Analysis of demographic factors and anaemia of the incidence of spontaneous abortion

Farikha Dewi Larasati[1], Sri Winarni*[1], Atik Mawarni[1], Farid Agushybana[1]

[1]Department of Biostatistics and Population, Faculty of Public Health, Universitas Diponegoro, Semarang, Indonesia

Original Article

ABSTRACT

Background: Abortion is associated with 4.7% to 13.2% of maternal deaths. In the Brebes Regency, spontaneous abortion incidence was 15% in 2014, which various factors may cause.

Objective: This study aims to analyse the association between maternal age, education level, employment status, and haemoglobin (Hb) levels with the incidence of spontaneous abortion.

Methods: This study was a quantitative study using a case-control design. The study comprised a sample of 78 females of childbearing age, including 39 cases and 39 controls. The study utilised questionnaires and blood tests as instruments for data collection. The collected data were analysed using frequency distribution tables and statistical tests, including Chi-Square continuity correction.

Results: The results demonstrated that Hb levels were associated with spontaneous abortion (p=0.028). Meanwhile, maternal age (p=1.000), education levels (p=1.000), and employment status (p=0.485) were not associated with spontaneous abortion. Respondents with low Hb levels have a six times greater risk of having a spontaneous abortion than respondents with normal Hb levels (OR=6.379)

Conclusion: Low Hb level was a risk factor for spontaneous abortion. Women of childbearing age need to take iron supplements before and during their pregnancy to prevent the dangers of anaemia during pregnancy.

Latar Belakang: Aborsi dikaitkan dengan 4,7% hingga 13,2% kematian ibu. Di Kabupaten Brebes, kejadian aborsi spontan mencapai 15% pada tahun 2014, yang dapat disebabkan oleh berbagai faktor.

Tujuan: : Penelitian ini bertujuan untuk menganalisis hubungan antara usia ibu, tingkat pendidikan, status pekerjaan, dan kadar hemoglobin (Hb) dengan kejadian aborsi spontan.

Metode: Penelitian ini merupakan studi kuantitatif dengan desain kasus kontrol. Penelitian ini melibatkan sampel sebanyak 78 wanita usia subur, terdiri dari 39 kasus dan 39 kontrol. Penelitian ini menggunakan kuesioner dan tes darah sebagai instrumen pengumpulan data. Data yang terkumpul dianalisis menggunakan tabel distribusi frekuensi dan uji statistik, termasuk Chi-Square continuity correction.

Hasil: Hasil penelitian menunjukkan bahwa kadar Hb berkaitan dengan aborsi spontan (p=0,028). Sementara itu, usia ibu (p=1,000), tingkat pendidikan (p=1,000), dan status pekerjaan (p=0,485) tidak berkaitan dengan aborsi spontan. Responden dengan kadar Hb rendah memiliki risiko enam kali lebih besar untuk mengalami aborsi spontan dibandingkan dengan responden dengan kadar Hb normal (OR=6,379).

Kesimpulan: Kadar Hb rendah merupakan faktor risiko untuk aborsi spontan. Wanita usia subur perlu mengonsumsi suplemen zat besi sebelum dan selama kehamilan untuk mencegah bahaya anemia selama kehamilan.

INTRODUCTION

Global maternal mortality in 2017 was 295.000 deaths or 211 per 100.000 live births.[1] Each year, 4.7–13.2% of maternal deaths could be attributed to abortion.[2] Abortion is the completion of the gestation period at 22 weeks of fetal age or <22

weeks.[3] Spontaneous abortion or miscarriage is the loss of pregnancy naturally before twenty weeks of gestation.[4] Abortions in Indonesia reach 4%.[5] The estimated number of abortions in Java in 2018 is 1.031.573 or 25.8 per 1.000 women of childbearing age. As many as 23.4 per 1,000 women of childbearing age in Central Java had an abortion.[6] Brebes Regency is the district with the highest maternal mortality rate in Central Java. In 2014, the incidence of spontaneous abortion in the Brebes Regency was 15%.[7]

Factors that cause spontaneous abortion are socio-demographic factors and haemoglobin (Hb) levels. Maternal age is associated with spontaneous abortion. The lowest risk is among women aged 25-29 (9.8%), with the absolute lowest risk at age 27 (9.5%), and the highest risk at age 45 and over (53.6%). The youngest mothers (<20 years) had a risk of 15.8%.[8] Maternal age who are at high risk (<20 and >35 years) have a three times greater chance of having an abortion compared to mothers who are not at risk (20-35 years) (odds ratio, OR=2.917).[9]

Education level and type of mother's occupation are associated with the incidence of spontaneous abortion. Women with higher educational attainment had a lower prevalence of spontaneous abortion compared with women with low educational attainment (adjusted odds ratio, AOR=0.90; 95% confidence interval, CI: 0.82–0.98).[10] This condition was caused by pregnant women with low education and low knowledge of antenatal care (ANC) status. There was a significant and direct association between the level of education and the level of knowledge with ANC status.[11]

The incidence of spontaneous abortion was reported to be greater in mothers who did not work (54.84%) compared to employed mothers (30.91%).[12] The risk of spontaneous abortion was only reduced in factory workers (AOR=0.59; 95%CI: 0.53–0.66) and professional workers (AOR=0.75; 95%CI: 0.66–0.84) compared with agriculture and associated workers.[10] Additionally, shallot farmers in Brebes Regency use a high number of pesticides.[13]

Anaemia is a condition in which the number of red blood cells or oxygen capacity is insufficient to meet physiological needs, which can vary depending on age, sex, height, smoking, and pregnancy status.[14] Severe anaemia is when the level of Hb in the blood drops below 11 g/dL. During pregnancy, this can lead to maternal and fetal morbidity and mortality.[15] Anaemia is also linked with an increased incidence of abortion, and a study has found that haemoglobin levels can affect the risk of spontaneous abortion.[16] Specifically, the effect of Hb level on the risk of spontaneous abortion was estimated to follow a U-shaped curve when Hb levels were less than 145 g/L.[17]

Brebes is a regency with the highest maternal mortality rate in Central Java, but there has been no study on the risk factors for spontaneous abortion in Brebes which have contributed to maternal mortality. This study examined the association between socio-demographic factors (age, education, and occupation) and Hb levels with the incidence of spontaneous abortion in the Brebes Regency.

METHODS

This quantitative study utilised a case-control design and was conducted between June and August 2022 in Larangan District, one of the districts in Brebes Regency, where residents actively use pesticides in shallot farming activities. The case population consisted of women of childbearing age who had experienced spontaneous abortion, while the control population consisted of women of childbearing age who had never experienced spontaneous abortion. Using Lemeshow's formula, each group's sample size of 39 was required. The sample was selected using a purposive sampling technique.

The independent variables were maternal ages, education levels, mother's employment status, and Hb levels, with the the incidence of spontaneous abortion as the dependent variable. Data were collected through the administration of questionnaires and blood tests to measure Hb levels. Univariate analysis was conducted using a frequency distribution table, while bivariate analysis utilised the Chi-Square test with a continuity correction and a significance level set at 5%. The dependent variable coding used code "1" for the case group and code "0" for the control group. The independent variables coding used code "1" for risky variables (age at risk, basic education, employment respondents, and low Hb levels) and code "0" for the opposite category.

This study received ethical approval (Number: 25/EA/KEPK-FKM/2022) issued by the Health Research Ethics Commission, Faculty of Public Health, Diponegoro University

RESULTS

Table 1 shows that the number of respondents with a risky age was higher in the case group (51.3%) compared to the control group (48.7%). Additionally, the control group had a higher percentage of respondents with basic education (87.2%) compared to the case group (84.6%). Furthermore, the case group had a higher percentage of respondents who worked (66.7%) compared to the control group (56.4%). Finally, a higher number of respondents with low Hb levels were found in the case group (25.6%) compared to the control group (5.1%).

Table 2 shows an association between Hb levels and the incidence of spontaneous abortion (p=0.028). Individuals with low Hb levels are at a six times greater risk of experiencing a spontaneous abortion compared to those with normal Hb levels (OR=6.379). However, age, education level, and work status did not associate with the incidence of spontaneous abortion, with the respective p-values of 1.000, 1.000, and 0.485.

DISCUSSION

Anaemia was associated with incidents of spontaneous abortion. In early pregnancy, it becomes an indicator of miscarriage.[18] Before pregnancy, severe anaemia was associated with an increased risk of spontaneous abortion.[17] In accordance, this study demonstrated a significant association between low Hb levels the incidents of spontaneous abortion. Women with low Hb levels have a six times greater risk of having a spontaneous abortion. Hb levels have an important role in the body, which play a role as a transport and nutrient for all tissues in the body.[19] Mothers who experience anaemia during pregnancy will hamper the fulfilment of iron needs for the growth of the fetus. Fetal growth

Table 1. Characteristic respondent for case and control group

Variable	Category			
	Case		Control	
	n	%	n	%
Maternal ages				
At risk	20	51.3	19	48.7
No risk	19	48.7	20	51.3
Education level				
Basic	33	84.6	34	87.2
Further	6	15.4	5	12.8
Work status				
Workers	26	66.7	22	56.4
Not workers	13	33.3	17	43.6
Hb level				
Low	10	25.6	2	5.1
Normal	29	74.4	37	94.9

Table 2. Association between demographic factors and Hb levels with the incident of spontaneous abortion

Variable	p-value	OR	CI 95%
Maternal ages	1.000	1,108	0.456-2.693
Education level	1.000	0.809	0.225-0.290
Work status	0.485	1.545	0.617-3.873
Hb level	0.028	6,379	1.296-31.411

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disorders at <20 weeks of gestation are at risk of having an abortion. Impaired delivery of oxygen and nutrients to the fetus will cause fetal anaemia, shock, and even death.[20] Besides, anaemia is one of the forming complications in pregnancy. As many as 62.3% of pregnancy complications were followed by anaemia in pregnant women.[21] Pregnant women with anaemia had a four times higher premature rupture of membranes than non-anaemic mothers (OR=3.59).[22] Pregnancy complications accompanied by anaemia could increase the risk of spontaneous abortion incidents.

This study was conducted in the Larangan District, an area where residents frequently use pesticides in shallot farming activities. Exposure to pesticides can lead to a decrease in production and an increase in the fusion of red blood cells, resulting in the formation of methemoglobin. The presence of methemoglobin in erythrocytes can interfere with the proper delivery of oxygen, leading to disruptions in the functioning of Hb.[23] This, in turn, can lead to a reduction in Hb levels, causing anaemia.[24] In patients with organophosphate poisoning, the entry of pesticides into the body can cause anaemia due to the formation of sulfhemoglobin and methemoglobin groups in red blood cells. The interaction of organophosphate pesticides with iron can also reduce the efficiency of Hb binding with iron, further exacerbating anaemia.[25] To address this issue, iron supplementation is needed to reduce the prevalence of iron deficiency anaemia.[26] Each iron supplement tablet contains FeSO4 mg, which provides 30 mg of iron. This iron reserve is essential for red blood cell synthesis during pregnancy, making it a crucial component of anaemia treatment.[27]

The ideal age for pregnancy or childbirth is considered to be between 20 and 30 years. Childbirth in women aged <20 years or >35 years is associated with a higher risk of maternal death.[9] Noer et al. conducted a study that found that maternal age was related to the incidence of abortion, with mothers who experienced abortions being either less than 20 years old or over 35 years old.[12] However, the results of this study demonstrated no significant association between maternal age and the incidence of abortion. The proportion of respondents in the at-risk age group for the case group (51.3%) was almost the same as the control group (48.7%). Similar results were also obtained by Wahyuni et al., in which reported no significant association between the age of pregnant women and the insidence of abortion (p=0.349).[28] While maternal age is a risk factor for spontaneous abortion, it is not the only factor. Zhou et al.[29] identified family history as another risk factor, which could be indicative of a genetic problem. Pregnant women aged 20-35 years can also experience spontaneous abortions due to factors such as egg and embryo disorders, chromosomal abnormalities, placenta formation issues, infections and illnesses during pregnancy, abnormal uterus, immune factors, and psychological disorders.[30]

Mothers' education level could have an impact on the incidence of abortion. Mothers with lower levels of education may be less concerned about the development and health of their pregnancy, while those with higher education tend to have a greater awareness of their health and pregnancy. Higher mothers' education levels are also associated with higher knowledge about the danger signs of pregnancy.[31] However, this study demonstrated no significant association between education levels and the incidence of spontaneous abortion. This finding is consistent with the study conducted by Adjei et al., which also found no significant association between education and the incidence of spontaneous abortion (p=0.051).[32] It is important to note that formal education is not the only factor determining a mother's level of awareness during her pregnancy. The most frequently used sources of information during pregnancy are health professionals, followed by informal sources (family and friends) and the internet.[33] Therefore, a pregnant woman's knowledge about her pregnancy is not solely dependent on her level of education but also on her willingness to learn about her pregnancy.

Mothers' employment status is often associated with the incidence of spontaneous abortion. Pregnant women who work have a higher risk of experiencing spontaneous abortion in the first trimester due to workload, while farmers have a higher risk of spontaneous abortion.[10] This study reveals no association between a mother's employment status and the incidence of spontaneous abortion, in line with Purwaningrum et al. Pregnant women, regardless of their employment status, often

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have a high level of awareness regarding their antenatal care. This can aid in the early detection of any changes or deterioration in the mother's condition during pregnancy.[34] The study was conducted in the Larangan District, a region known for its onion farming and high pesticide exposure. The majority of the participants (52.6%) were farmers. The respondents engaged in agricultural activities, including weeding, harvesting, and cleaning crops. Both working and non-working women (housewives) experience abortions because non-working women often part-time help their husbands with agricultural tasks that involve contact with pesticides, such as harvesting, weeding, and crop drying. So both farmers and non-farmers women are all exposed to pesticides. The prevalence and risk of spontaneous abortion were significantly higher in areas with higher pesticide use than those with lower use, as demonstrated by a previous study.[35] Pregnant women who were exposed to pesticides were nearly five times more likely to have a spontaneous abortion than those who were not exposed (OR=4.65).[36] However, this study found no association between a mother's employment status and spontaneous abortion, likely due to the fact that respondents had various types of work, even though a majority (52.6%) were farmers. Further studies focusing on farmer respondents could provide clearer insight into the role of pesticide exposure on spontaneous abortion.

This study has revealed that age, education levels, and the mother's employment status indirectly affect spontaneous abortion through their influence on lifestyle factors that affect Hb levels, which in turn directly affect spontaneous abortion. However, there are certain limitations to this study. For instance, the study did not measure the mother's knowledge about the importance of health during pregnancy, which might be more relevant in describing the mother's condition than her education level. Additionally, since all respondents, regardless of their employment status, are at risk of pesticide exposure, measuring malondialdehyde (MDA) levels may be necessary to determine free radical levels in the body. Therefore, future studies should focus on measuring the mother's knowledge about health during pregnancy and MDA levels as an indicator of free radical levels, which might

provide a better understanding of their effect on the incidence of spontaneous abortion.

CONCLUSION

The incidence of spontaneous abortion was found to be associated with haemoglobin levels in Brebes Regency, while maternal age, maternal education levels, and mother's employment status demonstrated no significant association. Therefore, it is recommended that women of childbearing age take iron supplements before and during pregnancy to prevent anaemia and reduce the risk of spontaneous abortion. Additionally, the Health Office should provide counselling to raise awareness about the dangers of anaemia for the fetus and emphasise the importance of consuming iron supplements.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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