IJH INTERNATIONAL JOURNAL OF HEALTH
Volume 01 Number 01 (May 2025)
e-ISSN: 3164-8835; p-ISSN: 3164-8827

Midwifery care for a pregnant woman at risk of chronic energy deficiency (CED): A case study

Rima Fitri Ramadana[1], Dwi Estuning Rahayu[1], Ira Titisari[1], Indah Rahmaningtyas[1]

[1]Midwifery Professional Education, Malang Health Polytechnic, Indonesia

Corresponding Author: Rima Fitri Ramadana, rimaftrramadana12@gmail.com

Check for updates

Abstract:

Chronic energy deficiency (CED) in pregnancy, identified by a mid-upper arm circumference (MUAC) below 23.5 cm, remains a public health concern in Indonesia because it is linked to adverse maternal and neonatal outcomes. Screening by MUAC alone can be misleading when other nutritional indicators are normal. This study describes midwifery care for a pregnant woman with a borderline MUAC and shows how screening indicators can be read together. A descriptive single-case study was conducted from 11 November 2024 to 22 March 2025. Data were collected through interviews, observation, physical examination, and review of antenatal records, and the case is reported following the CARE guideline. At 36 weeks of gestation, Mrs. N.S. had a MUAC of 23 cm, which is below the national cut-off of 23.5 cm and indicates a risk of mild CED. Her body mass index (19.8 kg/m²) was normal, estimated fetal weight was appropriate for gestational age, and other routine indicators were within normal limits. Care focused on regular monitoring, fetal growth surveillance, and nutrition education, and it ran smoothly according to the preventive plan. A borderline MUAC can occur together with normal nutritional status and normal fetal growth. MUAC is best used as a screening signal, interpreted with BMI, fetal growth, and antenatal findings, and followed by early preventive nutrition care.

Keywords:
midwifery care; pregnant women; chronic energy deficiency (CED); mid-upper arm circumference; case study

Article Info:
Submitted: 20-03-2025
Revised: 15-05-2025
Accepted: 18-05-2025
Published: 31-05-2025

https://doi.org/10.53713/ijh.v1i1.498

This work is licensed under the CC BY-SA License.

INTRODUCTION

Maternal nutrition is one of the strongest foundations of a healthy pregnancy. What a woman eats before and during pregnancy shapes her own health, her baby's growth, and the child's health later in life (Marshall et al., 2022). Research on the developmental origins of health and disease shows that the nutrient supply in the womb can program a child's metabolism and long-term risk of chronic disease (Hanson & Gluckman, 2014). Undernutrition is therefore not only a problem of the mother. It can pass from one generation to the next, because undernourished mothers are more likely to have small babies who are at risk of stunting and poor development (Black et al., 2013; Dewey & Begum, 2011).

Volume 01 Number 01 (May 2025)
e-ISSN: 3164-8835; p-ISSN: 3164-8827

One form of maternal undernutrition that midwives meet often is chronic energy deficiency (CED). CED describes a long-standing shortage of energy and protein intake that slowly reduces a woman's body reserves. In Indonesian antenatal care, a pregnant woman is considered at risk of CED when her mid-upper arm circumference (MUAC) is below 23.5 cm. A body mass index (BMI) below 18.5 kg/m² before pregnancy or in the first trimester is another risk criterion (Kementerian Kesehatan RI, 2023; Wati et al., 2024). MUAC is widely used for screening because it is quick and cheap, needs only a measuring tape, and changes little with gestational age or weight gain during pregnancy (Ververs et al., 2013).

The burden of maternal undernutrition is high in low- and middle-income countries. Undernutrition is reported in roughly 13% to 38% of pregnant women in developing nations, and 39.2% of women attending antenatal care in western Ethiopia were undernourished (Tafara et al., 2023). In Indonesia, the 2018 National Health Survey (Riskesdas) reported that about 17% of pregnant women had CED (Kementerian Kesehatan RI, 2022). Studies from Indonesian communities have linked CED to maternal characteristics, diet, nutritional knowledge, and socioeconomic conditions (Harismayanti & Syukur, 2021; Wati et al., 2024). Environmental and occupational factors may add to the risk. For example, women who work in agriculture can be exposed to pesticides, which has been associated with anemia and low birth weight (Faza et al., 2025; Kurniyawan et al., 2024).

CED matters because its effects reach both mother and baby. Maternal underweight increases the risk of preterm birth and low birth weight (LBW) (Han et al., 2011). In a review of studies from humanitarian settings, MUAC values below about 22-23 cm were associated with LBW, intrauterine growth restriction, and preterm birth (Ververs et al., 2013). For the mother, small body reserves may reduce strength during labor and have been linked with anemia and postpartum bleeding in Indonesian reports (Harismayanti & Syukur, 2021; Putri et al., 2023). Deficiencies in iron, folate, and other micronutrients often occur alongside energy deficiency and increase these risks (Gernand et al., 2016). Globally, undernutrition underlies an estimated 45% of deaths among children under five years of age (Black et al., 2013).

However, a low MUAC does not always lead to a poor outcome. Some women with CED give birth to babies of normal weight, because birth weight also depends on antenatal care, supplementation, genetics, and other factors (Abu-Saad & Fraser, 2010). A screening result is therefore a signal of risk, not a diagnosis. Midwives often face a "grey zone": a woman whose MUAC is just below the cut-off, but whose BMI and fetal growth are normal. There is little practical guidance on how to interpret and manage these borderline cases and single-case reports can show how screening results are read in daily practice.

Midwives are well placed to act in this grey zone. The World Health Organization recommends nutrition counseling and at least eight antenatal contacts to support a positive pregnancy experience (World Health Organization, 2016). Nutrition counseling can improve knowledge and dietary practice (Ginting et al., 2021; Girard & Olude, 2012; Kulsum & Wulandari, 2022). In undernourished populations, balanced energy–protein supplementation and multiple micronutrient supplements have been linked with better birth outcomes (Haider & Bhutta, 2017; Imdad & Bhutta, 2012). All these measures depend on early identification and regular follow-up.

Volume 01 Number 01 (May 2025)
e-ISSN: 3164-8835; p-ISSN: 3164-8827

This study describes midwifery care for a woman in her third trimester with a borderline MUAC (23 cm), a normal BMI, and normal fetal growth. It aims to show how MUAC, BMI, and fetal growth can be read together to guide preventive care. The case is reported in accordance with the CARE guidelines for case reports (Riley et al., 2017).

METHODS

This study used a descriptive single-case design, which is suitable for examining a care process in depth within its real clinical setting. The case is reported in accordance with the CARE guidelines (Riley et al., 2017). Care and data collection took place from 11 November 2024 to 22 March 2025 as part of the Midwifery Professional Education program at Poltekkes Kemenkes Malang (Malang Health Polytechnic), Indonesia. The participant was Mrs. N.S., a pregnant woman in her third trimester (36 weeks of gestation at the reported assessment) with indications of mild CED. She was purposively selected because her MUAC was below the national screening cut-off of 23.5 cm, and she agreed to receive continued midwifery care and to participate in the study.

Data were collected from four sources to allow triangulation: (1) interviews about obstetric history, daily diet and eating habits, and antenatal visit attendance; (2) direct observation of the participant's general condition; (3) physical examination, including vital signs (blood pressure, pulse, respiratory rate, and temperature), weight, fundal height (TFU), MUAC, and fetal assessment; and (4) review of antenatal care records.

MUAC was measured at the midpoint between the tip of the shoulder (acromion) and the tip of the elbow (olecranon) with a non-stretchable measuring tape and read to the nearest 0.1 cm. A MUAC below 23.5 cm was defined as a risk of CED (Kementerian Kesehatan RI, 2023). BMI was calculated as weight in kilograms divided by height in meters squared and interpreted with the WHO classification and the Asian cut-offs (WHO Expert Consultation, 2004). Because BMI varies with gestational weight gain, the national risk criterion (BMI below 18.5 kg/m²) is based on the pre-pregnancy or first-trimester value (Kementerian Kesehatan RI, 2023). Fetal growth was assessed from fundal height and estimated fetal weight (EFW) and judged against gestational age (Hadlock et al., 1985).

Care followed the standard steps of the midwifery care process: assessment, identification of problems and risks, care planning, implementation, and evaluation. The plan was preventive. It aimed to prevent progression to CED and support fetal growth, and it included regular monitoring of maternal and fetal conditions, nutrition education, and attention to macro- and micronutrient needs. Data were analyzed descriptively. Findings from the four sources were compared with the national and international reference values above and then summarized in tables and a narrative synthesis. The care given was evaluated against the preventive plan. The participant gave written informed consent for care, data collection, and publication of this report. Her identity is protected by using initials and omitting identifying details.

RESULTS

Mrs. N.S. received midwifery care in the third trimester of pregnancy during the study period (11 November 2024 to 22 March 2025). At the reported assessment, she was at 36 weeks of gestation. Table 1 summarizes the main maternal and fetal findings.

Table 1. Maternal nutritional and fetal growth findings of Mrs. N.S.

Indicator	Finding	Reference criterion	Interpretation
Gestational age	36 weeks (third trimester)	Third trimester: 28 weeks onward	Late third trimester
MUAC	23 cm	< 23.5 cm: at risk of CED (Kementerian Kesehatan RI, 2023)	Below cut-off; at risk of mild CED
BMI	19.8 kg/m²	18.5–24.9 kg/m² (WHO); 18.5–22.9 kg/m² (Asian cut-off)	Normal
Estimated fetal weight	Appropriate for gestational age	Within the expected range for gestational age	Normal fetal growth
Vital signs, weight, and fundal height	Within normal limits	Normal ranges for gestational age	No abnormal finding
Overall nutritional risk	At risk of mild CED (MUAC-based)	Combined reading of all indicators	Within physiological limits; no significant clinical effect

Note. MUAC = mid-upper arm circumference; BMI = body mass index; CED = chronic energy deficiency. BMI categories apply to non-pregnant adults; the national risk criterion (< 18.5 kg/m²) uses the pre-pregnancy or first-trimester BMI.

Her MUAC was 23 cm. This is 0.5 cm below the national cut-off of 23.5 cm, so she was classified as at risk of mild CED. In contrast, her BMI was 19.8 kg/m², which lies within the normal range of both the WHO and the Asian classifications. The estimated fetal weight matched gestational age, showing that the fetus was growing as expected. Vital signs, weight, and fundal height were within normal limits. In short, the only indicator to cross the screening threshold was MUAC, and it did so by a narrow margin.

Table 2. Midwifery care provided and its purpose

Care component	What was done	Purpose
Nutritional status monitoring	MUAC and weight assessed at antenatal visits	Detect progression from risk to CED
General condition and vital signs	Blood pressure, pulse, respiration, and temperature checked	Detect maternal complications early
Fetal growth surveillance	Fundal height and estimated fetal weight compared with gestational age	Detect growth restriction early
Nutrition education	Education on balanced nutrition during pregnancy	Improve knowledge and dietary intake
Macro- and micronutrient needs	Counseling on meeting energy, protein, and micronutrient needs	Prevent CED from developing and support fetal growth
Continuity of antenatal care	Follow-up through the study period according to the preventive plan	Keep monitoring and education regular

Note. CED = chronic energy deficiency; MUAC = mid-upper arm circumference.

Volume 01 Number 01 (May 2025)
e-ISSN: 3164-8835; p-ISSN: 3164-8827

Care was planned to prevent progression to CED and to protect fetal growth. Table 2 shows the care components and their purposes. Care ran smoothly according to the preventive plan, and the other nutritional and fetal indicators stayed within normal limits. Taken together, the findings describe a woman at risk of mild CED according to MUAC, with otherwise normal nutritional status and good fetal growth. Her condition was within physiological limits and had not yet produced significant clinical effects.

DISCUSSION

The main finding of this case is a mismatch between indicators. Mrs. N.S. had a MUAC of 23 cm, just under the national cut-off of 23.5 cm, but her BMI was normal, and her fetus was growing appropriately for gestational age. Under the national criterion, she was at risk of mild CED, yet she showed no clinical sign of harm. This is consistent with the view that CED risk lies on a spectrum, and that a woman near the cut-off may be at an early stage of risk rather than in established deficiency. It also reminds us that screening tools are built to catch as many at-risk women as possible, so some women who are flagged will do well.

The position of the cut-off matters. Indonesia uses 23.5 cm, while a review of humanitarian studies found that adverse birth outcomes were most strongly linked to MUAC values below 22-23 cm and proposed 23 cm as a practical threshold for enrolling pregnant women in nutrition programs (Ververs et al., 2013). Mrs. N.S. lies between these two thresholds. Under the national rule, she is flagged, while under the 23 cm rule she sits exactly at the limit. This does not mean that the national cut-off is wrong. A more sensitive threshold is sensible in a country where CED is common, and prevention is cheap and low-risk. But it shows why a single measurement should not be read as a final answer. A tape reading can vary slightly among observers, so a repeat measurement and the trend over time are more informative than a single value.

BMI and MUAC measure different things. MUAC reflects muscle and fat mass in the arm and is relatively stable during pregnancy, whereas BMI changes as the woman gains weight (Ververs et al., 2013). In Mrs. N.S., a normal BMI (19.8 kg/m^2) suggests that her overall body mass was adequate. This is reassuring, because it is maternal underweight, rather than a borderline arm size, that shows the clearest link with preterm birth and LBW in pooled studies (Han et al., 2011). Even so, a BMI measured in the third trimester cannot replace the pre-pregnancy or first-trimester BMI used by the national guideline for risk classification (Kementerian Kesehatan RI, 2023). When an early BMI is missing, MUAC remains a practical alternative, which is one reason it is used so widely in primary care.

Body composition may also help to explain the difference between the two indicators. Arm size depends on both muscle and fat, so women whose daily work involves heavy arm use may have a different MUAC from women with a more sedentary lifestyle, even when their overall nutrition is similar. This is one more reason to interpret MUAC in context.

Fetal growth was normal in this case despite a MUAC slightly below the cut-off. This aligns with the view that maternal body size is only one of many factors shaping fetal growth. Birth weight is also influenced by maternal age, parity, genetics, the quality of antenatal care, and household and environmental conditions (Abu-Saad & Fraser, 2010). Indonesian research that examined MUAC

Volume 01 Number 01 (May 2025)
e-ISSN: 3164-8835; p-ISSN: 3164-8827

alongside BMI and fundal height as predictors of birth weight supports the same idea: no single measure is sufficient (Kurdanti et al., 2020). In practice, a normal EFW should not lead to the conclusion that CED risk can be ignored. EFW is an estimate with its own error and a snapshot of growth at a single point in time (Hadlock et al., 1985). Growth can slow later in pregnancy if intake stays low, so repeated assessment is needed until delivery.

Environmental and occupational factors deserve attention in communities where many women work on or live near farmland. Pesticide exposure during pregnancy has been associated with anemia and LBW in agricultural areas (Faza et al., 2025; Kurniyawan et al., 2024). Exposure was not assessed in this case, but these reports suggest that history taking for women with a borderline MUAC should include occupation and household environment, together with diet and antenatal attendance. Doing so lets the midwife see risks that arm size and BMI cannot show.

Normal findings today do not remove the need for preventive care. Maternal nutrition affects pregnancy outcomes and the child's later health (Hanson & Gluckman, 2014; Marshall et al., 2022). Untreated undernutrition can limit nutrient availability to the fetus and may contribute to LBW and growth restriction (Black et al., 2013). For the mother, low energy reserves have been linked to anemia and reduced strength during labor, although most of the Indonesian evidence comes from observational and descriptive studies and should be read with caution (Harismayanti & Syukur, 2021; Putri et al., 2023). The low cost and low risk of preventive care, compared with the potential harm of a missed deficiency, support acting early in borderline cases.

The care given to Mrs. N.S. combined three elements: regular monitoring, fetal growth surveillance, and nutrition education. This combination aligns with international guidance on antenatal care, which emphasizes regular contact and nutrition counseling (World Health Organization, 2016). Indonesian studies reported improved nutrition knowledge following education based on local foods and health education aimed at reducing CED (Ginting et al., 2021; Kulsum & Wulandari, 2022). Reviews of international evidence suggest that counseling can improve maternal diet and weight gain, but that the effect on birth outcomes may be stronger when counseling is combined with food or supplements for women who need them (Girard & Olude, 2012; Ota et al., 2015).

For women with confirmed undernutrition, balanced energy–protein supplementation and multiple micronutrient supplements have been linked with fewer small and low-birth-weight babies (Haider & Bhutta, 2017; Imdad & Bhutta, 2012). Supplementary food is also part of the national response for pregnant women with CED, and the need for it in borderline cases is best assessed by the midwife based on dietary intake and trends in MUAC and fetal growth (Kementerian Kesehatan RI, 2023).

A further consideration is the role of family support and access to nutritious food in preventing maternal undernutrition. Nutrition counseling is more effective when recommendations reflect local food availability, household income, cultural practices, and the woman's daily workload. Midwives can involve family members in meal planning and encourage the use of affordable, nutrient-rich foods, while assessing whether additional nutritional support is needed. Regular follow-up can help identify inadequate weight gain or a decline in MUAC before complications develop. These actions are consistent with antenatal care recommendations that

Volume 01 Number 01 (May 2025)
e-ISSN: 3164-8835; p-ISSN: 3164-8827

emphasize nutrition counseling and continued monitoring throughout pregnancy (World Health Organization, 2016; Girard & Olude, 2012).

This case also highlights the need to distinguish screening results from confirmed nutritional problems. A MUAC of 23 cm indicates a borderline risk that deserves attention, but it does not independently establish the severity of maternal undernutrition or predict fetal outcomes. Combining repeated MUAC measurements with maternal weight trends, dietary assessment, hemoglobin levels, and fetal growth monitoring would provide a more complete clinical picture. Future studies should examine whether this combined approach improves the identification of women who need nutritional interventions and helps prevent adverse birth outcomes, particularly in primary care settings where MUAC screening is widely used (Ververs et al., 2013; Kurdanti et al., 2020; Kementerian Kesehatan RI, 2023).

Three practical lessons follow from this case. First, MUAC should be treated as a screening signal and always read together with BMI, fetal growth, and antenatal findings. Second, borderline cases should receive preventive care without delay because it is simple and safe: repeated MUAC and weight checks, fundal height and EFW tracking, and nutrition advice focused on foods available at home. Third, history-taking should look beyond diet to include workload, occupation, and environmental exposures, and the woman's family should be involved, as they influence what she eats. Clear referral triggers, such as a further fall in MUAC, poor weight gain, or slowing fetal growth, can help midwives escalate care in time.

This report has several strengths. It used four data sources, applied clear operational definitions, and compared the findings with national and international reference values. It also addresses a situation that midwives often encounter but rarely describe. There are also limitations. This is a single case, so the findings cannot be generalized. MUAC is reported as a single value, so changes over time cannot be described. Dietary intake, hemoglobin level, supplement use, and pre-pregnancy BMI were not reported, although they would help to explain the borderline MUAC. Birth outcomes were also outside the scope of this report. Future studies should follow similar women through delivery and the early neonatal period, repeatedly measure MUAC, classify birth weight by gestational age using international standards (Villar et al., 2014), and compare outcomes between women with borderline and normal MUAC in larger samples.

CONCLUSION

Mrs. N.S. had a MUAC of 23 cm, which put her at risk of mild CED, but her BMI was normal, and her fetal growth matched her gestational age. Her condition was within physiological limits and had not yet caused significant clinical effects. This case shows that MUAC works best as an early warning signal, read alongside other indicators, rather than as a stand-alone diagnosis. Regular monitoring, fetal growth surveillance, and nutrition education can be started early in borderline cases, and clear referral triggers should be set. Larger follow-up studies are needed to learn how a borderline MUAC relates to delivery and neonatal outcomes.

ACKNOWLEDGEMENT

The authors would like to thank the Midwifery Professional Education Study Program at Poltekkes Kemenkes Malang (Malang Health Polytechnic) and Mrs. N.S. for the opportunity to provide midwifery care during her pregnancy.

CONFLICT OF INTEREST

The authors declare no conflict of interest in this article.

REFERENCES

Abu-Saad, K., & Fraser, D. (2010). Maternal nutrition and birth outcomes. *Epidemiologic Reviews*, 32(1), 5–25. https://doi.org/10.1093/epirev/mxq001

Black, R. E., Victora, C. G., Walker, S. P., Bhutta, Z. A., Christian, P., de Onis, M., Ezzati, M., Grantham-McGregor, S., Katz, J., Martorell, R., & Uauy, R. (2013). Maternal and child undernutrition and overweight in low-income and middle-income countries. *The Lancet*, 382(9890), 427–451. https://doi.org/10.1016/S0140-6736(13)60937-X

Dewey, K. G., & Begum, K. (2011). Long-term consequences of stunting in early life. *Maternal & Child Nutrition*, 7(s3), 5–18. https://doi.org/10.1111/j.1740-8709.2011.00349.x

Faza, N., Novita, R., Trisnawati, D., Kurniyawan, E. H., Afandi, A. T., Kurniawan, D. E., & Nur, K. R. M. (2025). Pesticide exposure increases the incidence of low birth weight (LBW) in agricultural areas. *Journal of Nursing Periodic*, 2(2). https://doi.org/10.36858/jnp.v2i2.39

Gernand, A. D., Schulze, K. J., Stewart, C. P., West, K. P., Jr., & Christian, P. (2016). Micronutrient deficiencies in pregnancy worldwide: Health effects and prevention. *Nature Reviews Endocrinology*, 12(5), 274–289. https://doi.org/10.1038/nrendo.2016.37

Ginting, M., Mustafa, A., & Jaladri, I. (2021). Pedoman gizi seimbang berbasis pangan lokal terhadap pengetahuan, asupan dan status gizi ibu hamil. *Jurnal Vokasi Kesehatan*, 6(2), 104. https://doi.org/10.30602/jvk.v6i2.516

Girard, A. W., & Olude, O. (2012). Nutrition education and counselling provided during pregnancy: Effects on maternal, neonatal and child health outcomes. *Paediatric and Perinatal Epidemiology*, 26(s1), 191–204. https://doi.org/10.1111/j.1365-3016.2012.01278.x

Hadlock, F. P., Harrist, R. B., Carpenter, R. J., Deter, R. L., & Park, S. K. (1985). Estimation of fetal weight with the use of head, body, and femur measurements. *American Journal of Obstetrics and Gynecology*, 151(3), 333–337. https://doi.org/10.1016/0002-9378(85)90298-4

Haider, B. A., & Bhutta, Z. A. (2017). Multiple-micronutrient supplementation for women during pregnancy. *Cochrane Database of Systematic Reviews*, 2017(4), CD004905. https://doi.org/10.1002/14651858.CD004905.pub5

Han, Z., Mulla, S., Beyene, J., Liao, G., McDonald, S. D., & Knowledge Synthesis Group. (2011). Maternal underweight and the risk of preterm birth and low birth weight: A systematic review and meta-analyses. *International Journal of Epidemiology*, 40(1), 65–101. https://doi.org/10.1093/ije/dyq195

Hanson, M. A., & Gluckman, P. D. (2014). Early developmental conditioning of later health and disease: Physiology or pathophysiology? *Physiological Reviews*, 94(4), 1027–1076. https://doi.org/10.1152/physrev.00029.2013

Harismayanti, H., & Syukur, S. B. (2021). Analisis kekurangan energi kronik pada ibu hamil di wilayah kerja Puskesmas Telaga Biru. *Media Publikasi Promosi Kesehatan Indonesia (MPPKI)*, 4(2), 162–170. https://doi.org/10.56338/mppki.v4i2.1491

Imdad, A., & Bhutta, Z. A. (2012). Maternal nutrition and birth outcomes: Effect of balanced protein-energy supplementation. *Paediatric and Perinatal Epidemiology*, 26(s1), 178–190. https://doi.org/10.1111/j.1365-3016.2012.01308.x

Kementerian Kesehatan RI. (2022). *Profil kesehatan Indonesia 2021*. Kementerian Kesehatan Republik Indonesia. https://www.kemkes.go.id/downloads/resources/download/pusdatin/profil-kesehatan-indonesia/Profil-Kesehatan-2021.pdf

Kementerian Kesehatan RI. (2023). *Petunjuk teknis makanan tambahan balita dan ibu hamil*. Direktorat Gizi Masyarakat, Kementerian Kesehatan Republik Indonesia. https://kesmas.kemkes.go.id/assets/uploads/contents/others/20230516_Juknis_Tatalaksana_Gizi_V18.pdf

Kulsum, K., & Wulandari, D. (2022). Upaya menurunkan kejadian KEK pada ibu hamil melalui pendidikan kesehatan. *Jurnal Pengemas Kesehatan*, 1(01), 27–30. https://doi.org/10.52299/jpk.v1i01.6

Kurdanti, W., Khasana, T. M., & Wayansari, L. (2020). Lingkar lengan atas, indeks massa tubuh, dan tinggi fundus ibu hamil sebagai prediktor berat badan lahir. *Jurnal Gizi Klinik Indonesia*, 16(4), 168. https://doi.org/10.22146/ijcn.49314

Kurniyawan, E. H., Iswatiningtyas, N. F., Cahyarani, F. B., Sholihah, N. L. I. M., Wati, D. Y., Sapitri, R. D. A., & Afandi, A. T. (2024). Overview of reproductive health in women in agricultural areas due to exposure to pesticides. *Malang Journal of Midwifery (MAJORY)*, 6(1), 1–13. https://doi.org/10.31290/majory.v6i1.4131

Marshall, N. E., Abrams, B., Barbour, L. A., Catalano, P., Christian, P., Friedman, J. E., Hay, W. W., Jr., Hernandez, T. L., Krebs, N. F., Oken, E., Purnell, J. Q., Roberts, J. M., Soltani, H., Wallace, J., & Thornburg, K. L. (2022). The importance of nutrition in pregnancy and lactation: Lifelong consequences. *American Journal of Obstetrics and Gynecology*, 226(5), 607–632. https://doi.org/10.1016/j.ajog.2021.12.035

Ota, E., Hori, H., Mori, R., Tobe-Gai, R., & Farrar, D. (2015). Antenatal dietary education and supplementation to increase energy and protein intake. *Cochrane Database of Systematic Reviews*, 2015(6), CD000032. https://doi.org/10.1002/14651858.CD000032.pub3

Putri, A. A., Salsabila, S., Gizi, J., Kedokteran, F., Sultan, U., & Tirtayasa, A. (2023). Dampak penyakit KEK pada ibu hamil. *Student Scientific Creativity Journal (SSCJ)*, 1(3), 246–253. https://doi.org/10.55606/sscj-amik.v1i3.1525

Riley, D. S., Barber, M. S., Kienle, G. S., Aronson, J. K., von Schoen-Angerer, T., Tugwell, P., … Gagnier, J. J. (2017). CARE guidelines for case reports: Explanation and elaboration document. *Journal of Clinical Epidemiology*, 89, 218–235. https://doi.org/10.1016/j.jclinepi.2017.04.026

Tafara, L., Bikila, H., Feyisa, I., Desalegn, M., & Kaba, Z. (2023). The prevalence of under nutrition and associated factors among pregnant women attending antenatal care service in public hospitals of western Ethiopia. *PLoS ONE*, 18(1), e0278180. https://doi.org/10.1371/journal.pone.0278180

Ververs, M.-T., Antierens, A., Sackl, A., Staderini, N., & Captier, V. (2013). Which anthropometric indicators identify a pregnant woman as acutely malnourished and predict adverse birth outcomes in the humanitarian context? *PLoS Currents*, 5. https://doi.org/10.1371/currents.dis.54a8b618c1bc031ea140e3f2934599c8

Villar, J., Ismail, L. C., Victora, C. G., Ohuma, E. O., Bertino, E., Altman, D. G., … Kennedy, S. H. (2014). International standards for newborn weight, length, and head circumference by gestational age and

Volume 01 Number 01 (May 2025)
e-ISSN: 3164-8835; p-ISSN: 3164-8827

sex: The Newborn Cross-Sectional Study of the INTERGROWTH-21st Project. *The Lancet*, 384(9946), 857–868. https://doi.org/10.1016/S0140-6736(14)60932-6

Wati, E. K., Murwani, R., & Kartasurya, M. I. (2024). Determinants of chronic energy deficiency (CED) incidence in pregnant women: A cross-sectional study in Banyumas, Indonesia. *Narra J*, 4(1), e742. https://doi.org/10.52225/narra.v4i1.742

WHO Expert Consultation. (2004). Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *The Lancet*, 363(9403), 157–163. https://doi.org/10.1016/S0140-6736(03)15268-3

World Health Organization. (2016). *WHO recommendations on antenatal care for a positive pregnancy experience*. World Health Organization. https://www.who.int/publications/i/item/9789241549912