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FEEDING FOR TWO: THE IMPACT OF DIETARY PATTERNS ON BLOOD SUGAR CONTROL IN LATE PREGNANCY

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ABSTRAK : MEMBERI MAKAN UNTUK DUA ORANG: DAMPAK POLA MAKAN TERHADAP PENGENDALIAN GULA DARAH PADA AKHIR KEHAMILAN

Latar Belakang: Diabetes mellitus gestasional (DMG) terkait dengan morbiditas maternal dan neonatal. Pola makan berperan penting dalam pengendalian glukosa selama kehamilan.

Tujuan: Menganalisis pengaruh pola makan energi, makronutrien, dan asupan cairan terhadap kadar gula darah puasa pada ibu hamil trimester tiga di Rumah Sakit An- Nisa, Tangerang.

Metode: Penelitian potong lintang dilakukan pada 100 ibu hamil trimester tiga. Pola makan dinilai menggunakan recall 24 jam dan aplikasi Nutrinote. Kadar gula darah puasa diukur melalui metode laboratorium standar. Uji chi- square, korelasi Spearman, dan regresi logistik sederhana digunakan untuk menganalisis asosiasi dan mengontrol faktor perancu. Signifikansi ditetapkan pada α = 0,05.

Hasil: Indeks massa tubuh sebelum hamil berhubungan signifikan dengan kadar gula darah puasa (p = 0,014). Asupan energi (r = 0,351, p < 0,001), protein (r = 0,292, p = 0,002), dan karbohidrat (r = 0,358, p < 0,001) berkorelasi positif dengan kadar gula darah puasa, sedangkan lemak (r = 0,173, p = 0,085) dan cairan (r = 0,029, p = 0,773) tidak. Regresi logistik menunjukkan bahwa asupan energi (OR = 1,02; 95% CI 1,01–1,03; p = 0,001), protein (OR = 1,03; 95% CI 1,02–1,05; p < 0,001), dan karbohidrat (OR = 1,01; 95% CI 1,00–1,02; p = 0,001) secara signifikan meningkatkan peluang kadar gula darah puasa tinggi.

Kesimpulan: Manajemen pola makan yang tepat—terutama energi, protein, dan karbohidrat—penting untuk mencegah peningkatan kadar gula darah puasa pada ibu hamil. Edukasi gizi seimbang direkomendasikan untuk mencegah DMG.

Saran: Tenaga kesehatan diharapkan dapat memberikan edukasi gizi seimbang dan perencanaan pola makan yang disesuaikan agar risiko DMG dapat diminimalkan.

Kata Kunci: Diabetes Mellitus Gestasional, Gula Darah Puasa, Ibu Hamil, Pola Makan

ABSTRACT

Background: Gestational diabetes mellitus (GDM) is associated with adverse maternal and neonatal outcomes. Dietary patterns play a crucial role in glycemic control during pregnancy.

Objective: To analyze the effect of dietary patterns—energy, macronutrients, and fluid intake—on fasting blood glucose levels among third- trimester pregnant women at An- Nisa Hospital, Tangerang.

Methods: A cross- sectional study was conducted with 100 pregnant women in their third trimester. Dietary intake was assessed using a 24- hour recall and the Nutrinote application. Fasting blood glucose was measured via standard laboratory enzymatic methods. Chi- square tests, Spearman correlation, and simple logistic regression were used to examine associations and adjust for confounders. Significance was set at α = 0.05.

Results: Pre- pregnancy BMI was significantly associated with fasting blood glucose (p = 0.014). Energy intake (r = 0.351, p < 0.001), protein (r = 0.292, p = 0.002), and carbohydrate intake (r = 0.358, p < 0.001) correlated positively with fasting blood glucose, whereas fat (r = 0.173, p = 0.085) and water intake (r = 0.029, p = 0.773) did not. Logistic regression showed that higher energy (OR = 1.02; 95% CI 1.01–1.03; p = 0.001), protein (OR = 1.03; 95% CI 1.02–1.05; p < 0.001), and carbohydrate intake (OR = 1.01; 95% CI 1.00–1.02; p = 0.001) significantly increased the odds of elevated fasting blood glucose.

Conclusion: Proper management of dietary energy, protein, and carbohydrate intake is essential to prevent elevated fasting blood glucose in pregnant women. Balanced nutrition education is recommended to prevent GDM.

Recommendation: Healthcare providers should implement tailored nutrition education programs focusing on balanced macronutrient distribution and energy control to reduce the risk of GDM.

Keywords: Dietary Patterns; Fasting Blood Glucose; Pregnant Women; Gestational Diabetes Mellitus

INTRODUCTION

Gestational diabetes mellitus (GDM) is defined as glucose intolerance first recognized during pregnancy and is linked to increased maternal and neonatal morbidity (Indriani & Hardyanti, 2022). The prevalence of GDM in Indonesia ranges from 1.9% to 3.6% (Indriani & Hardyanti, 2022). Dietary patterns—comprising total energy, macronutrient distribution, and fluid intake—directly influence glycemic control (Diana et al., 2018). Excessive consumption of energy and carbohydrates has been shown to elevate blood glucose levels, whereas balanced intake can mitigate the risk of GDM (Amirullah et al., 2019; Nguyen, 2019).

Inadequate maternal nutrition also affects anthropometric indices; pre-pregnancy BMI has been identified as a risk factor for hyperglycemia in pregnancy (Mulianingsih et al., 2021). Despite these known associations, limited research has examined the combined effect of energy, macronutrients, and fluid intake on fasting blood glucose among Indonesian pregnant women.

This study aims to analyze the influence of dietary patterns—specifically energy, protein, carbohydrate, fat, and water intake—on fasting blood glucose levels in third-trimester pregnant women at An-Nisa Hospital, Tangerang.

RESEARCH METHODS

A cross-sectional study was conducted from October to December 2024 at the antenatal clinic of An-Nisa Hospital, recruiting 100 pregnant women in their third trimester through consecutive sampling. Inclusion criteria included singleton pregnancy, absence of pre-existing diabetes, and provision of informed consent, while exclusion criteria encompassed chronic diseases affecting glucose metabolism and the use of glucose-modifying medications. Sociodemographic and clinical data, including age, parity, education, income, occupation, and pre-pregnancy body mass index (BMI), were collected via questionnaires and medical records. Dietary intake was assessed using a single 24-hour dietary recall administered by trained dietitians and analyzed using the Nutrinote application to calculate average daily intake of energy (kcal), protein (g), carbohydrates (g), fat (g), and water (mL). Fasting blood glucose (FBG) levels were measured after an overnight fast using standard enzymatic laboratory methods, with elevated FBG defined according to ADA criteria (>95 mg/dL). Data analysis was performed using SPSS version 25, employing descriptive statistics for participant characteristics, chi-square tests for associations between categorical variables, Spearman correlation for relationships between continuous dietary variables and FBG levels, and simple logistic regression to calculate odds ratios (OR) and 95% confidence intervals (CI) for the effect of each dietary component on elevated FBG, with statistical significance set at $p < 0.05$.

ETHICAL CONSIDERATIONS

The protocol was approved by the Universitas Nasional Ethics Committee (No. 013/eKEPK/FIKES/I/2025). All participants provided written informed consent, and the study adhered to the Declaration of Helsinki.

RESEARCH RESULT

Participant Characteristics

The study included 100 pregnant women. The mean age was 29.4 ± 4.8 years; 60% were multiparous. Pre-pregnancy BMI classified 10% as underweight, 53% normal, and 24% overweight/obese. Education level, income, and occupation were not significantly associated with FBG status (all $p > 0.05$).

Dietary Intake and FBG

The mean daily intake was 1,850 ± 250 kcal energy, 65 ± 15 g protein, 250 ± 50 g carbohydrates, 55 ± 12 g fat, and 1,800 ± 300 mL water. Elevated fasting blood glucose (FBG) levels (>95 mg/dL) were observed in 30% of participants, based on ADA criteria.

Correlation Analysis

Energy ($r = 0.351$, $p < 0.001$), protein ($r = 0.292$, $p = 0.002$), and carbohydrate intake ($r = 0.358$, $p < 0.001$) showed significant positive correlations with FBG. Fat ($r = 0.173$, $p = 0.085$) and water intake ($r = 0.029$, $p = 0.773$) were not significantly correlated.

Logistic Regression

In unadjusted logistic regression models, each 100 kcal increase in energy intake was associated with 1.02 times higher odds of elevated FBG (OR 1.02; 95% CI 1.01–1.03; p=0.001). Similarly, each 10 g increase in protein (OR 1.03; 95% CI 1.02–1.05; p<0.001) and carbohydrate intake (OR 1.01; 95% CI 1.00–1.02; p=0.001) significantly increased the odds of elevated FBG.

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Tabel 1
Associations Between Demographic Characteristics, Nutrient Intake, and Fasting Blood Glucose

Variable	Test / Statistic	Correlation (r)	p- value	Logistic Regression p- value	Significant (α = 0.05)
Demographic Characteristics					
Age	Chi- square	—	0.972	—	No
Parity	Chi- square	—	0.184	—	No
Education Level	Chi- square	—	0.726	—	No
Family Income	Chi- square	—	1.000	—	No
Occupation	Chi- square	—	1.000	—	No
Pre- pregnancy BMI	Chi- square	—	0.014	—	Yes
Nutrient Intake					
Energy (kcal)	Spearman's r / Chi- square	0.351	0.000	0.000	Yes
Protein (g)	Spearman's r / Chi- square	0.292	0.003	0.001	Yes
Carbohydrate (g)	Spearman's r / Chi- square	0.358	0.000	0.001	Yes
Fat (g)	Spearman's r	0.173	0.085	—	No
Fluid (ml)	Spearman's r	0.029	0.773	—	No

Notes:
– Correlation coefficients (r) are from Spearman's rank test for nutrient intake.
– Chi- square tests were applied for demographic variables.
– Logistic regression p- values are shown only for variables significant in bivariable analysis

DISCUSSION

This study demonstrates that higher energy, protein, and carbohydrate intakes are associated with elevated fasting blood glucose in pregnant women, consistent with previous findings (Amirullah et al., 2019; Nguyen, 2019). Excessive energy intake may contribute to insulin resistance, while high carbohydrate consumption—especially of high- glycemic foods—directly elevates postprandial glucose (Diana et al., 2018).

This aligns with prior research indicating that excessive caloric intake contributes to insulin resistance through adipose tissue inflammation and dysregulated adipokine secretion (Barbour et al., 2018). Adequate protein consumption, on the other hand, may enhance insulin secretion and promote satiety, thereby moderating glycemic responses, though its positive correlation with FBG here suggests that overall macronutrient balance remains crucial (Koletzko et al., 2019).

Pre- pregnancy BMI was also significantly associated with FBG, aligning with evidence that overweight and obesity increase GDM risk via inflammatory and metabolic pathways (Mulianingsih et al., 2021). This underscores the need for preconception weight optimization as part of comprehensive maternal care.

These findings underscore too the importance of balanced dietary counseling during antenatal care. Interventions should target reduction of excess energy and refined carbohydrate intake, while ensuring adequate protein for fetal development (Setyaningrum et al., 2022). Future studies could employ longitudinal designs and consider glycemic index/load to further elucidate diet–glucose relationships.

Contrary to expectations, neither dietary fat nor fluid intake showed significant associations with FBG. The narrow range of fat consumption in our cohort may have limited the ability to detect effects, and overall adequate hydration likely minimized variability in fluid-related glycemic impact. Future studies should quantify types of dietary fats (e.g., saturated vs. unsaturated) and assess hydration status more precisely.

Limitations

As a cross-sectional study, causality cannot be established. The 24-hour recall method may introduce recall bias, and lack of data on glycemic index/load restricts insight into carbohydrate quality. Moreover, homogeneity in fat and fluid intake reduced statistical power for these variables.

Strengths

Key strengths include the integration of objective laboratory measurements of FBG with a validated digital dietary assessment (Nutrinote) in a real-world clinical setting, enhancing both internal validity and practical relevance.

Implications and Future Directions

These findings support the incorporation of tailored macronutrient counseling into antenatal care protocols, emphasizing moderation of total energy and refined carbohydrate intake while ensuring sufficient high-quality protein for fetal growth (Setyaningrum et al., 2022). Longitudinal and interventional trials are warranted to test the efficacy of specific meal plans—stratified by glycemic index/load—on glycemic control. Additionally, integrating continuous glucose monitoring could yield richer data on postprandial dynamics and inform personalized nutrition strategies in pregnancy.

In sum, optimizing maternal diet composition and pre-pregnancy BMI represents a critical avenue for GDM prevention, with implications for refining national antenatal nutrition guidelines and screening practices in resource-limited settings.

CONCLUSION

This study demonstrates that pre-pregnancy body mass index and maternal dietary intake of energy, protein, and carbohydrates are significant determinants of fasting blood glucose levels in pregnant women, whereas fat and fluid intake show no significant effect. Specifically, higher energy ($p < .001$), protein ($p = .001$), and carbohydrate ($p = .001$) consumption were associated with elevated fasting glucose, highlighting the critical role of macronutrient balance in glycemic control during pregnancy. These findings underscore the importance of individualized nutritional counseling and routine metabolic monitoring in antenatal care to mitigate the risk of gestational diabetes mellitus and its associated complications. Future interventions should prioritize tailored dietary guidance that optimizes energy and macronutrient distribution to support both maternal and fetal health.

SUGGESTION

For Scientific Advancement

Further in-depth studies are needed to explore additional factors influencing maternal fasting blood glucose, such as gut microbiota composition, genetic polymorphisms, and interactions between environmental factors and dietary patterns. Moreover, longitudinal research designs are strongly recommended to assess the long-term effects of maternal diet on metabolic health outcomes in both mother and child postpartum .

For Healthcare Services

These findings should inform nutritional management protocols for pregnant women to prevent and control gestational diabetes mellitus (GDM) within hospitals and primary care settings. Healthcare professionals including obstetricians, dietitians, nurses, and midwives should receive specialized training in evidence-based nutrition education. Hospitals and health centers are encouraged to implement routine dietary screening and early dietary interventions, particularly for high-risk groups. Multisectoral collaboration among healthcare providers, academic institutions, and policymakers is essential to develop integrated, effective GDM prevention strategies.

For Midwifery Practice

Midwives play a pivotal role in delivering nutritional counseling and managing dietary patterns for pregnant women. It is recommended that midwives enhance their skills in dietary counseling—specifically regarding the selection of low-glycemic-index carbohydrates, balanced macronutrient intake, and optimal hydration management. Midwives should also conduct regular fasting blood glucose monitoring to enable timely intervention. Utilizing digital educational tools, such as nutrition-tracking applications and instructional videos, may further improve adherence to healthy dietary practices among pregnant women.

REFERENCES

Adli, F. K. (2021). Diabetes Melitus Gestasional: Diagnosis dan Faktor Risiko. *Jurnal Medika Hutama*, *3*(01 Oktober), 1545-1551. Retrieved from https://jurnalmedikahutama.com/index.php/JMH/article/view/312

Adriati, F., & Chloranyta, S. (2022). Status Gizi Ibu Hamil Berdasarkan Pengukuran Lingkar Lengan Atas (LILA). *Jurnal Kesehatan*

 DOI 10.33024, http://ejurnalmalahayati.ac.id/index.php/kebidanan

Panca Bhakti Lampung, *10*(2), 127. https://doi.org/10.47218/jkpbl.v10i2.194

Akther, L., Hossain, M. B., Awwal, A. A., & Nesa, A. (2015). Anthropometric Assessment of Nutritional Status in Pregnant Women in Different Trimesters Attending at the Antenatal Clinic of DMCH. *Anwer Khan Modern Medical College Journal*, *6*(1), 20–24. https://doi.org/10.3329/akmmcj.v6i1.24980

American Diabetes Association. (2022). Standards of medical care in diabetes—2022. Diabetes Care, 45(Supplement 1), S1-S266. https://doi.org/10.2337/dc22-S001

American Diabetes Association (2021). 14. Management of Diabetes in Pregnancy: *Standards of Medical Care in Diabetes-2021*. *Diabetes care*, *44*(Suppl 1), S200–S210. https://doi.org/10.2337/dc21-S014

Amiri, F. N., Faramarzi, M., Bakhtiari, A., & Omidvar, S. (2021). Risk Factors for Gestational Diabetes Mellitus: A Case-Control Study. *American Journal of Lifestyle Medicine*, *15*(2), 184–190. https://doi.org/10.1177/1559827618791980

Amirullah., Simbolon, Z. K., & Septriani, M. (2019). Sistem Pendukung Keputusan Pemilihan Makanan Bergizi Untuk Ibu Hamil Menggunakan Metode TOPSIS. *Jurnal Info Media*, *4*. https://doi.org/10.30811/jim.v4i2

Astawan, M., & Wresdiyati, T. (2004). *Diet Sehat Dengan Makanan Berserat*. Solo: Tiga Serangkai Pustaka Mandiri.

Barbour, L. A., McCurdy, C. E., Hernandez, T. L., Kirwan, J. P., Catalano, P. M., & Friedman, J. E. (2018). Cellular mechanisms for insulin resistance in normal pregnancy and gestational diabetes. Diabetes Care, 41(2), 157–166. https://doi.org/10.2337/dc17-1893

Barker, D. J. (1990). The fetal and infant origins of adult disease. BMJ, 301(6761), 1111. https://doi.org/10.1136/bmj.301.6761.1111

Bhatia, M., Mackillop, L. H., Bartlett, K., Loerup, L., Kenworthy, Y., Levy, J. C., Farmer, A. J., Velardo, C., Tarassenko, L., & Hirst, J. E. (2018). Clinical implications of the NICE 2015 Criteria for Gestational Diabetes Mellitus. *Journal of Clinical Medicine*, *7*(10). https://doi.org/10.3390/JCM7100376

Brennan, A. M., & Mantzoros, C. S. (2010). Drug insight: The role of leptin in human physiology and pathophysiology—Emerging clinical applications. Nature Clinical Practice Endocrinology & Metabolism, 2(6), 318–327. https://doi.org/10.1038/ncpendmet0184

Buchanan, T. A., Xiang, A. H., & Page, K. A. (2020). Gestational diabetes mellitus: Risks and management during and after pregnancy. Nature Reviews Endocrinology, 17(9), 527–539. https://doi.org/10.1038/s41574-021-00528-4

Capula, C., Chiefari, E., Vero, A., Arcidiacono, B., Iiritano, S., Puccio, L., Pullano, V., Foti, D. P., Brunetti, A., & Vero, R. (2013). Gestational Diabetes Mellitus: Screening and Outcomes in Southern Italian Pregnant Women. *ISRN Endocrinology*, *2013*, 1–8. https://doi.org/10.1155/2013/387495

Chen, P. J., & Antonelli, M. (2020). Conceptual Models of Food Choice: Influential Factors Related to Foods, Individual Differences, and Society. *Foods (Basel, Switzerland)*, *9*(12), 1898. https://doi.org/10.3390/foods9121898

D'Auria, E., Borsani, B., Pendezza, E., Bosetti, A., Paradiso, L., Zuccotti, G. V., & Verduci, E. (2020). Complementary Feeding: Pitfalls for Health Outcomes. *International journal of environmental research and public health*, *17*(21), 7931. https://doi.org/10.3390/ijerph17217931

Damayanti, R., Suryani, S., & Wulandari, R. D. (2021). *Pengaruh Hidroterapi Minum Air Putih terhadap Penurunan Kadar Gula Darah Sesaat pada Penderita Diabetes Mellitus*. Jurnal Kesehatan, 12(1), 63-70.

Davy, B. M., Dennis, E. A., Davy, K. P., & Halliday, T. M. (2018). Water consumption reduces energy intake at a breakfast meal in healthy older adults. Journal of the Academy of Nutrition and Dietetics, 118(4), 641-645. https://doi.org/10.1016/j.jand.2017.12.007

Deitchler, M., Arimond, M., Carriquiry, A., Hotz, C., & Tooze, J. A. (2020). Planning and Design Considerations for Quantitative 24-Hour Recall Makanary Surveys in Low-and Middle-Income Countries Planning and Design Considerations for Quantitative 24-Hour Recall Makanary Surveys. *Lmics*.

Diana, R., Riris D. Rachmayanti, Faisal Anwar, Ali Khomsan, Dyan F. Christianti, & Rendra Kusuma. (2018). Food taboos and suggestions among Madurese pregnant women: a qualitative study. *Journal of Ethnic Foods*, *5*, 246–253.

Fahrudin, A., Fahrudin, F. I., Fahrudin, F. A., Yusuf, H., (2020), *Book Chapter 6 Konsep Pilihan Makanan*, pp. 75-90.

Faridi A., Trisutrisno, I., Irawan, A. M. A., Lusiana, S. A., Alfiah, E., Rahmawati, A. A., Doloksaribu, L. G., Suryan, A. E. Y., & Sinaga, T. R.

(2022). *Survei Konsumsi Gizi*. Medan: Yayasan Kita Menulis.

Fitri, R. I., & Wirawanni Y. (2014). Hubungan Konsumsi Karbohidrat, Konsumsi Total Energi, Konsumsi Serat, Beban Glikemik dan Latihan Jasmani dengan Kadar Glukosa Darah Pada Pasien Diabetes Mellitus Tipe 2. *JNH*, *2*(3): 1-27.

Frayn, K. N. (2010). Metabolic regulation: A human perspective (3rd ed.). Wiley-Blackwell.

Gao, S., Leng, J., Liu, H., Wang, S., Li, W., Wang, Y., Hu, G., Chan, J. C. N., Yu, Z., Zhu, H., & Yang, X. (2020). Development and Validation of an Early Pregnancy Risk Score for The Prediction of Gestational Diabetes Mellitus in Chinese Pregnant Women. *BMJ Open Diabetes Research and Care*, *8*(1). https://doi.org/10.1136/bmjdrc-2019-000909

Genova, M., Atanasova, B., Ivanova, I., Todorova, K., & Svinarov, D. (2018). Trace Elements and Vitamin D in Gestational Diabetes. *Acta Medica Bulgarica*, *45*(1): 45–49. https://doi.org/10.2478/amb-2018-0009

Gerich, J. E. (2010). Glucose counterregulation and its impact on diabetes mellitus. Diabetes, 59(10), 2333–2339. https://doi.org/10.2337/db10-0832.

Gibson, R. S., Charrondiere, R. U., & Bell, W. (2017). Measurement Errors in Makanary Assessment Using Self-Reported 24-hour Recalls in Low-Income Countries and Strategies for Their Prevention. *Advances in Nutrition*, *8*(6): 980–991. https://doi.org/10.3945/an.117.016980

Hall, K. D., Sacks, G., Chandramohan, D., Chow, C. C., Wang, Y. C., Gortmaker, S. L., & Swinburn, B. A. (2012). Quantification of the effect of energy imbalance on bodyweight. The Lancet, 378(9793), 826-837. https://doi.org/10.1016/S0140-6736(11)60812-X

Handayani, D. (2014). Faktor-Faktor Determinan Status Gizi Ibu Hamil. *Jurnal Al-Maiyyah*, *7*(1).

Indriani, I., & Hardyanti, S. (2022). A Descriptive Study of Gestational Diabetes Mellitus in Yogyakarta. *Journal of Maternal and Child Health*, *7*(2), 148–157. https://doi.org/10.26911/thejmch.2022.07.02.04

Irwinda, R. S., Sungkar, A. S., & Wibowo, N. S. (2019). *Panduan Persalinan Praterm (1st ed.)*. Pengurus Pusat Perkumpulan Obstetri dan Ginekologi Indonesia Himpunan Kedokteran Feto Maternal Indonesia Dinas Kesehatan Indonesia. www.pogi.or.id

Jenkins, D. J. A., Kendall, C. W. C., Augustin, L. S. A., Franceschi, S., Hamidi, M., Marchie, A., Jenkins, A. L., & Axelsen, M. (2018). Glycemic index: Overview of implications in health and disease. The American Journal of Clinical Nutrition, 108(3), 635–643. https://doi.org/10.1093/ajcn/nqy156.

Joewono, T. H., & Sulistyono, A. (2020). Maternal and Infant Outcomes of Gestational Diabetes Mellitus and Pregestational Diabetes Mellitus Booked Cases in Maternity. In *EurAsian Journal of BioSciences Eurasia J Biosci*, 14.

Johnson, R. J., Lanaspa, M. A., & Tolan, D. R. (2019). The role of vasopressin in glucose homeostasis. Current Opinion in Nephrology and Hypertension, 28(2), 127–133. https://doi.org/10.1097/MNH.0000000000000489

Johnson, R. J., Stenvinkel, P., Jensen, T., Lanaspa, M. A., Roncal-Jimenez, C. A., & Sánchez-Lozada, L. G. (2016). Metabolic and kidney effects of hydration. *Nature Reviews Nephrology,* *12*(2), 91–112. https://doi.org/10.1038/nrneph.2015.193.

Kebbe, M., Flanagan, E. W., Sparks, J. R., & Redman, L. M. (2021). Eating Behaviors and Makanary Patterns of Women During Pregnancy: Optimizing The Universal 'Teachable Moment.' *Nutrients*, *13*(9). https://doi.org/10.3390/nu13093298

Kementrian Kesehatan RI. (2018). *Pedoman Proses Asuhan Gizi Puskesmas*.

Kien, C. L., Bunn, J. Y., Poynter, M. E., Stevens, R., Bain, J., Ikayeva, O., & Fukagawa, N. K. (2013). A lipidomics analysis of the relationship between dietary fatty acid composition and insulin sensitivity in humans. Metabolism, 62(11), 1477–1488. https://doi.org/10.1016/j.metabol.2013.05.009

Kouhkan, A., Najafi, L., Malek, M., Baradaran, H. R., Hosseini, R., Khajavi, A., & Khamseh, M. E. (2021). Gestational diabetes mellitus: Major risk factors and pregnancy-related outcomes: A cohort study. *International Journal of Reproductive BioMedicine*, *19*(9), 827–836. https://doi.org/10.18502/ijrm.v19i9.9715

Kurniasari, R., Lubis, Z., & Siregar, M. (2017). Hubungan Asupan Karbohidrat, Lemak, dan Serat dengan Kadar Glukosa dan Trigliserida Darah pada Pasien Diabetes Mellitus Tipe 2. *Wahana Inovasi*, 6(2), 1-10.

Kwan, D. P., & Susanto, R. (2022). Prevalence And Characteristics Of Gestational Diabetes Mellitus at X Hospital West Jakarta for The Period of January 2021 - April 2022. *Science Midwifery*, *10*(4): 2484-2489. doi: 10.35335/midwifery.v10i4.677

Lee, S. G., Park, G. U., Moon, Y. R., & Sung, K. (2020). Clinical Characteristics and Risk Factors for Fatality and Severity in Patients with Coronavirus Disease in Korea: A Nationwide Population-Based Retrospective Study Using the Korean Health Insurance Review and Assessment Service (Hira) Database. *International Journal of Environmental Research and Public Health*, *17*(22), 1–13. https://doi.org/10.3390/ijerph17228559

Lestari, Zulkarnain, & Sijid, A. (2021). Diabetes Melitus: Review Etiologi, Patofisiologi, Gejala, Penyebab, Cara Pemeriksaan, Cara Pengobatan dan Cara Pencegahan. *Prosiding Biologi Achieving the Sustainable Development Goals with Biodiversity in Confronting Climate Change*. https://doi.org/10.24252/psb.v7i1.24229

Ludwig, D. S., Aronne, L. J., Astrup, A., de Cabo, R., Cantley, L. C., Friedman, M. I., Heymsfield, S. B., Johnson, J. D., King, J. C., Krauss, R. M., Lieberman, D. E., Taubes, G., Volek, J. S., Westman, E. C., Willett, W. C., Yancy, W. S. & Ebbeling, C.B. (2021). The Carbohydrate-Insulin Model: A Physiological Perspective on The Obesity Pandemic. *The American Journal of Clinical Nutrition*, *114*(6):1873–1885. https://doi.org/10.1093/ajcn/nqab270

Ludwig, D. S., & Ebbeling, C. B. (2021). The carbohydrate-insulin model of obesity: Beyond “calories in, calories out”. JAMA Internal Medicine, 181(1), 43–50. https://doi.org/10.1001/jamainternmed.2020.6984

Ma, Y., Olendzki, B. C., Pagoto, S. L., Hurley, T. G., Magner, R. P., Ockene, I. S., Schneider, K. L., Merriam, P. A., & Hébert, J. R. (2009). Number of 24-Hour Makan Recalls Needed to Estimate Energy Intake. *Annals of Epidemiology*, *19*(8), 553–559. https://doi.org/10.1016/j.annepidem.2009.04.010

Maki, K. C., Rains, T. M., Kaden, V. N., Raneri, K. R., & Davidson, M. H. (2009). Effects of a reduced-glycemic-load diet on body weight, body composition, and cardiovascular disease risk markers in overweight and obese adults. The American Journal of Clinical Nutrition, 90(5), 947–955. https://doi.org/10.3945/ajcn.2009.27653

Mennella, J. A., & Trabulsi, J. C. (2012). Complementary Foods and Flavor Experiences: Setting the Foundation. *Annals of Nutrition and Metabolism*, *60*: 40–50. https://doi.org/10.1159/000335337

Mirmiran, P., Bahadoran, Z., & Azizi, F. (2019). Dietary glycemic index and glycemic load in relation to metabolic health. Current Cardiology Reports, 21(11), 45. https://doi.org/10.1007/s11886-019-1142-1

Minschart, C., Beunen, K., & Benhalima, K. (2021). An Update on Screening Strategies for Gestational Diabetes Mellitus: A Narrative Review. *Diabetes, Metabolic Syndrome and Obesity*, *14*: 3047–3076. https://doi.org/10.2147/DMSO.S287121

Mitran, A. M., Gherasim, A., Niță, O., Mihalache, L., Arhire, L. I., Cioancă, O., Gafițanu, D., & Popa, A. D. (2024). Exploring Lifestyle and Makanary Patterns in Pregnancy and Their Impact on Health: A Comparative Analysis of Two Distinct Groups 10 Years Apart. *Nutrients*, *16*(3). https://doi.org/10.3390/nu16030377

Muche, A. A., Olayemi, O. O., & Gete, Y. K. (2020). Effects of Gestational Diabetes Mellitus on Risk of Adverse Maternal Outcomes: A Prospective Cohort Study in Northwest Ethiopia. *BMC Pregnancy and Childbirth*, *20*(1). https://doi.org/10.1186/s12884-020-2759-8

Mulianingsih, M., Nurmayani, W., Pratiwi, A., Rifky, N., & Safitri, H. (2021). *Nutritional Status and Weight of Pregnant Women to Birth Weight (BBL) to Early Detection of Stunting*. *10*(1), 138–150. https://doi.org/10.30994/sjik.v10i1.523

Mulyasari, Indri & Muis, Siti & Kartini, Apoina. (2016). Pengaruh asupan air putih terhadap berat badan, indeks massa tubuh, dan persen lemak tubuh pada remaja putri yang mengalami gizi lebih. Jurnal Gizi Indonesia (The Indonesian Journal of Nutrition). 3. 120-125. 10.14710/jgi.3.2.120-125.

Mussadi, Putri, L. A. R., & Muhim, H. I. (2022). Hubungan Sosial Ekonomi dan Pola Makan dengan Kejadian Kekurangan Energi Kronis (KEK) pada Ibu Hamil di Wilayah Kerja Puskesmas Nambo Kota Kendari. *Jurnal Gizi Ilmiah*, *9*(2), 19–26. https://doi.org/10.46233/jgi.v9i2.719

Moore, M. C., Coate, K. C., Winnick, J. J., An, Z., & Cherrington, A. D. (2012). Regulation of hepatic glucose uptake and storage in vivo. Comprehensive Physiology, 2(4), 1889–1926. https://doi.org/10.1002/cphy.c110029

Nachtergaele, C., Vicaut, E., Tatulashvili, S., Pinto, S., Bihan, H., Sal, M., Berkane, N., Allard, L., Baudry, C., Portal, J. J., Carbillon, L., & Cosson, E. (2021). Limiting the Use of Oral Glucose Tolerance Tests to Screen for Hyperglycemia in Pregnancy During Pandemics. *Journal of Clinical Medicine*, *10*(3), 1–13. https://doi.org/10.3390/jcm10030397

Nakshine, V. S., & Jogdand, S. D. (2023). A Comprehensive Review of Gestational Diabetes Mellitus: Impacts on Maternal Health, Fetal Development, Childhood Outcomes, and Long-Term Treatment Strategies. *Cureus*. https://doi.org/10.7759/cureus.47500

Nathania, D. A. R. (2019). *Kajian Kualitatif Penolakan Makan Selama Kehamilan Pada Ibu Hamil Kurang Energi Kronis*. Universitas Brawijaya.

Nguyen, A. H. (2019). Undernutrition during Pregnancy In Complications of Pregnancy. *IntechOpen*. https://doi.org/10.5772/intechopen.82727

O'Hara, C., & Gibney, E. R. (2024). Makanary Intake Assessment Using a Novel, Generic Meal-Based Recall and a 24-Hour Recall: Comparison Study. *Journal of Medical Internet Research*, *26*(1). https://doi.org/10.2196/48817

Plows, J. F., Stanley, J. L., Baker, P. N., Reynolds, C. M., & Vickers, M. H. (2018). The pathophysiology of gestational diabetes mellitus. In *International Journal of Molecular Sciences* (Vol. 19, Issue 11). MDPI AG. https://doi.org/10.3390/ijms19113342

Polit, F. D. & Beck, C. T. (2021). *Nursing Research: Generating and Assessing Evidence for Nursing Practice 11th Edition*. Lippincott Williams & Wilkins.

Popkin, B. M., D'Anci, K. E., & Rosenberg, I. H. (2017). Water, hydration, and health. Nutrition Reviews, 68(8), 439–458. https://doi.org/10.1111/j.1753-4887.2010.00304.x

Putra, F., Sari, D. K., & Wahyuni, S. (2022). Hydration and glucose metabolism: A review. Journal of Nutrition and Health, 14(3), 78–85.

Putra, I. D., Hendra, D., & Pratiwi, A. (2022). Hydroterapi minum air putih untuk menurunkan kadar gula darah sewaktu (GDS). Holistik Jurnal Kesehatan, 16(5), 464–470.

Ridwanto, M., Saleh AJ., Adiputra FB. (2024). Hubungan Asupan Protein terhadap Kadar Glukosa Darah 2 Jam Pasca Puasa pada Pasien Diabetes Melitus Tipe 2. *Jurnal Medika Indonesia*, *5*(1): 33-39.

Royani, I., Mappaware, N. A., Darma, S., Khalid, N., & Utami, D. F. (2021). The Relationship between Nutritional Status of Pregnant Women and Stunted Children. *Green Medical Journal*, *3*(1).

Roussel, R., Fezeu, L., Bouby, N., Balkau, B., Lantieri, O., Alhenc-Gelas, F., & Bankir, L. (2019). Low water intake and risk for new-onset hyperglycemia. Diabetes Care, 34(12), 2551–2554. https://doi.org/10.2337/dc11-2258

Safitri, A. N., Kusumawati, D., Muhlishoh, A., & Avianty, S. (2024). Hubungan Asupan Lemak, Asupan Serat dan Aktivitas Fisik dengan Kadar Trigliserida pada Penderita Diabetes Melitus Tipe 2 di Puskesmas Grogol, Sukoharjo. *Amerta Nutrition*, *8*(1): 55–60.

Sari, D. R., Sari, N. M., & Sari, D. M. (2017). Hubungan Lingkar Perut, Konsumsi Gula dan Lemak dengan Kadar Glukosa Darah Puasa pada Wanita Dewasa. *Nutrire Diaita*, 9(2), 1-8.

Semahegn, A., Tesfaye, G., & Bogale, A. (2014). Complementary Feeding Practice of Mothers and Associated Factors in Hiwot Fana specialized Hospital, Eastern Ethiopia. *Pan African Medical Journal*, *18*. https://doi.org/10.11604/pamj.2014.18.143.3496

Setyaningrum, R., Pujianti, N., Nisa, M. A., Paramita, N. P. D., & Yulia, I. D. A. (2022a). Education and Practice of Complementary Foods Among Mom's Groups on The Kemuning District Banjarbaru Selatan. *Jurnal Berkala Kesehatan*, *8*(1), 28. https://doi.org/10.20527/jbk.v8i1.12080

Shour, A., Garacci, E., Palatnik, A., Dawson, A. Z., Anguzu, R., Walker, R. J., & Egede, L. (2022). Association between Pregestational Diabetes and Mortality Among Appropriate-for-Gestational Age Birthweight Infants. *Journal of Maternal-Fetal and Neonatal Medicine*, *35*(25), 5291–5300. https://doi.org/10.1080/14767058.2021.1878142

Siswantoro, E., Purwanto, N. H., & Sutomo, N. (2018). Efektivitas Konsumsi Air Alkali terhadap Penurunan Kadar Gula Darah Acak pada Penderita Diabetes Mellitus Tipe 2. Jurnal Keperawatan, 11(1).

Sitorus, R. S., & Nurhayati, E. L. (2022). Gambaran Pola Makan Ibu Hamil. *Jurnal Keperawatan Jiwa*, *10*: 121–126.

Story, M., Kaphingst, K. M., Robinson-O'Brien, R., & Glanz, K. (2008). Creating Healthy Food and Eating Environments: Policy and Environmental Approaches. *Annual Review of Public Health*, *29:* 253–272. https://doi.org/10.1146/annurev.publhealth.29.020907.090926

Sulistiyah, I., Ernawati, N., & Shella. (2017). *Faktor Pendukung Timbulnya Resiko Gestasional Diabetes Mellitus Pada Ibu Hamil di BPS Kabupaten Malang*. http://www.novapdf.com/

Tajudin, T., Utami, T. F. Y., Iftihani, N. F. (2022). Hubungan Pola Makan Tinggi Kalori terhadap Kadar Glukosa pada Diabetes Melitus Tipe II Pasien Prolanis di UPTD Puskesmas Cilacap Utara II. *Prosiding Seminar Nasional Diseminasi*, 2.

Tayyem, R., & Allehdan, S. (2021). Article in Current Research in Nutrition and Food. *Science Journal*.

Thornton, S. N., Leiper, J. B., & Maughan, R. J. (2021). The role of hydration in the regulation of glucose metabolism. European Journal of Clinical Nutrition, 75(4), 553–561. https://doi.org/10.1038/s41430-020-00805-w

Tobias, D. K., Chen, M., Manson, J. E., Ludwig, D. S., Willett, W., Hu, F. B., & Zhang, C. (2018). The role of carbohydrate quality in diabetes risk. The American Journal of Clinical Nutrition, 107(2), 257–264. https://doi.org/10.1093/ajcn/nqx085

Vaira, R. & Karinda, M. (2022). Systematic Literature Review: Metode Deteksi Dini Diabetes Mellitus Gestasional. *SEHATMAS: Jurnal Ilmiah Kesehatan Masyarakat*, *1*(3), 429–439. https://doi.org/10.55123/sehatmas.v1i3.695

Wang, D. D., & Hu, F. B. (2019). Dietary fat and risk of type 2 diabetes: The role of types of fat and foods. BMJ, 366, l4507. https://doi.org/10.1136/bmj.l4507

Wade, A. N., Crowther, N. J., Abrahams-Gessel, S., Berkman, L., George, J. A., Gómez-Olivé, F. X., Manne-Goehler, J., Salomon, J. A., Wagner, R. G., Gaziano, T. A., Tollman, S. M., & Cappola, A. R. (2021). Concordance between Fasting Plasma Glucose and HbA1c in The Diagnosis of Diabetes in Black South African Adults: A Cross-Sectional Study. *BMJ Open*, *11*(6). https://doi.org/10.1136/bmjopen-2020-046060

Wolfe, R. R. (2017). Branched-chain amino acids and muscle protein synthesis in humans: Myth or reality? Journal of the International Society of Sports Nutrition, 14, 30. https://doi.org/10.1186/s12970-017-0184-9

Yang, X., Xiang, Z., Zhang, J., Song, Y., Guo, E., Zhang, R., Chen, X., Chen, L., & Gao, L. (2023). Development and Feasibility of a Theory-Guided and Evidence-Based Physical Activity Intervention in Pregnant Women with High Risk for Gestational Diabetes Mellitus: A Pilot Clinical Trial. *BMC Pregnancy and Childbirth*, *23*(1). https://doi.org/10.1186/s12884-023-05995-7

Zakiyaj, F. F., Indrawati, V., Sulandjari, S., & Pratama S. A. (2023). Asupan Karbohidrat, Serat, dan Vitamin D dengan Kadar Glukosa Darah pada Pasien Rawat Inap Diabetes Mellitus. *Jurnal Gizi Klinik Indonesia*, 20(1): 21-28.

Zhang, C., Rawal, S., & Chong, Y. S. (2020). Risk factors for gestational diabetes: Is prevention possible? Diabetologia, 63(5), 883–895. https://doi.org/10.1007/s00125-020-05128-