Research Article

Nutrition Effect on Iron, TIBC and Albumin Level in Underweight Pregnant Women for Preventing Underweight Baby

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ABSTRACT

According to data from the Indonesian Ministry of Health (2018) stunting is the nutritional problems for children under age of five, where in 2017 about 22.2% children under five experienced stunting. Indonesia is the third country with the highest prevalence stunting in Southeast Asia, where the average in 2005-2017 was 36.4% (WHO). This study focused on providing micronutrient supplements to pregnant women with CED for the prevention of stunting in newborns. Aims to analyze differences in maternal weight, anemia states, albumin levels and albumin levels before and after micronutrient administration. This study used an experimental pre and post test with randomization in the group of pregnant women with CED in Made Surabaya sub-district. Results: Weight comparison ($P < 0.001$) was significant; Comparison of LILA ($P < 0.001$) was significant; The ratio of Hb ($P < 0.001$) was significant; Albumin ratio ($P < 0.001$) was significant; The ratio of serum iron ($P = 0.015$) was significant; TIBC comparison ($P = 0.004$) was significant. In this study, the results of comparative analysis of CED pregnant women were given micronutrient supplementation and without administration, where in the analysis of body weight, LILA, Hb, Albumin, Serum iron and TIBC showed significant differences.

Keywords: Micronutrients, CED, stunting, anemia, albumin

INTRODUCTION

Stunting is a condition of children bellow 5th years with a length or height which not in accordance with age. Measured length or height > -2 SD median child growth standard from WHO, where stunting is a chronic nutritional problem caused by socio-economic conditions, maternal nutrition during pregnancy, infant morbidity and lack of infant nutrition. Stunting has an impact on toddlers, who experience difficulties in physical and cognitive development.[1]

According to the Data and Information Center of the Indonesian Ministry of Health in 2018, stunting is a nutritional problem in the world, where in 2017 it was found that 22.2% or around 150.8 million children under age of five experienced stunting, 55% occurred in Asia (South Asia 58.7% and Central Asia 0.9%). Indonesia is on the highest third prevalence in Southeast Asia, where the average in 2005-2017 was 36.4%.[1]

In the last decade, the critical period of growth and its impact that causes stunting has attracted attention. Nutrition education interventions to regulate food security and nutritional supplementation in situations where food will provide benefits for the linear growth of children.[2]

PERMENKES RI no. 39 year 2016 there are regulations related to PIS-PK (Healthy Indonesia Program with a Family Approach) to reduce the percentage of stunting by ensuring the nutritional adequacy of pregnant women on the regular basis. The actions taken are regulating nutritional intake, monitoring the increase in maternal weight during pregnancy, measuring upper circumference (LILA) before or during pregnancy and measuring anemia levels in pregnant women.[3,4]

Currently the cause of death in children are poor nutrition, one of the consequences is stunting, stunting lead to higher risk of mortality as a child, which reduced physical, cognitive dan educational attainments and lifelong health problems from reduced immunity. The long term effect are higher risk for lower development levels, decreased earnings and economic output, hamper economic growth for generation.[5]

Government has publish some of prevention way to become stunting, which are dietary supplementation, micronutrient supplementation, mandatory food fortification,

DOI: 10.20527/jbk.v8i1.12520 2022; 8(1): 39-44

infection control, nutrition promotion and behavior change, infant and young child feeding, early child care and development and water sanitation hygiene.[6]

Based on the existing background, a study was conducted on the provision of micronutrient supplements to pregnant women with CED for the prevention of stunting in newborns. Research by Charles (2021) shows that preganant women with CED found a decreasing in hemoglobin status compared to normal pregnant woman.[4]

This study aims to analyze differences in maternal weight before and after micronutrient administration, analyze baby's weight at birth, analyze anemia in pregnant women with CED, analyze albumin levels and analyze the relationship between albumin and infant weight outcomes.

METHOD

The research type is an pre and port test experimental. This study uses randomization of the population of pregnant women with CED in the district of Made Surabaya. This study aims to examine the effect of giving micronutrient supplements to pregnant women with CED for the prevention of stunting in newborns.

The study population was pregnant women with CED in Made sub-district in the third trimester. From the results of the sample calculation using the lameshow formula, the number of samples was 25. The sample collected by simple randomnization from the pregnant woman in Made district territory. We grouping into two, which are, normal pregnant woman and pregnant woman with CED. Statistic analyze using saphiro-wilk to find difference before and after treatment.

Treatment on this research using micronutrition and micronutririon. We socializing regarding the demand of pregnant woman and the callory needed. We give to all the pregnant woman are multivitamin combined with DHA. Pregnant woman given a milk formula special for pregnant woman to maintain the consumption of micronutrient. The treatment were given from 3rd trimester untuk the baby were born.

The inclusion criteria of this study were 3rd trimester with the criteria of being pregnant with CED. Pregnant woman with CED based on the calculation of the upper arm circumference. Exclusion criteria were pregnant patients outside the 3rd trimester and already expose to intervention before the research was done.

The independent variable in this study was the administration of multivitamins to pregnant women with CED in the third trimester. The dependent variables are maternal weight gain, newborn weight, anemia in pregnant women with CED and blood albumin levels Analisa statistic menggunakan saphiro walk.

RESULT AND DISCUSSION

These results was one of the many reports that research the effect of CED pregnant woman. CED on pregnant was one of the indicators of socioeconomic status as well as occupation on one country. One of the wealthy indicator of one country was the CED status on their public. In Indonesia specially in East Java we still found that CED still have higher presentation compared to other province. The CED status not only caused by socioeconomic but the knowledge of good nutrition was the main reason, why CED still our main problem.[4]

CED on pregnant woman have outcome worse than normal pregnant woman. The effect targeted to mother and children. For mother there will be systematic change that can effect pregnancy and the parturition complication and for the baby will be causing many side effect start from the underweight the growth of brain and the long effect can caused the stunting for the baby growth.[4]

This research sampling of 25 pregnant women with chronic energy deficiency, we conduct our pre test for measure the initial characteristic of the research.

Table 1. Research sample charactherize

No	Category	Mean ± SD	P value
1	Maternal Age	27,56 ± 4,83	0,013
2	Pregnancy age	29,24 ± 1,20	<0,0001
3	Mother Weight before pregnant	43,16 ± 4,85	0,008
4	Height	154,68 ± 4,44	0,004
5	BMI	18,01 ± 1,57	0,011
6	Systolic	105,92 ± 7,14	<0,0001
7	Diastolic	68,04 ± 6,20	0,005
8	Birthweight	2974±327,16	0,136

From the table we characterized 8 categories which are maternal age, pregnancy age, mother weight before pregnant, height, BMI, systolic pressure, Diastolic pressure, birthweight.

In this research, we found the difference in maternal age between the samples (27,56 ± 4,83; p: 0,013). The difference shows that there are a certain range in our sample. It shows that the underweight pregnant woman could happen from the early age to the advance of pregnancy. This result same with the Liu Bun result which the wide range variation of age could be happen in underweight pregnancy.[7]

From the pregnancy age, we found the difference of normal pregnant woman and CED pregnant woman are (29,24 ± 1,20; p< 0,0001), we found the difference in our research sampel, but all the sample are on their third trimester (more than 28 weeks). To homogenize the sample we use the third smester pregnant woman to be treated. This result are same with the recently research by Charles (2021) which the treatment was given in third trimester and found that the improvement in maternal status on CED preganant woman.[4]

This research measure mother body weight before pregnant, and shows that there are difference between normal pregnant woman and CED pregnant woman. The difference is 43,16± 4,85; p:0,008. This value shows that CED pregnant woman weight bellow the normal pregnant woman. This result same with Hendera research that shows difference in mother weight for CED pregnant woman. [8]

We compared pregnant woman height to find the difference between CED and normal pregnant woman. We found there are difference (154,68 ± 4,44; p: 0,004). It shows that the normal pregnant woman has height more than the CED pregnant woman. This result shows that CED is a chronically disease that can be start from beginning of life. Based on Winkivst research, Indonesian woman with CED has height bellow the standard range woman, therefore many CED preganant woman has height bellow the normal pregnant woman.[9]

Studies in other countries, investigated many risk factors among women with CED. One of the predictor is Body Mass index (BMI) among woman with CED. BMI related to socioeconomic status, the family's house environement and parity level also educational background. In our research BMI level has difference between CED pregnant woman and normal pregnant woman, the result is corelated with Winkivst research that BMI related to the CED pregnant woman. Based on the research said that BMI related to economic access and inadequate access to health care and reproductive stress.[9]

This research shows there are differenece ini systolic pressure and diastolic pressure between CED pregnant woman and normal pregannat woman. From our research shows that the CED pregnant woman has blood pressure bellow the normal pregnant woman (systolic 105,92 ± 7,14; p<0,0001 and diastolic 68,04 ± 6,20; p: 0,005). This result has the same outcome with Sugeng research, 2019. The research shows there are no correlation between blood pressure and pregnant woman status, almost all the pregnant woman with CED have normal blood pressure and low blood pressure.[10]

Birthweight is the indicator for a healthy pregnant. Birthweight related tomultifactorial and one of the main factor is mother nutrient. In this research we measure the baby birthweight for all the pregnant woman, which are CED pregnant woman and normal pregnant woman, which have be treated with multivitamin, formula milk and macronutrient. The research shows that there are no difference (2974±327,16; p:0,316) between treated CED pregnant woman and normal pregnant womant which both of them were treated. The result of this research similar with the Rahajoe research that shows the treated CED pregnant woman has impact on birthweight.[11]

Tabel 2. Analysis of CED Pregnant Woman multifactor

No.	Deskripsi	Kategori	Mean ± SD	Sig	Nilai p
1.	Maternal Weight	Before Treatment	47,84 ± 4,27	0,006	P <0,001
		After Treatment	52,32 ± 4,29	0,005	
2.	LILA	Before Treatment	22,26 ± 0,28	0,004	P <0,001
		After Treatment	22,88 ± 0,28	<0,0001	

No.	Deskripsi	Kategori	Mean ± SD	Sig	Nilai p
3.	Hb	Before Treatment	8,53 ± 0,22	0,006	P <0,001
		After Treatment	9,79 ± 0,26	0,023	
4.	Albumin	Before Treatment	3,52 ± 0,32	0,006	P <0,001
		After Treatment	3,82 ± 0,45	0,368	
5.	Iron	Before Treatment	109,65 ± 30,89	0,016	P = 0,015
		After Treatment	102,21 ± 29,51	0,244	
6.	TIBC	Before Treatment	236,84 ± 22,16	0,012	P = 0,004
		After Treatment	227,32 ±22,8	0,644	

Based on the research, the analysis of the examination of body weight before and after treatment, it was found that there was a significant change (P < 0.001). Based on research conducted by Rully Hevrialni and Yan Sartika (2021) regarding the intervention of pregnant women with CED through Continuity of Midwifery Care (CoMC) in preventing stunting, it was found that the difference with P value = 0.069 means that it has no effect on maternal weight gain given Food addition, but the difference could be due to the duration of the research conducted. Similar results to the research seen in Sri Handayani Bakri's (2021) study regarding the effect of supplementary food (MT) with increasing body weight, Hb and albumin levels in CED pregnant women, where the statistical test results P < 0.05 which means it looks significant effect on weight gain after supplementary feeding for pregnant women with CED in Labuan Lombok.[12–14]

Based on the research, the results of the upper arm circumference measure showed a significant change (P <0.001) in the LILA measurement of pregnant women with CED before and after treatment. Based on the research conducted by Sishi Clara Anggy Ayu (2021) regarding the provision of PMT biscuits to increase the LILA of pregnant women at the Rengas Dengklok Public Health Center, Karawang Regency in 2021, the results obtained P < 0.05 which means that there is a significant effect on the LILA of pregnant women with CED after giving PMT. The results from Salmon Charles Siahaan, (2021) regarding the intervention of pregnant women with CED through micronutrient supplementation in Surabaya in 2019, where P = 0.754 means that there was no significant difference between CED pregnant women who were given DHA and normal pregnancy. Which found from the research that micronutrient supplementation can increase the size of LILA from the CED pregnant woman. [4,15]

Recently the relation of hemoglobin examination on pregnant women with CED, show a difference (P <0.001) between before and after treatment. Looking at the research conducted by Sri Handayani Bakri where the results of P = 0.021 showed a difference in changes in Hb levels between those who received treatment and without treatment. Similar results were found in a study conducted by Amanda Elma Monica (2021) who examined Fe tablets and free-range chicken liver on increasing Hb levels of pregnant women, where the results were P < 0.05 which showed a significant effect on Hb in third trimester pregnant women at Pejawaran Public Health Center. Banjarnegara Regency. Research by hendera (2021) shows the correlation between HB states on CED pregnant woman with the Vitamin D states. The research show there is difference between normal pregnant woman dan CED pregnant woman.[8,16,17]

Based on the research, albumin levels as an indicator of changes in protein levels in CED pregnant women, there was a significant difference (P <0.001) in levels of pregnant women before and after treatment. Based on research conducted by St. Pasriany (2018) found supporting results, where protein administration was able to increase albumin levels from 2.1 g/dL to 3.0 g/dL. Other studies have shown different results, such as the research conducted by Sri Handayani Bakri where the results of P = 0.066 means that there is no significant difference in albumin levels of pregnant women with SEZ with treatment and without treatment. Wada (2021) shows that albumin level in third semester pregnancy correlated with the infant weight.[13,18]

DOI: 10.20527/jbk.v8i1.12520 2022; 8(1): 39-44

Based on research regarding serum iron levels to determine the causes of anemia before and after micronutrients were given to pregnant women with CED, there were significant changes (P = 0.015). Similar studies regarding the comparison of serum iron in CED pregnant women who are given micronutrient supplementation its still rare, so it is difficult to make comparisons with other or previous studies. In addition, research that has been carried out regarding Total iron binding Capacity (TIBC) in CED pregnant women to show improvement in iron status in CED pregnant women's blood, found a significant change (P = 0.004) between before and after treatment. Similar studies related to the comparison of TIBC in CED pregnant women who are given micronutrient supplementation and without administration are still not many, so it is difficult to make comparisons with other or previous studies. In this study, the average birth weight of babies was 2,974g, indicating that babies born were on the normal weight growth curve, which was not below the red line.[4,11,19,20]

Study by Charles, 2021 shows improvement in weight upper arm circumference, size of fundal heights, biparietal diameter size, Hemoglobin Status, and birthweight. In this study the patient treat with micronutrient on third smester and show an improvement and the better quality of birth weight. This study using ultrasonography measure for evaluating the size of head and body by measure biparietal diameter, abdominal circumference and femur length, the result of the measurement found on the last third trimester show, there are no difference on the size between normal and CED pregnant woman. The results conclude that the baby outcome between CED pregnant and normal pregnant woman after treated by micronutrient have same output.[4]

Studies by Sugeng Wiyono, found in rural area that the majority pregnant's age was over 30 years and 9,2% of pregnant suffer from CED, on second pregnancies and the experience of birthing mostly on second births. Macronutrient and micronutrient still play the important rule for the development of baby intrauterine. Eating habits are one of the causes of CED in pregnant, and the aspects of eating behavior related to the CED status. The research found that the CED status have relationship with knowledge, age, work status, education and poverty status. Educational level have relation to CED based on Nurdin study in Jeneponto.[10]

Studied in other countries also investigated risk factor for CED in pregnant woman. For example, BMI as predictor among mothers have been explored within the Nutrition Collaborative Research Support Program (CRSO) in Egypt, Mexico and Kenya. In this countries BMI not related to socioeconomic status, family's house, education level and parity. Compares to CED on Indonesia country, many caused by socioeconomic status and family's issue. In Egypt, age was associated with CED and BMI, more ageing and BMI more increase. In Bangladesh, educational level play important rule in CED status of one woman. In East Java, prevalence CED higher among women of lower parity. Another problem that corelated to CED especially in pregnant woman are infection. Infectious disease still the main problem in other islands and also in rural areas and among young people. In Indonesian we faced double disease burden where nutrition was the key role to finish the issue. Infection and nutrition make the CED become worse in the outcome of the pregnancy.[9]

In sum, Indonesia still faces the burden of CED in the future of our next generation. From this research we found there are some of many complications from CED pregnant woman, like: anemia, hypoalbuminemia, low weight, and the low iron states in mother. From our research we can sew that the maintenance of micronutrient, macronutrient and vitamin during the pregnancy even though we start in 3rd trimester of pregnancy, the result has become better that without any intervention. Any treatment for CED pregnant woman can make better outcome for mother and baby.

CONCLUSION

In this study, the results of the comparative analysis of CED pregnant women who were given micronutrient supplementation and normal pregnant women were obtained, in our analysis of body weight, LILA, Hb, Albumin, Serum iron and TIBC showed significant differences. This shows an improvement in all research markers after the intervention of providing adequate micronutrients.

ACKNOWLEDGEMENT

Apreciation to Ciputra University Surabaya for providing support for the on going research and to all parties who have been involved and helped to complete this research.

REFERENCES

1. Kementerian Kesehatan. Situasi Balita Pendek (Stunting) di Indoneisa. Atmarita, Zahrani Y, editors. Buletin Jendela Data dan Infomasi Kesehatan. 1st ed. 2018;1.
2. Colombo J, Koletzko B (Berthold), Lampl ML. Recent research in nutrition and growth : 89th Nestlé Nutrition Institute

Workshop, Dubai, March 2017. Vol. 89. 2017. 105–113 p.
3. Henukh D, Siti Nur Asyah Jamillah Ahmad, Aning Pattypeilohy. The Relationship Between Maternal Weight Gain and Newborn Weight With the Frequency of Stunting in South Central Timor District (TTS). EMBRIO. 2021 May 31;13(1):46–55.
4. Charles Siahaan S, Henderi H, Pristiwanto Dwi Safitri N, Ester Wakas B, Fadhil Ihsan Pratama M. Ibu Hamil Dengan Kurang Energi Kalori Melalui Suplementasi Mikronutrien Di, Intervensi. 2021;44(1):17–27. Available from: http://jurnalmka.fk.unand.ac.id
5. Cooper MW, Brown ME, Hochrainer-Stigler S, Pflug G, McCallum I, Fritz S, et al. Mapping the effects of drought on child stunting. Proceedings of the National Academy of Sciences. 2019 Aug 27;116(35):17219–24.
6. Herrin AN, Abrigo MRM, Tam ZC, Ortiz DAP. Child stunting prevention: The challenge of mobilizing local governments for national impact . 2018.
7. Liu B, Xu G, Sun Y, Du Y, Gao R,Snetselaar LG, et al. Association between maternal pre-pregnancy obesity and preterm birth according to maternal age and race or ethnicity: a population-based study. The Lancet Diabetes & Endocrinology. 2019 Sep;7(9):707–14.
8. Henderi H, Charles S, Siahaan PT, Kusumah IP, Cahjono H, Tannus FA, et al. Correlation of vitamin D with ferritin in pregnant mothers chronic energy deficiency of the second trimester. Vol. 17, Berkala Kedokteran. 2021.
9. Winkvist A, Nurdiati DS, Stenlund H, Hakimi M. Predicting under- and overnutrition among women of reproductive age: a population-based study in central Java, Indonesia. Public Health Nutrition. 2000 Jun 2;3(2):193–200.
10. Wiyono S, Burhani A, Harjatmo TP, Ngadiarti I, Prayitno N, . M, et al. Study causes of chronic energy deficiency of pregnant in the rural areas. International Journal Of Community Medicine And Public Health. 2020 Jan 28;7(2):443.
11. Santoso RI, Benyamin G, Messakh Y. Pemeriksaan laboratorium pada masa pubertas. Proseding Webinar Gerakan Anak Muda Lindungi Reproduksi Indonesia. 2021;1(1):3–3.
12. Hevrialni R, Sartika Y. Intervensi pendampingan kurangan energi kronik (KEK) pada ibu hamil engan pendekatan continuity of midwifery care (CoMC) sebagai upaya pencegahan stunting. Jurnal Riset Kesehatan Poltekkes Depkes Bandung. 2021 Oct 29;13(2):310–8.
13. Bakri S. Pengaruh pemberian makanan tambahan (MT) terhadap peningkatan berat badan, kadar hemoglobin (Hb) dan albumin pada ibu hamil kurang energi kronis. AL-IQRA MEDICAL JOURNAL : JURNAL BERKALA ILMIAH KEDOKTERAN. 2021;4(1):19–23.
14. Tulmaç ÖB, Dağ ZÖ, Erdoğan F, Sayan CD, Sağsöz N. Association of body mass index and weight gain patterns with albumin excretion in pregnancy. Journal of Obstetrics and Gynaecology Research. 2018 Mar;44(3):384–9.
15. clara anggy ayu S, Suciawati A. Efektivitas pemberian biscuit PMT terhadap peningkatan lingkar lengan atas ibu hamil di puskesmas Rengas Dengklok kabupaten Karawang tahun 2021. Mataram [Internet]. 2021;104(2):104–10. Available from: www.lppm-mfh.com
16. Monica A, Kusumawinakhyu T, Maulana A, Susiyadi, Putra R. Pengaruh konsumsi tablet fe dan ayam kampung. Jurnal Universitas Muhammadiyah Sumatera Utara. 2021;4(3):119–27.
17. Youssry MA, Radwan AM, Gebreel MA, Patel TA. Prevalence of Maternal Anemia in Pregnancy: The Effect of Maternal Hemoglobin Level on Pregnancy and Neonatal Outcome. Open Journal of Obstetrics and Gynecology. 2018;08(07):676–87.
18. Wada Y, Ehara T, Tabata F, Komatsu Y, Izumi H, Kawakami S, et al. Maternal Serum Albumin Redox State Is Associated with Infant Birth Weight in Japanese Pregnant Women. Nutrients. 2021 May 22;13(6):1764.
19. Noor MS, Husaini H, Puteri AO, Hidayat DT. Hubungan Faktor Ibu, Janin, dan Plasenta dengan Kejadian Berat Badan Lahir Rendah (BBLR). Jurnal Berkala Kesehatan. 2020 Nov 30;6(2):75.
20. Mahmood T, Rehman AU, Tserenpil G, Siddiqui F, Ahmed M, Siraj F, et al. The Association between Iron-deficiency Anemia and Adverse Pregnancy Outcomes: A Retrospective Report from Pakistan. Cureus. 2019 Oct 7;