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Hypertension in Pediatric Population: A Review of Literature

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Abstract

Risk factors for hypertension in Pediatric Population include obesity, high birth weight (LBW), consuming alcohol, smoking, consuming fast food rich in salt, environmental factors (rural), and exposure to particulate matter (PM) air pollution. Most of the 20 journals obtained for the literature in this study are obesity risk factors related to lifestyle (less activity, wrong diet), high BMI, and consuming sugary drinks.

Keywords: Hypertension; Pediatric Population

Introduction

Hypertension is a condition where there is a sudden increase in blood pressure in the blood vessels [1]. This is because the work of pumping blood on the heart is harder to meet the needs of nutrients and oxygen for the body [1]. If this continues, hypertension can affect the function of organs in the body, especially vital organs such as the kidneys and heart [1]. Hypertension generally occurs in adults >35 years old, but currently there is a shift in hypertension in adolescents aged 18 years [2]. Based on data from the Ministry of Health from 2013 to 2018, at the age of 18-24 years, there was an increase related to hypertension [2]. The number of hypertension cases according to WHO are 1.13 billion people, the number of hypertension cases in Asia and Europe in 2018 is approximately 63 million people [2]. Meanwhile, the death rate is approximately 427 people. The percentage of hypertension in East Java is 22.71% or as many as 2,360,592 residents of which men 18.99% or 808,009 residents and women 18.76% or 1,146,412 residents [3]. Adolescents in the age range of 15-25 years occurs in 1 in 10 people, while the number of pre-hypertension and hypertension in adolescents aged 20-30 years is 45.2% [4]. Based on the 2013 data, it was found that

hypertension data at the age of teenagers was 5.3%, the prevalence of hypertension in 2018 aged 18-24 years reached 13.2% [2]. Hypertension in adolescents from 2013 to 2018 was detected a high increase with a difference of 7.9% within 5 years [2]. The increase in hypertension in adolescents is caused by risk factors that are influenced by nutrients including sodium, carbohydrates and fats which have an impact such as obesity due to lack of eating patterns [5]. People who are overweight or obese more than 20% and hypercholesterolemia will have a greater risk of developing hypertension, these risk factors occur due to an unhealthy lifestyle [1]. Sodium, fat and sweetened drinks can affect blood pressure and vasodilation of blood vessels, lack of physical activity can cause cholesterol which is the cause of hypertension [5]. Risk factors other than nutrients, namely smoking, nicotine can cause an increase in blood pressure, this happens because of hormonal disorders that play a role in blood vessels and the heart [6]. Based on data in 2018, there are several risk factors that affect hypertension, namely overweight and obesity. Hypertension disease associated with overweight indicators with values >25.0 to 27.0, namely in 2007 as much as 10.5%, then in 2013 as much as 14.8%, and in 2018 as much as 21.8% [2]. In this case, there is an increase in overweight to obesity, so that the risk factors for hypertension will increase [2]. The lack of information and research related to hypertension requires an analytical study to find out what factors cause hypertension in adolescents. Based on the data above, it can be interpreted that cases of hypertension are very high with the increasing prevalence of hypertension among adolescents [2]. Therefore, researchers want to conduct a literature study of risk factors for the incidence of hypertension in adolescents as a form of effort to improve health status as a form of early prevention among adolescents. With efforts to increase information and knowledge of hypertension in Asian and European societies [5].

Methods

The research design used in this study is the Literature Review. Based on the data used is PubMed, proquest, science direct and Google scholar. The keywords were "risk factor and hypertension and PEDIATRIC POPULATION". The specified inclusion criteria include journals published in 2011-2021, international journals, and journals in English, journals that can be accessed in full text, journals with analytical cross sectional studies. Data analysis in this study was carried out using the thematic method of analysis.

Result and Discussion

There are 20 international journals related to hypertension risk factors, there are 6 journals from Proquest, 7 journals from PubMed, 3 journals from Science Direct, and 4 journals from Google Scholar. It can be concluded that the website portal that is obtained by many journals by researchers is PubMed. The selection of the 20 international journals has carried out the screening stage and then data extraction is carried out using tables that aim to make it easier to analyze journals, writing, year, research objectives, population, data analysis techniques and conclusions. Journals that have been analyzed are then rewritten important information using thematic analysis methods. Of the 20 journals obtained, there are 11 journals that discuss risk factors for obesity in hypertensive adolescents with a percentage of 55%, 2 journals discuss risk factors for low birth weight in hypertensive adolescents with a percentage of 10%, 2

journals discuss risk factors for fast food rich in salt. in hypertensive adolescents with a percentage of 10%, 1 journal discusses the risk factors for smoking in hypertensive adolescents with percentage of 5%, 2 journals discuss risk factors for alcohol consumption in hypertensive adolescents with a percentage of 10%, 1 journal discusses environmental risk factors in hypertensive adolescents with a percentage of 5%, and 1 journal discusses risk factors for air pollution exposure in hypertensive adolescents with a percentage of 5%. From the explanation above, it can be concluded that most of the 20 journals obtained as literature are risk factors for obesity which are the cause of hypertension in adolescents with a percentage of 55% with a total of 11 journals. Among the 20 journals above, there are 7 themes related to risk factors for hypertension in adolescents as follows: 1. The relationship between obesity and hypertension in adolescents 2. The relationship between high birth weight (LBW) and hypertension in adolescents 3. The relationship between alcohol consumption and hypertension in adolescents 4. The relationship between passive smoking and hypertension in adolescents 5. The relationship between consuming fast food rich in salt and hypertension in adolescents 6. The relationship between particulate air pollution (PM) and hypertension in adolescents 7. The relationship between environmental factors (rural) associated with hypertension in adolescents Based on the results of the analysis of the 20 journals, it was found that several factors could be risk factors for the incidence of hypertension in adolescents, including:

The Relationship between Obesity and Hypertension in Adolescents

Obesity is one of the risk factors for hypertension in adolescents because obesity can increase the activity of the sympathetic nervous system thereby increasing heart activity and can lead to hypertension based on journals 1, 2, 3, 4, 5, 6, 7, 8, 9, and 16. Obesity causes individuals to require higher blood pressure than the condition of people in general. The goal is to maintain a balance between renal sodium excretion and intake. In obese individuals, the way the kidneys work harder and will cause hypertension **[7]**. Obesity with hypertension associated with Body Mass Index (BMI). BMI as a measuring tool related to obesity, by calculating height and weight **[7].** BMI is related to body fat. Thus, BMI is not only important to determine the risk of hypertension in adolescents, but also the amount of fat in the body **[7].** Fat that accumulates in the stomach (abdominal). Abdominal obesity is determined by waist circumference. What is meant by abdominal obesity is if the waist circumference for men is > 102 cm and for women > 88 cm **[7].** Abdominal obesity is the biggest risk factor for hypertension in adolescents **[7].** Obesity is the most important factor that plays a role in physical activity. Usually obesity is associated with consuming too much food, but obesity is also due to lack of physical activity. Along with the times, there have been changes in lifestyle, especially in physical activity, namely sports, walking, and other physical activities that are increasingly rarely carried out. Hypertension in adolescents is also influenced by weight gain **[8].** According to research (Bandy et al., 2019) women who gain weight by 4.5-10 kg, to women whose weight gains more than 25 kg, are equally at risk of developing hypertension in adolescents. The higher the weight gain, the higher the risk of developing hypertension **[9].** The relationship between obesity and hypertension where

obese adolescents have higher blood pressure than adolescents with normal weight [8]. Hypertension in obesity occurs because of a relationship with sodium retention, activation of the sympathetic nervous system and selective insulin resistance [8]. Selective insulin resistance in obesity results in hyperinsulinemia resulting in impaired vascular function, sodium retention, impaired ion transport, and increased activity of the sympathetic nervous system including increased heart rate and blood pressure [8]. One of the most important things about obesity with hypertension in adolescents is that hypertension can cause complications of chronic disease [10]. Therefore, it is important to implement the prevention and control of hypertension in adolescents, namely by controlling body weight [10]. By losing weight, it can also help lower blood pressure. To be able to prevent obesity and complications of hypertension in adolescents, it can be done by adopting a healthy lifestyle by adopting a balanced diet and reducing foods that contain lots of salt and saturated fat, increasing physical activity and also exercising regularly [10].

The Relationship between Alcohol Consumption and Hypertension in Adolescents

Consuming alcohol is a risk factor for hypertension in adolescents. The effect of consuming alcohol in adolescence is very detrimental due to the dose / dependence on alcohol that causes hypertension in adolescents. Excessive alcohol consumption will have a bad impact on health in the future. One of the effects of excessive alcohol consumption is an increase in blood pressure or hypertension [11]. Alcohol is a cause of hypertension because alcohol has almost the same effect as carbon monoxide, namely the acidity of the blood increases, the blood will become thick and then the heart is forced to pump [12]. Excessive alcohol consumption for a long time will affect cortisol levels which increase in the blood so that the activity of the Renin-Angiotensin Aldosterone System (RAAS) will increase and cause hypertension in adolescents [12]. The mechanism underlying the relationship between hypertension and alcohol is: [11]: 1. Alcohol can affect vascular endothelial function by activating renin. Angiotensin aldosterone system and inhibits vasodilation. 2. Alcohol-induced inhibition of the catalytic activity of 11 -type hydroxysteroid dehydrogenase results in increased plasma cortisol levels and decreased aldosterone levels, which promote the development of hypertension. 3. Drinking alcohol can cause insulin resistance. 4. Ethanol consumption increases sympathetic nervous system activity, stimulation of the renin-angiotensin-aldosterone system, increased intracellular Ca2+ in vascular smooth muscle, increased oxidative stress and endothelial dysfunction. 5. Alcohol increases the concentration of Ca2+ and Na+ in vascular smooth muscle cells and causes vasoconstriction 6. Alcohol causes endothelial dysfunction and inhibition of Nitric Oxide (NO) synthesis. The habit of consuming alcohol not only causes hypertension, but can also trigger other chronic diseases. Therefore, to reduce the impact of consuming alcohol, countermeasures can be carried out such as abandoning old habits and managing a healthier lifestyle [11]. 3.3. The Relationship between High Birth Weight (LBW) With Hypertension in Adolescents High birth weight is part of the risk factors for hypertension in adolescents. This was proven in the 11th and 12th journals. The mechanism underlying the association between LBW and hypertension, namely LBW >4,000 g can lead to an

increased risk of obesity in later life, while obesity is associated with increased activity of the sympathetic nervous system, activation of the renin-angiotensin system., hormonal disorders, and damage to kidney structures that can cause hypertension [13]. If there is a BBLT > 4,000 g, there will be an increase in systolic and diastolic blood pressure, after adjustment for excess BMI in infancy, it will cause a higher BMI in childhood to adolescence. This is an indicator of an increase in blood pressure [14]. Therefore, to avoid LBW in infants, mothers can maintain a lifestyle such as maintaining an appropriate diet, controlling the baby's weight, and increasing physical activity as recommended.

The Relationship between Passive Smoking and Hypertension in Adolescents

One of the risk factors for hypertension, namely smoking (passive smoking) was proven in the 15th journal. Parents of smokers will have a bad impact on adolescent children because inhaled cigarette smoke will result in an increase in inflammatory substances, vascular damage, endothelial dysfunction, and plaque formation [15]. Many researchers explain the temporary effects that cause cigarette smoke, among others, an increase in heart rate and blood pressure with an increase in levels of the hormones norepinephrine and epinephrine due to activation of the sympathetic nervous system [16]. Hypertension is caused by smoking because of the chemicals in tobacco, namely nicotine which can stimulate the sympathetic nervous system, resulting in faster heart work which can cause blood circulation to flow faster and blood vessel constriction will occur which eventually leads to hypertension, as well as carbon monoxide. This replaces oxygen in the blood and forces the heart to meet the needs of oxygen in the body [16]. Carbon monoxide contained in cigarette smoke can also increase blood viscosity, causing hypertension [15]. In addition, carbon monoxide can be associated with red blood cells in the blood. As a result, it can disrupt the bond between red blood cells and the body's oxygen needs, the body also works harder to be able to distribute oxygen levels throughout the body [15]. In addition to nicotine and carbon monoxide, cigarettes also contain tar. When tar flows in blood vessels, it can force the heart to pump blood more strongly and hypertension will occur [15].

The Relationship between Consumption of Fast Food Rich in Salt and Hypertension in Adolescents

One of the causes of hypertension is the consumption of fast food rich in salt, as evidenced in journals 17 and 18. Fast food contains a lot of saturated fat, excessive consumption of fast food will lead to obesity which can trigger hypertension in adolescents [17]. Fast food contains saturated fat (50%), low iron, low calcium, low riboflavin, and low dietary fiber [17]. In addition, fast food is high in fat, high in calories, high in salt and sugar [17]. Consuming fast food rich in salt can increase thirst. This sensation of thirst will increase plasma osmolality due to excess sodium. As a result, water intake followed by fast food rich in salt can restore plasma osmolality in a healthy body [18]. However, the dipsogenic effect of excessive salt intake causes a transient increase in body fluid resistance which can lead to hypertension in salt-sensitive individuals [18]. This will result in an increase in the amount of blood volume and will cause hypertension [18].

The Relationship between Metter Particulate Air Pollution (PM) and Hypertension in Adolescents

One of the risk factors for hypertension in adolescents is exposure to particulate air pollution (PM) as evidenced in the 20th journal. Air pollution is considered the greatest environmental risk for health. Particulate Matter (PM) is the most important pollutant that affects more people than any other pollutant especially in children and adolescents **[19].** PM which contains ultra fine particles and dissolved metals will pass through the alveolar capillaries and penetrate into the circulatory system and directly affect the blood vessels which will then lead to hypertension.**[19].** PM particles are distinguished according to their size, namely coarse particles (PM 10, particles between 10 and 2.5), fine particles (PM 2.5, particles between 2.5 and 0.1), and ultra-fine particles (PM 0.1, particles up to 0.1) **[19].** These measures can determine and relate directly to potential toxicological effects in humans. Inhaled PM will cause changes in the autonomic nervous system which causes arterial vasoconstriction caused by sympathetic nerves **[19].** PM exposure can cause systemic inflammation and oxidative stress that can affect the function of the heart and blood vessels, thereby affecting the hemodynamic response which then results in hypertension **[19].**

The Relationship between Environmental (Rural) Factors with Hypertension in Adolescents

The environmental factor in the 19th journal is the rural environment which is one of the risk factors for hypertension among adolescents. In rural adolescents the lifestyle is very different from urban areas, rural adolescents have a high body mass index (BMI) compared to urban adolescents who have a normal BMI, so that adolescents in rural areas have a higher accumulation of abdominal fat and tend to be obese which is a risk factor. Hypertension **[20].** In addition to the association with BMI, adolescents in rural areas tend to have a higher family history of hypertension and obesity. This can indicate that rural environmental factors are associated with hypertension in adolescents **[20].**

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