Interaction of protein intake and number of family members as a risk factor for chronic energy deficiency in women of childbearing age

DEMSA SUMBOLON[1], LIA LORENA[1], OKDI NATHAN[1]
[1] Department of Nutrition, Poltekkes Kemenkes Bengkulu

Summary

Background. *Chronic Energy Deficiency (CED) is a condition in which the body is underweight or thin and the body has insufficient reserves of energy intake, this condition occurs due to a lack of nutrients. A person's condition can be said to be CED if the Mid-Upper Arm Circumference (MUAC) is low or < 23,5 cm. Women of Reproductive Age (WRA) who experience CED will have an impact on pregnancy. Based on the 2017 World Health Organization (WHO) the percentage of CED in pregnancy globally is 35-75% and deaths in developing countries related to CED are 40%.*
Methods. *Research design Descriptive analytic cross-sectional approach. The population WRA with a population of 7,183 the sample being 143 WRA. The analysis is univariate, bivariate (Chi-square), and multivariate (Regression Logistic).*
Results. *Found that the determinants of CED were factors affecting*

CED for WRA in the Kandang Health Center in Bengkulu City in 2023 are age (p-value = 0.018; ORa95% CI=2,495: 1.171-5.317), energy intake (p-value = 0.013; ORa95% CI = 2.990: 1.256-7.117), and the interaction of protein intake by several family members (p-value = 0.03; ORa 95%CI = 21.327: 1.343-338.671). The dominant factor is the interaction between protein intake and the number of family members. WRA with large families when protein intake is not enough risk 21 times to experience chronic lack of energy compared to adequate protein intake.
Conclusions. *Health workers need to make promotive and preventive efforts that can be done through community empowerment through health education about nutritional intake and family planning, so WRA understands about prevention of Chronic Energy Deficiency.*

Introduction

Chronic Energy Deficiency (CED) occurs due to a long-term lack of nutrients which causes underweight or thinness [1]. Women of Childbearing Age (WRA) are said to be CED if the Upper Arm Circumference (MUAC) is < 23.5 cm. CED in WRA will have an impact during pregnancy, risking a decrease in muscle strength during delivery [34]. Pregnant women with CED are at risk of giving birth to Low Birth Weight (LBW) and have a risk of death for both mother and child [5].
World Health Organization (WHO) data for 2017 the percentage of CED in pregnancy globally is 35-75% and deaths in developing countries related to CED are 40%. National Health Research Data for 2018, the percentage of CED in WRA who are not pregnant nationally reaches 14,5% [6]. The prevalence of CED in Bengkulu province is 11,10% (4533 people), with the prevalence for Bengkulu City itself being 14,59% (661 people). Data Bengkulu City Health Office for 2021 number WRA in Bengkulu City is 84.506 WRA. The highest CED problem was found in the Kandang Health Center in Bengkulu City, which was 46,8% (277 WRA) [7]. This study aims to determine the interaction risk between protein intake and the number of family members with Chronic Lack of Energy in Women of Childbearing Age.

Method

This study used a cross-sectional approach by examining the dynamics and risk factors and their impacts through direct observation and data collection. This research was conducted for 3 months (January-March 2023). The population used in this study were all Women of Reproductive Age (WRA) between 20-45 years at Kandang Health Center, Bengkulu City, with a population of 7,183 WRA. The minimum sample size required in this study was calculated by the application of the Sample Size in Health Study (Lwanga and Lemeshow) to test the proportion difference hypothesis to test the hypothesis *that the proportion of children not vaccinated is 50% or more, at the 5% level of significance*. The number of samples, namely 143 WRA in the Kandang Health Center, Bengkulu City. The inclusion criteria consisted of WRA Kandang Health Center, WRA aged 20-49 years, the sample lived permanently and was registered as residents in the Kandang Health Center, WRA was willing to be interviewed and used as research samples, WRA was in good health during the research, and exclusion criteria during the research process WRA moved house in the Kandang Health Center, WRA was sick, WRA was not willingly interviewed and not willing to be sampled. The sampling technique uses convenience sampling as a *non-probability sampling method where*

units are selected for inclusion in the sample due to convenience.

Data collection of Chronic Energy Deficiency (CED) by measuring Mid-Upper Arm Circumference (MUAC) with MUAC tape, WRA is declared CED if the size of MUAC < 23.5 cm. Collection of WRA characteristic data by conducting interviews using structured questionnaires. The age of WRA is categorized into risky (> 35 years) and not at risk (20-35 years) [41], WRA education is categorized as low (elementary and secondary) and high (diploma and bachelor education), employment status is categorized as working (getting treatment) and not working, the number of family members is categorized as a large family (> 4 people) and small family (≤ people) [14], history of infectious diseases (diarrhea, upper respiratory tract infection, malaria, tuberculosis) in one month is categorized as ever and never [42]. Nutritional intake was collected using Semi Food Frequency Questionnaire (S-FFQ) forms, food photo books, and measuring tape. The research procedure began by asking questions on a questionnaire and the S-FFQ form using a food photo book to clarify household size followed by measuring arm circumference. Categorization of nutritional intake based on Daily Value (DV) for Indonesians. Energy intake (Kcal), carbohydrate intake (gr), protein intake (gr), and fat intake (gr) are categorized as insufficient (< 80% DV) and sufficient (≥ 80% DV) [32]. Eating frequency data is the main eating frequency collected by interviews using questionnaires then categorized into good (≥ 3 times a day) and less good (< 3 times a day) [42].

Data analysis used univariate analysis to describe the characteristics of each research variable (age, occupation, education, number of family members, history of infectious disease in the last 1 month, energy intake, protein intake, fat intake, carbohydrate intake, and frequency of main meals in a day). Bivariate analysis used the Chi-Square test to determine the relationship between independent variable (age, occupation, education, number of family members, history of infectious disease in the last 1 month, energy intake, protein intake, fat intake, carbohydrate intake, and frequency of main meals per day) with CED. If the bivariate analysis results show a p-value < 0.25, it will be included in the multivariate analysis. Multivariate analysis uses multivariate logistic regression to determine the most influential variable the determinants of CED.

Before the research was carried out, there was an ethics research permit. The permit was first submitted to the Health Research Ethics Commission of the Ministry of Bengkulu Health Polytechnic with the Ethical Clearance Number No. KEPK.BKL/054/02/2023. Respondents who had been involved in this study had previously given written informed consent after explanation. The explanation given is in the form of the researcher's name, institution of origin, aims, and objectives as well as asking for approval regarding the availability of being a respondent.

Results

Table I shows that the individual characteristics show that most of the WRA age group are not at risk (51.7%), do not have work outside the home (83.9%), have low education (83.2%), lived with a small number of family members (65.7%), multipara parity (74.1%), and had no history of infection in the last 1 month (65%).

Table II shows that the description of intake and frequency of main meals in the day shows the most intake of good energy (67.8 %) with an average energy intake of 1840.4 kcal with a range between 1332.2-2606.5 kcal. Protein intake was mostly adequate (87.4%) with an average of 57.6 g with a range between 57.6±9.6 gr. Fat intake was mostly Not enough (66,4%) with an average of 77.2 g, ranging between 47-129.9 gr. Carbohydrate intake was mostly Not enough (88,8%) with an average of 231.8 g with a range between 153.4-370.1 gr, and most of the frequency of main meals in a day is good (62.2%).

Table III shows that 37.8% of WRA in the Kandang Health Center in Bengkulu City have experienced CED. The average size of MUAC WRA is 26.4 cm, with a range between 18.6 cm to 33 cm.

Table IV shows the results of the analysis with Chi-Square to determine the relationship of each independent variable with the incidence of CED and as a selection stage of independent variables that will be candidates for multivariate analysis (p-value = 0.25). The results showed there was a significant relationship between age (p-value = 0.037; ORc = 2.082) and number of family members (p-value = 0.046; ORc = 2.048) with the incidence of CED, but WRA characteristics based on maternal occupation (p-value = 0.748; ORc = 0.858), education (p-value = 0.069; ORc = 2.248), and a history of infection in the last 1 month (p-value = 0.259; ORc = 0.668) was not significantly associated with the incidence of CED. The prevalence of Chronic Energy Deficiency was higher in WRA aged ≤ 35 years (29%) compared to WRA aged > 35 years (45.9%), WRA not working (38.3%) compared to WRA working (34.8%), WRA higher education (54.2%) compared to WRA lower education (34.5%), extended family (49%) compared to small families (31.9%), and WRA who have experienced infectious diseases (44%) compared to those who have not experienced infectious diseases in the last 1 month (34.4%). Table IV also shows that the independent variables that are candidates for multivariate logistic regression analysis are WRA age, number of family members, and WRA education.

Table V shows a significant relationship between energy intake (p-value = 0.014; ORc = 2.436) and carbohydrate intake (p-value = 0.027; ORc = 4.853) with the incidence of CED, but no significant relationship between protein intake (p-value = 0.252; ORc = 0.562) and fat intake (p-value = 0.016; ORc = 2.781) with the incidence of CED. The prevalence of CED was higher. WRA with less energy intake (52.2%) than adequate energy intake (30.9%), insufficient protein intake (50%) compared to adequate protein intake (36%), fat intake less (100%),

Tab. I. Women of reproductive age characteristics.

Characteristics	Frequency		Statistics	
	n	%	Min-Max	$\overline{X} \pm SD$
Age (year) Risk (> 35 years) No risk (≤ 35 years)	69 74	48.3 51.7	21-48	34 ± 6.69
Work Not Working Work	120 23	83.9 16.1	-	-
Education Low (Primary and Secondary) Hight (Diploma and Bachelor)	119 24	83.2 16.8	-	-
Number of family members Small (≤ 4 person) Big (> 4 person)	94 49	65.7 34.3	2-8	4 ± 1.22
Parity Primipara (1 child) Multipara (1-3 children) Grandemultipara (> 3 children)	35 106 2	24.5 74.1 1.4	0-5	2 ± 0.96
History of infectious disease Ever Never	50 93	35.0 65.0	-	-

less carbohydrate intake (40.9%) compared to adequate carbohydrate intake (12.5%), fat intake was less (35.9%) than adequate fat intake (18.1%), and the frequency of

Tab. II. Overview of intake and frequency of eating women of child-bearing age.

Intake and Frequency of Eating	Frequency		Statistics	
	n	%	Min-Max	$\overline{X} \pm SD$
Energy Intake (Kcal) Not enough (< 80% DV) Good (≥ 80 DV)	46 97	32.2 67.8	1332.2-2606.5	1840.4 ± 230
Protein Intake (gr) Not enough (< 80% DV) Good (≥ 80 DV)	18 125	12.6 87.4	47-129.9	57.6 ± 9.6
Fat Intake (gr) Not enough (< 80% DV) Good (≥ 80 DV)	95 48	66,4 33,6	47-129.9	77.2 ± 14
Carbohydrate Intake (gr) Not enough (< 80% DV) Good (≥ 80 DV)	127 16	88.8 11.2	153.4-370.1	231.8 ± 37.5
Main Meal Frequency (times/day) Not enough (< 3 times/day) Good (≥ 3 times/day)	54 89	37.8 62.2	2-4	2.7 ± 0.6

DV: Daily Value

Tab. III. Overview of chronic energy deficiency.

Size of Mid-Upper Arm Circumference (MUAC)	Frequency		Statistics	
	n	%	Min-Max	$\overline{X} \pm SD$
CED (MUAC < 23.5 cm) No CED (MUAC ≥ 23.5 cm)	54 89	37,8 62,2	18,6-33.0	26,4 ± 3,57

CED: Chronic Energy Deficiency; MUAC: Mid-Upper Arm Circumference

eating was good (24.5%) compared to the frequency of eating was not good (13.3%). Table V also shows that the independent variables that are candidates for multivariate logistic regression analysis are WRA age, number of family members, and WRA education.

Table VI shows that the factors affecting CED for WRA in the Kandang Health Center in Bengkulu City in 2023 are age (p-value = 0.018; ORa95% CI = 2,495: 1.171-5.317), energy intake (p-value = 0.013; ORa95% CI = 2.990: 1.256-7.117), and the interaction of protein intake by several family members (p-value = 0.03; ORa95%CI = 21.327: 1.343-338.671). The dominant factor for CED is the interaction between protein intake and several family members, meaning the interaction between protein intake with family members this means that the number of family members influences the amount of WRA protein intake. WRA who have less protein intake, the risk of the number of small family members experiencing CED is 3,643 times (OR = $e^{-1,767 + 3,060}$ = 3,643) compared to the number of extended family members. For those at WRA who have good protein intake, the risk of the number of large family members for CED occurring is only 0.17 times (OR = $e^{-1,767}$ = 0.17) compared to the number of extended family members. This shows that protein deficiency is a precondition for the effect of the number of family members on the incidence of CED.

The results of the multivariate analysis obtained the last model as shown in Table VI the regression equation is as follows:

Logit P (CED Occurrence) = -1.024 + (0.914*at risk age) + (1.095*deficient energy) + (-0.849*deficient proteins) + (-1.767*small number of family members) + (3.060*protein intake*number of family members)

$$P = \frac{1}{1+e^{-(\alpha+\beta 1 X 1+\beta 2 X 2+\beta 3 X 3+\cdots.kXk)}}$$

$$P = \frac{1}{1+e^{-[-1.024 +0.914-1.767+ 1.095- 0.849+ 3.060]}} = 0.813 = 81.3\%$$

Based on the P = 81.3%, it means that 81.3% of the variation in the incidence of Chronic Energy Deficiency in. WRA is explained by risk age factors (> 35 years), less energy intake, less protein intake, large families, and interactions between less protein intake with large families. The remaining 18.7% variation in CED events in WRA is explained by other factors.

Tab. IV. Relationship between women of childbearing age characteristics and chronic energy deficiency.

Variable	Chronic Energy Deficiency Events						P-values[a]	ORc (95% CI)
	CED		No CED		Total			
	n	%	n	%	n	%		
Age (year)								
Risk (> 35 years)	20	29.0	49	71.0	69	100	0.037*	2.082 (1.042-4.162)
No risk (≤ 35 years)	34	45.9	40	54.1	74	100		
Work								
Not Working	46	38.3	74	61.7	120	100	0.748	0.858 (0.337-2.182)
Work	8	34.8	15	65.2	23	100		
Education								
Low (Primary and Secondary)	41	34.5	78	65.5	119	100	0.069*	2.248 (0.926-5.461)
Hight (Diploma and Bachelor)	13	54.2	11	45.8	24	100		
Number of Family Members								
Small (≤ 4 person)	30	31.9	64	68.1	94	100	0.046*	2.048 (1.009-4.159)
Big (> 4 person)	24	49.0	25	51.0	49	100		
History of infection in the Last 1 Month								
Ever	22	44.0	28	56.0	50	100	0.259	0.668 (0.330-1.349)
Never	32	34.4	61	65.6	93	100		

ORc: Odd Ratio Crude. *Candidate for multivariate analysis. [a] Chi-Square Test.

Discussion

Age and Chronic Energy Deficiency

This study found a significant relationship between age and incidence of CED. This happened because at the time the study was carried out on WRA who were in the Puskesmas, out of 143 WRA who were classified as at risk. This study is in line with research in Pati Regency, which obtained p = 0.003 which indicates an effect of age on the incidence of CED [8]. In addition, research in Betung Bay, Bandar Lampung Sari City, obtained a p-value = 0.000 which indicates the relationship between age and incidence of CED [9]. However, it is different from research in Central Kluet District, South Aceh Regency, which obtained p-value = 0.399 and shows no relationship between age and incidence of CED [10]. Age (35-49 years) is said to be vulnerable to CED events because besides this age there is aging and decreased body functions where at that age WRA still have young children which adds to the workload. In the old category (35-49 years) the metabolic process gradually decreases regularly so that the need for nutrients cannot be fully met [11, 12]. Apart from that, at this age, it is also susceptible to disease because the organs of the body are getting older and weaker, as well as the aging process that is starting to appear [8]. Affects during pregnancy, it requires a lot of energy. Then it takes additional energy sufficient to support the ongoing pregnancy [13].

Tab. V. Relationship between intake and frequency of main meals with chronic energy deficiency.

Variable	CED events						P-values[a]	ORc (95% CI)
	CED		No CED		Total			
	n	%	n	%	n	%		
Energy Intake (kcal)								
Not enough (< 80% DV)	24	52.2	22	47.8	46	100	0.014*	2.436 (1.185-5.011)
Good (≥ 80 DV)	30	30.9	67	69.1	97	100		
Protein Intake (grams)								
Not enough (< 80% DV)	9	50.0	9	50.0	18	100	0.252*	0.562 (0.208-1.519)
Good (≥ 80 DV)	45	36.0	80	64.0	125	100		
Fat Intake (grams)								
Not enough (<80% DV)	43	35.9	52	59.129.9	95	100	0.016*	2.781 (1.269-6.098)
Good (≥ 80 DV)	11	18,1	37		48	100		
Carbohydrate Intake (grams)								
Not enough (< 80% DV)	52	40.9	75	59.1	127	100	0.027*	4.853 (1.058-22.262)
Good (≥ 80 DV)	2	12.5	14	87.5	16	100		
Main Meal Frequency Per Day								
Not enough (< 3 times/day)	19	13.3	35	24.5	54	100	0.620	1.194 (0.592-2.409)
Good (≥ 3 times/day)	35	24.5	54	37.8	89	100		

DV: Daily Value; ORc: Odd Ratio Crude; * Candidate for multivariate analysis; [a] Chi-Square Test.

Tab. VI. Determinants of chronic energy deficiency.

Variable	B	P-values[a]	ORa (95% CI)
Age*	0.914	0.018	2.495 (1.171-5.317)
Energy intake*	1.095	0.013	2.990 (1.256-7.117)
Protein intake*	-0.849	0.192	0.428 (0.119-1.533)
Number of family members*	-1.767	0.185	0.171 (0.013-2.327)
Protein intake*number of family members*	3.060	0.030	21.327 (1.343-338.671)
Constant	-1.024		

[multivariate]Logistic Regression Test with categorical data scales; ORa: Odd Ratio Adjusted.

INTERACTION NUMBER OF FAMILY MEMBERS AND PROTEIN INTAKE

This study found a significant relationship between the interaction number of family members and protein intake with the incidence of CED (p-value = 0.03; ORa95% CI = 21.327: 1.343-338.671). The interaction between protein intake with family members means that the number of family members influences the amount of WRA protein intake. WRA with large families when protein intake is not enough risk 21 times to experience chronic lack of energy compared to adequate protein intake. Based on the results of research in the field where WRA who live with a small number of family members experience as much as 31.9%. This is because a small family has just married and the family economy is not yet stable. The results of this study are in line with research in Tuban Regency, which obtained p-value = 0.000 which shows that the number of family members is related to the incidence of CED [17]. This is different from research in a large-scale unbalanced district with p-value = 0.4 which shows that the total number of household members is not related to the occurrence of CED [18]. It is also different from studies in the City of Kupang and the City of Bengkulu, which obtained p-value = 0.302, which has no relationship between the number of family members and incidence [19].

Dependents are WRAs who are still related to the family or are considered family and their lives are borne. The number of dependents is determined by the number of family members living in a household [20]. Even though in this study the majority of family members from WRA were ≤4 person, which means that the number of children they had was only 1 or 2 person, nutrition fulfillment was still on WRA is still neglected. Even though the number of family members at WRA averages ≤ 4 people, which is not balanced with sufficient income will determine the nutritional status of WRA [21]. A heavy workload will increase the body's energy needs which can cause fatigue [22].

The results of this study found that protein intake was not directly related to the incidence of CED, but depended on the number of family members. WUS in this study have good protein consumption, this can be seen in habits of protein consumption and the portions consumed. Almost every WRA consumes 2-3x protein every week, especially animal protein. In addition, the availability of these foodstuffs is not difficult to obtain. This study is in line with research in the Terbanggi Besar District, Central Ampang Regency, which obtained p-value = 0.230 which indicated that there was no relationship between protein intake and incidence of CED. did not have a significant relationship with the incidence of CED [32]. In contrast to the study in Palembang, p-value = 0.004 was obtained which indicated that there was a relationship between protein intake and the risk of CED [29].

Foods that contain a lot of protein are tofu, tempeh, chicken, fish, eggs and milk. Protein has an important function for the body, protein is a source of energy after glycogen, besides that protein is also used as a constituent of tissue cell structures. There a person must have sufficient protein intake because this can have an impact on the health of WRA if it lasts for a long time. Protein intake that is less or more does not affect changes in body weight because excess protein intake is not stored by the body as occurs due to excess energy [32].

ENERGY INTAKE AND CHRONIC ENERGY DEFICIENCY

This study found a significant relationship between energy intake and incidence in WRA Kandang Health Center, Bengkulu City in 2023. This research is in line with research in Hibun village, Sanggau Regency, which obtained a p-value = 0.009 which indicates the relationship between energy intake and risk [28]. In addition, the study in Palembang obtained p-value = 0.004 which showed that there was a relationship between energy intake and the risk [29]. Just like the study in Makassar, it obtained a p-value = 0.011 which showed that there was a relationship between energy intake and the risk of Chronic Energy Deficiency [30].

The energy in the human body is the result of burning proteins, fats, and carbohydrates. Energy results can be stored by the body in adipose tissue. This energy reserve will be used if the intake of protein, fat, and carbohydrates is insufficient. Therefore, muscle mass is influenced by the intake of macronutrients, especially energy and protein. If energy reserves are continuously used for a long time, it will result in changes in nutritional status [31].

CARBOHYDRATES AND CHRONIC ENERGY DEFICIENCY

This study found a significant relationship between carbohydrate intake and the incidence of CED. This is because most WRA have less carbohydrate intake, whereas a high-carbohydrate food ingredient that is often consumed is rice. In addition, the consumption of high-carb foodstuffs did not vary, they were rarely consumed even if only a small amount was consumed. This study is in line with research in Tapung District, Kampar Regency, Riau, which obtained p-value = 0.027 which indicated that there was a relationship between carbohydrate intake and incidence of CED [33]. In contrast to the

study in Palembang, p-value = 0.094 was found which showed no relationship between carbohydrate intake and the risk of CED [29]. The results of this study were also different from studies in Central Lampung Regency, which obtained p-value = 0.455 indicating that there was no relationship between carbohydrate intake and incidence [32].

In the human body, there are specific cells such as neurons that require high glucose [37].Glucose is found in food sources of carbohydrates. The most consumed foods contain high carbohydrates such as rice, bread, noodles, corn, wheat flour, tubers, and others. Carbohydrate consumption generally comes from staple foods. Energy consumption that does not vary will affect energy intake. Where carbohydrates function as the main source of energy, carry out and carry out fat metabolism, and others. Carbohydrate intake was as much as 88.8% with an average of 231,8 g and was not sufficient for the daily RDA according to the standard [32].

Occupational and Chronic Energy Deficiency

This study found no significant relationship between work and incidence of CED. This can be a factor in the occurrence of CED. Even though the results of this study stated that there was no relationship, CED was often found in WRA who did not have jobs outside the home. This study is in line with research in Kediri Regency, which obtained p = 0.269 which indicated that the mother's occupation was not related to the incidence of CED [14]. In addition, research in the District of Central Kluet, South Aceh District with p=0.686 showed that there was no relationship between work and. the incidence of CED [10]. In contrast to research in Tuban Regency, p-value = 0.008 was obtained which indicated that there was a relationship between work and incidence of CED [2].

Stress is a condition that occurs due to a gap between physiology and psychology in a situation that originates from a person's biological, psychological, or social origins [15]. A person is inevitably very vulnerable to stress caused by various problems. Stress triggers themselves can be from within or outside the body which can influence a person's behavior towards food. WRA who work outside the home or do not have different stress factors. For example, for WRA who work stress factors can be caused by work outside the home not to mention work at home, while WRA who do not work outside the home have to think about housework, caring for children, and others [16].

EDUCATION AND CHRONIC ENERGY DEFICIENCY

This study found no significant relationship between education and incidence of CED. The results of this study also indicate that there are samples with low education that have normal MUAC sizes. Even though the results of the study stated that education had no relationship with the incidence of CED in WRA, CED was often found in WRA with low education.

This research is in line with research in Kediri Regency, which obtained p = 0.689 which indicated that education was not related to the incidence of CED [14].

In addition, research in Indramayu District obtained p-value = 1,000 indicating that education was not related to the nutritional status of pregnant women [16]. Tuban obtained p-value = 0.013 which shows the relationship between education and incidence [2].

Education affects nutritional status because a high level of education will participate in determining or influencing a person to receive nutrition information. Nutrition and health problems often occur due to ignorance and lack of information about fulfilling nutrition for health. This will have an impact on awareness and willingness to behave regarding health in everyday life [13].

However, the facts on the ground found that WRA with a high level of education experienced CED. What causes this to happen is that WRA who have a low level of education are not necessarily less able to meet their needs for nutrients and food compared to WRA who have a high level of education. Even though WRA have low education, they do not necessarily have low knowledge about nutrition and health, this is because health information is not only obtained by taking education. Apart from that, it could be because higher education provides opportunities for WRA to work with strenuous activities outside the home which can have an impact on workload which can become a burden on the mind (stress), and irregular eating patterns which can put WRA at risk of experiencing [13].

HISTORY OF INFECTION AND CHRONIC ENERGY DEFICIENCY

This study found no significant relationship between a history of infection and the incidence of CED. Results of interviews WRA who experienced. on average did not have a history of infection in the last 1 month. Even though infectious diseases can affect nutritional status, the history of illness experienced by WRA in the field is susceptible to a long period with the MUAC measurements carried out, besides that the history of illness experienced does not last for a long time. The most common infectious disease is upper respiratory tract infection, where if you are sick, you will go to the Puskesmas for treatment at the WRA so that the illness does not last long.

This research is in line with the study in Purwokerto, which obtained p = 0.121 which indicated that there was no relationship between. and infectious diseases [23]. In addition, the research conducted in Purwokertal has p-value = 0.156 which shows that contagious diseases are not related to Chronic Energy Deficiency Among Non-pregnant and Non-lactating Women of Reproductive Age [24]. The city of Bogor obtained p = 0.000 which indicated a relationship between infectious diseases and incidence [25].

Infectious disease is one of the factors that can affect the nutritional status of WRA. There is a relationship between infectious diseases and nutritional status [26]. Infectious diseases are closely related to malnutrition or undernutrition where there is a reciprocal relationship, namely infectious diseases can worsen the nutritional condition of WRA, and vice versa WRA who are in

poor nutritional conditions will make it easier for them to get infected [27]. WRA who suffer from infectious diseases will have an impact on the nutritional status of the WRA, this is because infectious diseases affect food intake which often decreases [26].

Fat Intake and Chronic Energy Deficiency

This study found no significant relationship between fat intake and the incidence of CED. Results of interviews with WRA, the average WRA often consume foods that contain lots of fat, such as coconut milk and fried dishes that are cooked by themselves or bought outside the home. The habit of consuming foods that are high in fat will make fat intake sufficient.

This study is in line with the study in Makassar, which obtained p-value = 0.595 which indicated that there was no relationship between fat intake and CED [30]. In addition, this study is also in line with research in Bandar Lampung, which obtained p-value = 0.204 which indicated that there was no relationship between fat intake and incidence of CED [34]. In contrast to the study in Palembang, p-value = 0.031 was obtained which showed that there was a relationship between fat intake and the risk [29].

Frequency of main meals in a day and Chronic Energy Deficiency

This study found no significant relationship between the frequency of main meals in a day and the incidence of CED. In this study, there were WRA whose eating frequency was in the good category but experienced, which was 24,5%. This can happen because the main eating frequency is not a factor causing it.

This can be caused by intake or food consumed does not meet the nutritional adequacy rate (RDA). In addition, imbalanced intake, type and variety of food consumed, nutrient content, meal portions, and frequency can affect whether intake is fulfilled or not. So even though the main meal frequency is good, in terms of intake it cannot be fulfilled or is not adequate for a long period, it does not rule out the possibility that the WRA will not experience [35].

This study is in line with research in Makassar City, which obtained p-value=0.667 which indicated no relationship between the frequency of the main meals in a day and the incidence of CED [20]. In addition, research in Kediri Regency obtained p-value=0.383 which showed that there was no relationship between eating frequency and incidence of CED [14]. In contrast to research in the city of Lampung, p-value=0.015 was obtained which showed that there was an effect of eating frequency on the incidence of Chronic Energy Deficiency (CED) in Pregnant Women [36].

Based on the researcher's direct experience in this research process, there are several limitations experienced and there can be several factors that future researchers can pay more attention to in further perfecting their research because this research itself certainly has shortcomings that need to be continuously improved. Further research, for example, needs to increase the number of samples,

use the cohort method, and collect consumption data using more valid instruments. Several limitations in this research include: the number of respondents was only 143 people, which is certainly not enough to describe the actual situation; the research object only focuses on WRA who are only aged 20-49 years; in the process of collecting data, the information provided by respondents via S-FFQ sometimes does not show the actual condition of the respondents, this happens because sometimes respondents do not remember what food they consumed in the last month as well as other factors such as the honesty factor in filling out the questionnaire.

Conclusions

Factors associated with the incidence of Chronic Energy Deficiency (CED) in Women of Reproductive Age (WRA) 20-45 years are age, energy intake, protein intake, number of family members, and the interaction between protein intake and the number of family members. The dominant factor is the interaction between protein intake and the number of family members. The effect of protein intake on the incidence of CED depends on the number of family members. In large families, WRA with less protein intake are at higher risk of developing CED compared to WRA from small families. Relevant health workers need to make promotive and preventive efforts that can be done through community empowerment through health education about nutritional intake and family planning, so WRA understands about prevention of chronic lack of energy through family planning, meeting nutritional needs, especially energy and protein intake. For future researchers, they can conduct further research on other factors in WRA such as culture, family income, socioeconomic status, age at marriage, and others.

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Conflict of interest statement

The authors declare no conflict of interest.

Authors' contributions

DS and LL: conceived of the presented idea, collected the data, performed the analysis, conceived and designed the analysis, and contributed data or analysis tools. DS and LL: verified the analytical methods, contributed to

the interpretation of the results, and designed the model and the computational framework. All Authors discussed the results and contributed to the final manuscript.

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