Analysis of the Influence of Respondents' Characteristics Factors, Disease History and Nutritional Intake on Preeclampsia in Madurese Pregnant Women in Bondowoso Regency

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Abstract:- The purpose of the study was to analyze the effect of respondent characteristics, disease history, and nutritional intake on Madurese pregnant women in Bondowoso Regency. The study was an analytic observational with a case-control research design. The number of samples was 93 respondents. Data analysis used chi-square test and logistic regression. The results showed that there was an influence between the characteristics of the respondents (age, education level, income, and BMI) on the incidence of preeclampsia in Madurese pregnant women. There is an influence between disease history (hypertension and preeclampsia/eclampsia) on preeclampsia in Madurese pregnant women. There is an influence between nutrient intake (sodium) on the incidence of preeclampsia in Madurese pregnant women. There is no effect between nutrient intake (energy, carbohydrates, protein, and fat) on the incidence of preeclampsia in Madurese pregnant women. The most dominant variables influencing include BMI.

Keywords:- Characteristic, Disease History, Nutrient Intake, Preeclampsia

I. INTRODUCTION

Maternal mortality rate (MMR) is one indicator of the health system in each country. Around 810 women get pregnant and die every day. 75% of the main causes of maternal death include bleeding, infection, and hypertension (preeclampsia and eclampsia). This shows that every country must achieve the Sustainable Development Goals (SDGs) target, namely by reducing the global Maternal Mortality Rate (MMR) to <70 per 100.000 births (Kartika et al., 2017; WHO, 2018; United Nations, 2019). MMR in Indonesia, in general, decreased during the period 1991-2015. Based on the results of the 2012 Indonesian Health Demographic Survey or *Survei Demografi Kesehatan Indonesia* (SDKI), 359 per 100.000 live births decreased to 305 per 100.000 live births (SDKI, 2013; BPS, 2017; Kemenkes RI, 2019). Although there is a tendency to decrease the MMR, it has not yet succeeded in achieving the 2015 MDGs target of 102 per 100.000 live births. Causes of maternal death include hypertension (33,07%), obstetric bleeding (27,03%), other non-obstetric complications (12,04%), infection in pregnancy (6,06%), and other causes (4,81 %) (Kemenkes RI, 2019).

The culture of the population of Bondowoso Regency is dominated by the Madurese (Juananingsih, Azza and Asih, 2015). According to Anggara et al., (2013) and Darmawan et al., (2018), explaining ethnicity is one of the factors of hypertension. Madurese people prefer to eat salty or savory which is at risk of increasing blood pressure. A similar study conducted by Andarini et al (2019) stated that most of the respondents who experienced hypertension were dominated by the Madurese and Javanese-Madura people. Excessive sodium consumption triggers an increase in blood pressure. In addition to excessive sodium consumption, fat consumption is also at risk of causing hypertension.

MMR in East Java Province has decreased from 91,92% per 100.000 live births (2017) to 91,45% per 100.000 live births (2018). The proportion of cases of AKI in East Java included other 32,57% (170 people), preeclampsia/eclampsia 31,32% (163 people), and massive bleeding 22,8% (119 people). Based on the Maternal Mortality Report or *Laporan Kematian Ibu* (LKI), Bondowoso Regency is the third highest in East Java Province at 187,73% after Blitar Regency and Pasuruan Regency with causes of death including preeclampsia, heart disease, and bleeding (Dinkes Provinsi Jawa Timur, 2019). Bondowoso Regency in 2019 and 2020 preeclampsia was the cause of MMR after heart disease and bleeding.

Until now, no research consensus mentions the exact cause of preeclampsia cases. According to The American College of Obstetricians and Gynecologists (ACOG), there are several risk factors for preeclampsia, including nullipara, multiple pregnancies, a history of preeclampsia in a previous pregnancy, chronic hypertension, diabetes before pregnancy, gestational diabetes, thrombophilia, SLE (Systemic Lupus Erythematosus), pregnancy with BMI > 30, antiphospholipid antibody syndrome, maternal age > 35 years, kidney disease, assisted reproductive technology, and obstructive sleep apnea (ACOG, 2019). Treatment that has been implemented in Indonesia based on *Peraturan Menteri Kesehatan Republik Indonesia Nomor 97 Tahun 2014* is an integrated ANC which includes 10T, namely measuring height and weighing, measuring blood pressure, measuring height and weighting, measure blood pressure, measure fundal height uteri, complete

TT (Tetanus Toxoid) immunization, distribution of 90 iron tablets during pregnancy.

Based on the background, the researcher is interested in conducting a study with the title "Analysis of the influence of respondents' characteristics factors, disease history and nutritional intake on preeclampsia in Madurese pregnant women in Bondowoso Regency".

II. LITERATURE REVIEW AND HYPOTHESES

A. Maternal Death

Maternal death is the death of a woman while pregnant or 42 days after giving birth, regardless of the duration of pregnancy from any cause related to or aggravated by pregnancy or medication during pregnancy but not caused by accident or incident. To facilitate the identification of maternal deaths in circumstances where the cause of death is unknown, a new category has been introduced that includes pregnancy-related deaths defined as the death of a woman while pregnant or within 42 days of termination of labor, regardless of the cause of death (WHO, 2020).

B. Preeclampsia

Preeclampsia is widespread endothelial damage and vasospasm that occurs after 20 weeks of gestation and can appear as late as 4-6 weeks postpartum (Lim and Editor, 2020). Systolic Blood Pressure (SBP) more than or equal to 140 mmHg or Diastolic Blood Pressure (DBP) more than or equal to 90 mmHg or higher. In addition to blood pressure criteria, proteinuria greater than or equal to 0,3 grams in a 24-hour urine specimen, protein (mg/dL)/creatinine (mg/dL) ratio 0,3 or higher, or urine protein +1 (if measurement quantitative data is not available) is needed to diagnose preeclampsia (ACOG, 2019). The classification of preeclampsia is grouped as follows:

➤ Gestational Hypertension

Gestational hypertension is characterized by BP (blood pressure) 140/90 mmHg or more for the first time during pregnancy, no proteinuria (negative), BP returns to normal less than 12 weeks postpartum, usually, the final diagnosis is made only after giving birth.

➤ Chronic Hypertension

Chronic hypertension is characterized by blood pressure of 140/90 mmHg or more before pregnancy or diagnosed before 20 weeks of gestation, not due to gestational trophoblastic disease or hypertension diagnosed first after 20 weeks of gestation and persisting after 12 weeks postpartum.

➤ Preeklampsia/ Eklampsia

Preeclampsia/eclampsia is characterized by a blood pressure (BP) of 140/90 mmHg or more after 20 weeks gestation in a woman with normal BP and proteinuria (≥0,3 g protein in a 24-hour urine specimen). Eclampsia is defined as seizures that cannot be attributed to other causes, in women with preeclampsia. Preeclampsia is classified into several types, including:
- Mild: BP ≥140/90 mmHg in a woman with previously normal BP, proteinuria (urine sample ≥300 mg/24 hours)

- Severe: BP ≥160/110 after 2 measurements with a span of 6 hours, proteinuria (urine sample ≥5 grams/24 hours), oliguria (<500 ml/24 hours), brain or visual disturbances, pulmonary edema or cyanosis, epigastric pain or tenderness right upper quadrant, impaired liver function, thrombocytopenia and stunted fetal growth (Stern et al., 2013).

C. Madurese Pregnant Women

One of the problems of mortality and morbidity in pregnant women is influenced by socio-cultural and environmental factors in society. Cultural factors, beliefs and knowledge such as food taboos, causal relationships between food and health conditions and illness, habits and ignorance often have positive and negative impacts on maternal health (Pasaribu, Setia and Gultom, 2014). The majority of pregnant women with Madurese like salty or savory foods. Several studies say that pregnant women of Madurese, apart from liking salty food which is a risk factor for hypertension, also have many dietary restrictions, especially animal protein (Laily, Azza and Kholifah, 2016).

D. Determinant Factors of Preeclampsia

Determinants of preeclampsia consist of several factors, including:

➤ Demographic Factor

Demographic factors are one of the factors that can influence the incidence of preeclampsia, including maternal age, namely <20 years and >35 years, low level of education, heavy work in pregnant women, length of marriage associated with the use of contraceptives, parity who is more at risk in primigravida than multigravida (Nursal, Tamela and Fitrayeni, 2017; Prikostanti, Salham and Nurjanah, 2019).

➤ Obstetric History

Obstetric history has several risk factors that cause preeclampsia, includes 1) Nulliparas are more at risk than multiparas; 2) A history of cesarean section, i.e. pregnant women who did not develop preeclampsia in the first pregnancy but delivered by cesarean section, was associated with an increased risk of preeclampsia in the second pregnancy; 3) A history of preeclampsia/eclampsia had a 6,7 times greater risk of developing preeclampsia.

➤ Disease History

A history of diseases that are a risk for preeclampsia includes 1) Diabetes mellitus, pregnant women with a history of diabetes mellitus have a risk of developing preeclampsia with complications compared to those without a history of diabetes mellitus (Shamsi et al., 2010; Lim and Editor, 2020); 2) Hypertension, women who have a previous history of hypertension are at risk of developing hypertension in a subsequent pregnancy (Brown et al., 2018; Martadiansyah, Qalbi and Santoso, 2019); 3) Kidney disease in pregnant women is at risk for preeclampsia and has an impact on fetuses with low birth weight and premature birth (Lopes van Balen et al., 2017); 4) Autoimmune disease, 9,72 times risk for preeclampsia (Duckitt and Harrington, 2005).

> *Nutritional Status Indicated By BMI*

Bodyweight is strongly correlated with an increased risk of preeclampsia. Research in the UK shows that 9% of very obese women develop preeclampsia compared to 2% of non-obese women (Knight et al., 2010; Lim and Editor, 2020). Obesity at term will increase the risk of preeclampsia with complications by 2,47 times (Wolf et al., 2002; Martadiansyah, Qalbi and Santoso, 2019).

> *Nutrition*

Nutrition is divided into two, namely consumption patterns and diversity of food types, 1) Consumption patterns consistent with the intervention were associated with a reduced risk of preeclampsia. Women at risk are advised to consume low-fat milk, sufficient fruits, and vegetables before and during pregnancy. The intake of macronutrients and micronutrients for pregnant women must comply with the RDA standards; 2) Diversity of food types is emphasized to consume a variety of vegetables and fruits to reduce the risk of preeclampsia (Agrawal, 2014)

The hypotheses in this study include:
- There is an influence between respondents' characteristics on the incidence of preeclampsia in Madurese ethnic pregnant women in Bondowoso Regency
- There is an influence between a history of disease and the incidence of preeclampsia in Madurese ethnic pregnant women in Bondowoso Regency
- There is an influence between nutritional intake on the incidence of preeclampsia in Madurese ethnic pregnant women in Bondowoso Regency

III. METHODS

This research is quantitative research and analytic observational research type. The design used in case-control. The study was conducted in Bondowoso Regency in April – June 2021. The population in this study were all pregnant women with preeclampsia and normal pregnant women. Determination of the sample used the odds ratio formula. The number of samples obtained was 31 people, with a ratio of 1:2, namely the case and control groups so that it became 93 people.

This research has conducted an ethical test with the number 1202/UN25.8/KEPK/DL/2021 which was carried out at the Faculty of Dentistry, University of Jember. The variables in this study are the characteristics of the respondents including maternal age, education level, income, and BMI. Medical history includes a history of chronic hypertension and a history of preeclampsia/eclampsia. Nutrient intake includes energy, carbohydrates, protein, fat, and sodium intake. Data analysis was divided into 3, namely univariate analysis for distribution, bivariate analysis used chi-square test, and multivariate analysis used logistic regression test.

IV. RESULT

The distribution of research results and bivariate test results consisted of respondents' characteristics including maternal age, education level, income, and BMI. Medical history includes a history of chronic hypertension and a history of preeclampsia/eclampsia. Nutrient intake which includes energy, carbohydrate, protein, fat, and sodium intake will be presented in Table 1. The results of the multivariate test analysis are presented in Table 2.

Variables	Case		Control		*p-value*
	Total (n)	Percentage (%)	Total (n)	Percentage (%)	
Respondents' Characteristics					
Age					
<20 years old	2	6,5	2	3,2	0,007*
20 – 35 years old	19	61,3	55	88,7	
>35 years old	10	32,2	5	8,1	
Level of Education					
Elementary School	15	48,4	13	20,9	0,011*
Junior High School	10	32,3	16	25,8	
Senior High School	5	16,1	28	45,2	
Diploma/Bachelor	1	3,2	5	8,1	
Income					
< UMK: Rp. 1.954.705	25	80,6	26	42	0,000*
>UMK: Rp. 1.954.705	6	19,4	36	58	
BMI					
≤30	12	38,7	58	93,5	0,000*
≥30	19	62,3	4	6,5	
Disease History					
Chronic Hypertension					
Yes	14	45,1	6	9,6	0,000*
No	17	54,8	56	90,4	
Preeclampsia/eclampsia					
Yes	11	35,4	2	3,2	0,000*
No	20	64,6	60	96,8	

Nutritional Intake					
Energy Intake					
≤2.550 kkal	21	67,7	49	79,1	0,175
>2.550 kkal	10	32,2	13	20,9	
Carbohydrate Intake					
≤400 gram	26	83,8	59	95,2	0,078
>400 gram	5	16,2	3	4,8	
Protein Intake					
≤67,3 gram/ ≤90 gram	20	64,5	34	54,8	0,253
>67,3 gram/ >90 gram	11	35,5	28	45,2	
Fat Intake					
≤67,3 gram	4	12,9	9	14,5	0,552
>67,3 gram	27	87,1	53	85,5	
Sodium Intake					
≤1500 mg	2	6,4	34	54,8	0,000*
>1500 mg	29	93,6	28	45,2	

Table 1. Distribution of Respondents' Characteristics, Disease History and Nutritional Intake of Preeclampsia in Madurese Pregnant Women in Bondowoso Regency 2021
*p-value significant <0.05

No	Independent Variables	B	Exp (B)	*p-value*
1.	BMI	-3.675	0,025	0,001*
2.	Sodium Intake	-2.430	0,088	0,016*

Table 2. Results of the Analysis of the Most Influential Factors on Preeclampsia in Pregnant Women in Bondowoso Regency in 2021
*p-value significant <0.05

> *Based on the Research Results can be Explained as Follows:*

The results of statistical tests using logistic regression test showed a p-value of 0,001, with an Exp (B) value of 0,025 (40) and a B value of -3,675. This means that pregnant women who have a BMI ≥30 tend to be at risk of experiencing preeclampsia 0,025 or 40 times compared to pregnant women who have a BMI <30. B value is -3.675, BMI harms preeclampsia in Madurese pregnant women, meaning that BMI has a risk of preeclampsia with a great chance of -3.675.

The results of statistical tests using logistic regression showed a p-value of 0,016, with an Exp (B) value of 0,088 (11.3) and a B value of -2,430. This means that pregnant women who have sodium intake more than the standard RDA of 1.500 mg tend to be 0,088 (11.3) times more likely to experience preeclampsia than pregnant women whose sodium intake is less than the RDA standard. The B value is -2.430, nutritional intake harms preeclampsia in Madurese pregnant women, meaning that nutritional intake has a risk of preeclampsia with a large chance of -2.430.

V.   DISCUSSION

The most influential factors in preeclampsia were BMI and sodium intake. The case group mostly had a BMI of 30, the control group almost all had a BMI <30. Research by Wirawan *et al.* (2013) showed differences in obesity rates in the Madurese and Javanese tribes. Madurese have higher central obesity than Javanese (Wirawan *et al.*, 2013). Central obesity is related to the wrong diet, which is to prefer foods that contain high fat and sodium. This is consistent with the results of a study conducted with the 2x24 hour food recall method, which showed that in the case group the intake of fat and sodium nutrients exceeded the RDA standard. Women who are overweight or obese have a risk of mild, moderate or severe preeclampsia, which can develop in early or late pregnancy. According to research by Robert (2011) stated that antioxidants have a role to inhibit preeclampsia. Antioxidants were found to be low in obese pregnant women (Roberts *et al.*, 2011).

The next most influential factor is sodium intake. In the case group, almost all of the sodium intake was more than the RDA standard, while the control group mostly had less sodium intake than the RDA standard. Excessive sodium intake risks increasing blood pressure and increasing sodium levels in the blood. The impact of sodium in addition to causing hypertension can also cause edema. Edema in pregnancy is caused by hydrostatic pressure (Rusnoto, Hidayah and Wahyuni, 2019). Madurese are known to prefer salty or savory foods. The results of interviews using food recall 2x24 hours show that savory (salty) foods do not only come from food sources that are used as side dishes but also savory/salty snacks. A similar study conducted by Arvizu *et al.* (2019) stated that second-trimester pregnant women with low sodium intake according to the guidelines from the Dietary Approach to Stop Hypertension (DASH) have a lower risk of developing hypertension and preeclampsia (Arvizu *et al.*, 2020).

Age in the case and control groups were mostly in the reproductive age between 20-35 years. Age is a determinant of the occurrence of complications in pregnancy until the postpartum period. Age is one of the risk factors for preeclampsia/eclampsia if pregnant at the age of <20 years and is a nulliparous pregnancy (Rizki, 2014; Herawati, 2017).

Madurese ethnic marriages consist of cultural or customary motifs. Based on cultural motives or marriage customs, there is no age limit, but generally, after puberty is considered an adult, so many parents marry off their children at a young age or underage. In Bondowoso Regency, the custom of early marriage has begun to shift with the emergence of religious school institutions such as MI, MTs, MAN and so on, so that early marriage can be prevented and can reduce the risk of preeclampsia (Sulaiman, 2012).

The education level of the case group is almost half of elementary school graduates/equivalent, while the control group is almost half of high school graduates/equivalent. The Madurese are known as a religious group, meaning they are more concerned with the afterlife than the world. Not all parents have the passion or desire in educating their children to become knowledgeable and skilled human beings, due to economic conditions or the low awareness of parents in educating their children (Marsidi, Rustiyarso and Alhidayah, 2019). In Bondowoso Regency, many parents are starting to realize the importance of education. This is indicated by the level of education in the control group, most of which have graduated from high school. Education affects the mother's level of knowledge, the better food education, the better the mother's prevention of the risk of preeclampsia. Mothers with a good level of education are easier to obtain, process and understand health information such as early detection and signs of complications. In line with the research conducted by Opitasari dan Andayasari (2014) which states that pregnant women with low education are 5.1 times more likely to experience preeclampsia (Opitasari and Andayasari, 2014).

The income of the case group is almost all income <Rp. 1,954,705, the control group mostly earned ≥ Rp. 1,954,705. The status of household income in ethnic Madurese is often assisted by the role of women (wife). Research conducted by Fatimah (2017) shows that the social status of ethnic Madurese women is said to have changed after marriage. A woman no longer has to work at home as a housewife in general, but can also have a career (Fatimah, 2017). Consumption expenditure for the respondent's daily food does not experience a shortage. Even though ethnic Madurese are married, if their income is below average, they still get help from their parents or relatives, either in the form of cooked or raw food. To anticipate that it will be evenly distributed as an alternative, the purchase of side dishes usually tends to be cheap, but one family can taste the food. Even though the ethnic Madurese culture is married, if it is not well established in the form of material it is still the responsibility of the parents, but in terms of food, the important thing is not to starve.

History of hypertension showed that the case and control groups were not much different from those without a history of hypertension. Pregnant women with chronic hypertension experience a decrease in blood pressure in early pregnancy and increase again in the third trimester. Preeclampsia is a complication that often occurs in pregnant women with a history of chronic hypertension. Hypertension is an inherited genetic disease. The high blood pressure of one parent has a 25% risk of suffering from high blood pressure as well. If both parents suffer from high blood pressure, there will be a 60%

risk of suffering from high blood pressure (Franceschini and Le, 2014; Lim et al., 2015; sari et al., 2016). The results of this study indicate that in the case group with a history of chronic hypertension as many as 14 people, in the control group with a history of chronic hypertension as many as 6 people. This shows that the incidence of chronic hypertension is only a small proportion who have a history of hypertension, while most of the others are dietary factors.

A history of preeclampsia/eclampsia indicated that the case and control groups had no history. The results showed that the case group with a history of preeclampsia was 11 people, while the control group had a history of hypertension as many as 2 people. This study has limitations, namely, it does not examine the genetic history of preeclampsia (mother and siblings). Women who have a history of preeclampsia are a risk factor for the occurrence of preeclampsia in their pregnancy. This is due to the inability of the cardiovascular system to recover from preeclampsia because the cardiovascular profile of women with recurrent preeclampsia is worse than that of normal pregnant women. In addition, women with preeclampsia have increased carotid intima-media thickness, as well as lower cardiac output (CO) and left ventricular mass, compared with women with normal subsequent pregnancies (Thilaganathan and Kalafat, 2019).

Energy intake showed that the case and control groups were mostly less than the RDA standard. The results of statistical tests showed that there was no effect of energy intake on the incidence of preeclampsia in the Madurese ethnicity in Bondowoso Regency. Energy intake in individuals is an obstacle to the fulfillment of other nutritional needs. If energy intake is met, all other macronutrients will usually be met (Hartono, Mas'ud and Haeru, 2018). The results of the analysis of this study showed that most of the case and control groups had less energy intake than the standard RDA of 2550 kcal.

Carbohydrate intake showed that the case group was almost entirely less than the RDA standard, while the control group was almost entirely less than the RDA standard. The results of statistical tests showed that there was no effect of carbohydrate intake on the incidence of preeclampsia in Madurese ethnic pregnant women in Bondowoso Regency. Low intake of carbohydrates, especially rice, can prevent pregnant women from being overweight/obese. Diabetes mellitus in pregnancy, gestational hypertension/preeclampsia, and preterm labor (Casas, Barquero and Estruch, 2020). The results of this study, most of the respondents, both case and control groups, indicated that their carbohydrate intake was less than the RDA. However, in the case group of pregnant women with carbohydrate intake less than the RDA, some already have a body weight exceeding BMI 30. These factors can affect the group of cases who experience preeclampsia.

Protein intake showed that the case and control groups were mostly less than the standard RDA. The results of statistical tests showed that there was no effect of carbohydrate intake on the incidence of preeclampsia in Madurese ethnic pregnant women in Bondowoso Regency. Protein intake usually requires 25-30% of total energy. Protein-rich intake

can lower blood pressure in pregnant women with preeclampsia. Protein contains amino acids that have an important role in the regulation of blood vessels. L-arginine which is widely found in animal and vegetable proteins is a substrate for nitric oxide (NO), nitric oxide functions as a vasodilator and regulator of vascular defense. The amino acids tryptophan and tyrosine which are also abundant in animal protein have antihypertensive effects due to the formation of serotonin in the central nervous system. In addition, protein function is needed in the trophoblast invasion process, pregnant women who experience protein malnutrition can increase the risk of preeclampsia (Teunissen-Beekman and Van Baak, 2013; Purwani and Widyastuti, 2015; Aanisah Zahran and Irma Nurbaeti, 2021). Madura is rich in culture, several ethnic Madurese cultures are related to maternal and child health. One of them is socio-cultural nutrition during pregnancy, there is a prohibition on consuming squid, meat, goat, shrimp, pineapple, jackfruit, durian and chili (Illahi and Muniroh, 2018). This culture still applies in Bondowoso Regency that pregnant women are prohibited from consuming squid and shrimp, as an alternative for respondents to consume "pindang" because the price is cheaper and evenly distributed for one family.

Fat intake showed that in the case and control groups almost all of them exceeded the RDA standard. Snacks are mostly fried foods that are high in fat. The results of interviews through a 2x24 hour food recall show that the most consumed snacks include fried foods (fried tempeh, stuffed tofu, "tahu petis", fried cassava and fried bananas), cassava chips and other snacks. Snacks are mostly fried which are high in fat. This in line with the research conducted by Aini et al. (2014) stated that in Bondowoso many agro-industry businesses process cassava into cassava chips which are quite well known among the public. The most produced taste, namely salty taste, is the taste that is most in demand by the Bondowoso community. This proves that Bondowoso Regency, whose majority population is Madurese, likes the salty taste. High-fat content increases the risk of placental vascular abnormalities which will stimulate endothelial abnormalities, atherosclerosis and thrombosis. Atherosclerosis based on excessive fat consumption is a risk factor in preeclamptic women that occurs in the placental spiral arteries. Atherosclerosis will increase the retention of blood vessel walls which can trigger the heart to increase its rate. An increase in heart rate can increase the volume of blood pressure flow which has an impact on increasing blood pressure (Menad, 2016; Hamsah, Murfat and Rosmiati, 2020).

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