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THE RELATIONSHIP BETWEEN VEGETABLE AND FRUIT CONSUMPTION AND THE INCIDENCE OF ASTHMA IN CHILDREN AGED 13-14 YEARS

Dave Christopher Manuhutu[1*], Ayu Setyorini Mestika Mayangsari[2], I Gusti Ayu Putu Eka Pratiwi[2], Komang Ayu Witarini[2]

Department of Paediatrics

[1*]Bachelor of Medicine, Faculty of Medicine, Udayana University, Denpasar, Bali
[2] Department of Paediatrics, Faculty of Medicine, Udayana University, Denpasar, Bali
e-mail: setyorini_mestika@yahoo.com
*e-mail: defmanuhutu@gmail.com

ABSTRACT

Asthma is a chronic inflammatory disorder of the respiratory tract. Oxidative stress is one of the causes of the inflammatory process in the airways of children with asthma. Oxidative stress can be reduced with antioxidants. The role of antioxidants in vegetables and fruits has not yet received attention in the management of asthma in children. The aim of this study is to determine the relationship between the consumption of vegetables and fruits and the occurrence of asthma in in children aged 13-14 years.The research was conducted using an observational analysis with a cross-sectional study approach. A total of 236 students were selected as research subjects using stratified random sampling techniques. Data were collected through direct questionnaire filling at Tunas Daud Junior High School and State Junior High School 10 in Denpasar. The results showed that 83 students had insufficient vegetable consumption and 153 students had sufficient vegetable consumption. The occurrence of asthma in children with sufficient vegetable consumption was 16.3%, whereas in children with insufficient vegetable consumption, it was 47%. 77 students had insufficient fruit consumption and 159 students had sufficient fruit consumption. The occurrence of asthma in children with sufficient fruit consumption was 15.1%, whereas in children with insufficient fruit consumption, it was 51.9%. The prevalence ratio of asthma in children with sufficient vegetable consumption was 4.5 (95% CI 2.5-8.3; p<0.001) and in children with sufficient fruit consumption, it was 6.1 (95% CI 3.3-11.3; p<0.001). The conclusion of this study is that there is a relationship between the consumption of vegetables and fruits and the occurrence of asthma in children aged 13-14 years.

Keywords : Asthma., Vegetable and Fruit Consumption., Children Ages 13-14 Years

INTRODUCTION

The World Health Organization (WHO) states that asthma is one of the major respiratory diseases, causing 0.3% of deaths out of a total of 17.4% worldwide in 2016. The prevalence of asthma in children varies significantly across different countries, ranging from approximately 1% to 18%.[1] The Basic Health Research (Riskesdas) in 2018 reported a 2.4% incidence of asthma in Indonesia, with the highest occurrence (6-7%) in children aged 13-14 years.[2]

Individuals suffering from asthma can only manage symptoms during an attack but cannot be completely cured.[3] The lack of control over childhood asthma can lead to decreased respiratory function, reduced quality of life, and the development of adult asthma if not properly addressed.[4]

One triggering factor for asthma is an increase in Reactive Oxygen Species (ROS) in the body, leading to oxidative stress. Oxidative stress is involved in activating various types of inflammatory cells, a crucial factor in the chronic inflammation process in the respiratory tract and systemic circulation of asthma patients. Balancing the levels of ROS and antioxidants in the body, derived from vegetables and fruits such as vitamin C, vitamin E, and β-carotene, can reduce oxidative stress and its impact.[5]

A study by Barrera-Mendoza et al. in 2018 found that low intake of vitamin E from green vegetables influenced asthma occurrence and increased symptom severity.[6] Similarly, a study by Christy et al. in 2019 revealed that vitamin E intake from vegetables could reduce the levels of inflammatory cytokines in lung tissue.[7] Another study by Hosseini et al. in 2017 found that consuming fruits containing the main carotenoid, particularly lycopene, could reduce oxidative stress and inflammation in the airways.[5] Vitamin C intake was also reported to significantly improve lung function in children.[6] However, some studies suggest that the consumption of vegetables and fruits may not have a significant impact on childhood asthma.[8]

Based on these findings, the relationship between vegetable and fruit consumption and asthma incidence requires further research. Therefore, the purpose of this study is to find the correlation between vegetable and fruit consumption and asthma occurrence in school students aged 13-14 years old.

LITERATURE REVIEW

The Global Initiative for Asthma (GINA) states that asthma is a diverse disease that typically involves chronic inflammation of the respiratory airways. The International Consensus on Pediatric Asthma (ICON) describes asthma as a long-term inflammatory condition associated with the obstruction of the

airways and hyperresponsive bronchi. Asthma is characterized by clinical symptoms such as shortness of breath, coughing, and recurrent wheezing.[3] The prevalence of asthma worldwide varies significantly and experiences a significant increase each year. Indonesia Basic Health Research in 2018 stated that Bali Province ranked sixth with a 6.2% asthma prevalence.[9] Theoretically, the course of asthma is caused by long-term inflammation characterized by contributions to the narrowing of the airway walls, excessive bronchial activity, and damage to the airways, ultimately leading to obstruction of airflow. Excessive activity in the airways results in the narrowing of the air passages and gives rise to the clinical manifestations of asthma.[3] Unique thing about airway inflammation is the activation of T lymphocytes, mast cells, eosinophils, and macrophages, especially in the lumen and mucosa of the respiratory tract..[10] One of the conditions that play a role in airway inflammation is oxidative stress.[5]

Oxidative stress is an imbalance in the body caused by a higher quantity of free radicals than antioxidants. Oxidative stress leads to smooth muscle contraction in the airways, induces bronchial hyperresponsiveness (BHR), increases mucus hypersecretion, causes epithelial shedding, and results in vascular exudation.[11] Oxidative stress in the body can be reduced by consuming antioxidants, which stabilize free radicals through chemical reactions. Vegetables and fruits are rich sources of antioxidants, such as flavonoids, carotenoids, lycopene, and vitamins.[12] Vitamin

Vitamins are divided into two groups: water-soluble vitamins, such as vitamin C, and fat-soluble vitamins, including vitamins A, D, E, and K.[13]A study by Biltagi et al. in 2009, conducted on asthma-afflicted children aged 7–10 years with a daily intake of 200 mg of vitamin C for 38 weeks, showed that this method significantly reduced inflammatory markers in sputum and could improve lung function in children.[6] Another study conducted by Hijazi et al. in 2000 found no correlation between the occurrence of asthma and vitamin C in 12 year old children.[8] The study conducted by Muharrom in 2017 found that after administering vitamin E to the research subjects for 28 days, there was an improvement in the condition of the respiratory tract tissues that had previously experienced inflammation.[7] The study conducted by Okamoto et al. in 2002 found that individuals with asthma who were given vitamin E experienced a significant impact. There was a decrease in inflammatory cytokines such as IL-4 and IL-5, followed by an improvement in lung tissues through reduced mucus production, thereby reducing the risk of asthma occurrences.[7] The study conducted by Bishopp et al. in 2017 found a reduction in the levels of inflammatory biomarkers in the respiratory tissues of asthma patients after receiving antioxidant intake.[14] Other research has also found that oral intake of lycopene can reduce oxidative stress and pathophysiological features of asthma, such as smooth muscle contraction in the airways, induction of bronchil hyperresponsiveness (BHR), and increased mucus hypersecretion.[5] Other antioxidants such as flavonoids and polyphenols have also been proven to significantly reduce the activation of inflammatory mediators in lung tissues, thereby reducing asthma occurrences in children.[15] The study by Zhao et al. in 2017 found a relationship between vitamin D and asthma in children through the expression of the Vitamin D Receptor (VDR) gene.[16] Another study conducted by Lorensia et al. in 2019 did not find a direct contribution of vitamin D to asthma or the progression of clinical asthma symptoms.[17]

METHOD

This study is an analytical observational research employing a cross-sectional method. It was conducted between May 28, 2023, and October 2, 2023, at both public and private junior high schools in Denpasar. The researcher used the formula for sample size calculation in unpaired categorical analytical research, determining the minimum sample size with a standard deviation of alpha at 1.645 and a standard deviation of beta at 0.842. The frequency of vegetable consumption was calculated with an estimated proportion in the risk factor group at 0.4 and an estimated proportion in the non-risk factor group at 0.2, resulting in a minimum of 64 samples. The fruit consumption frequency group was calculated with an estimated proportion in the risk factor group at 0.4 and an estimated proportion in the non-risk factor group at 0.19, yielding a minimum of 56 samples. Inclusion criteria for this study were children aged 13-14 years attending SMP Tunas Daud and SMP Negeri 10 Denpasar. Exclusion criteria were incomplete questionnaire submissions. Sampling in this study used the stratified random sampling technique by first determining the private and public school groups, then randomly selecting 1 private junior high school and 1 public junior high school from data obtained from the official website of the Ministry of Education and Culture. The researcher then selected the entire accessible population according to the sample selection criteria, resulting in a sample of 357 students. 121 students were excluded for not signing the informed consent, leaving 236 students to be analyzed. The measurement instruments used in this research were the ISAAC questionnaire and a questionnaire on the frequency of vegetable and fruit consumption, both of which had been tested for validity and reliability. Samples were considered to have asthma if they answered "yes" to questions 1 or 2, 3, and 4 of the ISAAC questionnaire. The vegetable and fruit consumption frequency groups were re-categorized by the researcher into two groups: Adequate (1 time per day and 3-4 times per week) and inadequate (1-2 times per week and 1-2 times per month). The risk factor for asthma occurrence controlled by design in this study was age, with samples taken from the 13-14 years age group. The asthma risk factor controlled by analysis was gender and family history of atopy. Gender was differentiated into female and male. The research sample was considered to have a family history of atopy if they answered "yes" to question 3 of the ISAAC questionnaire. The data from the questionnaire were processed using SPSS and presented in tabular form. The Research Ethics Committee (KEP) has approved this study with an ethics number 245/UN14.2.2.VII.14/LT/2023.

RESULT

Research Subject Characteristics

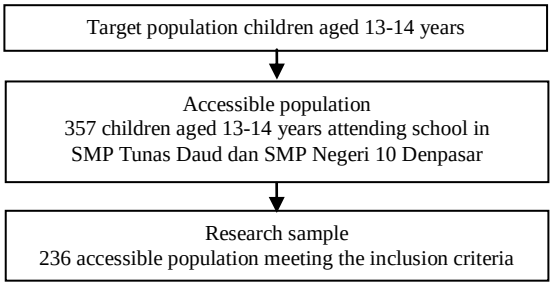

Figure 1. Sampling Procedure

Characteristics of the research subjects can be seen in Table 1.

Table 1. Research Subject Characteristics

Subject Characteristic		Asthma		p-value	PR (CI 95%)
		Yes n = 64	No n = 172		
Age	13 Years, n (%)	49 (76.6)	130 (75.6)	0.876	1.06 (0.54 - 2.07)
	14 Years, n (%)	15 (23.4)	42 (24.4)		
Gender	Female, n (%)	36 (56.3)	93 (54.1)	0.879	0.92 (0.51-1.63)
Family Atopic History	Yes, n (%)	59 (92.2)	24 (14.0)	<0.001	72.77 (26.51-199.72)
Vegetable Consumption Frequency	Inadequate, n (%)	39 (47.0)	44 (53.0)	<0.001	4.5 (2.5 – 8.3)
	Adequate, n (%)	25 (16.3)	128 (83.7)		
Fruit Consumption Frequency	Inadequate, n (%)	40 (51.9)	37 (48.1)	<0.001	6.1 (3.3 – 11.3)
	Adequate, n (%)	24 (15.1)	135 (84.9)		

DISCUSSION

Relationship between Vegetable Consumption and Incidence of Asthma in Children aged 13-14 years

These results are consistent with a previous study conducted by Hosseini et al. in 2017, which discovered that in populations consuming vegetables such as tomatoes, carrots, spinach, and other green vegetables, there was a lower incidence of asthma. The study by Hosseini et al. also found that populations with high antioxidant intake, such as flavonoids and carotenoids found in vegetables, had a lower incidence of asthma compared to those with low antioxidant intake.[5] Another study conducted by Barrera-Mendoza et al. in 2018 found that low intake of vitamin E from green vegetables was associated with a decrease in forced expiratory flow from forced vital capacity, thus affecting the occurrence and worsening of asthma symptoms.[6] Another study conducted by Putri et al. in 2022 found that the nutritional status of children is related to the occurrence of asthma through the release of inflammatory mediators by the leptin hormone produced by adipokin cells. This study found a higher incidence of asthma in obese children compared to those with a normal BMI.[18] Another study conducted by Christy et al. in 2019 found that high intake of vitamin E from vegetables such as corn, tomatoes, spinach, broccoli, and others could reduce inflammatory cytokine levels in mucus secretions and lung tissues, significantly impacting the occurrence of asthma. However, a study conducted by Tenero et al. in 2016 found no improvement in lung function in children with asthma who were given antioxidant intake for 1 month.[19]

Relationship between Fruit Consumption and Incidence of Asthma in Children aged 13-14 years

The results of this study are consistent with several previous studies, such as the study by Alwarith et al. in 2020, which found that the relative risk of asthma incidence in the group consuming vegetables and fruits with high intake category was lower compared to the group with low intake. The consumption of vegetables and fruits plays a role in reducing inflammation in the body by acting as a source of antioxidants, leading to improved lung function.[20] The research conducted by Hosseini et al. in 2017 found that the consumption of fruits containing antioxidants such as oranges, watermelon, kiwi, mango, and others can reduce oxidative stress in the body. Additionally, a study by Riccioni et al. in 2017 found that the level of consumption of antioxidant carotenoids and vitamin A contained in fruits correlated with a lower risk of asthma incidence. Low levels of oxidative stress are suspected to play a role in the pathophysiology of asthma by improving lung function, repairing smooth muscle contraction in the airways, reducing the induction of inflammatory cytokines, and decreasing mucus hypersecretion.[5] Another study conducted by Arifah and Aprilia in 2019 found that the flavonoid content in apples inhibits the activation of IL-5, resulting in reduced hypertrophy of smooth muscle in the bronchioles and improved histopathological features in lung tissue.[21] Another study conducted by Kuti et al. in 2021 found that antioxidant intake, especially Zinc and Selenium, which are micronutrients contained in fruits, is lower in individuals with asthma compared to those without asthma.[22]

CONCLUSION

Based on the conducted research, it can be concluded that there is a significant relationship between vegetable consumption frequency and the incidence of asthma, and there is a significant relationship between fruit consumption frequency and the incidence of asthma in students at SMP Tunas Daud Denpasar and SMP Negeri 10 Denpasar. This study has some limitations, such as the diagnosis of asthma still relying on clinical symptoms assessed through the ISAAC questionnaire, the absence of standardized research references for the categories of 'sufficient' and 'insufficient' vegetable and fruit consumption frequency, and the research focus is directed towards establishing relationships, thus not providing a comprehensive depiction of the risk factors for asthma incidence.

Suggestions from this study include that the diagnosis of asthma should be complemented by a reversibility test, assessing Forced Expiration Volume (FEV). Subsequent research should delve deeper into other asthma risk factors, such as genetic factors

and exposure to external environmental factors. Researchers hope that the results of this study can serve as a reference for further research on the relationship between vegetable and fruit consumption and the incidence of asthma.

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