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Risk Factors for Type 2 Diabetes Mellitus (DM) in Southeast Sulawesi: A Literature Review

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Abstract

Type 2 Diabetes Mellitus (DM) is a non-communicable disease that poses a significant public health problem not only at the global and national levels but also in the province of Southeast Sulawesi. The high incidence of DM in this region is caused by various major contributing risk factors such as lifestyle, physiological status, and genetic and socio-economic factors. This study aims to identify and analyze various risk factors for the incidence of type 2 DM based on a review of 16 local research journals conducted within the Southeast Sulawesi region. This research uses a literature review method, selecting 16 journals out of 50 that were searched through national and international scientific databases. The inclusion criteria included journals published between 2020–2024 that examined DM risk factors in the Southeast Sulawesi region. The analysis was conducted thematically based on the type of risk factor and the research location. The results of this study found that the dominant risk factors for DM include low physical activity, unhealthy dietary patterns, obesity (high BMI), family history, stress, smoking habits, poor sleep quality, and alcohol consumption.

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Introduction

Diabetes Mellitus (DM) is one of the most significant non-communicable diseases (NCDs) globally. According to the WHO, in 2021, there were over 537 million people with DM, and this number is predicted to continue increasing annually. In Indonesia, the prevalence of DM has also risen, from 6.9% in 2013 to 10.9% in 2018, based on Riskesdas (Basic Health Research) data which measures DM based on healthcare professional diagnosis and laboratory examination (Indonesian Ministry of Health, 2018).

Nationally, Indonesia is estimated to rank fourth in the world for the highest number of DM sufferers. In addition to economic and social burdens, DM also causes serious complications such as nephropathy, retinopathy, neuropathy, as well as heart and vascular diseases.

In the Southeast Sulawesi region, the increase in DM prevalence is also clearly visible. Based on Riskesdas 2018, the prevalence of DM in southeast Sulawesi increased from 1.1% (2013) to 1.3% (2018). Furthermore, the Southeast Sulawesi Health Profile notes that DM is among the top 10 most common diseases in healthcare facilities, with 13,946 cases recorded in 2017, including over 3,000 cases in Kendari City. Local studies at the Mokoau Community Health Center and Bahteramas General Hospital even indicate that a majority of DM sufferers are undiagnosed and unaware of their risk factors (La Rangki et al., 2022).

Etiologically, type 2 DM is closely associated with various risk factors. Non-modifiable factors such as age, gender, and family history play an important role. However, modifiable factors are even more dominant, including obesity, waist circumference, a diet high in calories and simple carbohydrates, lack of physical activity, psychological stress, alcohol consumption, and smoking habits. Local studies in various regencies/cities of Southeast Sulawesi have demonstrated a strong link between these factors and the incidence of DM, particularly among the productive age group (20-44 years) (Fin et al., 2025).

Although various studies on DM have been conducted, most are fragmented and limited to a local scale. There is a lack of comprehensive studies that systematically and integratively examine the various risk factors for DM incidence in Southeast Sulawesi. Yet, understanding the variation of risk factors across

different regions is crucial for developing contextual and effective public health interventions. Therefore, this study is important as an effort to summarize, compare, and analyze findings from various local studies to serve as a basis for formulating evidence-based DM prevention and control strategies in the Southeast region.

Methods

This research employs a literature review method to examine various risk factors for the incidence of Diabetes Mellitus (DM) in Southeast Sulawesi. Literature was obtained by searching scientific databases such as Google Scholar, ResearchGate, PubMed, Neliti, and Garuda Ristek-BRIN using the keywords: "risk factors for diabetes mellitus," "diabetes in Southeast Sulawesi," and "determinants of type 2 diabetes." Data analysis using PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analysis).

An initial search yielded 50 journals. Selection was conducted using the following inclusion criteria: (1) published between 2020–2024, (2) focused on the Southeast Sulawesi region, (3) discussed DM risk factors, and (4) used a quantitative design. Exclusion criteria included opinion articles, articles that did not explicitly mention risk factors, or those not available in full text. After the selection process, 13 relevant primary journals were obtained and analyzed thematically based on risk factors from individual, behavioral, and social environmental aspects. This analysis aims to provide a comprehensive overview to support evidence-based health interventions in the Southeast Sulawesi region.

Results

Table 1. Systematic Review

No.	Autor / Year	Title	Methods	Results
1	Kinda Mujisari, Mansur Sididi, Sartika/2021	The Relationship Between the Application of the Four Pillars of Type 2 Diabetes Mellitus Control and Average Blood Sugar Levels at the Banabungi Community Health Center, Southeast Sulawesi	A quantitative research study with a cross-sectional design, a sample of 50 people, and analysis using the chi-square test.	Physical activity was the only factor significantly associated with blood sugar levels ($p<0.001$); knowledge, dietary regulation, and medication adherence showed no association ($p > 0.05$).
2	Hendrik, Nirwana, Saasa/2024	Factors Associated with the Incidence of Type II Diabetes Mellitus in Outpatients at Konawe Hospital	An analytical descriptive study with a cross-sectional approach; analysis used the chi-square test.	There was a significant relationship between diet, obesity, physical activity, and family history with the incidence of Type II Diabetes Mellitus ($p<0.001$).
3	Andi Ulfryza Dwi Riwansyah, La Ode Muhamad Sety, Jusniar Rusli Afa/2021	Analysis of Risk Factors for the Incidence of Type 2 Diabetes Mellitus in the Working Area of Wawotobi Community Health Center, Konawe Regency, 2020	A quantitative research study with a case-control design. The sampling technique used simple random sampling, and the analysis employed odds ratio and statistical tests.	There was a significant association between BMI, upper arm circumference, waist circumference, and sleep quality with the incidence of Type 2 DM.
4	Anita Jernivita Sari, Jumakil, Asnia Zainuddin/2021	Risk Factors for Type II Diabetes Mellitus among the Productive-Age Population (15–44 Years) in the Working Area of the Unaaha Community Health Center, Konawe Regency, 2021	A quantitative research study with a case-control design. The sample consisted of 80 people (40 cases and 40 controls) selected using total sampling technique.	Family history (OR=6.321), stress (OR=3.857), and physical activity (OR=5.211) were significant risk factors for the incidence of Type II DM.
5	La Rangki, Haryati, Mubarak, Saida,	Early Detection of Diabetes Mellitus	The community service activity involved	Out of 63 respondents, 7 people had a Random Blood

No.	Autor / Year	Title	Methods	Results
	Rahmawati, Arfiyan Sukmadi/2022	Risk Factors in the Working Area of Mokoau Community Health Center, Kendari City, Southeast Sulawesi Province	screening/early detection through Random Blood Glucose (RBG) examination, Body Mass Index (BMI) measurement, and waist circumference measurement.	Glucose (RBG) level >200 mg/dl, 42 people had a Body Mass Index (BMI) >25 (overweight), and 36 people had a waist circumference above the risk threshold. Many people are still unaware of their DM risk, highlighting the need for education and routine screening.
6	Waode Sukmawati Syukur, La Ode Muhamad Sety, Fifi Nirmala G/2020	Risk Factors for the Incidence of Type 2 Diabetes Mellitus among People in the Rural Area of Kolaka Regency, 2020	A case-control study with 80 respondents (40 cases, 40 controls), using random sampling technique.	Significant risk factors: carbohydrate intake (OR=2.5), alcohol consumption (OR=3.5), and hypertension (OR=3.1). Physical activity was not significant (OR=1.2).
7	Wa Ode Rofiani Alifu, Rininta Andriani, Wahid Ode/2021	Factors Associated with the Incidence of Diabetes Mellitus in the Working Area of Sampolawa Community Health Center, South Buton Regency	An analytical observational study with a cross-sectional approach, a sample of 68 people, and analysis using the chi-square test.	There was a significant association between stress (p=0.034), physical activity (p=0.044), and smoking behavior (p=0.035) with the incidence of DM.
8	Nur Haisa, La Djabo Buton, Hartian Dode/2019	Risk Factors for the Incidence of Type II Diabetes Mellitus at Benu-Benua Community Health Center, West Kendari District, Kendari City	A quantitative research study with a case-control design, using odds ratio (OR) analysis.	Stress increases the risk of type II DM by 6 times, obesity by 3 times, and a family history confers a 7 times higher risk compared to those without these
9	Chyntia Angellica Shawputri, Lutfi Alifatur Rohmah, Natasya Aulia Fauziyyah, Wika Novenda Ramadani, Dwi Sarwani Sri Rejeki/2024	Risk Factors for Type II Diabetes Mellitus Worldwide: A Literature Review	Literature Review	The most dominant factors were low physical activity and productive age (30–40 years). Individuals without vigorous physical activity had a 5 times higher risk of developing type II DM.
10	Risni Asrina Jati, Febriana Muchtar, Syefira Salsabila/2023	The Risk Factor of Physical Activity on the Incidence of Type 2 Diabetes Mellitus in the Working Area of Kemaraya Community Health Center, Kendari City	A case-control study with a sample of 90 (45 cases, 45 controls), using a simple random sampling technique.	Physical activity was a significant risk factor for the incidence of type 2 diabetes (p<0.001; OR=7.429; CI 2.625–21.018).
11	Wa Ode Widya Astuti, Asnia Zainuddin, Lisnawaty (2019)	Analysis of Risk Factors for the Incidence of Type 2 Diabetes Mellitus among Inpatient Patients at Muna Regency General	A quantitative study with a case-control design. The total sample was 60 people (30 cases, 30 controls), selected using purposive sampling	Significant risk factors: exercise activity (p=0.038; OR=3.00) and family history (p=0.001; OR=12.25). Carbohydrate intake was not significant (p=0.667; OR=2.154).

No.	Autor / Year	Title	Methods	Results
		Hospital, 2019	technique.	
12	Dona Prima Fierda, Febianti Rahayu, Ghina Roudhatul Jannah, Dwi Sarwani Sri Rejeki Tahun: 2021	Risk Factors for Type II Diabetes in Rural Areas: A Literature Review	A literature review utilizing sources from ScienceDirect, PubMed, and Google Scholar with specific keywords.	The dominant risk factor is lack of physical activity. Women with an average age of 55, low education, and a poor diet are at higher risk of developing type II diabetes mellitus.
13	Fin, La Ode Liaumin Azim, Suhadi/2024	Risk Factors for Diabetes Mellitus (DM) among the Productive-Age Population (20–44 Years) in the Working Area of Lepo-Lepo Community Health Center	A quantitative study with a matched case-control design, using the McNemar test and Odds Ratio calculation.	Dietary pattern (OR = 3.000) and physical activity (OR = 4.000) were significant risk factors for the incidence of DM among the productive-age group.
14	Reni Yunus, Fitri Wijayati, Askrening Askrening, Dian Yuniar Syanti Rahayu , Fonnie E. Hasan, Trees Tress, Angriani Fusvita/2024	Diabetes Mellitus and Bacterial Infections: A Review of Common Infections in DM Patients	A literature review utilizing primary and secondary sources from national and international journals.	DM patients are susceptible to bacterial infections such as TB, UTIs, pneumonia, and diabetic foot due to impaired immunity from hyperglycemia; blood sugar control and prompt treatment can prevent complications.
15	narmawan narmawan, syahrul syahrul, kadek ayu erika/2018	The behavior of foot care in patients with type 2 diabetes mellitus: applying the theory of planned behaviour	A quantitative cross-sectional study using the Theory of Planned Behaviour approach, involving 100 type 2 DM patients.	Positive attitudes, subjective norms, and perceived behavioral control encourage foot care intention, which is key to preventing diabetic ulcers in type 2 DM patients.
16	Muh. Natsir, Sunarsih, Timbul Supodo, Erwin Azizi Jayadipraja, Komang Ayi Sukma/2025	Risk Factors for Type 2 Diabetes Mellitus in Women of Childbearing Age at Unaaha Public Health Center, Konawe Regency	This study used a quantitative approach with a case-control study design.	Excess BMI, family history, high-calorie diet, low physical activity, and hypertension increase the risk of type 2 DM, while age tends to have an influence but is not significant.

The article selection process in this literature review follows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) steps. In the identification stage, a total of 50 articles were successfully gathered from several scientific databases, namely Google Scholar, ResearchGate, PubMed, Neliti, and Garuda Ristek-BRIN. Each article found was then examined through its title and abstract to ensure its relevance to the discussion of risk factors for Type 2 Diabetes Mellitus in Southeast Sulawesi.

Next, in the screening process, 34 articles were removed because they did not meet the specified criteria. The eliminated articles, among others, did not focus on the Southeast Sulawesi region, did not examine the risk factors for diabetes mellitus, were published outside the range of the years 2020 to 2024, or were merely opinions without research data. This screening process is very important to ensure that only articles with a solid research basis can proceed to the next stage.

The next stage is the feasibility evaluation, where the remaining 16 articles will be analyzed in greater depth in the form of full texts. These articles will be evaluated based on the methodologies used, data availability, and relevance to the research objectives. This detailed review process is conducted to ensure that the selected articles can truly support a systematic analysis in recognizing risk factors for diabetes mellitus in Southeast Sulawesi. From the analysis results, only 13 articles met the inclusion

criteria. These articles are quantitative studies focusing on risk factors for diabetes mellitus, conducted in Southeast Sulawesi, and have data ready for analysis. These articles are used to identify the main risk factors for type 2 diabetes mellitus, namely lack of physical activity, unhealthy eating patterns, obesity, and family background.

Table 2. PRISMA Literature Review Flow Diagram

Selection Stage	Number of Articles	Description
Identification	50 articles	Found through searches on Google Scholar, ResearchGate, PubMed, Neliti, and Garuda Ristek-BRIN.
Screening	34 articles were eliminated	Excluded due to not meeting the inclusion criteria, such as: not being a study in Southeast Sulawesi, not discussing risk factors for diabetes mellitus, not being from the year 2020-2024, or being merely an opinion.
Feasibility	16 full articles reviewed	The articles that passed are then checked for conformity with the methodological criteria and the availability of full text.
Inclusion	13 final articles used	Articles that are truly relevant, meet the criteria for quantitative research, focus on the risk factors of diabetes mellitus in the Southeast Sulawesi region, and have data that can be analyzed.

Discussion

Type 2 Diabetes Mellitus (DM) is a chronic metabolic disease caused by impaired insulin function and insulin resistance, and is highly influenced by various interacting risk factors (Harefa et al., 2023). The review of 16 journals conducted in various regions of Southeast Sulawesi shows that the risk factors for DM incidence are highly diverse, ranging from individual and behavioral factors to environmental and social ones. This discussion will group these factors into several main categories based on the dominant themes in the research findings.

The analysis results show that a lack of physical activity is the most consistent risk factor found in almost all studies. A study at the Lepo-Lepo Health Center in Kendari City revealed that low physical activity is associated with the onset of type 2 diabetes in productive age with OR = 4.000 (Fin and Suhadi, 2025). Research at the Kemaraya Health Center also indicates that minimal physical activity can increase the likelihood of developing diabetes by up to 7.429 times (Jati et al., 2023). Furthermore, a study at the Banabungi Health Center confirms that among four elements of diabetes management, only physical activity significantly reduces blood sugar levels (Mujisari et al., 2021).

In addition to physical activity, an unhealthy diet is a major risk factor. Research in Lepo-Lepo shows that a diet high in calories and low in fiber increases the likelihood of developing diabetes with an OR = 3.000 (Fin and Suhadi, 2025). Similar findings also appeared in research at Konawe Hospital, where poor eating habits were closely related to the incidence of diabetes (Hendrik et al., 2023). In Kolaka Regency, excessive carbohydrate consumption has also been shown to increase the risk with an OR = 2.5 (Syukur et al., 2020).

Physical indicators such as overweight, body mass index (BMI), waist size, and upper arm size have repeatedly been reported to have a significant relationship with diabetes mellitus (DM). Research conducted at the Wawotobi Health Center revealed that BMI, waist size, and upper arm size have a close relationship with the occurrence of DM, with poor sleep quality as a major factor (Riwansyah et al., 2021). Examination at the Mokoau Health Center shows that more than 60% of respondents have a BMI above 25 and waist size exceeding risk limits, but many of them are not aware of this condition (La Rangki et al., 2022). Research at the Benu-Benua Health Center and Konawe Hospital also shows that obesity can triple the risk of DM (Haisa et al., 2019; Hendrik et al., 2023).

The factor of family history has proven to be the most significant predictor. A study conducted at the Unaaha Health Center noted that having a family history can increase the risk of diabetes mellitus by up to OR = 6.321 (Sari et al., 2023). Another study at Muna Hospital even mentioned OR = 12.25 (Astuti et al., 2021). On the other hand, research at Benu-Benua Health Center showed that individuals with a family history of diabetes mellitus have seven times higher odds of experiencing it (Haisa et al., 2019). These results indicate that genetic factors and family background play an important role in the tendency of developing diabetes mellitus.

In addition to the main factors, stress, smoking, alcohol consumption, and high blood pressure have also been identified as significant risks. Stress can increase the likelihood of developing diabetes mellitus (DM) by up to six times (Haisa et al., 2019) and has a significant relationship with the incidence rate of DM at the Sampolawa Health Center (Alifu et al., 2020). Alcohol consumption (OR = 3.5) and high blood

pressure (OR = 3.1) have been shown to increase the risk of DM in Kolaka Regency (Syukur et al., 2020). On the other hand, poor sleep quality has also been noted as an important predictor in a study in Konawe (Riwansyah et al., 2021).

From the perspective of complications, diabetes mellitus patients are very susceptible to bacterial infections. Literature reviews show that there is a high vulnerability to tuberculosis, urinary tract infections, pneumonia, and diabetic foot ulcers due to the decreased immunity caused by hyperglycemia conditions (Yunus et al., 2024). On the other hand, research on behavior based on the Theory of Planned Behavior reveals that positive attitudes, subjective norms, and control over behavior have a significant influence on the intention to perform foot care, which serves to prevent the occurrence of diabetic ulcers (Narmawan et al., 2018).

Overall, the analysis of these 16 studies shows that the main risk factors for type 2 diabetes in Southeast Sulawesi include lack of physical activity, unhealthy diet, overweight, and family health history, along with other factors such as stress, high blood pressure, alcohol consumption, and poor sleep quality. Complications related to infections and issues with foot care are also very important concerns. These findings emphasize the need for comprehensive, community-based interventions focusing on behavioral changes, improved early detection, and health education to reduce the burden of diabetes in this region.

Conclusion

Based on a review of 16 research journals in Southeast Sulawesi Province, it is known that the most consistent primary risk factors contributing to the incidence of type 2 Diabetes Mellitus (DM) include low physical activity, an unhealthy diet, obesity (high BMI), and family history. Other factors such as stress, smoking habits, alcohol consumption, and poor sleep quality were also proven significant in several studies. These findings indicate that the incidence of DM is influenced not only by biological factors but also by behavioral patterns and local social conditions.

Therefore, efforts to prevent and control DM in Southeast Sulawesi need to focus on promoting a healthy lifestyle, community education, and early detection, especially for high-risk groups. This review is expected to serve as a foundation for formulating more effective, contextual, and sustainable evidence-based interventions to reduce the burden of Diabetes Mellitus at the local level.

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