Original Article

Determinants of Chronic Energy Deficiency among pregnant women in Jeneponto regency

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Accepted for publication: 14 Jan 2018

Abstract

Background: The prevalence of Chronic Energy Deficiency (CED) in Indonesia reached 24.2% in 2013. The present study aimed to identify the determinants of CED in pregnant women.

Methods: A cross-sectional study was conducted between July 2016 - July 2017 in Jeneponto Regency. The standard used in Indonesia categorizes CED when MUAC <23.5 cm while the normal value is considered as ≥23.5 cm. A total 616 respondents were selected using proportional stratified non-random sampling. The independent variables were socio-economic, food intake, and environmental factors. Anthropometric data including Middle-Upper Arm Circumference (MUAC) was measured using MUAC tape. In addition, SECA digital weight scale was used to measure weight and Microtoice for height. Data were collected using structured questionnaires and the results were double input to ensure validity of data. Data analyses used were chi-square and logistic regression run in PASW Statistics for Windows, Version 18.0.

Results: The results showed that the prevalence of CED is quite high (n=131) (21.3%). The variables that contributed to the CED occurrence were age (OR=2.662, 95%CI=1.785-3.968, *P*<0.001) and education level (OR=0.505, 95%CI=0.340-0.751, *P*=0.001). Multivariate analysis showed only educational level and latrines availability became the determinant factors of CED in pregnant women (*P*<0.05). After controlling low carbohydrates and protein intake, there was no statistically significant variable as determinant factor of CED among pregnant women.

Conclusion: The present study concludes that age and education level are potential to be determinant factors for CED. Attempts should be made to prevent the impact of CED on pregnant women. The government needs to provide the proper program to overcome impact and prevalent of CED.

Keywords: Chronic Energy Deficiency; Indonesia; Malnutrition; Pregnant women

Cite this article as: Syafruddin Nurdin M, Hadju V, Imam Arundhana Thahir A. Determinants of Chronic Energy Deficiency among pregnant women in Jeneponto regency. SDH. 2018;4(1)3-11. DOI: http://dx.doi.org/10.22037/sdh.v4i1.19785

I Introduction

In developing countries, despite the presence of non-communicable diseases and overnutrition, the number of malnourished and communicable diseases still dominates. Specifically, malnutrition and nutritional deficiencies are still two burdens for these countries. In fact, when malnutrition is not addressed, then it may increase the risk of mortality, particularly in infants and pregnant women (1).

In addition, maternal mortality rate in Indonesia during the past decade was extremely high, roughly 359 per 100,000 live births in 2012 (2). It is believed that maternal and child mortality as well as nutritional problems in children, such as stunting and wasting, are strongly influenced by nutritional status of mother, especially Chronic Energy Deficiency (CED) occurred in the pre-pregnancy period. CED in pregnant mothers may increase maternal mortality risk (3). The prevalence of CED among pregnant women, according to the results of Indonesia Basic Health Research, reached 24.2% in 2013 (4). This figure should alert the government because a high number of pregnant women were at risk during their pregnancy.

Fundamentally, CED is the result of an energy imbalance in which the energy intake is lower than the body's needs. As a result, CED produces low body weight and fatty deposits (5). In pregnant women, malnutrition may have an effect on their quality of life and also on the outcome of pregnancy, such as low birth weight, impaired physical development of the foetus, and high risk of death in infants (6). The prevalence of stunting reached its peak in 2013 (37.2%) (4), probably caused by malnutrition before pregnancy (7). There are several determinants of malnutrition among pregnant women, such as low quality of diet, short inter-pregnancy intervals, recurrent infections, as well as some socio-economic factors (education level, income, age, and occupation) (8). Jeneponto regency, as one of the areas that suffered serious health problems regarding maternal and child, faces high maternal mortality rate that reaches 235 per 100,000 live births. This area is also considered as a region with a fairly high number of poor people, roughly 50.67% (9). Socioeconomic factors also contribute to health problems, including maternal and child nutrition (10).

In general, few studies have shown a linkage of nutritional status of pregnant women to the outcome of pregnancy. However, the existing data is not adequate to use as a base so as to provide appropriate intervention to increase health status of pregnant women and their pregnancy outcomes. Therefore, the present study was conducted to obtain such data. Pre-pregnancy interventions should be sought to prepare for better pregnancies. The aim of the present study was to investigate determinants of CED among pregnant women in Jeneponto Regency, Indonesia.

Methods

The current cross-sectional study was conducted in six sub-districts in Jeneponto regency, namely Bontoramba, Bangkala, Binamu, Tamalatea, Tarowang, and dan Tino between July 2016 - July 2017. A total of 628 participants were selected following proportional stratified non-random sampling, but data of only 616 participants could be analysed further because the questionnaire from 12 respondents could not be collected. Inclusion criteria were: 1) no more than the 2nd trimester, 2) no severe anaemia (Hb <7 g/dL), and 3) no pregnancy complication. The recruited enumerators were trained for three days including equality of understanding regarding the contents of questionnaire, anthropometric training, and field trials.

Data collection started by conducting screening to identify pregnant women and to ensure that they were not severe anaemic or had Hb concentration below 7 gr/dL. Also, all participants signed the informed consent.

The dependent variable was CED obtained by measuring middle-upper arm circumference (MUAC) as used in the Indonesian Basic Health Research Survey (4). MUAC measurement was obtained using MUAC tape issued by Indonesian Ministry of Health. When the results gained were below than 23.5 cm, then they were categorized as CED pregnant mother.

Independent variables were socio-economic (age, occupation, income, and education level), food quality (food diversity), and environmental health (latrine availability and water spring resources).

In the present study, the food group intake of the participants represented food quality. This variable was measured using a semi-quantitative food frequency questionnaire (SQ-FFQ) adopted from a previous study in Makassar city Indonesia (11). Weight and height were obtained to determine pregnant women's nutritional status. The tools used were SECA weight scale with precision of 0.1 kg for weight, and microtoice with precision of 0.1 cm for height. The enumerators interviewed the participant using structured questionnaire. After collecting the data, double entry was done to ensure the validity of data using EpiData (version 4.2.0). All data analysis was performed in PASW Statistics for Windows, Version 18.0. The analyses included chi-square, logistic regression, and multiple logistic regression. All of the phases were conducted by data management team.

The current study has obtained ethical approval from the Ethics Commission of the Faculty of Medicine, Hasanuddin University, Indonesia number UH16090723.

Results

During screening phase, 628 respondents were selected, but 12 respondents missed the interview phase. Therefore, the results obtained from 616 respondents could be analysed. The result of comparison between un-enrolled and enrolled participants is shown in Table 1. There was no significant difference in participant's characteristics between un-enrolled and enrolled participants. As shown in Table 2, the prevalence of CED, in general, reached 21.3%. The prevalence of CED is influenced by several factors. As for the age group, it was observed that the higher the participant's age, the lower the prevalence of CED. Conversely, CED prevalence increased by the increase in education level. The chronic energy deficiency among pregnant women was higher in high education level than those from low education level (29.4% vs 17.3%). In addition, there were statistically significant differences between CED and non-CED for weight at the first visit of antenatal care (ANC), carbohydrate intake, and protein intake (P<0.05), while the other variables were not significantly associated to CED among pregnant mothers.

The present study (as shown in Table 3) shows that those aged under 26 years old were likely to become CED (OR=2.662; 95%CI=1.785–3.968, P<0.001) compared to those aged 26 years old and above. Conversely, low education level in pregnant women seems to be a protective factor of CED (OR=0.505, 95%CI=0.340–0.751, P=0.001). In other words, those who had high education level were likely to become CED 1.98 times more than those with low education level. However, after controlling the first pregnancy variable, level of education was not found to be a determinant factor of CED (OR=0.636, 95%CI= 0.332–1.219, P=0.17).

Table 1. Comparison of characteristics between un-enrolled and enrolled participants

Characteristic	Participants		P^*
	Un-enrolled Mean±SD	Enrolled Mean±SD	
MUAC (cm)	25.53±3.46	25.72±2.94	0.336
Weight (kg)	56.55±12.75	53.88±9.45	0.101
Height (cm)	154.43±5.23	152.37±5.31	0.785
Age (year)	28.33±6.48	26.77±6.38	0.842

*independent t-test

Table 2. Characteristic of study participants

Variables		Chronic energy deficiency N (%) Yes 131 (21.3)	No 485 (78.7)	P^*
Age	<20 years old	36 (38.7)	57 (61.3)	<0.001
	20-24 years old	45 (29.2)	109 (70.8)	
	25-29 years old	24 (16.1)	125 (83.9)	
	30-34 years old	17 (12.3)	121 (87.7)	
	≥35 years old	9 (11.0)	73 (89.0)	
Level of education	Low (<Senior high school)	72 (17.3)	343 (82.7)	0.001
	High (≥Senior high school	59 (29.4)	142 (70.6)	
Occupation	Unemployed	109 (21.9)	388 (78.1)	0.851
	Officer	4 (19.0)	17 (81.0)	
	Entrepreneur	1 (25.0)	3 (75.0)	
	Others	17 (18.1)	77 (81.9)	
Expenses (IDR=Indonesian Rupiah)	≤1,000,000	43 (22.6)	147 (77.4)	0.554
	1,000,001-2,000,000	47 (18.6)	206 (81.4)	
	2,000,001-3,000,000	24 (21.6)	87 (78.4)	
	>3,000,000	17 (27.4)	45 (72.6)	
Diet quality (food group)	Low (<3)	113 (21.6)	410 (78.4)	0.80
	Average (3-4)	5 (22.7)	17 (77.3)	
	High (5)	13 (18.3)	58 (81.7)	
Number of children	≥3 children	4 (7.7)	48 (92.3)	0.14
	<3 children	58 (15.6)	313 (84.4	
Family members who smokes in the family	Yes	107 (21.1)	401 (78.9)	0.43
	No	24 (22.2)	84 (77.8)	
Latrine availability	No	52 (22.7)	177 (77.3)	0.28
	Yes	79 (20.4)	308 (79.6)	
Water resources	Government's clean water	37 (21.4)	136 (78.6)	0.96
	Artesian well	90 (21.3)	332 (78.7)	
	Water springs	5 (23.8)	16 (76.2)	
		(mean±SD)	(mean±SD)	P^{**}
Gestational age, weeks		17.5±4.62	17.1±4.24	0.09
Weight at the first visit of ANC, kg		38.6±12.80	50.9±16.32	0.03
MUAC, cm (mean±SD)		22±1.31	26.7±2.43	<0.001
Energy intake, kcal (mean±SD)		1175.8±718.83	1101±1258.20	0.51
Carbohydrate intake, g (mean±SD)		179.6±103.01	160.3±92.25	0.03
Protein intake, g (mean±SD)		50.2±40.19	42.2±29.98	0.01
Fat intake, g (mean±SD)		30.1±30.88	25.1±27.80	0.07

*Chi-square test; **independent t-test

Table 3. Binary logistic regression of determinants of chronic energy deficiency among pregnant women in Jeneponto Regency

Variables (N=616)		OR	95% CI	*P*
Age (years)	<26	2.662	1.785–3.968	<0.001
	≥26	1	Reference	
Educational Level	Low (<Senior high school)	0.505	0.340–0.751	0.001
	High (≥Senior high school)	1	Reference	
Educational Level those who are pregnant at the first time (N=240)	Low (<Senior high school)	0.636	0.332–1.219	0.17
	High (≥Senior high school)	1	Reference	
Occupation	Unemployed	1.239	0.744–2.061	0.41
	Employed	1	Reference	
Household income (Rp)	≤1,000,000	1.291	0.672–2.482	0.43
	1,000,001-2,000,000	1.656	0.872–3.145	
	2,000,001-3,000,000	1.369	0.668–2.808	
	>3,000,000	1	Reference	
Diet quality (number of food groups)	Low (<3)	0.813	0.430–1.537	0.80
	Average (3-4)	0.762	0.238–2.442	
	High (5)	1	Reference	
Number of children	≥3	0.450	0.156–1.295	0.13
	<3	1	Reference	
Family members who smokes in the family	Yes	0.934	0.566–1.542	0.43
	No	1	Reference	
Latrine availability	No	1.145	0.771–1.702	0.50
	Yes	1	Reference	
Water sources	Artesian well	1.004	0.652–1.545	0.96
	Water springs	1.156	0.367–3.645	
	Government's clean water	1	Reference	

Table 4. Multivariate logistic regression of chronic energy deficiency among pregnant women in Jeneponto Regency

Variables (N=616)		OR	95% CI	*P*
Age (year)	<26	1.390	0.777–2.489	0.26
	≥26	1	Reference	
Level of education	Low	0.424	0.225–0.798	0.008
	High	1	Reference	
Occupation	Unemployed	1.594	0.727–3.497	0.24
	Employed	1	Reference	
Expenses (IDR=Indonesian Rupiah)	≤1,000,000	1.190	0.853–1.660	0.30
	1,000,001-2,000,000			
	2,000,001-3,000,000			
	>3,000,000	1	Reference	
Diet quality (number of food groups)	Low (<3)	0.838	0.562–1.251	0.38
	Average (3-4)			
	High (5)	1	Reference	
Number of children	≥3	0.533	0.180–1.582	0.25
	<3	1	Reference	
Family members who smokes in the family	Yes	1.203	0.550–2.631	0.64
	No	1	Reference	
Latrine availability	No	2.047	1.113–3.765	0.02
	Yes	1	Reference	
Water sources	Artesian well	0.865	0.633–1.181	0.36
	Water springs			
	Government's clean water	1	Reference	

Table 5. Multivariate logistic regression of chronic energy deficiency among those pregnant women with low carbohydrate and protein intake

Variables (N=329)		OR	95%CI	*P*
Age	<26	1.501	0.746–3.020	0.25
	≥26	1	Reference	
Level of education	Low	0.573	0.259–1.270	0.17
	High	1	Reference	
Occupation	Unemployed	1.774	0.646–4.876	0.26
	Employed	1	Reference	
Expenses (IDR=Indonesian Rupiah)	≤1,000,000	1.002	0.676–1.483	0.99
	1,000,001- 2,000,000			
	2,000,001- 3,000,000			
	>3,000,000	1	Reference	
Diet quality (food groups)	Low (<3)	0.893	0.542–1.471	0.65
	Average (3-4)			
	High (5)	1	Reference	
Number of children	≥3	0.503	0.144–1.763	0.28
	<3		Reference	
Family members who smokes in the family	Yes	2.076	0.696–6.191	0.19
	No	1	Reference	
Latrine availability	No	1.723	0.817–3.634	0.15
	Yes	1	Reference	
Water sources	Artesian well	0.809	0.557–1.173	0.26
	Water springs			
	Government's clean water	1	Reference	

Occupation status, family income, quality of diet, availability of family members who smoke, number of children, latrines availability, and clean water resources were not observed to be statistically significant to the measured outcome (*P*>0.05).

Moreover, multivariate logistic regression (Table 4) demonstrated that determinant factors of CED, after controlling all variables, were level of education and latrines availability. In bivariate analysis, age group was initially found as a risk factor of CED. But, after adjustment with other variables, age group was excluded (*P*=0.26). Based on education level, pregnant women who had low education level had a very small risk, merely 0.424 times, to become CED (95%CI=0.225–0.798, *P*=0.008) or 2.36 times more at risk for those with high education level. In addition, latrine availability in household was observed to be one of the CED determinants. Pregnant women who shared latrines with other households were likely to become CED two times more compared with those who had latrines at home (95%CI=1113-3,765, *P*=0.02).

Table 5 shows the results of multivariate logistic regression by adjusting low carbohydrate and protein intake variables. Among those with low carbohydrate and protein intake, there was no statistically significant variable as a determinant factor of CED in pregnant women (*P*>0.05).

Discussion

A recent study showed that the prevalence of CED in pregnant women in Jeneponto regency was lower than the national proportion (24.2%) (4); therefore, it is important considering determinants of CED. The first result was that participants' age, education level, weight at the first visit of ANC, MUAC, carbohydrate, and protein intake were significantly different between CED and non-CED of pregnant women.

However, only participants' age and education level were found as determinants of CED among pregnant women. Similar results were reported in another study where younger age was stated to increase the risk of CED (OR=2.761, 95%CI=1.450–5.255) (12). In another study, young age was reported to be strongly associated with the incidence of CED in pregnant women (5). Comparatively, a study in Bhutan showed no significant increase of malnutrition risk in younger age of mother (13). Fundamentally, age determines the maturity of one's thinking and autonomy in determining their nutrition and health for themselves (14).

The present study was conducted expecting that dietary intake would be found as the risk factor of CED among pregnant women and would be a significant contribution to maternal malnutrition. However, as both bivariate and multivariate results revealed, dietary intake was not a risk factor for CED. In contrast to another study, carbohydrate and protein intake had significantly affects on nutritional status (10). In principle, food intake is closely related to CED events in terms of quantity and quality (15). A previous study showed that insufficient food intake might contribute to almost three-fold of CED risk (12). Maternal food intake is crucial because of its role not only for the mother but also for the foetus. However, this need should be prepared earlier even before conception, in the period of preconception, in order to assure the availability of food reserves (16). It is difficult to explain why the dietary intake was not significantly associated to CED, because the mechanism of CED not only involves food aspect but also other environment exposures (17–19).

Interestingly, the results of the present study showed negative role for education level. High education level was the determinant of CED. Theoretically, the high level of maternal education is a tremendous beneficial factor for maternal and child health. However, the results of the current study is in line with those of another study in Indonesia in which CED was found as dominant in high education group (5). Our results are however different from those reported in the study conducted in Ethiopia where the highest education level had the lowest percentage of malnourished pregnant mother (17). Although education is an important component which can develop knowledge and improve attitudes, in the end, it potentially changes behaviour, yet it is difficult to prove the association between education level and behaviour since psychological and socio-cultural factors affect it, too (20). Therefore, a further study should be done, such as investigating the knowledge of pregnant women since the mechanism is closely related to health behaviour and nutritional status (21).

However, after controlling the variable of first experience of pregnancy, education level was not significantly associated to CED. In another study, level of maternal education was observed to be a predictor of malnutrition in children. Mothers with low levels of education have a higher risk of stunting compared to those with high education level (22). It is possible that the level of education does not have a direct correlation with health; therefore, the food intake remained low.

The results of multivariate analysis showed that besides the level of education, latrine availability contributes to CED occurrence. Environmental factors also affect individually the health condition, especially in pregnant women. In a study report, sanitation factors contributed to malnutrition and it applied to all age groups, particularly vulnerable groups, such as pregnant women and children (23). In the current study, latrine availability was measured as representation of the role of environment on family health. It is evident in the systematic review that families whose latrine was used only by their family may avoid diarrhoea, which affects nutritional problems (24). Nevertheless, this hypothesis still needs stronger

verification with various study settings. However, there was no determinant of CED in pregnant women with low nutrient intake.

CED may have occurred due to lack of nutrients itself instead of determinant factors.

The present study concludes that age and level of education are potentially determinant factors of CED in pregnant women. However, among those who do not consume carbohydrate and protein, there were no significant determinants of CED. There should be efforts made on the part of pregnant women themselves and the government, in general, to prevent CED.

Conflict of interest

Authors declare no conflict of interests.

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