Relationship between Body Mass Index (BMI) and Physiological Mechanism of Blood Pressure in Vegetarians and Non Vegetarians

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ABSTRACT

The increasingly advanced world will improve human lifestyles, especially their physical, one part of body measurement is body mass index which can be used to measure a person's physical abilities, this is related to human hemodynamics, namely blood pressure, so there needs to be a clear problem solving so that the risk of disease due to blood pressure that we can know earlier by measuring body mass index, The purpose of the study is to determine the relationship between body mass index and the physiological mechanism of blood pressure in vegetarians and non-vegetarians. This type of research is a quantitative type with a survey design with a cross-sectional approach. Samples aged 18-49 years amounted to 25 vegetarians and 25 non-vegetarians, data collection of body mass index with anthropometric tools (scales and meters) while to measure blood pressure with an automatic sphygmomanometer. The results of the study showed that there was a strong positive significant relationship between body mass index and blood pressure with a p-value of 0.000, Thus, along with increasing BMI also increases blood pressure in vegetarians and non-vegetarians.

Keywords: Body Mass Index (BMI), Physiological, Blood Pressure

INTRODUCTION

Anthropometry is an action to measure the physical dimensions of the body. (Kumala et al., 2023, p. 103). BMI is a method of measuring body weight corrected for height and serves as an alternative to the traditional height-weight relationship. (Potter *et al.*, 2021). Body fat is fat located in adipose tissue and other tissues in the body. (Zuniawati, 2019, p. 1).

According to AHA (2020, p. 1336). Normal systolic blood pressure <130 and diastolic <85 mmHg, normal to high values are when systolic 130-139 and/or diastolic 85-89 mmHg, grade 1 hypertension: 140-159 and/or diastolic 90-99 mmHg and grade 2 hypertension: systolic ≥160 mmHg and/or diastolic ≥100mmHg. Physiologically, cardiac output (CO) is the volume of blood ejected from the left ventricle (or right ventricle). The blood pressure (BP) formula is (Delong & Sharma, 2024, p. 2).

The word vegetarian comes from the Latin vegetus, meaning strong, active and passionate. The definition of vegetarian is literally interpreted as a group of people who do not consume all animal meat, be it beef, goat, chicken, fish or other animal meat. Vegetarians consume foods that come from plants and plants have a lower calorie density than foods that come from animals. (Ivanova et al., 2021). In addition to having a lower calorie density, plant foods are also responsible for satiety. When dozens of common foods were studied for their satiety value, the most predictive characteristic was not how little fat or protein they contained, but how much water they contained. Most vegetables are over 90% water by weight, fruits are 80% water, starchy vegetables, and grains are 70% water. Eating a meal with high-

water, low-calorie vegetables can effectively shave 100 calories off a main meal. (Greger, 2020, pp. 2–5). Fat mostly consists of saturated fatty acids (saturated fats) which are found in abundance in meat (red meat). (Tortora & Derrickson, 2014, p. 46).

Whole plant foods tend to be lower in calories so weight gain will not occur even if not restricted because vegetables have less than 100 calories/cup while eggs, beef, pork, poultry have 300-600 calories/cup. Although the vegetarian diet provides beneficial effects, many still assume that the vegetarian diet is prone to deficiencies in several nutrients, namely protein, iron, zinc and vitamin B12. Plant protein has a protein that contains one or more essential amino acids in small amounts. Iron in plant foods is non-heme iron whose absorption process depends on external factors, zinc can be inhibited by phytate and fiber which are abundant in plant foods, while sources of vitamin B mostly come from animal products. Nutritional deficiencies can lead to nutritional deficiency diseases. As long as you eat a variety of plant foods in sufficient quantities, a vegan lifestyle is a nutritionally balanced and very healthy diet. It is the nature of all living things to maintain a healthy body condition and is even influenced by culture and others, research results show that vegetarians have lower gluteofemoral adiposity but similar total fat and lean mass. Vegans have lower fat index in all regions but similar lean mass (Desmond et al., 2021).

Observed differences in biomarker concentrations, including lower C-reactive protein, lower LDL cholesterol, lower vitamin D, lower creatinine, and lower γ-glutamyltransferase, in vegetarians and vegans may be associated with differences in future disease risk. (Tong et al., 2021). Vegetarian dietary patterns are characterized not only by the absence of meat and/or dairy products, but also by increased consumption of plant foods. There is growing evidence that such plant-based dietary patterns are associated with a number of beneficial health effects. (Miles et al., 2022). Vegetarian diets are heterogeneous and their health benefits may vary. This study aimed to compare cardiovascular risk between vegetarian diets that met existing health guidelines, those that did not, and diets that included red meat. (Petermann-Rocha et al., 2023). Vegetarianism is defined as a diet based on abstaining from the consumption of animal products. According to this diet, processed foods have been considered unhealthy, and the consumption of raw plant foods and unprocessed foods has been encouraged, however, these effects have not been fully proven and there are contradictions. (Pahlavani & Azizi-Soleiman, 2023). This is a research finding so researchers are interested in conducting research on this. Relationship between Body Mass Index (BMI) and Physiological Mechanism of Blood Pressure in Vegetarians and Non Vegetarians.

METHODS

This type of research is quantitative with a survey design with a cross-sectional approach, the number of samples is 25 vegetarians and 25 non-vegetarians. Instruments used to collect data

Anthropometric measurements, namely body weight is measured without wearing shoes and light clothing with a digital scale placed on a flat surface. (OneMed, EB 1612H). Height is taken in a standing position with the back of the head, back, buttocks and heels against the wall (GEA Medical). Waist, hip and neck circumferences are taken when respondents are wearing light clothing. Waist measurements are taken at the midpoint between the lower limit of the last palpable rib and the top of the iliac crest; hip circumference is taken at the largest hip area (OneMed, OD235) (Olfert et al., 2022, p. 4)

Before measuring systolic and diastolic blood pressure using an automatic sphygmomanometer (Elvasense, EMS10), all respondents were instructed to empty their bladder and rest for at least five minutes in a room with a comfortable temperature. According to AHA (Unger et al., 2020), normal systolic blood pressure <130 and diastolic <85 mmHg, normal to high values are systolic 130-139 and/or 85-89 mmHg, grade 1 hypertension: 140-159 and/or diastolic 90-99 mmHg and grade 2 hypertension: systolic ≥160 mmHg and/or diastolic ≥100mmHg. The position of blood pressure measurement in a sitting position and the back is supported on a chair, the arm rests on the table with the middle of the arm at heart level and the feet rest on the floor and are advised not to talk during the measurement. In this study using a correlation test, namely the Kendall's tau b test. The Kendall's tau b test is used on independent data groups (unpaired). The level of confidence set by the researcher is 95% therefore the critical value (α) is 0.05.

RESULT AND DISCUSSION

Table 1. Relationship between BMI and Blood Pressure

		Blood pressure				Total	τ	*p-value*
		N	N-T	HT1	HT2			
BMI	**Kr**	**4**	**0**	**0**	**0**	**4**	0,565	0,000
	Vege	2	0	0	0	2		
	NV	2	0	0	0	2		
	Ideal	**17**	**8**	**2**	**0**	**27**		
	Vege	7	6	1	0	14		
	NV	10	2	1	0	13		
	Pra-ob	**2**	**2**	**5**	**1**	**10**		
	Vege	1	1	3	0	5		
	NV	1	1	2	1	5		
	Ob1	**2**	**0**	**4**	**1**	**7**		
	Vege	1	0	1	0	2		
	NV	1	0	3	1	5		
	Ob2	**0**	**0**	**0**	**2**	**2**		
	Vege	0	0	0	2	2		
	NV	0	0	0	0	0		

(Kr= Thin; Ideal= Ideal; Pre-ob= Pre obesity; Ob1= Obesity class 1; Ob2= Obesity class 2; N=Normal, N-T= Normal-High; HT1= Hypertension grade 1; HT2= Hypertension grade 2; Vege= Vegetarian; NV=Non-vegetarian). The results of the Kendall's tau b test show a p-value of 0.000, which is less than the critical value (α -0.050) so that H0 is rejected. In addition, from the correlation coefficient value (τ = 0.565) it can be concluded that there is a strong correlation with a positive direction (+). This also applies to the vegetarian and non-vegetarian groups. So it can be concluded

that there is a strong positive significant relationship between body mass index and blood pressure. Thus, along with increasing BMI also increases blood pressure in vegetarians and non-vegetarians (τ = 0.548; p = 0.002 & τ = 0.583; p = 0.001).

The results of the study showed that there was a significant relationship between body mass index and blood pressure with a positive and strong correlation direction overall (τ=0.565; p= 0.000). The findings of this study indicate that some of the total respondents have an ideal BMI with a blood pressure classification that is also normal. The higher the BMI classification, the fewer respondents have normal blood pressure. These results are in line with research conducted by Mariha *et al.* (2019, p. 233) that the percentage of people with an ideal BMI, few have high blood pressure compared to obese BMI.

In addition, this finding was also significant in the vegetarian group (τ= 0.548; p= 0.002) and non-vegetarian (τ=0.583; p= 0.001). In the vegetarian group, the mean BMI was higher (25.068 kg/m2) and tended to have higher mean blood pressure both systolic (127.56 mmHg) and diastolic (85.04 mmHg). The lowest BMI in this group was 17.4 kg/m2 (thin) with blood pressure of 104/74 mmHg (normal). The highest BMI was 39.2 kg/m2 (class 2 obesity) with higher blood pressure both systolic 158 mmHg and diastolic (110 mmHg) (grade 2 hypertension).

In the non-vegetarian group, the average BMI was lower (24.088 kg/m2) compared to vegetarians, as well as the average blood pressure was lower both systolic (126.4 mmHg) and diastolic (81.88 mmHg). The lowest BMI in non-vegetarians was 16.2 kg/m2 (thin) with blood pressure of 111/76 mmHg (normal). The highest BMI in this group was 34.5 kg/m2 (class 1 obesity) with blood pressure of 158/93 mmHg (grade 1 hypertension).

In theory, anthropometry is related to hemodynamics, that is, obesity affects SV due to increased blood volume. According to AHA (2021, p. e994) The increased circulating blood volume factor in obesity is associated with excess adiposity that drives changes in cardiac function both directly through effects on the myocardium and blood vessels, and indirectly through obesity-related comorbidities. Excessive accumulation of adipose tissue causes hemodynamic changes, including higher blood volume and cardiac output. In addition, obesity has an increased total length of blood vessels which can also cause increased blood volume. (Tortora & Derrickson, 2014).

CONCLUSION

There is an anthropometric relationship, namely BMI with hemodynamics (blood pressure) with a positive and strong correlation direction (τ=0.565; p= 0.000), which also applies to vegetarians and non-vegetarians.

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