



ICASH-A036

**IMPACT OF OBESITY AND DIABETES MELLITUS TYPE II WITH
INCIDENCE OF HYPERTENSION IN AGE 45-65 YEARS OLD****Tiara Syamsa Noor Wildania, Shofa Nur Fauzah, Dini Sapardini Warsodoedi***Faculty of Medicine, Universitas Swadaya Gunung Jati, Cirebon, Indonesia*

*Corresponding author's email: Wildaniatiara@yahoo.com

ABSTRACT

Background: Hypertension is one of the main causes of mortality and morbidity in Indonesia. Hypertension is also the third biggest risk factor for early deaths. Several previous researches have shown that obesity and diabetes mellitus type II (DM type II) are the factors in the occurrence of hypertension. Previous research did not include the stage of obesity and DM type II, by this reason the research was aimed to analyze the correlation between the stage of obesity and stage of DM type II with hypertension.

Methodology: This research used observational analytic with cross-sectional design. This study involved 161 patients who were selected by consecutive sampling method. The inclusion criteria of the sample were aged 45-60 years old, obese, and have been diagnosed of DM type II and hypertension in Waled Regional General Hospital.

Results: The result revealed that stage of obesity and stage of DM type II were significantly associated with hypertension ($p < 0.01$, $p < 0.01$, respectively). Other variables that also significantly associated with hypertension were age and gender.

Conclusion: There was the strong correlation between stage of obesity and hypertension. Public health policy maker may promote to prevent the obesity in order to decrease the incidence of hypertension.

Keywords: Obesity, DM type II, Hypertension

INTRODUCTION

Hypertension is a disease that is a major cause of mortality and morbidity in Indonesia. [1] The disease is characterized by an increase in systolic blood pressure greater than 130 mmHg and diastolic blood pressure over 80 mmHg on two occasions with an interval of five minutes in rest or relax conditions [19].

According to the Basic Health Research (RISKESDAS) in 2018, the prevalence of hypertension in Indonesia at the age of 18 years is 34.1%. West Java province is one of the areas with the highest incidence rate of hypertension, which amounted to 29.4%. [2] According to the Health Department of West Java, in 2016 there are 790.382 cases of hypertension (24.6%) of the total population of more than 18 years old, the number of cases examined as many as 8.029.245 people, spread across 26 Districts or Cities. The highest case has found in Cirebon (17.18%) where Waled Regional General Hospital located and the lowest in Pangandaran District (0.05%). [3]

Juhaeri on his "Associations between weight gain and incident hypertension in a bi-ethnic cohort: the Atherosclerosis Risk in Communities Study" journal explains a linear relationship between the increase in Body Mass Index (BMI), and systolic and diastolic blood pressure. [4] Complications of diabetes mellitus II with hypertension is a disease with a fairly high incidence. [5] This study aims to look at the

correlation between stage obesity and stage diabetes mellitus type II with incidence of hypertension in age 45-65 years old.

Previous research has not addressed the stage of obesity and stage DM type II with the incidence of hypertension. So this research is expected to discuss more specific about the correlation between stage of obesity and stage DM type II with the incidence of hypertension.

MATERIALS AND METHODS

Ethical clearance approval No. 159 / EC / FK / X / 2018 was obtained from the ethical committee of Faculty of Medicine Universitas Swadaya Gunung Jati. The design of this study was observational analytic study with cross-sectional design. There are one hundred and sixty one patients with obesity and diabetes mellitus type II and hypertension in Waled Cirebon hospital, West Java, Indonesia has become the subject of this study by consecutive sampling. The subject is obese stage I, II, and III at the age of 45-60 years were obtained by measuring BMI and patients diagnosed with diabetes mellitus II stage prediabetes and diabetes at the age of 45-60 years were obtained from medical records. Exclusion criteria in this study were respondents who refuse to follow the procedure that has been determined.

Hypertension is determined by measuring the blood pressure on two occasions with an interval of five minutes in rest or relax conditions with the result of blood pressure 130/80 or above.[19] Obesity data was obtained from the calculation Body Mass Index (BMI) with the result of BMI 25 or above. Whereas diabetes mellitus type II of data obtained from data on present time blood glucose checks in subjects medical records at Waled Cirebon hospital.

RESULTS

Characteristics of respondents

Based on the research, respondents characteristics was obtained as will be written below.

Table 1. Characteristics of respondents

No.	Characteristics	Amount (n)	Percentage (%)
1	Non obesity	97	60.2
	Pre-obesity	20	12.4
	Obesity stage 1	19	11.8
	Obesity stage 2	21	13.1
	Obesity stage 3	4	2.5
2	Non diabetes mellitus	63	39.1
	Pre-diabetes mellitus	29	18.0
	Diabetes mellitus	69	42.9
3	45-50 years old	53	33.5
	51-55 years old	50	31.1
	56-60 years old	58	35.4
4	Male	73	45.3
	Female	88	54.7
5	Pre-hypertension	42	26.1
	Hypertension stage 1	56	34.8
	Hypertension stage 2	63	39.1

Characteristics of respondents in this study are presented in table 1. 161 respondents had obtained a majority in the range of 56-60 years old (35.4%), female gender (54.7%), obesity stage 2 (13.1%), diabetes mellitus (42.9%), and has a hypertension stage 2 (39.1%).

Bivariate analysis

The table below shows correlation of obesity with hypertension.

Table 2. Correlation of obesity with hypertension

Obesity	Hypertension						p value	r
	Prehypertension		hypertension 1		hypertension 2			
	N	%	N	%	N	%		
Non Obesity	35	36.1	42	43.3	20	20.6		
Preobesity	4	20.0%	6	30.0%	10	50.0%	0,000	0.446
Obesity stage 1	1	5.3%	1	5.3%	17	89.5%		
Obesity stage 2	1	4.8%	5	23.8%	15	71,4%		
Obesity stage 3	1	25.0%	2	50.0%	1	25.0%		

Table 2 shows that out of 161 respondents there were 17 respondents (89.5%) were obesity stage 1 with hypertension stage 2. In table 2 also shows the correlation between obesity and hypertension with a value of $p = 0.000$ and $r = 0.446$ which shows strength the correlation of these moderate variables.

The table below shows correlation between DM type II with hypertension.

Table 3. Correlation between DM type II with hypertension

Diabetes mellitus	Hypertension						p value	r
	Prehypertension		Hypertension 1		Hypertension 2			
	N	%	N	%	N	%		
Non Diabetes mellitus	32	50.8%	9	14.3%	22	34.9%		
Pre diabetes mellitus	3	10.3%	13	44.8%	13	44.8%	0.002	0.237
Diabetes mellitus	7	10.1%	34	49.3%	28	40.6%		

Table 3 shows from 161 respondents there were 34 respondents (49.3%) had DM type II stage diabetes mellitus with hypertension stage 1. In table 3 also shows the correlation between DM type II and hypertension with a value of $p = 0.002$ and $r = 0.237$ which shows strength the correlation of these weak variables.

The table below shows correlation between age with hypertension.

Table 4. Correlation between age with hypertension

Age group	Hypertension						p value	r
	Prehypertension		Hypertension 1		Hypertension 2			
	N	%	N	%	N	%		
45-50	23	43.4%	13	24.5%	17	32.1%		
51-55	17	34.0%	19	38.0%	14	28.0%	0.000	0.323
56-60	2	3.4%	24	41.4%	32	55.2%		

Table 4 shows that from 161 respondents there were 32 respondents (55.2%) aged 56-60 years old the incidence of hypertension stage 2. In Table 4 also shows the correlation between age and hypertension with a value of $p = 0.000$ and $r = 0.323$ which shows strength the correlation of these moderate variables.

The table below shows hypertension stage differences according to the subject's gender.

Table 5. Differences of gender with hypertension

Gender	Hypertension						p value	X ²
	Prehypertension		Hypertension 1		Hypertension 2			
	N	%	N	%	N	%		
Male	29	39.7%	26	35.6%	18	24.7%	0.000	16.700
Female	13	14.8%	30	34.1%	45	51.1%		

Table 5 shows that out of 161 respondents there were 45 respondents (51.1%) were female experiencing hypertension stage 2. In table 5 also shows that there is a correlation of gender and hypertension with a value of $p = 0.000$ and $X^2 = 16.700 > 5.991$.

DISCUSSION

Results of research conducted in Waled Cirebon hospital obtained that there is a tremendous correlation between obesity stages and DM type II stages with the incidence of hypertension. These results are consistent with previous research conducted by Diana Natalia in 2015 also stated that there is a correlation between obesity and hypertension ($p < 0.001$). [20] Another study conducted by Teguh Dhika Rohkuswara also stated that the respondents with obesity have a risk of 1.681 times to suffer from hypertension than non-obese patients [7]

Obesity theoretically caused by an imbalance of the input and output of calories from the body as well as a decrease in physical activity (sedentary life style) that causes the increasing fat in some parts of the body. Energy balance setting is played by the hypothalamus through physiological processes. This physiological processes occur through anabolic signal centered in the hypothalamus. [8] When the HPA (hypothalamic-pituitary-adrenal) dysregulation, the hypothalamus would increase the anabolic signal that an increase in triglycerides and the increase of fatty adipose tissue. Adipocytes (fat cells) will secrete leptin and adiponectin. an increase in leptin causing inflammation and activation of the sympathetic nervous system which will lead to the activation of the renin-angiotensin-aldosterone system that will be vasoconstriction of blood vessels and high blood pressure or hypertension. [9]

So it can be concluded that the higher stage of obesity will correlating with high blood pressure.

Results of research conducted in Waled Cirebon hospital shows that there is a tremendous correlation between DM type II stages and Obesity Stages with incident of hypertension. These results are consistent with research conducted by Yohanes Silih stating in 2015 that patients with type II diabetes mellitus have a risk of suffering hypertension 1.7 times higher compared to a subject not suffering from diabetes mellitus type II. [12] Another study conducted by Ayla efyu Winta, et al 2018 also states that there is a pretty strong correlation (correlation coefficient: 0.274) between blood glucose levels and hypertension in patients with diabetes melitus type II. [10]

Diabetes mellitus type II is theoretically a decrease in tissue sensitivity to insulin which is characterized by high blood glucose levels, or hyperglycemia. [11] One of the causes of diabetes mellitus type II is insulin resistance. [13] The mechanism of insulin resistance is generally caused by impaired insulin post receptor. Polymorphism in the IRS-1 associated with impaired glucose tolerance and increases the likelihood that the polymorphism of the various post-receptor molecules and combination and bring the state of insulin resistance. Insulin resistance also occurs due to disruption of signaling PI-3-kinase which reduces the translocation of glucose transporter (GLUT) 4 to the plasma membrane. [14] Insulin resistance can lead to increased production of ROS AGEs so as to reduce endothelial function and vasoconstriction of blood vessels that causes high blood pressure or hypertension. [11]

So it can be concluded that the higher the degree of diabetes mellitus will affect high blood pressure as seen from the data processing that most affect the high blood pressure is diabetes mellitus type II stage diabetes mellitus.

Results of research conducted in Waled Cirebon hospital obtained that there is a correlation between age with hypertension. These results are consistent with research conducted by Lilies Sundari in 2015 which states that there is a significant relationship between age and the incidence of essential hypertension (primary) in the village of Karang Anyar. [15] Another study conducted by Wahyuningsih in 2016 also states that there is influence of age with hypertension. [16]

Age theoretically in line with the increase in blood pressure because it is caused by changes in the structure of the large blood vessels, so that blood vessels become narrower and the walls of blood vessels become stiff, as a consequence is the increased systolic blood pressure. [17]

Results of research conducted in Waled Cirebon hospital acquired that there is a correlation between gender with hypertension. These results are consistent with research conducted by Risa Pitriani which states that gender have a meaningful relationship with OR 28.3. [18] Another study conducted by Jajuk Kusumawaty also states that there is a significant relationship between sex and hypertension in the elderly in Puskesmas Lakbok Ciamis District. [19]

Gender is theoretically has a close relation to the onset of hypertension. In female, the blood pressure will be higher when experiencing menopause. Female who have not experienced menopause are protected by estrogen that plays a role in increasing the levels of High Density Lipoprotein (HDL). High levels of HDL cholesterol are protective factors in preventing atherosclerosis. Protective effect of estrogen is considered as an explanation of their immunity at the age of premenopausal female. [19]

CONCLUSION

There is a correlation between Obesity stages and diabetes mellitus type II stages with the incidence of hypertension.

RECOMMENDATIONS

Indonesian Public Health Ministry has officially socializing about preventing non infectious disease that called CERDIK. Cerdik is a short for do a routine medical check (*cek kesehatan secara rutin*), quit smoking (*enyahkan asap rokok*), do physical activity frequently (*rajin aktifitas fisik*), balance diet (*diet seimbang*), get an optimal rest (*istirahat cukup*) and manage stress (*kelola stress*).

REFERENCES

1. PERKI. *Pedoman Tatalaksana Hipertensi pada Penyakit Kardiovaskular*. edisi 1 '(Hypertension Therapy guidelines on cardiovascular disease first edition)'. Jakarta : Perhimpunan Dokter Spesialis Kardiovaskular Indonesia; 2015.
2. Pusat data dan informasi kementerian kesehatan RI. *Hipertensi '(Hypertension)*. Jakarta: Kementerian Kesehatan Republik Indonesia; 2015.
3. Sukmara, Uus. *Profil Kesehatan Provinsi Jawa Barat '(Health Profile West Java Province)'*. Bandung: Dinas Kesehatan Provinsi Jawa Barat;2016.
4. Juhaeri. Associations Between Weight Gain and Incident Hypertension in Bi-Ethnic Cohort: The Atherosclerosis Risk in Communities Study. *International Journal of Obesity*. 2002;58-64.
5. Pusat data dan informasi kementerian kesehatan RI. *Situasi dan Analisis Diabetes '(Diabetes Situation and Analysis)'*. Jakarta: Kementerian Kesehatan Republik Indonesia; 2014.
6. Sulastrri, Delmi. Hubungan obesitas dengan kejadian hipertensi pada masyarakat etnik Minangkabau di kota Padang '(Correlation between Obesity with accident of Hipertension on Minangkabau Ethnic in Padang City)' . [document on internet] Desember 2012 [Downloaded at January 28 2018]. Available to access at <http://jurnal.mka.fk.unand.ac.id/index.php/art/article/view/127/123>
7. Dhika R, Teguh,dkk. Hubungan Obesitas dengan Kejadian Hipertensi Derajat 1 di Pos Pembinaan Terpadu Penyakit Tidak Menular (Posbindu PTM) Kantor Kesehatan Pelabuhan Bandung '(Correlation between obesity and accident of stage 1 hypertension at non infectious disease health center Public Health Bandung)' . Jakarta:Jurnal Epidemiologi Kesehatan Indonesia;2016.
8. Kumar, P., & Clark, M. L. *Kumar & Clark's Clinical Medicine 8th Edition*. Philadelphia : Elsevier.; 2012.
9. Yana K, Iva. Hubungan obesitas dengan penyakit hipertensi '(correlation between obesity with hypertension disease)'. Sulawesi utara: Jurnal UNSRAT; 2016.
10. Winta E, Ayla, dkk. Hubungan Kadar Gula darah dengan Tekanan darah pada Lansia DM tipe 2 '(correlation between blood glucose with hypertension in Elderly Patients)'. Blitar : Jurnal Ners dan Kebidanan;2018.
11. Guyton A.C, dan Hall, J.E. *Textbook of medical physiology*. Edisi 13. Philadelphia : Elsevier; 2016.
12. Silih, Yohanes. Hubungan Antara Diabetes dengan Kejadian Hipertensi '(Correlation Between Diabetes with accident of hypertension)' . [document on internet] Januari 2015 [downloaded at 28 Januari 2018]. Available <http://jurnal.untan.ac.id/index.php/jfk/article/view/8721>

13. Maitra A, Abbas AK. The endocrine system. Robbins and Cotran Pathologic Basis of Disease. Edisi ke-7. Philadelphia: Elsevier Saunders; 2005.
14. Fauci, et al. Harrison's : Principles of Internal Medicine. 19th edition. USA : McGraw-Hill, inc.,2016.
15. Sundari, Lilies. Faktor-faktor yang berhubungan dengan kejadian hipertensi '(Factors that correlated with Hypertension)'. Tanjungkarang : Jurnal Keperawatan;2015.
16. Wahyuningsih. Faktor Yang Mempengaruhi Hipertensi pada Usia Lanjut '(factor that impacts with hypertension in elderly age)'. Yogyakarta:Jurnal Ners dan Kebidanan Indonesia;2016.
17. Haskell WL, Lee IM, Pate RR, Powell, Blair SN, Franklin BA, et al. 2007. Physical activity and public health: updated recommendation for adults from the american college of sport medicine and the american heart association. American college of sports medicine and the american heart association, 14, 23-34.
18. Pitriani, Risa. Faktor-faktor yang mempengaruhi kejadian hipertensi pada lansia di wilayah kerja puskesmas rumbai pesisir '(Factors that impact accident of hypertension at elderly age on rumban pesisir health center)'. Pekanbaru:Jurnal Penelitian Kesehatan;2017.
19. Kusumawaty, Jajuk. Hubungan Jenis Kelamin dengan Intensitas Hipertensi pada Lansia di Wilayah Kerja Puskesmas Lakkok Kabupaten Ciamis.Ciamis:Mutiaramedika;2016.
19. Harvard, Health Publishing. Reading The New Blood Pressure Guidelines. [document on internet]. April 2018 [diunduh 12 juni 2019]. Tersedia dan diakses dari <https://www.health.harvard.edu/heart-health/reading-the-new-blood-pressure-guidelines>
20. Natalia, Diana. Hubungan Obesitas dengan hipertensi pada penduduk kecamatan Sintang Kalimantan Barat '(Correlation Between Obesity and Hypertension with Population in Sintang West Kalimantan)'. Tanjungpura:FKUT;2015.