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Effect of antioxidant dietary behaviour in smokers with chronic obstructive pulmonary disease risk during COVID-19 pandemic

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ABSTRAK

Latar Belakang: *Perokok berisiko mengalami Penyakit Paru Obstruktif Kronis(PPOK)yang mempunyai risiko penurunan kualitas hidup akibat penurunan fungsi paru. Penurunan fungsi paru akibat peningkatan radikal bebas. Asupan makanan yang mengandung antioksidan dapat membantu mengurangi radikal bebas.*
Tujuan: *Penelitian ini bertujuan untuk mengetahui pengaruh asupan antioksidan (vitamin A, C, dan E) terhadap perkembangan risiko PPOK pada perokok aktif.*
Metode: *Penelitian ini dilakukan pada bulan Mei-Juli 2023 di Surabaya. Penelitian ini menggunakan desain cross sectional, dengan metode purposive sampling dan snowball sampling. Subjek penelitian adalah perokok aktif dewasa. Asupan antioksidan terdiri dari asupan yang dikonsumsi subyek sehari-hari yang mengandung vitamin A, vitamin C, dan vitamin E dengan menggunakan metode Food Frekuensi Questionnaire (FFQ) untuk menggambarkan asupan gizi dalam periode tertentu. Penilaian risiko PPOK diukur menggunakan tes fungsi paru dengan spirometri, dengan penilaian rasio nilai volume ekspirasi paksa dalam satu detik (FEV1)/kapasitas vital paksa (FVC) di bawah 0,70 didefinisikan sebagai keterbatasan aliran udara. Data diuji dengan uji Spearman untuk melihat hubungan antara asupan antioksidan dari makanan dengan fungsi paru.*
Hasil: *Penelitian ini melibatkan 49 perokok aktif penderita PPOK. Sebagian besar subyek mengalami kekurangan asupan vitamin A (77,55%), vitamin C (87,76%), dan seluruh subyek mengalami kekurangan vitamin E. Makanan mengandung vitamin A yang paling banyak dikonsumsi adalah minyak sawit. Makanan mengandung vitamin C yang paling banyak dikonsumsi adalah pepaya, dan makanan mengandung vitamin E yang paling banyak dikonsumsi adalah daging ayam. Tidak terdapat hubungan antara vitamin A dengan perkembangan risiko PPOK (Sig.=0.187;r=-0.192), namun terdapat hubungan bermakna (negatif lemah) antara vitamin C dengan risiko perkembangan PPOK (Sig.=0.031;r=-0.309). Semua subjek mengalami defisiensi vitamin E.*
Kesimpulan: *Semakin rendah asupan vitamin C maka semakin besar risiko terjadinya PPOK yang ditandai dengan menurunnya fungsi paru.*

KATA KUNCI: *asupan makanan antioksidan; rasioFEV1/FVC; kuesioner frekuensi makanan; PPOK; perokok*

ABSTRACT

Background: *Smokers are at risk of Chronic obstructive pulmonary disease (COPD)which has a risk of decreasing in quality of life because of lung function decline and smoking habits. Decreased lung function due to an increase in free radicals. Intake of foods that contain antioxidants can help reduce free radicals.*

Objectives: *The research aimed to determine the effect of antioxidant intake (vitamins A, C, and E) on the development of COPD risk in active smokers.*

Methods: *This study was conducted in May-July 2023 in Surabaya. This study used a cross-sectional design, with purposive sampling and snowball sampling methods. The subjects were adult active smokers. Antioxidant intake consisted of the intake consumed by subjects daily containing vitamins A, vitamin C, and vitamin E using the Food Frequency Questionnaire (FFQ) method to describe nutritional intake in a certain period. COPD risk assessment was measured using a pulmonary function test with spirometry, with an assessment of the ratio of forced expiratory volume in one second (FEV1) / forced vital capacity (FVC) below 0.70 defined as airflow limitation. The data were tested using the Spearman test to see the relationship between antioxidant intake from food and lung function.*

Results: *This study involved 49 active smokers with COPD. Most subjects experienced deficiencies in vitamin A (77.55%), and vitamin C (87.76%), and all subjects experienced vitamin E deficiencies. The most consumed food containing vitamin A was palm oil, the most consumed food containing vitamin C was papaya, and the most consumed food containing vitamin E was chicken. There was no relationship between vitamin A and the development of COPD risk (Sig.=0.187; r=-0.192), but there was a significant relationship (weak negative) between vitamin C and the risk of developing COPD (Sig.=0.031; r=-0.309). All subjects had a deficiency of vitamin E.*

Conclusions: *The lower the intake of vitamin C, the greater the risk of COPD which is characterized by decreased lung function.*

KEYWORD***:*** *antioxidant dietary intake; FEV1/FVC ratio; food frequency questionnaire; COPD risk; smoker*

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INTRODUCTION

Respiratory problems can also come from smoking behavior because cigarette smoke has a lot of free radicals and triggers a decrease in antioxidant capacity even in plasma. Free radicals that continue to increase will cause oxidative stress and can cause systemic inflammation (1,2). Smoking behavior is very difficult to separate from society (3). A person who smokes means that the smoker will inhale the 4000 chemicals contained in cigarettes, especially nicotine. Cigarette nicotine is transported into the lungs by inhaled tar particles where a broad alveolar surface region facilitates accelerated incorporation into the circulation of the pulmonary system (4). Cigarette smoke contains various dangerous chemicals that have the potential to harm health. Cigarette smoke is also a major risk factor for the occurrence of several diseases such as chronic obstructive pulmonary disease (COPD) because it contains around 1015-1017 oxidants or free radicals (5). Chemicals that are produced from cigarette smoke when they enter the airways contain many types of free radicals. The human body has free radicals called endogenous free radicals which are the product of normal cellular metabolism but are caused by smoking, air pollution, and vehicle fumes. Free radicals at high concentrations will produce harmful modifications to cell components such as lipids, proteins, and DNA (deoxyribonucleic acid). If there is an increase in the number of free radicals continuously in the body it will trigger oxidative stress and stimulate peroxidation in cells and ultimately can cause death in body cells (6). Oxidative stress causes an

increase in the rate of cell damage due to oxygen induction, oxidative stress can have an impact on the development of chronic and degenerative diseases such as cancer, ischemia, etc (7).

The body can neutralize free radicals if the number of free radicals is not excessive with endogenous antioxidant defense mechanisms (6), endogenous antioxidants, or enzymatic antioxidants, namely Superoxide Dismutase (SOD), catalase, and glutathione peroxidase. These antioxidants include conjugate proteins so their activity is highly dependent on metal ions (8). Antioxidants work by giving electrons to free radicals so they can stop the process of cell destruction. Antioxidants will neutralize free radicals so that they cannot take electrons from DNA cells. Therefore, the body needs antioxidants that can help protect itself from the dangers caused by free radicals and radical compounds (6,8,9). Antioxidants are needed to prevent oxidative stress. Antioxidants are very easily oxidized, so free radicals will oxidize antioxidants and protect other molecules in cells from damage caused by oxidation by free radicals or reactive oxygen (10,11).

When the body cannot neutralize free radicals because of an imbalance in the number of endogenous antioxidants and free radicals in the body endogenous antioxidants are insufficient. The body needs antioxidants from the outside (6). By intake of exogenous antioxidants such as supplements of vitamin E, vitamin C, vitamin A, and others. Other body defense systems that can be used to fight free radicals can be affected by nutrients from food, by consuming food ingredients containing antioxidants and non-antioxidants so that endogenous antioxidants in the body can be maintained high (12,13). The Food Frequency Questionnaire (FFQ) is a method or way to be able to describe certain nutritional intake in a certain period. Several studies in Indonesia have examined the description of nutritional intake from their research using the FFQ such as Pratiwi et al. (9), Suryadinata and Lorensia (14). The aim of the research waseffect of antioxidant intake (vitamins A, C, and E) in food using the FFQ against respiratory disorders, on chronic obstructive pulmonary disease (COPD) risk development in smokers. The FFQ method was used to provide information about the food consumed and for the assessment of nutrients that have been consumed within a certain period (15).

MATERIALS AND METHODS

Research Design

This study was an observational study using a retrospective study design to measure the intake of antioxidants (vitamins A, C, and E) using the FFQ questionnaire. Data collection was carried out from May to July 2023 in South Surabaya area by filling out the questionnaires. The ethics committee of the University of Surabaya approved the study protocols (No. 127/KE/V/2023). The independent variable of this study was active smokers, in Rungkut District, Surabaya. The dependent variable of this research was levels of antioxidants (vitamins A, C, and E) from food intake and COPD risk development with lung function measurement. Smoking status was several questions that were asked to the subject about smoking and were categorized as active smokers, no longer smoked, and never smoked. Active smokers are individuals who have smoked ≥100 cigarettes in their life until now they still smoke >1 cigarette per day (16).

The Brinkman index is calculated by multiplying the number of cigarettes smoked per day by the number of years of smoking. If the number of years spent smoking was less than 1, the Brinkman index was calculated using 0.5 as the number of years of smoking. The value of the Brinkman Index (IB) is mild (0-199), moderate (200-599), and severe (>600) (17,18). Assessment COPD risk progression is measured using pulmonary function tests with a spirometer Cortec Sp10W. A forced expiratory volume in one second (FEV1)/forced vital capacity (FVC) value below 0.70 was defined as airflow limitation(19).

Antioxidant intake was the intake consumed by subjects daily containing vitamin A, vitamin C, and vitamin E using the FFQ which was a method for seeing or assessing the frequency of eating certain foods over a certain period. Vitamin A intake was the total amount of vitamin A content from food sources of vitamin A which was consumed on average per day by subjects, expressed in units of µg, the adequacy rate of vitamin A for ages 19-64 years was 600 µg/day (20). Antioxidant intake data were obtained by interview using the FFQ to examine antioxidant

intake. This method is a semi-qualitative method providing information about the food ingredients consumed only in the form of names and quantities that are not explicitly stated. This method also only requires information from a research subject about which foods are frequently or not frequently sampled without needing to be further broken down into the size and portion consumed by the subject. Another advantage of using this FFQ is that form recording can be done systematically, does not require a food scale instrument, can be done at low literacy, and of course can be done anywhere, and also does not force subjects to remember actual daily consumption (21,22). However, the FFQ method does not represent the actual daily consumption but only becomes the dietary pattern of each individual. Because at the time of conducting interviews using the FFQ, several obstacles depended on the honesty and memory of the research subject which was overcome by providing an overview of what foods had been eaten and how often the consumption research subject was helped to mention so that it could help the research subject to remember again (22,23,24).

The research subject was selected at the age of 18-45 years because 18 years of age was the highest prevalence in Indonesia (25). The maximum age taken was 45 years because it was the final age limit, if you entered the age of the elderly, they were susceptible to malnutrition (26). Age is related to the aging process where the older a person is, the greater the decrease in lung function capacity and also be influenced by environmental factors (27,28). The results of cross-tabulation also between age and the adequacy of antioxidant nutrition, namely vitamin A, vitamin C, and vitamin E, showed that there was a relationship between increasing age and will decrease in the intake of vitamins A, C, and E due to changes in diet or susceptibility to malnutrition (29).

Setting and Samples

The population used for this research were smokers. The subject used in this study was part of the population that met the following criteria: The inclusion criteria were (1) males aged >18 years; (2) active smokers, this type of cigarette used filter; (3) Willing to participate in research by signing informed consent; (4) Work on regular weekdays (min ±7 hours/day); (5) Didn't have eating disorders and gastrointestinal diseases such as gastroesophageal reflux disease (GERD), gastritis and dyspepsia; and (6) Didn't vegetarian or on a certain diet. The sampling technique used purposive sampling and snowball sampling. The sample size calculation uses the Lameshow formula, $n=[Z\alpha 2.p.q]/[d2]$, $Z\alpha 2$ is the critical value of the Normal distribution at $\alpha/2$ (for a confidence level of 95%, α is 0.05, and the critical value is 1.96); p is the estimated population proportion (0.5); q is 1-p; and d2 is the error tolerance (10%). So the minimum sample size is 49 research subjects.

The questionnaire was distributed in the South Surabaya area (Rungkut sub-district, Surabaya), then the smokers were facilitated to gather in a place for clinical examination by clinicians and filling in the database, then pulmonary function testing. The total number of smokers who were present became the total population. The total population in the Rungkut area was 65 people and those who did not meet the requirements: were 5 people who were not willing to be interviewed, 5 people who could not be contacted again, and 6 people who did not smoke. So the number of research subjects was 49 people.

Measurement and Data Collection

FFQ Data Preparation. Preparation for making a questionnaire by listing a list of foods containing vitamins A, C, and E based on foods that were often consumed. The food data was carried out by a preliminary study of 20 smokers in other regions. Food ingredients that were consumed less than 10% because they had never been consumed or were not usually consumed are excluded from the food list. Collecting data on the research subject was carried out using telephone interviews using the FFQ. The data collected in the form of household sizes would be processed to obtain data in the form of calorie intake using the Nutrisurvey program. Nutrisurvey is a powerful software for analyzing food nutrients from a menu or consumption survey. For example, to find the antioxidant intake obtained when consuming chicken meat, namely by opening the Nutrisurvey

software, enter the word "chicken meat" then enter the amount in grams that were asked during the interview, then the data on antioxidant intake in the form of vitamins A, C, and E will appear.

Data Analysis

The final nutritional survey result will show an analysis of the total food consumed at a certain time. The desired data such as vitamin A, vitamin C, and vitamin E showed the results in the form of numbers in units of each, namely vitamin A in units of µg, vitamin C, and vitamin E in units of mg. Then it was matched with the value of the Nutritional Adequacy Rate recommended for the Indonesian (20) (cut off).

The data collected in the form of household sizes would be processed to obtain data in the form of calorie intake using the program Nutrisurvey. Nutrisurvey is a powerful software for analyzing food nutrients from a menu or consumption survey. After the data on antioxidant intake were collected, the data were inputted into the SPSS version 24 program, then statistical analysis was carried out. The ordinal scale data was tested using the chi-square test and the ratio scale data with the Kolmogorov-Smirnov normality test which was then followed by an independent t-test to see differences in antioxidant intake from food in COPD risk development, which is divided into two, namely risk of clinically significant COPD (FEV1/FVC ratio <0.70) and no risk of clinically significant COPD (FEV1/FVC ratio ≥0.70). The chi-square test was said to be significantly different if the P value was <0.05. The data were also tested with the Spearman test to see the relationship between antioxidant intake from food and lung function.

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RESULTS AND DISCUSSIONS

Subjects in this study were grouped according to age and smoking severity (**Table 1**). The most research subjects found in early adulthood and late adulthood were 19 of 49 (38.76%) and late adults were 22 of 49 (44.90%). Most of the subjects were moderate smokers (26 of 49) and the most smoking duration was <20 years (**Table 1**).

Profile of Vitamin A Intake

The initial form of vitamin A can be found in chicken meat, chicken eggs, palm oil, spinach, apples, and papaya. Vitamin C intake was the total amount of vitamin C content from food sources of vitamin C consumed by subjects on average per day, expressed in mg units. The vitamin adequacy rate for ages 19-64 years was 75 mg/day (20). In all subjects, the average consumption of food intake that contained the highest vitamin A content in the research subject was palm oil at 109.00 µg/day followed by chicken eggs at 127.10 µg/day.

Table 1. Frequency distribution of characteristics

Characteristics	Frequency (n=49)	Percentage (%)
Age (years)		
Late adolescence (17-25)	8	16.33
Early adulthood (26-36)	19	38.76
Late adulthood (36-45)	22	44.90
Smoking severity (cigarettes per day) by Index Brinkman		
Light Smoker (8-10)	12	24.49
Moderate Smoker (11-12)	26	53.06
Heavy smokers (21-30)	11	22.45
Duration of smoking (years)		
<20	36	73.47
20-29	12	24.49
≥30	1	2.04
Lung function value (FEV1/FVC ratio) (%)		
Risk of clinically significant COPD (<0.70)	31	63.27
No risk of clinically significant COPD (≥0.70)	18	36.73

The results of the study of the frequency of foods most frequently consumed by the research subject containing vitamin A were chicken meat, chicken eggs, meatballs, tempeh, and bananas. In the sufficient level group, the average consumption of food intake that contained the highest vitamin A content in the research subject was palm oil at 181.12 µg/day followed by chicken eggs at 171.74 µg/day. The results of the study of the frequency of foods most frequently consumed by the research subject containing vitamin A were chicken meat, chicken eggs, meatballs, spinach, and bananas. In the deficit level group, the average consumption of food intake that contained the highest vitamin A content in the research subject was palm oil at 73.68 µg/day followed by chicken eggs at 124.61 µg/day. The results of the study of the frequency of foods that were most frequently consumed by the research subject containing sufficient vitamin A were chicken meat, chicken eggs, meatballs, tempeh, spinach, papaya, and banana (**Table 2**).

Table 2. Profile of Consumption Patterns of Vitamin A

Type of Food	Number of Subjects			Average (gram)	Standard Deviation	CI	Min (µg)	Max (µg)
	Total subjects (n=49)	Sufficient Category (n=11)	Deficit Category (n-=38)					
Corn	30	6	24	9.00	10.92	3.91	4.10	50.00
Chicken meat	48	11	34	48.21	46.77	13.23	6.67	240.00
Chicken eggs	46	9	37	66.92	66.07	19.09	4.28	240.00
Quail eggs	9	9	0	0.51	1.42	0.93	0.83	7.14
Mackarel tuna	12	11	0	4.91	17.97	10.17	3.33	120.00
Salted fish	17	6	11	6.58	18.58	8.83	2.50	120.00
Mackerel	5	5	0	1.23	5.82	5.11	1.25	40.00
Milkfish	18	5	13	3.70	7.64	3.53	3.33	40.00
Tilapia fish	18	8	10	7.80	18.81	8.69	3.33	120.00
Palm oil	21	9	12	2.18	2.55	1.09	5.00	6.67
Catfish	28	11	17	11.53	24.65	9.13	3.33	120.00
Meatballs	42	8	34	55.27	61.81	18.69	8.00	240.00
Tempe	45	11	34	75.45	62.36	18.22	14.28	150.00
Green beans	20	7	13	16.47	45.55	19.96	1.67	300.00
Long beans	28	7	21	8.20	14.55	5.39	3.33	60.00
Spinach	39	8	31	13.47	14.45	4.54	3.33	40.00
Cassava leaves	25	9	16	9.35	19.51	7.65	3.33	120.00
Gambas	2	2	0	1.07	5.97	8.27	11.43	40.00
Bean	19	7	12	3.03	5.11	2.30	3.33	20.00
Basil leave	25	7	18	3.28	6.65	2.56	0.83	42.85
Apple	19	6	13	6.30	17.99	8.09	3.33	120.00
Papaya	39	8	31	10.14	14.89	4.68	1.66	60.00
Banana	41	11	30	19.98	25.14	7.70	3.33	120.00
Mango	29	9	20	4.88	6.10	2.22	1.57	20.00
Orange	36	10	26	8.99	10.93	3.57	3.33	40.00
Guava	18	7	11	2.43	4.51	2.08	1.67	14.28

The types of food containing vitamin A that were most consumed by research subjects were chicken meat (average=48.21g±46.77) and chicken eggs (average=66.92g±66.07), which were widely consumed by both subjects in the sufficient category (100% and 81, 82%) and deficit (89.47% and 97.37%) (Table 2). Previous research by Fekete et al. (29), conducted a literature review between 2018 and 2023. No human RCTs or clinical trials on the association between COPD and vitamin A supplementation were found in the PubMed database in the past five years. For vitamin A, although serum antioxidant vitamin levels were significantly higher among those who took vitamin A supplements than in those who did not, there was no clear statistical evidence that vitamin A supplementation was necessary for the beneficial

effects of vitamin A on the lungs. Meanwhile, another study by Lorensia et al. (31), which looked at the relationship between vitamin A as antioxidant intake on lung function in construction workers, had a value of p=0.05, which means associated with lung function but is a very weak correlation (correlation coefficient value - 0.036).

Profile of Vitamin C Intake

Sources of vitamin C come from food, especially vegetables and fruits, that taste sour, such as oranges, pineapples, or papaya. In vegetables, the content of vitamin C is mostly found in spinach, cassava leaves, and basil leaves. In all subjects, the average consumption of food intake that contained the highest vitamin C content in the research subject was papaya at 6.30 mg/day followed by orange at 4.80 mg/day. The results of the study of the frequency of foods most frequently consumed by the research subject containing vitamin C were corn, spinach, papaya, orange, and bananas. In the sufficient level group, the average consumption of food intake that contained the highest vitamin C content in the research subject was papaya at 22.48 mg/day followed by potato at 17.03 mg/day.

The results of the study of the frequency of foods most frequently consumed by the research subject containing vitamin C were potato, cassava leaves, spinach, mango, banana, and orange. In the deficit level group, the average consumption of food intake that contained the highest vitamin C content in the research subject was papaya at 4.17 µg/day followed by orange at 4.32 µg/day. The results of the study of the frequency of foods that were most frequently consumed by the research subject containing sufficient vitamin C were spinach, papaya, banana, and orange (**Table 3**).

Table 3. Profile of consumption patterns of Vitamin C

Type of Food	Number of Subjects			Average (gram)	Standard Deviation	CI	Min (mg)	Max (mg)
	Total subjects (n=49)	Sufficient Category (n-=6)	Deficit Category (n-=43)					
Corn	30	3	27	9.00	10.92	3.91	4.10	50.00
Potato	25	5	20	27.71	61.84	24.24	3.33	300
Salted fish	17	2	15	6.58	0.10	8.83	2.50	120.00
Tilapia fish	18	0	18	7.80	0.10	8.69	3.33	120.00
Catfish	28	0	28	11.53	24.65	9.13	3.33	120.00
Long beans	28	4	24	8.20	14.55	5.39	3.33	60.00
Spinach	39	4	35	13.47	14.45	4.54	3.33	40.00
Cassava leaves	25	5	20	9.35	19.51	7.65	3.33	120.00
Gambas	2	2	0	1.07	5.97	8.27	11.43	40.00
Bean	19	0	19	3.03	5.11	2.30	3.33	0
Basil leave	25	4	21	3.28	6.65	2.56	0.83	42.85
Apple	19	3	16	6.30	17.99	8.09	3.33	120.00
Papaya	39	6	33	10.14	14.89	4.68	1.66	60.00
Pineapple	18	3	15	2.12	5.74	2.65	1.66	28.57
Banana	41	6	35	19.98	25.14	7.70	3.33	120.00
Mango	29	5	24	4.88	6.10	2.22	1.57	20.00
Orange	36	5	31	8.99	10.93	3.57	3.33	40.00
Guava	18	2	16	2.43	4.51	2.08	1.67	14.28

The types of food containing vitamin C that were most consumed by research subjects were bananas (average=19.98g±25.14) and papaya (average=10.14g±14.89), which were widely consumed by both subjects in the sufficient (100% and 100%) categories. deficit (81.40% and 76.74%) (Table 3). In previous research by Fekete et al. (30), conducted a literature review between 2018 and 2023, based on an estimate of total vitamin C consumption, it was found that patients with chronic respiratory disease consumed significantly less vitamin C than healthy controls. Effect of intravenous vitamin C on exercise-induced redox balance, inflammation, exertional

dyspnea, neuromuscular fatigue, and exercise tolerance in patients with COPD. Serum concentrations of antioxidants have been shown to correlate positively with FEV1 in patients with COPD, and supplementation with antioxidants such as vitamin C improves the symptoms of the disease. Another study by Lorensia et al. (31), which looked at the relationship between antioxidant (vitamin C) intake on lung function in construction workers, had a value of p=0.00 and r=0.63, which means there are differences in vitamin C with lung function of a smoker and non-smoker. The relationship between vitamins C got a correlation value of 0.000, meaning that the intake of vitamin C had no relationship or correlation. The most consumed food containing vitamin C was lodeh and sambal.

Profile of Vitamin E Intake

Vitamin E intake was the total amount of vitamin E content from food sources of vitamin E consumed by subjects on average per day, expressed in mg units. The adequacy rate of vitamins for ages 19-64 years was 15 mg/day (20). Vitamin E is widely found in food, especially in plant oils such as oil, spinach, fish, and eggs. Based on the results, none of the research subjects from the subjects in the research subject met the adequate intake of vitamin E, namely ≥15 mg/day. Based on **Table 4** shows that the largest average was 1.43 mg/day, namely chicken eggs, although the highest but does not meet the adequacy rate of vitamin E. and chicken eggs. The average consumption of food intake that contained the highest vitamin E content in the research subject was chicken eggs at 1.43 mg/day although the highest did not meet the adequacy rate of vitamin E. The frequency of foods most frequently consumed by research subjects containing vitamin E were tempeh and chicken eggs (**Table 4**).

The type of food containing vitamin E that was most consumed by research subjects was tempeh (average=0.79g±0.62) (**Table 4**). Previous research by Liu et al. (32), used data from NHANES (National Health and Nutrition Examination Survey) from 2013–2018, showing that vitamin E intake among U.S. adults was well below the recommended levels and that higher vitamin E intake was negatively associated with COPD incidence. Meanwhile, in another study by Lorensia et al. (31), which looked at the relationship between antioxidant (vitamin E) intake on lung function in construction workers, there was no relationship or correlation between the intake of vitamin E (P-value=1,000) in food with lung function in the respiratory distress group and without interference. The most consumed food containing vitamin E is fried egg/omelet and spinach.

Table 4. Profile of consumption patterns of Vitamin E

Type of Food	Total subjects (n=49)	Average (gram)	Standard Deviation	CI	Min (mg)	Max (mg)
Chicken eggs	**48**	1.43	1.29	0.36	0.10	4.80
Mackarel tuna	**7**	0.05	0.18	0.14	0.10	0.30
Salted fish	**14**	0.13	0.38	0.20	0.10	0.70
Milkfish	**18**	0.08	0.16	0.07	0.10	0.60
Tilapia fish	**17**	0.09	0.21	0.10	0.10	1.20
Palm oil	**21**	0.08	0.10	0.04	0.10	0.20
Catfish	**26**	0.21	0.49	0.19	0.10	2.40
Tempeh	**47**	0.79	0.62	0.18	0.10	1.50
Peanut shell	**15**	1.0	2.91	1.47	0.10	18.90
Spinach	**29**	0.15	0.24	0.09	0.10	0.40
Basil	**9**	0.03	0.07	0.05	0.10	0.40
Apple	**13**	0.14	0.61	0.32	0.10	4.10
Papaya	**25**	0.11	0.17	0.07	0.10	0.60
Mango	**15**	0.03	0.05	0.02	0.10	0.10
Guava	**7**	0.01	0.04	0.03	0.10	0.10

The relationship between vitamin A and C intake with COPD Risk

Table 5 showed that as many as 77.55% of the total research subjects were in vitamin A deficiency. The assessment of vitamin A intake from the research subject was assessed using the FFQ method and analyzed using the Nutrisurvey 2007. The table showed that as many as 87.76% of the total research subjects were in deficit of vitamin C. From the calculation results in **Table 5**, it is known that the Spearman Significance value between COPD risk and vitamin A intake was -309 with Sig. (2-tailed) of 0.187.

Because the Sig.=0.187>0.05, it can be concluded that there was no relationship between vitamin A and COPD risk development. While in the test between COPD risk and vitamin C intake, the Spearman's rho r Significance value was 0.031. Because the Sig.=0.031>0.05, it can be concluded that there was a significant relationship (weak negative) between vitamin C and COPD risk development. This is different from previous research by Wong et al. (33), who examined the relationship between dietary antioxidant intakes and CRDs using data from the 2001–2018 National Health and Nutrition Examination Survey (NHANES), and found that the association between composite dietary antioxidant index and prevalence of Chronic respiratory diseases was consistent across all subgroups, suggest that it was not influenced by these demographic factors. Higher dietary antioxidant intakes were associated with a lower prevalence of CRDs (particularly emphysema and chronic bronchitis) in general adults.

Other research by Lorensia et al. (31), showed no significant difference between antioxidant intake in the group of interference and without interference. Intake of vitamin A on lung function has a value of p=0.05, which means associated with lung function but has a very weak correlation (correlation coefficient value -0.036) while vitamins C and E have a value of p=1.00, which means there is a relationship, and is a very weak correlation (correlation coefficient value of -0.036).

Table 5. Distribution frequencies based on Vitamin A and C Intake

Antioxidant Intake	COPD risk		Frequency intake	Percentage intake (%)	Mean±SD Intake (µg)	Spearman test (r)
	risk of clinically significant COPD	No risk of clinically significant COPD				
Vitamin A intake						
Sufficient (≥600 µg/day)	3	8	11	22.45	630.98±21.07	-0.192
Deficit (≤600 µg/day)	28	10	38	77.55	370.00±146.02	
Total	31	18	49	100	1.000.98±168.81	
Vitamin C intake						
Sufficient (≥75 mg/day)	5	10	6	12.24	79.62±6.05	-0.309*
Deficit (≤75 mg /day)	26	8	43	87.76	21.56±16.70	
Total	31	18	49	100	98.18±23.84	

*Correlation is significant at the 0.05 level (2-tailed)

The types of food that are mostly consumed by subjects were:

Chicken Eggs were among the most consumed by the research subject. When the eggs were still raw they contained vitamin A of 160µg/100g, vitamin E 1050µg/100g. If the egg yolk was only taken and was still raw, the vitamin A content was 371 µg/100g, vitamin E was 2580 µg/100g. Meanwhile, if the egg white was only then there is no vitamin A and vitamin E content back (34). Different conditions of eggs that have undergone a cooking process or are processed into food such as boiling or frying. The research that has been done, has shown that several groups of eggs that are still raw materials, half-cooked eggs, and eggs that have been cooked until cooked have each group contains different vitamin A and vitamin E content. Raw whole eggs contain vitamin A of 182, 160 µg/100g, and vitamin E 1.43; 1.05 mg/100g. Soft-boiled eggs contain vitamin A 132; 160 µg/100g and vitamin E 2.17; 1.04 mg/100g. The last group of eggs that were cooked until cooked contained vitamin A 61.5; 149 µg/100g and vitamin E containing 1.03; 1.03 mg/100g (34). The nutritional quality of eggs produced by native chickens is superior to those

produced from farms. However, research that has been conducted in the United States states that the levels of vitamin A and vitamin E in eggs are not influenced by the type of residence of the birds in this study (35). The results of this study were that chicken eggs were the most consumed by the research subject but had limitations from the survey, which could not be known how the chicken eggs were processedChicken eggs were among the most consumed. According to research when whole eggs are still raw they contain vitamin A of 160µg/100g and vitamin E of 1050µg/100g. If the egg yolk was only taken and was still raw, the vitamin A content is 371 µg/100g, vitamin E was 2580 µg/100g.

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Corn contains dietary fiber that the body needs (with a relatively low glycemic index compared to rice so corn rice was recommended for people with metabolic diseases such as diabetes. Vitamin A and vitamin E were found in yellow corn as micronutrients, vitamins also act as natural antioxidants. Which could increase the body's immunity and inhibit degenerative cell damage. Vitamin A has activities to slow down aging, anticipates cancer, heart disease, stroke, and cataracts, and can catch free radical attacks that are considered to cause disease (37,38). The nutritional composition of the research that has been carried out, which is found in sweet corn in units/100g of the material contains 400 SI of vitamin A, whereas ordinary corn contains 117.0 SI. Jangung also contains vitamin C in units/100g of ingredients for sweet corn as much as 12.0 Mg and ordinary corn as much as 9.0 Mg (37,38).

Vegetable Spinach is one of the most important and nutritious vegetables eaten raw or cooked. Spinach provides excellent amounts of vitamin B6, riboflavin, folate, niacin, soluble dietary fiber, omega-3 fatty acids, and minerals. Spinach was also rich in iron (39). According to research on spinach extract that had been researched, spinach contains vitamin A (26.85 ± 0.154µg) and vitamin C (19.66 ± 0.21 µg) and besides that, the antioxidant activity and antidiabetic effect of spinach are comparable to IC50 of 3.03 µg/mL, 6.03 µg/mL, and 3.046 µg/mL respectively (40). The results of the study used spinach which has been processed into clear spinach soup.

Papaya is a fruit that is commonly consumed by many people with high nutritional value available at an affordable price. Low-calorie content (32 Kcal/100g ripe fruit) made this fruit a favorite fruit for someone who is losing weight. Papaya was low in carotene which helps prevent free radical damage compared to other fruits, but all the other nutrients are present. Papaya fruit contains many enzymes such as papain which is in a good amount in raw fruit which is very good for digestion, helping protein in food in acidic, alkaline, and neutral medium. All parts of this papaya from the leaves, seeds, and papaya juice show anti-free radical and antioxidant activity (41). The content of vitamin A contained in papaya according to research that has been done is 47µg/100g of papaya, the content of vitamin C in papaya is 60.9 mg/100g of papaya, while the content of vitamin E in papaya is 0.3 mg/100g of papaya (41).

Bananas were considered a source of some of the vitamins that are in their fruit. However, the results of the fruit morphological characteristics indicated that each banana cultivar had characteristics related to its genome group.

According to research conducted by using four cultivars of Indonesian bananas, namely the Berlin banana, green ambon banana, Bandung plantain, and Cardaba banana in a 100g meal portion containing high carbohydrates, total sugar, potassium, and vitamin C, moderate protein, low fat, and high calories due to its high nutritional value. Bananas are a nutritious food that is recommended for all in general (42).

Implication and limitations

Another method was the 24-hour recall method, which remembers the food consumed during the last 24 hours from midnight to midnight again. This method used household measurement tools in each household to determine the proportion of food consumed, such as food models, pictures, or photos of food. This method had limitations or shortcomings, namely, it is very dependent on the subject's memory, the need for skilled personnel, and the flat slope syndrome. So that with all the considerations, this study took the FFQ method because this method did not require repeated data collection after all during a pandemic like this it did not make it easier to meet directly and can lead to differences in perceptions between researchers and the research subject and also did not force the subject of researchers to remember for 24 hours they've consumed everything (43,44).

CONCLUSIONS AND RECOMMENDATIONS

Most of the subjects had a deficiency of vitamin A (77.55%), a deficiency of vitamin C (87.76%), and all subjects had a deficiency of vitamin E. There was no relationship between vitamin A and COPD risk development, but there was a significant relationship (weak negative) between vitamin C and COPD risk development, so the lower the intake of vitamin C, the greater the risk of developing COPD, which is indicated by a decrease in lung function from the FEV1/FVC ratio.

AUTHOR CONTRIBUTIONS

All authors equally contributed to this paper with the conception and design of the study, literature review and analysis, drafting and critical revision and editing, and final approval of the final version.

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