THE EFFECT OF CHRONIC ENERGY DEFICIENCY AND PROTEIN INTAKE ON THE INCIDENCE OF PREECLAMPSIA IN DR. H. ABDUL MOELOEK HOSPITAL LAMPUNG PROVINCE

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Abstract. Background: *Preeclampsia is one type of pregnancy hypertension and an obstetric emergency. One per ten of all maternal mortality are associated with hypertensive disorders in pregnancy and a quarter are associated with its complications. Maternal mortality rate (MMR) in Lampung Province in 2015 due to hypertension was found in 35 cases. Prevention efforts to avoid poor prognosis are needed by eradicating risk factors. Nutritional status of chronic energy deficiency (CED) and maternal protein intake during pregnancy are thought to be important risk factors of preeclampsia.* **Objective:** *To determine the effect of CED and maternal protein intake on the incidence of preeclampsia in Dr. H. Abdul Moeloek Hospital Lampung Province* **Subject and Method:** *This study was an observational analytic study with a cross sectional design. The subjects in this study were 66 pregnant women taken by purposive sampling method, have been more than 20 weeks pregnant, was not suffering molahidatidosa and diabetes mellitus. Preeclampsia is measured by obstetrician's assessment, CED is measured by mid-upper arm circumference and protein intake is measured by 2x24 hours food recall questionnaire. Data were analyzed using chi square test.* **Results:** *The results showed that of 66 respondents ,37.9% with CED, 81.8% with inadequate protein intake and 51.5% with preeclampsia. There is significant effect of CED to the incidence of preeclampsia (p = 0.001) and there is significant effect of maternal inadequate protein intake to the incidence of preeclampsia (p = 0,001).* **Conclusion:** *There is an effect of chronic energy deficiency and maternal protein intake on the incidence of preeclampsia in Dr. H. Abdul Moeloek Hospital Lampung Province.*

Keywords: *CED ,Preeclampsia, protein intake*

1. INTRODUCTION

The maternal mortality rate (MMR) is a serious global health problem. According to data from the World Organization of Health (WHO) (2014), Indonesia is ranked the highest in maternal death risk among countries in Southeast Asia. The maternal mortality rate (MMR) in Indonesia in 2015 based on the Millennium Development Goals (MDGs) program report was 228 per 100,000 live births. This MMR result is still far below Indonesia's target of 102 per 100,000 live births (Kemenkes RI, 2016). According to the Lampung Province health data profile in 2015 the highest number of maternal deaths occurred at the age of 20 to 34 years with a total of 102 incidents, followed by the number of maternal deaths at age ≥35 years with 41 incidents and age <20 years with the number of maternal deaths of 6 incidents. The highest maternal mortality rate in Lampung Province is in Bandar Lampung City. This high maternal mortality rate in Lampung Province are due to complications from bleeding, pregnancy hypertension, infection, vascular system disorders, metabolic disorders and others (DinkesProp Lampung, 2016).

According to WHO data (2014) complications in pregnancy consist of bleeding 27%, preeclampsia and eclampsia 14%, infection 11%, prolonged labour 9% and complications from abortion 8%. This data explained 75% of all the causes of maternal death (WHO, 2014). In Indonesia, maternal mortality due to preeclampsia reached 25% in 2014 and increased the following year to 27.1% (Kemenkes RI, 2016). Based on preliminary surveys, at the Regional General Hospital (RSUD) Dr. H. Abdul Moeloek (RSAM) in Lampung province, 481 incidents of preeclampsia were recorded in 2013 and 337 incidents in the following year. The incidence of preeclampsia greatly contributes to the increase in maternal deaths, as reported in 2019 from January to June in RSAM , 71 per 425 pregnant women had preeclampsia with 2 of them died due to complications of preeclampsia.

Preeclampsia is a specific syndrome characterized by high blood pressure (hypertension) and proteinuria (protein in the urine) at the gestational age more than 20 weeks. According to WHO data in 2011, hypertension in pregnancy affects about 10% of all pregnancies in the world. Preeclampsia occurs due to endothelial damage, plasma insudation to blood vessel walls, myointimal cell proliferation, necrosis and vasospasm, which interferes organ perfusion (Cunningham et al., 2010). Although the etiology of preeclampsia is not yet clear, several studies have shown that mineral and nutritional factors play a role as the etiology of preeclampsia (Prawirohardjo & Wiknjosastro, 2016).

Lack of protein intake in pregnant women can trigger hypoproteinemia, decrease in serum albumin levels and endothelial tissue changes. Disruption of endothelial tissue regeneration can trigger vascular abnormalities with clinical manifestations such as high blood pressure, proteinuria and edema (Veronika, Serudji & Sastri, 2015). There are other risk factors that cause preeclampsia such as pregnant women with chronic energy deficiency (CED). CED is a condition where body suffer lacks of energy and protein intake continuously which can be diagnosed by measuring mid upper arm circumference index (MUAC) <24.9 cm (Almatsier, 2010; Ariyani, Achadi & Irawati, 2012). The lack of protein and energy consumption are expected to reduce blood protein levels and trigger endothelial dysfunction. CED has also been linked to anemia, decreased calcium serum, magnesium and zinc levels which are expected to have a role in maintaining vascular resistance which can trigger preeclampsia when levels are low in the blood (Bahadoran et al., 2010).

Nutritional status and adequate energy intake, especially protein for pregnant women, are still the main issues in health development in Indonesia (Kemenkes RI, 2016). According to the results of the Riset Kesehatan Dasar (Riskesdas) in 2013, the prevalence of women in reproductive age suffering with CED in Indonesia reached 20.8% and pregnant women with CED reached 24.2% (Kemenkes RI, 2013). In Lampung Province, the incidence of CED in pregnant women is not much different, which is 21.3%. In Bandar Lampung, the prevalence of CED reached 24.5% with a case finding of 1197. According to data from the total diet study (TDS) (2014) more than 50% of pregnant women in Indonesia were having less than 70% recommended daily allowance (RDA) and only 14% of pregnant women are at a sufficient level of energy. Likewise with the adequacy of protein, as many as 49.6% of pregnant women in urban areas and 55.6% of pregnant women in rural areas get protein intake ≤80% from the standard of protein adequacy rate (PPA) (Dinkesprop Lampung, 2016).

The results of Furqi (2016) research stated that there was a relationship between protein intake and the incidence of CED (p = 0.003). In another study conducted by Anas (2013) stated that there was a relationship between measurements of MUAC <23.5 cm with the incidence of preeclampsia (p = 0,000). Other research on the relationship between nutritional factors and the incidence of preeclampsia by Nuryani et al. (2013) states that there is a relationship between low protein intake and the incidence of preeclampsia (p = 0,000). Further research that combines directly the effect between chronic lack of energy and less protein intake in pregnant women with the incidence of preeclampsia has never been done. The purpose of this study was to determine the effect of CED and protein intake in pregnant women on the incidence of preeclampsia at Abdul Moeloek Hospital in Lampung Province.

2. LITERATURE REVIEW

2.1. Pregnancy

According to Wiknjosastro & Prawirohardjo (2014) pregnancy is a process between the integration of sperm and ovum so that conception occurs until the birth of the fetus. The duration of the normal pregnancy phase is 280 days or 40 weeks calculated from the first date of last menstruation (HPHT). Pregnant women are a group of women of childbearing age (CBA) aged 19-49 years with

gestational age ranging from 20-35 years. The peak fertility period in the CBA group is age 20-29 years with a 95% chance of getting pregnant and will drop to 90% when entering the age of 30 years. The probability of pregnancy will be reduced to 40% when entering the age of 40 years and will continue to decrease to 10% with the addition of age each year.

During pregnancy, changes are found in almost all maternal organ systems. This change begins with the secretion of hormones from the corpus luteum and placenta. The mechanical effects of uterine enlargement and compression of structures around the uterus play an important role when entering the II and III trimesters. These changes include changes in hematological, cardiovascular, respiration, metabolic and gastrointestinal functions. Pregnant women need adequate nutrition to meet the nutritional needs of mothers and fetuses. The nutritional adequacy rate (RDA) of pregnant women is different from the nutritional adequacy of women who are not pregnant because the addition of nutrients needed for fetal growth and development (Prawirohardjo & Wiknjosastro, 2016).

Pregnant women need additional calories around 300 kcal so that food intake becomes 2,800-3,000 kcal per day. According to nutritional adequacy figures for 2004, additional energy needs per day of pregnant women are differentiated based on the trimester of pregnancy in progress. In the first trimester, the additional calorie intake was 180 kcal while in trimester II and III need additional 300 kcal. The total calories needed are around 80,000 kcal with 36,000 kcal for burning and the remaining 44,000 kcal for building new tissue. Protein consumption of pregnant women increases compared to before pregnancy. Based on the RDA, the additional protein needed during pregnancy is 17 grams per day with the fulfillment of animal-based protein greater than vegetable protein. The portion of food consumption such as fish, eggs, meat and milk needs to be consumed more than tofu, tempeh and beans. This is due to the structure of animal protein that contain more complex amino acids and easier to digest. (WNPG, 2004).

The need for folic acid during pregnancy has doubled. Folic acid plays a role in the maturation of red blood cells, the development of young cells, DNA cell synthesis and energy metabolism. Some studies say that folic acid deficiency is related to the low birth weight babies (LBW). Increased need for folic acid in pregnant women is 400-800 mcg per day and not recommended more than 1000 mcg. Vitamin D is needed for the growth of bones, teeth, and the development of the heart, muscles and nerves of the fetus. Vitamin D deficiency in pregnant women results in impaired calcium metabolism in the mother and fetus. Disorders can include hypocalcemia, osteomalacia in mothers and tetany in newborns. Sources of vitamin D are mainly found in sunlight. The body will convert skin cholesterol into calcitrol (vitamin D3) which is then channeled into the liver and renal to produce vitamin D when exposed to sunlight. The need for iron in pregnant women is increased to 200 - 300% which is around 800 mg with 300 mg for fetal development and 500 mg for mothers. Second and third trimester pregnant women are advised to consume 30-60 mg of iron tablets every day for 3 months starting from the 12th week of pregnancy (WNPG, 2004).

2.2. Pre Eclampsia

Preeclampsia is a specific syndrome characterized by high blood pressure and proteinuria at more than 20 weeks' gestation. Preeclampsia occurs due to endothelial damage, plasma insudation to blood vessel walls, myointimal cell proliferation, necrosis and vasospasm so that perfusion to organs is disturbed (Cunningham et al., 2010). The minimum criteria for preeclampsia are blood pressure ≥140 / 90 mmHg and proteinuria of 300 mg or more in urine samples per 24 hours or 30 mg / dL (1+ on dipstick) in random urine samples. Edema also includes as symptoms of preeclampsia but often does not included as diagnostic criteria because many are found in women with normal pregnancies (Wiknjosastro & Prawirohardjo, 2014).

Preeclampsia can be divided into two namely mild preeclampsia and severe preeclampsia with the following criteria (Prawirohardjo & Wiknjosastro, 2016). Mild preeclampsia is a patient with blood pressure ≥140 / 90 mmHg after 20 weeks gestation and protein excretion in urine ≥ 300 mg / 24 hours or ≥ +1 dipstick, protein: creatinine ratio ≥ 30 mg / mmol. Severe preeclampsia if one or more of the following signs are found: blood pressure ≥ 160/110 mmHg for at least six hours on two examinations, proteinuria ≥ 5 g / 24 hours or ≥ + 3 dipstick in random urine samples collected at least once every four hours, thrombocytopenia <100,000 / ul and microangiopathic hemolysis, increased SGOT (serum glutamic oxaloacetic transaminase) and SGPT (serum glutamic pyruvic transaminase) with epigastric or right upper abdominal pain due to stretching of the Glisson capsule, persistent headache and scotoma

vision, fetal growth retardation, oligohidramnios and placental abruption, pulmonary edema and congestive heart failure, or oliguria ≤ 500 ml / 24 hours and plasma creatinine increase ≥ 1.2 mg / dL (Suwanti, Wibowo & Safitri, 2015; Wiknjosastro & Prawirohardjo, 2014).

Risk factors causing preeclampsia include primigravida, primimaternity, hyperplacentosis, age (> 35 years or <20 years), family history of preeclampsia / eclampsia, history of kidney disease and hypertension before pregnancy, nutritional status and nutritional deficiencies (Prawirohardjo & Wiknjosastro, 2016). Complications of preeclampsia consist of maternal complications and fetal complications. Complications of maternal preeclampsia consist of seizures / eclampsia, placental abruption, and multiple maternal failure (renal failure, liver necrosis, liver rupture, brain bleeding, pulmonary edema, and retinal detachment) (Prawirohardjo & Wiknjosastro, 2016). Complications of preeclampsia in the fetus consist of prematurity, retardation of intrauterine fetal growth, and intrauterine death (Harmon et al., 2015).

2.3. Chronic Energy Deficiency (CED)

Chronic energy deficiency (CED) is a condition where there is a continuous lack of energy and protein intake that can affect health conditions that can be seen from the measurement index. The measurement index for chronic energy deficiency is classified into levels based on body mass index (BMI) and arm circumference (LILA) (Almatsier, 2011). Anthropometric measurements to determine nutritional status during pregnancy include measurements of height, weight before pregnancy, weight gain during pregnancy and upper arm circumference. Chronic energy deficiency (CED) is determined by measurements of MUAC <23.5 cm (Ministry of Health, 2016), or LILA <24.9 cm (Ariyani, Achadi & Irawati, 2012).

MUAC measurement is done in the middle area between the shoulder and elbow of the left arm (except left-handed people are measured on the right arm). MUAC measurements must be in a free position, the sleeves and muscles of the arms are not tense and the measurement device are in good condition in the sense that they are not wrinkled or folded. The advantage of MUAC / age index as an indicator to assess severe CED and PEM are cheap, lightweight and color-coded to determine nutritional status. While the shortcomings of the MUAC / age index are limited to identifying women with CED and children with severe PEM, it is difficult to determine the threshold and it is difficult to assess the growth of children at the age of two to five years because the changes are not apparent (Supariasa, 2012).

The causes of CED can be divided into two, namely direct and indirect causes. The immediate cause consists of food intake and infectious disease. Food intake is the amount of food consumed by a person with the aim of getting a number of nutrients needed by the body for each nutrient content to provide different functions (Almatsier, 2011). According to Surasih (2006) energy intake of pregnant women can affect the incidence of chronic energy deficiency (KEK) ie mothers with low energy intake are at risk of experiencing CED with p value = 0.0000. Protein intake of pregnant women can also affect the incidence of chronic energy deficiency (KEK) according to Furqi (2016) research where low protein intake is a risk of causing CED in pregnant women with p value = 0.003. The type of protein such as animal and vegetable protein did not affect the incidence of CED of pregnant women with a p value of 0.559. Protein is the main structural component of the body that functions as a constituent of enzymes and hormones. Increased protein remodeling in the body during pregnancy and number of proteins accumulate in line with the growth of the fetus, uterus, blood volume, placenta, amniotic fluid. Nutritional disorders with chronic energy and protein deficiency are caused by many factors such as incorrect food composition in terms of quantity and quality due to lack of food availability, poverty, ignorance, wrong eating habits or infectious diseases so that nutrients cannot reach the cells after food consuming (Shils et al., 2006).

Indirect causes of CED include hindrance to the utility of nutrients, hindrance to the use of nutrients because the composition of amino acids in the body is not balanced so that it reduces appetite and food consumption (Simarmata, 2008), absorption barriers due to infectious diseases such as worm infections, lack of knowledge about nutrition and education of pregnant women (Furqi, 2016), poor hygiene conditions (Shafique et al., 2007), nutritional status before pregnancy and the age of pregnant women (Furqi, 2016).

Chronic energy deficiency conditions of pregnant women before and during pregnancy for a long period of time will increase the risk of abortion, difficult and prolonged labor, premature labor and

bleeding after delivery, the birth of low birth weight babies (LBW), asphyxia in newborns, neonatal death, congenital defects, susceptibility to infection both mother and fetus and stunted fetal brain growth (Muliawati, 2013).

2.4. Protein

Protein is one of the essential components in building the body that can be found in hair, nails, muscles, bones, and most of the tissues in the body including hemoglobin, collagen, and myosin. Proteins are macromolecules composed of single amino acid chains that are connected by peptide bonds through hydrogen bonds between oxygen and nitrogen atoms or through side-to-side interaction. Amino acid components consist of carbon, hydrogen, oxygen, and nitrogen with nitrogen as the most forming elements which is about 16% by weight of protein. Amino acids are the building blocks of proteins used to determine the identity and function of proteins in which there are 20 types of amino acids that are combined in quantities varying from 50 to 1000 units. Of the twenty known amino acids, 9 of them are essential amino acids and the remaining 11 are non-genetic amino acids (Barasi, 2007).

Proteins are classified based on their shape and structure. The classification of proteins based on their shape is divided into fiber proteins (fibrous) and globular proteins. Fiber protein is a water-insoluble protein whose polypeptide bonds form fibers or long strands that are relatively the same and function more in the body's structure. Globular protein is a type of protein that is more water-soluble with polypeptide bonds forming a circle and more functioning in the body's metabolic (Murray, Granner & Rodwell, 2009).Protein has a variety of functions for the body. Protein function is generally divided into three, namely as new tissue-forming substances, regulating body systems and energy sources if carbohydrate and fat requirements are not fulfilled. After going through the digestion process, the protein which is broken down into amino acids is used for synthesis and endogenous turn over. Other functions of protein in the body play a role in hormone homeostasis, receptors, acid and base balance, immune function, intestinal integrity, neurotransmitters, and fluid balance. In addition to playing a role in homeostasis, proteins play a role in the formation of blood clotting factors, as carrier molecules, as enzyme-forming compounds that function for digestion, synthesis, energy production and protection and play a role in the process of growth and maintenance of various body structures (Barasi, 2007).

Myoglobin heme protein and hemoglobin function to maintain the supply of essential oxygen for oxidative metabolism. Myoglobin serves to store oxygen reserves if at any time there is oxygen deficiency. While hemoglobin, the erythrocyte tetrameric protein, functions to transport O2 from the lungs to the tissues and carry CO2 + from the tissues to the lungs. Myoglobin protein and hemoglobin contain heme which is joined by the C-methylene bridge (Murray, Granner & Rodwell, 2009).

Protein needs according to the RDA is 10-15% of the total food needs. During pregnancy, an additional protein intake as much as 17 grams per day is needed, so that the total intake per day is 67 grams (WNPG, 2004). Fulfillment of animal-sourced protein must be greater than vegetable protein requirements, so fish, eggs, meat and milk need to be consumed at least one-fifth (20%) compared to tofu, tempeh and beans because the structure of animal protein is easier to digest (Supariasa, 2012). Protein needs of pregnant women can also be calculated based on actual body weight and correction factors, so that the average protein adequacy for adult pregnant women over the age of 18 years is around 1.0 - 1.2 g / kg / day (Fahmida & Dillon, 2016). The level of adequacy of protein intake is categorized as good if the value is between 91% - 119% of the RDA and said to be less if the value is <90% (WNPG, 2004).

2.5. Food Intake Assessment

Assessment of individual food intake using the 2x24 hour food recall method is done by noting the type and amount of food consumed in the past 2x24 hour period in a row by asking the respondent to tell everything that was eaten and drunk from midnight to midnight again, or from waking up to waking up again which is recorded in household size (URT). The 2x24 hour food recall method has several advantages and disadvantages. The advantages of this method are that it is easy to do and does not burden the respondent, the cost is relatively cheap, does not require special equipment, the process is fast, can reach large samples, can be used on illiterate subjects, can provide a real picture of individual consumption and can calculate daily nutrient intake . The disadvantages of this method are the accuracy depend very much on the memory of the respondent, the need for skilled personnel and the tendency for patients with the flat slope syndrome, namely the tendency of respondents to report their

consumption. Thin respondents will report more consumption and obese respondents will report less consumption, so that it is less representative of the actual intake of energy, protein, carbohydrates, and fat. This method is not suitable for respondents under the age of 7 years, over 70 years and respondents who have lost their memories or forgetful people (Sirajudin, Nadimin & Mustamin et al., 2012).

Interviewing as an interaction process to get accurate results needs to pay attention to preparation before the interview, during the interview, and when ending the interview. There are four steps in the 24 hour food recall method, namely (1) the officer / enumerator asks for food consumed during the 24 hour period yesterday in the URT, (2) the officer / enumerator estimates the URT in gram weight, (3) the officer analyzes the energy and nutrients a day, and (4) the officer analyzes the level of adequate energy and nutrients a day. The technique of extracting 24-hour food recall information requires five stages of interview, namely (1) Quick list (making a concise list of food consumed one day yesterday), (2) reviewing the completeness of the quick list with respondents, (3) exploring the food consumed is related to time eating and activities, (4) asking for details of dishes according to the type of food, amount, weight and source of their consumption consumed one day prior, and (5) reviewing all answers to avoid the possibility of food being consumed but forgotten (Sirajudin et al., 2012).

3. METHODS

This research was an analytic observational with cross sectional design. Research was conducted in Dr. H. Abdul Moeloek hospital in Bandar Lampung city, on September-November 2019. Research population was all pregnant women in Dr. H. Abdul Moeloek hospital. Based on calculation of sample size, a minimum sample size of 66 subjects was obtained. Calculation of sample size was conducted by unpaired categorical analytic formula (Dahlan, 2019) with 95% confidence interval and 80% power of test. Proportion of CED in preeclampsi subjects was 0,167. Samples were obtained by consecutive sampling. Inclusion criteria was pregnant women with more than 20 weeks gestational age. Exclusion criteria were pregnant women with molahidatidosa and diabetes mellitus. Independent variables in this research were CED and protein intake. Dependent variable was preeclampsia.

Chronic energy deficiency (CED) was measured by mid upper arm circumference (MUAC) which values < 24,9 cm (Ariani, achadi, 2012). Protein intake was measured by 2x24 hours food recall questionnaire in weekday and weekend. Results of protein intake estimation were compared with the value of mean recommended dietary allowance (RDA) for Indonesian which were adjusted for age group, and were classified into 3 groups: inadequate (if < 80% RDA), adequate (80-110% RDA) and excessive (>110% RDA). Preeclampsia was measured by obstetricians assessment.

Data collection was conducted by researcher with assistance from 2 enumerators with previous briefing and training. Data were then tested statistically with 95% confidence interval and value of $p<0.05$ by using chi square test. This study get approval ethical clearance by health research ethic comitte medical faculty of Lampung university with ID 3406/UN26.18/PP.05.02.00/2019.

4. RESULT AND DISCUSSION

The measurement of the nutritional status of CED pregnant women using the MUAC measurement method showed that the distribution of CED pregnant women was 37.9% (25 people) and 62.1% (41 people) of non-CED pregnant women. The mean arm circumference of pregnant women in this study was 26 cm with a minimum of 21 cm and a maximum of 35 cm. In this study the distribution of pregnant women with less protein intake as much as 81.8% (54 people), pregnant women with adequate protein intake as much as 18.2% (12 people) and pregnant women with over protein intake were not obtained. The mean protein intake of pregnant women is 43.07 grams with a minimum of 17 grams and a maximum of 69 grams. The results of this study indicate that there are 51.5% (34 people) pregnant women experience preeclampsia both mild and severe preeclampsia and there are 48.5% (32 people) pregnant women who do not experience preeclampsia based on obstetric physician diagnosis.

Table 1. Study variabel characteristic

Characteristic	n	%	mean	max	min
Chronic energy deficiency					
a. Yes	25	37,9			
b. No	41	62,1			
Mid Upper Arm Circumference			26	35	21

Protein Intake				43,07	69	17
a.	Less	54	81,8			
b.	Adequate	12	18,2			
c.	More	0	0			
Preeclampsia						
a.	Yes	34	51,5			
b.	No	32	48,5			

The results of this study indicate the number of pregnant women who experienced CED in Lampung Province Hospital as much as 37.9% (25 people). The results obtained in this study are greater when compared with the national data on the prevalence of pregnant women with CED in Indonesia, which is 24.2%, in Lampung Province 21.3% and in Bandar Lampung City as much as 24.5% (Dinkesprop Lampung, 2016; Kemenkes RI, 2013). The number of pregnant women experiencing CED in this study shows that CED is still a public health problem in Bandar Lampung because its prevalence is more than 20% (World Health Organization, 2014).

Pregnant women who experience CED are at high risk for problems during pregnancy. Pregnant women with CED are at risk of complications such as anemia, bleeding, abnormal weight gain and susceptible to infectious diseases. Malnutrition in pregnant women can also affect the labor process, namely prolonged labor, premature birth, postpartum bleeding and increased incidence of labor with surgery. Pregnant women with low BMI or chronic lack of energy, especially proteins, are at risk of developing preeclampsia through the mechanism of decreasing serum albumin levels by interfering with vascular permeability that can result in vascular endothelial dysfunction (Dharma, Noroyono & Raranta, 2005). The impact of CED on pregnant women against the fetus include stunted growth and development of the fetus, triggering abortion, low birth weight (LBW), congenital defects and stillbirths. The high incidence of pregnant women with CED can be influenced by food intake, low education level and work status so that most pregnant women ignore the adequacy of nutrition. Food intake is one of various factors that play an important role in the occurrence of chronic energy deficiency (CED). Women usually pay special attention to their body shape. They are always afraid of things that make them look fat. Body image dissatisfaction and the desire to be thinner are factors associated with women on a diet. So that most women are afraid to consume foods that contain lots of calories.

The results of this study indicate 81.8% of all pregnant women who become respondents consume less protein, that is <80% of the adequacy level of nutrition (TKG) per day. This result is far higher than the 2014 Indonesian Individual Food Consumption Survey data which states that there are 49.6% of pregnant women who meet the protein adequacy level <80% of the protein adequacy rate (Kemenkes RI, 2014). This result is also much higher when compared to the protein adequacy of pregnant women in Lampung Province who consume protein <80% protein adequacy rate as much as 51.5% (BPS, 2016).

Protein is one of the main nutritional needed by pregnant women. Protein intake during pregnancy is very necessary for the process of fetal growth and embryogenesis so that the baby can be born under normal conditions. Inadequate protein intake can cause impaired fetal growth in the womb so that the baby can be born with a low weight (Knudsen et al., 2008). In this study, the source of protein consumed by respondents came from vegetable protein and animal protein. Vegetable protein sources consumed by respondents from cereals, tubers and processed products as much as 21.1% and nuts and seeds and processed as much as 5.2%. Sources of animal protein consumed by respondents derived from meat and processed products by 18.2%, eggs 15.6%, fish and processed products 9.3% and milk and processed products by 8.8%.

The results of the study of protein intake of pregnant women as measured through the 24 hour food recall questionnaire were carried out with precision measurements not in 2 consecutive times but on weekdays and weekends. Measurements are converted from household size results (URT) to nutritional adequacy levels (TKG) based on nutritional adequacy rates (RDA) of pregnant women. The results of the measurement of maternal protein intake can be divided into three categories namely less, adequate and more. Less category if TKG protein <80% RDA, adequate category if TKG protein 80-110% RDA and more category if TKG protein> 110% RDA (Supariasa, 2012). Retrieval of food intake data conducted on weekdays and weekends in fact affects the average daily protein intake of pregnant

women. The average protein intake of pregnant women on weekdays is higher when compared to weekends. This might be because weekends are usually used by most people for refreshing from assignments or work and spending time with family or friends. The results of this study are in line with research conducted by Jahns et al. (2017) which states that food intake on weekends is higher than weekdays.

The high incidence of pregnant women with less protein intake can be caused by the condition of emesis gravidarum which affects food uptake into the body. The emesis condition in pregnant women can be influenced by the pregnancy hormone, progesterone. The progesterone can affect some smooth muscles in the body, including the throat, become more relaxed and weakened, so that the rest of the food that is still in the stomach can go back up to the throat. The size of the uterus, which increases as the gestational age increases, also affects the emesis condition because of pressure on the other abdominal organs which in turn will be compressed to the top and push the diaphragm. Underlying medical conditions such as severe stage preeclampsia can also cause symptoms of nausea, vomiting and epigastric pain (Prawirohardjo & Wiknjosastro, 2016).

The results showed that pregnant women who suffer from preeclampsia mostly experienced CED that is 80% (20 people) while pregnant women suffering from preeclampsia who did not experience CED amounted to 34.1% (14 people). Pregnant women who did not experience preeclampsia but CED were 20% (5 people) and 65.9% (27 people) did not. There is an effect on the nutritional status of pregnant women with CED on the incidence of preeclampsia with a p-value (significance) of 0.001 (<0.05) and an Odds Ratio (OR) of 7.7. The OR value of 7.7 states that pregnant women who suffer from CED have a 7.7 times higher risk of developing preeclampsia.

The results showed that most pregnant women suffering from preeclampsia had a low protein intake of 67.4% (31 people) and pregnant women suffering from preeclampsia who had adequate protein intake amounted to 15% (3 people). Pregnant women who did not experience preeclampsia but consumed less protein were found as much as 32.6% (15 people) and pregnant women who did not preeclampsia with adequate protein intake as much as 85% (17 people). There is an influence of protein intake of pregnant women on the incidence of preeclampsia with a p-value (significance) of 0.001 (<0.05) and an Odds Ratio (OR) of 11.7. The OR value of 11.7 states that pregnant women who have less protein intake are 11.7 times more likely to develop preeclampsia.

Table 2. Effect of CED and Protein Intake on Preeclampsia in Pregnant Women

Variabel	Preeclampsia				*POR*	*p value*	*95% CI*
	Yes		No				
	n	%	n	%			
CED							(0,000) – (0,001)
a. Yes	20	80	5	20	7,7	0,001*	
b. No	14	34,1	27	65,9			
Protein intake							(0,000) – (0,001)
a. Less	31	67,4	15	32,6	11,7	0,001*	
b. Adequate	3	15	17	85			

The results of the cross tabulation of the nutritional status of pregnant women with CED with preeclampsia in proportion were more that 80% compared to preeclampsia pregnant women who were not CED which was 34.1%. This is consistent with the theory that has been explained that the nutritional status of CED pregnant women is a risk factor for preeclampsia. The results of this study are in line with research conducted by Anas (2013) which states that there is a significant relationship between arm circumference of less than 23.5 cm (CED nutritional status) of pregnant women and the incidence of preeclampsia (p = 0,000). The results of this study are also in line with research conducted by Andriani, Lipoeto & Utama, (2016) which states that there is a relationship between poor body mass index and the incidence of preeclampsia.

The nutritional status of pregnant women with CED can cause preeclampsia because it is associated with anemic condition which is characterized by a decrease in hemoglobin levels. Decreased hemoglobin levels in the blood can cause tissue hypoxia which then disturbs the balance between

vasodilator agents and vasoconstrictors. Nitric Oxide (NO) plays a role in regulating vascular resistance during pregnancy whose availability at the tissue level is regulated by hemoglobin by binding to the bioactivity of NO into a form of methemoglobin (metHB) and iron-nitrosyl-hemoglobin (HbNO). So the decrease in NO will cause a decrease in renal function, an increase in vascular resistance and hypertension (Gladwin, Crawford & Patel, 2004). Patients with severe anemia, the incidence of preeclampsia is 3.6 times higher than those without anemia and according to research by Prasetya (2018) states that first trimester pregnant women who suffer from anemia have a 3.9 times greater risk of preeclampsia.

The results of the study using the chi-square test showed that there was a significant effect between pregnant women with less protein intake on the incidence of preeclampsia with a p-value of 0,000 (<0.05). Preeclampsia is caused by an imbalance between angiogenic and anti-angiogenic factors. The central hypothesis shows the results of preeclampsia from the remodeling of a damaged spiral artery leading to cellular ischemia in the placenta, which ultimately results in an imbalance between anti-angiogenic and pro-angiogenic factors. Imbalance of anti-angiogenic factors that cause extensive endothelial dysfunction that can affect all maternal organ systems and stunted fetal growth (Gathiram & Moodley, 2016).

Protein intake can affect the formation of albumin in the body because amino acids such as tryptophan, lysine, orthinin, arginine, proline, threonine and phenilanin as a simple form of protein can stimulate albumin formation (Murray, Granner & Rodwell, 2009; Harvey & Ferrier, 2011). Low serum albumin levels (hypoalbuminemia) are associated with multiorgan hypoperfusion and overall endothelial damage that can affect the feto-placental circulation (Veronika, Serudji & Sastri, 2015). Placental hypoxia can stimulate the release of vasoactive substances that have an effect on the vascular and heart. Endothelial dysfunction can interfere with prostaglandin metabolism as a trigger for platelet aggregation which causes vasoconstriction of blood vessels due to higher thromboxane levels than prostacyclin so that clinical symptoms arise in the form of increased blood pressure. Increased perfusion pressure results in the displacement of fluid into the interstitial fluid resulting in edema and hypovolemia (Cunningham et al., 2010). In addition, endothelial dysfunction also causes vascular permeability to increase so that edema and proteinuria occur which are manifestations of preeclampsia (Dharma, Noroyono & Raranta 2005).

CONCLUSION

The prevalence of pregnant women with preeclampsia is high at 51.5%, with CED 37.9%, and less protein intake 81.8%. There is an effect of CED and protein intake on the incidence of preeclampsia in pregnant women. Based on the results of this study, we advise health workers to always provide education and ongoing assistance regarding nutritional status (CED) in pregnant women and the fulfillment of both macronutrient and micronutrient nutrition during pregnancy as a promotive and preventive effort against CED incidence and pregnancy complications such as preeclampsia in the context to reduce maternal mortality rates in Indonesia.

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