

SYSTEMATIC REVIEW

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Food Consumption and Family Income Associated with Chronic Energy Deficiency in Pregnant Women in Coastal Areas of Indonesia: Systematic Review

Konsumsi Makan dan Tingkat Pendapatan Keluarga dengan Kejadian Kekurangan Energi Kronik Pada Ibu Hamil di Wilayah Pesisir di Indonesia: Tinjauan Pustaka Sistematis

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ABSTRACT

Background: In Indonesia, Chronic Energy Deficiency (CED) is still a prevalent nutritional concern among pregnant women. CED causes anemia, bleeding, irregular maternal weight gain, and infection. CED is influenced by food consumption intake, which is indirectly also influenced by cultural factors and family income levels. Pregnant women who live in coastal areas tend to have low purchasing power.

Objectives: Analyzing the relationship between food consumption patterns and family income levels with the incidence of CED during pregnancy in coastal areas based on the results of other authors' researches.

Methods: This systematic review was carried out following the PRISMA guidelines to select and assess the quality of the articles. Data sources came from PubMed, DOAJ, Garuda Portal, Proquest, and Google Scholar from 2013-2022. The keywords used were "Food Consumption" AND "Family Income" AND "Chronic Energy Deficiency Incidence" AND "Pregnancy in Coastal Areas", AND "Socio-Cultural", AND "Health Services", AND "Food Access" and produced 18 articles.

Discussions: Thirteen of 18 articles studied only discussed one variable, namely food consumption or family income, and five journals discussed two variables, namely food consumption and family income. 12 of 13 articles stated a significant relationship between food consumption and the incidence of CED in pregnancy in coastal areas; one article concluded the opposite. Pregnant women in coastal areas have a higher risk of experiencing CED due to low family income and lack of access to nutritious food.

Conclusions: Prevention of CED for pregnant women in coastal areas is carried out by increasing family income and access to sufficient nutritious food.

INTRODUCTION

Chronic Energy Deficiency (CED) is a nutritional problem caused by a continuous lack of macronutrient energy¹. CED is a common manifestation of malnutrition in pregnant women. According to Hayati et al. (2020) the incidence of CED in pregnant women can cause various risks, such as anemia, bleeding, irregular increase in maternal weight, and infection². The CED indicator is measured through the upper arm circumference (LILA) < 23.5 cm³. According to the Indonesian Ministry of Health, the prevalence of CED in pregnant women of childbearing age in Indonesia is 17.3%, representing a decline from 2013 figures of 24.2%, with East Java recording a rate of 19.6% among pregnant women and 13.4% among non-

pregnant women⁴. Furthermore, the prevalence of CED in pregnant women in Jember is 39.5%.⁵ Given the regional disparities in CED prevalence, it is essential to understand the factors contributing to CED, as well as its impact, in order to develop targeted public health strategies for prevention and mitigation. CED is influenced by a combination of direct and indirect factors. Direct factors include food consumption and infection⁶, whereas indirect factors encompass income⁷, occupation⁸, education⁹, knowledge, and culture¹⁰.

Several studies have mentioned the connection between food consumption and the incidence of CED, aligned with the research by Erwinawati et al., 2018, indicating a significant association between energy intake

and CED¹¹. The findings of this research correspond with various other studies suggesting a substantial connection between energy as well as protein intake and the occurrence of CED^{12,13,14}. Indonesia has a variety of cultures, social and customs that influence people's food choices. Different cultures in each family can form different eating habits. Apart from that, eating habits are also formed from different ecological conditions. Environmental factors can influence food consumption habits, as shown by the differences in dietary practices between coastal and inland communities, particularly in terms of ingredient selection, food preparation methods, and overall eating patterns¹⁵.

Another indirect factor associated with CED is the level of family income with income inequality in several regions of Indonesia serving as a significant determinant for its prevalence. Diverse geographical conditions, such as mountains and coasts, influence people's economic activities¹⁶. Limited access to certain food sources, combined with the unstable income conditions faced by coastal communities, can negatively impact their health and daily food consumption¹⁷. In general, as the majority of people living in coastal areas works as fishermen, if incomes in these regions increase, both the quantity and variety of their food consumption are likely to improve¹⁸. Cheap selling prices for catch are an obstacle in coastal areas that prevent people from being able to buy food in the quantities they need. Setyaningrum et al. (2020) also found a significant connection between household income and the incidence of chronic energy deficiency (CED).¹⁹ Likewise, Wati and Haslinda (2012) also found a marked relationship between food consumption and CED among pregnant women living in the Sungai Siak area, Pekanbaru²⁰. Nevertheless, no statistically significant correlation was observed between household income and earthworm infections in pregnant women diagnosed with CED.

The current research offered insight involving the incorporation of coastal regions which indirectly influence food intake and family income. Interestingly, despite the significant results regarding the relationship between food consumption and CED, divergent outcomes have also been observed in certain studies. Oktriyani et al., (2016), for example, discovered that there was not any statistically significant evidence to support the relationship between food consumption, specifically protein and energy consumption, and the incidence of Chronic Energy Deficiency (CED) in pregnant women²¹. According to Sari & Munawar (2012), consumption reflects the economic aspect of a family by illustrating how they allocate their financial resources. Food plays an important role in a nation's economic activities and has a strong impact on economic balance.

Modification of financial activities affects food quality, consequently influencing the national income of the country. In this context, some pregnant women in this area are at risk of developing CED, which entails imposing dietary restriction. Food consumption is important in economic activities in these areas and can affect family welfare²². Notably, low-income families find it difficult to meet their nutritional needs²³. In light of these findings, a comprehensive investigation is necessary to elucidate the interplay between food consumption, family income, and CED during pregnancy. This study aims to conduct a systematic review of existing literature to critically examine the current understanding of this complex relationship and identify areas for further research.

METHODS

The data in this study came from secondary sources, specifically the findings of previous researchers, and did not rely on primary data obtained through direct experience. A systematic literature review was undertaken, encompassing 18 articles that examine the occurrence of CED in pregnant women, with a focus on the interplay between food consumption, family income, and coastal areas. The electronic databases consulted during the literature search included Google Scholar, PubMed, Proquest, DOES and Garuda Portal, from 2013 to 2022. The inclusion criteria in this study entailed selecting studies that investigated the incidence of CED in pregnancy in coastal areas (*Problem*), assessing food consumption and income of families with CED in pregnancy (*Intervention*), restricting the inclusion of only research designs other than systematic literature reviews. Furthermore, publications written in either Indonesian or English were also considered. The keywords in this study were "Food Consumption" AND "Family Income" AND "Chronic Energy Deficiency Incidence" AND "Pregnancy in Coastal Areas", AND "Socio-Cultural", AND "Health Services", AND "Food Access".

This research used the established protocols of the Center for Studies and Dissemination and the Joanna Briggs Institute guidelines to evaluating the quality of summarized research.²⁴ Article search workflow *checklist* was employed to critically appraise the literature review, pertinent to the research objectives, by meticulously selecting studies that meet the inclusion criteria. This prescribed protocol comprehensively assessed the quality of the literature review, encompassing examination of the title, abstract, background, research methods, findings, and discussion sections. This protocol also took into account several collected sources related to the results of the literature selection.

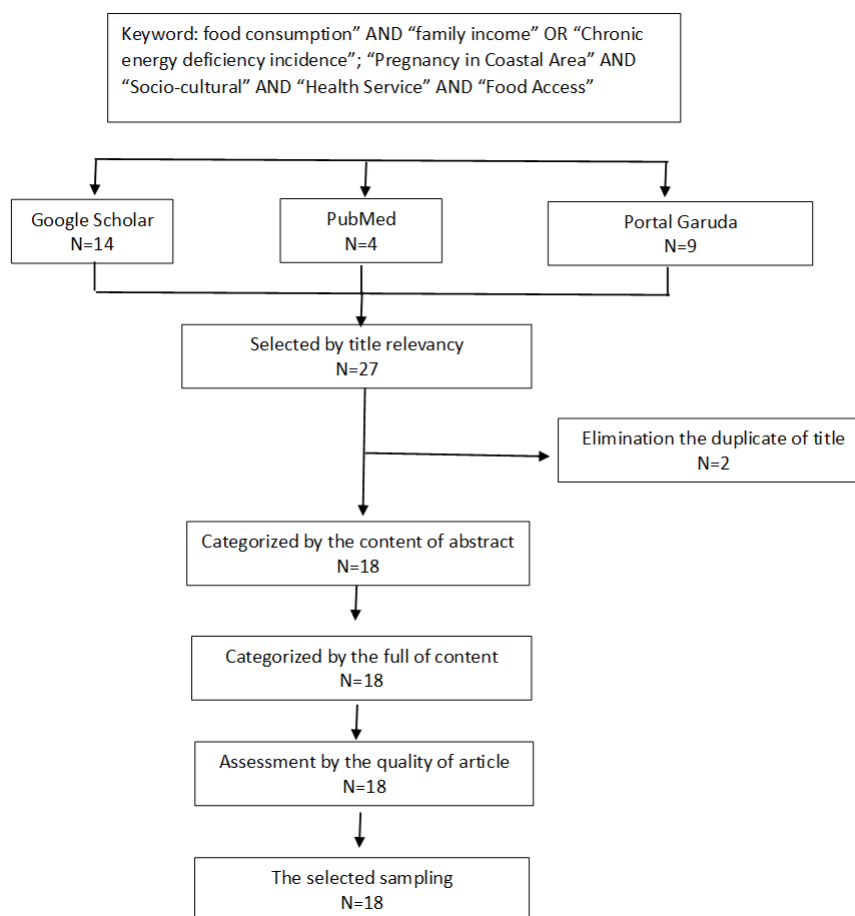


Figure 1. PRISMA Frame Work Study

The approach used in searching for academic publications used the PICOS framework, which stands for P=population/problem, I=intervention, C= comparison (comparison)/control, O=outcome and S=Study design/research design. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines were used for retrieval of search results and subsequent selection of studies. The methodology was carried out methodically by adhering to appropriate research methods or protocols. A systematic review is a careful approach to evaluating, analyzing, organizing and categorizing existing evidence that has been previously generated. Search results were used to examine journal articles from 27 different publications for duplication. The researcher then carried out a screening process based on the abstracts to obtain 18 journals. The researcher thoroughly studied all these texts and made necessary adjustments to the research literature, ultimately resulting in 18 similar journals. Journals

receiving an appraisal and meeting the inclusion criteria then underwent a comprehensive evaluation process to ensure the quality of their research, resulting in the selection of up to 18 journals that successfully received appraisal and consequently a total of 9 journal articles were not used.

DISCUSSIONS

The characteristics of respondents in studies investigating food consumption, family income levels, and CED in pregnant women in coastal areas shows that most studies used samples of more than 50 pregnant women. Birth spacing was also taken into considerations in selecting samples in several studies. Further, the size of the Upper Arm Circumference (MUAC) was often used as an inclusion criterion. Table 1 describes the identity of the article, title, population and sample, type of study, data collection methods, and important findings from the articles analyzed in this review.

Table 1. Characteristics of studies analyzed in this systematic review

No	Author, Year	Title	Population and sample	Types of research	Important Findings
1	Akbarini & Siswina, 2022 ⁷	Factors affecting the incidence of chronic energy deficiency (CED) in pregnant women	Population: All pregnant women aged 18-49 years at the Puskesmas Bangka Village, Pontianak, a sample of 40 pregnant women	Quantitative, analytical survey	This research shows that the relationship between food consumption, parity, type of work and education, and the incidence of CED in pregnant women is not statistically significant. Meanwhile, the chi-square test results reveal a significant association (p-value = 0.000, $\alpha = 0.05$) between pregnancy distance, income, and CED occurrence among pregnant women .
2	Aisyah et al., 2022 ²⁵	Effect of Counseling Packages on the Diet of Pregnant Women with Chronic Energy Deficiency	The population is unknown, the research sample was 30 pregnant women	Quasi experimental (quantitative)	Providing a more in-depth counseling influences the eating patterns of pregnant women with CED
3	Aji et al., 2019 ²⁶	Vitamin D deficiency status and its related risk factors during early pregnancy: a cross-sectional study of pregnant Minangkabau women, Indonesia	Population 239 pregnant women, sample 232 pregnant women	Crossectional study	Vitamin D deficiency is associated with the health of pregnant women in coastal areas. As for <i>odd ratio</i> in this study was 95%.
4	Astuti et al., 2022 ²⁷	Chronic Energy Deficiency in Women from Muna District: Association with Body Image and Knowledge	The total sample was 57 pregnant women in the Maabodo Health Center working area	Quantitative, analytical survey	Food consumption is significantly related to CED in pregnant women. Apart from that, it was also found that the prevalence of CED was related to the knowledge and <i>body image</i> of pregnant women, but there is no relationship between parity and the prevalence of CED in pregnant women.

5	Desiman et al., 2022 ⁸	The Incidence of Chronic Energy Deficiency (KEK) in Pregnant Women at Borong Health Center	Population: pregnant women in the Borong Community Health Center working area. Sample: 56 pregnant women in the Borong Community Health Center working area	Crossectional study	There is a relationship between food consumption and family income and the incidence of CED in pregnant women in coastal areas. Apart from that, it was also found that maternal age, maternal occupation, family income, pregnancy distance, energy intake and protein intake were related to the incidence of CED in pregnant women. However, research also shows that maternal health, education level and parity have no relationship with the incidence of CED in pregnant women in the work area of the Borong Community Health Center, East Manggarai Regency.
6	Edowai et al., 2018 ¹⁰	Factors Influencing Malnutrition Pregnant at Tigi District Deiyai Regency	Sample: All pregnant women registered at Waghete Health Center and Damabagata Health Center	Qualitative	The nutritional intake of pregnant women and ethnic culture influence malnutrition in pregnant women. Sociocultural factors influence the dietary practices of communities, households, and individuals. At Waghete Community Health Center and Damabagata Community Health Center in Deiyai District, there is a correlation between knowledge and the incidence of CED in pregnant women
7	Helliyana et al., 2019 ²⁸	The Associations between Maternal Education, Chronic Energy Deficit, and Anemia in Pregnant Women: An Evidence from Lhokseumawe, Indonesia	The total sample was 90 pregnant women	Quantitative, Cross-sectional study	The incidence of CED is related to the prevalence of anemia in pregnant women at the Muara I Community Health Center, Lhokseumawe City.
8	Meshram et al., 2015 ²⁹	Trends in nutritional status and nutrient intakes and correlates of overweight/obesity among rural adult women (≥18–60 years) in	Women aged 16-60 years in 10 states in India	Analytical survey	The results of this study indicate that nutritional status can influence the occurrence of CED in pregnant women. This study also shows an increase in overweight/obesity in rural Indian women, which

		India: National Nutrition Monitoring Bureau (NNMB) national surveys			is associated with increased consumption.
9	Moediars o, 2020 ¹⁶	Differentiate Factors of Pregnant Women with Chronic Energy Deficiency Occurrence in Bajulmati Village, Wongsorejo District, Banyuwangi Regency 2019	All pregnant women in Wongsorejo village	Quantitative	There is a relationship between family income and the occurrence of CED in pregnant women.
10	Nadimin et al., 2019 ³⁰	Increasing of Nutrition Status of Pregnant Women after Supplementation of Moringa Leaf Extract (Moringa Oleifera) in the Coastal Area of Makassar, Indonesia	70 pregnant women	Quasi experimental	Nutritional intake can affect the health of pregnant women which is also related to CED. The increase in the nutritional status of pregnant women by consuming iron folate supplements is comparable to the increase in the nutritional status of pregnant women who consume Moringa leaf extract.
11	Mansyarif et al., 2022 ³¹	Causes and Solutions of the Problem of Chronic Energy Lack in Coastal Area, Especially in Maligano Community Health Center, Konawe Selatan Regency	Sample: 42 pregnant women with CED	Quantitative	The incidence of CED in pregnant women in coastal areas is influenced by economic status. Chronic energy deficiency is one of the nutritional problems that currently occur in coastal areas where enabling factors include education, income, employment, health service facilities and local culture. Other causal factors such as the first pregnancy or more than 4 pregnancies can also allow CED to occur.
12	Purwanto et al., 2020 ³²	The Effect of Socioeconomic on Chronic Energy Deficiency among Pregnant Women in the Sudiang Raya Health Center, 2019	Population: pregnant women at Sudiang Raya Community Health Center Sample: 99 pregnant women	Quantitative, Cross-sectional study	Family income influences the occurrence of CED in pregnant women. Employment is one of the most influential factors in CED; Unemployed women are 11,734 times more likely to suffer from CED than employed women.
13	Saimin et al., 2019 ³³	Socio-Demographic and Nutritional Determinants of Birth Weight in Coastal Areas	Population: Mothers giving birth to full-term babies. Sample: 215 mothers giving birth to full-term	Quantitative, Cross-sectional study	The research results show that the incidence of CED in pregnant women in coastal areas is related to food consumption.

			babies at Mata, Nambo and Abeli Community Health Centers		The incidence of LBW is influenced by several factors, namely age, education level, and ANC which are sociodemographic factors. Other factors from a nutritional perspective that are related to the incidence of BBL are the consumption of iron tablets and LILA size.
14	Fitriani et al., 2019 ³⁴	The Effect of Health Education About Balanced Nutrition on the Level of Pregnant Women Knowledge Who Suffers Chronic Energy Lacks	Population: 72 people Sample: 42 pregnant women	Quasi-experimental	The research results show that food consumption and economic conditions are related to the incidence of CED in pregnant women.
15	Mukkadas et al., 2021 ⁹	Analysis of the Characteristics of Chronic Energy Deficiency in Pregnant Women during the Covid-19 Pandemic	Population: pregnant women in the Anggaberri Community Health Center working area. Sample: 115 pregnant women	Quantitative, Cross-sectional study	The incidence of CED in pregnant women during COVID-19 is related to food consumption, where the immunity of pregnant women has the potential to be lower than usual.
16	Wiyono et al., 2020 ³⁵	Study causes of chronic energy deficiency of pregnant in the rural areas	Population: pregnant women in Kemrajen Village, Banyumas, Central Java Sample: 130 pregnant women	Quantitative, Cross-sectional study	Food consumption and economic conditions influence the incidence of SEZ.
17	Nur et al., 2020 ³⁶	The effect of moringa leaf extraction increasing hemoglobin and bodyweight in post-disaster pregnant women	Sample: 40 pregnant women	Quasi-experimental	The research results show that good nutritional intake can increase HB, MUAC and <i>body weight</i> in pregnant women, to prevent the occurrence of CED.
18	Afrinis et al., 2022 ³⁷	Energy Intake and Food Restriction as Determinant Factors of Chronic Energy Deficiency among Pregnant Women in Rural Area of Sungai Sembilan, Riau, Indonesia.	Population: all pregnant women in the Sungai Sembilan Community Health Center working area in June 2020 Sample: 13	Quantitative	Research shows that food consumption is related to the incidence of CED in pregnant women. Maternal age, food restrictions, history of infectious diseases, protein, and energy intake were found to be associated with CED. After adjusting for potential confounders, this study highlights energy intake and food restriction in pregnancy as important predictors of CED in pregnant women.

Eighteen articles were reviewed, focusing on the relationship between food consumption and Chronic Energy Deficiency (CED) in pregnant women. Thirteen articles concentrated solely on food consumption as a cause of CED, while others explored the interaction between food consumption, household income, and CED. One article specifically addressed the impact of family income on CED incidence. Among the studies, twelve reported a significant link between food intake and CED in coastal regions. However, Akbarini and Siswina's research presented contradictory findings, suggesting no association between food consumption and CED in coastal areas. Their study also highlighted an insignificant relationship between food consumption and gestational ketosis. Additionally, various factors such as parity, education, income, and employment were found to correlate significantly with CED occurrence in pregnant women⁷.

Analysis of the relationship between food consumption and the incidence of CED in pregnancy in coastal areas

In 13 articles discussing the relationship between food consumption and the incidence of Chronic Energy Deficiency (CED), the pivotal role of energy and protein consumption in the health of pregnant women is highlighted, as inadequate intake of both can lead to CED. Desiman et al. and Afrinis et al., in their respective studies, emphasized that energy and protein consumption were significantly associated with CED. It is crucial for the diet of pregnant women to be diverse and aligned with the recommended nutritional requirements, which can be met through the intake of macro and micronutrients. Pregnant women residing in coastal regions exhibit a tendency of lower energy and protein intake levels compared to the recommended nutritional adequacy rate^{8,37}. According to Desiman et al., pregnant women who consume less than 76 grams of protein per day, falling below the Nutritional Adequacy Rate (AKG) of 56 grams per day along with an additional 20 grams per day for second and third trimester pregnancies, are at risk of experiencing CED⁸. Chronic Energy Deficiency (CED), synonymous with malnutrition, arises from insufficient energy intake among pregnant women. Research findings by Afrinis et al. indicated a significant rise in the likelihood of CED among individuals consuming less than 80% of the Recommended Daily Allowance (RDA) for energy, particularly those restricting food intake during pregnancy³⁷. Izzati and Mutalazimah suggested that CED manifests in pregnant women when there is a prolonged inadequacy of energy intake (from carbohydrates and fats) to meet the body's demands. The root cause of CED lies in the imbalance between energy intake to fulfill requirements and energy expenditure. During the initial trimester of pregnancy, energy consumption among pregnant women increases by +180 kcal, while in the subsequent trimesters, it rises to +300 kcal³⁸. Soi (2013) stated that coastal areas, often synonymous with fishing communities, should ideally have higher protein intake levels compared to highland regions due to the abundant fish resources available³⁹. However, Asiku highlighted a discrepancy where malnutrition issues were prevalent in coastal areas, as evidenced by the Central Statistics Agency survey⁴⁰.

Other nutrients discussed regarding the causes of CED are vitamin D and iron. Research by Aji et al. (2019) stated that Minangkabau women often experience vitamin D deficiency in the early stages of pregnancy and this situation is associated with health problems during pregnancy, one of which is CED²⁶. Research by Helli yana et al. (2019) stated that there was a relationship between the incidence of CED and the prevalence of anemia in pregnant women at the Muara I Community Health Center, Lhokseumawe City²⁸. Furthermore, Saimin et al. (2019) asserted that administering iron supplements to pregnant women can effectively reduce the occurrence of low birth weight babies, a factor influenced by the presence of CED in pregnant women³³. Consuming Moringa leaf extract, characterized by its high iron content, emerges as the optimal approach for averting anemia and augmenting the body weight of expectant mothers (Nur et al., 2020)³⁶. Correspondingly, a study by Nadimin et al. (2019) indicates that administering Moringa leaf extract leads to an increase in the upper arm circumference of pregnant women³⁰. Vitamin D and iron from food sources, including fish, have an important role for pregnant women. In instances where pregnant women reside in coastal regions, where their spouses engage in fishing activities and sell the catch for a living, the adequate consumption of fish becomes a challenge. This is predominantly attributed to the proceeds from fish sales being allocated towards purchasing staple foods like rice, consequently resulting in a reduced frequency of protein intake²⁶. This phenomenon can be ascribed to the insufficient awareness within coastal communities regarding the pivotal role of specific nutritional elements, as expressed by Bitjoli, et al., (2012) indicating a notable deficiency in coastal communities' knowledge concerning the diversity, preparation, and advantages of nutritious foods, particularly those rich in iodine, causing coastal communities to potentially experience malnutrition.⁴¹ Meanwhile, the low compliance of pregnant women with taking blood supplement tablets causes a lack of iron intake in pregnant women in coastal areas. Pregnant women in coastal areas are less likely to consume iron supplements. It is a myth in coastal communities that swallowing iron pills can increase blood pressure and can have an impact on pregnancy. In addition, undesirable drug effects, such as nausea and loose stools³³.

Four articles delved into socio-cultural factors influencing food consumption. Astuti et al. (2022) discussed how body image and nutritional knowledge impact CED rates²⁷. Edowai et al. (2018) highlighted the influence of dietary practices on nutritional intake in community health centers¹⁰. Mansyarif (2022) emphasized the prevalence of CED in coastal areas due to factors like education, income, and local culture³¹. Afrianis et al. (2022) explored food taboos in pregnant women and their connection to CED³⁷, while Aisyah et al. (2020) identified significant changes in eating habits post-counseling for pregnant women²⁵. Continuous counseling by midwives is crucial to ensure pregnant women with CED meet their nutritional requirements. Moreover, educating women on healthy eating habits and preventing CED is vital for maternal health²⁵.

In coastal regions, traditional beliefs and food restrictions during pregnancy persist, contributing to CED

prevalence. Oloko et al. (2022) noted that food taboos, especially among pregnant fisherwomen, aim to safeguard infants from potential harm⁴². Chakona and Shackleton (2019) highlighted prohibitions on iron-rich foods, carbohydrates, and animal proteins for pregnant women, underscoring the impact of cultural practices on maternal nutrition⁴³.

Analysis of the Relationship between Family Income and the Occurrence of KEK in Pregnancy in Coastal Areas

Analysis of 18 articles revealed that three of them examined variables related to household income. In these three journals, an important correlation was found between household income in coastal areas and the occurrence of SEZ during pregnancy. Income refers to the reward or compensation that individuals receive for their work, which can take the form of monetary payments or agricultural produce. Socioeconomic factors have a significant impact on health and education. Socioeconomic position has the potential to influence food consumption patterns. Income is the main determining factor that influences the quality and quantity of food. The correlation between a person's financial resources and their ability to access higher-quality food is clear. In particular, individuals with higher incomes can allocate a larger portion of their income to purchasing nutritious foods such as fruits, vegetables, and other food choices¹⁰.

In Minahasa Regency, located in North Sulawesi Province, a majority of the population are engaged in agriculture or work as farm laborers, while some individuals operate small roadside stalls near their residences, with fishing being a secondary source of income, despite inhabiting coastal areas. The average income hovers around IDR 2,150,000 monthly, with monthly expenses amounting to IDR 2,655,000, to satisfy the 11 essential needs. This financial analysis underscores the precarious financial situation of coastal inhabitants, as income instability poses repercussions on consumption patterns⁴⁴.

Sulistyaningsih, (2011) explains the importance of consuming a variety of foods every day, including staple foods, animal and vegetable complementary foods, as well as vegetables and fruit, to form a comprehensive and nutritious diet. Apart from that, eating frequency also plays an important role in meeting nutritional needs. A balanced diet often includes breakfast, lunch, dinner and snacks⁴⁵.

Household purchasing power can be negatively impacted by low household income, limiting their ability to access a variety of healthy food options. Low-income households often face constraints in choosing food options, resulting in a reliance on foods with lower quality and nutritional value. The potential consequences of this phenomenon can harm the overall nutritional status and well-being of pregnant women. Higher income levels tend to improve the quality of food consumed, while lower income levels are associated with lower-quality food consumption¹⁴.

CONCLUSIONS

Based on the systematic review conducted, 18 journals indicated that food consumption and family

income levels are significantly associated with the incidence of Chronic Energy Deficiency (CED) among pregnant women in coastal areas. Food consumption in these regions is also influenced by cultural factors and the mothers' level of knowledge. The relatively low income levels in coastal areas affect the limited access to and quality of food, which in turn contributes to the incidence of CED in pregnant women. Therefore, ensuring adequate food consumption, particularly of protein and energy, is crucial for pregnant women, and can be obtained from fish caught by the fishermen's families. The low family income in coastal areas can be supplemented by encouraging fishermen to engage in side businesses, such as selling processed fish products.

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CONFLICT OF INTEREST AND FUNDING DISCLOSURE

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AUTHOR CONTRIBUTIONS

The author's contribution to the preparation of this article is: AIJ: formal analysis, resources, writing-review and editing; FUN: conceptualization, investigation, methodology, supervision, writing-review and editing; RBA: supervision, writing-review and editing.

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