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Correlation of advanced glycation end products (AGEs) intake with prehypertension incidence among adults

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Abstract

Background*: The incidence of prehypertension in adults has a threefold risk of developing hypertension and triggering heart disease when compared to other age groups. This study aimed to correlate the intake of advanced glycation end products (AGEs) with the incidence of prehypertension in adults in Kota Jambi.*
Method *: A cross-sectional used in this study with a correlation method. A sample of 134 people participated for people aged 21 – 59 years who came for treatment at the Tanjung Pinang Public Health Center, Kota Jambi and the sample was selected by purposive sampling. Data was collected by using a questionnaire and analyzed by Spearman rank.*
Results*: a strong relationship between AGEs intake and prehypertension (p = 0.000; r: 0.725). Food intake that contains high levels of AGEs in the body has a negative impact on metabolic health processes and may contribute to metabolic disorders. Healthy eating habits have been an important aspect of controlling increased blood pressure in adulthood.*
Conclusion *AGEs intake has a correlation with the incidence of prehypertension in adults.*

Keywords: *Adults, AGEs Intake, Prehypertension*

Abstrak

Latar Belakang : Kejadian prehipertensi pada usia dewasa memiliki risiko tiga kali lipat menjadi hipertensi dan memicu penyakit jantung bila dibandingkan dengan kelompok usia lain. **Tujuan:** Penelitian ini bertujuan untuk mengetahui korelasi asupan *advance glycation end Products* (AGEs) dengan kejadian prehipertensi pada usia dewasa di Kota Jambi.
Metode: Penelitian *cross-sectional* ini menggunakan metode korelas. Adapun jumlah sampel sebanyak 134 orang dengan kriteria usia 21 – 59 tahun yang datang berobat ke puskesmas Tanjung Pinang Kota Jambi dan dipilih secara *purposive sampling*. Pengumpulan data menggunakan kuesioner *food recall* dan dan data dianalisis dengan *Spearman rank*
Hasil: hubungan yang kuat antara asupan AGEs dengan prehipertensi (p=0.000; r: 0.725). Asupan makanan yang mengandung kadar AGEs yang tinggi di dalam tubuh memberikan dampak buruk bagi proses metabolisme dan berkontribusi pada kelainan metabolisme. Kebiasaan pola makan sehat menjadi aspek penting dalam mengendalikan peningkatan tekanan darah di usia dewasa.
Kesimpulan: Asupan AGEs memiliki korelasi dengan kejadian prehipertensi pada usia dewasa.

Kata kunci: Asupan AGEs, Prehipertensi, Usia Dewasa

BACKGROUND

The increase in blood pressure greatly affects heart health. This condition is known as prehypertension cases. Prehypertension became a serious health problem in rural and urban community areas (1). Prehypertension is not treated immediately, it develops into hypertension and triggers heart disease, stroke, brain aneurysm, heart failure, heart attack, and kidney disease (2). For young

adults or older than 18 years the target has a risk of increasing blood pressure, three times compared to other age groups. Thus, blood pressure control is needed.

Based on the World Health Organization (3) reported that uncontrolling blood pressure became an additional burden for the heart and blood vessels. The diseases caused by blood pressure such as hypertension are non-communicable diseases between developing countries such as Indonesia. In Indonesia, hypertension has been addressed with high treatment costs and long treatment periods (4). Meanwhile, in Jambi, hypertension cases reached 5.4% and became the sixth rank of the non-communicable disease category with as many as 125,098 people (5). Based on the initial survey, it was found that the highest number of hypertension cases in 2020 was in the Tanjung Pinang Public Health Center in Kota Jambi. Also, hypertension cases increased from 1.6% to 2.3% in 2020, with the productive age (1820 people) higher than the age of 65 years and over (1067 people). The proportion of cases is caused due to several factors.

The incidence of hypertension requires efforts to control behavior and trigger factors (6). Several studies found factors that influence the development of prehypertension consisting of diet and intake of Advanced Glycation End Products (7). AGEs of dietary origin contribute substantially to the systemic burden of metabolism in the body and therefore predispose individuals to oxidative stress and inflammation, which play an important role in the causation of chronic diseases including hypertension. Another supporting research is to broadly address what is currently known and what areas of research need to be emphasized to enhance our understanding of the role of dietary AGEs in health and prevention of hypertension.

It was a trigger factor for increasing blood pressure, but there were still few studies related to this. According to research by (8) that people who do not live a healthy lifestyle had a risk factor for hypertension of 0.82 times. Another study by Khotimah (9) showed that people in Indonesia who regulate unhealthy lifestyle behaviors had a 1.5 times higher risk of significantly increasing blood pressure.

The impact of increasing blood pressure conditions is very important to understand. The life safety of people with hypertension is balanced by checking themselves and making appropriate efforts to control blood pressure within normal limits (9). Controlling and preventing blood pressure assessment can begin with the regulation of healthy living behaviors. explained that modification of a healthy lifestyle can be done as an initial step to maintain normal blood pressure (10). This strategy included eating behavior promotion for improving knowledge of modifiable risk factors in young adult age groups in the family and community environment.

Based on the Kota Jambi Health report (2019) showed that most prehypertension incidence for Kota Jambi occurred higher in the Tanjung Pinang Public Health Center than in other public health centers. In addition, hypertension cases increased from 1.6% to 2.3% in 2020. This figure is the productive age (1820 people) higher than those aged 65 years and over (1067 people). Also, based on a field survey of blood pressure measurement data in January 2022, it is known that adults are the biggest group with the most significant increases in blood pressure triggering prehypertension conditions in the community of Tanjung Pinang Public Health center This report also showed that as many as 65% of adult visits had a systolic blood pressure of 120-139 mmHg and a diastolic blood pressure of 80-89 mmHg.

The results of an interview with 15 adults who visited the public health center said that they did not routinely measure blood pressure if the systolic was 120-139 mmHg, diastolic was 80-89 mmHg, so they did not realize that the results of blood pressure measurements were in the category of prehypertension. In addition, it is known that 8 people have high-fat eating habits and like high-glucose intake, 3 people complain of difficulty sleeping when the neck starts to feel stiff and have headaches, 2 people say that they are fine so they rarely go to the health center if they don't have one. significant complaints and 2 other people said that they rarely do sports, the

condition felt by this patient needs attention for Public Health Center officers.

Food intake is associated with the incidence of prehypertension (11). Previously studies assumed that research on the intake of AGEs with prehypertension in adults is still very rare in Indonesia, especially Jambi.. Therefore, this study will be able to strengthen the evidence that supports the importance of dietary intake management in the adults group for the primary prevention of prehypertension in adults. Based on the condition above, this study aims to identify the correlation between AGEs intake and prehypertension incidence among adults

METHOD

This quantitative study was to use a cross-sectional approach (12). The place of study was Tanjung Pinang Public Health Center Kota Jambi. it held on June 2022. This study aimed to identify the correlation between AGEs intake with the incidence of prehypertension in adults.

The study population was the entire adult population who came to visit and got treatment at the Public Health Center in 2020 as many as 1820 people. While the research sample size was calculated using the Lemeshow formula with a 95% confidence degree and 10% precision (12). The study involved the participation of 134 adults by purposive sampling. The inclusion criteria consisted of men or women aged 21-59 years who were recorded for treatment at the Tanjung Pinang Public Health Center in Kota Jambi, who were willing to become respondents by signing the informed consent form, being cooperative, who were be able to read read and to write in Indonesian. The research exclusion criteria were patients who get hospitalization and severe complication

Respondent data was collected by using a questionnaire. The research data included demographic characteristics of age, gender, education level, body mass index (BMI), living together, and family history of hypertension. The independent variable was Advanced Glycation End Products (AGEs) intake. AGEs intake was identified by using the food questionnaire 3 x 24 hours recall to measure the intake of Advanced Glycation End Products (AGEs) respondents during the past week. AGEs intake divided into categories: a low AGEs intake category if the score < the subject's average AGES intake and high AGEs intake if the score > the average AGES intake (13). The dependent variable is prehypertension which is assessed from the results of systolic and diastolic blood pressure measurements using a Riester brand of mercury manual tensimeter. Blood pressure consisted to the systolic pressure results are between 120-139 mmHg, diastolic between 80-89 mmHg is included in the prehypertension category and the category is not prehypertension if systolic blood pressure measurement < 120 mmHg diastolic < 80 mmHg (14).

Data collection activities were carried out after obtaining permission from the head of the Tanjung Pinang Public Health Center Kota Jambi. Next, the researcher met the respondents in the Adult Unit Center and gave related explanations about the process, methods, and benefits of the research. For respondents who have volunteered without coercion to sign the informed consent form, they can participate and fill out the research questionnaire for 30-45 minutes. If the respondent had to ask a question, the researcher provided time to explain again. The application of research ethics is considered in the data storage process and data confidentiality. All research activities were examined and approved by the Health Research Ethics Committee (KEPK) Poltekkes Kemenkes Jambi with ethical letter number LB.02.06/2/122/2022.

The questionnaire data were analyzed in univariate and bivariate. The univariate analysis result is presented in the frequency distribution in table form for each research variable. While the Spearman-rank correlation was used in the bivariate analysis test to identify the relationship between variables and the incidence of prehypertension in adults. The significance level was marked with 0.05. If the p-value <0.05, it means that there is an influence between the variables studied (Ho is rejected) and if the p-value is > 0.005, there is an effect

between the variables studied (Ho is accepted). Data were analyzed using IBM SPSS v.21 software.

RESULT

Study results showed that general characteristic among respondents (Table 1), it is known that 79.1% of early adults, women (66.4%), with basic education level (87.3%), who had normal body mass index (50.7%), and who had no family history of hypertension (85.1%), people living with nuclear family (85.1%), also 60.4% of respondents were categorized high intake of AGEs and 70.9% of respondents with prehypertension.

Tabel 1. General Characteristics

General Characteristics	n	%
Age		
Young adults (21 – 39 tahun)	106	79.1
Adults (40 – 59 tahun)	28	20.9
Gender		
Male	45	33.6
Female	89	66.4
Pendidikan		
Basic level (SD, SMP,SMA)	117	87.3
Advanced level (DIPLOMA, PT)	17	12.7
Body Mass Index (BMI)		
Unnormal	66	49.3
Normal	68	50.7
Living with		
Nuclear Family	114	85.1
Extended Family	20	14.9
Family History Hypertension		
Yes	20	14.9
No	114	85.1
AGEs Intake		
High	81	60.4
Low	53	39.6
Prehypertension		
Yes	95	70.9
No	39	29.1

Table 2. Spearman Rank Analysis

Variable	***p-value***	**r**
AGEs intake with prehypertension	0.000[1]	0.725**

*[1]*p<0.001*

Table 2 presented the b analysis results of the Spearman rank correlation, it was identified a strong relationship between AGEs intake and prehypertension (p = 0.000; r = 0.725).

DISCUSSION

General characteristics of respondents

In this study, most of the female respondents were early adults aged between 21 - 59 years with prehypertension. The adult population had a higher frequency of health

problems than the elderly group (15). In this study, it is also known that adult women have an abnormal BMI category. This refers to health survey result (16), it reported that the incidence of excess body weight is more common among women of early adult age. Abnormal weight affected the increase in uncontrolled blood pressure, and it became the main trigger for non-communicable diseases such as hypertension. In addition, the respondent also currently lived with a nuclear family, and the respondent also does not have a family history of hypertension (17). This condition is supported by Indonesian culture, where adults still live at home with their parents and siblings.

The description of prehypertension was identified in the respondents of this study. This condition can be influenced by several modifiable and non modifiable factors. Prehypertension is signed early warning at a young age which denotes the risk of hypertension later on in life. Two studies performed in Indonesia among young adults aged 18-29 years old demonstrated a prevalence of prehypertension of 34.11% and 30.16% However, both these studies and the present studies were conducted among early adults and adolescents located in an urban area and did not truly represent the general population (18).

Adulthood is a complex transition process of emotional independence and lifestyle, for Indonesian adults were identified as having sedentary behavior, predisposing vulnerable subjects to elevated blood pressure. Most adults prefer to take lunch with meals eaten away from home than to have a home-prepared meal. Eating away from home is linked to higher total energy, fat and salt intake, lower micronutrient intake, and becoming overweight or obese, which may modulate increased blood pressure. A study by (18) found that high AGES food consumption among adults such as junk food and soft drink. This condition revealed poor dietary habits as risk factors for prehypertension for junk food and soft drink consumption.

Prehypertension for adults correlated with adverse dietary practices such as added salt and pickle intake, using butter in meals, and eating junk food (17) . Higher salt intake is associated with higher blood pressure. Another study investigated the association between 24 h sodium excretion and blood pressure and revealed that a higher sodium intake by 2.3 mg/day was reflected in higher SBP 3-6 mm Hg.

In this study, it also was found that most of the respondents did not have unmodifiable factors such as having a family history of hypertension (17). However, there are also known modifiable factors from respondents' behavior such as respondents had high self-esteem, poor sleep quality, high intake of AGEs, and low levels of physical activity (18). The incidence of prehypertension is not realized by adults because it appears without being accompanied by symptoms.

The relationship between AGEs Intake and the incidence of prehypertension in adults

This study shows that there was a strong relationship between AGEs intake (eating pattern) and the incidence of prehypertension among adults in Tanjung Pinang Public Health Centre Kota Jambi (p=0.000). Eating behavior patterns had a big impact on increasing uncontrolled blood pressure among adults, including high AGEs intake.

AGEs, also known as glycotoxins (18)., was a group of highly oxidant compounds and it implicated in the development of diabetes and a number of other chronic diseases. Research by Lube et al, 2020 found that AGEs are formed through a non-enzymatic process of free sugars to free amino acids from proteins, fats, and nucleic acids. The balance of serum AGE levels described the balance between food intake, endogenous formation, and AGEs catabolism (20).

This research supported by (21) investigated that food high in protein and fat has the potential to form AGEs consumption in the cooking process. AGEs levels of carbohydrate sources such as fruit, vegetables, and whole grains can be maintained low after the cooking process such as vinegar or lemon juice, and high AGEs intake can be reduced. The most

effective way to reduce the intake of foods rich in AGEs is to modify their processing methods (21). The process of synthesizing AGEs intake is carried out by an endogenous method, when food is cooked and food is processed through the Maillard reaction. It is a complex, multistep, non-enzymatic reaction initiated by a glycation condensation process between reducing sugars, such as glucose and fructose and the free amino groups of proteins, lipids, and nucleic acids resulting in the formation of Schiff bases. This reaction is a relatively fast and highly reversible process. Furthermore, rearrangement can be done from the Schiff base. This process can also form more stable Amadori products which develop into covalent additions and accumulate in proteins (27) while the results that can be seen in the body from this process are Amadori products; Glycated hemoglobin (HbA1c) serves as an accurate marker of long-term exposure to high circulating glucose. The formation of a reversible product Amadori intermediate in the formation of AGEs levels may be useful for the identification of high-risk patients and provide valuable information for making decisions regarding prehypertension treatment [26]

Research by (22) compared several types of cooking methods and it found that dry heat has the potential to increase AGEs formation 10 to 100 times compared to before processing in all food categories. This result study is also supported by (22) showed that low AGEs food intake was quite easy to implement. In this study adjusted the food processing methods using lower temperatures and higher humidity compared to roasting, and baking or frying processes. Another supporting study by (23) also recommends preferably boiling (stewing, poaching), and avoiding pre-packaged and fast food. Another supporting study by (26) found that healthy adults absorb AGEs rapidly, resulting in a rapid increase in serum AGE levels.

The general public knows the effect of the amount and composition of food on the incidence of hypertension. What has not been noticed is that food preparation has the potential for uncontrolled blood pressure to become a cause of the non-communicable disease diabetes; in the modern era (24). Foods that are processed through high temperature processes (prepackaged & fast food) have a high potential to trigger the formation of these pro-inflammatory AGEs oxidatively. An increasing number of studies point to the potential of AGEs as a high-risk factor for diabetes and its complications. Processing guidelines should also provide recommendations on the method, amount and composition of food according to health recommendations. Another study conducted by (25) investigated that changes in dietary habits were necessary times to achieve optimal long-term effects.

CONCLUSION

The study concluded that AGEs intake had a strong correlation with hypertension incidence among adults in Kota Jambi

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