

Original Article

The Effect of Deppamil Dangke in Increasing Upper Arm Circumference and Haemoglobin Levels in Pregnant Women with Chronic Energy Deficiency

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ABSTRACT

The prevalence of chronic energy deficiency in pregnant women in Indonesia is relatively high, requiring some actions to be taken to lower it. This study aims to analyze the roles of deppamil dangke administration in increasing upper arm circumference and haemoglobin levels in pregnant women with chronic energy deficiency (CED) in Enrekang Regency. This research is of the quasi-experimental type with a non-equivalent control group design. The population consisted of 28 CED pregnant women with gestational age >20 weeks using exhaustive sampling technique, there were two test groups involved, namely, an intervention group and a control group, each consisting of 14 samples. The intervention group was given deppamil dangke 6 pieces/day (60 gr) plus government food supplement while the control group was given government food supplement 3 pieces/day (100 gr) with an intervention duration of 18 weeks. UAC and haemoglobin levels were measured before and after the intervention. The results of this study indicated that there was an increase in the size of UAC in both groups but not significantly different as both the intervention and control groups experienced increases in upper arm circumference with the same p value ($p = 0.001$). But it was significant in increasing the hemoglobin level of CED pregnant women because the intervention group experienced a significant increase with a p value of 0.020 while the control group had a p value of 0.506. Future.

Keywords: *Deppamil Dangke, Upper Arm Circumference, Haemoglobin Levels, Pregnant Women with Chronic Energy Deficiency.*

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INTRODUCTION

The nutritional problems of pregnant women with chronic energy deficiency (CED) in Indonesia are still highly prevalent¹. Chronic energy deficiency is a condition of malnutrition that has lasted for a long time, thereby resulting in non-fulfilment of the nutritional needs of pregnant women². A body mass index (BMI) below 18.5 cm and upper arm circumference (UAC) below 23.5 cm are signs of CED in

pregnant women³. UAC is not an indicator of SEZ but can be used as an indicator of SEZ risk⁴. Research shows that there is a relationship between the size of the upper arm circumference and the baby's birth weight⁵. UAC describes how a person consumes energy and protein in the long term⁶. CED causes pregnant women to be unable to meet the needs of their foetuses and their own due to increased blood volume need for growth⁷.

Other studies have shown that there is a

relationship between CED pregnant women and the incidence of anemia⁸. And there are still pregnant women who do not adhere to consuming Fe tablets⁹. The lack of macro- and micronutrients in the womb can affect the condition of the baby before birth¹⁰. Monitoring pregnant women with CED through education/socialization is important to reduce the prevalence of CED¹¹. In the context of Indonesia, one way to overcome CED in pregnant women is to provide food supplements that contain energy and iron for pregnant women¹². Local wisdom can be incorporated in making innovations in processing food products, which can be used as an alternative to address existing nutritional problems¹³.

Enrekang Regency is a producer of animal food products from cow/buffalo milk. One of such products is dangke. It has been reported by previous research that dangke is a superior local food product from Enrekang Regency that contains high nutrients important for the body¹⁴. Dangke is made using papaya sap and fermented milk starter culture inoculation technology with isolated *Lactococcus lactis* in a banana leaf wrap¹⁵. Dangke contains nutrients such as fat, protein, and carbohydrate, as well as water, and it can be used as a basic ingredient for various side dishes, such as grilled dangke, pepes, and even for various cakes and crackers¹³. In an examination by the Makassar Health Laboratory Center in 2022 dangke was reported to contain iron (Fe) at 0.86 µg/g, calcium at 1,281.37 µg/g, carbohydrate at 0.74%, and glucose 0.82%. In another study, it was reported to contain carbohydrate at 19.36%, lactic acid at 0.48%, protein at 24.54%, water at 44.93%, and fat at 8.03% at pH 4.8¹⁴. Previous research revealed that giving dangke crackers at 100 g/day to anemic pregnant women for 12 weeks could increase haemoglobin levels¹⁶.

Providing supplemental food is one of the strategies to address nutritional problems in Indonesia¹⁷. Considering that dangke is rich in nutrients needed by pregnant women, it can be processed as a basic ingredient into a supplementary food product in the form of pregnancy cookies called "deppamil dangke", which means cookies for pregnant women in the local language spoken in Enrekang Regency. Deppamil dangke had gone through an organoleptic test at a public health center in Makassar on 30 pregnant female panelists. Using a human sensory approach, the test was

conducted to assess taste, texture, color, and aroma to determine the quality of this product. The results of an analysis using SPSS (Statistical Package for the Social Sciences) show that most pregnant women liked the taste, aroma, texture, and color of deppamil dangke. Thus, it can be concluded that deppamil dangke is to the liking of pregnant women.

This study aims to analyze the roles of deppamil dangke administration in increasing upper arm circumference and haemoglobin levels in pregnant women with chronic energy deficiency (CED) in Enrekang Regency.

METHOD

This research is of the quantitative, *quasi-experimental* type with a *non-equivalent* control group design. It was carried out in Enrekang Regency for 18 weeks from November 2022 to March 2023. The sample was taken by *exhaustive sampling* technique, where the population and sample were the same. The sample consisted of pregnant women with CED and gestational ages of > 20 weeks in the working area of the Public Health Center of Enrekang Regency. The sample of 28 respondents was divided into two groups, namely, an intervention groups and a control group, each consisting of 14 respondents. The intervention group was given 6 pieces/day (60 gr) of *deppamil dangke* plus supplementary food from the government until delivery, while the control group only consumed government-provided supplementary food (100 gr/day) *with an intervention duration of 18 weeks*. UAC and haemoglobin levels were measured before and after intervention. The data were analyzed with the *Wilcoxon* and *Mann-Whitney* tests to see if the intervention had an effect.

The ingredients used were *dangke*, an egg yolk, margarine, palm sugar, cocoa powder, chocolate chips, and wheat flour. The equipment used included an oven, oven trays, baking sheets, a spatula, a digital scale, a cheese grater, and cake molds. The making of the cookies began with pulverizing 100 grams of *dangke* using a cheese grater, followed by mixing it with 1 egg yolk, 100 grams of margarine, 50 grams of palm sugar, 4 grams of cocoa powder until everything was well-mixed. One hundred and seventy-five grams of flour was added then. The dough produced was kneaded well, and then 20 grams of chocolate chips was added to it. The researcher left the

dough for a while to heat an oven to 150 °C for 10 minutes. To do so, the heating system was adjusted up and down. While waiting for the oven to be heated to the desired temperature, the dough was molded into some smaller pieces on a baking tray with a baking sheet separating the dough from the surface of the baking tray. The molded pieces of dough was then baked at 150 °C for 15 minutes. This recipe has been

patented by the Ministry of Law and Human Rights with an IPR certificate in 2022. This research has received ethical approval by the commission ethics of Muhammadiyah University health research in Makassar with Number 210/UM.PKE/XI/44/2022.

Table 1. Distribution of Respondent Characteristics.

Respondent Characteristics		Research Respondent Groups				p-value
		Intervention		Control		
		n	%	n	%	
Age	17 - 26 years	7	50.0	0	0	0.008
	27 - 36 years	6	42.9	13	92.9	
	37 - 46 years	1	7.1	1	7.1	
Gestational Age	20 - 24 weeks	6	42.9	10	71.4	0.252
	≥ 25 weeks	8	57.1	4	28.6	
Parity	P 1	6	42.9	2	14.3	0.077
	P 2	5	35.7	6	42.9	
	P 3	2	14.3	1	7.1	
	P 4	0	0.0	5	35.7	
	P 5	1	7.1	0	0.0	
Occupation	Teacher	1	7.1	3	21.4	0.331
	Honorary	0	0.0	1	7.1	
	Housewife	5	35.7	6	42.9	
	Farmer	8	57.1	4	28.6	

*Chi-Square test and Fisher exact test (table 2x2)

Table 1 shows the demographic characteristics of respondents in the intervention and control groups. In terms of age, there was a difference between the intervention and control groups, where the average age of the intervention group was 26.42 ± 6.29 years and the average age of the control group was 32.14 ± 4.36 years. In the control group, the majority of respondents were in the 27–36 years age category (13 people, 92.9%), while in the intervention group, the majority were in the 17–26 years age group (7 people, 50.0%). In terms of gestational age, the control group was dominated by those with gestational ages of 20–24 weeks (71.4%) and the intervention group was dominated by those

with gestational ages of ≥ 25 weeks (57.1%). However, there was no difference in gestational age between the intervention and control groups ($p = 0.252$). In terms of parity, there was no significant difference between the control and intervention groups ($p = 0.077$). While the intervention group was dominated by para 1 (6 people, 42.9%), the control group was dominated by para 2 (6 people, 42.9%). Likewise, in terms of job, there was no difference between the intervention and control groups either ($p = 0.331$). The largest proportion of the intervention group comprised farmers (57.1%), while the largest proportion of the control group did housewives (42.9%).

Table 2. Distribution of Respondent Characteristics According to Energy Intake.

Energy Intake		Research Respondent Group				p-value
		Intervention		Control		
		n	%	n	%	
Pre	<2527 kcal	13	92.9	12	85.7	1.000
	≥2527 kcal	1	7.1	2	14.3	
Post	<2527 kcal	0	0	7	50.0	0.006
	≥2527 kcal	14	100	7	50.0	

*Chi-Square test and Fisher exact test (table 2x2)

Table 2 shows the distribution of respondents by food intake, where there was no difference between the intervention and control groups prior to intervention ($p = 1,000$), with both groups being dominated by energy intake of $< 2,527$ kcal. However,

after intervention, 100% of the respondents in the intervention group had an increase in energy intake ($> 2,527$ kcal), while in the control group only 50% did. There was a significant difference between both groups after intervention ($p = 0.006$).

Table 3. Changes in the Upper Arm Circumference (UAC) of the Intervention and Control Groups before and after Intervention.

Variables	n	Mean \pm SD		Δ (Post - Pre)	p-value
		Pre	Post		
Upper Arm Circumference (UAC)					
Intervention	14	21.71 \pm 0.91	24.10 \pm 0.90	2.39 \pm 1.09	0.001 ^a
Control	14	21.46 \pm 1.39	23.77 \pm 24.10	2.30 \pm 1.38	0.001 ^a
p-value	14	0.745 ^b	0.170 ^b	0.627 ^b	

^aWilcoxon Test

^bMann-Whitney U test

Table 3 shows that, before intervention, there was no difference in UAC between the intervention and control groups ($p = 0.745$) with an average values of 21.71 \pm 0.91 cm and 21.46 \pm 1.39 cm, respectively. There was no difference in UAC post-intervention between the intervention and control groups ($p = 0.170$)

either, with average values of 24.10 \pm 0.90 cm and 23.77 \pm 24.10 cm, respectively. The differences between the posttest and pretest average values of UAC in the intervention and control groups did not appear to be different, where both groups experienced an increase in value with a p-value of 0.001 each.

Table 4. Changes in the and Haemoglobin Levels of the Intervention and Control Groups before and after Intervention.

Variables	n	Mean \pm SD		Δ (Post - Pre)	p-value
		Pre	Post		
Haemoglobin Levels					
Intervention	14	13.00 \pm 0.87	14.39 \pm 1.52	1.38 \pm 1.72	0.020 ^a
Control	14	11.40 \pm 1.25	11.74 \pm 1.62	0.24 \pm 1.04	0.506 ^a
p-value	14	0.001 ^b	0.001 ^b	0.029 ^b	

^aWilcoxon Test

^bMann-Whitney U test

Table 4. show that, there was no difference in haemoglobin levels between the intervention and control groups, the intervention and control groups were significantly different prior to the intervention, with values of 13.00 \pm 0.87 gr% and 11.40 \pm 1.25 gr%, respectively ($p = 0.001$). After intervention, the two groups experienced increases in Hb. The average value of the intervention group was greater after treatment (14.39 \pm 1.52 gr%), with an increase of 1.38 \pm 1.72 gr%, and so was the average value of the control group (11.74 \pm 1.62 gr%), with an increase of 0.24 \pm 1.04 gr% (p -values < 0.001 and 0.029, respectively). In respect to haemoglobin levels, the intervention group experienced a significant change after intervention ($p = 0.020$), but the control group did not ($p = 0.506$).

DISCUSSION

The Effect of Giving Deppamil Dangke on Increasing the Upper Arm Circumference.

In pregnant women, UAC describes the state of long-term energy and protein consumption. Chronic energy deficiency prevents pregnant women from having adequate nutrient reserves for fetal growth and development⁶. Pregnant women with CED inadequately consume macronutrients such as energy, carbohydrate, protein and fat¹⁸. However, UAC is not an indicator of SEZ because it cannot change in a short period of time. Therefore, it cannot be used as a benchmark to describe a person's condition at a particular time. However, its value can be used as an indicator of CED risk⁴.

Although none of the two groups experienced a statistically significant increase, the administration of *deppamil dangke* and government-provided complementary food had the same effect in increasing UAC due to the improved nutrition taken by pregnant women who experienced CED. This is evidenced by the increase in food intake after intervention among pregnant women who consumed either *deppamil dangke* or government-provided complementary food, which resulted in the increase in their upper arm circumference to the normal limits.

From the data on the distribution of respondents' food intake, it can be seen that more respondents in the intervention group than in the control group had a food intake of < 2,527 kcal. However, the post-intervention results obtained show that everyone in the intervention group experienced nutritional improvements. The control group also had an increase in nutrition intake, but not in the same distribution of the intervention group. Only 50% of the control group had a food intake of > 2,527 kcal post-intervention. This finding mirrors that of a study which found a significant difference in UAC among pregnant women with CED after the administration of government-provided supplementary food¹⁹. A small number of pregnant women who received the intervention did not reach the normal UAC category, but none of them experienced a reduction in UAC. This might be due to women not regularly taking additional food or them experiencing boredom. Their intake of basic nutrition in terms of both quantity and quality did not meet the standards of balanced nutritional intake. Otherwise, the women were pursuing unhealthy lifestyles¹⁹.

Based on the data gained in the study, the researcher assumed that the occurrence of a stagnated measure of UAC in some of the pregnant women with CED in the intervention group was influenced by the age of the pregnant women. In the intervention group, there were seven people (50%) who were aged 17–26 years and one person (7.1%) who as aged 37–46 years, indicating that several respondents were under 20 years old and one was over 35 years old. The ages below 20 years and above 35 years are risky for pregnancy. The reproductive organs of younger women are not biologically ready for conception. Additionally, younger women have yet to reach maturity psychologically. As a result, the nutrition

required by the pregnant women's bodies and the fetuses is unbalanced, which could also lead to malnutrition. On the other hand, the body of a woman older than 35 years needs more energy because the body's system is starting to deteriorate⁷.

Pregnant women with chronic malnutrition are advised to consume protein, especially from animal sources²⁰. The consumption of *deppamil dangke*, which is high in protein, may not be followed by the intake of other protein-high foods due to the demographic and occupational conditions of the respondents. On average, the respondents in the intervention group were farmers who consumed more greens than meat, fish, or chicken. Enrekang Regency is famous for its agricultural vegetable produce but does not have a sea area, so it derives animal protein from the outside. Chicken and meat are only on the menu on certain occasions, so that the daily diet is dominated by vegetable protein only.

The location where the research was conducted was also diversified. The control group resided in downtown Enrekang, and the individuals within the group, who were dominated by housewives, had an easy access to markets and varied food, which enabled them to increase the intake of more diverse and abundant foods. As found in a research study in Afghanistan, the types of foods consumed in rural and urban areas are clearly different, where urban people tend to have a higher interest in what they consume than do those living in rural areas²¹. Therefore, even though no intervention was given, the control group still experienced nutritional improvements due to their more varied food intake. Parity might also have an effect, considering that the intervention group was dominated by primigravida (42.9%). In the control group, primigravida only accounted for 14.3%. Pregnant women who are pregnant for the first time may have different knowledge than multigravida. Primigravida usually have a higher degree of self-protectiveness and are generally afraid to take varied foods. They may also lack of the experience and understanding to maintain pregnancy⁷. In addition, high parity indicates a higher number of family members. High-parity households usually reduce the consumption of fish, meat, eggs, and milk, which are relatively expensive sources of animal protein²².

The Effect of Giving *Deppamil Dangke* in Increasing Haemoglobin Levels.

In pregnant women, CED is closely related to the incidence of anemia⁸, where the former is a risk factor for the latter²³. A prolonged deficiency or inadequate intake of macronutrient and micronutrient will lead to anemia^{18:24}. The results of the analysis of changes in hemoglobin levels show that all pregnant women with CED experienced an increase in hemoglobin levels, but the increase was more significant in the intervention group than in the control group. This finding is in line with another study on *dangke*, which found a significant increase in haemoglobin levels among anemic pregnant women¹⁶.

In pregnancy, women experience some physiological changes, including increases in fluid volume and red blood cells as well as decreases in protein nutrition in circulating blood and in micronutrients²⁵. The needs of pregnant women increase, especially at the end of the second trimester, when a hemodilution process occurs. This hemodilution process causes an increase in blood volume, which affects the hemoglobin concentration²⁶. A deficiency in the amount of hemoglobin results in an obstructed supply of nutrients and oxygen to the foetus, resulting in impaired growth and development of the foetus²⁵.

One of the macronutrients that plays an important role in increasing hemoglobin levels is protein. Protein is useful as a building and regulatory substance which also has a role in transporting iron to the spinal cord for the formation of red blood cells²⁷. Protein also helps the absorption of vitamin C to support the process of red blood cell synthesis¹⁸. Protein is the main component of globin, which plays a role in the transportation and storage of iron²⁸. The absorption of iron in the small intestine is assisted by the proteins transferrin and ferritin²⁹. This study is in line with a research finding that there is a significant relationship between protein intake and the incidence of anemia, where the lower the protein intake the lower the hemoglobin level³⁰.

In addition to protein, iron (Fe) is a vital element that is needed for the formation of haemoglobin³¹. Haemoglobin functions to transport oxygen²⁴. In absorbing iron, vitamin C, which functions in iron metabolism, is needed³². It has been found that giving Fe to women during pregnancy is not effective enough in increasing Hb levels³³. So it is still

necessary to consume other sources of iron³⁴. *Dangke*, a food ingredient sourced from processed cow/buffalo milk, contains high protein and iron¹³.

CONCLUSION

From the results of the data analysis conducted in this study, it is concluded that there was an increase in the size of UAC in both groups but not significantly different as both the intervention and control groups experienced increases in upper arm circumference with the same p value. Meanwhile, with respect to haemoglobin levels, the administration of *deppamil dangke* led to a significant increase in the intervention group, with a p value of 0.020. Future researchers are advised to make other preparations from *dangke* as highly nutritious local food.

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CONFLICTS OF INTEREST:

The authors declare no conflict of interest.

REFERENCE

1. Ministry of Health of the Republic of Indonesia. Ministry of Health Performance Report 2020. Ministry of Health Republic of Indonesia. 2021.
2. Nisa LS, Sandra C, Utami S. Causes of Chronic Energy Deficiency in High-Risk Pregnant Women and Utilization of Antenatal Care in the Work Area of the Jelbuk Jember Health Center. *J Adm Health Indonesia*. 2018;6(2):136.
3. Ruaida N, Soumokil O. Correlation between the status of pregnant and underweight women and stunting in toddlers at the Tawiri Health Center, Ambon City. *J Integrated Health (Integrated Heal Journal)*. 2018;9(2):1–7.
4. Achadi EL, Achadi A, Anindita T. Stunting Prevention The Important Role of the First 1000 Days of Life. Achadi EL, Achadi A, Anindita T, Auliya P, editors. 2021.

5. Nuryani, Ayu Mustika Handayani. Relationship of Upper Arm Circumference (LiLA), Hemoglobin (Hb), and Fe Intake on Infant Birth Weight. *Poltekita J Health Sciences* [Internet]. 2022;16(2):228–34. Available from: <https://jurnal.poltekkespalu.ac.id/index.php/JIK/article/view/1255>
6. Ernawati A. Nutritional Issues Among Pregnant Mothers. *J. Litbang.* 2017;13(1):60-9.
7. Husna A, Willis R, Rahmi N, Fahkrina D. Hubungan Pendapatan Keluarga dan Pemberian ASI Eksklusif dengan Kejadian Stunting pada Balita Usia 24-36 Bulan di Wilayah Kerja Puskesmas Sukajaya Kota Sabang. *Journal of Healthcare Technology And Medicine.* 2023;9(1):583-92.
8. Subriah S, Safitri ID, Umar S, Saadong D. Chronic energy deficiency associated with anemia in pregnant women. *J Midwifery Malakbi.* 2021;2(2):30.
9. Pont AV, Lisnawati. Pregnant Mother ' S Consumes Fe Tablets and Anemia in Palu City. *Poltekita J Ilmu Kesehat.* 2020;14(1):76–81.
10. Ningrum N, Hidayatunnikmah N, Rihardini T. Prevent stunting from an early age with nutritious food for pregnant women. *E-Dimas J Servant to the Community.* 2020;11(4):550–5.
11. Sari RE, Ibnu IN, Ramadhani A. Implementation of Monitoring for Pregnant Women with Chronic Lack of Energy in an Effort to Accelerate the Improvement of the First 1000 Days of Life. *Poltekita J Health Sciences.* 2022;16(1):80–8.
12. Syafiq A, Fikawati S, Muharrani NP, Mardatillah. Milk supplementation increases mid-upper arm circumference and haemoglobin level among pregnant women in Kupang, Indonesia: Evidence from a regression discontinuity design. *Malays J Nutr.* 2022;28(2):191–202.
13. Arfan M, Rizal M, Rahmiati D, Nur. Culinary Cultural Identity Study of Dangke Typical Food of Massenrempulu. *J Lingue Language, Culture, and Literature.* 2020;2(1):88–95.
14. Malaka R, Syabil S, Maruddin F. Physico-chemical properties and microstructure of Dangke cheese by inoculated of *Lactococcus lactis* at different temperature storage Physico-chemical properties and microstructure of Dangke cheese by inoculated of *Lactococcus lactis* at different temperatu. *Conf proceeding Acad Bus Retail Manag.* 2017;9(2):292–8.
15. Zakariah MA, Malaka R, Laga A, Ako A. Effect of banana leaf and plastic material packaging on microbial contamination dangke fresh white cheese. *Int J Eng Adv Technol.* 2019;8(4):204–6.
16. Riyandani R, As'ad S, Hidayanty H, Ahmad M, Usman AN. Effectiveness of giving dangke crackers on improving hemoglobin levels in trimester pregnant woman ii with anemia. *Int J Curr Res Rev.* 2020;12(22):158–61.
17. Setyawati E, Nurasmı N, Irnawati I. Study of Nutritional Analysis of Functional Biscuits Substituting Moringa Flour and Snakehead Fish Meal. *J Health Science Sandi Husada.* 2021;10(1):94–104.
18. Abadi E, Putri LAR. Consumption of Macronutrients in Pregnant Women with Chronic Energy Deficiency (KEK) during the Covid-19 Pandemic. *J Health Manarang.* 2020;6(2):85.
19. Pastuty R, Km R, Herawati T, Ministry of Health P, Midwifery PJ. The Effectiveness of the Food Supplement Program towards Pregnancy Women With Chronic Energy Deficiency in Palembang City. *J Public Health Sciences.* 2018;9(3):179–88.
20. Bhutta ZA, Sadiq K. Protein Deficiency [Internet]. Fourth Edi. Vols. 4–4, *Encyclopedia of Human Nutrition.* Elsevier; 2023. 111–115 p. Available from: <http://dx.doi.org/10.1016/B978-0-12-821848-8.00125-6>
21. Oria A, Management BA, Empowerment Y, Shahidi H, Management BA, Member B, et al. Consumption Pattern Within Rural and Urban Household's. 2018;
22. Sari NA. Analysis of Food Consumption Patterns in Urban and Rural Areas and their Relation to Socio-Economic Characteristics in East Kalimantan Province. 2016;69–81.
23. Abdi Utama DM, Sutiari NK, Tresna A,

- Sagung Sawitri AA. Risk Factors Associated with Anemia of Pregnant Women in Dajan Peken Village and Delod Peken Village, Tabanan District in 2019. 2019;1–23.
24. Nugraheni A, Prihatini M, Arifin A, Retiaty F, Ernawati F. Profil Zat Gizi Mikro (Zat Besi, Zink, Vitamin A) dan Kadar Hemoglobin Pada Ibu Hamil. mgmi [Internet]. 30Jul.2021 [cited 27May2023];12(2):119-30. Available from: <http://ejournal2.litbang.kemkes.go.id/index.php/mgmi/article/view/4648>
 25. Widiyanto J, Lismawati G. Maternal age and anemia are risk factors of low birthweight of newborn. *Enferm Clin*. 2019 Mar 1;29:94–7.
 26. Sulaiman M, Flora R, Zulkarnain M, Yuliana I, Tanjung R. Defisiensi Zat Besi dengan Kejadian Anemia pada Ibu Hamil. *Journal of Telenursing (JOTING)* [Internet]. 6Feb.2022 [cited 27May2023];4(1):11-9. Available from: <https://doi.org/10.31539/joting.v4i1.3254>
 27. Kusmiyati M. Cells and Chemical Compounds as The Basis Of Life. 2017;1–228.
 28. Fitriah, AH, Supariasa, IDN, Riyadi, BD, Bakri, B. *Buku Praktis Gizi Ibu Hamil*. 2018. 1–84.
 29. Achebe MM, Gafter-Gvili A. How I treat anemia in pregnancy: Iron, cobalamin, and folate. *Blood*. 2017;129(8):940–9.
 30. Ni'matush Sholihah, Sri Andari, Bambang Wirjatmadi. Correlation between Consumption Levels of Protein, Vitamin C, Iron and Folic Acid with the Incidence of Anemia in Young Girls at SMAN 4 Surabaya. *Amerta Nutr*. 2019;3(3):135–41.
 31. Minhat HS, Thangarajah P. Anaemia and its associated factors among pregnant women in Malaysia. *Malays J Nutr*. 2022;28(1):53–63.
 32. Paramita F. Nutrition in Pregnancy. *Poor*; 2019. 01–37 p.
 33. Sudarmaningsih DP, Hikmah F, Widada NS, Ariningpraja RT. Anemia and Low Birth Weight Risk After Fe Therapy in Pregnancy, Kebayoran Baru District Health Center. *J Nursing Science (Journal Nurs Sci)*. 2021;9(1):109–15.
 34. Sikoway S, Mewo Y, Assa Y. Description of Hemoglobin Levels in Third Trimester Pregnant Women at Robert Wolter Mongisidi Hospital Manado. *Med Scope J*. 2020;1(2):82–5.