ISSN:3026-0442

Proceedings of the 1st International Conference on Education, Science Technology And Health (ICONESTH 2023 Universitas Bina Bangsa Getsempena, Dec 12-14, 2023, Banda Aceh, Indonesia)

NUTRITION IN PREGNANCY

Fitria[1], Risna Fazlaini[2], Dewina Susanti[3], Nizam Mauyah[4]
[1,2]Universitas Bina Bangsa Getsempena, Banda Aceh, Indonesia
[3]Akademi Kebidanan Saleha, Indonesia
[4]Jurusan Kebidanan, Poltekkes Kemenkes Aceh

***** Corresponding email: *fitriazahary@bbg.ac.id*

ABSTRACT

Based on the mid upper arm circumference, 23.9% of the pregnant women were found to be undernourished (MUAC < 23.0 cm). The Ministry of Health announced the results of the Indonesia Nutrition Status Survey (INSS) at the National Family Planning Coordinating Board (BKKBN) National Working Meeting, where the prevalence of stunting in Indonesia decreased from 24.4% in 2021 to 21.6% in 2022. Researchers conducted a systematic search using a computer and explored the electronic databases PubMed in November 2023. Using PRISMA procedures, a systematic review was conducted by searching in biomedical databases clinical trials and interventions for pregnant women. The PubMed Central search strategy yielded a total amount of 386 articles. Based on the analysis, optimizing weight gain during pregnancy according to IOM recommendations includes maintaining a normal BMI at the beginning of pregnancy. First, clinicians should assess the mother's pre-pregnancy weight, recommend weight gain during pregnancy, and create a weight gain plan during pregnancy by developing a curve or graph. Second, individual assistance and counseling are provided before and during pregnancy to help mothers choose a diet and physical activity that play a role in controlling weight gain. Third, assisting mothers in returning to normal BMI postpartum. Fourth, the increase in daily calorie requirements is only about 340 Kcal/day in the second trimester and 450 Kcal/day in the third trimester. For multiple pregnancies, the increase in calories is calculated based on per fetus, requiring an additional 300 Kcal/day.

Keywords: *nutrition, pregnancy, maternal, diet, food*

INTRODUCTION

Malnutrition is a global health issue concerning children and pregnant women in lowand middle-income countries (LMICs). The focus of maternal nutrition primarily revolves around preventing nutritional deficiencies (both macro and micronutrients), which impact inadequate weight gain and suboptimal fetal outcomes. Both nutrient deficiencies and excesses can affect pregnancy, ranging from infections due to lowered immunity to metabolic diseases due to obesity. Epidemiological research indicates that Body Mass Index (BMI) and fat reserves have a greater impact on pregnancy compared to weight gain during pregnancy. Women who start pregnancy with a lower BMI are at an increased risk of preterm birth, small-for-gestational-age infants, and low birth weight compared to those with normal BMI. Pre-pregnancy obesity increases the risk of spontaneous abortion, congenital abnormalities, gestational diabetes, intrauterine fetal death, pregnancy-induced hypertension, cesarean section, thromboembolic events, postpartum complications, and maternal mortality.(Pribadi, C.Moses, & Anwar, 2015)(Urgell-Lahuerta, Carrillo-álvarez, & Salinas-Roca, 2021)

Dietary diversity is the consumption of a broad range of foods or food groups within a specified timeframe. It plays a crucial role in determining the accessibility, utilization, and quality of an individual's or a family's diet. During pregnancy, the diversity of one's diet serves as a useful proxy indicator for assessing nutritional sufficiency. Given the increased nutritional demands during pregnancy, it is highly recommended for expectant mothers to diversify their diet. Consequently, pregnant women should aim for a varied diet to meet their nutritional requirements, enhancing their overall nutritional well-being, and positively impacting both maternal and fetal outcomes.(Gebremichael & Belachew Lema, 2023)

Furthermore, the 2030 Agenda for Sustainable Development Goals (SDG) adopted by the United Nations in 2015 identifies the importance of ending hunger and malnutrition (SDG #2), clear water, and sanitation (SDG #6) for global health. Based on the mid upper arm circumference, 23.9% of the pregnant women were found to be undernourished (MUAC < 23.0 cm). The Ministry of Health announced the results of the Indonesia Nutrition Status Survey (INSS) at the National Family Planning Coordinating Board (BKKBN) National Working Meeting, where the prevalence of stunting in Indonesia decreased from 24.4% in 2021 to 21.6% in 2022. The government aims to reduce the prevalence of stunting through the Healthy Pregnant Women movement. This effort is part of specific interventions for stunting before birth. The stunting reduction target for 2024 is 14% from the 2021 rate of 24.4%, or approximately 3.5% per year as per President Joko Widodo's target. The government has identified 12 priority provinces for stunting reduction, which have the highest number or prevalence of stunting.(dr. Siti Nadia Tarmizi, 2023)

Pregnant women face several barriers in implementing nutrition and exercise recommendations, including limited knowledge and access to information on safe physical activity in pregnancy, lack of skills to operationalize physical activity and dietary recommendations, and competing priorities that may take precedence over healthy behaviors. Additionally, pregnancy symptoms such as fatigue and nausea make it more challenging to engage in physical activity and healthy eating. Women's beliefs and values, as well as the influence of friends and family, also impact their behaviors, with some seeing pregnancy as a time to indulge and relax, receiving encouragement to eat unhealthy foods and avoid physical activity. Inadequate and ineffective counseling from healthcare providers, as well as difficulties operationalizing the information in guidelines, further contribute to the barriers faced by pregnant women in adhering to nutrition and exercise recommendations.(Blondin & LoGiudice, 2018)(Grenier et al., 2021).

METHODS

Researchers conducted a systematic search using a computer and explored the electronic databases PubMed in November 2023. Subsequently, the researchers performed an advanced search in these three databases. To obtain relevant articles, the publication period was restricted to a seven-year range between 2016 and 2023, using the following keyword combination: 'nutrition' AND 'pregnancy' AND 'maternal' OR 'diet' OR 'food'.

Using PRISMA procedures, a systematic review was conducted by searching in biomedical databases clinical trials and interventions for pregnant women. The PubMed Central search strategy yielded a total amount of 386 articles. The researcher also considered studies from all countries. Articles that did not display full text and those in the form of reviews, literature reviews, meta-analyses, systematic reviews, book chapters, dissertations, and theses were excluded. Details of the search strategy for qualifying articles were reviewed and analyzed in the following diagram:

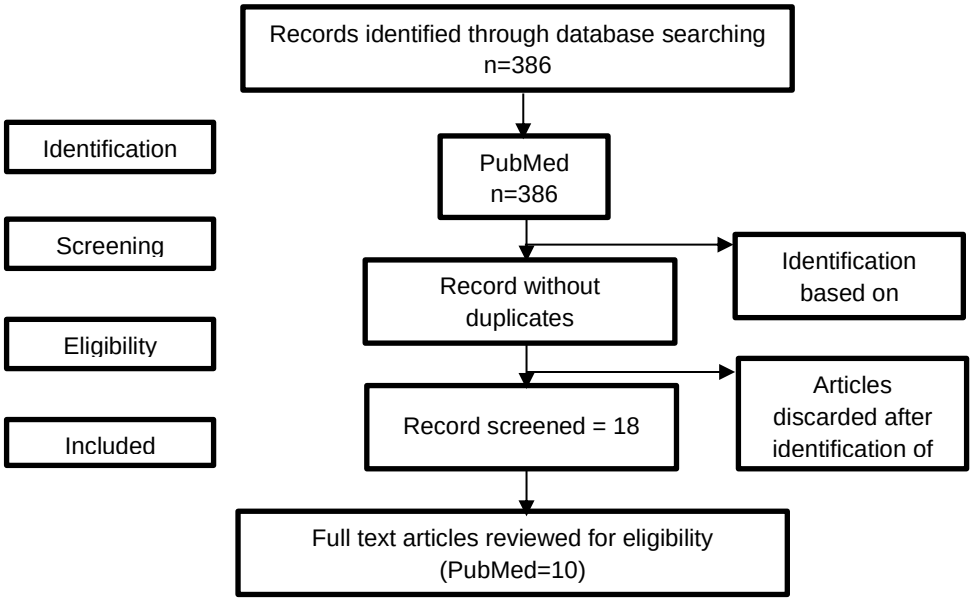

Figure 1. Diagram Prisma

RESULTS AND DISCUSSION

Optimal dietary diversity is crucial during pregnancy as nutritional deficiencies can significantly impact the health of both the mother and the fetus. Pregnant women have inadequate dietary diversity and experience malnutrition. This study will assess dietary diversity, nutritional status, and related factors in pregnant women.

No	*Authors/years/place of study*	*Title*	*Participant*	*Method, intervention, and results*
1	Mitsiwat Abebe Gebremichael, and Tefera Belachew Lema. The study was conducted in the Ambo district from April 1 to June 1, 2018. Ambo district is located in West Shoa Zone, Oromia Regional State, and west-central Ethiopia	Dietary Diversity, Nutritional Status, and Associated Factors Among Pregnant Women in Their First Trimester of Pregnancy in Ambo District, Western Ethiopia	750 pregnant women	A community-based cross-sectional study design and a multi-stage sampling technique. The Food and Nutrition Technical Assistance questionnaire was modified to collect data on dietary diversity. The nutritional status of pregnant women was assessed by measuring the mid-upper arm circumference. First, descriptive statistics like mean, Standard deviation,

				frequency and percentage were used, then bivariable and, finally, multivariable logistic regression analysis was used to assess the association of the predictors with the outcome variable The study revealed that 73.6% and 23.9% of pregnant women had low dietary diversity and were undernourished, respectively. Being in food secured household (AOR=4.44, 95% CI: 2.14-9.15), having good knowledge (AOR=3.32, 95% CI: 2.10-5.23) and favorable attitude toward nutrition and health (AOR=1.71, 95% CI: 1.10-2.66) were significantly associated with dietary diversity, whereas household size (having 1-3 household members AOR=6.59, 95% CI: 2.53-17.21, having 4-5 household members AOR=5.62, 95% CI: 3.15-9.99), being in food secured household (AOR=5.64, 95% CI: 2.79-11.38), having high dietary diversity (AOR=8.49, 95% CI: 2.47-29.23), and having optimal practice on nutrition and health (AOR=6.85, 95% CI: 3.23-14.55) were significantly associated with undernutrition (P < .05) (Gebremichael & Belachew Lema, 2023)
2	Rocío Olmedo-Requena, Julia Gómez-Fernández, Juan Mozas-Moreno, Anne-Mary Lewis-Mikhael, Aurora Bueno-Cavanillas & José-Juan Jiménez-Moleón May 2016	Factors associated with adherence to nutritional recommendations before and during pregnancy	1,175 pregnant Spanish women	This study aimed to examine the degree of adherence to nutritional recommendations among 1,175 pregnant Spanish women and the factors associated with such adherence to pre-pregnancy and during the first half of pregnancy. Data were collected during June 2004–March 2007 and included socio-

				demographic and lifestyle factors. Factors associated with adherence to the nutritional recommendations were similar before and during pregnancy. Adherence to the Spanish Society of Community Nutrition dietary recommendations was lower among pregnant women who were younger, from a low social class, smokers, and had a low level of physical activity. These findings suggest that nutritional education should become an essential part of antenatal care. (Urgell-Lahuerta et al., 2021)
3	Ann K. Lal, MD and Michelle A. Kominiarek, MD, MS	Weight gain in twin gestations: Are the Institute of Medicine guidelines optimal for neonatal outcomes?	Database contained 228,438 deliveries	This was a retrospective cohort study of twins delivered at ≥ 24 weeks. GWG was defined using the IOM guidelines as the referent. Birthweight and NICU admissions were compared with Chi-square and ANOVA tests, stratified by BMI In all three BMI groups, mean birthweight of the larger and smaller twin increased as GWG increased, p< 2500 g, < 2500 g increased in all groups with GWG below the IOM guidelines, p < 0.01. In the multivariate analysis, both twins < 2500 g was significantly decreased with GWG above IOM guidelines. There was no difference in NICU admissions with GWG above the IOM guidelines GWG above the IOM guidelines may improve twin birthweights, with the findings most significant in underweight/normal weight women. (Lal & Kominiarek, 2015)

4	Hemi Fitriani, Achmad Setya R, Popy Nurdiana April 2019/ Cigugur Tengah Health Center's working area	Risk Factors of Maternal Nutrition Status During Pregnancy to Stunting in Toddlers Aged 12–59 Months	180 mothers	The method used an analytic study of a case-control with a retrospective design. The population was mothers who had toddlers aged 12 to 59 months who lived in the Cigugur Tengah Health Center's working area.. The MCH card was a population requirement to get historical data about the mother's weight and height before pregnancy and weight gain during pregnancy. Data regarding maternal weight before pregnancy, weight at the end of pregnancy and height at pregnancy are secondary data obtained from the MCH card. The mothers' poor nutritional status caused as many as 85% of stunted toddlers' prevalence during pregnancy. Results showed that maternal nutritional status during pregnancy was significantly associated with stunting among children (p-value: 0.000). The OR value was 13,222, which means children born to mothers with inadequate nutrient supply during pregnancy were more likely to be stunted as much as 13,222 times, than children born to mothers who had good nutrient supply. It is recommended that health workers prevent stunting from pregnancy by providing supplementary food to pregnant women, and promoting the health of the maternal nutritional status during pregnancy. (Fitriani, Achmad Setya, & Nurdiana, 2020)
5	Lindsay N. Grenier, Stephanie A. Atkinson, Michelle F. Mottola, Olive Wahoush, Lehana Thabane, Feng Xie, Jennifer	Be Healthy in Pregnancy: Exploring factors that impact pregnant women's	122 women between 16 and 24 weeks gestation	This qualitative study presents data from focus groups conducted with healthy pregnant women between 16 and 24 weeks

	Vickers-Manzin, Caroline Moore, Eileen K. Hutton, and Beth Murray-Davis	nutrition and exercise behaviours		gestation. The study was nested within a large randomized controlled trial (RCT) examining the likelihood of attaining optimal gestational weight gain (GWG) through a physical activity and nutrition intervention introduced in early pregnancy, compared with usual prenatal care(Grenier et al., 2021)
6	Fernanda Scherer-Adami, Michele Dutra-Rosolen, Francieli Schedler, Ioná Carreno, Mabel N Alves	Nutritional status and dietary intake of pregnant women	255 pregnant women	A cross-sectional study with the participation of 255 pregnant women. Socioeconomic and demographic variables were collected using a structured questionnaire. Women were evaluated for nutritional status and dietary intake. Data related to the age of the pregnant woman, gestational week, current weight, pregestational weight, and height were obtained from the prenatal follow-up form. The Statistical Package for the Social Sciences (SPSS) was used for statistical analysis. Pregestational nutritional status assessment showed that 43.2% (n=110) of the women started gestation with overweight and 4.3% (n=11) started with low weight. 51% percent (n=130) gained gestational weight above the recommended level. The mean age of women with pregestational BMI ≥ 25 kg/m2 was significantly higher than that of those with BMI <25 kg/rrP (p<0.001). Total energy (p=0.037) and calcium (p=0.004) intake were higher in women with weight gain above the recommended. The results presented highlight the importance of strategies in public health to avoid excess

				weight gain during pregnancy. (Fernanda Scherer-Adami, Michele Dutra-Rosolen, Francieli Schedler, Ioná Carreno, 2020)
7	Natalia Misan, Katarzyna Paczkowska, Magdalena Szmyt, Katarzyna Kapska, Lidia Tomczak, Grzegorz H Bręborowicz, Mariola Ropacka-Lesiak	Nutritional behavior in pregnancy	250 pregnant women	The survey study included 250 pregnant women. The survey concerned dietary behavior refferedto the type of diet, the number of meals per day, snacking between meals, consumption of meat, fish, dairy products,bread, fruits and vegetables. 88.8% of the respondents were not on a special diet. The most of the women ate more than three times a day.The women usually ate fruits and vegetables, yogurt and sweets as snacks between meals. The majority of respondentsconsumed meat and sliced meats twice or once a day with the preference of poultry. Only 17.6% of them ate fish with therecommended frequency and as much as 21.2% chose not-recommended species. Almost 29.6% of patients consumed3 to 4 servings of milk or milk products a day and 16.8% of them excluded milk. Half of the respondents declared eating wheat bread and 24% of them chose wheat roll during pregnancy. Despite the large number of women who consumedwheat baking, a considerable amount of women chose wholemeal bread and wholemeal rolls. Nutritional behaviors were correlated with on education level and weight gain during pregnancy. (Misan et al., 2019)
8	Silvia González-Martínez,[1,2,*] María Riestra-Fernández,[2,3] Eduardo Martínez-Morillo,[4] Noelia	Nutritional Iodine Status in Pregnant Women from Health Area IV in	318 pregnant women	An observational study was carried out between May and June 2017 on women in the first

	Avello-Llano,[4] Elías Delgado-Álvarez,[1,2,5,†] and Edelmiro Luis Menéndez-Torre	Asturias (Spain): Iodised Salt Is Enough		trimester of pregnancy from Health Area IV in Asturias. The women completed a questionnaire related to their consumption of iodine and samples were taken to analyse UIC and thyroid function. Three hundred and eighteen pregnant women were involved. Of these, 51.10% used iodised salt, 48.90% consumed ≥ 2 servings of dairy products daily and 87.08% took iodine supplements. The median UIC was 171.5 µg/L (116–265 µg/L) and 60.41% of women had UIC ≥ 150 µg/L. Multivariate logistic regression analysis demonstrated that iodised salt had a protective effect on UIC < 150 µg/L (odds ratio (OR) 0.404 (0.237–0.683), $p = 0.001$), but not iodine supplements (OR 0.512 (0.240–1.085), $p = 0.080$). The average level of thyroid stimulating hormone (TSH) was 2.26 ± 0.94 mIU/L; 68.40% of pregnant women taking iodine supplements had TSH < 2.5 mIU/L compared to 30.00% of those who were not taking supplements ($p = 0.031$) (González-Martínez et al., 2021)
9	Irani Nur Ramadhani, Masni, Aminuddin Syam, Arifin Seweng, Stang, Rosmala Nur	The relationship between socioeconomic status and nutritional status of pregnant women in temporary shelter, Talise, Palu	85 pregnant women	This research was a quantitative observational study with a cross-sectional study approach. Sampling was done by random sampling technique, which obtained 85 pregnant women. Based on the Chi-Square test, p-value=0.001, which means that difference between socioeconomic status and nutritional status in pregnant women was significant ($p<0.05$). Variable of parity factor that was at risk and no risk

				in pregnant women showed p-value=0.030 and p-value=0.048. Additionally, the variable of pregnancy gap factor that was at risk and no risk in pregnant women showed p=0.070 and p=0.159. In addition, infectious disease factor that was at risk and no risk in pregnant women showed p-value=0.017 and p-value=0.027. Last but not least, implementation of ANC variable that was in line with standards and not in line with standards in pregnant women showed p-value=0.019 and p=0.043. (Nyirjesy & Lonergan, 2013)
10	Rehman Mehmood Khattak, Zuhra Saifullah, Ghulam Khadija, Amina Fayyaz, Salma Zaman, Mahwish Gul, Muhammad Nasir Khan Khattak , Birgit Schauer [1], Henry Völzke [1], Till Ittermann	Regional Influences on Nutritional Iodine Status of Pregnant Women in Pakistan	246 pregnant women in all trimesters of pregnancy	Data were collected from 1246 pregnant women in all trimesters of pregnancy who visited antenatal clinics for routine checkups in five Khyber Pakhtunkhwa province districts. Information concerning iodized salt intake and knowledge of iodine deficiency disorders (IDD) was obtained through an interview questionnaire. Among study participants, 87.7% had no knowledge about IDD, and only 21.0% were consuming iodized salt. Goiter was present in 25.5% of the women. The median UIC level was 131 µg/L, and 41.3% of study participants had a UIC ≥150 µg/L. There were no significant differences between pregnant women from rural and urban settings in regions with a solid socioeconomic status with respect to knowledge about IDD, iodized salt intake, iodine deficiency, and goiter prevalence. Urban-rural differences were observed

				only in socioeconomically disadvantaged districts. Only pregnant women living in the Lakki Marwat district had higher odds of having knowledge of IDD and iodized salt intake than those from rural regions. Trimesters of pregnancy and previous pregnancy outcomes had no significant effect on the outcome measures. (Rocío Olmedo-Requena, Julia Gómez-Fernández, Juan Mozas-Moreno, Anne-Mary Lewis-Mikhael, Aurora Bueno-Cavanillas, n.d.)

CONCLUSION

Optimizing nutritional status and good metabolism should be prepared from the preconception period. Ensuring that the preconception state is in good condition is crucial, making every pregnancy need to be prepared for optimal pregnancy outcomes. The Institute of Medicine (IOM) recommended weight gain during pregnancy as follows:(Nyirjesy & Lonergan, 2013)

Prepregnancy Weight Category	***Body Mass Index****	***Recommended Range of Total Weight (lb)***	***Recommended Rates of Weight Gain in the second and third trimester (lb/wk)***
Underweight	Less than 18.5	28-40	11-1.3)
Normal Weight	18.5-24.9	25-35	1 (0.8-1)
Overweight	25-29.9	15-25	0.6 (0.5-0.7)
Obese	30 and greater	11-20	0.5 (0.4-0.6)
Multiple pregnancy			
Normal	18.5-27	-	-
Overweight	15.5-25	-	-
Obese	12.5-21	-	-

Based on: American College of Obstetricians and Gynecologists, 2013

Controlling excessive weight gain can be achieved through physical activity during pregnancy. The CDC recommends 150 minutes of moderate-intensity aerobic exercise per week for a normal pregnancy. Low-impact activities such as swimming, walking, prenatal yoga, and stationary biking can be done by pregnant women.(Lal & Kominiarek, 2015)(Nyirjesy & Lonergan, 2013)

Nutritional Behaviors with Education and Weight Gain

Nutritional behaviors were correlated with education level and weight gain during pregnancy. Women with higher education levels tended to have better dietary habits, including consuming more meals per day, more vegetables, yogurt, beef, and fish of the best choices. On the other hand, weight gain during pregnancy was associated with the consumption of wholemeal bread, beef, herring, and watermelon, as well as eating between meals and consuming meat in general. The importance of proper nutritional behavior in pregnancy for the well-being of both mother and fetus. It emphasized the need to expand nutritional education and develop awareness among mothers in perinatal care programs, as many pregnant women did not follow food recommendations, leading to nutritional mistakes such as low. (Misan et al., 2019)

In 2009, the IOM (Institute of Medicine) revised its guidelines and suggested that women with a normal weight carrying twins should gain between 17-25 kg. They also updated the recommendations for overweight and obese women, recognizing the impact of pre-pregnancy BMI on outcomes such as premature birth and intrauterine growth restriction. For overweight women, the guidelines suggest a weight gain of 14-23 kg, and for obese women, it is recommended to gain 11-19 kg. These guidelines were developed based on the 25th-75th percentiles of weight gain in women with twin births whose weights exceeded 2500 g at term. However, it's important to note that the committee did not conduct the same rigorous analysis of outcomes for gestational weight gain in twins as it did for singleton gestations, resulting in provisional guidelines.(Lal & Kominiarek, 2015)(Nyirjesy & Lonergan, 2013)

The IOM established different weight gain guidelines for twin pregnancies compared to singleton pregnancies due to various factors influencing maternal weight gain in twin gestations. These factors include maternal physiological adaptations to carrying twins, pre-pregnancy weight, and birth weight discordance. Birth weight in twin gestations differs from singletons, as the 10th percentile of birth weight for singletons is equivalent to the mean birth weight for twins at 38 weeks gestation. Additionally, while twins represent only 3% of all live births in the United States, approximately 60% are born preterm, and around 25% are classified as very low birth weight.(Nyirjesy & Lonergan, 2013)(Lal & Kominiarek, 2015)

Optimizing weight gain during pregnancy according to IOM recommendations includes maintaining a normal BMI at the beginning of pregnancy. (1) Clinicians should assess the mother's pre-pregnancy weight, recommend weight gain during pregnancy, and create a weight gain plan during pregnancy by developing a curve or graph. (2) Individual assistance and counseling are provided before and during pregnancy to help mothers choose a diet and physical activity that play a role in controlling weight gain. (3) Assisting mothers in returning to normal BMI postpartum. (4) Even though the mother's food intake supports the lives of two individuals, it does not mean that the daily portion should be doubled. The increase in daily calorie requirements is only about 340 Kcal/day in the second trimester and 450 Kcal/day in the third

trimester. For multiple pregnancies, the increase in calories is calculated based on per fetus, requiring an additional 300 Kcal/day.

ACKNOWLEDGEMENT

We would like to express our sincere gratitude to team members who actively contributed to the systematic review.

REFERENCES

Blondin, J. H., & LoGiudice, J. A. (2018). Pregnant women's knowledge and awareness of nutrition. *Applied Nursing Research*, *39*, 167–174. https://doi.org/10.1016/J.APNR.2017.11.020

dr. Siti Nadia Tarmizi, M. E. (2023). *B u m i l S e h a t , Tu r u n k a n S t u n t i n g d a n A n g k a Kematian Ibu* . (November), 1–6.

Fernanda Scherer-Adami, Michele Dutra-Rosolen, Francieli Schedler, Ioná Carreno, M. N. A. (2020). Nutritional status and dietary intake of pregnant women. *Rev Salud Publica (Bogota)*, *22*(1), 27–33. https://doi.org/10.15446/rsap.V22n1.72795

Fitriani, H., Achmad Setya, R., & Nurdiana, P. (2020). Risk Factors of Maternal Nutrition Status During Pregnancy to Stunting in Toddlers Aged 12-59 Months. *Jurnal Keperawatan Padjadjaran*, *8*(2), 174–182. https://doi.org/10.24198/jkp.v8i2.1305

Gebremichael, M. A., & Belachew Lema, T. (2023). Dietary Diversity, Nutritional Status, and Associated Factors Among Pregnant Women in Their First Trimester of Pregnancy in Ambo District, Western Ethiopia. *Nutrition and Metabolic Insights*, *16*. https://doi.org/10.1177/11786388231190515

González-Martínez, S., Riestra-Fernández, M., Martínez-Morillo, E., Avello-Llano, N., Delgado-álvarez, E., & Menéndez-Torre, E. L. (2021). Nutritional iodine status in pregnant women from health area iv in asturias (Spain): Iodised salt is enough. *Nutrients*, *13*(6), 1–13. https://doi.org/10.3390/nu13061816

Grenier, L. N., Atkinson, S. A., Mottola, M. F., Wahoush, O., Thabane, L., Xie, F., … Murray-Davis, B. (2021). Be Healthy in Pregnancy: Exploring factors that impact pregnant women's nutrition and exercise behaviours. *Maternal and Child Nutrition*, *17*(1), 1–9. https://doi.org/10.1111/mcn.13068

Lal, A. K., & Kominiarek, M. A. (2015). Weight gain in twin gestations: Are the Institute of Medicine guidelines optimal for neonatal outcomes? *Journal of Perinatology*, *35*(6), 405–410. https://doi.org/10.1038/jp.2014.237

Misan, N., Paczkowska, K., Szmyt, M., Kapska, K., Tomczak, L., Breborowicz,

G. H., & Ropacka-Lesiak, M. (2019). Nutritional behavior in pregnancy. *Ginekologia Polska*, *90*(9), 527–533. https://doi.org/10.5603/GP.2019.0090

Nyirjesy, I., & Lonergan, W. M. (2013). Weight gain during pregnancy. *Obstetrics and Gynecology*, *33*(1), 139. https://doi.org/10.1515/9783111714134-004

Pribadi, A., C.Moses, J., & Anwar, A. D. (2015). *Kehamilan Resiko Tinggi*. CV. Sagung Seto.

Rocío Olmedo-Requena, Julia Gómez-Fernández, Juan Mozas-Moreno, Anne-Mary Lewis-Mikhael, Aurora Bueno-Cavanillas, J.-J. J.-M. (n.d.). Factors associated with adherence to nutritional recommendations before and during pregnancy. *Women Health Epub 2018 Jan 2.*, *10*(58), 1094–1111. https://doi.org/10.1080/03630242.2017.1388332

Urgell-Lahuerta, C., Carrillo-álvarez, E., & Salinas-Roca, B. (2021). Interventions on food security and water uses for improving nutritional status of pregnant women and children younger than five years in low-middle income countries: A systematic review. *International Journal of Environmental Research and Public Health*, *18*(9). https://doi.org/10.3390/ijerph18094799