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Sociodemographic and Environmental Characteristics of Pregnant Women with Chronic Energy Deficiency

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ABSTRACT

Chronic Energy Deficiency (CED) during pregnancy remains a major maternal nutrition problem associated with adverse pregnancy outcomes. This study aimed to describe the sociodemographic and environmental characteristics of pregnant women with CED attending Independent Midwifery Practices in Panjang District, Bandar Lampung City. A descriptive cross-sectional study was conducted in 2024 involving pregnant women identified with CED based on mid-upper arm circumference measurements of <23.5 cm. Total sampling was applied. Data were collected through interviewer-assisted structured questionnaires, anthropometric measurements, and antenatal care record reviews. Descriptive analysis was performed using frequency and percentage distributions. The findings showed that CED occurred across various maternal age groups, including women aged 20–35 years. CED was more common among pregnant women with low educational attainment, informal employment, and low household income. Most respondents also had a history of CED or malnutrition, low body mass index, low protein intake frequency, infrequent consumption of nutrient-dense foods, inadequate antenatal care visits, limited family support, and exposure to secondhand smoke. In conclusion, CED among pregnant women was associated with multiple sociodemographic, nutritional, and environmental characteristics. These findings highlight the importance of strengthening nutritional monitoring, family support, and antenatal care services at the primary health care level to support maternal nutritional status during pregnancy.

INTRODUCTION

Chronic Energy Deficiency (CED) among pregnant women remains an important public health nutrition problem associated with increased risks of pregnancy complications, low birth weight, and impaired fetal growth and development (World Health Organization, 2016). In Indonesia, the prevalence of CED among pregnant women remains relatively high and varies across regions due to differences in socioeconomic conditions, dietary practices, and access to health services (Ministry of Health of the Republic of Indonesia, 2018).

Previous studies have identified several determinants associated with CED, including maternal education, household economic status, nutritional history, dietary intake, antenatal care utilization, and family support (Lestari et al., 2019; Hidayati & Pradanie, 2020). Inadequate protein intake and limited dietary diversity among pregnant women from low-income households also contribute to poor maternal nutritional status (Food and Agriculture Organization, 2017; World Health Organization, 2022). In addition, limited antenatal care visits may reduce opportunities for nutritional counseling and early detection of maternal nutritional problems (Putri & Wahyuni, 2021).

Independent Midwifery Practices (IMPs) have a strategic role in providing antenatal care, nutritional assessment, and maternal health education at the primary health care level. However, studies specifically describing the sociodemographic and environmental characteristics of

pregnant women with CED within the context of Independent Midwifery Practices remain limited. Most previous studies have primarily focused on analytical associations between isolated risk factors and CED, while comprehensive descriptions of maternal characteristics in community-based primary care settings are still scarce.

Panjang District, Bandar Lampung City, is characterized by heterogeneous socioeconomic and environmental conditions that may influence maternal nutritional status. Preliminary observations from several Independent Midwifery Practices in this area indicated the continued presence of pregnant women with CED from diverse sociodemographic and environmental backgrounds.

Therefore, this study aimed to describe the sociodemographic and environmental characteristics of pregnant women with CED attending Independent Midwifery Practices in Panjang District, Bandar Lampung City. This study provides contextual evidence from primary health care settings that may support the development of more targeted promotive and preventive maternal nutrition interventions.

METHOD

This study employed a descriptive cross-sectional design to describe the sociodemographic and environmental characteristics of pregnant women with Chronic Energy Deficiency (CED) at a single point in time without examining causal relationships (Notoatmodjo, 2018). Data were collected using structured questionnaires administered through interviewer-assisted interviews conducted by trained researchers or enumerators to ensure that respondents fully understood each question and completed the questionnaire accurately. Anthropometric measurements and antenatal care record reviews were also performed to support data completeness.

The study was conducted at Independent Midwifery Practices (IMPs) in Panjang District, Bandar Lampung City. Data collection was carried out in 2024 concurrently with routine antenatal care services provided at the IMPs. The study population consisted of all pregnant women who attended antenatal care at Independent Midwifery Practices in Panjang District, Bandar Lampung City, during the study period. The study sample included all pregnant women identified as having Chronic Energy Deficiency (CED) and who met the inclusion criteria. A total sampling technique was applied, whereby all pregnant women with CED recorded at the IMPs during the study period were recruited as respondents.

The inclusion criteria were as follows: Pregnant women registered and receiving antenatal care at Independent Midwifery Practices in Panjang District. Pregnant women identified as having Chronic Energy Deficiency based on a mid-upper arm circumference (MUAC) measurement of <23.5 cm. Pregnant women who provided informed consent to participate in the study. The exclusion criteria were pregnant women who declined to participate or had incomplete data.

The study variables comprised sociodemographic and environmental characteristics of pregnant women with CED, including:

1. Sociodemographic characteristics: maternal age, educational level, employment status, and economic status.
2. Nutritional and health characteristics: history of CED, history of malnutrition, and body mass index (BMI).
3. Dietary intake characteristics: frequency of protein consumption and intake of foods with high nutritional value.
4. Environmental characteristics: family support and exposure to secondhand smoke.

Chronic Energy Deficiency (CED) was defined based on a mid-upper arm circumference (MUAC) measurement of <23.5 cm, in accordance with the standards of the Ministry of Health of the Republic of Indonesia (Ministry of Health of the Republic of Indonesia, 2020). Data on sociodemographic characteristics, dietary intake, and environmental factors were collected through structured interviews using a standardized questionnaire. Nutritional and health status data were obtained through anthropometric measurements and a review of antenatal care records at the Independent Midwifery Practices.

Data were collected using the following methods: Structured interviews with pregnant women using a questionnaire. Anthropometric measurements, including MUAC assessment and

calculation of body mass index. Review of secondary data from the Maternal and Child Health (MCH) handbook and antenatal care records maintained at the Independent Midwifery Practices. Data were analyzed descriptively by presenting frequency distributions and percentages for each study variable. The results were presented in tables and narrative form to describe the sociodemographic and environmental characteristics of pregnant women with Chronic Energy Deficiency (Notoatmodjo, 2018).

This study received ethical approval from the Health Research Ethics Committee of Poltekkes Kemenkes Tanjungkarang, as evidenced by the Ethical Clearance Certificate No. 492/KEPK-TJK/VII/2024. All respondents were provided with detailed information regarding the study objectives and procedures and were required to sign an informed consent form prior to participation. Confidentiality of participants' identities was strictly maintained in accordance with ethical principles for health research (World Medical Association, 2013).

RESULTS

Table 1 presents the sociodemographic, nutritional, and environmental characteristics of pregnant women with Chronic Energy Deficiency (CED) at Independent Midwifery Practices in Panjang District, Bandar Lampung City. Overall, CED was identified across various maternal age groups and socioeconomic backgrounds.

The findings showed that pregnant women with CED were most frequently found among those aged 20–35 years, accounting for 27 respondents (32.1%), although CED was also observed among women aged below 20 years and above 35 years, totaling 6 respondents (37.5%). Based on educational background, higher proportions of CED were observed among women with lower educational attainment (elementary to junior high school), with 19 respondents (50.0%), compared with those who had senior high school or university education (22.6%).

Regarding employment and economic conditions, CED was more common among pregnant women working in the informal sector, comprising 29 respondents (33.7%). Similarly, women with lower household income levels (IDR 1–3 million per month) demonstrated higher proportions of CED, accounting for 28 respondents (44.4%), whereas only 5 respondents (13.5%) with income above IDR 4 million experienced CED. Based on parity, pregnant women with zero to one child represented the largest proportion of CED cases, totaling 27 respondents (35.5%).

Nutritional history and maternal nutritional status also showed important patterns. Pregnant women with previous histories of CED and malnutrition accounted for 48.4% and 46.7% of CED cases, respectively. In addition, most pregnant women with CED had low body mass index, comprising 22 respondents (75.9%).

Dietary intake characteristics indicated that CED was more prevalent among women with lower protein intake frequency (0–3 times per week), accounting for 25 respondents (43.1%). Similarly, women who rarely consumed nutrient-dense foods represented the highest proportion of CED cases, totaling 25 respondents (51.0%). Antenatal care utilization also differed between groups, as pregnant women with fewer antenatal care visits (0–3 visits) accounted for 28 respondents (46.7%), while those with more than three visits showed considerably lower proportions of CED (12.5%).

Environmental and family-related factors were also evident. Pregnant women who did not receive adequate family support accounted for 20 respondents (55.6%), whereas women receiving family support demonstrated lower proportions of CED (20.3%). Exposure to secondhand smoke was frequently reported among pregnant women with CED, comprising 30 respondents (37.5%). Additionally, respondents with a history of chronic disease showed relatively higher proportions of CED (66.7%), although the number of cases was limited.

Table 1. Distribution of characteristics of pregnant women with Chronic Energy Deficiency (CED) at independent midwifery practices

Characteristics	Category	CED		Non-CED	
		n	%	n	%
Maternal age	<20 and >35 years	6	37.5	10	62.5
	20–35 years	27	32.1	57	67.9
Formal education	Elementary–Junior High School	19	50.0	19	50.0
	Senior High School–University	14	22.6	48	77.4
Employment status	Informal employment	29	33.7	57	66.3
	Formal employment	4	28.6	10	71.4
Economic status	Monthly income IDR 1–3 million	28	44.4	35	55.6
	Monthly income > IDR 4 million	5	13.5	32	86.5
Number of children	>1 child	6	25.0	18	75.0
	0–1 child	27	35.5	49	64.5
History of CED	Previous history of CED	15	48.4	16	51.6
	No history of CED	18	26.1	51	73.9
History of malnutrition	Previous history	14	46.7	16	53.3
	No history	19	27.1	51	72.9
Protein intake	0–3 times/week	25	43.1	33	56.9
	≥4 times/week	8	19.0	34	81.0
Intake of nutrient-dense foods	Rarely/occasionally	25	51.0	24	49.0
	Frequently/routinely	8	15.7	43	84.3
ANC visit frequency	0–3 visits	28	46.7	32	53.3
	>3 visits	5	12.5	35	87.5
Family support	No support	20	55.6	16	44.4
	Received support	13	20.3	51	79.7
History of chronic disease	Present	2	66.7	1	33.3
	Absent	31	32.0	66	68.0
Exposure to secondhand smoke	Exposed	30	37.5	50	62.5
	Not exposed	3	15.0	17	85.0
Body mass index (BMI)	Low	22	75.9	7	24.1
	Normal & high	11	15.5	60	84.5

DISCUSSION

This study provides a comprehensive description of the sociodemographic characteristics, nutritional status, dietary patterns, and environmental factors among pregnant women with Chronic Energy Deficiency (CED) attending Independent Midwifery Practices (IMPs) in Panjang District, Bandar Lampung City. The findings indicate that CED among pregnant women is a multifactorial condition influenced by the interaction of individual characteristics, socioeconomic conditions, nutritional behaviors, and family and environmental factors, rather than being determined by a single factor.

Maternal age characteristics

The results show that pregnant women with CED were not only found in biologically high-risk age groups (<20 years and >35 years) but were also prevalent among women of optimal reproductive age (20–35 years). This finding suggests that biological age alone is not a sufficient determinant of CED. The World Health Organization emphasizes that maternal nutritional status during pregnancy is more strongly influenced by adequate energy and nutrient intake, socioeconomic conditions, and access to health services than by age alone (WHO, 2016). Therefore, pregnant women within the optimal reproductive age range may still be at risk of CED if nutritional and health-supporting factors are not adequately met.

Several studies have also demonstrated that maternal nutritional problems may occur even among women within the ideal reproductive age group due to inadequate dietary intake, poor household food security, and limited access to quality antenatal care services. A study conducted in Ethiopia by Gebre et al. (2018) found that maternal age was not independently associated with

Chronic Energy Deficiency after controlling for socioeconomic and dietary variables. Similar findings were reported in Bangladesh, where household poverty and inadequate dietary diversity contributed more strongly to maternal undernutrition than maternal age alone (Ahmed et al., 2020). These findings support the current study, indicating that CED among pregnant women is influenced by broader social and nutritional determinants beyond biological age factors.

Formal education

A higher proportion of CED was observed among pregnant women with lower levels of formal education (elementary to junior high school). Education plays a critical role in shaping maternal knowledge, attitudes, and behaviors related to nutritional intake during pregnancy. Women with lower educational attainment tend to have limited capacity to understand nutrition information, select nutritious foods, and optimally utilize health services. This finding is consistent with the Indonesian Basic Health Research (Riskesdas) 2018, which reported a higher prevalence of maternal nutritional problems among women with low educational levels (Ministry of Health of Indonesia, 2018). Previous studies in Indonesia have also demonstrated a strong association between maternal education and the ability to manage dietary intake and adopt healthy behaviors during pregnancy (Lestari et al., 2019; Hidayati & Pradanie, 2020).

Maternal education contributes substantially to health literacy and decision-making related to food selection, health-seeking behavior, and compliance with antenatal recommendations. Women with higher educational attainment are generally more capable of accessing and understanding maternal nutrition information. Previous studies in developing countries have consistently shown that low maternal education is associated with poor dietary diversity and increased risk of maternal undernutrition (Nguyen et al., 2018; Rahman et al., 2021). Therefore, educational interventions during antenatal care should be strengthened, particularly among women with lower educational backgrounds.

Employment status and economic status

In terms of employment status, CED was more frequently found among pregnant women working in the informal sector. Informal employment is commonly associated with income instability and limited social protection, which may adversely affect household capacity to meet nutritional needs. In line with this, CED was more prevalent among women with lower household income. The World Health Organization identifies economic constraints as a major determinant of inadequate energy and protein intake among pregnant women, particularly in urban settings characterized by socioeconomic disparities (World Health Organization, 2016; Food and Agriculture Organization, 2017). These findings underscore the substantial role of economic factors in the occurrence of CED through limited access to nutritious foods and health services.

Economic vulnerability limits household purchasing power and affects the availability of protein-rich and micronutrient-dense foods during pregnancy. Women employed in the informal sector often experience unstable income and lack maternity protection, which may contribute to inadequate nutritional intake. Similar findings were reported by Torlesse et al. (2021), who highlighted that maternal undernutrition in Southeast Asia remains closely associated with poverty, food insecurity, and unequal access to health services. Household income also influences the ability of pregnant women to attend regular antenatal care and obtain nutritional supplements.

Number of children

The study revealed that CED was more commonly found among pregnant women with no children or only one child. This suggests that CED is not limited to multiparous women but also affects women with limited pregnancy experience. This condition may be related to insufficient knowledge and experience in meeting nutritional requirements and managing pregnancy, particularly during the first pregnancy. According to public nutrition theory, previous pregnancy experience can influence maternal preparedness in fulfilling nutritional needs during subsequent pregnancies (Supariasa, 2019).

History of CED and malnutrition

A higher proportion of CED was observed among pregnant women with a prior history of CED and malnutrition. Previous nutritional status reflects maternal energy and nutrient reserves that are essential during pregnancy. Women with poor nutritional status before conception are at greater risk of developing CED if no sustained nutritional intervention is provided. This finding aligns with the life-cycle approach, which emphasizes the importance of improving nutritional status before pregnancy to prevent nutritional problems during gestation (Black et al., 2021).

Protein intake and consumption of nutrient-dense foods

The results indicate that pregnant women with CED were more likely to have low protein intake frequency and infrequent consumption of nutrient-dense foods. Inadequate energy and protein intake can impair maternal metabolic needs and fetal growth. Both the WHO and FAO emphasize that sufficient protein intake and dietary diversity are key components in preventing maternal undernutrition during pregnancy (Food and Agriculture Organization, 2017; World Health Organization, 2022). Limited dietary diversity among pregnant women with CED reflects constraints related to nutritional knowledge, economic conditions, and access to nutritious foods.

Dietary diversity is recognized as an important indicator of maternal nutritional adequacy during pregnancy. Inadequate intake of protein-rich foods and micronutrients may impair fetal growth and maternal metabolic adaptation. A multicountry analysis by Nguyen et al. (2018) demonstrated that low dietary diversity among pregnant women was strongly associated with maternal undernutrition and anemia. Moreover, insufficient intake of animal-source foods has been linked to poor maternal weight gain and increased risk of low birth weight infants.

Antenatal care visit frequency

CED was more prevalent among pregnant women with a low frequency of antenatal care (ANC) visits. ANC visits serve as a primary platform for monitoring nutritional status, providing nutrition counseling, and early detection of maternal health problems. Inadequate ANC attendance may result in delayed identification and management of nutritional deficiencies. Several national studies have reported that insufficient ANC visits are associated with a higher risk of CED due to limited exposure to nutrition education and timely interventions (Ministry of Health of Indonesia, 2020; Putri & Wahyuni, 2021).

Regular ANC visits provide opportunities for nutritional screening, counseling, iron-folic acid supplementation, and early management of pregnancy-related complications. According to WHO recommendations, adequate ANC utilization improves maternal nutritional monitoring and supports positive pregnancy outcomes. A study by Ekholuenetale et al. (2020) reported that women with inadequate ANC attendance were significantly more likely to experience maternal nutritional problems compared with women receiving regular ANC services.

Family support and exposure to secondhand smoke

The findings show that CED occurred more frequently among women who did not receive family support and those exposed to secondhand smoke. Family support, particularly from husbands, plays a crucial role in decision-making related to nutritional intake, health service utilization, and adherence to health recommendations. Lack of family support may exacerbate poor nutritional conditions during pregnancy (Hidayati & Pradanie, 2020). Furthermore, exposure to secondhand smoke may negatively affect maternal health and interfere with nutrient utilization, thereby increasing the risk of CED (Ministry of Health of Indonesia, 2018).

Family involvement, particularly husband support, plays an important role in improving maternal dietary practices and psychological well-being during pregnancy. Supportive family environments may encourage pregnant women to consume balanced diets, attend health services regularly, and maintain healthy lifestyles. Conversely, limited family support may reduce maternal motivation to comply with nutritional recommendations. This finding is consistent with previous studies emphasizing the role of social support in maternal nutritional improvement programs (Yuliani et al., 2022).

Body Mass Index (BMI)

Most pregnant women with CED had a low body mass index (BMI). BMI reflects maternal nutritional status before and during pregnancy and is closely related to energy reserves. The WHO states that low BMI among pregnant women is associated with increased risk of energy and nutrient deficiencies and adverse pregnancy outcomes (World Health Organization, 2016; Black et al., 2021). This finding highlights the importance of early BMI monitoring as an integral component of antenatal care in primary health care settings.

CONCLUSION

This study provides a descriptive overview of the sociodemographic and environmental characteristics of pregnant women with Chronic Energy Deficiency (CED) attending Independent Midwifery Practices in Panjang District, Bandar Lampung City. The findings indicate that CED occurs across various maternal age groups, including women of optimal reproductive age (20–35 years), suggesting that biological age alone is not the sole risk factor for the occurrence of CED.

Pregnant women with CED were more frequently found among those with low educational attainment, employment in the informal sector, and low economic status. These conditions reflect the important role of sociodemographic factors in influencing maternal capacity to meet nutritional requirements during pregnancy.

In terms of nutritional and health status, most pregnant women with CED had a history of CED and prior malnutrition, as well as a low body mass index, indicating limited maternal energy reserves before and during pregnancy. Regarding dietary patterns, pregnant women with CED tended to have low protein intake frequency and infrequent consumption of nutrient-dense foods.

Furthermore, CED was more commonly observed among women with inadequate antenatal care visit frequency, lack of family support, and exposure to secondhand smoke. Overall, the findings demonstrate that CED among pregnant women in Independent Midwifery Practices in Panjang District is influenced by a combination of sociodemographic factors, nutritional status, dietary intake, and family environmental conditions.

Midwives are encouraged to strengthen routine monitoring of maternal nutritional status, particularly among pregnant women with high-risk sociodemographic and environmental characteristics. This includes regular assessment of mid-upper arm circumference and body mass index, enhanced nutrition education on balanced diets, and efforts to improve compliance with recommended antenatal care visits as key strategies for preventing CED.

Families, particularly husbands, are expected to provide optimal support to pregnant women in meeting nutritional needs, participating in health-related decision-making, and creating a healthy home environment free from tobacco smoke exposure to support maternal nutritional status during pregnancy.

The findings of this study may serve as a basis for planning promotive and preventive programs aimed at improving maternal nutrition, especially in urban areas with diverse socioeconomic backgrounds. Strengthening the role of Independent Midwifery Practices as frontline maternal health service providers should be supported through appropriate policies, continuous supervision, and capacity-building initiatives.

Future studies are recommended to examine factors associated with CED among pregnant women using analytical study designs or qualitative approaches to obtain a deeper understanding of CED determinants and to develop more effective intervention strategies.

AUTHOR'S DECLARATION

Authors' contributions and responsibilities

NI: Conceptualization, study design, project administration, funding acquisition, data collection supervision, initial draft writing, and manuscript finalization; NN: Data collection, formal analysis, data interpretation, and manuscript drafting support; **RL:** Methodology development, validation, literature review, and manuscript editing; **RN:** Data management, visualization, statistical interpretation, and critical review of the manuscript; **AO:** Investigation, literature searching,

manuscript review, and editing; **EB:** Supervision, validation, critical revision of the manuscript, and final approval of the version to be published. All authors have read and approved the final manuscript and are responsible for the integrity, validity, and accuracy of the data analysis and conclusions presented in this article.

Availability of data and materials
All data are available from the authors.

Competing interests
The authors declare no competing interests.

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