COMPARISON OF RISK FACTORS FOR PRIORITY NON-COMMUNICABLE DISEASES AMONG HAJJ PILGRIMS IN BANDUNG REGENCY, 2024

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ABSTRACT

The most common diseases among Indonesian hajj pilgrims are non-communicable diseases (NCDs). To optimize the health *istita'ah* policy of the Ministry of Religious Affairs, further analysis of NCD risk factors in hajj pilgrims is needed. This study aimed to compare the risk factors of NCDs (hypertension and diabetes mellitus) among hajj pilgrims in Bandung Regency. A case-control study was conducted in Bandung Regency, West Java, Indonesia using secondary data from the Integrated Hajj Computerized System for Health (*Siskohatkes*). Each case and control group consisted of 178 hajj pilgrims. The research variables analyzed as risk factors included age, sex, and comorbid diseases. Logistic regression analysis was performed. The results showed that age (OR=4.34; 95% CI=1.45–13.02) and comorbidities (OR=7.65; 95% CI=4.59–12.73) were risk factors for hypertension, while age (OR=2.65; 95% CI=1.14–6.15) and comorbidities (OR=7.00; 95% CI=4.31–11.34) were also risk factors for diabetes mellitus. Hajj pilgrims aged ≥40 years or with comorbidities were more likely to develop hypertension than diabetes mellitus. Therefore, health coaching for hajj pilgrims should emphasize lifestyle modification and adherence to routine medical control.

Keywords: Diabetes Mellitus, Hajj Pilgrims, Hypertension, Risk Factors

INTRODUCTION

Indonesia is known as the largest Muslim-majority country in the world, with approximately 87.08% of its population adhering to Islam. Each year, the Indonesian government sends around 200,000 pilgrims to perform Hajj in Saudi Arabia, except during the COVID-19 pandemic when the pilgrimage was suspended (Muhamad, 2024).

Data from the Hajj Organizing Committee (*PPIH*) between 2016 and 2022 indicate that the three most common diseases among Indonesian Hajj pilgrims are hypertension, metabolic disorders, and cardiovascular diseases (Kementerian Kesehatan RI, 2023). In 2022 alone, among 100,051 pilgrims, 1,724 (1.7%) were diagnosed with heart and vascular diseases, 5,697 (5.7%) with diabetes mellitus, and 15,315 (15.3%) with hypertension (Kementerian Kesehatan RI, 2022). Cardiovascular diseases including hypertension, coronary heart disease, congestive heart failure, hypertensive heart disease, and arrhythmia constitute the leading causes of morbidity and mortality among Indonesian Hajj pilgrims (Ardiana et al., 2023).

The mortality data from recent years further emphasize this issue. In 2023, the number of Hajj pilgrim deaths reached 775, higher than in 2019 (473 deaths) and 2018 (385 deaths). The main causes of death were sepsis and cardiogenic shock, with the majority of deceased pilgrims being elderly. Mortality and morbidity rates were found to rise sharply during the Mina and post-Armina rituals. This high death rate may be attributed to the increasing number of elderly pilgrims and the high proportion of high-risk pilgrims, which estimated to account for 75% of the total quota (Ulya & Rastika, 2023).

Age has been identified as a key determinant of mortality among pilgrims with cardiovascular diseases. The average waiting time for Indonesian Muslims from registration to departure ranges between 22 and 46 years (Kementerian Sekretariat Negara RI, 2023). This long waiting period inevitably increases the age of pilgrims at the time of departure, which in turn raises the risk of death due to

cardiovascular conditions (Rahman et al., 2024).

In response to these challenges, the Ministry of Religious Affairs of the Republic of Indonesia has established three main policies to improve the quality of Hajj guidance: (1) general Hajj education for pilgrims, (2) health education before, during, and after the pilgrimage, and (3) coordination with the Ministry of Health in implementing health guidance. Starting in 2024, the Ministry of Religious Affairs has introduced the *Istita'ah* policy, requiring pilgrims to obtain health clearance as a prerequisite for completing their Hajj payment (*BPIH*) (Salma, 2024).

The implementation of this policy necessitates readiness at all levels of government health services particularly primary healthcare centers to conduct comprehensive health screenings. Health coaching before departure is the responsibility of the Health Centers and the District or City Health Offices. Pilgrims who are declared "istita'ah" (fit to perform Hajj) based on the first health examination are allowed to proceed with the payment of their Hajj fees.

To support this system, the Integrated Computerized Hajj Health System (*Siskohatkes*) is utilized to collect and classify pilgrims' medical data from hospitals and health centers, enabling effective monitoring and control of high-risk health factors among Hajj pilgrims (Budiarto et al., 2022). The variables recorded in Siskohatkes include age, sex, family history of hypertension, body mass index (BMI), cholesterol, and triglyceride levels (Kementerian Kesehatan RI, 2022).

Although numerous studies have utilized Siskohatkes to analyze health risk factors among Indonesian Hajj pilgrims, studies that examine regional-level data, particularly in Bandung Regency, remain limited (Prihatini, 2021; Sugeng et al., 2025). Furthermore, previous studies generally analyzed single NCDs independently or treated them collectively as a single group under the category of NCD (Roikhan & Rahmah, 2025; Saidah et al., 2023). To date, few studies have compared the relative

magnitude of hypertension and diabetes mellitus risk factors within the same population.

Comparing the risk factors for hypertension and diabetes mellitus provides a more comprehensive understanding of how demographic and comorbid variables contribute differently to each disease. This comparison is essential to identify which conditions pose a greater health burden among Hajj pilgrims and to guide the prioritization of health interventions accordingly (Pane, 2024).

This study also aligns with the 2024–2025 Priority Program of the Indonesian Ministry of Health, which emphasizes the control and prevention of NCDs as a key pillar of primary healthcare services (Kementerian Kesehatan RI, 2024). In accordance with Minister of Health Regulation No. 71 of 2015, Article 6, the implementation of NCDs control programs is prioritized for diseases that have a high mortality or disability rate, high morbidity rate, or high treatment costs. Within this framework, hypertension and diabetes mellitus are identified as priority diseases requiring enhanced management and monitoring efforts (Kementerian Kesehatan RI, 2015).

Therefore, this study aims to compare the risk factors of NCDs prioritized by the Ministry of Health (hypertension and diabetes mellitus) among Hajj pilgrims in Bandung Regency. The results are expected to support the optimization of regional health screening and coaching programs for high-risk pilgrims.

METHOD

This study is an observational study with a case-control design. This design was chosen because it is suitable for identifying whether certain factors is associated with diseases (Tenny et al., 2023). The research was conducted in Bandung Regency from January to August 2025.

The study population consisted of all Hajj pilgrims from Bandung Regency in the 1445 Hijri / 2024 AD departure period, totaling 3,309 people. The population of cases included Hajj pilgrims diagnosed with hypertension or diabetes mellitus, while the population of controls included Hajj

pilgrims without either of these diseases. The ratio of case and control groups was 1:1.

Samples were selected from both populations using inclusion and exclusion criteria. The inclusion criteria were: (1) registered as regular Hajj pilgrims according to the Ministry of Religious Affairs' regulations for the 1445 Hijri / 2024 AD departure period; (2) had undergone the Hajj health examination with results recorded in Siskohatkes; and (3) had a final diagnosis of hypertension (ICD-10: I10) or diabetes mellitus (ICD-10: E11) for the case group, and diagnosed with diseases other than hypertension and diabetes mellitus for the control group.

The exclusion criteria were: (1) residing outside Bandung Regency and (2) incomplete health data recorded in Siskohatkes. The dependent variables in this study were hypertension and diabetes mellitus, while the independent variables were age, sex, and comorbid diseases.

The data used in this study were secondary data obtained from Siskohatkes. Data analysis included chi-square tests and logistic regression. Multivariable analysis was performed with a comparison of odds ratios (OR) between the hypertension and diabetes mellitus groups. This study obtained ethical clearance from the Health Research Ethics Committee.

RESULTS

Table 1 shows that the majority of pilgrims in the hypertension case group (97.8%) and diabetes mellitus (94.4%) were in the high risk age category (the majority in the 50-59 year age group). In the control group, the proportion of pilgrims with high risk age was also high, namely 82% for hypertension and 85.4% for diabetes mellitus. The gender composition was relatively balanced with slightly more female pilgrims than male pilgrims in both the case and control groups. Most pilgrims in the hypertension case group (66.3%) and diabetes mellitus (64.6%) had comorbidities. The most common comorbidities among pilgrims were endocrine, nutritional, and metabolic disorders. Meanwhile, in the hypertension control group (81.5%) and diabetes mellitus (79.2%) pilgrims tended not to have comorbidities.

Table 1. Frequency Distribution of Respondent Characteristics

Variables	Hypertension						Diabetes Mellitus					
	Case		Control		Total		Case		Control		Total	
	n	%	n	%	n	%	n	%	n	%	n	%
Age												
≥40 years	174	97,8	146	82	320	89,9	168	94,4	152	85,4	320	89,9
<40 years	4	2,2	32	18	36	10,1	10	5,6	26	14,6	36	10,1
Gender												
Woman	95	53,4	96	53,9	191	53,7	92	51,7	93	52,2	185	52
Man	83	46,6	82	46,1	165	46,3	86	48,3	85	47,8	171	48
Comorbidity												
Yes	118	66,3	33	18,5	151	42,4	115	64,6	37	20,8	152	42,7
No	60	33,7	145	81,5	205	57,6	63	35,4	141	79,2	204	57,3
Total	178	100	178	100	356	100	178	100	178	100	356	100

The results of bivariate analysis (Table 2) showed that the variables of age (OR=9.53; 95%CI=3.29-27.58) and comorbidities (OR=8.64; 95%CI= 5.29-14.09) were significantly related (p-value <0.0001) to the incidence of hypertension. In the incidence of diabetes mellitus, the variables of age (OR=2.87; 95%CI=1.34-6.15) and comorbidities (OR=6.95; 95%CI=4.32-11.18) were also significantly related with p-value=0.005 and p-value <0.0001 respectively. Meanwhile, the gender variable was not significantly related to the incidence of hypertension or diabetes mellitus.

Although the bivariate analysis of the gender variable did not show a significant relationship, the gender variable was still included in the selection of the best regression model considering the results of previous research which found a significant relationship between gender and the incidence of hypertension in Hajj pilgrims (Danny & Sudaryo, 2023).

After multivariable analysis, it was seen that the gender variable had a p-value >0.05 so it was removed for the second analysis. In Multivariable Model 2, it was seen that there was no change in OR >10%, so the gender variable should have been removed from the final model because it was not considered as a confounder. However, several other criteria, namely the R2

value, G Statistics, Hosmer-Lemeshow test, and Overall Percentage were used to determine the best logistic regression model (Ailobhio & Ikughur, 2024). Based on these criteria, Multivariable Model 1 where gender variable is still included was selected as the final multivariable model because it had a higher value.

Table 2. Bivariate and Multivariable Analysis of Risk Factors for Hypertension and Diabetes Mellitus

Variables	Hypertension		Diabetes Mellitus	
	Crude OR (95% CI)	**Adjusted OR (95% CI)**	**Crude OR (95% CI)**	**Adjusted OR (95% CI)**
Age ≥40 years <40 years	**9,53**** (3,29 - 27,58)	**4,34*** (1,45 - 13,02)	**2,87*** (1,34 - 6,15)	**4,4*** (1,46 - 13,21)
Gender Woman Man	0,97 (0,64 - 1,48)	0,73 (0,44 - 1,19)	0,97 (0,64 - 1,48)	-
Comorbidity Yes No	**8,64**** (5,29 - 14,09)	**7,65**** (4,59 - 12,73)	**6,95**** (4,32 - 11,18)	**7,28**** (4,42 - 12)

**p-value<0,05 **p-value<0,001*

Table 3 shows that the age variable is significantly related to the incidence of hypertension (p-value=0.009) and diabetes mellitus (p-value=0.022). Pilgrims with the high risk age category (≥40 years) are 4.34 times more likely to experience hypertension (95%CI=1.45-13.02) and 2.65 times more likely to experience diabetes mellitus (95%CI=1.14-6.15) compared to pilgrims aged <40 years. The comorbidity variable is also significantly related to the incidence of hypertension and diabetes mellitus (p-value <0.0001). Pilgrims with comorbidities are 7.65 times more likely to experience hypertension (95%CI= 4.59-12.73) and 7 times more likely to experience diabetes mellitus (95%CI=4.31-11.34) compared to pilgrims who do not have comorbidities.

DISCUSSION

Hypertension Risk Factors

Age is one of the most important determinants of hypertension among Hajj pilgrims. Pilgrims in the high-risk age category (≥40 years) were more likely to suffer from hypertension, consistent with the findings of previous study (Roikhan & Rahmah, 2025). The increase in hypertension risk with advancing age is related to natural physiological changes in the cardiovascular system, such as hormonal alterations, decreased arterial elasticity, and vascular narrowing. These changes contribute to increased vascular resistance and blood pressure over time (Singh et al., 2023; Warjiman et al., 2020).

Comorbidities also play a substantial role in the development of hypertension. In this study, the most common comorbidity among hypertensive pilgrims was classified under Group E, which includes endocrine, nutritional, and metabolic disorders (excluding E11). Hypertension frequently coexists with diabetes mellitus (Jia & Sowers, 2021). The coexistence of both diseases greatly amplifies cardiovascular risks—individuals with both hypertension and diabetes have a 4–5 times higher likelihood of developing coronary heart disease and stroke, and their combined presence can increase cardiovascular morbidity and mortality by up to 60% (Danny & Sudaryo, 2023).

Hypertension with comorbidities remains one of the leading causes of death globally (Wandile, 2024). Severe hypertension can lead to serious complications such as stroke, with hypertensive individuals facing a 4–6 times higher risk compared to normotensive individuals. It is estimated that nearly 70% of stroke patients have a history of hypertension (Chang & Bhalla, 2020). Such complications are particularly concerning among Hajj pilgrims, where physical strain and extreme environmental conditions can exacerbate cardiovascular risks. Insufficient monitoring between the second and third health screenings, which typically spaced about four months apart, can allow uncontrolled hypertension to progress, increasing the

risk of complications and potentially affecting the pilgrims' health eligibility for departure.

Although the gender variable was not significantly associated with hypertension in this study, the prevalence of hypertension among female pilgrims was slightly higher than among male pilgrims, a pattern consistent with previous findings (Connelly et al., 2022; Pardede et al., 2020). This difference may be explained by hormonal changes associated with menopause. The decline in estrogen levels during the post-menopausal period is known to reduce vascular protection and increase susceptibility to hypertension (Iswandari & Hasanah, 2023; Warjiman et al., 2020).

Diabetes Mellitus Risk Factors

This study found a significant relationship between age and the incidence of diabetes mellitus, consistent with the findings of previous study (Nasution et al., 2021). The risk of diabetes generally increases after the age of 45 years, as advancing age is associated with physiological decline in metabolic efficiency. Aging contributes to reduced pancreatic β-cell function, increased insulin resistance, and diminished organ performance—particularly in individuals with low physical activity levels (Tudurí et al., 2022).

There are various diseases that accompany diabetes mellitus. The coexistence of hypertension and diabetes mellitus is among the most frequent comorbidities, with hypertension being approximately twice as common among individuals with diabetes compared to those without (Bodke et al., 2023).

In this study, the most comorbidities in the diabetes group were in group E and complications of group E. ICD10 in group E has 10 categories, namely thyroid gland disorders (E00-E07), diabetes mellitus (E08-E13), other disorders of glucose regulation and pancreatic internal secretion (E15-E16), other endocrine gland disorders (E20-E35), intraoperative endocrine complications (E36-E39), malnutrition (E40-E46), other nutritional deficiencies (E50-E64), obesity and other hyperaliment

(E65-E68), metabolic disorders (E70-E88), endocrine and metabolic post-procedural and unclassified (E89-E89).

In this study, gender was not significantly associated with the incidence of diabetes mellitus, consistent with the findings of Nasution et al. (2021). However, several other studies have shown differing results, indicating that men are generally more likely to develop type 2 diabetes, while women tend to experience more severe complications once the disease develops (Kautzky-Willer et al., 2023; Muilwijk et al., 2022).

Comparison of Priority NCD Risk Factors

Age was found to be a stronger risk factor for hypertension than for diabetes mellitus in this study. Danny (2023) reported that Hajj pilgrims aged over 56 years had a 1.45 times greater risk of developing hypertension, while Saidah (2023) found that pilgrims aged ≥60 years had nearly twice the risk (Danny & Sudaryo, 2023; Saidah et al., 2023). In contrast, Nasution (2021) reported that Hajj pilgrims in the high-risk age category were 5.6 times more likely to develop diabetes mellitus (Nasution et al., 2021). When compared to these findings, the results of this study differ, as the effect of age on hypertension was greater than on diabetes. This discrepancy may be attributed to variations in study populations and methodological approaches.

The influence of comorbidities on the occurrence of both hypertension and diabetes was found to be stronger than that of age. The comorbidities most commonly found among Hajj pilgrims before departure are hypertension, dyslipidemia, and diabetes mellitus. Therefore, early health screening is conducted to enable proper health management and ensure that pilgrims' physical conditions are well controlled, supporting the smooth performance of their pilgrimage (Yezli et al., 2021). Special attention should also be given to the frequent coexistence of hypertension and diabetes, as both conditions affect similar target organs and substantially increase the risk of complications such as atherosclerosis, retinopathy, kidney

failure, and cardiovascular disease (Warjiman et al., 2020).

Strengths and Limitations of the Study

This study provides region-specific evidence from Bandung Regency, an area that has been rarely explored in previous research, offering valuable insights for local health planning. The comparative approach adopted in this study allows a deeper understanding of how similar risk factors differ in their impact on each diseases. By identifying key risk factors of prioritized NCDs, this research can serve as a useful reference for improving the implementation of the istita'ah health policy.

Despite its contributions, this study also has several limitations that should be acknowledged. The analysis was limited to three independent variables due to data availability, which may reduce the comprehensiveness of the findings. The use of secondary data may also present issues related to completeness and accuracy. Furthermore, although a case-control approach was applied, the cross-sectional nature of the dataset limits causal interpretation. Lastly, the frequent coexistence of hypertension and diabetes may have resulted in overlapping effects when estimating their respective risk magnitudes.

CONCLUSION

This study found a significant relationship between age and comorbidities with hypertension and diabetes mellitus. Hajj pilgrims with both risk factors have a greater probability of experiencing hypertension than diabetes mellitus. Meanwhile, gender is not significantly related to hypertension and diabetes mellitus. Thus, the management of hypertension and diabetes mellitus in hajj pilgrims must include modification of modifiable factors. Hajj and NCD managers at the Health Center and Health Office should include education on routine control compliance, especially for hajj pilgrims who will depart in the following year. In addition, further research can be conducted regarding the magnitude of the risk of complications of

hypertension and diabetes mellitus with a different research design.

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