RPCPE
ISSN 2613-943X (print)
ISSN 2620-5572 (online)
Journal Homepage:
https://jurnal.ugm.ac.id/rpcpe
Review of Primary Care Practice and Education
(Kajian Praktik dan Pendidikan Layanan Primer)

The Precision of Screening Questionnaires for Diabetes Mellitus Type 2 and Hypertension Compared with the Gold Standard in Primary Care

Seta Nurhayati Mularum[1], Hari Kusnanto[2], Wahyudi Istiono[2]

[1] Pandak 1 Community and Primary Health Care Center; Yogyakarta; Indonesia
[2] Department of Family and Community Medicine; Faculty of Medicine, Public Health and Nursing; Universitas Gadjah Mada; Indonesia

Corresponding Author:
Seta Nurhayati Mularum: *Puskesmas* Pandak 1, Jalan Gesikan, Wijirejo, Wijirejo, Kec. Bantul, Bantul, Daerah Istimewa Yogyakarta - 55761, Indonesia.
Email: setanurhayatimularum@gmail.com

To cite this article:
Mularum SN, Kusnanto H, Istiono W. The precision of screening questionnaires for diabetes mellitus type 2 and hypertension compared with the gold standard in primary care. Rev Prim Care Prac and Educ. 2018; 1(2): 75-81.

ABSTRACT

Background: Diabetes mellitus (DM) and hypertension are health issues that are the focus of the Indonesian government, especially in the era of Universal Health Coverage/*Jaminan Kesehatan Nasional* (JKN). The prevalences have been steadily increasing daily. Special Region of Yogyakarta (DIY) has the highest prevalence of DM in Indonesia, while hypertension prevalence is 25.7% according to data from *Riskesdas* 2013. Complications from diabetes and hypertension lead to decreased quality of life and premature death, therefore it is necessary to have a better management strategy to reduce the risks. Nowadays, there are no diabetes and hypertension screening questionnaires which have been validated and implemented in the district of Bantul. Therefore, it is important to develop screening questionnaires for early detection of diabetes and hypertension as a tool for primary care physicians to perform tasks at the preventive level. **Objective:** This study aimed to measure the accuracy of screening questionnaires to detect diabetes mellitus and hypertension in primary care in Bantul DIY. **Methods:** This study used a cross-sectional method. The subjects of the study were a group of individuals aged 40-60 years in Bantul who met the inclusion criteria and the exclusion criteria. The study subjects were asked to complete the screening questionnaires of diabetes and hypertension. The results were then compared with the gold standard of fasting blood sugar and blood pressure check. The data were analyzed by using multivariate regression tests. **Results**: The results of multivariate analysis showed that the risk factors were a history of baby born weight ≥ 4 kg or gestational diabetes mellitus and the abdominal circumference was an independent risk factor for the incidence of diabetes in general population. Being a baby born with weight ≥ 4 kg and abdominal circumference had $p = 0.001$: RR 2.75 (CI 95%: 1.5 to 5.0) and $p = 0.036$: RR of 8.08 (CI 95%: 1.15 to 56.8), respectively. The risk factor of age was an independent risk factor for hypertension with $p = 0.003$: RR of 3.1 (CI 95%: 1.4 to 6.6). **Conclusions:** History of a baby born with weight ≥ 4 kg and abdominal circumference were appropriate for screening DM, meanwhile the age was appropriate for screening hypertension.

Keywords: *Diabetes Mellitus, Hypertension, Screening, Risk Factors*

BACKGROUND

Diabetes mellitus and hypertension are health issues that the Indonesian government tries to manage especially in the era of JKN due to the prevalence of diabetes mellitus and hypertension which are increasing rapidly day by day, besides the economic cost of these cases are obviously high[1]. Basic Health Research (RISKESDAS) in 2013 recorded that the prevalence of diabetes mellitus which was diagnosed by primary care in the province of DIY is the highest one in Indonesia (2.6%). Meanwhile, the prevalence of hypertension in the province of DIY is 25.7% which is almost the same as prevalence hypertension in Indonesia (25.8%)[2]. In the residence of Bantul, diabetes mellitus and hypertension are always recorded in the big 10 of case quantity. District Health Office of Bantul Residence recorded that in 2015, the rank of hypertension case in the public health center (*Puskesmas*) in Bantul was ranked number 2 and diabetes mellitus was ranked number 4[3].

The risk factors for diabetes mellitus and hypertension are correlated with genetic factors and lifestyle. The complications of diabetes mellitus will affect the life quality and can cause premature death, thus it needs a better management strategy to reduce the risks[4]. Therefore, it is very important for doctors at primary care units to really understand the cases of diabetes mellitus and hypertension,

and be able to make a pre-detection and know when they have to refer to secondary health care[1]. It means that screening for diabetes mellitus and hypertension is very important to be provided.

This study aimed to have a precision screening recommendation for diabetes mellitus and hypertension at primary care units and also to get a precision education method about diabetes mellitus and hypertension.

RESEARCH METHODS

Research methods with cross-sectional design were used in this study. This study was conducted to measure the precision of screening questionnaires for diabetes mellitus type 2 and hypertension to pre-detect the diabetes mellitus and/or hypertension in the general population compared with the gold standard as fasting blood sugar at ≥ 126 mg/dl and blood pressure at ≥ 140/90mmHg. The sample population was a group of people with certain characteristics. The target population was an individual person who came to primary care units in 5 primary health cares in Bantul Residence wand met the inclusion and exclusion criteria. From this population, 160 people were included as subjects to be observed.

Criteria for inclusion and exclusion:

The subjects of the study then completed the screening questionnaires of diabetes mellitus and hypertension which were prepared by the researchers according to other studies about screening[5,6]. Questionnaire completion was guided by medical officers who were coached previously by the researchers about study mechanism/data sampling. Afterwards, fasting blood sugar and blood pressure were checked, and the results were recorded into a database for next analysis.

Table 1. Inclusion criteria and exclusion criteria

No.	Inclusion criteria	Exclusion criteria
1.	Age between 40-60 years	Incapable of reading and writing.
2.	Without diagnosed with diabetes mellitus and or hypertension	Has disorder of hearing and speaking.
3.	Willing to be subject of study by signing an informed consent form	Have serious illness

In this study, criteria for diabetes mellitus is fasting blood sugar (glucose) ≥ 126 mg/dl[7], and this criterion is based on commonly used criteria from another previous study. The hypertension criteria are when the subject has blood pressure >140 (systolic) or >99 (diastolic), and this criterion is based on JNC (Joint National Committee) criterion[8].

Statistical analysis was done with Stata 12, using univariate analysis, logistic regression with bivariate and multivariate analysis. For screening, the result was tested with validation tests.

RESULTS

From univariate analysis, there were 160 people as the subjects of research, in which 38 people were male (23.75 %) and 122 people female (76.25%). Based on age, 63 people were 40-50 years old (39.38%) and 97 people were 50-60 years old (60.63%).

The bivariate analysis (Table 2) showed that abdominal circumference size of males ≥ 90 cm and females ≥ 80

Table 2. The result of bivariate analysis on the person who has risks of diabetes mellitus

Risk factors		Diabetes Mellitus				Value *p*	RP or RR	Confidence Interval 95%
		Yes		No				
		N	%	N	%			
Gender	Female	26	68.42	96	78.69	0.194	0.86	0.68-1.09
	Male	12	31.58	26	21.31			
Age (Yrs.)	40-49	12	31.58	51	41.80	0.26	1.17	0.90-1.52
	50-60	26	68.42	71	58.20			
Hypertension	Yes	15	39.47	26	21.31	0.025	1.85	1.10 -3.11
	No	23	60.53	96	78.65			
Body Mass Index ≥ 23 Kg/M2	Yes	29	76.32	80	65.57	0.21	1.16	0.93-1.44
	No	9	23.68	42	34.43			
Abdominal Circumference Size Male ≥ 90cm Female ≥ 80 Cm	Yes	34	89.47	74	60.66	0.001	1.47	1.23-1.76
	No	4	10.53	48	39.43			
Diabetes Mellitus Family Genetic	Yes	19	50.00	51	41.80	0.215	1163	0.93-1.44
	No	19	50.00	71	58.20			
History, Weight of Baby Born ≥ 4kg	Yes	8	30.77	8	8.33	0.003	3.69	1.53 -8.85
	No	18	69.23	88	91.67			
Dyslipidemia	Yes	10	26.32	32	26.32	0.992	1.00	0.54-1.84
	No	28	73.68	90	73.77			
Physical Inactivity	Yes	13	34.21	20	16.39	0.018	2.08	1.15-3.78
	No	25	65.79	102	83.61			

RP = *Ratio Prevalence*

Table 3. The result of bivariate analysis on classical symptoms of diabetes mellitus

Risk Factors of Diabetes Mellitus		Diabetes Mellitus				Value *p*	RP or RR	Confidence Interval 95%
		Yes		No				
		n	%	N	%			
Polydipsia	Yes	13	32.21	18	14.75	0.008	2.31	1.25-4.28
	No	25	65.79	104	85.25			
Polyphagia	Yes	15	39.47	16	13.22	0.004	2.98	1.63-5.45
	No	23	60.53	105	86.78			
Polyuria	Yes	18	47.37	30	24.59	0.007	1.92	1.21-3.04
	No	20	52.63	92	75.41			
Decreasing of Body Weight	Yes	13	34.21	12	8.84	0.00	3.47	1.73-6.96
	No	25	65.79	110	84.38			

RP = *Ratio Prevalence*

Table 4. The result of Bivariate analysis on Hypertension risk

Risk Factors of Hypertension		Hypertension				Value *p*	RP	*Confidence Interval* 95%
		Yes		No				
		n	%	N	%			
Gender	Female	34	82.93	88	73.95	0.244	1.12	0.94-1.33
	Male	7	17.07	31	26.05			
Age (Years)	40-49	7	17.07	56	47.06	0.001	1.56	1.25-1.95
	50-60	34	82.93	63	52.94			
Body Mass Index ≥ 23 Kg/M^2	Yes	32	78.05	77	64.71	0.114	1.20	0.97-1.48
	No	9	21.95	42	35.29			
Abdominal Circumference Size Male ≥ 90cm Female ≥80cm	Yes	33	80.49	75	63.03	0.04	1.27	1.04-1.56
	No	8	19.51	44	36.97			
GDP≧126mg/Dl	Yes	15	36.59	38	23.75	0.025	1.89	1.09-3.26
	No	26	63.41	122	76.25			
Family Genetic of Hypertension	Yes	26	63.41	59	49.58	0.126	1.27	0.95-1.71
	No	15	36.59	60	50.42			
Smoking	Yes	7	17.07	22	18.49	0.839	0.92	0.42-2.00
	No	34	82.93	97	81.51			
Salt Consumption	Yes	18	43.90	50	42.02	0.833	1.04	0.69-1.56
	No	23	56.10	69	57.98			
Coconut Milk Consumption	Yes	20	48.78	50	42.02	0.452	1.16	0.79-1.69
	No	21	51.22	69	57.98			
Animal Fat Consumption	Yes	22	53.66	71	59.66	0.501	0.89	0.65-1.23
	No	19	46.34	48	40.34			
Stress Condition	Yes	19	46.34	43	36.13	0.247	1.28	0.85-1.92
	No	22	53.66	76	63.87			
Insomnia	Yes	21	51.22	38	31.93	0.027	1.60	1.07-2.38
	No	20	48.78	81	68.07			
Parent's History of Heart Illness	Yes	1	2.44	7	5.88	0.383	0.41	0.05-3.26
	No	40	97.56	112	9412			
Physical Inactivity	Yes	9	21.95	24	20.17	0.808	1.08	0.55-2.14
	No	32	78.05	95	79.83			

RP = *Ratio Prevalence*

cm has a significant correlation with a case of diabetes mellitus statistically at $p = 0.001$, while hypertension is also significant at level $p = 0.025$ with RR 1.85. Additionally, the history of a baby born with weight ≥ 4 kg or gestational diabetes mellitus is also significant at level $p = 0.003$ with RR 3.69. Physical inactivity is also significant at level $p = 0.018$ with RR 2.08.

The result of bivariate analysis (Table 3) showed classical symptoms of diabetes mellitus toward diabetes mellitus occurrence has a significant correlation, with polydipsia at level $p = 0.008$: RR 2.31, polyphagia at level $p = 0.004$: RR 2.98 and polyuria at $p = 0.007$: RR 1.92 and body weight is decreasing without special reason at level $p = 0.00$: RR 3.47.

Table 4 shows the result of bivariate analysis on hypertension risk and found that age, abdominal circumference size, insomnia and diabetes mellitus have a significant correlation with hypertension.

After multivariate analysis (Table 5), it is found that abdominal circumference, history with the weight of a baby born ≥ 4 kg are significant factors of diabetes mellitus occurrence. Age was a significant independent factor in hypertension occurrence.

The sensitivity of each factor of diabetes mellitus occurrence was as follows: abdominal circumference (92.3%), history baby born ≥ 4 kg (83%) and physical inactivity (80.3%). Specificity of risk factors as follows: abdominal circumference (31.5%), history baby born ≥ 4 kg (50%) and physical inactivity (39.4%). Combination of history with baby born ≥ 4 kg and abdominal circumference was as follows: sensitivity 87.3% and specificity 40.9%. Combination of the three factors of risk as abdominal circumference, history baby born ≥ 4 kg and physical

Table 5. The result of Multivariate analysis of logistic regression on diabetes mellitus and hypertension risk factor

Variable	*p* value	RR	*Confidence Interval* (CI 95%)
Diabetes Mellitus			
Abdominal Circumference Size	0.036	8.08	1.15 – 56.8
History Weight of Baby Born ⩾ 4 Kg	0.001	2.759	1.51 – 5.03
Hypertension			
Age	0.003	3.15	1.49 – 6.67

Table 6. Validation test on the risk factor of diabetes mellitus occurrence

Screening Variable	Sensitivity	Specificity	roc	LR +	LR-	OR	PPV (%)	npv (%)
Abdominal Circumference Size	92.3	31.5	0.619	1.35	0.244	5.51	3.47	99.4
History Weight of Baby Born⩾ 4 Kg	83	50	0.665	1.66	0.34	4.89	4.24	99.1
Physical Inactivity	80.3	39.4	0.599	1.33	0.5	2.65	3.42	98.7
Abdominal Circumference Size + History Baby Born > 4kg	100	58.3	0.792	2.4	0	-	6.02	100
History Baby Born > 4kg + Inactivity	85.2	50	0.676	1.7	0.295	5.77	4.35	99.2
Abdominal Circumference Size + History Baby Born > 4kg + Inactivity	100	60	0.8	2.5	0	-	6.26	100

Table 7. Validation tests on the risk factor of hypertension occurrence

Screening factor	Sensitivity	Specificity	roc	LR +	LR-	OR	PPV (%)	npv (%)
Age	88.9	35.1	0.62	1.37	0.317	4.32	32.1	90.1
Abdominal Circumference	84.6	30.6	0.576	1.22	0.503	2.42	29.6	85.2
Insomnia	80.2	35.6	0.579	1.25	0.556	2.24	30.1	83.9
Age + Abdominal Circumference	90.9	41.8	0.664	1.56	0.218	7.18	35.1	93
Age + Insomnia	91.3	42.9	0.671	1.6	0.203	7.88	35.6	93.4
Abdominal Circumference + Insomnia	93.3	40.5	0.669	1.57	0.164	9.55	35.2	94.6
Age + Abdominal Circumference + Insomnia	100	45.2	0.726	1.82	0	.	38.7	100

inactivity have sensitivity 100% and specificity 60%.

The sensitivity of each risk factor for hypertension occurrence is: age (88.9%), abdominal circumference (84.6%) and insomnia (80.2%). Specificity of each risk factor of hypertension is as follows: age (35.1%), abdominal circumference (30.6%) and insomnia (35.6%). Combination of age and abdominal circumference has 90.9% of sensitivity and 41.8% of specificity. Combination of abdominal circumference and insomnia has sensitivity 93.3% and specificity 40.5%. Combination of the three risk factors of age, abdominal circumference and insomnia have 100% of sensitivity and 45.2% of specificity.

DISCUSSIONS

This study found that the age factor does not have any significant correlation with diabetes mellitus occurrence, while some other studies said that the age factor is one of the risk factors of diabetes mellitus occurrence. Risk of pre-diabetes will increase with the age[9]. With age increasing muscle mass will diminish, and thus β cells of the pancreas will also diminish[10].

In this study, there is some discrepancy of body mass index (BMI), but statistically, it is not significant. BMI does not precisely show the mass of fat and its distribution, especially for Asian populations[11]. BMI measurement has a limitation, for those who have big muscle and big bone, while the BMI is high, they could be in a healthy condition, and also for an older person, their muscle mass could be tiny, but the BMI could be normal[12].

This study found that there is a significant correlation between abdominal circumference and DM occurrence. Abdominal circumference ≥80cm for females and ≥ 90cm for males will increase the risk of DM occurrence by 1.4 times. Abdominal belly fat has a stronger correlation with body metabolism. It is caused by omentum and mesentery releasing some radical free acid fat which comes inside the vena portal firstly before coming to the systemic circulation. That condition will affect strongly the metabolism of glucose and then it will become an insulin metabolism disorder and eventually become a condition of insulin resistance and DM type 2[13].

Concerning a family history of the DM, this study found that family history is not a significant factor of DM due to there is no record that could predict the situation. One study said that family history of DM is a very important factor, and it involves genetics. One finding explained that someone who has siblings with DM type 2, would have 30% greater chance of DM[14].

All classical symptoms of DM have a significant correlation, based on the bivariate analysis. A high blood glucose concentration will affect cell dehydration caused by osmotic pressure in a cell, and this causes plasma of the cells to come out and enter the urine generating a condition of osmotic diuresis, which will cause a condition that is called polydipsia. Polyphagia will occur if there is an insufficient supply of glucose to the cells of the body due to insulin not opening glucose channels, and glucose concentration will accumulate, but the body will always feel hungry due to there is not enough supply of energy. Because the glucose cannot support enough energy, the body will look for another source of energy such as from fat and protein, and eventually, the DM patient's weight will decrease day by day [15].

Bivariate analysis showed that history of a baby born ≥ 4 kg has a significant correlation to DM, and statistically it will increase the risk of DM occurrence 3.69 times. The progressive increase of insulin resistance, especially at second and third semester, will increase the risk of fetal macrosomia and also increase the risk of fetal death[16]. A similar study showed the subjects who have a history of gestational diabetes mellitus have risk 3.5 times greater to suffer from DM compared to the general population[17].

In this study, the prevalence of hyper-cholesterol history was not significant. This study only observed whether the subject had consumption of medical cholesterol-lowering drugs or not, and this study did not check the patient's lipid profiles, therefore this study could not determine whether the patient was dyslipidemia or not.

Statistically, physical inactivity has a significant correlation. This statement is aligned with another study's finding which said that a low physical activity will affect T2DM, since the sport activity will increase insulin sensitivity and prevent obesity. The study found that physical inactivity will increase the risk T2DM by 2 times[11].

In this study, the prevalence of hypertension was 36.8 % of subjects who were diagnosed as DM, which means there is a significant correlation to DM. Another study also similarly states that hypertension will increase the risk of DM in subjects who have a family history of DM with OR 1.35[18]. In cases that patients have essential hypertension, the insulin sensitivity is decreasing about 20-40%[19].

Validity analysis showed that a combination of the factors had a high sensitivity. Combination of abdominal circumference and history as baby born weight ≥ 4 kg or gestational diabetes mellitus had sensitivity 100 % and specificity 58.3%. The combination of the three factors will raise the specificity up to 60%.

This study found that female prevalence of hypertension was higher than male prevalence. Another study similarly states that female prevalence of hypertension was 25% and male prevalence was 24%[20]. This study found that most of the hypertension is diagnosed in the subjects of 50-60 years of age, compared to 40-49 years in the previous study. Aligned to the age, almost everyone experiences increases in blood pressure when they grow older. Systolic pressure continues to increase up to 80 years and diastolic pressures continues to increase until age 55-60 years[21].

In this study, discrepancies in body mass index (BMI) did not have any statistical significance. Another study found that there is a linear correlation between BMI and blood pressure, which occurs in some developing countries such as Indonesia, Ethiopia, and Vietnam. Hypertension risk in people who are overweight and obesity with BMI ≥ 25.0 is

higher in Indonesia (OR=7.68, 95% CI: 3.88-15.0)[20]. The weakness of this study is that subjects were not determined into overweight and obesity categories; thus it cannot be seen in detail whether the subject with BMI ≥23 kg/m^2 has a higher risk of hypertension.

Abdominal circumference has a significant correlation with hypertension occurrence. Another study found that females with abdominal circumference ≥ 88 cm will have a higher risk of hypertension (OR = 7.17 $p < 0.002$)[22]. Abdominal circumference could inform about central fat distribution and it is not interfered by body height [23].

This study found that family history does not have any significant correlation with hypertension due to there being not enough medical records to inform how the situation was in the past. A study of Mannan et al.[12] said that risk of hypertension is 4.36 times higher for the subjects who have a family history of hypertension. This study also showed that cigarette consumption has no significant correlation with hypertension. One study found on the contrary that cigarette consumption has a significant correlation with hypertension OR = 2.32. The habit of cigarette consumption could cause a vasoconstriction in peripheral and kidney vascular systems and eventually, they will increase the blood pressure[24]. The weakness of this study was that we only observed whether the subject is a cigarette consumer or not, and did not observe how many cigarettes they consume and for how long was that habit.

In this study, the factor of salty food diet did not have any significant correlation with hypertension. Sodium intake from salty food will affect hypertension by increasing the volume of plasma and blood pressure[25]. This study was conducted in a village where the population usually consumes only a little quantity of salt.

In this study, the habit to consume food with coconut milk and animal fat has no statistically significant correlation with hypertension occurrence. The weakness of this research is that food recalling was not implemented to confirm information.

In this study, the psychological burden has no significant correlation with hypertension occurrence. The same result of the study by Schwartz et al. [26] did not show any correlations between depression and blood pressure.

In this study, insomnia has a significant correlation with hypertension occurrence. Another study found that sleeping duration ≤ 5 hours will increase the risk of hypertension at age 32-59 years old with RR 2.1. A short duration of sleeping in long period will disturb the circadian rhythm and autonomic balance[27].

In this study, parent's history of heart disease has no significant correlation with hypertension occurrence. The family history of heart disease of 40-59 years old males in the population will increase the risk of death 5 times by cardiovascular attack with hypertension as an independent risk factor. A male who has a family history of heart illness would be recommended to implement an intervention to any independent risk factors such as mild hypertension[28].

In this study, activity factor does not have any significant correlation with hypertension occurrence. Another study stated that physical activity is a factor of hypertension with OR = 2.67. Someone with physical inactivity tends to have a higher frequency of heart rate, which means the heart's muscles must work harder to pump blood, and thus artery blood pressure is increased[29].

In this study's results, the age factor is an independent factor of hypertension occurrence and it will increase from 2.8 times to become 3.1 times for hypertension occurrence.

Based on this study, the researcher recommends to provide a medical check of blood glucose concentration for DM screening, in cases as follows:

1) Female who has a history of baby born weight ≥ 4 kg;
2) Female who has abdominal circumference size ≥ 80 cm, and Male who has abdominal circumference size ≥ 90 cm;
3) Diagnosed with hypertension; and
4) Has some symptoms of polyuria, polyphagia, polydipsia, and weight decreasing without special reason.

The researcher also recommends providing a medical check of blood pressure for hypertension screening for everybody who is aged ≥ 50 years old. A special program is required to control DM and HT in the population which is detected of DM/HT after the screening. Also, healthy lifestyle education is required to be promoted to control risk factors for DM and HT.

CONCLUSIONS

Diabetes mellitus prevalence is about 23.75% of the research population. History factors of baby born weight BB ≥ 4 kg or gestational diabetes mellitus and abdominal circumference are independent factors of DM occurrence in general population. Other clinical symptoms that have a significant correlation with DM with the value of $p < 0.005$ are hypertension, polyphagia, polyuria, polydipsia and weight decreasing. High sensitivity would occur if there is combination of risk factors such as combination of abdominal circumference and history baby born weight ≥ 4 kg (gestational diabetes mellitus) which has 100% sensitivity; combination of the three risk factors for abdominal circumference, physical inactivity, and history baby born weight ≥ 4 kg (gestational diabetes mellitus) which also has 100% sensitivity.

Prevalence of hypertension is 25.6 % in this research population. The risk factor of age is an independent factor to hypertension occurrence in the general population. Other symptoms such as abdominal circumference and insomnia have a significant correlation to the hypertension occurrence. High sensitivity has occurred if there is a combination of risk factors between abdominal circumference and insomnia which has 93.3% sensitivity, while the combination of the three factors: age, abdominal circumference and insomnia has 100% sensitivity.

Acknowledgment

I would like to thank all medical nurses, and all medical

analysts for helping in this research.

Ethical Approval and Informed Consent

The study was approved by the Medical and Health Research Ethical Committee (MHREC) from the Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, Yogyakarta with reference number KE/FK/1063/EC/2016.

Funding

Self-funding.

Availability of Data and Materials

Data and material can be accessed via the corresponding author.

Conflict of Interest

None.

REFERENCES

1. Social Security Agency for Health. Reference guide for JKN participants. Jakarta: Social Security Agency for Health. 2014.
2. Health Research and Development Agency. Basic health research. Jakarta: Health Research and Development Agency Ministry of Health Republic of Indonesia. 2013.
3. Bantul Health Office. Profile of Bantul District Health Office. Yogyakarta: Directorate General of Medical Services. 2016.
4. International Diabetes Federation. Global Guideline for Type 2 Diabetes. Brussel Belgium. 2012.
5. Harahap H, WidodoY, Muljati S, Triwinarto A, Effendi I. Development of screening tool for hypertension. Nutrition Indonesia. 2010;33(2):96-107.
6. Emery JD, Reid G, Prevost AT, Ravine D, Walter FM. Development and validation of a family history screening questionnaire in Australian primary care. The Annals of Family Medicine. 2014 May 1;12(3):241-249.
7. Buell C, Kermah D, Davidson MB. Utility of A1C for diabetes screening in the 1999–2004 NHANES population. Diabetes Care. 2007 Sep 1;30(9):2233-2235.
8. The seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure: The JNC 7 report. Jama: Department of Health and Human Services US. 2003.
9. American Diabetes Association. ADA's clinical practice recommendations. Diabetes Care. 2014;37(suppl):S1-S159.
10. Eriksson J, Lindström J, Tuomilehto J. Potential for the prevention of type 2 diabetes. British Medical Bulletin. 2001 Nov 1;60(1):183-199.
11. Bilous R, Donelly R. Handbook of diabetes. Jakarta: Earth Medika. 2015.
12. Hartono A. Nutrition therapy and hospital diet. Jakarta: EGC Medical Book. 2004.
13. Mcfarlane SI, Banerji M, Sowers JR. Insulin resistance and cardiovascular disease. The Journal of Clinical Endocrinology & Metabolism. 2001 Feb 1;86(2):713-8.
14. Triwibowo, Rochmah W, Pramantara IDP, Bayupurnama P, Dinarti LK, Probosuseno, Widita H. Friendly with diabetes in old age. Yogyakarta: SMF Geriatri RSUP Dr. Sardjito.1997.
15. Guyton AC, Hall JE. Medical school physiology textbook 11. Jakarta: EGC. 2007.
16. Megia A, Gallart , Manuel J, Real F, Vedre J, Simon I,Gutierres C,Richardt C. 2011. Mannose biding lectin gene polymorphisms are associated with gestasional diabetes melitus JCEM. Endojournal Society. 2011;89:5881-5887.
17. Lee H, Jang HC, Park HK, Metzger BE, Cho NH. Prevalence of type 2 diabetes among women with a previous history of gestational diabetes mellitus. Diabetes Research and Clinical Practice. 2008 Jul 1;81(1):124-129.
18. Amini M, Janghorbani M. Diabetes and impaired glucose regulation in first-degree relatives of patients with type 2 diabetes in isfahan, iran: prevalence and risk factors. The Review of Diabetic Studies: RDS. 2007;4(3):169-176.
19. Wardani K. Diet and obesity as a risk factor for diabetes mellitus type 2 at Sanglah Hospital Denpasar. Yogyakarta: Faculty of Medicine UGM. 2006.
20. Tesfaye F, Nawi NG, Van Minh H, Byass P, Berhane Y, Bonita R, et al. Association between body mass index and blood pressure across three populations in Africa and Asia. Journal of Human Hypertension. 2007 Jan;21(1):28-37.
21. Krummel DA. Medical nutrition therapy in hypertension. Di dalam: Mahan LK dan Escott-Stump S, editor. 2004. Food, Nutrition and Diet Therapy. USA: Saunders co. 2004;900-918.
22. Warren TY, Wilcox S, Dowda M, Baruth M. Peer reviewed: Independent association of waist circumference with hypertension and diabetes in African American women, South Carolina, 2007–2009. Preventing Chronic Disease. 2012;2019.
23. Guagnano MT, Ballone E, Colagrande V, Della Vecchia R, Manigrasso MR, Merlitti D, et al. Large waist circumference and risk of hypertension. International Journal of Obesity. 2001 Sep;25(9):1360-1364.
24. Wardoyo. Prevention of coronary heart disease. Solo: Agency Book Store. 1996.
25. Williams GH. Hypertensive vascular disease. In Book: Wilson Jean D. et al (editors). Harrison's Principles of internal medicine - 12th ed. Spanish: McGraw-Hill, Inc. 1991;1001-1015.
26. Schwartz S, Feller A, Perlmuter LC. Postprandial systolic blood pressure and subsyndromal depression. Experimental Aging Research. 2001 Dec 1;27(4):309-18.
27. Gangwisch JE, Heymsfield SB, Boden-Albala B, Buijs RM, Kreier F, Pickering TG, et al. Short sleep duration as a risk factor for hypertension: Analyses of the first national health and nutrition examination survey. Hypertension. 2006 May 1;47(5):833-839.
28. Khaw KT, Barrett-Connor E. Family history of heart attack: A modifiable risk factor?. Circulation. 1986 Aug 1;74(2):239-244.
29. Mannan H, Wahiduddin, Rismayanti. Risk factors of hypertension occurrence in the work area of *Puskesmas* Bangkalan, Jeneponto Region. Napier: Epidemiology UNHAS. 2012.