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RESEARCH ARTICLES

Percentage of Visceral Fat Associated with Blood Pressure in Type II DM Patients at Hajj Medan Hospital

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Abstract: Diabetes mellitus is a metabolic disorder with chronic hyperglycemia due to genetic and lifestyle interactions. Type 2 diabetes and hypertension are often comorbidities because they share risk factors such as endothelial dysfunction, vascular inflammation, atherosclerosis, dyslipidemia, and obesity. Increased blood pressure in diabetics is triggered by hyperinsulinemia, insulin resistance, and sleep apnea. Visceral fat also plays an important role in the development of hypertension, especially in adulthood. This study aims to determine the relationship between visceral fat percentage and blood pressure in Type II DM patients at Haji Medan Hospital The research conducted was observational analytical research with *a cross sectional* approach. The largest age group is 50–59 years old and the most gender is male (53.6%). The most blood pressure category is grade I hypertension (50.7%), and the most visceral fat category is high (10–14%). Systolic blood pressure had an average value of 142.4 mmHg, diastolic 81.8 mmHg, and MAP 102 mmHg. The correlation of blood pressure with visceral fat has a coefficient of 0.14 which indicates a moderate relationship. The correlation of systolic and visceral fat (r = 0.350) showed a low relationship, while the correlation of diastolic and visceral fat (r = 0.416) showed a moderate relationship. The most patients diagnosed with type 2 DM at Haji Medan Hospital are male with a percentage of 53.6% with the highest age range of 50-59 years, there is a positive correlation between the percentage of visceral fat and blood pressure, both systolic and diastolic.

Keywords: Diabetes mellitus, sistolic, diastolic, visceral fat, correlation

INTRODUCTION

Diabetes mellitus is a metabolic condition characterized by chronic hyperglycemia and the result of an interaction between genetic and lifestyle factors.[1] Diabetes mellitus is a metabolic condition characterized by chronic hyperglycemia and the result of an interaction between genetic and lifestyle factors. According to the International Diabetes Federation (IDF), there are estimated that in the world there are 415

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million people with diabetes mellitus, 91% of whom have type 2 diabetes mellitus. Of the entire world's population, 8.8% are diabetics and the IDF predicts that the number of diabetes cases will increase to 642 million by 2040.[2] The prevalence of type 2 diabetes mellitus continues to increase, in Indonesia, according to data from the International Diabetes Federation (IDF) Atlas in the 10th edition of this year, 19.5 million people with diabetes mellitus reached 19.5 million people. Referring to 2017 data, there are 34,978 people with diabetes mellitus in the Medan area.[3,4]

The World Health Organisation (WHO) warns that the prevalence rate of people with diabetes mellitus in Indonesia will continue to increase which is estimated to be 21.3 million by 2030.[3] A surge in incidents can occur if the state is not serious about prevention and handling efforts. The highest prevalence of diabetes mellitus is found in residents with the age of >60 years. The results of the 2018 Basic Health Research (Riskesdes) show that the prevalence of diabetes mellitus in Indonesia based on a doctor's diagnosis at the age of 15 years is 2%.[4] This figure shows an increase compared to the case of diabetes mellitus at the age of 15 years in the 2013 Riskesdes results of 1.5% where the prevalence of diabetes mellitus in urban areas reached 5.7% and 73.7% of people with diabetes mellitus were undiagnosed and did not take medication. Globally, the prevalence of diabetes mellitus has increased due to one factor, obesity. The prevalence of overweight attributed to an individual's body mass index (BMI) will increase to 57.8% by 2030 in the global adult population.[5]

Type 2 diabetes mellitus and hypertension are common comorbidities. Diabetes and hypertension are closely linked to similar risk factors, such as endothelial dysfunction, vascular inflammation, artery remodelling, atherosclerosis, dyslipidemia, and obesity.[2] Hypertension is twice as common in patients with DM compared to those who do not have DM. In addition, patients with hypertension often show insulin resistance and are at greater risk of diabetes.[6] The interconnectedness between these circumstances can be a threat to a person's quality of life.

The increase in blood pressure is caused by an increase in plasma volume and also an increase in cardiac output related to *hyperinsulinemia*, insulin resistance, and also *sleep apnea syndrome* which is also related to diabetics such as insulin resistance. In addition to the different features in the pathophysiology of hypertension in youth, there is growing evidence that *visceral fat,* along with environmental factors associated with today's lifestyle, may play a role in the development of increased blood pressure.[8]

Poor visceral distribution is one of the key predictors of hypertension in people with type 2 diabetes. It has been shown that individuals with excess *visceral fat* (VF) are prone to developing abnormal lipid profiles, abnormal glucose tolerance, high blood pressure, and other disorders often

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associated with metabolic syndrome. *Visceral fat* is more harmful than subcutaneous fat because the fat cells of visceral fat release proteins that contribute to inflammation, atherosclerosis, dyslipidemia, and hypertension. As a result, visceral adipose tissue may be more closely associated with type 2 diabetes than other obesity indices. Some studies have suggested that a high body mass index and visceral fat may be associated with hypertension in patients with type 2 DM.[9]

Based on the explanation above, there have not been many studies that explain the relationship between visceral fat and blood pressure in patients with type 2 diabetes, so researchers want to conduct research on the relationship between visceral fat and blood pressure in patients with type 2 diabetes at Haji Medan Hospital.

METHOD

This study used a cross-sectional *analytical observational design* to find the compatibility of the specified free variable (*visceral fat*) with the bound variable (blood pressure). This research was conducted at the Internal Medicine Polyclinic of Haji Medan Hospital on Jl. H. Hospital no. 47 Kenangan Baru, Percut Sei Tuan District, Deli Serdang Regency, North Sumatra in June 2022 - April 2023. The population taken in this study is patients with type 2 DM at the Endocrine Polyclinic of Haji Medan Hospital who have been confirmed with medical records in the period from February to May 2023.

The data analysis used consisted of univariate and bivariate analysis. Univariate analysis was used to describe the characteristics of the data, while bivariate analysis was used to determine the relationship between visceral fat variables and blood pressure. The results of the correlation test are indicated by the value of the correlation coefficient (r) which describes the direction and strength of the relationship. The entire analysis process was carried out using *Statistical Product and Service Solutions* (SPSS) software.

RESULT

Table 1. Respondent Profile

Result	Frequency	Presentase (%)
Gender		
Woman	32	46,4
Man	37	53,6
Age		
40-49 y.o	24	34,8
50-59 y.o	45	65,2
Total	69	100

Based on table 1 above, it can be seen that the majority of respondents in this study are male and are in the age range of 50–59 years. This shows that this age group is more dominant in the sample studied.

Table 2: Blood Pressure

Blood pressure	Frequency	Percentage(%)
Optimal	8	**11,6**
Normal	6	8,7
Normal Tinggi	10	14,5
Hypertension Degree I	35	50,7
Hypertension Grade II	10	14,5
Total	69	100

Based on table 2, it can be seen that most of the respondents in this study are in

BULETIN FARMATERA
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the category of degree I hypertension, while the smallest proportion is in the category of normal blood pressure. This indicates a high prevalence of hypertension in patients.

Table 3: Visceral Fat

Visceral Fat	Frekuensi	Persentase(%)
Normal	9	13
High rate	31	44,9
Very high rates	29	42,0
Total	**69**	**100**

Based on table 3, it can be seen that the majority of respondents have visceral fat levels that are in the high and very high categories, indicating a tendency to accumulate fat in the abdominal cavity which can increase health risks, including hypertension and metabolic diseases.

Table 4: Descriptive Statistics of Visceral Fat, Systolic, Diastolic, and MAP Blood Pressure in Respondents

Data Criteria	Visceral Fat (%)	Systolic (mmHg)	Diastolic (mmHg)	MAP (mmHg)
N	69	69	69	69
Mean	13.5	142.4	81.8	102
Median	14	145	82	102.7
Modus	16	149	82	102
Min	6	97	61	73
Max	23	174	101	123.3

Table 4 shows that respondents generally have *high levels of visceral fat* and blood pressure (systolic, diastolic, and MAP). This indicates a significant potential risk of hypertension in this group. These data are important for analyzing the relationship between visceral fat and blood pressure in patients with type 2 diabetes.

Table 5: Relationship *of Visceral Fat* to Blood Pressure

Variabel		Spearman (r)	P
Visceral Fat (%)	Diastolic	0.416	0.000
	Sistolic	0.35	0.000

Based on Table 5, it can be seen that there is a significant relationship between visceral fat and blood pressure, both diastolic and systolic, with *a p* value of < 0.05. The correlation between visceral fat and diastolic blood pressure showed moderate relationship strength (r = 0.416), while systolic blood pressure showed weak relationship strength (r = 0.35). Both relationships are positive, which means that the higher visceral fat, the higher the blood pressure.

The Relationship Between Visceral Fat and Systolic Blood Pressure

The results showed a positive correlation between visceral fat and systolic blood pressure in patients with type 2 Diabetes Mellitus with a significance value of 0.000 (<0.05). In addition, the correlation coefficient obtained has a positive value, which is 0.350. This means that the higher the visceral fat level, the higher the systolic blood pressure in patients with type 2 diabetes mellitus. Increased visceral fat can also affect the function of the endothelial, which is the inner lining of blood vessels. Impaired endothelial function can lead to narrowing of blood vessels and increased blood vessel resistance, which in turn can increase systolic blood pressure.[10]

This study is in line with the research of Malden et al (2019) on the relationship between visceral fat and subcutaneous fat measured by the BIA (*Bioelectric Impedance Analysis*) method on blood

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pressure in students of the Faculty of Medicine, Islamic University of Indonesia. The results of the study showed that with a significance of p=0.002, visceral fat had a significant relationship with systolic blood pressure.[11] This is different from a study conducted by Muqorrobin (2022) on the elderly of Jomblang Village, where the study found that visceral fat was not significantly related to systolic blood pressure. [12]

The difference in the results of this study can be caused by several factors. One of them is confounding factors that are not fully controlled in the study. The presence of co-occurring factors such as differences in lifestyle, diet, or drug use that are not fully measured or controlled in the study may cause differences in outcomes.

The Relationship Between Visceral Fat and Diastolic Blood Pressure

The results showed a significant positive correlation between visceral fat and diastolic blood pressure in patients with type 2 diabetes mellitus. The results of the statistical analysis showed that the significance value was 0.000 (<0.05), indicating a high level of confidence. A positive correlation coefficient of 0.416 indicates that the higher the visceral fat level, the higher the diastolic blood pressure in patients with type 2 diabetes. In other words, the results of this study provide strong evidence of a reliable relationship between visceral fat levels and diastolic blood pressure in this population.

This study is in line with the research of Malden et al (2019) on the relationship between visceral fat and subcutaneous fat measured by the BIA (*Bioelectric Impedance Analysis*) method on blood pressure in students of the Faculty of Medicine, Islamic University of Indonesia. The results of the study showed that with a significance of p=0.003, visceral fat had a significant relationship with diastolic blood pressure.[11] This is different from the study conducted by Muqorrobin (2022) on the elderly of Jomblang Village, where the study found that visceral fat did not have a meaningful relationship with diastolic blood pressure.[12]

Overall, these findings provide a deeper understanding of the relationship between visceral fat and diastolic blood pressure in patients with type 2 Diabetes Mellitus. This provides support for the important role of visceral fat in blood pressure regulation in diabetic patients, and highlights the importance of visceral fat management in diastolic blood pressure control in patients with type 2 Diabetes Mellitus.

The Relationship Between Visceral Fat and Blood Pressure

The study at Haji Medan Hospital aims to evaluate the relationship between visceral fat levels and blood pressure in patients with type 2 Diabetes Mellitus. The research method used using the measurement of visceral fat levels can provide important information in the

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management of patients with type 2 diabetes mellitus, especially in cardiovascular risk monitoring. Therefore, it is important for patients with type 2 Diabetes Mellitus to evaluate visceral fat levels.

The results showed a positive correlation between visceral fat and blood pressure in patients with type 2 diabetes mellitus. This relationship can be explained by complex pathophysiological mechanisms, including insulin resistance, inflammation, and impaired endothelial function associated with increased visceral fat.[13] These results demonstrate the importance of attention to the reduction of visceral fat as part of a therapeutic approach in patients with type 2 Diabetes Mellitus. Visceral fat reduction strategies can involve lifestyle changes, such as a balanced diet, increased physical activity, and weight management. Through a decrease in visceral fat levels, it can be expected to reduce blood pressure and improve blood sugar control in patients, as well as a reduction in the risk of cardiovascular complications associated with type 2 diabetes mellitus.[13]

The results of this study are in line with a study by Malden et al (2019) who conducted a study on body fat distribution and blood pressure in 10,000 adults with whole-body imaging based on the UK Biobank and Oxford Biobank.[11] These findings strengthen the understanding of the importance of the role of visceral fat in the regulation of blood pressure and cardiovascular risk. In addition, this study could serve as a theoretical basis for exploring pathophysiological mechanisms that identify more specific and effective treatment strategies in managing blood pressure in patients with type 2 diabetes mellitus.

The relationship between visceral fat and blood pressure in type 2 Diabetes Mellitus patients at Haji Medan Hospital has important implications in the management of the disease. Visceral fat, which is closely linked to abdominal obesity, has been shown to be an important risk factor in increasing blood pressure in the general population. However, in the context of patients with type 2 Diabetes Mellitus, increased visceral fat levels may be more significant due to the interaction with insulin resistance and systemic inflammation that accompanies type 2 diabetes mellitus.

These findings suggest that attention to reducing visceral fat levels is an important aspect in the management of type 2 Diabetes Mellitus patients to control blood pressure and prevent cardiovascular complications. Through an approach that focuses on reducing abdominal fat, including visceral fat, patients can experience improvements in blood sugar control as well as a reduced risk of hypertension and cardiovascular disease. Management strategies that involve healthy lifestyle changes, such as increased physical activity and the adoption of a balanced diet, can help reduce visceral fat levels and contribute to blood pressure control in patients with type 2 Diabetes Mellitus.[13]

The relationship between visceral fat and blood pressure in patients with type 2

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Diabetes Mellitus at Haji Medan Hospital has become the focus of research. Visceral fat, which is fat that accumulates around internal organs, has been linked to an increased risk of hypertension or high blood pressure. In patients with type 2 diabetes mellitus, increased visceral fat can worsen blood sugar control and increase the risk of cardiovascular complications, including hypertension.[14] Therefore, the reduction of visceral fat through healthy lifestyle changes and proper management can be an important approach in the management of patients with type 2 Diabetes Mellitus.

In addition, in this study the average MAP value was about 102 mmHg, reflecting the arterial pressure that the subjects in the sample might experience. These parameters are useful in health monitoring and the potential diagnosis of blood pressure disorders as well as the risk assessment of cardiovascular disease. In this context, high visceral fat can negatively impact MAP through several mechanisms. First, visceral fat can trigger chronic inflammation that damages the walls of blood vessels and stimulates the release of chemicals that increase blood vessel contraction, resulting in increased blood vessel resistance and blood pressure. Second, excessive visceral fat is also associated with insulin resistance, which can affect blood pressure regulation through impaired endothelial function of blood vessels. This imbalance can lead to increased arterial pressure.[13]

Thus, monitoring visceral fat percentage and MAP can be an important tool in efforts to prevent cardiovascular disease and hypertension. Recognizing the relationship between these two factors can help individuals and medical personnel take more effective preventive measures and plan appropriate interventions to maintain cardiovascular health.

CONCLUSION

The results of the study showed that there was a positive relationship between blood pressure, both systolic and diastolic, and the percentage of visceral fat in patients with type 2 diabetes mellitus. The correlation between overall blood pressure and diastolic blood pressure to visceral fat showed a strength of correlations, while the relationship between systolic blood pressure and visceral fat showed a mild correlation. This indicates that increased visceral fat is associated with increased blood pressure in patients with type 2 diabetes.

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