

ECOLOGICAL STUDY: PREVALENCE OF CHRONIC ENERGY DEFICIENCY AMONG PREGNANT WOMEN IN NUSA TENGGARA PROVINCES, INDONESIA

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ABSTRACT

Background: Pregnant women who experience Chronic Energy Deficiency (CED) will be at risk of decreased muscle strength, which will impact the process of childbirth, resulting in the occurrence of various complications such as low birth weight babies, miscarriage, birth defects, premature births, and even infant death. The problem of CED among pregnant women requires an intervention not only concerning the nutritional aspects but also touching on the socio-economic aspects. **Purpose:** This study aimed to overview chronic energy deficiency among pregnant women in Nusa Tenggara in 2018 and the factors that influence it. **Methods:** The approach used in this study was ecological analysis. All districts and cities in West Nusa Tenggara and East Nusa Tenggara were included in this study. This study looked at the prevalence of CED among pregnant women and 4 other independent variables, namely the percentage of supplementary feeding, the percentage of added blood tablets, as well as the respondent's poverty rate, and literacy rate. The data was analyzed using cross-tabulation. **Results:** The results show that supplementary feeding and the literacy rate do not affect the incidence of CED. However, other variables such as the provision of blood booster supplements and the poverty rate do affect the incidence of CED. **Conclusion:** Health care facilities need to improve their services and counseling regarding the importance of nutrition during pregnancy, and the need for government support to improve the socio-economic status of the community to reduce the prevalence of CED in Nusa Tenggara.

Keywords: chronic energy deficiency, supplementary feeding, blood booster tablets

INTRODUCTION

One of the determining factors of the health of pregnant women is their nutritional status. The nutritional status of pregnant women can be used to see whether a mother is able to go through her pregnancy well without experiencing any disturbances. The nutritional status of the mother before and during pregnancy can affect the growth and development of the fetus. The development and growth of the fetus in the womb is determined by the nutritional intake of the mother, both during pregnancy and after delivery (Hamzah, 2017).

A pregnant woman who has poor nutritional status can develop health problems, including chronic energy deficiency (CED). In Indonesia, one of the indicators commonly used to find out whether pregnant women are at risk of chronic energy deficiency (CED) or not is the size of the upper arm circumference or LiLA, where the size of LiLA <23.5cm is the limit for the size of pregnant women identified as having a risk of CED. One focus of the attention on health issues in Indonesia is pregnant women who experience chronic energy deficiency. Based on the results of the 2018 Riskesdas, the prevalence of CED among pregnant women in the Nusa Tenggara region is 29.85%. Nationally, the prevalence of CED in pregnant women in Indonesia is 17.3%, and this figure is 2.4% lower than the 2018 target set in the 2015-2019 Public Health Program Action Plan of 19.7% (Health Research and Development Agency, 2019).

According to Febriyeni (2017), the inadequate consumption of a balanced nutritional diet, including fresh vegetables and meat or fish, can disrupt the fulfillment of essential nutritional needs during pregnancy, leading to CED. The prevention of CED among pregnant women related to the fulfillment of nutrition can be done by consuming a varied diet that contains enough calories and protein. One of the strategies used to improve the nutritional status of pregnant women is by providing supplementary food (PMT). Based on research by Pastuty *et al.*, (2018) providing supplementary food for recovery (PMT-P) in the form of biscuit bread had an effect on increasing the size of LiLA among pregnant women suffering from chronic energy deficiency in Palembang City. Apart from

nutritional intake factors, according to Pomalingo *et al.* (2018), the choice of food and diet among pregnant women is influenced by knowledge and attitudes about the importance of fulfilling nutritional intake during pregnancy. However, constraints in the fulfillment of these nutrients often occur due to a lack of purchasing power and the economic level of the family. This shows that there is a relationship between education and economic level on the incidence of pregnant women experiencing CED. In another study conducted by Larasati (2018), the results show that pregnant women with anemia experienced chronic energy deficiency (CED).

According to Ernawati (2018), pregnant women must have a normal nutritional status. If the nutritional status of pregnant women is that of being undernourished, this will have a negative impact on the health of the fetus. Pregnant women with the condition of chronic energy deficiency will be at risk of decreased muscle strength, which is needed during the birth process, resulting in various complications such as low birth weight babies (LBW), miscarriage, birth defects, premature babies, and even infant death.

The uniqueness of this research is that it calculates the prevalence of CED in pregnant women using ecological studies as a reference. CED in pregnant women is a complex public health problem and requires holistic efforts to solve it. Additionally, this article uses an ecological analysis approach, focused on group-level comparisons rather than individual-level data. This approach was used to assess the impact of nutritional and socio-economic factors on the prevalence of CED at the district/city level in the Nusa Tenggara region. The novelty of this article is the analysis of the prevalence of chronic energy deficiency in pregnant women not only concerning nutritional aspects such as providing additional food and iron tablets but also taking into account socio-economic aspects such as the poverty and literacy rates. Based on the conditions described in the background above, this study aims to determine the various factors, both nutritional and socio-economic, that influence the prevalence of chronic energy deficiency (CED) among pregnant women in the Nusa Tenggara region in 2018.

METHOD

Research Design

The ecological analysis approach was used in this study. Ecological studies focus on comparisons between groups, not individuals. The data analyzed was aggregate data at a certain group or level, which in this study was at the district/city level. Variables in ecological analysis can be aggregate measurements, environmental measurements, or global measurements (Laksono & Kusri, 2019; Morgenstern, 1995).

The ecological analysis approach used in this study aimed to determine the effect of nutritional and socioeconomic factors on the prevalence of chronic energy deficiency at the level of a fairly broad unit of analysis, which in this case was at the district/city level in West Nusa Tenggara and East Nusa Tenggara region, by utilizing secondary data that has been published by trusted institutions.

Data Source

The research in this article used published secondary data from the NTB Province Basic Health Research (RISKESDAS) report in 2018, the NTB Province Poverty Data and Information for 2014-2018, the NTB Province Education Statistics 2018, the NTT Province RISKESDAS Results 2018, the Summary Poverty Data and Information for the Province of NTT in 2018, and the Education Statistics for the Province of NTT for 2018. This study used the regency and city levels (equivalent regency level) in the province of West Nusa Tenggara and East Nusa Tenggara as the unit of analysis consisting of 29 regencies and 3 cities. West Nusa Tenggara and East Nusa Tenggara provinces are the two provinces that have the highest prevalence of CED in Indonesia based on Riskeudas 2018, where the West Nusa Tenggara province occupies the eighth position and East Nusa Tenggara province occupies first position.

Table 1. Data Sources for the Ecological Analysis of the Prevalence of Chronic Energy Deficiency in Nusa Tenggara in 2018

Source	Variable
RISKESDAS 2018	Chronic Energy Deficiency Provision of supplementary foods to pregnant women Giving blood booster supplement tablets to pregnant women
Poverty data and information from Statistics Indonesia	Poverty rate
Education statistics from the Statistics of Indonesia	Literacy rate

Data Analysis

The dependent variable in this study was the prevalence of chronic energy deficiency among pregnant women, namely the proportion of pregnant women experiencing chronic energy deficiency characterized by an upper arm circumference (LiLA) of less than 23.5 cm. In addition to the prevalence of chronic energy deficiency as the dependent variable, there were 4 independent variables analyzed in this study, namely 1) the percentage of supplementary feeding, namely the proportion of pregnant women who received supplementary food (SF) with the type of additional food in the form of program biscuits, non-program biscuits, powdered milk, liquid milk, raw food ingredients, and cooked food ingredients; 2) the percentage of iron tablets given, namely the proportion of pregnant women who received iron tablets during pregnancy; 3) the poverty rate percentage, namely the proportion of the population that has an average expenditure per

capita per month below the poverty line; and 4) the literacy rate percentage, namely the proportion of the population aged 15 years and over able to read and write.

The data was processed starting from selecting the variables to be studied, through to the process of cleaning and recoding the variables into categorical data. The data for each variable was then analyzed using univariate and bivariate methods using cross-tabulation tests. Univariate analysis using descriptive analysis for each variable was conducted in order to obtain an overview of the distribution of frequencies and proportions for each variable studied. Bivariate analysis was carried out using cross-tabulation to determine whether there was any association between each independent variable and the dependent variable. All analysis processes were carried out using the SPSS 21 software.

Ethical Clearance

The research in this article used secondary data from published studies or reports. The data is issued periodically by official institutions and is not confidential data, meaning that it can be used responsibly by the public. Based on this reasoning, ethical clearance was not required for the conducting of this research.

RESULTS

Table 2 shows the results of the descriptive analysis of the variable 'prevalence of pregnant women experiencing CED' as the dependent variable and the 4 independent

variables. The highest prevalence of CED occurred in Malacca District with a value of 56.71%, while the lowest was in Nagekeo District with a percentage of 0.30%. The highest percentage of supplementary feeding (PMT) was in Central Sumba Regency at 57.10% and the lowest was in Mataram City with a value of 4.19%. The largest percentage of iron supplementation tablets (TTD) occurred in Nagekeo District, and the lowest was in Bima District. The most severe poverty rate, namely 34.85%, occurred in Central Sumba Regency and the lowest literacy rate occurred in Southwest Sumba Regency with a value of 79.24%.

Table 2. Distribution of the Prevalence of CED, PMT, the Granting of Iron Tablets, Poverty Rate, and Literacy Rate by Regency/City

Regency/City	Variable (%)				
	Prevalence CED	PMT	TTD	Poverty Rate	Literacy Rate
West Lombok	25,92	20,97	43,20	15,20	83,72
Central Lombok	19,00	6,94	33,67	13,87	81,42
East Lombok	20,17	24,56	31,81	16,55	86,69
Sumbawa	33,90	36,80	40,77	14,08	93,96
Dompu	25,95	19,06	39,68	12,40	92,14
Bima	16,15	26,36	25,32	14,84	88,40
West Sumbawa	8,47	18,63	34,19	14,17	95,03
North Lombok	29,19	22,28	31,67	28,83	83,91
Mataram city	14,76	4,19	61,60	8,96	94,04
Bima city	40,29	14,18	35,85	8,76	92,83
West Sumba	20,98	12,21	45,27	28,51	80,79
East Sumba	39,69	20,91	48,72	30,13	89,52
Kupang	22,70	29,16	46,70	23,10	90,40
South Central Timor	42,16	14,35	51,14	28,06	86,97
North Central Timor	55,61	13,40	71,17	22,31	92,75
Belu	34,17	27,93	72,21	15,70	86,89
Alor	41,15	21,25	44,76	21,63	96,61
Lembata	31,63	46,88	61,54	26,45	96,12
East Flores	30,70	33,19	65,14	11,05	95,78
Sikka	21,46	44,86	50,90	13,82	92,72
Ende	15,22	37,69	61,26	24,20	95,45
Ngada	6,65	17,44	46,55	12,94	98,66
Manggarai	38,45	20,59	36,33	20,83	95,18
Rote Ndao	32,73	15,62	30,79	28,08	90,60
West Manggarai	33,30	7,45	55,43	18,14	96,37

Continuation of Table 2. Distribution of the Prevalence of CED, PMT, the Granting of Iron Tablets, Poverty Rate, and Literacy Rate by Regency/City

Regency/City	Variable (%)				
	Prevalence CED	PMT	TTD	Poverty Rate	Literacy Rate
Central Sumba	27,74	57,10	39,76	34,85	86,02
Southwest Sumba	49,75	12,61	27,09	28,88	79,24
Nagekeo	0,30	15,54	80,24	12,98	95,04
East Manggarai	37,72	25,88	54,20	26,50	94,56
Sabu Raijua	42,19	14,67	54,14	30,83	89,99
Malaka	56,71	34,93	35,56	16,34	85,88
Kupang city	40,24	17,22	50,55	9,61	98,06

Source: Agency of Health Research and Development, 2018, 2019; Statistics Indonesia, 2018, 2019a, 2019b, 2019c

Table 3 shows the results of the cross-tabulation between the prevalence of CED and the percentage of PMT in pregnant women in Nusa Tenggara in 2018. The table shows that the prevalence of low category CED ($\leq 19.10\%$) is dominated by the low category PMT percentage ($\leq 21.82\%$). Meanwhile, the prevalence of CED in the high category

($\geq 37.91\%$) was dominated by a percentage of PMT in the low category ($\leq 21.82\%$) as well. This means that regarding the administration of PMT among pregnant women who experience SEZ, there is no clear or consistent relationship between the percentage of PMT and the prevalence of CED among pregnant women.

Table 3. Cross-tabulation of PMT percentage with CED prevalence among pregnant women in Nusa Tenggara in 2018

Provision of Supplementary Food (PMT) to Pregnant Women	Prevalence of Chronic Energy Deficiency (CED) Among Pregnant Women					
	Low ($\leq 19,10\%$)		Medium (19,11%-37,90%)		High ($\geq 37,91\%$)	
	n	%	n	%	n	%
Low ($\leq 21,82\%$)	5	71,4%	5	33,3%	9	90,0%
Medium (21,83%-39,45%)	2	28,6%	7	46,7%	1	10,0%
High ($\geq 39,46\%$)	0	0,0%	3	20,0%	0	0,0%
Total	7	100,0%	15	100,0%	10	100,0%

Source: Agency of Health Research and Development, 2018, 2019

Table 4 shows the results of the cross-tabulation between the prevalence of CED and the percentage of iron tablets given to pregnant women in Nusa Tenggara in 2018. Based on Table 4, it can be seen that the prevalence of CED in the low category ($\leq 19.10\%$) is dominated by the percentage of low ($\leq 43.62\%$) and medium TTD administration (43.63%-

61.92%). The prevalence of CED in the high category ($\geq 37.91\%$) was dominated by the percentage of giving iron tablets in the medium category (43.63%-61.92%). This means that the prevalence of high CED among pregnant women occurs mostly among pregnant women who have received blood supplement tablets at a low percentage.

Table 4. Cross-tabulation of the Percentage of Iron Tablets Given with the Prevalence of Chronic Energy Deficiency (CED) to Pregnant Women in Nusa Tenggara in 2018

Giving Blood Supplement Tablets (TTD) to Pregnant Women	Prevalence of Chronic Energy Deficiency (CED) Among Pregnant Women					
	Low ($\leq 19,10\%$)		Medium (19,11%-37,90%)		High ($\geq 37,91\%$)	
	n	%	n	%	n	%
Low ($\leq 43,62\%$)	3	42,9%	7	46,7%	4	40,0%
Medium (43,63%-61,92%)	3	42,9%	6	40,0%	5	50,0%
High ($\geq 61,93\%$)	1	14,3%	2	13,3%	1	10,0%
Total	7	100,0%	15	100,0%	10	100,0%

Source: Agency of Health Research and Development, 2018, 2019

Table 5 shows the results of the cross-tabulation between the prevalence of CED and the poverty rate in Nusa Tenggara in 2018. From the table, it can be seen that the prevalence of CED in the low category ($\leq 19.10\%$) was dominated by the poverty rate

in the low category ($\leq 17.45\%$). Meanwhile, the prevalence of CED in the high category ($\geq 37.91\%$) was dominated by the poverty rate in the high category ($\geq 26.15\%$). This means that the higher the poverty level, the higher the prevalence of CED among pregnant women.

Table 5. Cross-tabulation of Poverty Rate and the Prevalence of CED Among Pregnant Women in Nusa Tenggara in 2018

Poverty rate	Prevalence of Chronic Energy Deficiency (CED) Among Pregnant Women					
	Low ($\leq 19,10\%$)		Medium (19,11%-37,90%)		High ($\geq 37,91\%$)	
	n	%	n	%	n	%
Low ($\leq 17,45\%$)	6	85,7%	7	46,7%	3	30,0%
Medium (17,46%-26,14%)	1	14,3%	2	13,3%	3	30,0%
High ($\geq 26,15\%$)	0	0,0%	6	40,0%	4	40,0%
Total	7	100,0%	15	100,0%	10	100,0%

Source: Agency of Health Research and Development, 2018, 2019; Statistics Indonesia, 2019a, 2019b

Table 6 shows the cross-tabulation results between the prevalence of CED and the literacy rate in Nusa Tenggara in 2018. Based on Table 6, it can be seen that the prevalence of CED in the low category ($\leq 19.10\%$) was dominated by a literacy rate in the high category

($\geq 92.19\%$). Meanwhile, the prevalence of CED in the high category ($\geq 92.19\%$) was dominated by a high category of literacy rate ($\geq 92.19\%$) as well. This means that literacy rate did not have an impact on the prevalence of Chronic Energy Deficiency in pregnant women.

Table 6. Cross-tabulation of Literacy Rate with CED Prevalence Among Pregnant Women in Nusa Tenggara in 2018

Literacy Rate	Prevalence of Chronic Energy Deficiency (CED) Among Pregnant Women					
	Low ($\leq 19,10\%$)		Medium (19,11%-37,90%)		High ($\geq 92,19\%$)	
	n	%	n	%	n	%
Low ($\leq 85,71\%$)	1	14,3%	3	20,0%	1	10,0%
Medium (85,72%-92,18%)	1	14,3%	6	40,0%	4	40,0%
High ($\geq 92,19\%$)	5	71,4%	6	40,0%	5	50,0%
Total	7	100,0%	15	100,0%	10	100,0%

Source: Agency of Health Research and Development, 2018, 2019; Statistics Indonesia, 2018, 2019c

DISCUSSION

The results of the Riskesdas for the Nusa Tenggara in 2018 showed that the highest prevalence of CED among pregnant women occurred in Malacca District at 56.71%, and that the lowest prevalence occurred in Nagekeo District at 0.30%. Based on the descriptive table, it can be seen that the literacy rate has the highest average score when compared to the other variables at 90.80%. This was followed by the administration of blood supplement tablets (TTD) at 47.10%, supplementary feeding (PMT) at 22.96%, and finally, the poverty rate with an average value of 19.77%. Efforts to overcome CED among pregnant women can be conducted through various interventions, including providing additional food and blood

supplement tablets, alleviating poverty, and increasing the literacy rate in Nusa Tenggara.

The health status of pregnant women can be determined through anthropometric measurements, especially the size of the upper arm circumference, commonly known as LiLa. Pregnant women with a LiLa size of less than 23.5 cm is an indication of chronic energy deficiency or CED. The purpose of giving PMT is to improve pregnant women's nutritional status and health to avoid the risk of various diseases during pregnancy. The cross-tabulation results in this study showed there to be no effect due to supplementary feeding on the incidence of CED among pregnant women. These results differ from the previous study by Hernawati and Kartika (2019), which explained there to be an increase in the LiLa

measurements of pregnant women who were given PMT. This is supported by the research by Putri *et al.*, (2019), where there was an increase in body weight and LiLA after being given PMT biscuits for 90 days among a population of pregnant women who experienced chronic energy deficiency. In addition, Bakri's (2021) research also showed that there was a relationship between giving PMT and the condition of pregnant women who experience CED.

The incidence of anemia is a significant health problem, especially for mothers who are undergoing pregnancy. Pregnant women who experience anemia will be at a higher risk of various health problems during pregnancy. The results showed there to be an effect due to iron supplementation on the prevalence of CED in pregnant women. This is in line with the research conducted by Lestari (2019), where the more obedient pregnant women were in consuming blood-supplement tablets, the more they reduced the risk of the pregnant women experiencing CED. Other studies have also stated there was a relationship between anemia and the occurrence of CED in pregnant women (Larasati, 2018). Recent research by Mahmudian *et al.* (2021), explained that the incidence of CED and anemia among pregnant women have a sufficiently close relationship.

Economic status is one aspect that affects a person's nutritional status. Family income can affect the ability of pregnant women to fulfil their nutrition during pregnancy. Research shows that the higher the poverty level, the higher the prevalence of CED in pregnant women. According to Sukmawati *et al.* (2018), most women whose income is below the UMR suffer from CED, while pregnant women who have an income above the minimum wage do not suffer from CED. This is reinforced by Andini's (2020) research, which explained that income and SEZ events have a relationship. The higher the family's income, the more able the family is to meet the necessary nutritional intake to prevent CED. This is supported by Yunita and Ariyati's (2021) research which stated that the smaller the family income, the higher the risk of CED for pregnant women. Family income affects the pregnant women's ability to buy highly nutritious food to support the pregnancy process and prevent chronic energy deficiency (CED).

According to Statistic Indonesia (2022), finding out the number of people who can read and write both Latin and other letters, as one indicator of education in Indonesia, requires the use of the literacy rate. The ability to expand access to information must have basic skills, namely reading and writing, including accessing information about health problems during pregnancy, namely chronic energy deficiency (CED). However, this study showed there was no effect due to literacy rate on the prevalence of CED in Nusa Tenggara in 2018. These results are different from the research by Fitrianingtyas *et al.* (2018), which showed that personal knowledge, especially among pregnant women, has a significant relationship with the incidence of chronic energy deficiency they experienced. These results are also supported by Sari and Deltu's (2021) research that there is a significant relationship between knowledge and the incidence of CED. Husna *et al.*, (2020) also stated that pregnant women with a low education have a 13.2 times greater chance than those with higher education of experiencing CED.

The advantage of this study was that it used nationally representative prevalence data that was regularly collected and published by Statistics Indonesia and the Indonesian Minister of Health, making it easy to access and use in research. At the same time, the limitations of this study were that the risk factors and status of health problems or diseases at the individual level could not be known. As a result, the causal relationships between the risk factors and disease at the individual level could not be known either.

CONCLUSION

The problem of Chronic Energy Deficiency among pregnant women is multi-dimensional, and not only related to aspects of nutritional status but also to socio-economic aspects as well. Health service facilities and health workers need to improve their services and provide counselling about the importance of fulfilling nutrition during pregnancy. There is a need for a program from the government to improve the community's socioeconomic status to overcome the problem of Chronic Energy Deficiency in pregnant women in Nusa Tenggara.

SUGGESTION

The problem of Chronic Energy Deficiency among pregnant women is multi-dimensional, and not only related to aspects of nutritional status but also the socio-economic aspects as well. Therefore, there is a need for cooperation from all interested parties. Health care facilities and health workers need to improve their services and provide counseling on the importance of nutrition during pregnancy and the need for government programs to improve the socio-economic status of the community in overcoming the problem of Chronic Energy Deficiency in pregnant women in the Nusa Tenggara region. In addition, the community also needs to support the various solutions offered by the government and health care facilities by participating in every existing program.

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CONFLICT OF INTEREST

The author has no conflicts of interest.

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AUTHOR CONTRIBUTION

Muhammad Aji Sukmo Selamet was responsible for the data collection, analysis, manuscript writing, literature review, and references. Hario Megatsari was in charge of the study design, data supervision, and manuscript supervision. Farizah Mohd Hairi was in charge of reviewing the article.

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