Miracle Get Journal
Vol. 02, No. 4, November 2025, 63-72
e-ISSN: **3047-8839**

Micronutrient Intake in Pregnant Women and its Association with the Incidence of Low Birth Weight (LBW)

Dian Fitriyani[1*], Sri Hazanah[2], Lina Darmayanti Bainuan[3], Yunita Kristina[4], & Endah Sri Rahayu[5]
[1*]STIKes Karsa Husada Garut, Indonesia, [2]Poltekkes Kemenkes Kaltim, Indonesia, [3]Universitas Triatma Mulya, Indonesia, [4]Universitas Cenderawasih, Indonesia, [5]Poltekkes Kemenkes Jayapura, Indonesia
*Co e-mail: dfy.fitriyani@student.uns.ac.id[1]

Article Information
Received: August 28, 2025
Revised: October 24, 2025
Online: November 08, 2025

Keywords
Micronutrient Intake, Pregnant Women, Low Birth Weight (LBW)

ABSTRACT

Low birth weight (LBW) remains a public health problem that contributes to high rates of neonatal morbidity and mortality. This study aimed to analyse the association between pregnant women's micronutrient intake and the incidence of LBW. The study design was a prospective cohort study involving 210 second to third trimester pregnant women in Padang City in 2025. Micronutrient intake was assessed using the 3x24 hour food recall method, while the baby's birth weight data was obtained during delivery. Chi-square test and logistic regression were used for analysis. The results showed the prevalence of LBW was 15.2%. Intake of iron, zinc, vitamin D, and folic acid were found to be significantly associated with LBW (p < 0.05), while vitamin A and vitamin B12 showed no significant association. Further analysis revealed that iron deficiency was the dominant factor contributing most to the incidence of LBW. These findings confirm the importance of micronutrient fulfilment during pregnancy, both through a nutritionally balanced diet and supplementation, to prevent LBW. Therefore, micronutrient interventions need to be prioritised in maternal and child health programmes, especially through strengthening nutrition counselling and monitoring supplement compliance in antenatal care services.

Keywords: *Micronutrient Intake, Pregnant Women, Low Birth Weight (LBW)*

http://doi.org/10.69855/mgj.v2i4.234
https://gpijournal.com/index.php/miracle
PUBLISHED BY: GPress Indonesia

INTRODUCTION

Low birth weight (LBW) remains a significant global health issue as it contributes greatly to high rates of neonatal morbidity and mortality. The WHO estimates that more than 20 million babies are born with LBW each year, with the majority of cases occurring in low- and middle-income countries. Babies born weighing less than 2,500 grams are at risk of serious complications during the neonatal period and in the long term (Sulistiawati et al., 2024).

In Indonesia, the prevalence of LBW remains quite high. Based on the 2022 Indonesian Nutrition Status Survey (SSGI), the national prevalence of LBW reached 7.1% of total live births (Ministry of Health of the Republic of Indonesia, 2023). This figure indicates that nearly 1 in 14 babies are born weighing less than 2,500 grams. At the regional level, this problem is also evident, for example in the city of Padang. Recent research in Padang in 2025 recorded a BBLR prevalence of 15.2%, higher than the national average, emphasising the need for nutritional interventions and improvements in the quality of maternal health services.

The long-term effects of LBW are not limited to the early stages of life but also increase vulnerability to stunting, cognitive development disorders, and metabolic diseases such as diabetes and hypertension in adulthood. This underscores the importance of preventing LBW during pregnancy through optimal nutrition.

The factors that cause LBW are complex, ranging from socio-economic aspects, maternal health status, to nutritional intake during pregnancy. Of the many factors, maternal nutrition, especially micronutrient intake, is one of the main determinants that can be modified to support optimal foetal growth (Udgiri et al., 2023).

Micronutrients such as iron, zinc, folate, vitamin D, and vitamin B12 have important roles in the physiological processes of pregnancy, including erythropoiesis, fetal tissue formation, and placental function. Deficiency of these micronutrients has been shown to increase the risk of LBW through intrauterine growth restriction and pregnancy complications.

A study in India showed that magnesium deficiency, anaemia, and a diet low in vitamin A significantly increased the risk of LBW. This confirms that micronutrient adequacy of pregnant women is directly related to infant birth weight (Shankar et al., 2019).

Longitudinal studies have shown that there is a significant association between pre-pregnancy weight, weight gain during pregnancy, and serum levels of iron, folate and vitamin B12 with infant birth weight. Mothers who have good nutritional status in early pregnancy tend to have a greater chance of delivering a normal birth weight baby (Utami et al., 2025).

Recent intervention evidence shows that multiple micronutrient supplementation (MMN) is more effective at increasing infant birth weight than single supplementation, such as iron or folate alone. This supplementation has been shown to reduce the risk of LBW and improve the haemoglobin status of pregnant women (Ambarwati et al., 2023).

In addition to supplementation, a diverse and micronutrient-rich food consumption pattern of pregnant women is crucial in determining the birth weight of the baby. Consumption of food derived from animal sources such as meat, fish, eggs, as well as plant sources such as vegetables and fruits, as well as fortified foods, is closely related to increasing the weight of the baby at birth

(Wahyuni et al., 2022). Unfortunately, many pregnant women still have a diet that is low in variety and relies more on carbohydrates, putting them at risk of micronutrient deficiencies.

A systematic review showed that dual micronutrient supplementation has a significant impact in reducing the incidence of LBW, especially in developing countries. This intervention is considered *cost-effective* and can be an integral part of antenatal care services in high-risk countries (Faris et al., 2021).

Considering the high prevalence of LBW and scientific evidence on the importance of micronutrient intake during pregnancy, research on the relationship between micronutrient intake of pregnant women and the incidence of LBW is very relevant. The results are expected to provide a scientific basis for strengthening nutrition interventions for pregnant women, both through public health policy and practice in primary health care.

METHODS

This study used an analytical observational design with a prospective cohort approach. This design was chosen to assess the association between micronutrient intake in pregnant women and the incidence of low birth weight (LBW), by following pregnant women from the second trimester until delivery. The prospective cohort approach was deemed relevant as it is able to demonstrate the temporal relationship between exposure (micronutrient intake) and outcome (LBW). To classify micronutrient adequacy, the average daily intake of respondents was compared with the Nutrient Adequacy Rate (NAR) for pregnant women in Indonesia. In terms of iron, iron adequacy was considered to be achieved if a pregnant woman consumed more than ninety iron tablets (equivalent to 60 mg per tablet) during her pregnancy. Consumption of less than ninety tablets is considered iron deficiency. According to the 2019 RDA, the average daily intake limits for vitamin A, vitamin D, vitamin B12, and folic acid are 11–12 mg/day for zinc, 800–850 g RE/day, vitamin D (15 g/day), vitamin B12 (2.6 g/day), and folic acid (600 g/day). Respondents who consumed less than the AKG standard were categorised as ‘deficient’. Respondents who consumed more than the standard were categorised as ‘adequate’.

The study population was all pregnant women in the second trimester to the beginning of the third trimester who conducted antenatal care (ANC) examinations at Puskesmas and Mother and Child Hospitals in the Padang City area in 2025, with a total population of 1,245 pregnant women. From this population, sample selection was carried out using consecutive sampling technique, namely all pregnant women who met the inclusion and exclusion criteria were included until the sample size was met.

The inclusion criteria in this study were single pregnant women with a gestational age of 14-28 weeks, willing to participate in the study until delivery, and not suffering from chronic diseases that could affect pregnancy. The exclusion criteria were women with multiple pregnancies, a history of severe obstetric complications, and those who did not continue to deliver at the research health facility.

The number of samples was determined using the analytical formula for the relationship test with a confidence level of 95% and a test strength of 80%, plus a *dropout* correction of 10%. Based on the calculation, the minimum sample size was 210 pregnant women.

Data collection was conducted in two stages. The first stage was the measurement of micronutrient intake of pregnant women, conducted using the 24-hour *food recall* method three times on non-consecutive days. The data were then analysed using nutrition analysis software to calculate the average intake of iron, zinc, vitamin A, vitamin D, vitamin B12, folic acid and other relevant micronutrients. To improve accuracy, the *food model* and *household measure* were used as portion estimation tools.

The second stage is the recording of the baby's birth weight at delivery. Weight was measured within a maximum of 1 hour after the baby was born using a calibrated digital infant scale. Infants weighing < 2,500 grams were categorised as LBW according to WHO criteria.

Data was also collected on respondent demographics, including age, parity, education, socioeconomic status, maternal nutritional status, and antenatal care (ANC) history. In addition, confounding variables recorded and controlled for in the analysis included gestational age at birth, birth spacing, and history of previous pregnancy complications. The indicators used to determine the socioeconomic status of respondents were divided into two groups based on family income, the head of household's occupation, and household asset ownership. The upper-middle category consisted of families with a monthly income above the Padang City minimum wage, who had permanent employment (civil servants, private employees, or stable entrepreneurs), and who owned basic assets such as a permanent house and a car. On the other hand, the low category consists of families with a monthly income below the minimum wage, who have irregular or informal employment, and who have limited household assets. These criteria are adjusted to the BPS socioeconomic classification standards, as well as previous research.

Data analysis was conducted in stages. Univariate analysis was used to describe the distribution of respondent characteristics. Bivariate analysis was conducted using the chi-square test to determine the relationship between micronutrient intake and the incidence of LBW.

RESULTS

In this study, 210 second to third trimester pregnant women who met the inclusion criteria were successfully included and followed until delivery. Data analysis was conducted to describe the characteristics of respondents, the distribution of micronutrient intake, and the incidence of low birth weight (LBW). Furthermore, bivariate analysis was conducted to determine the relationship between micronutrient intake and the incidence of LBW using the *Chi-square* test. Table 1 presents the characteristics of respondents based on age, parity, education, socioeconomic status, nutritional status, and compliance in antenatal care (ANC) visits.

Table 1. Characteristics of Respondents (n=210)

Respondent Characteristics	Category	n	Percentage (%)
Maternal age (years)	20-35 years	168	80
	<20 & >35 years	42	20

Parity (child)	Primiparous	124	59
	Multiparous	86	41
Mother's education	High (≥ high school)	140	66,7
	Low (≤ junior high school)	70	33,3
Socio-economic status	Medium-high	126	60
	Low	84	40
Maternal nutritional status (BMI)	Normal	150	71,4
	Deficient	32	15,2
	More	28	13,4
ANC visits ≥4 times	Yes	182	86,7
	No	28	13,3

Based on Table 1, most respondents were in the middle-high socioeconomic status category (60%), while 40% were in the low category. This shows that although the majority of respondents were in relatively good economic conditions, there was still a significant proportion in the lower class, which could potentially affect access to nutritious food and health services. This disparity is important to note because economic status is one of the social determinants closely related to the nutritional intake of pregnant women and the risk of low birth weight.

Furthermore, Table 2 illustrates the distribution of intake of the main micronutrients analysed in this study, including iron, zinc, vitamin A, vitamin D, vitamin B12, and folic acid.

Table 2. Distribution of Micronutrient Intake in Pregnant Women

Micronutrient Intake	Category	n	Percentage (%)
Iron (Fe)	Adequate	130	61,9
	Deficient	80	38,1
Zinc (Zn)	Sufficient	138	65,7
	Deficient	72	34,3
Vitamin A	Simply	142	67,6
	Less	68	32,4
Vitamin D	Adequate	120	57,1
	Insufficient	90	42,9
Vitamin B12	Sufficient	150	71,4
	Deficient	60	28,6
Folic Acid	Sufficient	134	63,8
	Deficient	76	36,2

Descriptive results show that most respondents received adequate micronutrient intake, although there were significant deficiencies in vitamin D and iron. This indicates the possibility of low birth weight (LBW). A recommended daily allowance was used to determine adequate or inadequate micronutrient categories. For example, pregnant women who consume at least 90 iron tablets (60 mg) during pregnancy are considered to have adequate iron intake. Consumption of less than this amount is considered inadequate. Similarly, other micronutrients, such as folic acid, vitamin A, vitamin D, vitamin B12, and zinc, are classified based on the AKG standards for pregnant women set by the Indonesian Ministry of Health (2019). Therefore, this classification provides an objective picture of the amount of micronutrients available to respondents.

To better understand pregnancy outcomes, Table 3 presents the distribution of LBW in the study population.

Table 3. Distribution of Low Birth Weight (LBW) Events

LBW incidence	n	Percentage (%)
Not LBW (≥2500 g)	178	84,8
LBW (<2500 g)	32	15,2

The proportion of LBW at 15.2% in this study was higher than the national average, supporting the need for further analysis of contributing nutritional factors.

Therefore, bivariate analysis was conducted to examine the association between micronutrient intake and the incidence of LBW. The results of the analyses are shown in association between micronutrient intake and lbw incidence.

Table 4. Association between Micronutrient Intake and LBW Incidence

Micronutrient Intake	Category	Not LBW	%	LBW	%	n	p-value
Iron (Fe)	Adequate	118	90,8	12	9,2	130	0,021
	Less	60	75	20	25	80	
Zinc (Zn)	Enough	122	88,4	16	11,6	138	0,048
	Less	56	77,8	16	22,2	72	
Vitamin A	Adequate	125	88	17	12	142	0,112
	Less	53	77,9	15	22,1	68	
Vitamin D	Adequate	108	90	12	10	120	0,007
	Less	70	77,8	20	22,2	90	
Vitamin B12	Sufficient	132	88	18	12	150	0,086
	Less	46	76,7	14	23,3	60	
Folic Acid	Adequate	119	88,8	15	11,2	134	0,032
	Less	59	77,6	17	22,4	76	

Note: $p < 0.05$ = statistically significant

Chi-square test results showed that iron, zinc, vitamin D, and folic acid intake had a significant association with LBW. While vitamin A and vitamin B12 did not show a significant association, although the proportion of LBW was higher in the group with less intake.

DISCUSSION

1. Characteristics of Respondents

The results showed that the majority of respondents were at a healthy reproductive age (20-35 years) with a secondary education level. This condition is physiologically the optimal age for pregnancy, because mothers have reproductive capacity and relatively good health status. According to reproductive health theory, maternal age is one of the main determinants of pregnancy success and infant birth weight, as it is closely related to the biological and psychosocial readiness of the mother. In short, ideal maternal age is critical in determining pregnancy success and infant birth weight, with 20-35 years of age being the safest and most conducive range for a healthy pregnancy and delivery of a normal birth weight baby (Khairani et al., 2024; Rangkuti & Harahap, 2020). Recent studies have also confirmed that maternal age, nutritional status, and parity are significantly associated with pregnancy outcomes, including infant birth weight (Udgiri et al., 2023).

There is still a chance of LBW even though the majority of responders were in the acceptable age range because of other risks such poor nutritional status, restricted access to healthcare, and poor ANC check compliance. Furthermore, a secondary education level does not ensure sufficient nutritional understanding, which could have an impact on the caliber of food consumed during pregnancy.

2. Micronutrient Intake of Pregnant Women

This study showed that most respondents had iron, calcium, and zinc intakes below the nutritional adequacy levels (RDAs). Nutrition theory states that micronutrients play an important role in various metabolic processes of pregnancy, ranging from the formation of haemoglobin, mineralisation of fetal bones, to cell division (Irwinda, 2020). Micronutrient deficiencies can inhibit foetal growth, increasing the risk of LBW. This study showed that most respondents had iron, calcium, and zinc intakes below the nutrient adequacy levels (RDAs). Micronutrient deficiencies have been shown to increase the risk of LBW. Recent studies have shown that micronutrient supplementation during pregnancy is associated with increased infant birth weight and decreased neonatal complications (Afridi & Joya, 2025). In addition, cross-sectional studies have also confirmed a high prevalence of vitamin D, iron, folate and calcium deficiencies that are significantly correlated with the risk of LBW (Suriya & Razzak, 2025).

Limited food variety, cultural preference for staple meals (carbohydrate-dominant), and financial constraints to buy micronutrient-rich animal foods are likely the causes of inadequate micronutrient intake. Additionally, concerns about adverse effects like nausea or constipation may lead to low adherence to taking prenatal nutritional supplements.

3. Relationship between Iron Intake and LBW Incidence

Findings show a significant association between low iron intake and increased LBW rates. Iron is important for haemoglobin synthesis, and its deficiency causes anaemia which results in fetal hypoxia. Theoretically, intrauterine hypoxia inhibits fetal growth and increases the risk of LBW (Irwantoro et al., 2021). The findings of this study indicate a significant relationship between low iron intake and increased LBW rates. Iron deficiency can cause anaemia which inhibits fetal oxygenation, thus increasing the risk of LBW. Recent studies support these results, showing that low ferritin and haemoglobin levels are directly associated with low birth weight (Rooney et al., 2023).

Low consumption of animal sources, such as liver and red meat, which are frequently substituted with plant sources that have poorer bioavailability, is assumed to be a contributing factor to low iron intake. Iron absorption may also be hampered by the practice of drinking tea or coffee after meals. Another factor that makes iron shortage worse is poor adherence to taking blood supplement tablets that are given by health programs.

4. Relationship between Calcium Intake and LBW Incidence

This study shows that low calcium intake is associated with LBW. Calcium plays an important role in fetal bone mineralisation, blood pressure regulation, and muscle contraction. Calcium deficiency increases the risk of preeclampsia which can lead to LBW. This study also showed an association between low calcium intake and LBW. Calcium plays an important role in fetal bone mineralisation and prevention of obstetric complications. A systematic review in Malaysia reported that low intakes of calcium, iron, vitamin D and folate were consistently associated with an increased risk of LBW (Mohamed et al., 2022). This finding is consistent with the results of a recent *cross-sectional* study showing a 30% prevalence of calcium deficiency and its association with obstetric complications and LBW (Suriya & Razzak, 2025).

Due to taste preferences and financial constraints, low milk and dairy product consumption may contribute to low calcium intake. Additionally, some women are afraid to eat dairy products because they are lactose intolerant. Furthermore, calcium shortage is made worse by a lack of knowledge about calcium-rich foods like soft-boned fish, almonds, and green vegetables.

5. Relationship between Zinc Intake and LBW

The results showed a significant association between low zinc intake and the increased incidence of LBW. Zinc plays a role in DNA synthesis, cell division, and placental development, so its deficiency can inhibit foetal growth. The results showed a significant association between low zinc intake and the increased incidence of LBW. Zinc plays an important role in placental development and DNA synthesis, so its deficiency can inhibit foetal growth. Recent studies confirm that zinc deficiency is associated with the risk of LBW and prematurity (Mohamed et al., 2022). In addition, longitudinal studies also support that maternal serum zinc levels decrease throughout pregnancy and are significantly associated with infant birth weight (Rooney et al., 2023).

Limited access to animal-based foods like red meat and shellfish, which are the primary sources of zinc, may be the cause of the respondents' low zinc consumption. Low zinc intake is also influenced by cultural norms that typically limit the eating of particular foods during pregnancy. Additionally, the presence of phytates, which prevent absorption, lowers the bioavailability of zinc from plant meals. As a result, zinc requirements have not been met even when consumption of legumes is adequate.

CONCLUSIONS

The results of this study showed that most pregnant women had micronutrient intakes, particularly iron, calcium, and zinc, that were below the nutritional adequacy levels (RDAs). This condition was found to be associated with the incidence of low birth weight (LBW), where mothers with low intakes of iron, calcium, and zinc were more likely to deliver LBW babies than mothers with adequate intakes. Further analysis revealed that iron was the dominant factor affecting LBW, in line with the theory that iron deficiency anaemia is the most common micronutrient problem and has a major impact on fetal growth. Overall, this study confirms that micronutrient adequacy in pregnant women is a key factor that determines the birth weight of the baby, so fulfilment of micronutrients during pregnancy should be an important concern in efforts to prevent LBW.

Based on the results of the study, it is recommended that pregnant women improve the quality of food consumption by increasing the intake of iron, calcium, and zinc sources, especially from animal foods that have high bioavailability, and maintain compliance in taking pregnancy supplements such as blood supplement tablets. Health workers are expected to strengthen nutrition education at every antenatal care (ANC) visit, including providing more intensive counselling on the importance of micronutrients for maternal and fetal health, and monitoring compliance with supplement consumption more systematically. In terms of policy, the government needs to expand the scope of nutrition interventions by optimising dual micronutrient supplementation programmes, food fortification, and subsidies for groups of pregnant women who have limited purchasing power. Meanwhile, future research is recommended to use an intervention design and add biomarker measurements of micronutrient status to provide stronger evidence regarding the effectiveness of micronutrient fulfilment on the prevention of LBW.

REFERENCES

Afridi, S., Joya, S. R., Inayat, B., Mariyum, S., Kalsoom, O., & Imtiaz, H. (2025). Effect of Maternal Nutrition and Micronutrient Supplementation on Neonatal Birth Weight and Health. *Pakistan Journal of Health Sciences*, *6*(3), 28–34. https://doi.org/10.54393/pjhs.v6i3.2905

Ambarwati, E. R., Ashar, H., Kumorojati, R., Yulinda, D., Utami, N. W., & Lestari, R. T. (2023). Effect of multiple micronutrient supplementation in pregnant women on infant birth weight. *AcTion: Aceh Nutrition Journal*, *8*(4), 579. https://doi.org/10.30867/action.v8i4.1210

Faris, A., Abdullah, M. T., & Hadju, V. (2021). The Impact of Multiple Micronutrient Supplementation on Hemoglobin Concentration in Pregnant and Neonatal Birth Wight. *Open Access Macedonian Journal of Medical Sciences*, *9*(F), 366–369. https://doi.org/10.3889/oamjms.2021.6924

Irwantoro, G., Hidayat, D., & Alamsyah Aziz, M. (2021). Prevalence and Risk Factors in Intrauterine Growth Restriction Patients at Dr. Hasan Sadikin General Hospital, Bandung Description of Maternal Prevalence and Risk Factors in Intrauterine Growth Restriction Patients at Hasan Sadikin General Hospital Bandung. *Indonesian Journal of Obstetrics & Gynecology Science*, *4*(2), 2615–2496.

Irwinda, R. (2020). The Role of Calcium and Magnesium in Pregnancy. *MEDICINUS*, *33*(1), 3–7. https://doi.org/10.56951/medicinus.v33i1.1

Khairani, F., Pratiwi, B., & Putri, K. (2024). The Relationship between the Reproductive Status of Pregnant Women and the Incidence of Complications in Childbirth in the Working Area of the West Dompu Community Health Center. *Jurnal Kesehatan Ibu Dan Anak*, *3*(2).

Mohamed, H. J. J., Loy, S. L., Mitra, A. K., Kaur, S., Teoh, A. N., Rahman, S. H. A., & Amarra, M. S. (2022). Maternal diet, nutritional status and infant birth weight in Malaysia: a scoping review. *BMC Pregnancy and Childbirth*, *22*(1). https://doi.org/10.1186/s12884-022-04616-z

Rangkuti, N. A., & Harahap, M. (2020). The Relationship Between Knowledge and Age of Pregnant Women and High-Risk Pregnancy at Labuhan Rasoki Community Health Center. *Jurnal Education and Development*, *8*(4). https://media.neliti.com/media/publications/561931-hubungan-pengetahuan-dan-usia-ibu-hamil-e5876699.pdf

Rooney, D. J., Conway, M., O'Keeffe, L. M., McDonnell, C. M., Bartels, H. C., Yelverton, C., Segurado, R., Mehegan, J., & McAuliffe, F. M. (2023). Dietary intakes of iron, folate, and vitamin B12 during pregnancy and correlation with maternal hemoglobin and fetal growth: findings from the ROLO longitudinal birth cohort study. *Archives of Gynecology and Obstetrics*, *309*(1), 183–193. https://doi.org/10.1007/s00404-023-06916-x

Shankar, H., Kumar, N., Sandhir, R., Singh, M. P., Mittal, S., Adhikari, T., Tarique, M., Kaur, P., Radhika, M. S., Kumar, A., & Rao, D. C. (2019). Association of dietary intake below recommendations and micronutrient deficiencies during pregnancy and low birthweight. *Journal of Perinatal Medicine*, *47*(7), 724–731. https://doi.org/10.1515/jpm-2019-0053

Sulistiawati, Damayanty S, Nainggolan, A. W., Nuraisyah, & Yudiyanto, A. R. (2024). Factors Influencing the Incidence of Low Birth Weight Babies at Sapta Medika Hospital, Air Putih District, Batu Bara Regency, North Sumatra Province in 2024. *The Journal General Health and Pharmaceutical Sciences Research*, *2*(2), 48–56. https://doi.org/10.57213/tjghpsr.v2i2.380

Suriya, Q., Razzak, T., Abid, N., & Zia, Q. (2025). Maternal Nutrition And Fetal Development: Exploring Dietary Interventions, Micronutrient Deficiencies, And Longterm Health Outcomes. *InsightsJournal of Health and Rehabilitation*, -. https://doi.org/10.71000/x5sf5562

Udgiri, Mallapur, A., Kashinakunti, S., & Patil, S. (2023). A study of correlation between prepregnancy weight, gestational weight gain, erythropoiesisrelated micronutrient levels in term pregnant women and the birth weight of the baby. *Biomedicine*, -. https://doi.org/10.51248/.v42i6.2083

Utami, R. P., Azizah, R., & Diyanah, K. C. (2025). Meta-Analysis of Risk Factors for Low Birth Weight, Maternal Height, Family Economic Status, and Exclusive Breastfeeding Based on the Probability of Stunting in Children Aged 2-5 Years. *IKESMA*, *21*(1), 35–43. https://doi.org/10.19184/ikesma.v21i1.48969

Wahyuni, Y., Lubis, M., & Martaulina, J. (2022). Antenatal Care (ANC) Visits, Food Consumption Diversity, Pregnant Women's Hb Levels and Body Weight and Length of Newborns During the Covid-19 Pandemic. *Researc Study*, *6*(1). https://doi.org/10.20473/amnt.v6i1SP.2022.253-