Asian Journal of Health Research
Journal Homepage: https://a-jhr.com
Published by Ikatan Dokter Indonesia Wilayah Jawa Timur

Original Research

Anaemia and Family Income are associated with Preeclampsia Maternal Death in Jember District, Indonesia

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ARTICLE HISTORY
Received: 3 July 2022
Revised: 13 July 2022
Accepted: 27 July 2022

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KEYWORD
Anaemia; Low-income; Preeclampsia; Maternal Mortality; Case Control

ABSTRACT

Introduction: Preeclampsia is a pregnancy-related complication causing maternal morbidity and mortality. Having anaemia and being low income have been recognized as risk factors for preeclampsia. This study aimed to determine the relationship between anaemia and family income, and maternal death from preeclampsia in the Jember district.

Methods: This case-control study used data from maternal verbal autopsy, from January 2016 to December 2019. Forty-three mortality cases from preeclampsia were acquired using total sampling, while forty-three survived mothers from preeclampsia (controls) were taken using purposive sampling. The Chi-square test was administered to test the relationship between anemia, family income, and maternal death from preeclampsia.

Results: Mothers who died from preeclampsia were more likely to age between 20 and 35 years (44.19%), primipara 20 people (46.51%), have anaemia (83.72%), and being low income (86.05%). Anaemia (COR 3.703, 95% CI p-value 0.009) and low income (COR 4.032, 95% CI, p-value 0.007) were associated with preeclampsia maternal mortality.

Conclusion: Anaemia and low family income were associated with maternal death from preeclampsia in the Jember district. To reduce the prevalence of death from preeclampsia, a preventive measurement for anaemia during pregnancy should be undertaken. In addition, women with low income during pregnancy should be encouraged to have health insurance.

Cite this as: Gayatri M, Fathiyyah N, Mulyadi J, Wardani DS, Indrawan IWA (2022) Anaemia and Family Income are associated with Preeclampsia Maternal Death in Jember District, Indonesia. *Asian J Heal Res*. 1 (2): 35-39. doi: https://doi.org/10.55561/ajhr.v1i2.45

INTRODUCTION

Preeclampsia occurring during pregnancy is a cause of maternal morbidity and mortality. Blood pressure and urine protein examination are the measures to identify preeclampsia. Preeclampsia is characterized by an increase in blood pressure (140 mmHg systolic and 90 mmHg diastolic pressure), starting after 20 weeks of gestation [1]. Elevated blood pressure in preeclampsia reflects multisystem endothelial dysfunction leading to vascular, renal, and hepatic damage [2].

Preeclampsia contributes to approximately 15% of pregnancy complications and 18% of maternal deaths globally, with an estimated 62,000 to 77,000 cases annually [3]. According to the Indonesian Health Profile, maternal mortality cases have increased by 406 deaths, which constituted 305 deaths per 100,000 live births in 2020 [4]. Jember, a district in East Java Province, Indonesia, is the district with the highest maternal mortality; 61 cases or 173 per 100,000 live births in 2020 [5]. Preeclampsia (26.2%) was the second leading cause of maternal deaths in the district.

Anaemia is recognized as a risk factor for preeclampsia. Anaemia is defined as haemoglobin levels <11.0 g/dL in the first and third trimesters of pregnancy and hemoglobin levels <10.5 g/dL in the second trimester of pregnancy [6]. Anaemia results in placental hypoxia and causes endothelial dysfunction and multiorgan injury [7].

e-ISSN: 2828-9269 • p-ISSN: 2829-2979

Lower household income is closely related to lower levels of education, unhealthy behaviour, more stressful environments, limited access to adequate housing or utilities, increased maternal infections, and unwanted pregnancies, resulting in lower commitments for prenatal care [8]. Women in the low-income socio-economic group tended to show higher rates of abortion, cesarean section, preeclampsia, preterm delivery, and obstetrical bleeding compared to the high socio-economic group. Therefore, stakeholders should consider investigating what barriers exist or what factors could influence this outcome [9]. Low economic status is related to the ability of the family to meet the need for nutritious and healthy food to prevent the occurrence of preeclampsia and worsen the condition of preeclampsia [10].

Jember, a district in East Java, consistently has the highest maternal mortality in the province. In 2020, the MMR was 173 per 100,000 live births [11]. In 2020, the percentage of maternal mortality related to hypertensive disorder dropped (26.9%). However, hypertensive disorder has consistently been the main cause of maternal deaths in East Java since 2015 [11]. Gestational hypertension (26.90%) continues to be the leading causes to maternal mortality in this province. In 2020, 2,536,729 people resided in Jember [12,13]. Four antenatal visits, institutional birth coverage, and three postnatal visits were high (82%, 94.3%, and 92.3% respectively) in 2020; nonetheless, the MMR has continued to be the highest in the province for the last several years. This study aimed to determine the relationship between anaemia and socioeconomics, and maternal mortality from preeclampsia in the Jember district.

MATERIAL AND METHODS

Study design, Data, and Sample

This was a case-control study conducted in the Jember, East Java, Indonesia. Our study used Verbal Maternal Autopsy from January 2016-December 2019, Jember District Health Office provided. According to the Minister of Domestic Affairs and the Minister of Health number 15 of 2010N 2009, number 162/ MENKES/ PB / I / 2010 article number 6 [14]. A verbal autopsy includes questions regarding mothers' sociodemographic information, history of pregnancy, labor, and postpartum, as well as risk factors for deaths [15,16]. To complete the questions, doctors, trained nurses and midwives interview the mothers' families or other related parties [14].

Maternal records in 26 Community Health Centres in Jember were taken to complement the data. The total respondents were 86 mothers with preeclampsia, consisting of 43 pf 58 preeclampsia death cases taken using total sampling, and 43 survived mothers from preeclampsia (controls) through purposive sampling. The research criteria included at-term pregnancy, with no complications besides preeclampsia, including Intrauterine Foetal Deaths (IUFD). Anaemia is defined as a hemoglobin level <11.0 g/dL in the blood in the third trimester (Yes/ No) [6] and Low income is the salary earned by the mother and husband for one month lower than the Jember Regency Minimum Wage Standard from 2020 to 2021 (Yes/ No).

Data Analysis

The bivariate analysis of this study used the Chi-Square test followed by a Crude odds ratio (COR) with a 95% confidence interval (CI) to report the association between each risk factor and mortality. Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) version 25.0 for windows.

Ethics

Ethical approval was sought from the Ethical Board of Faculty of Medicine, Universitas Brawijaya (#55/EC/KEPK-S2/02/2022).

RESULTS

Demographic Information

Table 1 presents the sociodemographic characteristics of the respondents. The sample size achieved was a total of 43 cases and 43 controls. The number of women aged 20 – 35 years who died from preeclampsia was 19 women (44.19%) among cases and 19 people (44.19%) among controls. The number of primiparas was 20 women (46.51%) among cases,and multipara was 20 persons (46.51%) among controls.

Table 1. Demographic Information

Variables	Cases (N = 43)	Controls (N =43)
Age		
<20 years	16 (37.21%)	13 (30.23%)
20 – 35 years	19 (44.19%)	19 (44.19%)
>35 years	8 (18.60%)	11 (25.58%)
Parity		
Primipara	20 (46.51%)	15 (34.88%)
Multipara	17 (39.53%)	20 (46.51%)
Grande multipara	6 (13.95%)	8 (18.60%)

Risk Factors for Maternal Mortality from Preeclampsia in the Jember District

Table 2 shows the sociodemographic characteristics of our respondents. The sample size achieved was a total of 43 cases and 43 controls. The percentage of women with anaemia who died from preeclampsia was (83.72%%) among cases and (58.14%) among controls. The association is statistically significant as p-value ≤ 0.05, p 0.009 (COR 3.703, 95% CI: (1.347 – 10.179).

Table 2. Risk factors for maternal mortality from preeclampsia in Jember district, Indonesia from January 2016 to December 2019

Variables	Cases (n = 43)	Controls (n= 43)	*P-value*	COR (95% CI)
Anaemia				
Yes	36 (83.72%)	25 (58.14%)	0.009	3.703
No	7 (16.23%)	18 (41.86%)		(1.347 – 10.179)
Low Income				
Yes	37 (86.05%)	26 (60.47%)	0.007	4.032
No	6 (13.95%)	17 (39.57%)		(1.401 – 11.606)

Therefore, the null hypothesis is rejected and thus restated as; there is a significant relationship between anaemia and preeclampsia maternal mortality.

Low income was 86.05% among cases and 60.47 among controls. The association is statistically significant as p-value ≤ 0.05, p 0.007 (COR 4.032, 95% CI: (1.401 – 11.606)). Therefore, the null hypothesis is rejected and thus restated as; there is a significant relationship between low income and preeclampsia maternal mortality.

DISCUSSION

Our study found a significant effect between anaemia and maternal death from preeclampsia. Our finding is consistent with the previous study conducted in northern Ethiopia, which revealed that women with anaemia had a 3.23-fold increased risk of death from preeclampsia, compared to those without anaemia [17]. Anaemia causes a decrease in sufficient oxygen levels in the blood, which leads to placental hypoxia. Subsequently, placental hypoxia affects trophoblast cell differentiation and spiral artery remodelling. The secretion of hypoxia-stimulated antiangiogenic and inflammatory factors, sFlt-1 for instance, may lead to endothelial dysfunction and multiorgan injury, which are hallmarks of preeclampsia [18]. Another study showed that anaemia causes iron deficiency, folate levels, or other metabolic disorders. It could be associated with the reduction of antioxidant micronutrients, resulting in vascular endothelial oxidative stress, endothelial dysfunction, associated multiorgan damage, and preeclampsia [7].

In addition, anaemia contributes to the poor outcome of preeclampsia due to uteroplacental insufficiency, which results in impaired blood supply to the fetus and increases the prevalence of premature birth [19].Uteroplacental insufficiency is associated with impaired blood flow, characterized by decreased blood flow [20]. Decreased blood flow caused by anaemia occurs progressively, which causes vascular narrowing, resulting in obstruction of blood flow in all tissues; one of which is the placenta. According to the theory of placental ischemia, an ischemic and hypoxic placenta will produce oxidants in the form of hydroxyl radicals. Hydroxyl radicals will damage cell membranes that contain a lot of unsaturated fatty acids into fatty peroxides. The increase in fatty peroxides proves that hypertension occurs in pregnancy [21]. Damage to endothelial cells will eventually result in impaired circulation in the vasa vasorum. Furthermore, there will be leakage of endothelial cells so that blood-forming elements such as platelets and fibrinogen are buried in the subendothelial layer. Permeability to protein will increase so that proteinuria will occur [22].

Quality of antenatal care and the number of visits can prevent anaemia during pregnancy [23]. At the present, the minimum standard of antenatal care in Indonesia comprises seven procedures that must be carried out by healthcare professionals; weight measurement, blood pressure measurement, fundal height measurement, provide tetanus toxoid immunization, provide 90 iron tablets during pregnancy, perform sexually transmitted disease test, and provide referral plan- related education [24].

In our study, it was found that there was a significant relationship between low income and the incidence of maternal deaths from preeclampsia. Economic status or family income has a significant relationship to the incidence of preeclampsia related to the family's ability to get good and quality health services so with high family income or high family economic status. Furthermore, this will increase access or ability to get the best health services. In other words, pregnant women who have a high risk of preeclampsia may get the right treatment because of the ability of the family to pay for the delivery. As a result, the prevalence of death in childbirth can be reduced [25]. Another study also showed that socioeconomic status had a significant relationship with maternal mortality from preeclampsia; the lower the level of family income, the higher the risk of pregnant women experiencing preeclampsia and death [26]. A family's economic level or family income can affect the incidence of preeclampsia, as well as deaths from preeclampsia [27].

Women with low family income tend not to get access to good health services [28]. Economic barriers may limit women's health-seeking behavior, making pregnancy and childbirth dangerous [29]. Families who have a low economic level or low income tend to have limitations in accessing health services in getting an early diagnosis of preeclampsia because, with the low economic status of the family, the mother tends to lack antenatal care visits; hence, the risks of complications in pregnancy and labor are unavoidable [27]. Intervention in economic factors can be done by focusing on ensuring health insurance for women from the prenatal period to the postnatal period [30].

CONCLUSION

The results of our study have important implications for reducing maternal mortality from preeclampsia. We found strong evidence that anaemia and income increased the risk of death from preeclampsia. Low family income was found to affect maternal mortality caused by preeclampsia in addition to being related to compliance with antenatal care and prenatal care due to low family income. Anemia is one of the risks of preeclampsia and can aggravate the condition of preeclampsia so that complications of preeclampsia severity and death can occur. Optimizing the preventive measures for maternal anaemia and increasing the coverage of health insurance among pregnant women are encouraged. In addition, our findings can be supporting evidence for the local government in making maternal health-related decisions.

ACKNOWLEDGMENT

We would like to thank the Jember District Health office and midwives in 26 community health services in the Jember district for assisting with the data collection.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

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