID-19 is practicing a healthy lifestyle to increase the body's immunity (Salman and Baru, 2021).

Nutritional knowledge of women of childbearing age (WUS) is one of the factors that can influence a person's intake, because nutritional knowledge is a determinant in choosing food to consume to fulfill the body's nutrition (Notoatmojo, 2012). One of the causes of a lack of nutritional intake in WUS is a lack of nutritional knowledge which can cause WUS to tend to make mistakes in choosing the food they consume. This can occur starting from irregular eating patterns and consuming food without knowing the nutritional needs that must be met.

Micronutrients or micronutrients include vitamins and minerals. To meet the needs of these vitamins and minerals, it is necessary to consume a balanced and varied diet. The body

only needs these nutrients in small amounts, but each one has an important role for the body. One of them is as an antioxidant in improving the body's immune system. Antioxidants are substances that can significantly reduce negative effects due to reactive species formed in the body (Amaliah and Fery, 2021). One vitamin that has an antioxidant role is vitamin C.

Vitamin C also has a role in reduction in maintaining iron and copper atoms in metalloenzymes in a reduced state (Gropper & Simth, 2012). The recommended need for vitamin C for Indonesians is based on the daily nutritional adequacy figure for each person aged 15-49 years of 75 mg (Ministry of Health, 2019). Ordinary people who don't understand about vitamin C often don't pay attention to their diet every day and tend to underestimate the lack of vitamin C in their bodies, for those who eat is important. Even though vitamin C deficiency can affect health. It could also be because we don't consume the right food, or the body cannot absorb it due to digestive problems.

The important reason for providing vitamin C nutrition in COVID-19 cases is that it has a role as an electron donor which can quickly break the reaction chain of Reactive Oxygen Species (ROS) and Reactive Nitrogen Species (RNS). Immune cells can be protected from damage caused by free radicals because vitamin C can easily donate electrons to free radicals. Therefore, vitamin C has a very close role with the body's immunity as an antioxidant (Siswanto et al., 2014).

Someone who has a history of COVID-19 complains that their health has not returned to perfection and there are several symptoms that persist continuously and even experience substantial organ dysfunction after being exposed to SARS-CoV-2 infection. These are what are called long-term symptoms or long-term post-COVID-19 symptoms. 19 (Greenhalgh et al., 2020). Based on surveys conducted, these symptoms can attack anyone who has been infected with COVID-19 depending on a person's immune system and immunity. Therefore, someone who has a history of COVID-19 needs proper food intake and giving vitamin C also helps in returning vitamin C levels to normal (Carr & Maggini, 2017).

A dose of 1-2 grams/day has proven effective in preventing upper respiratory tract infections, because not only through food sources, but vitamin C supplementation is also recommended for individuals who are susceptible to respiratory infections, one of which is individuals who have a history of COVID-19 (Hasan et al., 2021). Taking vitamins should be in accordance with the recommended dosage because if you consume more than the maximum limit in the long term it will result in side effects, such as diarrhea, nausea and headaches (Wijaksana et al., 2022).

Based on the results of a survey using the SQ-FFQ form which was carried out in several villages, Bakalan village is a village with a low average intake of vitamin C, namely 42.31 mg/day. This intake is still below the AKG standard, namely 75 mg/day. This is caused by not consuming enough vegetables and fruit as a source of vitamin C. Based on the background of the problem above, researchers are interested in conducting research entitled "The Relationship between Nutritional Knowledge Related to Immunity and History of COVID-19 Illness with Vitamin C Intake in Women of Childbearing Age (WUS) in Bojonegoro".

## METHOD

This research is a type of quantitative research using a cross-sectional design. The population used in this research was 470 respondents, while the sample used was 88 respondents. The sampling technique used simple random sampling which was carried out by creating a list of 470 respondents who constituted the population in Microsoft Excel

which was then randomized using the RAND program and adjusted to the sample size of 88 respondents.

Techniques for collecting data on nutritional knowledge and history of COVID-19 illness using questionnaires and data on vitamin C intake using the SQ-FFQ form with the interview method. The data analysis technique uses the chi-square test with the condition that if $p < 0.05$ then there is a relationship between variables, but if $p > 0.05$ then there is no relationship between variables.

Categories in the vitamin C intake variable, namely if vitamin C intake is ≥ 75 mg then the intake is good and if < 75 mg then the intake is insufficient. For the nutritional knowledge category, if the score is > 50% then knowledge is good and if the score is ≤ 50% then knowledge is poor.

## RESULTS AND DISCUSSION

**Table 1.** Characteristics of Respondents

| Subject Characteristics | N | % |
|---|---|---|
| **Age** | | |
| 25-30 Years | 26 | 29.5 |
| 31-35 Years | 19 | 21.6 |
| 36-40 Years | 15 | 17.1 |
| 41-45 Years | 28 | 31.8 |
| **Educational background** | | |
| elementary school | 13 | 14.7 |
| Middle school/equivalent | 35 | 39.7 |
| High school/equivalent | 35 | 39.7 |
| College | 5 | 5.9 |
| **Work** | | |
| Work | 54 | 61.4 |
| Doesn't work | 34 | 38.6 |

Based on table 1, the largest age group is 41-45 years old with 28 people or 31.8%. Age influences a person's level of maturity and strength in working and thinking. Someone being able to think maturely is one of the results of previous experiences and the maturity of their soul (Wawan and Dewi, 2019).

Most respondents' education was junior high school/equivalent and high school/equivalent, namely 35 respondents (39.7%). The respondent's education level influences their level of knowledge. A good level of education of respondents makes it easier for respondents to receive information about nutritional knowledge related to immunity. The higher a person's education, the more knowledge they have. Behavior that is based on knowledge, positive attitudes and awareness will be better than behavior that is not based on knowledge (Damayanti & Sofyan, 2022).

The majority, namely 61.4% of respondents, work outside the home. Women who work outside the home tend to have less time to prepare food. It is very possible for eating patterns to be disturbed. In some communities in Indonesia, work is an important thing that must be a priority because it is related to income that can be used to fulfill daily living needs.

**Table 2.** Distribution of Nutrition Knowledge

| Nutrition Knowledge | Frequency | Percentage (%) |
|---|---|---|
| Good (>50%) | 72 | 81.8% |
| Less (≤50%) | 16 | 18.2% |
| Total | 88 | 100% |

According to Budiman (2013), knowledge can be categorized into 2 categories, namely good knowledge and poor knowledge. Good knowledge has a score of ≥ 50% while poor knowledge has a score of < 50%. Table 2 shows that of the 88 respondents, 72 respondents (81.8%) had good knowledge and 16 respondents (18.2%) had poor knowledge.

Several factors characteristic of respondents that can influence knowledge include education, mass media, socio-economics, culture, environment, experience and age. Musriah (2018) also explains that a person's experience can influence his knowledge because valuable experience will be used by a person as a reference or basis for subsequent actions. Nutritional knowledge is the basis for implementing good and correct intake behavior, including consuming vitamin C intake among wus. An individual's lack of nutritional knowledge will also have an impact on nutritional intake, resulting in errors in choosing the food they consume. Starting from an irregular eating pattern and

consuming food without paying attention to its nutritional content can have a lasting impact on health (Puspasari, 2019).

**Table 3.** Distribution of Nutrition Knowledge

| History of COVID-19 Illness | Frequency (n) | Percentage (%) |
|---|---|---|
| Yes | 14 | 15.9% |
| No | 74 | 84.1% |
| Total | 88 | 100% |

Based on table 3, it can be seen that there were 14 respondents (15.9%) who had a history of COVID-19 illness and 74 respondents (84.1%) who had no history of COVID-19 illness. COVID-19 infection with acute respiratory syndrome can begin with or without symptoms, causing illness that can threaten life (Greenhalgh et al., 2020). The description of the history of COVID-19 in this study was measured using a questionnaire with questions asking whether or not the respondent had ever been infected with COVID-19. If the respondent has been infected with COVID-19, it is also necessary to know the length of the COVID-19 infection period from the first test to the last test.

In research conducted by Greenhalghet al (2020), 35% of 274 symptomatic respondents said that their health had not recovered after 2 weeks or more after receiving a positive result of being infected with COVID-19, including 26% of those aged 18-34 years. Symptoms that are often experienced are fatigue and dyspnea, as well as dysfunction of certain organs such as the heart and lungs. Many patients experience persistent respiratory symptoms several months after being infected with COVID-19, such as chronic cough, fibrotic lung disease, bronchiectasis, and pulmonary vascular disease (Fraser, 2020).

**Table 4.** Distribution of Vitamin C Intake

| Vitamin C Intake | Frequency (n) | Percentage (%) |
|---|---|---|
| Good | 63 | 71.6% |
| Less | 25 | 28.4% |
| Total | 88 | 100% |

Table 4 shows that there are 62 respondents (73%) who have good vitamin C intake. This indicates that the respondent's vitamin C intake was sufficient. On the other hand, 23 respondents (27%) had insufficient vitamin C intake. Vitamin C intake in this study was measured using the SQ-FFQ form over a period of three months. The principle of the SQ-FFQ method is to record the frequency of food consumed in the last three months.

The main function of vitamin C is its contribution to maintaining the body's immunity by supporting the epithelial barrier function in fighting pathogens and increasing the activity of cleaning skin oxidation so that it can potentially protect against environmental oxidative stress (Carr & Maggini, 2017). Based on the results of this research, it is known that subjects who had insufficient vitamin C intake were because the respondents rarely consumed fruit and vegetable sources of vitamin C or supplements.

The body can only store 1500 mg of vitamin C, so the recommendation for consuming vitamin C a day is around 100 mg/day. Consuming vitamin C can restore the immune system of a sick body, but it can also be used as a treatment so that it is consumed every day. Consuming vitamins should be in accordance with the recommended dosage because if you consume above the maximum limit in the long term it will result in side effects, such as diarrhea, nausea and headaches (Wijaksana et al., 2022).

According to the SQ-FFQ that was carried out, it was found that respondents who had less vitamin C intake were due to consuming fruit and vegetables that are sources of vitamin C in small amounts and frequency. Meanwhile, respondents who have a good intake of vitamin C are because they regularly consume fruit (apples, oranges, mangoes, pears, etc.) every day. Based on the data collection that has been carried out, a statistical description of the respondents' vitamin C intake variables is seen in table 5.

**Table 5.** Statistical Description of Vitamin C Intake Variables

| Variabel | Min | Max | Mean | Std |
|---|---|---|---|---|
| Vitamin C Intake | 32,7 | 146,4 | 82,77 | 21,3 |

Based on table 10, it can be seen that the average intake of vitamin C for respondents is 82.774 mg/day. This shows that the average intake of vitamin C for respondents is sufficient according to the 2019 AKG recommendations, namely for women aged 25-45 years, it is 75 mg/day. In the SQ-FFQ results, respondents consumed adequate sources of vitamin C in frequency and quantity. The minimum intake of vitamin C is 32.7 mg/day. This lack of intake could be caused by respondents consuming fruit and vegetables sources of vitamin C in small quantities and frequency.

**Table 6.** Relationship between Nutritional Knowledge and Vitamin C Intake

| Nutrition Knowledge | Vitamin C Intake | | | | | | *p* | OR |
|---|---|---|---|---|---|---|---|---|
| | Less | | Good | | Total | | | |
| | n | % | n | % | n | % | | |
| Good | 11 | 73,3 | 4 | 26,7 | 15 | 100 | 0,000 | 10,633 |
| Less | 15 | 20,3 | 48 | 79,5 | 73 | 100 | | |

The results of cross tabulation regarding the relationship between nutritional knowledge and vitamin C intake in table 6 show that there were more respondents with good vitamin C intake than respondents with good knowledge, namely 58 respondents (79.5%). The results of the chi-square test show that p-value = 0.001 (p-value < 0.05), which indicates that there is a significant relationship between nutritional knowledge and vitamin C intake. The Odds Ratio value in this study shows the number 10.633 which can be interpreted as meaning that respondents who those who have poor nutritional knowledge are 10.633 times more likely to experience less vitamin C intake compared to respondents who have good nutritional knowledge.

Nutritional knowledge is often linked to a person's consumption patterns. Because if someone has extensive nutritional knowledge, they will tend to be able to choose nutritious foods. On the other hand, if someone's nutritional knowledge is low, their consumption of nutritious food will also be low because they do not pay attention to the nutrients in the food they consume (Sulistiana, 2021). Based on the SQ-FFQ results from 88 respondents, those who have knowledge in the good category tend to have good vitamin C intake too. Food sources of vitamin C that are widely consumed by respondents, such as apples, oranges, mangoes, grapes, etc.

Respondents' nutritional knowledge was obtained from information in print and electronic media. The ease of respondents in obtaining nutritional knowledge apart from print media and online media, namely the availability of facilities such as socialization activities regarding nutrition provided by local health center officers. Respondents are generally good at operating gadgets, so this ability supports respondents in searching for information about types of nutritious food so that their knowledge about nutrition increases (Mardhina, 2014).

In line with research by Wahyuni et al., (2023) that knowledge includes everything that can be known directly through experience or even spontaneously. Based on suspicion, knowledge can be one of the factors that influences individual intake. From the results of the research conducted, there was a significant relationship between nutritional knowledge in efforts to increase immunity and food intake of food sources of vitamin C with the result that respondents who had good knowledge and good vitamin C intake were 45.8%. This is evidence that knowledge does have a significant relationship with an individual's vitamin C intake. This statement is also in line with Jenisdoong et al (2020) that good nutritional knowledge has an influence on a person's actions in fulfilling their nutrition through daily food consumption, this is because the knowledge a person has can shape behavior and create actions. So the higher a person's nutritional knowledge, the more adequate their nutritional intake will be because they can pay attention to their food consumption in terms of quality and type.

**Table 7.** Relationship between history of COVID-19 illness and vitamin C intake

| History of Covid-19 Illness | Vitamin C Intake | | | | Total | | *p* |
|---|---|---|---|---|---|---|---|
| | Less | | Good | | | | |
| | n | % | n | % | N | % | |
| No | 26 | 35.1 | 48 | 64.9 | 74 | 100 | 0.008 |
| Yes | 0 | 0 | 14 | 100 | 14 | 100 | |

The results of the cross tabulation of the relationship between history of COVID-19 illness and vitamin C intake in table 7 show that respondents who had a good intake of vitamin C were more likely than respondents who had no history of illness, namely 48 respondents (64.9%). This is due to their attitude of paying more attention to immunity so as not to be infected with COVID-19. During the ongoing pandemic, consuming vitamin C became one of the popular ways among the public to prevent this virus. Vitamin C was widely consumed during the COVID-19 pandemic because it has a role as an antioxidant that can increase immunity, so vitamin C is used to anticipate COVID-19 disease (Carr & Maggini, 2017).

Based on the chi-square test in table 13, it is known that the chi-square test does not meet the requirements because the Expectation value in chi-square is more than 20%. So the alternative test requirement is to look at the Fisher's Exact Test value. Fisher's Exact Test value = 0.008 (< 0.05) which indicates that there is a significant relationship between a history of COVID-19 illness and vitamin C intake. People who have a history of COVID-19 illness will experience cognitive impairment, sleep disturbances caused by oxidative stress and inflammation which can disrupt blood circulation and neurotransmitter function, besides that you tend to experience fatigue easily. This is what causes people with a history of COVID-19 to pay more attention to vitamin C intake because vitamin C is one of the most effective antioxidants that shows anti-inflammatory effects (Vollbracht and Kraft, 2021). According to Aisy's research (2021), someone with a history of COVID-19 can increase awareness of the importance of vitamin C because when patients were infected with COVID-19 it was explained that they reported improvement in symptoms such as flu, fever and shortness of breath after almost 1 week of intervention.

The results of other research state that patients with a history of COVID-19 often experience shortness of breath as a symptom of long-covid. This shortness of breath has a prevalence of 4.6% at five weeks after COVID-19 (Suparti et al., 2022). This is in line with research by Crook et al., (2021), there are several mechanisms that cause respiratory problems after COVID-19, including the chronic inflammation that occurs will cause continued production of pro-inflammatory cytokine storms and Reactive Oxygen Species (ROS) so that they spread to the tissues. and other blood flow. Vitamin C itself has a role as an electron donor which can quickly break the Reactive Oxygen Species (ROS) chain. Immune cells can be protected from damage caused by free radicals because vitamin C can easily donate electrons to free radicals (Siswanto et al., 2014).

## CONCLUSION

The conclusion of this research is that there is a relationship between nutritional knowledge and a history of COVID-19 illness with vitamin C intake. This is proven by the chi-square results on the variable nutritional knowledge and vitamin C intake, namely p-value= 0.000 (p-value < 0, 05) and for the variable history of COVID-19 illness with vitamin C intake, the result was p-value = 0.008 (p-value < 0.05). Suggestions for respondents are that it is hoped that respondents can increase their intake of vitamin C by consuming foods sourced from vitamin C every day and for the village it is necessary to collaborate with the local health service or community health center to provide education regarding the importance of vitamin C for body immunity.

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## CONFLICT OF INTEREST

There are no conflicts of interest in this study.

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