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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 be used in the process of childbirth resulting in the occurrence of various complications such as low birth weight babies, miscarriage, birth defects, premature, and even infant death. The problem of CED among pregnant women requires intervention not only in nutritional aspects but also in socio-economic aspects. **Purpose:** This study aimed to determine the overview of the 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 methods. 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, poverty rate, and literacy rate. The data were analyzed using cross-tabulation. **Results:** The results show that supplementary feeding and literacy rates do not affect the incidence of CED. However, other variables such as the provision of blood booster supplements and poverty rate affect the incidence of CED. **Conclusion:** Health care facilities need to improve services and counseling regarding the importance of nutrition during pregnancy and the need for government support in improving 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

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INTRODUCTION

One of the determining factors for the health status 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 she contains. The development and growth of the fetus in the womb is determined by the nutritional intake by the mother, both during pregnancy and after delivery (Hamzah, 2017).

A pregnant woman who has poor nutritional status can develop health problems, namely 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 to use 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 the risk of CED. One focus of 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%. Meanwhile nationally, the prevalence of CED in pregnant women in Indonesia is 17.3% where this figure is 2.4% lower than the 2018 target set in the 2015-2019 Public Health Program Action Plan, which is 19.7%. (Health Research and Development Agency, 2019)

According to Febriyeni (2017), 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. Prevention of CED among pregnant women related to the fulfillment of nutrition is to consume a varied diet and contain enough calories and protein.One of the strategies to improve the nutritional status of pregnant women is by providing supplementary food (PMT). Based on research by Pastuty *et al.*, (2018) showed that 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, the constraints in the fulfillment of these nutrients often occur due to lack of purchasing power or economic level of the family. So 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 showed that pregnant women with anemia experienced chronic energy deficiency (CED).

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

The uniqueness of this research is that it calculates the prevalence of CED in pregnant women with a research design using ecological studies. 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, which focuses 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 on nutritional aspects such as providing additional food and iron tablets but also on socio-economic aspects such as poverty and literacy rates. Based on the conditions described in the background above, this study aims to determine various factors, both nutritional and socio-economic factors, that influence the prevalence of chronic energy deficiency (CED) among pregnant women in the Nusa Tenggara region in 2018.

METHOD

Research Design

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

Ecological analysis approach used in this study aims 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, in this case 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 the following secondary data that has been published, such as: the NTB Province Basic Health Research (RISKESDAS) report in 2018, NTB Province Poverty Data and Information for 2014-2018, NTB Province Education Statistics 2018, NTT Province RISKESDAS Results 2018, Summary Poverty Data and Information for the Province of NTT in 2018, and Education Statistics for the Province of NTT for 2018. This study used the regency and city level (equivalent regency level) in the province of West Nusa Tenggara and East Nusa Tenggara as a unit of analysis consisting of 29 regencies and 3 cities. West Nusa Tenggara and East Nusa Tenggara provinces are the 2 provinces that have the highest prevalence of CED in Indonesia based on Riskesdas 2018, where West Nusa Tenggara province occupies the eighth position while East Nusa Tenggara province occupies the first position.

Table 1. Data Source 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 the Statistics Indonesia	Number of Poverty
Education Statistics from the Statiatics 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 percentage of the poverty rate, namely the proportion of the population that has an average expenditure per capita per month below the poverty line; and 4) percentage of literacy rate, namely the proportion of population aged 15 years and over who are able to read and write.

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

variable. All analysis processes were carried out using SPSS 21 software.

Research in this article used secondary data from published studies or reports. Data is issued periodically by official institutions and is not confidential data so that it can be used responsibly by the public. Based on these reasons, ethical clearance was not required in conducting this research.

RESULT

Table 2 showed the results of the descriptive analysis of the variable Prevalence of pregnant women experiencing CED as the dependent variable and 4 other independent variables. The highest prevalence of SEZ occurred in Malacca District with a value of 56.71%, and the lowest 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. Then, the largest 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 Prevalence of CED, PMT, 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 Prevalence of CED, PMT, 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 showed 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 showed that the prevalence of low category CED (≤19.10%) is dominated by the low category PMT percentage (≤21.82%) . Meanwhile, the prevalence of CED in the high category (≥37.91%) was dominated by the percentage of PMT in the low category (≤21.82%) as well.This means that 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 SEZ 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 (≤19,10%)		Medium (19,11%-37,90%)		High (≥37,91%)	
	n	%	n	%	n	%
Low (≤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 (≥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 showed 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 (≤19.10%) is dominated by the percentage of low-level TTD administration (≤43.62%) and Medium (43.63%-61.92%). While the prevalence of CED in the high category (≥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 received blood supplement tablets with 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 (≤19,10%)		Medium (19,11%-37,90%)		High (≥37,91%)	
	n	%	n	%	n	%
Low (≤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 (≥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 showed 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 (≤19.10%) was dominated by the poverty rate in the low category (≤17.45%). Meanwhile, the prevalence of CED in the high category (≥37.91%) was dominated by the poverty rate in the high category (≥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 Prevalence of CED Among Pregnant Women in Nusa Tenggara in 2018

Poverty rate	Prevalence of Chronic Energy Deficiency (CED) Among Pregnant Women					
	Low (≤19,10%)		Medium (19,11%-37,90%)		High (≥37,91%)	
	n	%	n	%	n	%
Low (≤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 (≥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 showed 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 (≤19.10%) was dominated by the literacy rate in the high category (≥92.19%). Meanwhile, the prevalence of CED in the high category (≥92.19%) was dominated by the high category of literacy rates (≥92.19%) as well. This means that literacy rates did not affect 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 (≤19,10%)		Medium (19,11%-37,90%)		High (≥92,19%)	
	n	%	n	%	n	%
Low (≤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 (≥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 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 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 other variables, namely 90.80%. It 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 literacy rates 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 will indicate 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 no effect of supplementary feeding on the incidence of CED among pregnant women. These results differ from previous studies by Hernawati & Kartika (2019), which explained an increase in LiLA measurements of pregnant women who were given PMT. This is

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

The incidence of anaemia is a significant health problem, especially for mothers who are undergoing pregnancy. Pregnant women who experience anaemia will be at higher risk of various health problems during pregnancy. The results showed an effect of iron supplementation on the prevalence of CED in pregnant women. This is in line with research conducted by Lestari (2019), that the more obedient pregnant women were in consuming blood-supplement tablets will reduce the risk of pregnant women experiencing CED. Other studies also stated there was a relationship between anaemia and the occurrence of CED in pregnant women (Larasati, 2018). Recent research by Mahmudian *et al*., (2021), explained that the incidence of CED and anaemia 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 nutrition during pregnancy. Research showed 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 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 was to meet adequate nutritional intake to prevent CED. It was supported by Yunita & Ariyati's (2021) research which stated that the smaller the family income, the higher the risk of CED for pregnant women. Family income affects 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), to find out the number of people who can read and write both Latin and other letters, as well as one indicator of education in Indonesia is to use the literacy rate. 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 between literacy rates and the prevalence of CED in Nusa Tenggara in 2018. These results were different from the research by Fitrianingtyas *et al*., (2018), that personal knowledge, especially among pregnant women has a significant relationship with the incidence of chronic energy deficiency they experienced. These results were also supported by Sari & Deltu's (2021) research that there was a significant relationship between knowledge and the incidence of CED. The research also reinforced this Husna *et al.,* (2020) stated that pregnant women with low education have a 13.2 times greater chance than those with higher education to experience CED.

The advantage of this study was that it used prevalence data that was regularly collected and published by Statistics Indonesia and the Indonesian Minister of Health so that it was 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 cannot be known. As a result, the causal relationship between risk factors and disease at the individual level cannot be known either.

CONCLUSION

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

SUGGESTION

The problem of Chronic Energy Deficiency among pregnant women is multi-dimensional, not only related to aspects of nutritional status but also socio-economic aspects. Therefore, there is a need for cooperation from all interested parties. Health care facilities and health workers need to improve 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 conflict of interest.

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Faculty of Public Health, Universitas Airlangga, Surabaya.

AUTHOR CONTRIBUTION

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

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