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Research Article

Determinants of Complications of Diabetic Among Adult with Type 2 Diabetic Patients at Hubaal Specialist Hospital and Libaan Hospital in Mogadishu: Case Control Study

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Abstract

Background: Diabetes mellitus is a major global health issue characterized by persistently high blood sugar levels due to insufficient insulin production or decreased insulin efficacy. Over 422 million adults have diabetes worldwide, with an expected rise to 642 million by 2040. Type 2 diabetes accounts for about 90% of these cases. Sub-Saharan Africa is seeing a notable rise in type 2 diabetes due to lifestyle changes and an aging population In Somalia, the private-sector-dominated healthcare system, exacerbated by prolonged armed conflicts, struggles with affordable diabetes management, leading to increased diabetic complications. With an estimated 5% prevalence of diabetes in Somalia, the lack of routine screening and limited access to affordable healthcare further elevate the prevalence and complications, particularly among those with type 2 diabetes. *Objective*: This study aimed to identify socio-demographic, healthcare, lifestyle, and clinical factors associated with diabetic complications among adults with type 2 diabetes at selected hospitals in Mogadishu, Somalia. *Methods*: A case-control study of 187 type 2 diabetes patients used purposive sampling and structured questionnaires to collect data. Analysis was performed using SPSS version 27.0 with bivariate and logistic regression, and significance was set at $p \leq 0.05$. *Results*: The study found that participants aged over 47 years had significantly higher odds of developing diabetic complications compared to those aged 18-27 years (OR: 3.17, 95% CI: 1.26-7.96, $p = 0.014$). In the multiple regression analysis, the duration of diabetes significantly influenced the risk of complications, with those diagnosed for 5-10 years (AOR: 3.50, 95% CI: 1.19-10.28, $p = 0.029$) and more than 10 years (AOR: 3.59, 95% CI: 1.36-9.49, $p = 0.011$) having increased odds. Uncontrolled blood glucose levels were also a significant predictor of complications (AOR: 3.55, 95% CI: 1.82-6.91, $p < 0.001$). Other factors, such as marital status and monthly income, were not significant in the multiple regression analysis. *Conclusion*: This study highlights the importance of early detection and management of diabetes to prevent complications, especially among older adults and those with longer disease duration. Interventions should focus on improving glycemic control and managing comorbid conditions. Targeted education and support for patients, especially those at higher risk, are crucial to mitigating the impact of diabetic complications.

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Keywords

Diabetic Complications, Type 2 Diabetes, Glycemic Control, Risk Factors, Case-Control Study, Mogadishu, Somalia

1. Introduction

1.1. Background of the Study

Diabetes Mellitus (DM) is a metabolic condition characterized by persistently high blood sugar levels due to deficiencies in the production or effectiveness of insulin. Type 2 diabetes accounts for approximately 90% of all diabetes cases globally. Glycemic management in patients with DM is considered satisfactory when blood glucose levels are near normal, reducing the risk of DM-related complications. In contrast, management is deemed unsatisfactory when blood glucose levels remain elevated, increasing the risk of diabetes-related complications. [1]

Patients with DM are at increased risk of complications related to their diagnosis, and this risk has been recognized as a serious threat to the population's health. These complications vary widely and are typically categorized as either micro- or macro vascular. Micro vascular complications include those conditions that result from damage to the body's smaller blood vessels (e.g. retinopathy, neuropathy or nephropathy), whereas macro vascular complications include those conditions that result from damage to the body's larger blood vessels (e.g. cardiovascular disease) [2].

Globally The prevalence of DM is increasing rapidly worldwide, with the number of adults with DM more than tripling from an estimated 151 million in 2000 to 537 million in 2021. this number will have more than tripled.23 If nothing is done, the number of diabetics worldwide would rise to 643 million by 2030 and 783 million by 2045 [3].

DM is growing at an alarming rate throughout the world, and approximately 80% of diabetics live in developing countries. Its burden is highest in resources limited countries, where screening and access to care and treatment are not readily available [4].

DM continues to be a serious global public health concern, irrespective of a nation's degree of development or income. Undiagnosed DM poses a significant concern, particularly in wealthy nations that have both universal healthcare access and advanced medical tools [1].

Regionally. According to the latest predictions from the International DM Federation (IDF) in 2021, around 24 million adults in Africa, which is equivalent to 1 in 22 persons, are affected with DM. According to the IDF, the prevalence of DM is expected to increase the most in Africa due to the projected aging of Africa's currently youthful populations, as well as the rise in urbanization and related changes in lifestyle. This will ultimately result in a significant burden on inadequate health care systems that are poorly organized and insufficiently funded to handle non-communicable diseases (NCDs) such as DM. Two Furthermore, the prevalence of undiagnosed DM continues to rise in Africa. Within the IDF regions, Africa exhibits the greatest percentage of undiagnosed diabetes, accounting for approximately 54% of all instances. Most patients in Africa are diagnosed with coexisting severe comorbidities at a late stage, and inadequate diabetes management is still prevalent in most clinical settings. Three The lack of knowledge about DM, healthcare systems primarily focused on managing communicable diseases rather than NCDs, low rates of DM screening for early diagnosis, limited access to affordable essential diagnostic tests and medications for DM, and gaps in knowledge and practice among healthcare practitioners can explain this phenomenon. [6]

Sub-Saharan Africa, like the rest of the world, is experiencing an increasing prevalence of diabetes alongside other non-communicable diseases [7].

The International Diabetes Federation (IDF) estimated that in 2015, about 14.2 million people living in Africa (including Ethiopia) had DM. This number is expected to rise to 32.4 million by 2040 [8]. The factors that are thought to be associated with the development of the disease and its risk factor are the level of knowledge, attitude, and behavior towards making lifestyle changes in DM patients [7].

Somalia, a country in sub-Saharan Africa, has seen prolonged armed war, leading to a broken national public healthcare system. As a result, the private sector generally controls the healthcare system in the country, making it too expensive for a major percentage of the people to pay. While there is a dearth of comprehensive data on diabetes in Somalia, the World Health Organization approximated its occurrence to be 5% in 2016, with 22% of the population being classified as overweight or obese. According to the latest statistics from the World Bank in 2021, the prevalence of diabetes among adults aged 20 to 79 in Somalia is 6.5%. The absence of routine diabetes screening and stringent management for diagnosed diabetes patients has played a role in the rising prevalence of DM cases and associated consequences, such as diabetic foot ulcers, neuropathy, retinopathy, and cardiovascular diseases. This study is the initial examination of the frequency and factors influencing the occurrence of diabetic complications among persons diagnosed with type 2 diabetes [9].

1.2. Objective of the Study

1.2.1. General Objective

This study is therefore aiming to determine diabetic complications among adult with type 2 diabetic Patients at Hubaal Specialist Hospital and Liban Hospital in Mogadishu.

1.2.2. Specific Objective

1. To identify socio-demographic factors associated with diabetic complications among adult with type 2 Diabetic patients at Hubaal Specialist Hospital and Liban Hospitals in Mogadishu.
2. To evaluate healthcare related factors associated with diabetic complications among Adults with Type 2 diabetes at Hubaal Specialist Hospital and Liban Hospitals in Mogadishu.
3. To examine lifestyle and clinical related factors associated with diabetic complications among adults with Type 2 diabetes Hubaal Specialist Hospital and Liban Hospitals in Mogadishu.

2. Methodology

2.1. Study Design

An unmatched case-control study was conducted at Hubaal and Liban Hospitals in Mogadishu, Somalia. The study involves 187 cases and controls. Cases are 63 adults with Type 2 diabetes who have developed diabetic complications. The control group includes 124 adults with Type 2 diabetes who have not developed any diabetic complications.

2.2. Study Population

Adults with Type 2 Diabetes attending Hubaal and Liban Hospitals during the study period (April 2024 to August 2024).

2.3. Inclusion Criteria and Exclusion Criteria

2.3.1. Inclusion Criteria

Cases: Any adult presenting to Hubaal and Liban Hospitals during the data collection periods, with previously diagnosed diabetes mellitus and with diabetic complications.

Controls: Any adult presenting to Hubaal and Liban Hospitals during the data collection periods, with previously diagnosed diabetes mellitus and without diabetic complications.

2.3.2. Exclusion Criteria

The study excluded patients critically ill and unable to communicate.

Patients who refused to give consent.

2.4. Sample Size Determination

Sample size was determined using EpiInfo statistical software version 7 using the following assumptions of two population proportion formula for the unmatched case-control studies: poor medication adherence (was taken as main exposure variable as it gave maximum sample size compared to other exposure variables), 95% confidence level, 80% power, 2: 1 control to case ratio, 58.6% expected prevalence of poor diabetic medication adherence among patients free of diabetic complication (controls) with odds ratio of 3.0. As a result, 170 (57 cases and 113 controls) after considering 10% for non-response, the sample size become 187 (63 cases and 124 controls) will consider participating in the main study. [10]

2.5. Sampling Technique

All patients with type 2 diabetes mellitus attending the diabetic clinic during the working time of the clinic and eligible are enrolled using a purposive sampling technique. Study participants are interviewed upon their exit from the diabetic clinic to recruit the required sample sizes for both groups (cases or controls).

2.6. Study Variables

The dependent variable of the study is diabetic complications, while the independent variables encompass several categories. Socio-demographic factors include age, gender, income, education, and occupation. Health care-related factors involve healthcare accessibility, medication adherence, and the frequency of medical check-ups. Lifestyle factors cover physical activity, dietary habits, and obesity. Clinical factors consist of the duration of diabetes, glycemic control, and the presence of other comorbid conditions. This comprehensive approach helps identify the determinants of diabetic complications among adults with type 2 diabetes.

2.7. Data Collection Tool and Procedures

This study uses questionnaires as the main tool for data collection. The researcher collects primary data through questionnaires to capture information relevant to the study's objectives and research questions. Questionnaires are an effective way to gather information about phenomena that are not directly observable and are also efficient for reaching a larger group.

2.8. Data Analysis Process

The data analysis process involved coding and transforming data using SPSS to identify socio-demographic, healthcare, lifestyle, and clinical factors related to diabetic complications in adults with type 2 diabetes in Mogadishu hospitals. Logistic regression was used to estimate adjusted odds ratios with 95% confidence intervals, with statistical significance set at a p-

value of 0.05. Data were collected through a pre-tested questionnaire and chart reviews, with interviews conducted for patients unable to read or write. The chart reviews provided information on diabetes type, family history, diagnosis duration, and complications, with diagnoses confirmed by physicians and laboratory results extracted from patient records. Daily checks ensured data completeness and accuracy before analysis, allowing for a comprehensive assessment of factors influencing diabetic complications.

2.9. Validity and Reliability

Validity explains how well the collected data covers the actual area of investigation (Sal kind, 2000).

In this study, content validity was concerned with how accurately the questions asked tended to elicit the information sought.

Reliability means that the scores of an instrument are stable and consistent, Accurate and careful phrasing of each question to avoid ambiguity and leading respondents to a particular answer ensured reliability of the tool. The respondents were informed of the purpose of the study and of the need to respond truthfully.

2.10. Ethical Considerations

The researcher obtained written permission from the Research Committee of the Benadir University School of Postgraduate and Research Studies, as well as the administrations of Hubaal Specialist Hospital and Libaan Hospital, to ensure that the research adhered to all ethical considerations. Prior to data collection, respondents were informed of the purpose of the research and their rights to choose whether or not to participate. To maintain confidentiality, respondents were coded instead of using their names. Acknowledgments were provided to the authors cited in this study and to the author of the standardized instrument through proper citations and referencing. Finally, the findings were presented in a generalized manner. This study posed no known risks.

3. Result

3.1. Sociodemographic Characteristics

Table 1 outline various demographic variables, including age, gender, monthly income, educational level, occupation, employment status, and family history of diabetes.

Regarding the age ranges, 32 (50.8%) of the case responders were older than 47, 13 (20.6%) were between the ages of 38 and 47, 7 (11.1%) of the cases were between the ages of 18 and 27, and only 11 (17.5) were between the ages of 28 and 37. While 78 (62.9%) of the controls were older than 47, 24 (19.4%) were between the ages of 28 and 37, 10 (8.1) were between the ages of 38 and 47, and 12 (9.7%) of the controls were between the ages of 18 and 27.

The gender distribution is similar in the case and control groups. Of the responders in the case group, 44.4 (44.4%) were male and 55.6 (55.6%) were female. The control group's gender distribution was 55.6 (55.6%) female and 44.4 (44.4%) male respondents, which was similar to that of the case group.

Regarding monthly earnings, the data indicates that the majority of respondents in the case group—28 (44.4%)—earn more than $300, which is followed by 26 (41.3%) who make between $100 and $200, and 9 (14.3%) who make less than $100. On the other hand, the control group has a distinct pattern, with 33 (26.6%) receiving $100 or less, 39 (31.5%) receiving between $100 and $200, and 52 (41.9%) receiving more than $300. 19 (30.2%) of the case respondents are degree holders, followed by 17 (27.0%) people with only a primary education, 16 (25.4%) people who are illiterate, and 11 (17.5%) people with a secondary education. Of the control group, 41 (33.1%) had the highest percentage of degrees, followed by 40 (32.3%) illiterate, 23 (18.5%) with only a primary education, and 20 (16.1%) with a secondary education.

Examining the data by occupation, we find that 25 (39.7%) of the case group have jobs, 19 (30.2%) are jobless, and 19 (30.2%) are housewife. In the control group, there are more employed people than unemployed people: 70 (56.5%), compared to 30 (24.2%) and 24 (19.4%) housewives. Among those who are employed, the data indicates that in the case group, 29 (65.9%) are self-employed, while 15 (34.1%) are laborers. In the control group, 49 (62.0%) are self-employed, and 30 (38.0%) are laborers.

Lastly, in terms of family history of diabetes, 34 (54.0%) of the case respondents have a family history of diabetes, while 29 (46.0%) do not. In the control group, this is evenly split, with 62 (50.0%) having a family history and 62 (50.0%) not having one.

Table 1. *Demographic Characteristics.*

Demographic Variables			
	Case (%)	**Control (%)**	**Overall (%)**
Age			

Demographic Variables			
	Case (%)	**Control (%)**	**Overall (%)**
18-- 27	7 (11.1)	12 (9.7)	19 (10.2)
28-- 37	11 (17.5)	24 (19.4)	35 (18.7)
38 --47	13 (20.6)	10 (8.1)	23 (12.3)
More than 47	32 (50.8)	78 (62.9)	110 (58.8)
Gender			
Male	28 (44.4)	55 (44.4)	83 (44.4)
Female	35 (55.6)	69 (55.6)	104 (55.6)
Monthly Income			
≤100$	9 (14.3)	33 (26.6)	42 (22.5)
100$ ---200$	26 (41.3)	39 (31.5)	65 (34.8)
≥ 300$	28 (44.4)	52 (41.9)	80 (42.8)
Educational level			
Illiterate	16 (25.4)	40 (32.3)	56 (29.9)
Primary Education	17 (27.0)	23 (18.5)	40 (21.4)
Secondary	11 (17.5)	20 (16.1)	31 (16.6)
Degree	19 (30.2)	41 (33.1)	60 (32.1)
Occupation			
Employed	25 (39.7)	70 (56.5)	95 (50.8)
Unemployed	19 (30.2)	30 (24.2)	49 (26.2)
Housewife	19 (30.2)	24 (19.4)	43 (23.0)
If employed			
Self-employed	29 (65.9)	49 (62.0)	78 (63.4)
Labor	15 (34.1)	30 (38.0)	45 (36.6)
Family History of Diabetes			
Yes	34 (54.0)	62 (50.0)	96 (51.3)
No	29 (46.0)	62 (50.0)	91 (48.7)

3.2. Healthcare Variables of the Respondents

Table 2. demonstrates the healthcare variables included in this analysis, including the availability of medical facilities, patients' adherence to taking their prescribed diabetes medications, the frequency of check-ups, the kind of medication, the frequency of missed doses, and the incidence of medication forgetfulness. It also describes the typical causes of medication non-adherence in the case and control groups. In terms of healthcare facility accessibility, the data indicates that 21 (33.3%) of the case group are located less than one km away from a facility. 18 people (28.6%) reside within a 1–5 km range, 11 people (17.5%) live between 5 and 10 km away, and 13 people (20.6%) live more than 10 km away from a facility. Comparatively, of the control group, 31 (25.0%) are less than 1 km from a facility, 55 (44.4%) are between 1 and 5 km away, 8 (6.5%) are between 5 and 10 km away, and 30 (24.2%) are farther away.

Of the case group, 22 (34.9%) regularly followed their prescribed regimen for taking their diabetes medications, whereas 25 (39.7%) only occasionally did so. Furthermore, 4 (6.3%) rarely took their medication, and 12 (19.0%) of the participants never took their prescriptions as directed. Of the individuals in the control group, 68 (54.8%) regularly take their medications as prescribed, 39 (31.5%) occasionally do

so, 12 (9.7%) infrequently do so, and 5 (4.0%) never do.

Of the case group, 18 (31.7%) had monthly check-ups and 20 (31.7%) had check-ups every six months. Conversely, 13 people (20.6%) report yearly physicals, while 12 people (19.0%) say they've never had one, indicating gaps in the frequent tracking of health. Thirteen (10.5%) of the control group report never having check-ups, whereas 27 (21.8%) have monthly check-ups, 63 (50.8%) have check-ups every six months, and 21 (16.9%) have annual check-ups.

Regarding the type of medication respondent demonstrates that of the case group, 28 (44.4%) were receiving insulin therapy, and 26 (41.30%) were using oral medicine. Furthermore, 9 people (14.30%) did not take any medication. In the control group, on the other hand, 78 people (62.90%) took oral medication, 40 people (32.30%) received insulin therapy, and only 6 people (4.80%) did not take any medication at all. "Although the combination of insulin and oral medications, as well as non-insulin injectables like GLP-1 receptor agonists, are treatment options in diabetes management, none of the participants in this study reported using these medications (n = 0)."

Regarding the miss dosage response, the majority of the case group (20/31.7%) said they had never forgotten to take their diabetes medicine. Furthermore, of those who reported missing a dose, 12 (19.0%) said they did it once a month, and 22 (34.9%) said they missed it once a week. Finally, 9 (14.3%) of the case group acknowledged that they regularly missed their medication. 49 people (39.5%) in the control group said they had never missed a dosage of their diabetes medication. Of those who reported missing a dose, 22 (17.7%) reported doing so once a month, and 38 (30.6%) reported doing so once a week. Lastly, 15 individuals (12.1%) in the control group reported missing their prescription on a daily basis.

In reference to the problem of forgetting to take diabetic medicine, 21 cases (33.3%) did not forget, whereas 42 cases (66.7%) reported forgetting. On the other hand, 56 (54.2%) of the controls did not forget their pills, whereas 68 (54.8%) of the controls said they did. When the common causes of missed medication were examined, 20 cases (46.5%) involved forgetting to take the medication, 6 cases (14.0%) involved running out of medication, and 5 cases (11.6%) involved experiencing side effects. In addition, 5 (11.6%) mentioned financial reasons, and 6 (14.0%) felt better and thought the drug wasn't necessary. Just 1 (2.3%) decided not to take their prescription since they were feeling worse. Controls, on the other hand, said they forgot to take their medicine 26 times (26.8%), ran out of 19 times (19.6%), and had side effects 14 times (14.4%). Thirteen (13.4%) reported feeling better and thinking the drug wasn't necessary, while twenty-four (24.7%) cited financial concerns. Of the controls, just one (1.0%) decided not to take their prescription because they felt worse.

Table 2. *Healthcare Variables.*

Healthcare Variables Healthcare Variables			
	Case (%)	**Control (%)**	**Overall (%)**
Healthcare facility			
Less than 1 km	21 (33.3%)	31 (25.0%)	52 (27.8%)
1-5 km	18 (28.6%)	55 (44.4%)	73 (39.0%)
5-10 km	11 (17.5%)	8 (6.5%)	19 (10.2%)
More than 10 km	13 (20.6%)	30 (24.2%)	43 (23.0%)
Prescribed diabetes medications			
Always	22 (34.9%)	68 (54.8%)	90 (48.1%)
Sometimes	25 (39.7%)	39 (31.5%)	64 (34.2%)
Rarely	4 (6.3%)	12 (9.7%)	16 (8.6%)
Never	12 (19.0%)	5 (4.0%)	17 (9.1%)
Check-ups			
Monthly	18 (28.6%)	27 (21.8%)	45 (24.1%)
Every 6 months	20 (31.7%)	63 (50.8%)	83 (44.4%)
Annually	13 (20.6%)	21 (16.9%)	34 (18.2%)
Never	12 (19.0%)	13 (10.5%)	25 (13.4%)

Healthcare Variables Healthcare Variables			
	Case (%)	**Control (%)**	**Overall (%)**
Type of medication			
Oral medication	26 (41.3%)	78 (62.9%)	104 (55.6%)
Insulin	28 (44.4%)	40 (32.3%)	68 (36.4%)
No Medication	9 (14.3%)	6 (4.8%)	15 (8.0%)
Miss a dose			
Never	20 (31.7%)	49 (39.5%)	69 (36.9%)
Once a month	12 (19.0%)	22 (17.7%)	34 (18.2%)
Once a week	22 (34.9%)	38 (30.6%)	60 (32.1%)
Daily	9 (14.3%)	15 (12.1%)	24 (12.8%)
Forget to take your diabetes medications			
Yes	42 (66.7%)	68 (54.8%)	110 (58.8%)
No	21 (33.3%)	56 (45.2%)	77 (41.2%)
Common reasons			
Forgetting	20 (46.5%)	26 (26.8%)	46 (32.9%)
Ran out of medication	6 (14.0%)	19 (19.6%)	25 (17.9%)
Experienced side effects	5 (11.6%)	14 (14.4%)	19 (13.6%)
Felt better and didn't think medication was necessary	6 (14.0%)	13 (13.4%)	19 (13.6%)
Financial reasons	5 (11.6%)	24 (24.7%)	29 (20.7%)
Felt worse and chose not to take it	1 (2.3%)	1 (1.0%)	2 (1.4%)

3.3. Lifestyle Variables of the Respondents

Table 3. gives a summary of the physical activity patterns of the case and control respondents, including information on how often they exercised and how long their sessions lasted. The information describes the levels of physical activity, frequency of exercise, and length of sessions for both the case and control responders.

Among the case group, 32 individuals (50.8%) were physically active, while 31 (49.2%) were sedentary. In the control group, 80 individuals (64.5%) were physically active, and 44 (35.5%) were sedentary. For exercise frequency among those who were active, 13 (40.6%) in the case group exercised daily, compared to 34 (42.5%) in the control group. Additionally, 11 (34.4%) in the case group exercised a few times a week, while 18 (22.5%) in the control group did. A total of 8 (25.0%) in the case group exercised once a week, compared to 12 (15.0%) in the control group. No individuals in the case group exercised a few times a month (0.0%), while 10 (12.5%) in the control group reported this frequency. Lastly, no participants in the case group indicated they never exercised (0.0%), whereas 6 (7.5%) in the control group did.

Regarding the duration of exercise sessions, 9 individuals (30.0%) in the case group exercised for less than 15 minutes, compared to 27 (33.8%) in the control group. For 15-30 minutes, 11 (36.7%) in the case group and 21 (26.3%) in the control group reported this duration. Additionally, 7 (21.9%) in the case group exercised for 30-60 minutes, while 27 (33.8%) in the control group did. Finally, 5 (6.3%) in the case group exercised for more than 60 minutes, compared to 5 (15.6%) in the control group. These results indicate that the control group engaged in more frequent and longer exercise sessions compared to the case group.

Regarding special diet plans, the data indicates that 37 (58.7%) of the case respondents follow a specific food plan for managing their diabetes, while 26 (41.3%) do not. In contrast, 28 (44.4%) of the control responders do not follow a specific diet plan, whereas 35 (55.6%) do. In terms of seeing a dietician, 42 case responders (100%) have done so for diabetes management; in contrast, only 54 controls (43.5%) have done so, and 70 controls (46.0%) have not. Regarding following suggested diets, 22 case respondents (34.9%) follow them consistently, 22 (34.9%) occasionally, 7 (11.1%) infrequently, and 12 (19.0%)

never follow them. By contrast, there is a higher level of adherence among controls, with 57 (46.0%) adhering constantly, 34 (27.4%) occasionally, 10 (8.1%) infrequently, and 23 (18.5%) never adhering. Regarding present BMI, four case responders (6.3%) have a BMI of less than 18.5, sixteen (25.4%) are in the 18.5-24.9 range, thirty (15.2%) are in the 25-29.9 BMI range, and twelve (19.1%) are in the ≥30 BMI range. On the other hand, 67 (54.0%) of the controls have a BMI in the range of 18.5-24.9, 30 (24.2%) have a BMI in the range of 25-29.9, and 20 (16.1%) have a BMI of ≥30.

Table 3. *Lifestyle Variables respondents.*

Lifestyle Variables			
	Case (%)	**Control (%)**	**Overall (%)**
Lifestyle Factors			
How often do you engage in physical activity?			
Physically active	32 (50.8%)	80 (64.5%)	112 (59.9%)
Sedentary	31 (49.2%)	44 (35.5%)	75 (40.1%)
If you are physically active, how many times you do exercise?			
Daily	13 (40.6%)	34 (42.5.%)	47 (432.5%)
A few times a week	11 (34.4%)	18 (22.5%)	29 (25.5%)
Once a week	8 (25.0%)	12 (15.0%)	20 (17.9%)
A few times a month	0 (0.0%)	10 (12.5%)	10 (8.9%)
Never	0 (0.0%)	6 (7.5%)	6 (5.4%)
During your exercise sessions, on average, how long do they last			
Less than 15 minutes	9 (30.0%)	27 (33.8%)	36 (32.1%)
15-30 minutes	11 (36.7%)	21 (26.3%)	32 (28.6%)
30-60 minutes	7 (21.9%)	27 (33.8%)	34 (30.4%)
More than 60 minutes	5 (6.3%)	5 (15.6%)	10 (8.9%)
Specific diet plan			
Yes	Yes	Yes	Yes
No	No	No	No
Consulted a dietitian for your diabetes management			
Yes	42 (100.0%)	54 (43.5%)	96 (57.8%)
No	0 (0.0%)	70 (46.0%)	70 (42.2%)
Adhere to your recommended diet			
Always	22 (34.9%)	57 (46.0%)	79 (42.2%)
Sometimes	22 (34.9%)	34 (27.4%)	56 (29.9%)
Rarely	7 (11.1%)	10 (8.1%)	17 (9.1%)
Never	12 (19.0%)	23 (18.5%)	35 (18.7%)
Current BMI			
≤18.5	4 (6.3%)	7 (24.2%)	11 (5.9%)
18.5-24.9	16 (25.4%)	67 (54.0%)	83 (44.4%)
25-29.9	31 (49.2%)	30 (24.2%)	61 (32.6%)
≥30	12 (19.1%)	20 (16.1%)	32 (17.1%)

3.4. Clinical Variables Respondents

The health metrics for blood glucose monitoring, complications from diabetes, and other chronic illnesses are shown in the above table for both case and control responders. In terms of how long a case respondent has had a diabetes diagnosis, 17 (27.0%) have had it for 5 years or less, 27 (42.9%) for 5–10 years, and 19 (30.2%) for more than 10 years. By comparison, 58 individuals from the control group (46.8%) reported having diabetes for less than five years, 43 (34.7%) for between five and ten years, and 23 (18.5%) for more than ten years. Of all responders, 42 (22.5%) have had a diagnosis for more than ten years, 70 (37.4%) for five to ten years, and 75 (40.1%) for five years or less. When it comes to monitoring blood glucose, 36 people (57.1% of those with diabetes) do it at home, while 83 controls (66.9% of those without complications) do the same. This means that 119 people (63.6%) measure at home total. On the other hand, out of 68 people (36.4%), 27 case responses (42.9%) and 41 controls (33.1%) do not check their blood glucose levels. All case responders (63 people, 100.0%) report having experienced problems related to their diabetes, which is in stark contrast to the control group (0 people, 0.0%), where no one reported experiencing complications. As a consequence, there are 63 people (33.7%) who have complications overall.

In evaluating other chronic illnesses than diabetes, 20 case responders (31.7%) and 50 controls (40.3%) had hypertension, for a total of 70 people (37.4%) having hypertension. A total of 26 people (13.9%) report having heart disease, of which 14 case respondents (22.2%) and 12 controls (9.7%) report having it. Eight case respondents (12.7%) and ten controls (8.1%) report having asthma, for a total of 18 people (9.6%) with this ailment. Lastly, 73 people (39.0%) do not have any other chronic conditions, of which 21 case respondents (33.3%) and 52 controls (41.9%) report not having any.

Table 4. Clinical Variables respondents.

Clinical Variables	Case (%)	Control (%)	Overall (%)
How long have you been diagnosed with diabetes?			
≤5 years	17 (27.0%)	58 (46.8%)	75 (40.1%)
5-10 years	27 (42.9%)	43 (34.7%)	70 (37.4%)
>10 years	19 (30.2%)	23 (18.5%)	42 (22.5%)
Is your blood glucose controlled?			
Controlled	34 (54.0%)	100 (80.6%)	134 (71.7%)
Uncontrolled	29 (46.0%)	24 (19.4%)	53 (28.3%)
measure blood glucose at home			
Yes	36 (57.1%)	83 (66.9%)	119 (63.6%)
No	27 (42.9%)	41 (33.1%)	68 (36.4%)
Have you developed diabetic complication?			
Yes	63 (100.0%)	0 (0.0%)	63 (33.7%)
No	0 (0.0%)	124 (100.0%)	124 (66.3%)
Do you have any other chronic conditions in addition to diabetes?			
Hypertension	20 (31.7%)	50 (40.3%)	70 (37.4%)
Heart disease	14 (22.2%)	12 (9.7%)	26 (13.9%)
Asthma	8 (12.7%)	10 (8.1%)	18 (9.6%)
No	21 (33.3%)	52 (41.9%)	73 (39.0%)

3.5. Type of Complication Respondents

The distribution of diabetes complications in the study population is shown in figure 1. The most prevalent complication is renal complications, comprising 28% of the cases. This is followed by neuropathic complications at 24%, and eye complications, which account for 22% of the complications. Foot ulcers represent 19% of the total, while coronary artery disease accounts for a smaller percentage, 2%. Lastly, erectile dysfunction makes up 5% of the reported complications.

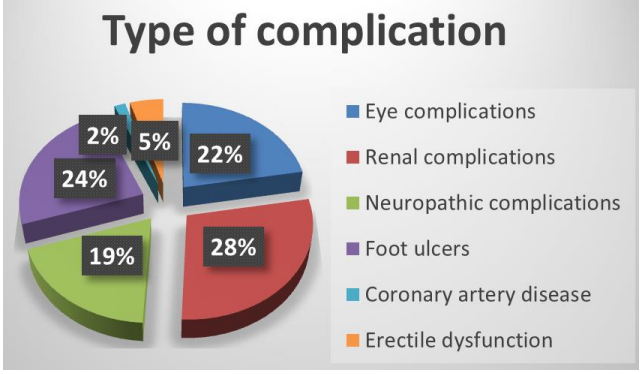

Figure 1. *Type of complication respondents.*

3.6. Sociodemographic Factors of the Respondents Using Simple Logistic Regression Analysis.

This section presents the findings from the simple logistic regression analysis, examining the risk factors associated with diabetic complications among adult patients with type 2 diabetes, with a focus on variables showing statistical significance at p-values less than 0.05.

Table 5 shows the sociodemographic traits that, when examined using Simple Logistic Regression, are linked to the likelihood of diabetic complications in adult patients with type 2 diabetes. First, patients over 47 years old had a significantly higher of developing diabetic complications compared to those between the ages of 18 and 27. Specifically, the odds ratio (OR) for this age group was 3.169 (95% CI: 1.261 - 7.962, p = 0.014), indicating a more than three timed increase in the likelihood of diabetic complications.

In terms of education, being illiterate was significantly associated with higher odds of diabetic complications when compared to those with a degree (OR = 0.463, 95% CI: 0.269 - 0.798, p = 0.006). Similarly, having only primary education also posed a significant risk, with an OR of 0.400 (95% CI: 0.224 - 0.714, p = 0.002).

Another important predictor was employment status, with unemployed individuals showing more likely than employed people to experience diabetic complications (OR = 0.451, 95% CI: 0.212 - 0.960, p = 0.039). Marital status was another characteristic that was found to be associated with a decreased risk of experiencing problems when compared to married individuals (OR = 0.417, 95% CI: 0.199 - 0.871, p = 0.020). Additionally, there was a strong correlation between a family history of diabetes and the development of complications from the disease (OR = 0.468, 95% CI: 0.301 - 0.727, p < 0.001). On the other hand, variables such as gender, monthly income, secondary education, housewife occupation, and labor employment were not significantly associated with diabetic complications, as indicated by p-values greater than 0.05.

Table 5. *Sociodemographic factors.*

Variable	Case (%)	Control (%)	COR (95 % CI)	P value
Age				
18-- 27	7 (11.1)	12 (9.7)	1	
28-- 37	11 (17.5)	24 (19.4)	1.422 (0.513 - 3.939)	0.498
38 --47	13 (20.6)	10 (8.1)	1.117 (0.490 - 2.546)	0.792
More than 47	32 (50.8)	78 (62.9)	3.169 (1.261 - 7.962)	0.014
Gender				
Male	28 (44.4)	55 (44.4)	1	
Female	35 (55.6)	69 (55.6)	1.004 (0.545 - 1.848)	0.991
Monthly Income				
≥ 300$	28 (44.4)	52 (41.9)	1	
≤100$	9 (14.3)	33 (26.6)	0.80 (0.41 - 1.58)	0. 536
100$ ---200$	26 (41.3)	39 (31.5)	0.40 (0.16 - 0.99)	0.049
Educational level				

Variable	Case (%)	Control (%)	COR (95 % CI)	P value
Degree	19 (30.2)	41 (33.1)	1	
Illiterate	16 (25.4)	40 (32.3)	.463 (0.269 - 0.798)	.006
Primary Education	17 (27.0)	23 (18.5)	.400 (0.224 - 0.714)	.002
Secondary	11 (17.5)	20 (16.1)	.739 (0.395 - 1.383)	.345
Occupation				
Employed	25 (39.7)	70 (56.5)	1	
Unemployed	19 (30.2)	30 (24.2)	0.451 (0.212 - 0.960)	0.039
Housewife	19 (30.2)	24 (19.4)	0.800 (0.348 - 1.839)	0.599
If employed				
Self-employed	29 (65.9)	49 (62.0)	1	
Labor	15 (34.1)	30 (38.0)	1.184 (0.547 - 2.560)	0.668
Marital status				
Married	38 (60.3)	74 (59.7)		
Single	15 (23.8)	26 (21.0)	.417 (0.199 - 0.871)	.020
Divorced	10 (15.9%)	24 (19.4%)	.577 (0.306 - 1.089)	.090
Family History of Diabetes				
No	29 (46.0)	62 (50.0)	1	
Yes	34 (54.0)	62 (50.0)	.468 (0.301 - 0.727)	<.001

3.7. Healthcare Factors of the Respondents Using Simple Logistic Regression Analysis

Table 6 shows the association, as shown by Simple Logistic Regression, between healthcare variables and adult type 2 diabetes patients' likelihood of developing diabetic complications. Accessibility to healthcare services and the likelihood of developing complications from diabetes were found to be strongly correlated. In particular, patients who lived more than 10 km away from a hospital were more likely to experience problems than patients who lived closer (OR = 3.173, 95% CI: 1.036 - 9.719, p = 0.043). The results of the investigation showed a significant relationship between the development of diabetes complications and the using of prescription diabetes drugs. Complications were substantially less common in patients who occasionally took their prescriptions as prescribed (OR: 0.135, 95% CI: 0.043 - 0.425, p < 0.001). There was also a lower risk for those who didn't always follow through (OR: 0.267, 95% CI: 0.084 - 0.853, p = 0.025). Moreover, there was a markedly reduced risk of problems for individuals who never took their prescriptions as prescribed (OR: 0.139, 95% CI: 0.030 - 0.647, p = 0.012). Compared to individuals who saw a doctor every six months, those who saw a doctor monthly had a lower risk of problems (OR = 0.344, 95% CI: 0.135 - 0.873, p = 0.025). Compared to patients taking oral medicine, insulin patients had a significantly lower chance of problems (OR = 0.222, 95% CI: 0.072 - 0.684, p = 0.009). P-values larger than 0.05, however, suggest that variables other than frequency of missed doses, forgetting to take medication, and common causes for missing medication did not demonstrate significant relationships with diabetic problems.

Table 6. *Healthcare factors.*

Variable	Case (%)	Control (%)	COR (95 % CI)	P value
Healthcare facility				
Less than 1 km	21 (33.3%)	31 (25.0%)	1	

Variable	Case (%)	Control (%)	COR (95 % CI)	P value
1-5 km	18 (28.6%)	55 (44.4%)	1.563 (0.65-3.67)	0.306
5-10 km	11 (17.5%)	8 (6.5%)	0. 755 (.326 - 1.75)	0.513
More than 10 km	13 (20.6%)	30 (24.2%)	3.173 (1.036 - 9.719)	.043
Prescribed medications				
Always	22 (34.9%)	68 (54.8%)		
Sometimes	25 (39.7%)	39 (31.5%)	.135 (.043 -.425)	<.001
Rarely	4 (6.3%)	12 (9.7%)	.267 (.084 -	.025
Never	12 (19.0%)	5 (4.0%)	.139 (.030 -.647	.012
Check-ups				
Every 6 months	20 (31.7%)	63 (50.8%)	1	
Monthly	18 (28.6%)	27 (21.8%)	.344 (.135 -.873)	.025
Annually	13 (20.6%)	21 (16.9%)	.722 (.270 - 1.935)	.518
Never	12 (19.0%)	13 (10.5%)	.671 (.236 - 1.909)	.454
Type of medication				
Oral medication	26 (41.3%)	78 (62.9%)	1	
Insulin	28 (44.4%)	40 (32.3%)	.222 (.072 -.684)	.009
No Medication	9 (14.3%)	6 (4.8%)	.467 (.149 - 1.460)	.190
Miss a dose				
Daily	9 (14.3%)	15 (12.1%)	1	
Never	20 (31.7%)	49 (39.5%)	0.40 |(0.24 | 0.68)	0.516
Once a month	12 (19.0%	22 (17.7%)	0.60 (0.26 -1.37)	0.863
Once a week	22 (34.9%	38 (30.6%)	0.57 |(0.34 0.97)	0.894
Forget Medication				
No	21 (33.3%)	56 (45.2%)	1	
Yes	42 (66.7%)	68 (54.8%	0.(.227 -.619)	0.122
Common Reason				
Felt better	6 (14.0%)	13 (13.4%)	1	
Forgetting	20 (46.5%)	26 (26.8%)	0.462 (.175 - 1.214)	0.117
Ran out of medication	6 (14.0%)	19 (19.6%)	0.769 (.429 - 1.378)	0.375
Experienced side effects	5 (11.6%)	14 (14.4%)	0.316 (.126 -.791)	0.721
Financial reasons	5 (11.6%)	24 (24.7%)	0.357 (.129 -.992)	0.254
Felt worse	1 (2.3%)	1 (1.0%)	0.208 (.079 -.546)	0.606

3.8. Lifestyle Factors of the Respondents Using Simple Logistic Regression Analysis

Table 7 shows the relationship between lifestyle factors and adult type 2 diabetes patients' chance of developing diabetic complications. Patients who exercise a few times per week show a considerably decreased risk of problems when compared to those who exercise daily, with an OR of 0.271 (95% CI: 0.147 - 0.500, $p < 0.001$) compared to those who exercise daily. Additionally, those who exercise once a week also show a significantly reduced risk of complications, with

an OR of 0.407 (95% CI: 0.202 - 0.821, p = 0.012). Patients who exercise a few times a month have an OR of 0.571 (95% CI: 0.240 - 1.362, p = 0.207), while those who never exercise have an OR of 0.000 (95% CI: 0.000 - infinity, p = 0.998), neither of which are statistically significant.

In relation to Individuals who are overweight and have a body mass index (BMI) between 25 and 29.9 have a significantly lower odds of complications (OR) of 0.571 (95% CI: 0.167 - 1.952, p < 0.001), while those who have a BMI of 30 or higher have a slightly higher risk (OR: 1.033, 95% CI: 0.626 - 1.707, p = 0.045). On the other hand, there is no significant correlation between complications and patients with a BMI of less than 18.5 (OR: 0.239, 95% CI: 0.138 - 0.412, p = 0.203). There was no statistically significant correlation found between the other variables and problems related to diabetes. These comprise one's level of physical activity, the length of one's workouts, following a certain food plan, speaking with a dietician, and how often one follows a diet recommendation.

Table 7. Lifestyle Factors.

Variables	Case (%)	Control (%)	COR (95 % CI)	P value
Lifestyle Factors				
Physical activity				
Physically active	32 (50.8%)	80 (64.5%)	1	
Sedentary	31 (49.2%)	44 (35.5%)	1.76 (.095 - 3.26)	0.72
Exercise frequency				
Daily	13 (40.6%)	34 (42.5.%)	1	
A few times a week	11 (34.4%)	18 (22.5%)	.271 (.147 -.500)	<.001
Once a week	8 (25.0%)	12 (15.0%)	.407 (.202 -.821)	.012
A few times a month	0 (0.0%)	10 (12.5%)	.571 (.240 - 1.362)	.207
Never	0 (0.0%)	6 (7.5%)	.000 (.000 -.)	.998
Exercise sessions duration				
Less than 15 minutes	9 (30.0%)	27 (33.8%)	1	
15-30 minutes	11 (36.7%)	21 (26.3%)	2.222 (.532 - 9.275)	.273
30-60 minutes	7 (21.9%)	27 (33.8%)	1.905 (.483 - 7.516)	.358
More than 60 minutes	5 (6.3%)	5 (15.6%)	1.524 (.362 - 6.407)	.565
Specific diet plan				
Yes	37 (58.7%)	69 (55.6%)	1	
No	26 (41.3%)	55 (44.4%)	0.47 (.360 -.799)	0.678
Consulted a dietitian				
No	0 (0.0%)	70 (46.0%)	1	
Yes	42 (100.0%)	54 (43.5%)	0.000 (.000 -.)	0.996
Recommended diet				
Always	22 (34.9%)	57 (46.0%)		
Sometimes	22 (34.9%)	34 (27.4%)	0.386 (.236 -.631)	0.489
Rarely	7 (11.1%)	10 (8.1%)	0.647 (.378 - 1.106)	0.632
Never	12 (19.0%)	23 (18.5%)	0.700 (.266 - 1.839)	0.629
Current BMI				
18.5-24.9	16 (25.4%)	67 (54.0%)	1	
≤18.5	4 (6.3%)	7 (24.2%)	0.239 (.138 -.412)	0.203

Variables	Case (%)	Control (%)	COR (95 % CI)	P value
Lifestyle Factors				
25-29.9	31 (49.2%)	30 (24.2%)	0.571 (.167 - 1.952)	<.001
≥30	12 (19.1%)	20 (16.1%)	1.033 (.626 - 1.707)	0.045

3.9. Clinical Factors of the Respondents Using Simple Logistic Regression Analysis

Table 8 gives an overview of the link between clinical factors and the chance of complications in adults with type 2 diabetes. First, there was a substantial correlation between the length of diabetes since diagnosis and the complications connected with it. Individuals with diabetes for five to ten years were more likely to experience complications than those with the disease for five years or less (COR = 2.14, 95% CI: 1.03 - 4.41, p = 0.039). Furthermore, the risks of problems were considerably greater for those who had had diabetes for more than ten years (COR = 2.81, 95% CI: 1.25 - 6.35, p = 0.013). This suggests that a longer course of diabetes is associated with a higher chance of complications. Furthermore, blood glucose regulation was still another important component linked to problems. Comparing those with regulated blood glucose levels to those with uncontrolled blood glucose levels, the odds of complications were considerably greater (COR = 3.55, 95% CI: 1.82 - 6.91, p < 0.001). This implies that keeping blood glucose levels under control is essential for lowering the risk of problems in those with diabetes. Furthermore, there was a strong correlation between diabetic problems and cardiac disease. Compared to those without any other chronic diseases, those with heart disease had a greater chance of experiencing problems (COR = 0.400, 95% CI: 0.238 - 0.672, p = 0.024). This result emphasizes the higher risk of problems in individuals with concomitant cardiac disease. Nevertheless, there was no statistically significant correlation found between the remaining characteristics and the complications of diabetes, including home blood glucose monitoring and the presence of other chronic illnesses such as asthma or hypertension.

Table 8. *Clinical Factors.*

Variable	Case (%)	Control (%)	COR (95% CI)	P value
Clinical Variables COR (95% CI)				
Duration of diabetes after diagnosis				
≤5 years	17 (27.0%)	58 (46.8%)		
5-10 years	27 (42.9%)	43 (34.7%)	2.14 (1.03 - 4.41)	0.039
>10 years	19 (30.2%)	23 (18.5%)	2.81 (1.25-6.35)	0.013
Glycemic control				
Controlled	34 (54.0%)	100 (80.6%)		
Uncontrolled	29 (46.0%)	24 (19.4%)	3.55 (.1.82-6.91)	<.001
Measure blood glucose at home				
Yes	36 (57.1%)	83 (66.9%)		
No	27 (42.9%)	41 (33.1%)	0.434 (.293 -.641)	0.189
Other chronic conditions				
No	21 (33.3%)	52 (41.9%)		
Hypertension	20 (31.7%)	50 (40.3%)	0.404 (.243 -.670	0.979
Heart disease	14 (22.2%)	12 (9.7%)	0.400 (.238 -.672	0.024
Asthma	8 (12.7%)	10 (8.1%)	1.167 (.540 -2.522)	0.206

3.10. Factor Associated with Diabetic Complications Among Adult Type 2 Patients Using Multiple Logistic Regression

This section presents the results of the multiple logistic regression analysis, performed to adjust for confounding variables and identify independent risk factors associated with diabetic complications among adult type 2 diabetes patients.

Table 9 looks into the association using multivariate analysis between blood glucose control, the length of time a person has been diagnosed with diabetes, and the prescription drugs used to treat the condition. The 95% confidence intervals (CI) and p-values for the crude odds ratios (COR) and adjusted odds ratios (AOR) are given.

Compared to patients who consistently take their diabetes medicine, those who never take it are much more likely to have problems. Even after controlling for other variables, the link is still significant, as evidenced by the AOR of 0.13 (95% CI: 0.03–0.64, p = 0.012), which is 0.13 (95% CI: 0.03–0.64). indicating that confounders had no significant effect on the relationship between never taking medications and complications. For those who take their medication infrequently (AOR: 0.77, 95% CI: 0.19-3.10, p = 0.718) or occasionally (AOR: 0.66, 95% CI: 0.13-3.35, p = 0.624), the connection is not statistically significant.

Retaining blood glucose regulation is crucial for avoiding diabetic complications. Patients with uncontrolled blood glucose have a considerably greater risk (COR of 3.55, 95% CI: 1.82-6.91, p < 0.001). Even after adjusting for other variables, this risk remains significant with an AOR of 0.20 (95% CI: 0.06-0.62, p = 0.003), indicating that uncontrolled blood glucose is a potent predictor of issues.

Patients with a diabetes duration of 5-10 years had a higher risk of complications, with a COR of 2.14 (95% CI: 1.03-4.41, p = 0.039) in comparison to individuals with fewer than 5 years of diabetes. However, after adjusting for confounders, the AOR increased to 11.72 (95% CI: 0.74-184.34, p = 0.080), indicating that while the risk remained elevated, it was not statistically significant. Similarly, patients with more than 10 years of diabetes had a significant risk of complications, with a COR of 2.81 (95% CI: 1.25-6.35, p = 0.013). After adjustment, the AOR rose to 20.00 (95% CI: 1.67-238.63, p = 0.018), indicating a statistically significant association. This suggests that a longer duration of diabetes, particularly over 10 years, is an independent risk factor for complications, even when controlling for other variables.

Table 9. Factor associated with diabetic complications among adult type 2 patients using multiple Logistic Regression.

Variable	Case (%)	Control (%)	COR (95 % CI)	P-value	AOR (95 % CI)	P-value
Prescribed diabetes medications						
Always	22 (34.9%)	68 (54.8%)	1			
Sometimes	25 (39.7%)	39 (31.5%)	0.13 (0.04-0.42)	<0.001	0.66 (0.13-3.35)	0.624
Rarely	4 (6.3%)	12 (9.7%)	0.26 (0.08-0.85)	0.025	0.77 (0.19-3.10)	0.718
Never	12 (19.0%)	5 (4.0%)	0.13 (0.03–0.64)	0.012	0.13 (0.03-0.64)	0.012
Blood glucose control						
Controlled	34 (54.0%)	100 (80.6%)	1			
Uncontrolled	29 (46.0%)	24 (19.4%)	3.55 [1.82-6.91]	<0.001	0.20 (0.06-0.62)	0.003
Duration of diabetes after diagnosis						
≤5 years	17 (27.0%)	58 (46.8%)	1			
5-10 years	27 (42.9%)	43 (34.7%)	2.14 (1.03 - 4.41)	0.039	11.72 (0.74-184.34)	0.080
>10 years	19 (30.2%)	23 (18.5%)	2.81 (1.25-6.35)	0.013	20.00 (1.67-238.63)	0.018

4. Discussion

Patients over 47 years old had a significantly higher of developing diabetic complications compared to those between the ages of 18 and 27. Specifically, the odds ratio (OR) for this age group was 3.169 (95% CI: 1.261 - 7.962, p = 0.014), indicating a more than three timed increase in the likelihood of diabetic complications. Similar study conducted in Ethiopia discovered that the likelihood of diabetic complications

rose with age. The odds for the age categories of 38–47 and over 47 were 4.81 and 5.6 times higher, respectively, then for the 18–27 age group. According to this study, there is an increased risk of complications as people age. [11] According to similar research, the age group >47 years old accounts for 29.4% of cases and 33.1% of controls; this is the age range where the majority of cases and controls are located. [11] An additional study conducted in Brazil revealed that age increment was a significant risk factor for diabetes complications and that older age groups had a higher frequency of diabetic complications [12]. This is frequently linked to dietary changes, a decline in physical activity, and physiological changes brought on by ageing [13].

Marital status was another characteristic found to be associated with a decreased risk of experiencing complications compared to married individuals, with those who were single having a lower likelihood of developing problems (OR = 0.417, 95% CI: 0.199 - 0.871, p = 0.020).

A study found that widowed individuals had a 75% lower likelihood of developing diabetic complications compared to married individuals [14]. This supports the finding that unmarried individuals may have a lower risk of complications. This study suggests that social support may play a role in this association A comparable study conducted in Saudi Arabia discovered that married patients were more likely than single patients to achieve target levels of glycosylated hemoglobin (odds ratio: 0.541, 95% confidence intervals: 0.30-0.99) [15] Another study conducted in Korea reports that married individuals with diabetes were more likely to comply with their diabetes treatment regimens than single individuals [12].

These varied study results suggest that marital status and diabetes complications are complicated and may be affected by several factors. More study is needed to determine how marital status affects diabetes complications.

When it came to education, those without a degree had a considerably lower chance of developing diabetic complications than did those with a degree (OR = 0.463, 95% CI: 0.269 - 0.798, p = 0.006). A comparable significant risk was associated with merely having a primary education, with an OR of 0.400 (95% CI: 0.224 - 0.714, p = 0.002). A strong correlation was seen between glycemic control and education levels (p <.01) in a study examining the status of glycemic control among individuals diagnosed with Type 2 Diabetes. [12] This result is consistent with research conducted in Ghana [16] and Ethiopia [17] that was finished. According to these research, patients' degree of knowledge plays a critical role in providing them with specific instructions for managing their diabetes. Conversely According to a South Korean study, patients did not always indicate a higher need for education when their diabetes consequences were more severe. Given the gap between actual health state and the perceived need for education, it appears that information alone may not be sufficient to induce behavior change [12].

Among prescribed diabetes medications the results of the investigation showed a significant relationship between the development of diabetes complications and the using of prescription diabetes drugs. Complications were substantially less common in patients who sometimes took their prescriptions as prescribed (OR: 0.135, 95% CI: 0.043 - 0.425, p < 0.001). There was also a lower risk for those who didn't always follow through (OR: 0.267, 95% CI: 0.084 - 0.853, p = 0.025). Additionally, there was a noticeably lower chance of problems for individuals who never took their drugs as prescribed (OR: 0.139, 95% CI: 0.030 - 0.647, p = 0.012). Similar study conducted in Ethiopia shows the odds of diabetic complication is 5.14 in poorly adhered diabetic patients as compared to those who strictly adhered to treatment drugs. The significant association of adherence and diabetic complication implies that aggressive treatment adherence will keep blood glucose as close as normal and optimum glycemic control will be achieved to prevent undesirable complications [11].

Among duration of diabetes after diagnosis individuals with diabetes for five to ten years were more likely to experience complications than those with the disease for five years or less (COR = 2.14, 95% CI: 1.03 - 4.41, p = 0.039). Furthermore, the risks of problems were considerably greater for those who had had diabetes for more than ten years (COR = 2.81, 95% CI: 1.25 - 6.35, p = 0.013). In a similar vein, research has shown that longer-term diabetes is associated with an increased risk of problems because high blood sugar exposure causes organ and tissue damage over time [13].

Control of blood glucose was another important factor linked to problems. Comparing those with regulated blood glucose levels to those with uncontrolled blood glucose levels, the odds of complications were considerably greater (COR = 3.55, 95% CI: 1.82 - 6.91, p < 0.001). Research from a variety of contexts, such as urban China, Pakistan, India, and Africa, often corroborate this conclusion, highlighting the importance of glycaemic control in diabetes therapy on a worldwide scale [18].

Furthermore, other chronic diseases showed a strong correlation between diabetic problems and cardiac disease. Compared to those without any other chronic diseases, those with heart disease had a greater chance of experiencing problems (COR = 0.400, 95% CI: 0.238 - 0.672, p = 0.024). This result emphasizes the higher risk of problems in individuals with concomitant cardiac disease. On the other hand, there was no statistically significant correlation found between having other chronic illnesses such as asthma or hypertension and the complications of diabetes. According to one source, heart disease was present in almost half of the individuals with diabetic retinopathy in addition to other microvascular problems [10]. On the other hand, a number of studies have indicated that having other chronic illnesses is a substantial risk factor for diabetic complications [8].

5. Conclusion

The study pinpointed important variables that predict diabetic complications, emphasizing the intricate interplay between clinical, sociodemographic, and healthcare-related factors that affect an adult's risk of problems from type 2 diabetes. The necessity for early intervention and proactivity for individuals at higher risk is highlighted by the significant non-modifiable risk variables, which included age over 47 and a family history of diabetes. A higher risk of problems was also found to be substantially correlated with modifiable risk factors, such as uncontrolled blood glucose levels and inconsistent medication adherence. These findings highlight the necessity of a patient-centered strategy for managing medications, one that improves education, removes adherence obstacles, and offers continuous assistance. In order to prevent long-term harm, the study also highlighted the fact that the risk of problems grows dramatically with the length of diabetes, especially after ten years. This emphasizes the importance of early identification and treatment.

According to these results, focused interventions can be successfully used to enhance patient outcomes.

6. Recommendations

Provide comprehensive education programmes covering medication adherence, blood glucose monitoring, healthy lifestyle choices (diet and exercise), and early recognition of complication symptoms.

Implement strategies to address barriers to medication adherence, such as financial assistance programmes, medication reminder systems, and simplified medication regimens.

Implement routine screening for diabetes and its complications, particularly for individuals over 47 years old and those with a family history of diabetes.

Equip patients with the knowledge and tools to effectively manage their blood glucose levels through individualized treatment plans, self-monitoring, and regular communication with healthcare providers.

Conduct further research to explore the impact of other potential risk factors, such as diet and comorbid conditions, on diabetic complications in the Mogadishu population. This will help refine intervention strategies and improve overall patient care.

These suggestions should be incorporated by hospitals and the Ministry of Health (MOH) into their diabetes treatment plans. By doing so, they can better address social determinants of health and enhance patient education, medication adherence, early identification, and glycemic control. In order to do out additional study on diabetic problems unique to the Mogadishu setting, they can potentially work with research organizations.

7. Strength and Limitations

7.1. Strength of the Study

The study fills in a major knowledge vacuum on diabetes complications in Somalia, a country with underdeveloped demographics and insufficient healthcare facilities, The assessment of risk variables related with diabetes complications helps direct medical practitioners in offering more customized treatment strategies.

7.2. Limitation

The results of the study might not be applicable to every adult type 2 diabetic in Mogadishu, Somalia. Two particular hospitals in Mogadishu—Hubaal Specialist Hospital and Libaan Hospital—which might not be entirely representative of the city—were the site of the investigation.

The study did not investigate the possible impact of cultural elements on diabetes care and the evolution of complications inside the particular framework of Mogadishu, Somalia. Developing successful treatments and enhancing health outcomes depend on an awareness of cultural beliefs, practices, and views on diabetes. Additionally, the study often lack details about the specific lookback periods used for questions related to lifestyle factors like exercise and diet, making it difficult to assess the long-term impact of these behaviors on complications.

The study did not provide details on the frequency of home blood glucose monitoring or treatment adjustments, which limits understanding of their impact on complications. Future research should focus on these factors and their relationship with the long-term development of diabetes complications.

Abbreviations

T2DM	Type 2 Diabetes Mellitus
DM	Diabetes Mellitus
BMI	Body Mass Index
HbA1c	Glycated Hemoglobin
FBG	Fasting Blood Glucose
NCDs	Non-communicable Diseases
IDF	International Diabetes Federation
WHO	World Health Organization
OR	Odds Ratio
CI	Confidence Intervals
AOR	Adjusted Odds Ratio
SPSS	Statistical Package for the Social Sciences
SSA	Sub-Saharan Africa
DSMES	Diabetes Self-Management Education and Support
MNT	Medical Nutrition Therapy

Author Contributions

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Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] Legese GL, Asres G, Alemu S, Yesuf T, Tesfaye YA, Amare T. Determinants of poor glycemic control among type 2 diabetes mellitus patients at University of Gondar Comprehensive Specialized Hospital, Northwest Ethiopia: Unmatched case-control study. Front Endocrinol. 2023 Feb 9; 14: 1087437.

[2] Yaghoubi M, Mansell K, Vatanparast H, Steeves M, Zeng W, Farag M. Prevalence of Type 1 and Type 2 Diabetes-Related Complications and Their Association With Determinants Identified in Canada's Survey on Living With Chronic Diseases—Diabetes Component. Can J Diabetes. 2020 Jun; 44(4): 304-311. e3.

[3] Alfulayw MR, Almansour RA, Aljamri SK, Ghawas AH, Alhussain SS, Althumairi AA, et al. Factors Contributing to Noncompliance With Diabetic Medications and Lifestyle Modifications in Patients With Type 2 Diabetes Mellitus in the Eastern Province of Saudi Arabia: A Cross-Sectional Study. Cureus [Internet]. 2022 Nov 28 [cited 2024 Sep 6].

[4] Yosef T, Nureye D, Tekalign E. Poor Glycemic Control and Its Contributing Factors Among Type 2 Diabetes Patients at Adama Hospital Medical College in East Ethiopia. Diabetes Metab Syndr Obes Targets Ther. 2021 Jul; Volume 14: 3273–80.

[5] Atrese T, Fekadu L, Kune G, Shita A, Woldemikael K. Prevalence of undiagnosed diabetes mellitus and associated factors among adult residents of Mizan Aman town, Southwest Ethiopia: Community-based cross-sectional study. Badeso MH, editor. PLOS ONE. 2024 May 7; 19(5): e0302167.

[6] Kibirige D, Chamba N, Andia-Biraro I, Kilonzo K, Laizer SN, Sekitoleko I, et al. Indicators of optimal diabetes care and burden of diabetes complications in Africa: a systematic review and meta-analysis. BMJ Open. 2022 Nov; 12(11): e060786.

[7] Yusuf Mohamud MF, Omar Jeele MO. Knowledge, attitude, and practice regarding lifestyle modification among type 2 diabetes patients with cardiovascular disease at a Tertiary Hospital in Somalia. Ann Med Surg [Internet]. 2022 Jul [cited 2024 Jun 29]; 79.

[8] Korsa AT, Genemo ES, Bayisa HG, Dedefo MG. Diabetes Mellitus Complications and Associated Factors Among Adult Diabetic Patients in Selected Hospitals of West Ethiopia. Open Cardiovasc Med J. 2019 Dec 31; 13(1): 41–8.

[9] Salad AM, Duale HA, Sheikh IM, Hassan GD, Farah AA, Gele A. Prevalence of diabetes foot ulcers and associated factors among adult diabetic patients in three referral hospitals in Mogadishu, Somalia. Front Public Health. 2023 Jul 20; 11: 1195483.

[10] Garoma D, Merga H, Hiko D. Determinants of diabetic retinopathy in Southwest Ethiopia: a facility-based case-control study. BMC Public Health. 2020 Dec; 20(1): 503.

[11] Kidanie BB, Alem G, Zeleke H, Gedfew M, Edemealem A, Andualem A. Determinants of Diabetic Complication Among Adult Diabetic Patients in Debre Markos Referral Hospital, Northwest Ethiopia, 2018: Unmatched Case Control Study. Diabetes Metab Syndr Obes Targets Ther. 2020 Feb; Volume 13: 237–45.

[12] Hwang Y, Lee D, Kim YS. Educational Needs Associated with the Level of Complication and Comparative Risk Perceptions in People with Type 2 Diabetes. Osong Public Health Res Perspect. 2020 Aug 30; 11(4): 170–6.

[13] Silveira AOSM, Gomides MDA, Sadoyama G. Analysis of the impact of a diabetes education program on glycemic control and prevalence of chronic complications. Arch Endocrinol Metab [Internet]. 2022 Dec 5 [cited 2024 Sep 7].

[14] Gebre BB, Assefa ZM. Magnitude and associated factors of diabetic complication among diabetic patients attending Gurage zone hospitals, South West Ethiopia. BMC Res Notes. 2019 Dec; 12(1): 780.

[15] Albarakat M, Guzu A. Prevalence of type 2 diabetes and their complications among home health care patients at Al-Kharj military industries corporation hospital. J Fam Med Prim Care. 2019; 8(10): 3303.

[16] Kugbey N, Oppong Asante K, Adulai K. Illness perception, diabetes knowledge and self-care practices among type-2 diabetes patients: a cross-sectional study. BMC Res Notes. 2017 Dec; 10(1): 381.

[17] Belsti Y, Akalu Y, Fekadu H, Animut Y. Awareness of complications of diabetes mellitus and its associated factors among type 2 diabetic patients at Addis Zemen District Hospital, northwest Ethiopia. BMC Res Notes. 2019 Dec; 12(1): 602.

[18] Hintsa S, Dube L, Abay M, Angesom T, Workicho A. Determinants of diabetic nephropathy in Ayder Referral Hospital, Northern Ethiopia: A case-control study. Bjornstad P, editor. PLOS ONE. 2017 Apr 12; 12(4): e0173566.