Differences in Vitamin C Intake Among Vocational School Students in the New Normal Era Based on Their Nutrition and Immunity Knowledge

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Abstract. The body's immune system plays a significant role in fighting viruses that enter the body. One way to increase immunity is by providing adequate intake for the body, one of which is vitamin C. Food sources containing vitamin C are important in supporting immunity because they serve as antioxidants. Nutrition knowledge is essential for adolescents to know which food groups are high in vitamin C. However, 37.83% of students showed inadequate knowledge on this issue. This study aims to determine the difference in vitamin C intake based on nutrition knowledge and immunity in the new normal era among students of SMK Penda 3 Jatipuro Karanganyar, Central Java Indonesia. This is analytical observational quantitative research using a cross-sectional design. The subjects were adolescents in vocational schools who met the inclusion criteria. This study involved 81 samples taken using a simple random sampling technique. The data used were primary data obtained from nutrition and immunity knowledge questionnaires and SQ-FFQ forms over the last 3 months. The statistical tests used were the independent t-test and Mann-Whitney U test. The results of this study show that adolescents with good knowledge account for 54.3%, while adolescents with good intake are 61.7%. Adolescents with good knowledge and good intake have an average vitamin C intake of 120.7 mg and adolescents with inadequate knowledge have an average intake of vitamin C of 98.7 mg. The test differences for gender, age, maternal education, parental income, place of residence, social media use, television use and knowledge are 0.084; 0, 0526; 0,094; 0,018; 0,428; 0,019; 0.929 and 0.036 respectively. This study concludes that there are differences in vitamin C intake among students in the new normal era based on their parents' income, social media use, and nutrition and immunity knowledge. This study recommends that adolescents should maintain their vitamin C intake and increase their nutrition knowledge concerning the sources of vitamin C and the role of vitamin C in immunity.

Keywords: Vitamin C intake · Immunity · Nutrition knowledge · Adolescents

1 Introduction

At the end of 2019, China reported a case of pneumonia caused by the novel coronavirus in Wuhan, Hubei Province, China, to the World Health Organization (WHO) [1]. The new coronavirus is the Novel Corona Virus SARS-Cov-2 which is highly contagious disease [2]. The virus can be transmitted from human to human through splashing saliva and snot when a person coughs or sneezes [3]. Symptoms caused by the coronavirus generally appear after 2–14 days of incubation. The symptoms caused by the virus will disappear in a person with a strong immune system, and the body will return to health [4]. Based on the findings of the studies conducted in Surakarta, the community had properly implemented health protocols [5]. However, people must also strengthen their immune systems to avoid the virus by maintaining a healthy diet and exercising regularly. Moderate aerobic exercise can improve the body's immune system during the COVID-19 pandemic and can be used as a preventive measure so that the body is not easily exposed to the COVID-19 virus [6].

One way to maintain the body's immune system is through a balanced diet [7]. During the COVID-19 pandemic, people's eating habits have changed. People increase their consumption of vegetables and fruits that are rich in vitamins, including vitamin C, and have also experienced an increase in supplement consumption [8]. Vitamin C supplements are popular among the general public because they are thought to have anti-inflammatory properties that can support the immune system [9].

Vitamin C can increase the demethylation enzymes Ten Eleven Translocation (TET) and Jumonji C Domain-containing Histone Demethylase (JHDM) by decreasing the activity of iron. When TET and JHDM are active, DNA demethylation occurs, which is enhanced by catalyzing 5-methylcytosine, 5-hydroxymethylcytosine, 5-formylcytosine, 5-carboxylcytosine attached to the histone. After demethylation, cytokines become active, and immune cells become active and develop [9]. Vitamin C is also involved in the epithelial barrier. The skin serves as the primary barrier for pathogens to enter the body; if the epithelial barrier in the human body is disturbed, pathogens can easily enter the body, making a person susceptible to disease [10]. Vitamin C also acts as a powerful antioxidant to combat free radicals because it acts as a donor electron and can activate cytokines [11].

Observations in European countries hit hardest by the pandemic show suboptimal vitamin C intake. Thus, the percentage of the population with low vitamin C intake is associated with the incidence or death from covid-19 [12]. Research conducted in the Jatinangor area showed that the intake of vitamin C for young women did not meet the needs of 67% of people [13]. Another study was carried out at SMK Penerbangan Bina Dhirgantara in Karanganyar and it showed vitamin C intake was less than 86.8% [14]. Vitamin C is a limiting factor in the immune response to fight infection. A wide variety of vegetables and fruits contain vitamin C. Research shows that there is a relationship between nutrition knowledge and vegetable and fruit consumption behavior [15].

Nutrition knowledge can help adolescents understand that the food they consumed is healthy and how healthy food can affect their health. Knowledge is the basis of one's behavior [16]. Behavior is the actual manifestation of knowledge and attitudes. This knowledge will influence a person's attitude because attitude is formed after being exposed to particular information, seeing or even touching an object. This knowledge

and attitudes will form real deeds called behavior [17]. Therefore, nutrition knowledge is the foundation of a person's nutritional behavior, which has an impact on an individual's diet and nutritional status [18]. Knowledge will provide information and guide a person's behavior in selecting food to consume [19]. 71.8% of village residents have good knowledge of the use of vitamin C to boost body immunity [20]. Good knowledge can be caused by exposure to information from social media and the availability of food served at home. Many advertisements or health promotions are presented on social media to entice adolescents to improve their eating habits [21].

Food consumption behavior will affect food intake. Adolescents' eating intake is influenced by eating habits, peers, social media, and lifestyle [22, 23]. There was an increase in vitamin C supplement consumption in adolescents before the pandemic (45.9%) and during the Covid-19 pandemic (57.1%). The increase in vitamin C consumption occurred due to teenagers' desire to maintain their body health and increase their immunity to avoid infection by the Covid-19 virus. Adolescent vitamin C intake can be sourced from supplements and herbs other than daily food [24]. However, vitamin C intake in adolescents is still considered insufficient [25].

According to the results of a preliminary survey conducted on 30 respondents, 37.83% of respondents had inadequate knowledge and 100% of respondents had less vitamin C intake due to respondents' vitamin C intake of 62.5 mg based on EAR. Data from the Karanganyar Regency Health Office, Central Java Indonesia, showed that the recent COVID-19 case numbers have decreased.

2   Method

This is analytical observational research using a cross-sectional design. This research was conducted at SMK Penda 3 Jatipuro Karanganyar, Central Java, Indonesia, with a total of 81 respondents. Samples were collected using a simple random sampling technique, with inclusion criteria for grade X, XI, and XII students who did not have acid disease, and were not on a diet, and exclusion criteria for students who did not complete the questionnaire and moved out of school. This research aims to determine the difference in vitamin C intake based on nutrition knowledge and immunity.

In this research, data were collected using a questionnaire instrument to assess the level of adolescent nutrition and immunity knowledge with a questionnaire grid containing basic COVID-19 knowledge, how to increase immunity, sources of vitamin C, and the role of vitamin C in increasing immunity, with a total 25 questions. This nutrition knowledge questionnaire uses a correct and incorrect answer choice, with a score 1 for the correct answer and 0 for the incorrect answer, with a total score of 30. If the answers are all correct, the score is 100 with a mean score of 72. This nutrition and immunity knowledge questionnaire has been tested for its reliability, and the results show a Cronbach's alpha value of 0.862.

Vitamin C intake was assessed with the Semi Quantitative Food Frequency Questionare (SQ-FFQ) form over the last 3 months with a list of foods in the form of staple foods, animal side dishes, vegetables, fruits, drinks, and supplements. The list of food references was obtained by conducting a preliminary study with 30 students using the 24-h food recall method for 3 days, the Indonesian Food Composition Table (TKPI)

book, and the nutrisurvey application. SQ-FFQ data collection was done using photo book tools. The results of vitamin C intake were compared to the Estimated Average Requirements (EAR). EAR was obtained from the Nutritional Adequacy Rate (AKG) divided by the conversion factor of the AKG. The cut off of vitamin C intake in men was 75 mg, and in women it was 62.5 mg.

Data analysis was performed using univariate analysis and bivariate analysis. A univariate analysis was used to determine the characteristics of adolescents and describe each of the variables studied. Bivariate analysis used independent t-tests for normally distributed data and Mann Whitney U for abnormally distributed data. Statistical testing was done using the SPSS 20 application.

3   Result and Discussion

3.1   Differences in Vitamin C Intake

The characteristics of adolescents in this study include gender, age, maternal education, parental income, place of residence, use of social media, and use of television. The results of the analysis of differences in vitamin C intake based on adolescent characteristics and knowledge can be seen in Table 1.

Based on Table 1, the majority of adolescents is male, namely 58 people (71.6%). Gender determines the magnitude of a person's nutritional needs because the growth and development of individuals is very different between men and women. Men require more energy than women due to differences in body composition and growth rate [26].

Referring to the age distribution, the majority of teenagers are under 17 years old, namely 43 people (53.%). Adolescence is a stage of human development that occurs between the ages of 10 and 18 years [27]. Age can affect an individual's understanding and way of thinking. During adolescence, and individual will express a higher curiosity and be easily influenced by the people around him. The environment and perception of the environment will make a person self-motivated, including in making health-related decisions. Adolescent decision-making ability will result in behaviors that adolescents find interesting and able to help themselves develop [28].

The distribution of adolescents by maternal education level shows that the primary education level (86.4%) is the most common. The highest education level of the respondent's mother is junior high school and the lowest is college graduates. Maternal education is critical because parents with a higher education tend to have better knowledge and have an impact on food provision. Maternal education is an important factor because it affects the health status of her family. The higher the mother's level of education, the more her knowledge of her child's nutritional needs of her child will be influenced. Mother's education also affects her ability to provide food for her family [29, 30].

The distribution of students based on parental income shows that most parental income is in the ≥minimum wage category, with 58 people (71.6%). Parents' income will influence the quality and quantity of food consumed by the family, the higher the income of parents, the higher their purchasing power of food. A high level of income will be followed by a large amount and type of food consumed [31]. In this study, there was a significant difference in vitamin C intake between students whose parents earned below the minimum wage and above the minimum wage. Table 1 shows that the

Table 1. Differences in vitamin C intake in adolescents based on the characteristics as well as nutrition and immunity knowledge

Variable	Respondent		Vitamin C Intake				p-value
			Adequate 50 (61,7%)		Inadequate 31 (38,3%)		
	n	**%**	**mean**	**SD**	**Mean**	**SD**	
Gender							
Male	58	71,6	110,8	42,5	42,6	19,3	0,084
Female	23	28,4	112,7	26,1	51,1	21,5	
Age							
< 17	43	53,1	102,4	25,4	52,8	17,4	0,526
$\geq$ 17	38	46,9	121,3	46,3	34,4	18,1	
Maternal Education							
Basic education	70	86,4	107,2	34,5	43,0	19,4	0,094
Further education	11	13,6	137,5	49,2	54,5	22,0	
Parental Income							
< Minimum wage	23	28,4	112,3	38,8	47,1	22,0	0,018*
> Minimum wage	58	71,6	98,7	6,6	43,3	19,0	
Residence							
With parents	63	77,7	109,7	28,6	47,6	16,3	0,428
Without parents	18	22,3	119,5	67,5	36,9	25,9	
Use of social media							
Short (<4 h/day)	31	38,3	122,6	42,5	47,6	23,5	0,019*
Long (> 4 h/day)	50	61,7	102,6	31,7	43,3	18,5	
Use of Television							
Short (<3 h/day)	70	86,5	112,2	35,1	43,8	21,0	0,929
Long (> 3 h/day)	11	13,5	106,8	54,7	49,1	6,6	
Knowledge							
Inadequate	37	45,7	98,7	32,7	44,5	21,5	0,036*
Good	44	54,3	120,7	39,0	44,5	18,5	

average vitamin C intake is higher in students with parents who have incomes below the minimum wage. Although the quality and quantity of foodstuffs are influenced by purchasing power, there are differences related to the type of food ingredient selection. In the present day, where there is a shift in diet, it is also followed by a real shift in consumption to high-fat, refined-carbohydrates, low-fiber diets that characterize today's high-income society [32].

The distribution of adolescents by place of residence informs that most adolescents live with their parents, as many as 63 people (77.7%). A growing body of evidence suggests that a home food environment, especially sharing family meals, is important in promoting healthy adolescent development. Children and adolescents who share food with their families are leaner, have healthier diets, and are less likely to engage in irregular eating behaviors. Many hypotheses have been put forward to explain the positive impact of eating with family on adolescents' healthy development. Most obviously, eating with the family can provide opportunities for children and adolescents to eat healthy foods while also providing opportunities for parents to exemplify healthy eating behaviors. However, in this study, there was no difference in intake between adolescents living with parents and adolescents living without parents [33]. This can be influenced by a variety of factors, including food availability. The availability of fruits and vegetables at home and at school is positively related to the consumption of vegetable and fruits in adolescents [32].

The distribution of adolescents based on social media use shows that most adolescents used social media above 4 hours/day (length), with a total 50 people (61.7%). The average vitamin C intake is higher in adolescents with short social media use compared to adolescents who used social media in a longer duration, the average vitamin C intake was 122.6 mg compared to 102.6 mg. The duration of social media use also has a major influence on the diet of adolescents. One of the impacts of media is that it can affect food consumption through advertisements and promotions. In addition to marketing, social media also serves as a source of nutrition information distribution. Media exposure has a significant influence on fruit and vegetable consumption behavior [35].

The distribution of adolescents based on time spent on television shows that most adolescents spent time on television under 3 hours/day, with a total of 70 people (86.5.7%). Statistical tests showed no difference in average intake between adolescents who watched TV for long or short duration. According to research, screen time exposure from television advertisements is more likely to increase the intake of low-nutrient and high-energy foods, including fast food products, savory snacks/potatoes, cheese, sweets/sweets/chocolates, cakes/muffins, ice cream/desserts, breakfast cereals, or high-sugar drinks [36].

Table 2. Sources of Information related to COVID-19 Knowledge

Sources of Information	n	%
Sources of Information about COVID 19		
Parents	1	1,2
Public Figures	6	7,4
Social media	72	88,9
Mass media	1	1,2
Local Health Workers	1	1,2
Total	**81**	**100**

From Table 2, the distribution of adolescents based on COVID-19 information sources shows that adolescents get the most information about COVID-19 from social media, namely 72 people (88.9%). This is in line with the research finding which states that information about COVID-19 is obtained through social media [37]. Some guidelines and information about COVID-19 have been made available online by the WHO, which is easily accessible to internet users. This type of access to reliable information can aid in the elimination of citizen's misunderstandings, misinformation, and ignorance about COVID-19. However, media, particularly social media, can affect a person's mental health, with increased anxiety caused by news on social media [38].

The distribution of adolescents based on nutrition and immunity knowledge reveals that as many as 44 adolescents (54.7%) have good knowledge. According to the results of research conducted by Hayati, et al., (2022), adolescent knowledge about the importance of eating vegetables and fruits during the COVID-19 pandemic is very important, and is classified in adequate category. This is motivated by teenagers who are pursuing education in the health sector so that they have knowledge related to good food for consumption [39]. The average vitamin C intake was higher in adolescents with good knowledge compared to adolescents with inadequate knowledge, the average vitamin C intake was 120.7 mg compared to 98.7 mg, which showed significant test results.

3.2 Overview of Adolescent Nutrition and Immunity Knowledge

A questionnaire distributed to 81 students yielded the results of adolescent nutrition knowledge in improving immunity. The level of knowledge was assessed by answering 25 questions, with each correct answer was scored 1 and incorrect answer was scored 0. Nutritional knowledge is the foundation upon which a person decides what food to consume. Nutrition knowledge is a person's provision to improve their ability to apply nutrition knowledge in choosing and processing food ingredients to meet their nutritional needs [40]. The results showed a relationship between nutrition knowledge and fruit and vegetable consumption behavior. Nutrition knowledge is a person's understanding of the science of nutrition, nutrients, and the interaction of nutrients on the health of the body [35]. Knowledge of healthy food will affect the behavior of choosing the food to be consumed by the individual. Low nutrition knowledge will cause a person to choose the wrong foods, which will have an impact on his nutritional and health problems [15]. As a result, nutrition knowledge is critical to achieving the behavior of choosing healthy foods to fulfill their nutritional needs. Nutritional knowledge is the main capital in food selection [41] (Table 3).

Based on Table 4, it can be seen that on the grid of knowledge about COVID-19 many adolescents provided incorrect answers. The sub-theme of vitamin C sources is an example of a low-latency food source. On the grid of the role of vitamin C, adolescents gave many incorrect answers to the statement that vitamin C does not play a role in wound healing.

Table 3. Attributed Answers to the Nutrition and Immunity Knowledge Questionnaire

No.	Statement	Incorrect answer	
		n	%
COVID-19 KNOWLEDGE			
1	Close contacts, such as physical contact and face-to-face contact with an infected individual, are not one of the causes of COVID-19 transmission.	37	45,7
2	The main clinical symptoms of COVID-19 are fever, fatigue, a dry cough, and no muscle pain (myalgia).	77	95,1
3	Isolation and treatment of COVID-19 patients are effective ways to reduce the spread of the virus.	1	1,2
HOW TO IMPROVE IMMUNITY			
4	Eating vegetables can increase the body's immunity because they contain a lot of vitamins.	0	0
5	Increasing the body's immunity can be done by eating a nutritionally balanced diet.	0	0
6	Protein, vitamins, and minerals are nutrients that function to increase endurance.	0	0
7	Vitamin C is a type of vitamin that can increase the body's immunity.	0	0
SOURCES OF VITAMIN C			
8	Chili is a food ingredient that contains more vitamin C.	53	65,4
9	Broccoli, mustard greens, and pak choi are vegetables that contain vitamin C.	34	42
10	Fruits that contain a lot of vitamin C are guava, papaya, and strawberry.	10	12,3
11	Excess vitamin C intake will be excreted through the urine.	18	22,2
12	Vitamin C is also found in animal side dishes such as chicken liver and duck liver.	53	65,4
THE ROLE OF VITAMIN C IN THE BODY'S IMMUNITY			
13	The need for vitamin C at the age of 16–18 years, according to the Nutritional Adequacy Figure, is 75 mg for women and 90 mg for men.	16	19,8

(continued)

Table 3. (*continued*)

No.	Statement	Incorrect answer	
		n	%
14	Taking health supplements such as vitamin C in amounts of more than 2000 mg will have a bad impact on the body.	18	22,2
15	Vitamin C plays a role in increasing the killing of microbes.	21	25,9
16	Vitamin C plays a role in improving the migration/transfer of neutrophils to infected areas.	37	45,7
17	Vitamin C does not play a role in increasing antioxidants in the body.	37	45,7
18	Vitamin C has a role in neutralizing free radicals (damaged cells) present in the body.	20	24,7
19	Vitamin C protects the body from infection by stimulating the formation of an antibody.	10	12,3
20	Vitamin C can reduce the duration of the flu and relieve cold symptoms.	9	11,1
21	Vitamin C plays a role in the epithelial barrier so that it can inhibit the entry of viruses into the body.	8	9,9
22	Vitamin C does not play a role in wound healing.	55	67,9
23	Vitamin C can increase important cytokines/proteins that have a major function in the body's immune response.	4	4,9
24	Vitamin C plays a role in the phagocytosis process (eating pathogens) in the body.	41	50,6
25	Vitamin C plays an important role in the formation of collagen (protein from amino acids) in the skin.	6	7,4

3.3   Overview of Adolescent Vitamin C Intake

Vitamin C intake was calculated using the Semi Quantitative-Food Frequency Questionnaire (SQ-FFQ) form over the last 3 months. Vitamin C intake was compared to the Estimated Average Requirement (EAR). The following table lists of food that adolescents frequently consume.

Table 4. Distribution of Consumed Food

No	Food	Mean(mg) ± SD
	Staple foods	
1	Cassava	8.36 ± 12.25
2	Gethuk	3.38 ± 6.78
3	Yellow sweet potato	3.3 ± 5.69
4	Purple sweet potato	2.82 ± 5.27
5	White sweet potato	2.67 ± 4.24
	Animal side dishes	
1	Chicken liver	1.68 ± 2.77
2	Beef liver	0.44 ± 0.48
3	Duck liver	0.38 ± 0.38
4	Salted hairtail fish	0.23 ± 1.0.1
5	Whitefish	0.08 ± 0.18
	Vegetables	
1	Spinach	6.29 ± 9.74
2	Mustard greens	3.21 ± 7.66
3	Broccoli	3.00 ± 3.62
4	Chicory	3.00 ± 5.50
5	Cassava leaves	1.98 ± 6.38
	Fruit	
1	Guava	42.01 ± 74.16
2	Papaya	12.22 ± 22.32
3	Orange	11.62 ± 40.32
4	Soursop	4.17 ± 11.69
5	Longan	3.52 ± 4.13
	Drinks	
1	Low fat ultramilk	14.19 ± 27.19
2	Guava juice	12.58 ± 16.62
3	Orange juice	6.14 ± 12.99
4	Orange ice	5.8 ± 12.28
5	Strawberry cimory milk	4.45 ± 8.01
	Supplements	
1	Imboost	193.3 ± 267.27

Table 4. (*continued*)

No	Food	Mean(mg) ± SD
2	You C 1000mg	55 ± 63.95
3	Vitamin C 500mg	41.66 ± 33.29
4	CDR	30 ± 0.0

Based on Table 4, adolescents have the habit of consuming foods that contain vitamin C derived from staple foods, animal side dishes, vegetables, fruits, drinks, and vitamin C supplements. Animal side dishes that are popular among teenagers are chicken liver, beef liver, duck liver, salted hairtail fish, and milkfish. Vegetables that are widely consumed by teenagers are spinach, mustard greens, broccoli, chicory, and cassava leaves. The fruits consumed by teenagers are guava, papaya, orange, soursop, and longan. The drinks consumed by teenagers are ultramilk low fat, guava juice, orange juice, iced orange, and cimory low fat milk. Supplements that are widely consumed by teenagers are imboost, You-C 1000mg, vitamin C 500mg, and CDR. These are foods that have a high content of vitamin C. Vitamin C is easily activated and absorbed by the upper small intestine before entering the bloodstream through the port vein. Vitamin C is then transported to all tissues in the highest concentrations and is found in the tissues of the adrenal glands, pituitary gland, and retina. Vitamin C functions as an antioxidant that can combat free radicals. In a dry state, vitamin C has stable properties, however, in a soluble state it is easily damaged by the contact with air (oxidation), especially when exposed to heat. Caffeine-containing food, such as tea, coffee, and chocolate, can inhibit vitamin C absorption [42].

Vitamin C (ascorbic acid) is an essential nutrient for humans that should be consumed regularly from outside the body to prevent deficiency [43]. Different tissues and organs have varying conditions for vitamin C, as reflected in the concentration of vitamin C in tissues. The tissues with the highest concentrations of vitamins include the brain, adrenal, and pituitary glands. This reflects one of the main functions of vitamin C, which acts as a cofactor for the family of regulatory metalloenzymes, including those involved in the synthesis of catecholamines and peptide hormones [44]. Recent research has also demonstrated the role of vitamin C in genetic and epigenetic regulation through enzymes that regulate gene transcription, DNA, and histone methylation [45]. As a result, vitamin C has the potential to regulate thousands of genes in the body and thus play a pleiotropic role in human health and disease. There is growing evidence that increased vitamin C intake has a beneficial effect on long-term health outcomes. Vitamin C is widely acknowledged to play an important role in optimal immunological function [10]. Vitamin C deficiency has been linked to respiratory infections such as pneumonia. Leukocytes from the innate and adaptive immune systems contain high concentrations of vitamin C and are believed to play an important role in immune development and function. Vitamin C affects several aspects of immunity, including supporting epithelial barite function, innate and adaptive immune cell growth and function, migration of white blood cells to the site of infection, phagocytosis and microbial killing, and antibody production [46]. While optimal intake remains unclear, a healthy intake of at least 200 mg/day can

protect against a number of globally prevalent infectious diseases [47]. Increased intake may also prevent less severe infections from progressing to more severe conditions, such as sepsis, which is a leading cause of morbidity and mortality from infectious diseases worldwide [48]. People who are deficient in vitamin C are prone to severe respiratory infections such as pneumonia. Supplementing with vitamin C has also been shown to reduce the duration and severity of upper respiratory tract infections, such as the common cold, and significantly reduce the risk of infection [47]. High doses of vitamin C supplements help to normalize serum vitamin C levels and leukocytes. Vitamin C has several pharmacological, antiviral, anti-oxidant, anti-inflammatory, and immunomodulatory properties, making it a potential therapeutic option for COVID-19 management. Intravenous administration of high doses of vitamin C for COVID-19 management in China and the United States has shown promising results, although it still requires further research [49].

The results of a study that aimed to examine vitamin C intake using the 3-day method of weighing foodstuffs and plasma concentrations of vitamin C in adolescents showed that nutrition knowledge, in addition to the size of the respondent's family and age, was an important variable in influencing consumption [50]. Studies using interventions in the form of nutrition education yielded that the intervention increased the participants' nutrition knowledge followed by an increase in the intake of vitamin C and other micronutrients. It increased by more than 50% after intervention [51]. Research by Azrimaidaliza et al., (2021) found that there was no relationship between nutrition knowledge and nutritional behavior in increasing immunity during the COVID-19 pandemic, but subjects with inadequate knowledge tended to have poor behavior. Information on how to live a healthy life will increase a person's knowledge and raise his awareness concerning healthy behavior, but it will take time. To change a person's behavior to a better direction, knowledge will necessitate a lengthy process. An individual may not realize that nutrition knowledge is required to form eating habits and to maintain health that will have an effect in old age [53].

Other factors that can affect adolescent intake include food preference, availability of food served at home, parents' income, and media exposure. Adolescent eating behavior will be heavily influenced by media exposure because on social media, teenagers will encounter many advertisements and promotions that will affect their food consumption behavior, including eating foods high in vitamin C to increase body immunity. There is a relationship between media exposure and fruit and vegetable consumption behavior in adolescents [54].

Adolescent good category of nutrition knowledge with adequate vitamin C intake can be caused by the fact that adolescents get information from social media and the availability of food served at home. Many advertisements or health promotions are presented on social media to attract adolescents to improve their eating habits [21]. Fruit and vegetable consumption increased in adolescents both before and after the pandemic. This increase is thought to be the results of health promotion regarding the importance of consuming fruit and vegetable. Various education programs are carried out to improve adolescent habits in implementing a balanced nutrition pattern [55].

4   Conclusion

This research concludes that 54.3% of adolescents participated in this research have good nutrition knowledge and 61.7% of them have a good intake. Adolescent with good knowledge and good intake have an average vitamin C intake of 120.7 mg, while adolescents with inadequate knowledge have an average intake of 98.7 mg. It shows that there are differences in vitamin C intake among students at SMK Penda 3 Jatipuro Karanganyar, Central Java, Indonesia in the new normal era influenced by their parents' income, the use of social media, and knowledge of nutrition and immunity.

Authors' Contribution.   DDAP contributed in designing this research, collecting the data, processing the data, and interpreting the data. LRR interpreted the findings and wrote the discussion section. Both authors are responsible for this research report.

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