



Overview of Hypertension Incidence in People with Diabetes Mellitus in Indonesia

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ABSTRACT

Individually, hypertension or DM increases the risk of cardiovascular disease and the risk increases sharply when the two coexist and it cause a premature death. This quantitative descriptive study with a cross-sectional design aims to describe the prevalence and risk factors for hypertension in people with diabetes mellitus (DM) in Indonesia. After going through the data cleaning process, as many as 11644 participants obtained from the 2018 RISKESDAS secondary data were recruited in this study. The results showed that the prevalence of hypertension in People with Diabetes Mellitus in Indonesia was 37,4%. The majority of People with Diabetes Mellitus in Indonesia who suffer from hypertension are female, aged ≥ 45 years, have low education, have DM duration in the old category (≥ 10 years), lack of physical activity, lack of fruit and vegetable consumption, eat fatty foods < 1 serving/day, having obesity and having mental-emotional disorders.

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1. INTRODUCTION

Based on data from the International Diabetes Federation, Indonesia is ranked 7th in the world with 10.7 million cases in 2019 (International Diabetes Federation, 2019). The trend of increasing DM prevalence in Indonesia has been seen since 2007 by 5.7%, increasing in 2013 by 6.9% and showing a more significant increase at 8.5% in 2018 (Ministry of Health of the Republic of Indonesia, 2007; 2013; 2018). Even the prevalence of hypertension has also increased in Indonesia, namely in 2013 from 25.8% increased to 34.11% in 2018 (Kementrian Kesehatan RI, 2018). This prevalence rate is still very far from the indicator figures discussed by the Indonesian government in the 2015-2019 National Action Plan for the Management of Non-Communicable Diseases, which is to reduce the prevalence of high blood pressure in the population aged >18 years, with a prevalence rate of 23.4% (Kementrian Kesehatan RI, 2018).

Changes in people's lifestyles, specifically inactivity and poor consumption patterns, may contribute to the increase in people with diabetes in Indonesia, similar to what has occurred in several other countries worldwide (Sluik D et al, 2014). Diabetes mellitus with complications is the third leading cause of death in Indonesia. From 2007 to 2016, Indonesia saw a 5.7% increase in cases of diabetes mellitus, rising to 6.9% in 2016. The increase in DM cases continues; in 2013, there were DM cases; in 2018, there were DM cases at a rate of 1.3% to 1.5%; this increase indicates that this disease is becoming more prevalent in the community (Kementrian Kesehatan RI, 2018).

Consumption of high-glucose foods is one of the triggers of diabetes. High-glucose foods are those that have a high Glycemic Index (GI). When eating foods with a high Glycemic Index (GI), blood sugar levels rise rapidly, whereas when eating foods with a low Glycemic Index (GI), blood sugar levels remain stable. If you regularly consume foods with a high Glycemic Index (GI), your risk of developing diabetes tends to increase (Marine, 2015). Consumption of high-glucose foods and beverages increases the risk of developing diabetes mellitus; this is inextricably linked to an increase in blood glucose levels. It is hoped that patients with diabetes mellitus can maintain control of their blood glucose levels by avoiding foods high in sugar (Soviana, 2020; Fatimah, 2020).

Individually, hypertension or Diabetes Mellitus increases the risk of cardiovascular disease and the risk increases sharply when the two coexist and even result in premature death (Yu, 2015). Furthermore, the development of hypertension in DM patients complicates treatment strategies and increases health care costs (Aroda, 2017). Several hypotheses are thought to explain the pathogenic relationship between hypertension and diabetes mellitus, and these include (i) insulin resistance producing stimulatory effects on the sympathetic nervous system and the renin-angiotensin system and (ii) abnormalities in catecholamine and sodium metabolism. However, hypertension is asymptomatic and is usually diagnosed incidentally or after major organ damage has occurred (Susanti, 2020b). It is clear that the coexistence of these two conditions in patients poses an excessive risk for micro- and macro-vascular complications, and mortality. A Framingham study, one of the largest meta-analysis surveys, showed a strong association between the two diseases (Fox, 2015).

Ignoring cofactors or risk factors for hypertension in People with Diabetes Mellitus means failing to treat the diabetics as a whole and losing the opportunity to control cardiovascular disease in the most vulnerable diabetics (Khisore, 2018). Based on the data and facts above, the researcher is interested in conducting a study entitled "Overview of Hypertension Incidence in People with Diabetes Mellitus in Indonesia". This study aims to

describe the prevalence and risk factors for hypertension in People with Diabetes Mellitus in Indonesia.

2. Research Methode

This study is a quantitative descriptive study with a cross-sectional design conducted in Indonesia in 34 provinces in Indonesia. This study uses secondary data from Basic Health Research (RISKESDAS). The research on the 2018 Basic Health Research was carried out in March 2018 and then the researchers conducted further research in December 2020 to June 2021 which was carried out in Medan City, North Sumatra Province.

The population in this study were individuals aged 15 years who were the sample at Basic Health Research (RISKESDAS) in 2018. The inclusion criteria in this study were individuals aged 15 years who were diagnosed with DM. Meanwhile, the exclusion criteria in this study were pregnant women and missing individual data. After the researcher got the raw data from Basic Health Research 2018, which was 13,192, then the researchers cleaned the data so that the final sample used in this study was 11,644 samples. This study used the RKD18 Individual Instrument questionnaire in Basic Health Research. Analysis of the data used in this study using univariate data analysis to see the description of the prevalence and risk factors for the incidence of hypertension in People with Diabetes Mellitus in Indonesia.

3. RESULT AND ANALYSIS

This study was conducted to determine the level of satisfaction of outpatients on the quality of pharmaceutical services at the UPTD Public Health Centre DTP Bandar.

Table 1. Prevalence of Hypertension Incidence in People with Diabetes Mellitus in Indonesia

Variable	n	%	95% CI	
			Lower	Upper
Hypertension				
Yes	4354	37.4	36.5	38.3
No	7290	62.6	61.7	63.5

This study indicates that the prevalence of hypertension in People with Diabetes Mellitus in Indonesia is 37.4% (95% CI = 36.5 - 38.3).

Table 2. Distribution of Characteristics of People with Diabetes Mellitus in Indonesia

Variable	n	%	95% CI	
			Lower	Upper
Gender				
Female	7240	62.2	61.3	63.1
Male	4404	37.8	36.9	38.7

Age				
≥ 45 Years Old	10077	86.5	85.9	87.2
< 45 Years Old	1567	13.5	12.8	14.1
Last Education				
Low	7325	62.9	62.0	63.8
High	4319	37.1	36.2	38.0
DM duration				
Old (≥ 10 Years)	2543	21.8	21.1	22.5
Early (< 10 Years)	9101	78.2	77.5	78.9

This study indicates that the majority of participants in this study were female, namely 4404 (62.2%; 95% CI = 61.3 - 63.1). The majority of participants aged 45 years were 10077 participants (86.5% 95% CI = 85.9 - 87.2). Furthermore, the majority of participants' last education was in the low category (no school, finished elementary and junior high school/equivalent) as many as 7325 participants (62.9%; 95% CI = 62.0 - 63.8). As for the DM duration variable, 2543 (21.8% ; 95% CI = 21.1 - 22.5) participants were in the old category (10 years).

Table 3. Distribution of Obesity Status of People with Diabetes Mellitus in Indonesia

Variable	n	%	95% CI	
			Lower	Upper
Obesity				
Yes	5550	47,7	46.8	48.6
No	6094	52,3	51.4	53.2

Based on Table 3, it is known that as many as 5550 (47.7%; 95% CI = 46.8 - 48.6) participants were in the obese category.

Table 4. Behavioral Distribution of People with Diabetes Mellitus in Indonesia

Variable	n	%	95% CI	
			Lower	Upper
Physical Activity				
Less	2501	21.5	2.,8	22.2
Enough	9143	78.5	77.8	79.2
Consumption of Fatty Foods				
1 serving/day	4051	34.8	34.0	35.7
< 1 serving/day	7593	65.2	64.3	66.0
Consumption of Fruit and Vegetables				
Less (< 5 servings/day)	9644	83.9	83.2	84.5
Enough (≥ 5 servings/day)	1853	16.1	15.5	16.8

Based on Table 4, it is known that as many as 2501 participants did physical activity in the less category (21.5%; 95% CI = 20.8 - 22.2).. Furthermore, as many as 4051 participants (34.8%; 95% CI = 34.0 - 35.7) consumed 1 serving of fatty foods. A total of 9644 participants (83.9%; 95% CI = 83.2 - 84.5) consumed fruits and vegetables in the less category.

Table 5. Distribution of Mental-Emotional Disorders in People with Diabetes Mellitus in Indonesia

Variable	n	%	95% CI	
			Lower	Upper
Mental-Emotional Disorders				
Yes	2151	18.5	17.7	19.2
No	9493	81.5	80.8	82.3

Based on Table 5, it is known that DM sufferers experience mental-emotional disorders as many as 2151 participants (18.5%; 95% CI = 17.7 - 19.2).

Table 6. Distribution of Risk Factors for Hypertension Incidence in People with Diabetes Mellitus in Indonesia Based on Gender

Variable	Hypertension			
	Yes		No	
Gender	n	%	n	%
Female	3013	41.6	4227	58.4
Male	1341	30.4	3063	69.6

This study indicates that The majority of People with Diabetes Mellitus who also suffer from hypertension are female, namely 3013 participants (41.6%).

Table 7. Distribution of Risk Factors for Hypertension Incidence in People with Diabetes Mellitus in Indonesia Based on Age

Variable	Hypertension			
	Yes		No	
Age	n	%	n	%
≥ 45 Years Old	3971	39.4	6106	60.6
< 45 Years Old	383	24.4	1184	75.6

Based on Table 7, it is known that the majority of People with Diabetes Mellitus who also suffer from hypertension are in the age category ≥ 45 years, as many as 3971 participants (39.4%).

Table 8. Distribution of Risk Factors for Hypertension Incidence in People with Diabetes Mellitus in Indonesia Based on Recent Education

Variable	Hypertension			
	Yes		No	
Last Education	n	%	n	%
Low	2905	39.7	4420	60.3
High	1149	33.5	2870	66.5

Based on Table 8, it is known that the majority of People with Diabetes Mellitus who also suffer from hypertension are in the low education category, namely as many as 2905 participants (39.7%).

Table 9. Distribution of Risk Factors for Hypertension Incidence in People with Diabetes Mellitus in Indonesia Based on DM Duration

Variable	Hypertension			
	Yes		No	
DM Duration	n	%	n	%
Old (≥ 10 Years)	1009	39,7	1534	60,3
Early (< 10 Years)	3345	36,8	5756	63,2

This study indicates that as many as 1009 (39.7%) People with Diabetes Mellitus who also suffered from hypertension had DM duration in the old category (≥ 10 years).

Table 10. Distribution of Risk Factors for Hypertension Incidence in People with Diabetes Mellitus in Indonesia Based on Physical Activity

Variable	Hypertension			
	Yes		No	
Physical Activity	n	%	n	%
Not Enough	1082	43.3	1419	56.7
Enough	3272	35.8	5871	64.2

This study indicates that as many as 1082 (43.3%) People with Diabetes Mellitus who also suffer from hypertension are in the category of less physical activity.

Table 11. Distribution of Risk Factors for Hypertension Incidence in People with Diabetes Mellitus in Indonesia Based on Consumption of Fruits and Vegetables

Variable	Hypertension			
	Yes		No	
Consumption of Fruits and Vegetables	n	%	n	%
Kurang (< 5 servings/day)	3658	37.9	5986	62.1
Cukup (≥ 5 servings/day)	647	34.9	1206	65.1

This study indicates that the majority of People with Diabetes Mellitus who consume less fruit and vegetables also suffer from hypertension, namely 3658 participants (37.9%).

Table 12. Distribution of Risk Factors for the Incidence of Hypertension in People with Diabetes Mellitus in Indonesia Based on Fatty Food Consumption

Variable	Hypertension			
	Yes		No	
Consumption of Fatty Foods	n	%	n	%
≥ 1 serving/day	1472	36.3	2579	63.7
< 1 serving/day	2882	38.0	4711	62.0

This study indicates that that as many as 1472 (36.3%) People with Diabetes Mellitus who also suffer from hypertension are in the category 1 serving/day consuming fatty foods.

Table 13. Distribution of Risk Factors for Hypertension Incidence in People with Diabetes Mellitus in Indonesia Based on Obesity Status

Variable	Hypertension			
	Yes		No	
Obesity	n	%	n	%
Yes	2336	42.1	3214	57.9
No	2018	33.1	4076	66.9

Based on Table 13 it is known that the majority of People with Diabetes Mellitus who also suffer from hypertension are in the obesity category as many as 2336 (42.1%).

Table 14. Distribution of Risk Factors for Hypertension Incidence in Diabetics in Indonesia Based on Mental-Emotional Disorders Status

Variable	Hypertension			
	Yes		No	
Mental-Emotional Disorders Status	n	%	n	%
Yes	990	46.0	1161	54.0
No	3364	35.4	6129	64.6

Based on Table 14, it is known that as many as 990 (46.0%) People with Diabetes Mellitus who also suffer from hypertension are in the category of experiencing mental-emotional disorders.

4. Discuss

The prevalence of hypertension in people with Diabetes Mellitus varies worldwide. The prevalence of hypertension in people with Diabetes Mellitus in Indonesia is 37.4%. This study is not much different from the Tripathy study (Tripathy, 2017) where the prevalence of hypertension in people with Diabetes Mellitus in his study was 36%. However, the prevalence of hypertension in people with Diabetes Mellitus in Iraq reached 89.6%. The difference in prevalence in each country occurs because of the different characteristics of the participants in each study.

Hypertension along with DM is a strong cause of vascular complications and a major cause of morbidity and mortality. In Kilonzo's study (Kilonzo, 2017) it was reported that the most common complications of hypertension in people with Diabetes Mellitus were peripheral neuropathy, 23 (11.2%), stroke, 21 (10.2%), and chronic kidney disease, 16 (7.8%). In fact, mortality increases by 7.2 times when HTN is present in People with Diabetes Mellitus (Amoussou-Guenou, 2015). Hypertension in diabetes is generally associated with hyperinsulinemia resulting in increased renal sodium resistance and/or sympathetic nervous system activity. Hyperinsulinemia induces hypertension through increased insulin resistance, renal tubular reabsorption of Na⁺ and water, increased sympathetic nervous system activity, proliferation of vascular smooth muscle cells and changes in transmembrane cation transport (Alabi A. N. et al, 2014).

The majority of participants in this study were female, which was 62.2%. This is in line with the research by Guenou (Amoussou-Guenou, 2015) which showed that 66% of women represented the participants. The majority of the incidence of hypertension occurred in female participants, namely 41.6%. This is also not much different from the research by Guenou (Amoussou-Guenou, 2015) which showed 49.5% of the incidence of hypertension in female participants. Possible explanations for the occurrence of hypertension in female People with Diabetes Mellitus are lower adherence to prescription drugs or lifestyle recommendations and physiological differences due to vascular stiffness and the hormone estrogen (Coylewright et al., 2008).

The results of this study showed that the majority of the participants were 86.5% aged ≥ 45 years. From this study, it is also known that the incidence of hypertension in People with Diabetes Mellitus in Indonesia is the majority in the age group ≥ 45 years, which is 39.4%. These results are the same as the results of Tadesse's research (Tadesse, 2018) which

showed a much higher prevalence of hypertension among the group of People with Diabetes Mellitus aged ≥ 45 years, which was 20%.

Previous studies have confirmed that age is a significant variable (p value <0.001) with the incidence of hypertension in diabetics (Franklin, 2017). Increasing age (aging) is generally associated with a decrease in various physiological functions. By having pathophysiological implications in People with Diabetes Mellitus, it can lead to the incidence of hypertension (Lindholm, 2002). In fact, the vascular system changes with age due to changes and the relative reduction of elastic fibers that are replaced by collagenous tissue in the arterial walls. This evolution induces more arterial stiffness which contributes to an increase in blood pressure (Amoussou-Guenou, 2015). High blood pressure is gradual in the early stages and may take at least 10-15 years to fully develop, which means increasing age is associated with the appearance of symptoms and complications of hypertension among People with Diabetes Mellitus.

Education is related to the individual's ability to receive information and process that information which in the end can determine his behavior which in terms of health education has an important role in the health status of the individual. Therefore, when an individual has a high education, it will be easier for him to receive and manage the information he has obtained properly. Otherwise, when individuals have low education, it will be increasingly difficult to receive information and manage the information they get (Soekidjo Notoadmodjo, 2010). The results of this study indicate that the majority of participants in this study have the latest education in the low category, namely 62.9%, of which 39.7% suffer from hypertension. Education is a modifiable risk factor. Providing health education on how to prevent the incidence of hypertension for diabetics with low education will help diabetics to obtain a healthy lifestyle so as to reduce the risk of hypertension in diabetics.

The results of this study indicate that 21.8% of People with Diabetes Mellitus in Indonesia have DM duration ≥ 10 years with 39.7% of them suffering from hypertension. The results of this study are not much different from the research conducted by Guenou (Amoussou-Guenou, 2015) in Benghazi that 33.8% of People with Diabetes Mellitus who have DM duration ≥ 10 years suffer from hypertension. The duration of DM is a risk factor that is almost always present at every stage of hypertension suffered by diabetics (Kemche, 2020). The duration of DM is theoretically related to chronic hyperglycemia resulting in endothelial damage that causes thickening of the arterial walls and then increases blood pressure (Amoussou-Guenou, 2015). In addition, changes caused by DM, such as microvascular damage, sympathetic damage, increased renin-angiotensin system, and decreased insulin sensitivity will be more severe and worsen hypertension. The duration of DM is a risk factor variable that cannot be modified so that the way to reduce the risk of hypertension in People with Diabetes Mellitus is to manage a healthy lifestyle such as doing adequate physical activity, a balanced diet and controlling body weight. Physical activity is the movement of body parts that produce energy that has great benefits for the body, spirit and quality of a healthy lifestyle (Serly, 2015; Siregar, 2020).

Previous studies have shown that People with Diabetes Mellitus who are active, do sufficient physical activity tend to be higher with less prevalence of hypertension (Amoussou-Guenou, 2015). The results of this study indicate that People with Diabetes Mellitus in Indonesia perform physical activity in the less category, which is 21.5 where 43.3% of them suffer from hypertension. A sedentary lifestyle negatively affects quality of life, threatens life independence and personal autonomy and increases both formal and informal care needs (Cagliero et al., 1991). People with diabetes who develop hypertension should be physically active on a regular basis and to include exercise that strengthens muscles and improves

balance (Standley, 2003). Exercise has long been recommended to prevent and treat chronic comorbidities and usually such as Diabetes Mellitus (Standley, 2003).

Epidemiological findings show that eating fruits and vegetables lowers blood pressure. Diets by consuming more fruits and vegetables can be an alternative for drug therapy in patients with hypertension and as a population approach, can prevent hypertension (Akita et al., 2003). However, the results of this study indicate that the majority of DM sufferers in Indonesia, namely 83.9% consume less fruit and vegetables, of which 37.9% suffer from hypertension. The results of this study are not much different from the research of Nawfal (Nawfal, 2017) which shows that only 9.1% of 5,032 respondents and 1.3% of 4,946 respondents each take sufficient amounts of fruits and vegetables. Therefore, it is highly recommended for people with diabetes to increase their fruit and vegetable consumption patterns.

Fajarini's research (Fajarini, 2019) showed that fat intake was significantly associated with the incidence of hypertension in People with Diabetes Mellitus (P value < 0.05). In this case, excess saturated fat in the body will result in the buildup and formation of plaque in blood vessels so that blood vessels become narrower and their elasticity decreases (Pusparani, 2016). The results of this study showed that 34.8% of participants consumed fatty foods ≥ 1 servings/day. Meanwhile, 36.3% of participants who experienced hypertension in this study had a habit of consuming fatty foods ≥ 1 servings/day.

One of the unique findings of this study is the variable consumption of fatty foods, the majority of the incidence of hypertension in People with Diabetes Mellitus in Indonesia consumes fatty foods < 1 serving/day. Whereas theoretically consuming excess saturated fat in the body will result in the buildup and formation of plaque in blood vessels so that blood vessels become narrower and their elasticity decreases (Pusparani, 2016). This can happen because the consumption of fruits and vegetables in people with DM is less so that consuming fat < 1 day can increase the risk of hypertension in people with DM. However, it will be more interesting if in further research this variable consumption of fatty foods can be analyzed further so that a more valid hypothesis is obtained.

Study (Siregar, 2021) showed that people with diabetes consume approximately 2-3 servings of vegetables per day, but many people with diabetes do not consume fruit daily. Non-diabetics typically consume 2-3 servings of vegetables and 2-3 servings of fruit per day. Individuals who do not consume fruit have an 8,094-fold increased risk of developing diabetes mellitus than those who consume fruit (2-3 servings/day). Consumption of fruits plays a critical role in lowering the risk of developing diabetes mellitus.

Obesity can be defined as a condition in which there is an abnormal or excessive accumulation of fat in adipose tissue to such a degree that it can damage health. The results of this study indicate that the majority of people with DM in Indonesia are obese, namely 47.7%, of which 42.1% suffer from hypertension. This is in line with Tripathy's research (Tripathy, 2017) which showed hypertension was seen among 60% of People with Diabetes Mellitus. Previous research has shown that someone who is obese with diabetes and hypertension fails significantly in achieving treatment goals (Tripathy, 2017).

The way to prevent obesity is to lose weight. The trick is through lifestyle interventions such as regulation of diet and regular physical activity that will help obese individuals achieve tighter control of blood pressure and glucose and thus reduce complications (Tripathy, 2017). Obesity is known to increase the risk of dyslipidemia and hypertension. Interventional studies show that successful weight loss type 2 diabetes patients often enjoy modest improvements in glycemic control and cardiovascular risk profile as long as weight loss is maintained (Emdin, 2015).

Mental-emotional disorders variables include variables that are rarely studied in studies related to hypertension in People with Diabetes Mellitus, whereas theoretically stress

conditions which are one of the mental-emotional disorders experienced by DM sufferers can affect the pattern of controlling blood sugar levels, where the stress response will increase the adrenaline hormone which can convert glycogen reserves in the liver into glucose and end up in uncontrolled blood sugar levels (Susanti, 2020a). If blood sugar levels are not controlled, it will cause hyperglycemia conditions which result in complications, including hypertension (Kurniawan, 2020). This study shows that 46.0% of People with Diabetes Mellitus in Indonesia who experience mental-emotional disorders also suffer from hypertension.

Usually what causes DM sufferers to experience mental-emotional disorders is because they feel burdened by the DM they suffer where they have to maintain their diet strictly in the sense that they cannot eat all kinds of food like they used to (Ningrum, 2019). Thus, a strong motivation is needed for DM sufferers to undergo treatment and treatment of their disease so that complications do not occur. The motivation can be obtained from family support because the family is the closest person from the social environment of people with DM (Ningrum, 2019).

5. Conclusion

Based on the risk factors, the majority of People with Diabetes Mellitus in Indonesia who suffer from hypertension are female (41.6%), aged 45 years (39.4%), low education (39.7%), having DM duration in the old category (39.7%), lack of physical activity (43.3%), consume less fruit and vegetables (37.9%), are obese (42.1%) and have mental-emotional disorders (46.0%). Meanwhile, 36.3% of People with Diabetes Mellitus in Indonesia who suffer from hypertension consume fatty foods < 1 serving/day

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