



RISK FACTORS FOR PREDIABETES IN PRODUCTIVE AGE: ANALYSIS OF NCD SCREENING DATA

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ABSTRACT

One way to prevent diabetes mellitus is by preventing prediabetes, or glucose intolerance. Prediabetes is a reversible condition, while diabetes is irreversible. Prediabetes offers a valuable opportunity to prevent or delay the progression to diabetes. Nearly 4-9% of people with prediabetes will develop diabetes each year. Within 3-5 years, prediabetes will develop into type 2 diabetes mellitus in around 25% of patients and as many as 70% of patients are predicted to experience diabetes mellitus throughout their lives. If current trends continue, efforts must be made to stem the wave of new cases that are likely to emerge in the future. Therefore, it is crucial to determine the most effective indicators for predicting the development of prediabetes and to identify people at higher risk of developing prediabetes. Various studies have shown a causal relationship between prediabetes and cardiovascular disease and all-cause mortality. This study aimed to analyze the risk factors for prediabetes in the productive age group (aged 15-64) in Balikpapan City. This research design uses a cross-sectional design, utilizing secondary data, namely the results of 2024 Non Communicable Disease screenings in Balikpapan City. Data were collected using a structured questionnaire administered directly to respondents and supported by secondary data from medical records. Sampling in this study used purposive sampling technique. The formula used to determine the sample size is the Lemeshow formula. A total of 290 subjects (94 males, 196 females, productive age; 15 – 64 years old) whom have prediabetes screening. Univariate, bivariate, and multivariate analyses were conducted using logistic regression. The data comes from medical records containing the variables age, gender, and prediabetes risk factors. Out of 290 subjects, results of analysis showed that age ($p = 0.006$; OR = 0.404), gender ($p = 0.039$; OR = 2.237), and physical activity ($p = 0.046$; OR = 2.148) were significantly associated with prediabetes. Based on the Odds Ratio (OR), specific gender groups were 2.2 times more likely to experience prediabetes compared to the reference group. Demographic factors and physical activity significantly influence prediabetes risk.

Keywords: NCD screening; prediabetes; productive age; risk factors

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INTRODUCTION

In 2021, the prevalence of prediabetes in the age group of 20-79 years worldwide was 9.1% or 464 million people and this figure is predicted to increase to 10% or 638 million people in 2045. (Rooney et al. 2023) In the Southeast Asia region, the prevalence data for prediabetes in 2021 was 4.5%, still below the North America and Caribbean region, which was 13.1%. Based on the 2018 Riset Kesehatan Dasar (RISKESDAS) data, the prevalence of prediabetes in Indonesia reached 10.2%, which means that around 24 million Indonesians suffer from prediabetes. In 2019, Indonesia was ranked third with 29.1 million cases of prediabetes for adults aged 20-79 years. (Laporan Riset Kesehatan Dasar, 2018). One way to prevent diabetes mellitus is by preventing prediabetes, or glucose intolerance. Prediabetes is a reversible condition, while diabetes is irreversible. Prediabetes presents a significant opportunity to prevent or delay the progression to diabetes. Nearly 4-9% of people with prediabetes will develop diabetes each year. The prevalence of prediabetes continues to increase rapidly worldwide, with an estimated 470 million people expected to develop prediabetes by 2030. Research by Suwondo and Pramono estimates that 10% of Indonesia's population (33 provinces) already suffers from prediabetes. (Andriani et al., 2022)

The purpose of this study was to determine the relationship between risk factors that influence the incidence of prediabetes in productive age groups in Balikpapan. According to the European Society for Cardiology (ESC) and the European Association for the Study of Diabetes (EASD), risk factors for prediabetes are associated with several non-modifiable conditions, including advanced age, family history, and hypertension, as well as modifiable risk factors, namely obesity, central obesity, physical inactivity, and insufficient consumption of fruits and vegetables. The prediabetes consensus by the American College of Endocrinology (ACE) and the American Association of Clinical Endocrinology (AACE) states that risk factors for prediabetes include family history, coronary heart disease, hypertension, overweight and obesity, and an unhealthy lifestyle. Behavioral factors that contribute to the occurrence of prediabetes include high fat consumption, lack of fiber, lack of physical activity, and smoking. High fat intake of more than 30% of total calories, especially saturated fat, can cause insulin resistance that leads to prediabetes. (Andriani et al., 2022;) (Armato et al., 2018)

Prediabetes sufferers need to make better lifestyle modifications to prevent the development of diabetes mellitus. Approximately 25% of prediabetes patients develop type 2 diabetes mellitus within 3–5 years, and 70% of patients are predicted to develop diabetes mellitus throughout their lives (Liberty et al., 2022; Hostalek, 2019).. If current trends continue, efforts must be made to stem the wave of new cases that are likely to emerge in the future. Therefore, it is crucial to determine the most effective indicators for predicting the development of prediabetes and identify individuals at higher risk of developing it.. (Liberty et al., 2022)

To date, few publications have found effective ways to predict which segments of the prediabetic population are most vulnerable to developing diabetes. It is crucial to identify who is most vulnerable and where they live to guide the efficient allocation of prevention resources. To achieve this, a measure of vulnerability patterns that can be applied across communities and used to identify at-risk groups is essential. Therefore, the aim of this study was to identify risk factors associated with prediabetes among people of working age.

METHOD

This research design uses a cross-sectional design, utilizing secondary data, namely the results of 2024 Non Communicable Disease screenings in Balikpapan City, obtained from the Balikpapan City Health Office. This cross-sectional study was conducted from January to December, 2024. The design was used to analyze risk factors influencing the incidence of prediabetes in productive age. Sampling in this study was conducted based on the research population, namely the productive-age population (15-64 years old) who underwent health checks during 2024 in Balikpapan City. Data were collected using a structured questionnaire administered directly to respondents and supported by secondary data from medical records. The sampling technique used in this study was purposive sampling, which is the deliberate selection of samples based on specific criteria or objectives determined by the researcher and deemed most relevant and representative of the research problem. The formula used by the researcher to determine the sample size was the Lemeshow formula. The Lemeshow formula has a significance level or error rate of 0.05 or 5% with a 95% confidence level and a proportion value of 75%.

The research instrument used in this study was secondary data from medical record which consisted of data on age, gender, BMI, waist circumference, fasting blood sugar, physical activity, smoking history, diastole blood pressure, family history of diabetes, and hypertension status. descriptive statistic were used to determine the frequency and percentage off all variables. The chi square were performed to investigate the relationship between health insurance ownership and hypertension as the outcome in the present study. And the multivariate analysis using binary logistic regression to investigate the most dominant risk factor. Ethical approval for this study was obtained from the Health Research Ethics Committee of RSJD Atma Husada Mahakam under approval number

000.9.2/671/RSJD-AHM/3/X. This study strictly adhered to ethical standards, ensuring the confidentiality and rights of all participants in accordance with established medical research ethics guidelines

RESULT

Table 1, among the 290 subjects, majority of subjects were women (67.6%), aged <45 years (56.6%), had an overweight BMI (63.4%), had a normal waist circumference (54.8%). Had been prediabetes category (73.1%), no history of smoking (92.1%). Had been normal physical activity (70%), had been normal blood pressure (79.3%), and had no history of diabetes (91.4%)

Respondent Characteristics	f	%
Gender		
Male	94	32,4
Female	196	67,6
Age		
≥ 45 years old	126	43,4
< 45 years old	164	56,6
BMI		
Overweight	184	63,4
Normoweight	82	28,3
Underweight	24	8,3
Waist Circumference		
Over	131	45,2
Normal	159	54,8
Fasting Blood Sugar (FBS)		
Prediabetes	212	73,1
Non Prediabetes	78	26,9
Smooking History		
Smooking	23	7,9
Not Smooking	267	92,1
Physical Activity		
Low	87	30
Normal	203	70
Blood Pressure		
High	60	20,7
Normal	230	79,3
Family history of diabetic		
Yes	25	8,6
No	265	91,4
Hypertension Disease Status		
Yes	32	11
No	258	89

The relationships between the variables studied showed at Table 2. A significant association was found between age, gender, and physical activity with the incidence of prediabetes. Multivariate analysis showed at Table 3. Using binary logistic regression showed that age (OR 0,404, 95%CI 0,228-0,715; p=0.002), gender (OR 2,237, 95%CI 1,203-4,162; p=0.011)and physical activity (OR 2,148, 95%CI 1,134-4,071; p=0.019) significantly associated with prediabetes. Among the risk factors for prediabetes in this study, gender status emerges as the most dominant risk factor.

Table 2.
Association between risk factor and Prediabetes

Variabel Independen		Prediabetes		Tidak Prediabetes		Total		P value
		f	%	f	%	f	%	
Gender								0,039*
Male		76	80,9	18	19,1	94	100	
Female		136	69,4	60	30,6	196	100	
Age								0,006*
≥ 45 years old		109	66,5	55	33,5	164	100	
< 45 years old		103	81,7	23	18,3	126	100	
Body Mass Index								0,347
Overweight		139	75,5	45	24,5	45	100	
Normoweight		55	67,1	27	32,9	82	100	
Underweight		18	75	6	25	24	100	
Waist Circumference								0,467
Over		99	75,6	32	24,4	131	100	
Normal		113	71,1	46	28,9	159	100	
Smooking History								0,737
Smooking		18	78,3	5	21,7	23	100	
Not Smooking		194	72,7	73	27,3	267	100	
Family history of diabetic								0,714
Yes		17	68	8	32	25	100	
No		195	73,6	70	26,4	265	100	
Physical Activity								0,046*
Low		71	81,6	16	18,4	87	100	
Normal		141	69,5	62	30,5	203	100	
Hypertension Disease Status								0,063
Yes		19	59,4	13	40,6	32	100	
No		193	74,8	65	25,2	258	100	
Blood Pressure								0,592
High		166	72,2	64	27,8	230	100	
Normal		46	76,7	14	23,3	60	100	

*Chi-Square test significant ($p < 0.05$)

Table 3.
Result of Multivariate Analysis

Variabel	B	P value	Exp (B)	95%CI	
				Lower	Upper
Age	-0,907	0,002*	0,404	0,228	0,715
Gender	0,805	0,011*	2,237	1,203	4,162
Physical Activity	0,765	0,019*	2,148	1,134	4,071

*Significant based on binary logistic regression test ($p < 0.05$)

DISCUSSION

The study of subject characteristics showed that the majority of participants were <45 years old (67.6%), female (69.4%), have high BMI (63.4%), normal waist circumference (54.8%), had no smoking history (92.1%), had no family history of diabetes (91.4%), normal physical activity (70%), normal blood pressure (79.3%), and no history of hypertension (89%). This study aims to find the relationship between risk factors and insciden of prediabetes.

A significant association was found between age, gender, and physical activity with the incidence of prediabetes. Based on age, a Chi-Square test yielded a p value = 0.006, indicating a statistically significant correlation. Participants with age had a 0,4 -fold increased risk of developing prediabetes. The results of this study align with research conducted by Astuti (2019), which found a

link between age and the development of prediabetes. The risk of prediabetes increases in those aged 45-60 years, due to the aging process, which causes insulin resistance, which reduces the cells' ability to produce insulin. (Liberty et al., 2022).

Based on gender, a Chi-Square test yielded a p value = 0.039, indicating a statistically significant correlation. Participants with specific gender had a 2,237-fold increased risk of developing prediabetes. The results of this study are consistent with research by Komariah & Rahayu (2020), who found that men and women have an equal risk of developing prediabetes and diabetes. The prevalence of men with IGT and women with IGT may be due to differences in risk between men and women in terms of glucose metabolism disorders, such as differences in fat distribution, insulin sensitivity, and hormonal differences. Visceral fat in men can increase insulin resistance, which triggers IGT, while hormonal fluctuations in women (estrogen/progesterone) contribute to impaired glucose tolerance (IGT). (Sevtiyani & Mivtahurrahimah, 2025)

Based on physical activity, a Chi-Square test yielded a p value = 0.046, indicating a statistically significant correlation. Participants with low physical activity had a 2,148-fold increased risk of developing prediabetes. This finding is consistent with research by Pratiwi et al. (2024) which found that two out of three participants (64.2%) had low and moderate levels of physical activity. The diabetes and prediabetes groups were more dominant compared to those without diabetes at low levels of physical activity. Physical activity levels have various health benefits, such as regulating blood sugar levels and preventing diabetes. Physical activity is effective in individuals with prediabetes in reducing predictors of diabetes changes (Pratiwi et al., 2024)

This study did not find a significant association between BMI and waist circumference with the incidence of prediabetes. These results are consistent with research by Andriani et al., 2022, which stated that obesity based on Body Mass Index (BMI) does not increase the incidence of prediabetes. Similar results were also found in a study conducted on overweight male subjects aged 30-45 years, which found no association between BMI and fasting blood sugar levels. BMI measurement has limitations in people with high fat-free mass who can have a high BMI but still be healthy, as well as in the elderly. BMI measurement cannot indicate body fat distribution. Upper body fat, as measured by the waist circumference ratio and waist-to-hip ratio, has a stronger correlation with diabetes mellitus. (Andriani et al., 2022). The lack of a significant association between smoking history, hypertension, and family history of diabetes and the incidence of prediabetes aligns with research by Park et al. (2019), which found that current lifestyle factors are more influential on the incidence of prediabetes than medical history. Research by Putri et al. (2022) in Indonesia also reported that family medical history is not always directly related to prediabetes, especially in the productive-age population where behavioral risk factors are predominant. (Pratiwi et al., 2024)

The major strength of this research is the identification risk factor influencing incidence of prediabetic in productive ages at Balikpapan City. So that it can provide more accurate data in management strategies for hypertensive patients.

CONCLUSION

Age, gender, and physical activity was risk factors with significant association with the incidence of prediabetes in productive ages, based on the results of non-communicable disease screening in Balikpapan City in 2024. Among the risk factors for prediabetes in this study, gender status emerges as the most dominant risk factor. So that special policies are needed for prediabetes prevention according to the risk factors that have been studied.

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