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Prevalence and determinant factors of Chronic Energy Deficiency (CED) in pregnant women

Prevalensi dan faktor determinan kejadian kurang energi kronis (KEK) pada ibu hamil

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Abstract

Pregnant women with Chronic Energy Deficiency (CED) are prone to malnutrition due to prolonged imbalances in the intake of essential nutrients. This study aimed to analyze the factors associated with the risk of CED in pregnant women. This study had a quantitative, cross-sectional design and was conducted from June to August 2023 in the working area of the Parung Panjang Health Center, Bogor Regency. The sample size in this study was 140 pregnant women using purposive sampling. The respondents' characteristics were obtained through questionnaire interviews. MUAC was collected through MUAC tape, dietary intake using a Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ) form, and hemoglobin through a rapid test. Analysis was performed using the chi-square statistical test at 95% CI. The results of this study showed that the prevalence of CED was 20,7%. There was a significant relationship between maternal age, parity, gestational age, history of infectious diseases, knowledge, energy, and protein adequacy and CED in pregnant women (p <0,05). There was no significant relationship between income, anemia status, fat and carbohydrate adequacy, and the occurrence of CED (p> 0,05). In conclusion, the determinants of CED include maternal age, parity, gestational age, history of infection, knowledge, energy, and protein intake.
Keywords: Energy, CED, parity, protein

Abstrak

Kekurangan Energi Kronis (KEK) pada ibu hamil merupakan salah satu bentuk masalah kurang gizi yang timbul akibat asupan zat gizi yang tidak seimbang dalam jangka waktu yang cukup lama. Tujuan penelitian ini yaitu menganalisis faktor-faktor yang berhubungan dengan risiko kejadian KEK pada ibu hamil. Penelitian ini merupakan studi kuantitatif dengan design cross sectional. Penelitian dilaksanakan mulai Juni sampai Agustus 2023 di wilayah kerja Puskesmas Parung Panjang Kabupaten Bogor. Jumlah sampel pada penelitian ini yaitu 140 ibu hamil secara purposive sampling. Karakteristik responden diperoleh melalui wawancara kuesioner, LiLA dikumpulkan melalui pita LiLA, asupan makanan menggunakan formulir Kuesioner Frekuensi Makanan Semi Kuantitatif (SQ-FFQ), dan kadar hemoglobin melalui rapid test. Analisis menggunakan uji statistik chi square pada CI 95%. Hasil penelitian menunjukkan bahwa prevalensi masalah KEK di wilayah kerja puskesmas parung panjang kabupaten bogor yaitu 20,7%. Ada hubungan signifikan antara usia ibu hamil, paritas, jarak kehamilan, riwayat penyakit infeksi, pengetahuan, tingkat kecukupan energi dan protein dengan kejadian KEK pada ibu hamil (p<0,05). Tidak ada hubungan signifkan antara pendapatan, status anemia, tingkat kecukupan lemak dan karbohidrat dengan kejadian KEK (p>0,05). Kesimpulan, faktor-faktor yang mempengaruhi kejadian KEK yaitu usia ibu hamil, paritas, jarak kehamilan, riwayat infeksi, pengetahuan, asupan energi dan protein.
Kata Kunci: Energi, KEK ibu hamil, paritas, protein

Introduction

Pregnant women are among the most vulnerable populations because of their high nutritional needs (Izzati & Mutalazimah, 2022). Pregnancy is the period of fetal growth and development leading up to birth, making it susceptible to nutritional problems (Harna et al., 2020). Chronic energy deficiency (CED) in pregnant women is a form of malnutrition that arises from unbalanced nutrient intake over a prolonged period of time (Harna et al., 2023). The WHO Health Organization reports that the prevalence of CED in pregnant women worldwide is 35%-75%. The Survey of Basic Health Research Indonesia (Riskesdas) reported that the prevalence of CED in pregnant women aged 15-19 years was 33,5% and in those aged 20-24 years was 23,3%, with a total national prevalence of 17,3% (Kemenkes, 2018).

Chronic Energy Deficiency (CED) in pregnant women can lead to anemia, bleeding, inadequate maternal weight gain, exposure to infectious diseases, and indirectly cause maternal death. The effect of CED on childbirth can lead to difficult and prolonged labor, imminent preterm labor (IPL), postpartum bleeding, increased rates of cesarean section, intrauterine growth retardation (IUGR), intrauterine fetal death (IUFD), and congenital abnormalities (Mijayanti et al., 2020; Teguh et al., 2019).

In pregnant women, CED may be caused by both direct and indirect factors. Direct factors that can cause CED include lack of nutrient intake and infectious diseases. A lack of energy and protein intake in pregnant women can increase the risk of developing CED. Indications that pregnant women are at risk of CED include a Mid-Upper Arm Circumference (MUAC) of less than 23,5 cm (Rahmah et al., 2022). Pregnant women with CED have a higher risk of becoming sick and thus require special attention during pregnancy. Maintaining a nutritious and balanced diet is crucial for pregnant women to ensure normal nutritional status before and during pregnancy (Izzati & Mutalazimah, 2022).

Pregnancy increases energy metabolism, leading to an increased need for energy and other nutrients. During pregnancy, an additional 340-450 calories per day are required in the second and third trimesters (de Kok et al. 2021; Harna et al. 2022). A pregnancy that concludes at the appropriate time requires an energy intake of approximately 80,000 calories for maternal and fetal metabolism, as well as fetal and placental growth (Kominiarek & Rajan, 2016). Additional energy sources for pregnant women are usually provided by macronutrients such as carbohydrates, proteins, and fats. A critical review study indicated that energy and protein intake are related to the incidence of CED in pregnant women (Izzati & Mutalazimah, 2022).

Indirect factors related to CED in pregnant women include socioeconomic conditions that result in low education, short birth intervals, parity, young or teenaged maternal age, anemia, and occupation(Dharma 2019; Ekowati et al. 2017; Fitrianingtyas et al. 2018). Educational status may be partly due to a lack of knowledge about proper nutrition during pregnancy and the importance of maintaining healthy weight. Parity is the number of live births a woman has, and high-grade multipara is a high-risk status in pregnancy (Al Rahmad, 2023; Rosita & Rusmimpong, 2022). Previous research has shown a significant relationship between parity and CED incidence in pregnant women (Humairoh et al., 2023). There was also a significant relationship between pregnancy interval and the incidence of CED. Anemia has also been identified as a contributing factor to CED. Anemia can cause fatigue, weakness, and decreased ability to fight infections, all of which can contribute to poor nutritional status (Ahmad et al., 2022).

Age can increase the risk of CED in pregnant women. Pregnant women under 20 years of age are at a 2-5 times higher risk of maternal death than those aged 20-35 years. Maternal death rates increased threefold after the age of 35 years. Previous research has shown a significant relationship between maternal age and CED incidence (Andini, 2020). In addition to previous research that proved the factors influencing the incidence of malnutrition in pregnant women, several studies also showed insignificant results. Furthermore, few studies have comprehensively examined the factors that influence the incidence of malnutrition in pregnant women. This study aimed to analyze factors related to the risk of developing CED in pregnant women.

Methods

The design used in this quantitative study was cross-sectional. This study was conducted in the

working area of the Parung Panjang Community Health Center in Bogor Regency. The data collection period was June to August 2023. The population in this study was all pregnant women who routinely had their pregnancies checked at a health center. Based on a minimum sample size calculation, this study involved 140 samples were chosen by purposive sampling. The inclusion criteria were (1) pregnant women registered at the Parung Panjang Community Health Center, (2) having a KIA book, and (3) no complications such as gestational DM and preeclampsia. The exclusion criteria were as follows: (1) following a certain diet to lose weight and (2) not participating until the end of the study. Informed consent was obtained from each participant prior to data collection

The variables in this study were the incidence of CED; maternal knowledge level; parity; maternal age; education level; occupation pregnancy interval; anemia status; Infection History; and energy, protein, carbohydrate, and fat adequacy levels. Characteristic data were collected through the interviews. The technique to acquire incidence of CED was determined by measuring the mid-upper arm circumference of pregnant women using MUAC tape. The result of MUAC was divided into two categories; it was considered as normal nutrition status if MUAC is ≥ 23,5 cm and it was CED if MUAC is < 23,5 cm.

The respondents in this study were divided into two age groups: <20 years or >35 years (at-risk pregnancy) and ≥20 years or <35 years (not-at-risk pregnancy). Pregnancy intervals were divided into two categories: at-risk (<2 years) and not-at-risk (≥2 years). The level of knowledge was obtained from the respondents' scores with a total of 15 questions. Level of knowledge was divided into two categories: good (score ≥ average) and poor (score < average). Anemia status was obtained from the measurement of hemoglobin levels through rapid testing using easy touch devices, which were then categorized into two groups: normal (≥11 g/dL) and anemia (<11 g/dL).

Data on energy and macronutrient intake were collected by an in-depth interview using a Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ) form. The consumed daily energy and macronutrient intake data were analyzed using Nutrisurvey software, indicated in grams, and compared to the Recommended Dietary Allowances (RDA). Energy and macronutrient intake levels of pregnant women are categorized into two groups; the categorization is based on nutritional adequacy compared to RDA based on Indonesian Community Food and Nutrition, which is separated into two categories: inadequate (<90% and >110%) and adequate (90-110%).

Data analysis was performed using SPSS 23 and presented in both the univariate and bivariate forms. Univariate analysis was used to describe each variable. Bivariate analysis was used to test the hypotheses to identify the factors that influence the incidence of malnutrition in pregnant women. A chi-square statistical test with a confidence level of 95% was used in the bivariate analysis. This study was approved by the Health Research Ethics Committee of the Universitas Esa Unggul (approval number 0923-10.001 /DPKE-KEP/FINAL-EA/UEU/X/2023). All relevant data are presented in the paper and its Supporting Information files.

Result and Discussion

Characteristics of Respondents

The characteristics of respondents Based on the results of the study in Table 1, the majority of respondents were in the third trimester of pregnancy (46,4%). Approximately 76,4% of the mothers were between the ages of 20-35, and 93,6% were unemployed and categorized as housewives. Furthermore, 44,3% of respondents' husbands were self-employed. Additionally, 64,3% of the respondents had a low level of education, and most were junior high school graduates. It was found that 58,6% of husbands had a low level of education.

As shown in Table 1, the prevalence of Chronic Energy Deficiency (CED) among pregnant women was 20,7%, which was higher than the national rate of 17,3%. In this study, CED status was determined based on Mid-Upper Arm Circumference (MUAC) measurements. Specifically, if MUAC <23,5 cm, it was categorized as CED, while if MUAC ≥23,5 cm, it was considered normal. CED is a nutritional problem that needs to be addressed to prevent adverse effects in newborns (Pratiwi et al., 2023).

Table 1. Characteristics of respondents (n= 140)

Characteristic	n	%
Gestational Age		
Trimester 1	22	15,7
Trimester 2	53	37,9
Trimester 3	65	46,4
Mother's Age		
<20 years	14	10
20-35 years	107	76,4
>35 years	19	13,6
Mother's Occupation		
Unemployed	131	93,6
Employed	9	6,4
Father's Occupation		
Self-employed	62	44,3
Laborer	51	36,4
Employee	20	14,3
Civil Servant	4	2,9
Unemployed	3	2,1
Mother's Education		
Low	90	64,3
High	50	35,7
Father's Education		
Low	82	58,6
High	58	41,4
Status of CED		
Normal	111	79,3
CED	29	20,7

Determinant factors of CED

Several factors influence the incidence of CED in pregnant women. The factors investigated in this study were maternal age, family income, parity status, pregnancy interval, anemia status, history of infectious diseases, and maternal knowledge level. Table 2 shows a significant correlation between maternal age and the incidence of CED ($p < 0,05$). Pregnant women aged <20 or > 35 years were at a higher risk of experiencing CED, with an odds ratio (OR) of 2,472 for the at-risk group. Nutritional needs are affected more significantly by younger or older maternal age, making these age groups more susceptible to CED (Hamzah, 2017). These findings are consistent with those of previous research that demonstrated a significant correlation between maternal age and incidence (Sari et al., 2023).

The latest findings showed no significant correlation between family income and the incidence of CED in pregnant women ($p > 0,05$). This is consistent with previous research that also found no correlation between family income and incidence (Hamzah, 2017). Income is a crucial factor in fulfilling primary needs that affect maternal health. Parity was also found to increase the risk of CED, with a significant correlation between parity status and CED incidence in pregnant women ($p<0,05$), with an OR of 4,125. Pregnant women with a higher number of children (parity) had a 4,125 times higher risk of developing CED than those with fewer children. Parity significantly influences pregnancy outcomes, and women should be cautious, especially those who have been pregnant or have given birth four or more times. These findings are consistent with previous research showing a significant correlation between parity and the incidence of CED in pregnant women (Sari et al., 2023; Suryani et al., 2021).

The pregnancy interval was also found to be significantly correlated with CED incidence in pregnant women ($p<0,05$). Those with a pregnancy interval of less than 2 years had a 2,959 times greater chance of developing CED than those with a non-risky pregnancy interval (≥2 years). A total of 36% of respondents with a high-risk pregnancy interval suffered from CED. These findings are consistent with those of a previous study that showed a significant correlation between the pregnancy interval and CED incidence (Hamzah, 2017). Repeated pregnancies over a short period of time can deplete fats, proteins, glucose, vitamins, minerals, and folic acid, leading to a decrease in body metabolism. As a result, catabolism occurs in the body, depleting food reserves and resulting in decreased energy levels. This can exhaust pregnant women and increase the risk of developing CED (Nugraha et al., 2019).

Anemia status was not significantly correlated with the incidence of CED in pregnant women ($p>0,05$). Among pregnant women with anemia, the majority (73%) did not suffer from CED, whereas approximately 27% of pregnant women with anemia suffered from CED. However, a significant correlation was observed between a history of infectious disease and the incidence of CED in pregnant women ($p<0,05$). Of the respondents with a history of infectious diseases, 87,5% had CED. In this study, respondents suffered from infectious diseases such as hepatitis, cough, and diarrhea, which can trigger malnutrition by reducing appetite, interfering with nutrient absorption in the

digestive tract, or increasing the need for nutrients because of the disease. The relationship between infectious diseases and CED is reversed, where infectious diseases can worsen malnutrition and malnutrition can facilitate the incidence of infection (Febrianti et al., 2020).

Table 2. Factors associated with incidence of CED during pregnancy

Variables	Incidence of CED				Total		p-value	OR	CI (95%)
	Normal		CED						
	n	%	n	%	n	%			
Age									
Low Risk	89	83,2	18	16,8	107	76,4	0,041*	2,472	1,02-5,98
High Risk	22	66,7	11	6,8	33	23,6			
Income									
< RMW	84	78,5	23	21,5	107	76,4	0,681	0,812	0,29-2,20
≥ RMW	27	81,8	6	18,2	33	23,6			
Parity									
Primipara	63	90	7	10	70	50	0,002*	4,125	1,62-10,45
Multipara	48	68,6	22	31,4	70	50			
Pregnancy Interval									
Low Risk	92	83,6	18	16,4	110	78,6	0,015*	2,959	1,20-7,26
High Risk	19	63,3	11	36,7	30	21,4			
Anemia Status									
Normal	84	81,6	19	18,4	103	73,6	0,269	1,637	0,67-3,94
Anemic	27	73	10	27	37	26,4			
Infection History									
None	109	87,9	15	12,1	124	88,6	0,001*	3,646	1,02-12,94
Yes	2	12,5	14	87,5	16	11,4			
Knowledge Level									
Well	41	66,1	21	33,9	62	44,3	0,001*	0,223	0,09-0,54
Low	70	89,7	8	10,3	78	55,7			

RMW: Regional Minimum Wage

This study found that maternal knowledge levels indirectly caused CED in pregnant women. The research showed A significant correlation was observed between the knowledge level and CED incidence (p<0,05), with an OR value of 0,223. Pregnant women with low knowledge had a 0,223 higher chance of developing CED than those with good knowledge. These findings are consistent with previous research, which found a significant correlation between knowledge and CED incidence in pregnant women (p<0,05) (Humairoh et al., 2023). It is anticipated that pregnant women with sufficient knowledge about the consequences of and ways to prevent CED will have good health behaviors and avoid the risk of CED during pregnancy.

CED is a nutritional problem caused by long-term lack of energy and protein intake. The level of nutritional adequacy in this study was divided into two categories: adequate (90%-110%) and inadequate (<90% and >110%). Table 3 shows the significant relationship between energy intake and the incidence of CED in pregnant women (p<0,05). A total of 65,5% of the respondents with inadequate energy intake experienced CED. The statistical results showed an OR value of 0,392, meaning that pregnant women with inadequate energy intake were 0,392 times more likely to experience CED than those with adequate energy intake. Previous research has shown similar results, indicating a significant relationship between energy intake and CED in pregnant women (Mutalazimah et al., 2020).

CED occurs because of an imbalance between energy intake and the body's energy needs. When the body lacks sufficient energy to meet its energy needs, a state of low energy availability occurs, leading to various health problems and complications (Nurbaiti, 2023; Mahirawati, 2014). When energy intake is insufficient, the body seeks alternative sources

of energy to meet its metabolic needs. Body fat reserves can be used as an energy source. However, prolonged use of these fat reserves leads to the conversion of proteins in the liver and muscles into energy. This can result in loss of muscle mass, which can be indicated by a MUAC measurement of less than 23,5 cm (Murray et al., 2009). The use of protein as an energy source can cause the loss of muscle mass, which is a sign of Chronic Energy Deficiency (CED). CED is a condition in which the body's energy needs are not met for a long period of time, causing weight loss and other health problems. CED can occur when low-energy intake continues and is not met by other energy sources (Izzati and Mutalazimah, 2022). Measurement of Mid-Upper Arm Circumference (MUAC) is one way to detect CED. A MUAC of less than 23,5 cm may indicate CED, as it indicates a lack of muscle mass caused by inadequate energy intake (Chakraborty et al., 2011). Therefore, it is essential to be aware of adequate energy intake to prevent CED and minimize the risk of health problems related to chronic energy deficiency.

Table 3. Relationship between energy and macronutrients with the incidence of CED

Variables	Incidence of CED				Total		p-value	OR	CI (95%)
	Normal		CED						
	n	%	n	%	n	%			
Energy Adequacy Level									
Adequate	19	17,1	10	34,5	29	20,7	0,040*	0,392	0,15-0,97
Inadequate	92	82,9	19	65,5	111	79,3			
Protein Adequacy Level									
Adequate	16	14,4	9	31	25	17,9	0,037*	0,374	0,14-0,96
Inadequate	95	85,6	20	69	115	82,1			
Fat Adequacy Level									
Adequate	6	5,4	2	6,9	8	5,7	0,758	0,771	0,14-4,03
Inadequate	105	94,6	27	93,1	132	94,3			
Carbohydrate Adequacy Level									
Adequate	19	17,1	7	24,1	26	18,6	0,387	0,649	0,24-1,73
Inadequate	92	82,9	22	75,9	114	81,4			

*significant at 95% CI

Adequacy of protein intake was also found to be significantly related to the incidence of CED ($p<0,05$). A total of 69% of respondents who had inadequate protein intake experienced CED. The analysis showed an odds ratio (OR) of 0,397, indicating that pregnant women with inadequate protein intake were 0,397 times more likely to experience CED than those with adequate protein intake. This research is consistent with a previous study that indicated a significant relationship between protein intake and CED incidence in pregnant women (Izzati & Mutalazimah, 2022).

The relationship between CED and protein intake shows that protein is an important nutrient for the body's metabolic processes as a transporter, enzyme builder, and an alternative energy source. Pregnancy and fetal growth increase the need for nutrients. Inadequate protein intake can result in a lack of amino acids and minerals, decreased immunity to disease, and loss of muscle mass. The principle of nutrient intake and a person's nutritional status shows that if pregnant women have good food diversity and adequate protein intake, their nutritional status will improve. Consuming protein-rich foods can increase optimal absorption to maintain and increase muscle mass. Inadequate protein consumption can lead to hyperphagia, thermogenesis, and the loss of fat mass and body weight. Other studies have reported a relationship between protein intake and CED in pregnant women. Therefore, pregnant women must have a balanced diet and nutritional needs to ensure the health of both their mothers and babies (Ambarwati et al., 2023; Iskandar et al., 2022; Murray et al., 2009).

The results indicated no significant relationship between fat and carbohydrate intakes ($p > 0,05$). A correlation was observed between the distribution of fat adequacy levels and the incidence of CED. A total of 27

respondents with inadequate fat intake experienced CED, indicating that a possible lack of fat intake may contribute to the occurrence of CED. A total of 22 respondents with inadequate carbohydrate adequacy levels tended to experience CED.

Conclusion

The prevalence of CED problems in the working area of the Parung Panjang Community Health Center in Bogor Regency, was 20,7%. There was a significant relationship between maternal age, parity, pregnancy interval, history of infectious diseases, level of knowledge, energy and protein adequacy level, and CED incidence in pregnant women in the area. As a suggestion for further research, an experimental study should be conducted to provide additional food to pregnant women experiencing CED to improve their nutritional status.

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