ORIGINAL RESEARCH

Key determinants of blood sugar control in reproductive-age women with type 2 diabetes in Indonesia

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Abstract

Type 2 diabetes often affects women due to a combination of physical and psychological factors. For women of reproductive age, complications include prenatal morbidity and mortality, increased rates of cesarean deliveries, and chronic hypertension. When left untreated, this will impact the patient's quality of life. This study aims to identify the risk factors influencing blood sugar control among women of reproductive age with type 2 diabetes. A correlational study design was employed, with a sample of 43 respondents selected using total sampling techniques. Multiple linear regression was used for statistical analysis. The study identified significant associations between blood sugar control and risk factors such as body mass index, physical activity, food intake, and employment ($p < 0.05$). Further research is necessary to explore these risk factors in greater depth and to develop targeted nursing interventions.

Keywords: Diabetes care; women health; community nursing; risk factors; preventive strategies

Introduction

Diabetes is a metabolic disorder characterized by hyperglycemia resulting from insulin function insufficiency, affecting people worldwide (Williams, Jones, & Stephens, 2022). This condition is fundamentally marked by the body's inability to effectively regulate blood sugar levels, leading to a range of symptoms including polyuria (frequent urination), polydipsia (excessive thirst), polyphagia (increased hunger), fatigue, and blurred vision (Ramachandran, 2014). According to the American Diabetes Association (ADA, 2020), diabetes is a heterogeneous disease marked by hyperglycemia, with varied clinical presentations and disease progressions. The hormone insulin, produced by pancreatic beta cells, plays a crucial role in blood sugar metabolism. The classification of diabetes by the World Health Organization (WHO, 2019) includes Type 1 diabetes mellitus, gestational diabetes, and other specific types, each with unique pathophysiological mechanisms and clinical implications. Insulin, a hormone produced by pancreatic beta cells, is pivotal in the metabolism of blood glucose. Inadequate insulin function disrupts this metabolic process, leading to elevated blood glucose levels that can cause significant vascular and neurological complications over time (Rahman et al., 2021). Regular monitoring and management of type 2 diabetes (T2D) through capillary blood sugar testing, both random (GDS) and fasting (GDP), are essential for preventing long-term complications (Janapala et al., 2019). Study indicates significant correlations between poor glycemic control and secondary medical complications in T2D patients, influenced by factors such as gender, age, HDL levels, diabetes duration, and medication type (Haghighatpanah et al., 2018). Effective diabetes management must address glycosylated hemoglobin levels, lipid profiles, and uric acid to reduce glycemic variability and delay the onset of complications, thereby enhancing the quality of life for DM patients (Gan et al., 2023).

The prevalence of diabetes has been increasing globally, with particularly notable rises among women of reproductive age (Kapur & Seshiah, 2017). For instance, data from 2013 and 2018 highlight a troubling increase in diabetes cases among this demographic in Indonesia, from 16.400 to 52.348. This trend is mirrored in the Central Java province, which reported 662.882 cases in 2019. In Magelang Regency, the number sufferers surged from 3.380 to 6.483 in 2018 (Dinas Kesehatan, 2019). In addition, the Secang II Health Center has seen a steady increase in diabetes cases, from 495 in 2021 to 523 in 2022, encompassing both insulin-dependent and non-insulin-dependent

types. Unique risk factors for women of productive age at Secang II Health Center include BMI, dietary habits, and physical activity levels, underscoring the multifaceted nature of diabetes and the importance of tailored intervention strategies to address this growing public health challenge. The increase in diabetes prevalence is attributed to various risk factors, which are divided into modifiable factors—such as body mass index (BMI), physical activity, knowledge, and diet—and non-modifiable factors, including age, gender, occupation, and heredity (Ismail, Materwala, & Al Kaabi, 2021). Complications of diabetes include prenatal issues, increased morbidity and mortality, higher cesarean delivery rates, and chronic hypertension in mothers (Moon & Jang, 2022). Women with diabetes during the first trimester of pregnancy **(Figure 1)**, if their glycemic control is suboptimal, are more likely to give birth to babies with congenital defects or low birth weight (Nakshine, & Jogdand, 2023). High blood sugar and abnormal hemoglobin levels in the mother can impair fetal brain development, increase the risk of bleeding before or during delivery, and, if the mother has severe anemia (hemoglobin <8g/dL), lead to maternal and fetal death due to inadequate oxygen and nutrient supply from the placenta (Alfadhli, 2015; Raets, Ingelbrecht, & Benhalima, 2023).
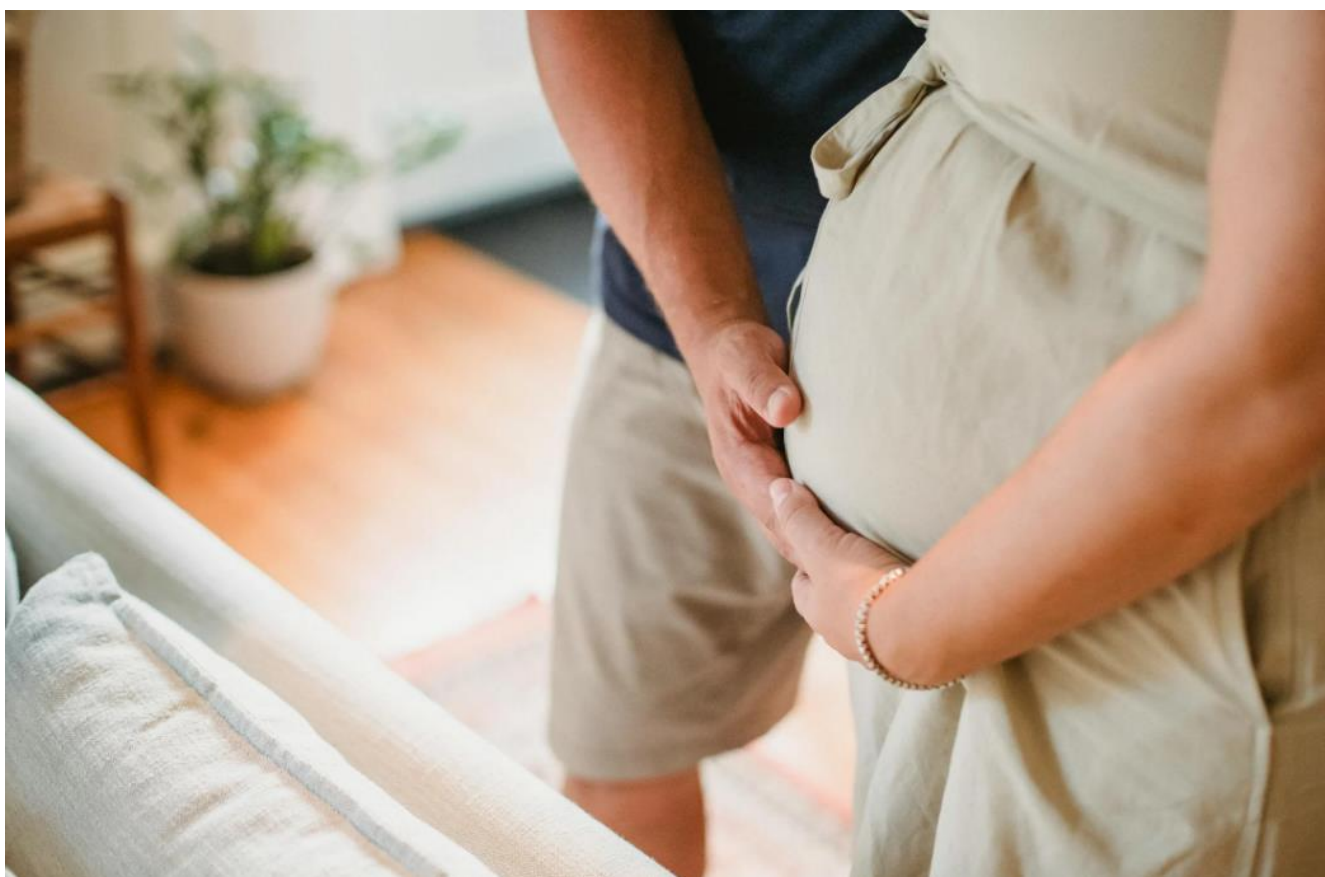

Figure 1. Illustration of diabetes in pregnancy (*Courtesy of unsplash.com*).

Diabetes among women of reproductive age (15-49 years) is a growing public health concern, characterized by significant metabolic disruptions that can have far-reaching implications for both maternal and child health (Akinyemi et al., 2023). This age group is particularly vulnerable due to the dual demands of managing diabetes while maintaining reproductive health. Factors such as BMI, physical activity, and dietary habits play crucial roles in the onset and progression of diabetes among these women (Alduayji & Selim, 2023). Poor glycemic control during pregnancy can lead to serious complications, including congenital anomalies and low birth weight in infants (Wang & Xue, 2023). Additionally, high blood sugar levels can impair placental function, leading to inadequate nutrient and oxygen supply, which may result in preterm labor, increased cesarean deliveries, and heightened maternal and fetal morbidity and mortality (Li et al., 2023). Managing diabetes in women of reproductive age requires a comprehensive approach that includes regular monitoring of blood sugar levels, appropriate dietary management, and maintaining

an active lifestyle (Mukherjee & Dawson, 2022). Effective diabetes management not only helps in controlling blood sugar levels but also reduces the risk of long-term complications such as chronic hypertension and cardiovascular diseases (Sandu et al., 2021). Educational initiatives focusing on the importance of balanced nutrition, physical exercise, and the risks associated with gestational diabetes are crucial in this context. Healthcare providers play a vital role in offering guidance and support, ensuring that women in this age group receive the necessary care to manage their condition effectively (Sahu et al., 2021). It is possible to improve the overall health outcomes for women of reproductive age living with diabetes, thereby ensuring better quality of life for them and healthier futures for their children by addressing both modifiable and non-modifiable risk factors, and through tailored interventions **(Figure 2)**.

Figure 2. Illustration of hospital diabetes care (*Courtesy of pexels.com*).

Despite substantial research on diabetes management, there remain significant gaps in our understanding of diabetes among women of reproductive age. One key gap is the lack of longitudinal studies that track the long-term outcomes of diabetes management strategies specific to Indonesia. Most existing studies focus on short-term outcomes and do not adequately address how interventions during reproductive years impact long-term health. For example, there is limited evidence on the effectiveness of various lifestyle interventions tailored specifically for women in this age group, taking into account their unique physiological and psychological needs. Additionally, research often overlooks the intersectionality of diabetes with other health conditions prevalent in women of reproductive age. Another significant gap is the insufficient exploration of sociocultural and economic factors influencing diabetes management among women of reproductive age particularly in Indonesia. Many studies do not adequately consider how factors such as socioeconomic status, educational background, and cultural beliefs impact diabetes care and outcomes. For instance, access to healthcare resources, nutritional education, and support systems can vary widely, affecting how effectively women can manage their condition. Moreover, there is a need for more research on the role of mental health in diabetes management, as stress, anxiety, and depression are

known to affect glycemic control. Addressing these gaps through comprehensive, multidimensional research could lead to more effective, personalized diabetes management strategies, ultimately improving health outcomes for women of reproductive age. Therefore, this study aimed to determine the effectiveness of various strategies for blood sugar control among reproductive-age women with T2D in Indonesia. Recognizing the unique challenges faced by this demographic, including hormonal fluctuations, lifestyle factors, and cultural influences, the research seeks to explore how these elements impact diabetes management. The study intends to provide insights into the specific needs and barriers encountered by these women. Ultimately, the findings will contribute to developing tailored interventions that promote better blood sugar control and overall health outcomes within this population, thereby addressing a critical public health concern in Indonesia.

Method

The research conducted is a descriptive observational study employing a cross-sectional design to investigate the factors influencing blood sugar control among reproductive-age women with T2D in Indonesia. This study utilized a correlational research design with multiple regression analysis to identify potential risk factors affecting glycemic control. Moreover, the study aims to provide a comprehensive understanding of the dynamics at play in managing diabetes among women of reproductive age in Indonesia, a demographic often overlooked in diabetes research. To ensure the integrity and relevance of the findings, specific inclusion and exclusion criteria were established. Eligible participants included women aged 15 to 49 years who had been diagnosed with T2D for at least three months and were willing to engage as respondents. Furthermore, candidates needed to possess basic literacy skills to ensure they could comprehend the study materials. Conversely, individuals who did not have diabetes, those diagnosed for less than three months, and women unable to participate due to physical limitations or unwillingness were excluded from the study. The sampling method used in this study was accidental sampling, which involved 50 respondents. This research was conducted from November to December 2023. Ethical approval was obtained before the study was carried out. The Food Frequency Questionnaire (FFQ) and the Global Physical Activity Questionnaire (GPAQ) were utilized in this study to assess their validity and reliability. Additionally, a demographic questionnaire was employed to provide a comprehensive profile of the respondents. Data analysis was conducted using multiple regression analysis to explore the relationships among the variables. Statistical significance was established at $p < 0.05$, ensuring that the results would provide reliable insights into the health challenges faced by this demographic and inform future interventions aimed at improving diabetes care in Indonesia.

Results

The following are the study results, which reflect both the methodology employed and the objectives outlined at the outset of the research. These findings provide valuable insights into the factors influencing blood sugar control among reproductive-age women with T2D. Moreover, these results serve to validate the initial hypotheses and research questions, demonstrating the effectiveness of the chosen sampling methods and analytical techniques. They offer a comprehensive overview of the participants' profiles, including demographic characteristics and lifestyle factors, thereby enriching our understanding of the challenges faced by women in managing their diabetes. The table above indicates that the majority of respondents are aged between 36 and 49 years, with a total of 43 participants (100%) falling within this age range. Among them, most have completed junior high school education, accounting for 46.5% of the respondents **(Table 1)**. The majority of respondents (55.8%) had ordinary risk factors. Physical activity was categorized as good for 29 respondents (67.4%), and food intake was also considered good for 28 respondents (65.1%). Additionally, the majority of respondents (79.1%) were employed **(Table 2)**. The table showed that the variables of physical activity (X_2) and food intake (X_3) had a significant effect on the incidence of diabetes (Y), with significant alphas of 0.029 and 0.000, respectively. In contrast, the variables of BMI (X_1) and occupation (X_4) did not significantly affect variable Y, with significant alphas of 0.616 (X_1) and 0.328 (X_4), indicating that their p-values are greater than 0.05. Therefore, it can be concluded that BMI and occupation do not have a significant effect on the incidence of diabetes **(Table 3)**. The table shows a calculated F value of 7.951 with a significance level (P Value) of 0.000. Based on this comparison, H_0 is rejected, indicating that the variables BMI, physical activity, food intake, and occupation significantly influence the incidence of diabetes **(Table 4)**.

Table 1. Age and education profile.

Variables	Frequency	Percentage (%)
Age (years old)		
<20		
21 to 35	43	100.0
36 to 49	43	100.0
Education		
Elementary School	11	25.6
Junior High School	20	46.5
Senior High School	10	23.3
Diploma	2	4.7

Table 2. Respondent's health profile.

Variable	Frequency	Percentage (%)
BMI		
Under weight	3	7.0
Normal	24	55.8
Obesity	16	37.2
Physical Activity		
Low	14	32.6
Sufficient	29	67.4
Food Intake		
Low	15	34.9
Sufficient	28	65.1
Work		
Not work	9	20.9
Work	34	79.1

Table 3. Statistically testing among variables.

Variables	Testing results	
	t	sig.
BMI	0.505	0.616
Physical Activity	-2.267	0.029
Food Intake	-4.253	0.000
Work	-0.992	0.328

Table 4. Analysis among variables.

Model	Sum of Squares	F	sig.
Regression	40878.850	7.951	0.000
Residual	48800.825		
Total	89279.674		

Discussion

BMI is a widely used indicator that helps assess an individual's nutritional status by considering their weight relative to their height (Khanna, Peltzer, Kahar, & Parmar, 2022). According to the World Health Organization (WHO), BMI categories include underweight (<18.5), normal weight (18.6-24.9), overweight (25-29.9), and obese (>30). Obesity, characterized by excessive fat accumulation, is particularly significant in the context of diabetes mellitus, especially T2D (Wondmkun, 2020). This condition can cause increased cell uptake of fatty acids, which ultimately inhibits the utilization of glucose in muscles. As a result, the risk of insulin resistance and subsequent hyperglycemia rises,

making obesity a critical risk factor for the development of T2D (Ruze et al., 2023). However, the relationship between BMI and diabetes is not always straightforward. Research has shown that while a higher BMI is often associated with an increased risk of T2D, other factors also play a crucial role. For instance, in this study involving women of productive age at the Secang II Community Health Center, 55.8% of respondents had a normal BMI, yet diabetes prevalence was still notable. This suggests that factors such as lifestyle, physical activity, diet, and genetic predisposition can influence diabetes risk independently of BMI (Iheanacho, Osoba, & Eze, 2021). Moreover, even individuals with a normal or low BMI can develop diabetes if other risk factors are present. This complexity underscores the need for a comprehensive approach to diabetes prevention and management that goes beyond simple BMI measurements to include a holistic assessment of lifestyle factors **(Figure 3)**.

Figure 3. Illustration of healthy lifestyle (*Courtesy of unsplash*.com).

In this study, out of 43 samples, 24 respondents (55.8%) had a normal BMI (18.6-24.9), 16 respondents (37.2%) were classified as obese (BMI >24.9), and 3 respondents (7.0%) were underweight (BMI <18.5). Statistical tests showed a P-value of 0.616, indicating no significant relationship between BMI and blood sugar control for T2D in women of productive age at the Secang II Community Health Center. The correlation strength between the variables was weak, with a coefficient of 0.142. The study also reveals that obesity does not necessarily correlate with diabetes, as thin individuals can also have diabetes due to internal factors such as poor lifestyle and lack of physical activity. These findings align with a study, which also found no relationship between BMI and diabetes incidence (Komariah & Rahayu, 2020). Similarly, a study concluded no correlation between BMI **(Figure 4)** and blood sugar levels in diabetes mellitus patients (Adriani, Hurin, & Amani, 2023). However, this contrasts with a study findings, which suggested a relationship between BMI and diabetes incidence, although not statistically significant (Anri, 2022). This discrepancy may arise from various factors that influence blood sugar levels, one of which is patient compliance with medication. Adherence to prescribed medication regimens is crucial for effective diabetes management, as it directly impacts glycemic control (Sahoo, Mohanty, Kundu, & Epari, 2022). When patients fail to

take their medications as directed—whether due to forgetfulness, misunderstanding, side effects, or a lack of perceived need—their blood sugar levels can fluctuate significantly, leading to poor health outcomes. Moreover, patient compliance can be affected by personal beliefs about the disease and treatment, socioeconomic status, and access to healthcare resources (Gharaibeh & Tawalbeh, 2018). For instance, individuals with limited financial means may struggle to afford necessary medications, leading to inconsistent use. Similarly, those who do not fully understand the importance of their treatment may prioritize other aspects of their lives over their health, resulting in missed doses. Furthermore, psychological factors such as depression and anxiety can also hinder medication adherence (Yang, Wu, Gui, Cheng, & Zhang, 2023). Patients experiencing emotional distress may find it challenging to maintain a consistent routine, further complicating their ability to manage their diabetes effectively. In addition, the complexity of diabetes management—often requiring multiple medications, dietary changes, and regular monitoring—can overwhelm patients, making it difficult for them to comply fully. Educational interventions and support systems are essential to help patients understand their condition and the importance of adherence to treatment plans (Shiferaw et al., 2021).

Figure 4. Illustration of body weight assesment for BMI (*Courtesy of unsplash.com*).

Physical activity is a crucial factor in preventing and managing T2D (Kanaley et al., 2022). According to the World Health Organization (WHO, 2019), it is recommended that individuals with diabetes engage in at least 150 minutes of moderate-intensity physical activity per week (Colberg et al., 2010). This activity can be assessed using the Global Physical Activity Questionnaire (GPAQ), which categorizes physical activity into three levels: light, moderate, and vigorous. In this study, out of 43 samples, 29 respondents (67.4%) had good physical activity levels, while 14 respondents (32.6%) had poor activity levels. The results of statistical tests in this study showed a P-value of 0.029, indicating a significant relationship between physical activity and blood sugar control for type 2 DM in women of productive age at the Secang II Community Health Center. The correlation strength between the variables was moderate, with a correlation coefficient of 0.421. These findings are consistent with a study study, which also found a significant relationship between physical activity and diabetes mellitus (Bahriah et al., 2022). Similarly, research demonstrated a significant correlation between physical activity and the incidence of T2d (Anri, 2022).

Additionally, a study noted that individuals with lower body fat levels have a reduced risk of developing diabetes, further emphasizing the importance of physical activity in diabetes management (Hariawan, Fathoni, & Purnamawati, 2019).

Food intake is a crucial aspect of regulating the amount and type of food consumed to maintain health, ensure proper nutritional status, and aid in the healing process (Anri, 2022). For individuals with diabetes, a well-structured eating pattern is essential. This typically involves scheduling six meals per day, which includes three main meals and three snacks (Wahyuni, Ma'ruf, & Mulyono, 2019). Poor food consumption patterns that can contribute to diabetes often consist of diets high in calories, saturated fats, and sugars, while being low in fiber and micronutrients. Such dietary habits can lead to obesity, nutritional imbalances, and increased free radicals, ultimately resulting in a shift from infectious diseases to non-communicable chronic diseases, as well as the emergence of degenerative conditions (Timah, 2019). In this study, based on a sample of 43 respondents, it was found that 28 participants (65.1%) had good food intake, while 15 respondents (34.9%) exhibited poor food intake. Statistical tests revealed a P-value of 0.000, indicating a significant relationship between food intake and blood sugar control **(Figure 5)** in women of reproductive age at the Secang II Community Health Center. The strength of the correlation between these variables was moderate, with a correlation coefficient of 0.571. These findings align with previous research; for instance, a study demonstrated a significant relationship between food intake and the incidence of diabetes (Wahyuni, Ma'ruf, & Mulyono, 2019).

Figure 5. Illustration of blood sugar control (*Courtesy of pexels.com*).

Work refers to the process by which individuals strive to earn an income through employment in either the formal or informal sector to meet their daily needs. Occupational factors can significantly influence the risk of developing diabetes. Jobs that involve light physical activity may lead to insufficient energy expenditure, causing excess energy to be stored as fat, which can result in obesity (Arania et al., 2021). In this study, among the 43 respondents, 34 participants (79.1%) were employed as farmers or traders, while 9 respondents (20.9%) were

unemployed. Statistical analysis yielded a P-value of 0.328, indicating no significant relationship between employment status and blood sugar control in women of reproductive age at the Secang II Community Health Center. The correlation between these variables was weak, with a correlation coefficient of 0.163. The lack of influence from job factors on diabetes risk in this study may be attributed to the nature of the respondents' occupations, which do not create high-stress environments. Many participants view their work as a form of entertainment rather than a source of stress, and their jobs do not expose them to harmful substances or cause physical discomfort.

Conclusion

This study highlighted that the variables of physical activity and dietary intake play a crucial role in influencing the incidence of diabetes. The findings indicate that individuals who engage in regular physical activity and maintain a balanced diet are at a significantly lower risk of developing diabetes compared to those with sedentary lifestyles and poor dietary habits. Therefore, public health initiatives should focus on promoting physical activity and healthy eating habits within communities to mitigate the risk of diabetes. Future research should continue to explore the interplay between these variables and consider additional factors such as genetics and environmental influences to develop comprehensive prevention strategies.

References

Adriani, D., Hurin, S., & Amani, P. (2023). Hubungan indeks massa tubuh dengan kadar hba1c pada penderita Diabetes Melitus Tipe-2. Jurnal Penelitian Dan Karya Ilmiah Lembaga Penelitian Universitas Trisakti, 8(2), 190–198. https://doi.org/10.25105/pdk.v8i2.14034

Akinyemi, O. A., Weldeslase, T. A., Odusanya, E., Akueme, N. T., Omokhodion, O. V., Fasokun, M. E., Makanjuola, D., Fakorede, M., & Ogundipe, T. (2023). Profiles and Outcomes of Women with Gestational Diabetes Mellitus in the United States. Cureus, 15(7), e41360. https://doi.org/10.7759/cureus.41360

Alduayji, M. M., & Selim, M. (2023). Risk Factors of Gestational Diabetes Mellitus Among Women Attending an Antenatal Care Clinic in Prince Sultan Military Medical City (PSMMC), Riyadh, Kingdom of Saudi Arabia: A Case-Control Study. Cureus, 15(8), e44200. https://doi.org/10.7759/cureus.44200

Alfadhli E. M. (2015). Gestational diabetes mellitus. Saudi medical journal, 36(4), 399–406. https://doi.org/10.15537/smj.2015.4.10307

American Diabetes Association (ADA). (2020). Classification and diagnosis of diabetes: Standards of Medical Care in Diabetes-2020. Diabetes Care, 43, S14–S31. https://doi.org/10.2337/dc20-S002

Anri. (2022). Pengaruh Indeks Massa Tubuh, Pola Makan, dan Aktivitas Fisik Terhadap Kejadian Diabetes Melitus Tipe 2. JNPH, 10(1), 7–13

Arania, R., Triwahyuni, T., Prasetya, T., & Cahyani, S. D. (2021). Hubungan Antara Pekerjaan Dan Aktivitas Fisik Dengan Kejadian Diabetes Mellitus Di Klinik Mardiwaluyo Kabupaten Lampung Tengah. Jurnal Medika Malahayati, 5(3).

Bahriah, I. A., Usman, A., Tana Toraja Rismawati, D., Purnamasari, A. P. S. B. DI, Malla, M., Djeny Randa, Y., Bahri, R., Jimung, M., Ramadhani Belman I, Sampeangin, H., & Karmila Jurnal Kesehatan Vol, D. (2022). Gambaran Faktor Risiko Diabetes Melitus Pada Lansia Di Pukesmas Lapadde Kota Parepare. Jurnal Kesehatan, 9. https://www.lppmfatimaparepare.org

Colberg, S. R., Sigal, R. J., Fernhall, B., Regensteiner, J. G., Blissmer, B. J., Rubin, R. R., Chasan-Taber, L., Albright, A. L., Braun, B., American College of Sports Medicine, & American Diabetes Association (2010). Exercise and type 2 diabetes: the American College of Sports Medicine and the American Diabetes Association: joint position statement. Diabetes care, 33(12), e147–e167. https://doi.org/10.2337/dc10-9990

Dinas Kesehatan. (2019). Profil Kesehatan Provinsi Jawa Tengah Tahun 2019. 3511351(24).

Gharaibeh, B., & Tawalbeh, L. (2018). Beliefs and Practices of Patients with Diabetes toward the Use of Herbal Therapy. AIMS public health, 4(6), 650–664. https://doi.org/10.3934/publichealth.2017.6.650

Hariawan, H., Fathoni, A., & Purnamawati, D. (2019). Hubungan Gaya Hidup (Pola Makan Dan Aktivitas Fisik) Dengan Kejadian Diabetes Melitus Di Rumah Sakit Umum Provisi NTB. 1(1). http://jkt.poltekkes-mataram.ac.id/index.php/home/index

Iheanacho, C. O., Osoba, D. O., & Eze, U. I. (2021). Evaluation of predominant risk factors for type 2 diabetes mellitus among out-patients in two Nigerian secondary health facilities. African health sciences, 21(2), 693–701. https://doi.org/10.4314/ahs.v21i2.27

Ismail, L., Materwala, H., & Al Kaabi, J. (2021). Association of risk factors with type 2 diabetes: A systematic review. Computational and structural biotechnology journal, 19, 1759–1785. https://doi.org/10.1016/j.csbj.2021.03.003

Janapala, R. N., Jayaraj, J. S., Fathima, N., Kashif, T., Usman, N., Dasari, A., Jahan, N., & Sachmechi, I. (2019). Continuous Glucose Monitoring Versus Self-monitoring of Blood Glucose in Type 2 Diabetes Mellitus: A Systematic Review with Meta-analysis. Cureus, 11(9), e5634. https://doi.org/10.7759/cureus.5634

Kanaley, J. A., Colberg, S. R., Corcoran, M. H., Malin, S. K., Rodriguez, N. R., Crespo, C. J., Kirwan, J. P., & Zierath, J. R. (2022). Exercise/Physical Activity in Individuals with Type 2 Diabetes: A Consensus Statement from the American College of Sports Medicine. Medicine and science in sports and exercise, 54(2), 353–368. https://doi.org/10.1249/MSS.0000000000002800

Kapur, A., & Seshiah, V. (2017). Women & diabetes: Our right to a healthy future. The Indian journal of medical research, 146(5), 553–556. https://doi.org/10.4103/ijmr.IJMR_1695_17

Khanna, D., Peltzer, C., Kahar, P., & Parmar, M. S. (2022). Body Mass Index (BMI): A Screening Tool Analysis. Cureus, 14(2), e22119. https://doi.org/10.7759/cureus.22119

Komariah, K., & Rahayu, S. (2020). Hubungan usia, jenis kelamin dan indeks massa tubuh dengan kadar gula darah puasa pada pasien Diabetes Melitus Tipe 2 Di Klinik Pratama Rawat Jalan Proklamasi, Depok, Jawa Barat. Jurnal Kesehatan Kusuma Husada, 11(1), 41–50. https://doi.org/10.34035/jk.v11i1.412

Li, X., Li, T. T., Tian, R. X., Fei, J. J., Wang, X. X., Yu, H. H., & Yin, Z. Z. (2023). Gestational diabetes mellitus: The optimal time of delivery. World journal of diabetes, 14(3), 179–187. https://doi.org/10.4239/wjd.v14.i3.179

Moon, J. H., & Jang, H. C. (2022). Gestational Diabetes Mellitus: Diagnostic Approaches and Maternal-Offspring Complications. Diabetes & metabolism journal, 46(1), 3–14. https://doi.org/10.4093/dmj.2021.0335

Mukherjee, S. M., & Dawson, A. (2022). Diabetes: how to manage gestational diabetes mellitus. Drugs in context, 11, 2021-9-12. https://doi.org/10.7573/dic.2021-9-12

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, 15(10), e47500. https://doi.org/10.7759/cureus.47500

Raets, L., Ingelbrecht, A., & Benhalima, K. (2023). Management of type 2 diabetes in pregnancy: a narrative review. Frontiers in endocrinology, 14, 1193271. https://doi.org/10.3389/fendo.2023.1193271

Rahman, M. S., Hossain, K. S., Das, S., Kundu, S., Adegoke, E. O., Rahman, M. A., Hannan, M. A., Uddin, M. J., & Pang, M. G. (2021). Role of Insulin in Health and Disease: An Update. International journal of molecular sciences, 22(12), 6403. https://doi.org/10.3390/ijms22126403

Ramachandran A. (2014). Know the signs and symptoms of diabetes. The Indian journal of medical research, 140(5), 579–581.

Ruze, R., Liu, T., Zou, X., Song, J., Chen, Y., Xu, R., Yin, X., & Xu, Q. (2023). Obesity and type 2 diabetes mellitus: connections in epidemiology, pathogenesis, and treatments. Frontiers in endocrinology, 14, 1161521. https://doi.org/10.3389/fendo.2023.1161521

Sahoo, J., Mohanty, S., Kundu, A., & Epari, V. (2022). Medication Adherence Among Patients of Type II Diabetes Mellitus and Its Associated Risk Factors: A Cross-Sectional Study in a Tertiary Care Hospital of Eastern India. Cureus, 14(12), e33074. https://doi.org/10.7759/cureus.33074

Sahu, B., Babu, G. R., Gurav, K. S., Karthik, M., Ravi, D., Lobo, E., John, D. A., Oakley, L., Oteng-Ntim, E., Nadal, I. P., & Kinra, S. (2021). Health care professionals' perspectives on screening and management of gestational diabetes mellitus in public hospitals of South India - a qualitative study. BMC health services research, 21(1), 133. https://doi.org/10.1186/s12913-021-06077-0

Sandu, C., Bica, C., Salmen, T., Stoica, R., Bohiltea, R., Gherghiceanu, F., Pacu, I., Stefan, S., Serafinceanu, C., & Stoian, A. P. (2021). Gestational diabetes - modern management and therapeutic approach (Review). Experimental and therapeutic medicine, 21(1), 81. https://doi.org/10.3892/etm.2020.9512

Shiferaw, W. S., Akalu, T. Y., Desta, M., Kassie, A. M., Petrucka, P. M., & Aynalem, Y. A. (2021). Effect of educational interventions on knowledge of the disease and glycaemic control in patients with type 2 diabetes mellitus: a systematic review and meta-analysis of randomised controlled trials. BMJ open, 11(12), e049806. https://doi.org/10.1136/bmjopen-2021-049806

Timah, S. (2019). Hubungan Pola Makan Dengan Kejadian Diabetes Mellitus Di Rumah Sakit Islam Sitty Maryam Kecamatan Tuminting Kota Manado. Jurnal Ilmiah Kesehatan Diagnosis, 14, 2302–2531.

Wahyuni, R., Ma'ruf, A., & Mulyono, E. (2019). Hubungan Pola Makan Terhadap Kadar Gula Darah Penderita Diabetes Mellitus. Jurnal Medika Karya Ilmiah Kesehatan, 4(2), 2541–4615

Wang, B. B., & Xue, M. (2023). Early neonatal complications in pregnant women with gestational diabetes mellitus and the effects of glycemic control on neonatal infection. World journal of diabetes, 14(9), 1393–1402. https://doi.org/10.4239/wjd.v14.i9.1393

WHO. (2019). Klasifikasi Diabetes Mellitus 2019 (F. Naumann, Ed.). http://apps.who.int/bookorders.

Williams, D. M., Jones, H., & Stephens, J. W. (2022). Personalized Type 2 Diabetes Management: An Update on Recent Advances and Recommendations. Diabetes, metabolic syndrome and obesity: targets and therapy, 15, 281–295. https://doi.org/10.2147/DMSO.S331654

Wondmkun Y. T. (2020). Obesity, Insulin Resistance, and Type 2 Diabetes: Associations and Therapeutic Implications. Diabetes, metabolic syndrome and obesity: targets and therapy, 13, 3611–3616. https://doi.org/10.2147/DMSO.S275898

Yang, H., Wu, F., Gui, M., Cheng, Y., & Zhang, L. (2023). The role of medication adherence in the association between depressive symptoms and quality of life in older adults with type 2 diabetes mellitus. BMC geriatrics, 23(1), 196. https://doi.org/10.1186/s12877-023-03929-8

Author's perspective

Key points
- Physical activity and dietary intake play a crucial role in influencing the incidence of diabetes
- Occupational factors can significantly influence the risk of developing diabetes
- Adherence to prescribed medication regimens is crucial for effective diabetes

Potential areas of interest
- How can the healthcare professionals be integrated in diabetes care?
- What influencing factors lead to a better diabetes treatment?
- When must innovation in healthcare technology be used in diabetes care?