2023-07-06

Risk Factors of Diabetic Ketoacidosis Among Diabetes Mellitus Patients in East Gojjam Zone Public Hospitals, North West Ethiopia, 2023. Unmatched Case Control Study Design Principal

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BAHIR DAR UNIVERSITY

COLLEGE OF MEDICINE AND HEALTH SCIENCES

SCHOOL OF HEALTH SCIENCES

DEPARTMENT OF ADULT HEALTH NURSING

RISK FACTORS OF DIABETIC KETOACIDOSIS AMONG DIABETES MELLITUS PATIENTS IN EAST GOJJAM ZONE PUBLIC HOSPITALS, NORTH WEST ETHIOPIA, 2023.

UNMATCHED CASE CONTROL STUDY DESIGN

PRINCIPAL INVESTIGATOR: YONAS WONDIE (BSc)

THIS THESIS IS SUBMITTED TO DEPARTMENT OF ADULT HEALTH NURSING, SCHOOL OF HEALTH SCIENCES, COLLEGE OF MEDICINE AND HEALTH SCIENCES, BAHIR DAR UNIVERSITY IN PARTIAL FULFILLMENT FOR THE REQUIREMENTS OF MASTER OF SCIENCES IN ADULT HEALTH NURSING.

JULY, 2023

BAHIR DAR, ETHIOIA

BAHIRDAR UNIVERSITY, COLLEGE OF MEDICINE AND HEALTH SCIENCE, DEPARTMENT OF ADULT HEALTH NURSING

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The full title of the thesis	Risk factors of diabetic ketoacidosis among diabetes mellitus patients in East Gojjam Zone public hospitals, North West Ethiopia, 2023.
Study period	From March 15th to May10th 2023
Study area	East Gojjam zone, Northwest Ethiopia.
The total cost of the study	28,657.20 Ethiopian Birr

DECLARATION SHEET

This is to certify that the thesis entitled “Risk factors of diabetic ketoacidosis among diabetes mellitus patients in East Gojjam Zone public hospitals, North West Ethiopia, 2023” submitted in partial fulfillment of the requirements for the degree of masters of science in adult health nursing, department of adult health nursing, Bahir Dar University, is prepared solely by myself and it has not been submitted, in whole or in part, in any previous application for a master’s degree. Except where states (BDU) otherwise by reference or acknowledgment, the work presented is entirely my own.

Name of the candidate: Yonas Wondie (BSc) _____ _____

Signature Date

ADVISOR'S APPROVAL FORM

APPROVAL OF THESIS REPORT

I hereby certify that I have supervised, read, and evaluated this thesis report titled "Risk factors of diabetic ketoacidosis among diabetes mellitus patients in East Gojjam zone public hospitals, North West Ethiopia, 2023" by Yonas Wondie prepared under my guidance. I recommend the thesis report be submitted for oral defense.

Mr. Emiru Ayalew (Assistant Professor of AHN) _____ _____

Signature Date

Sr. Alemwork Desalegn (MSc) _____ _____

Signature Date

EXAMINER'S APPROVAL FORM

APPROVAL OF THESIS REPORT

I hereby certify that I have examined this thesis report entitled "Risk factors of diabetic ketoacidosis among diabetes mellitus patients in East Gojjam zone public hospitals, North West Ethiopia, 2023" by Yonas Wondie. We recommend and approve the thesis report for a degree of "Masters of Science in Adult Health Nursing".

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ACKNOWLEDGEMENTS

First of all, I would like to thank Bahir Dar University College of medicine and health Sciences, school of health Sciences, department of adult health nursing for giving the opportunity to conduct this study and also I would like to thank Amhara regional health bureau for sponsoring me to learn this master of science in adult health nursing program.

Next, my deepest gratitude goes to my advisors, Mr. Emiru Ayalew (MSc, Assistant Professor of AHN) and Sister Alemwork Dessalegn (MSc), for their unreserved effort by providing step-by-step constructive comments in proposal development up to the end of this thesis development.

Finally, I would like to give my deepest appreciation to East Gojjam Zone selected public hospital managers and staff members for their willingness as well as cooperativeness during data collection period.

Lastly, I gratefully acknowledge all study participants, data collectors, and supervisors for their willingness and cooperation during the time of data collection.

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LIST OF ABBREVIATIONS AND ACRONYMS

8-MMS	8 Item Morisky Medication Adherence Scale
AUDIT	Alcohol Use Disorders Identification Test
AOR	Adjusted Odds Ratio
BDU	Bahir Dar University
BMI	Body Mass Index
CBHI	Community Based Health Insurance
CI	Confidence Interval
COR	Crude Odd Ratio
DKA	Diabetic Ketoacidosis
DM	Diabetes Mellitus
ESRD	End-Stage Renal Disease
IDF	International Diabetes Federation
IPAQ	International Physical Activity Questionnaire
NCD	Non-Communicable Chronic Diseases
NGO	Non- Governmental Organization
OR	Odd Ratio
PAID-5	Problem Areas in Diabetes Scale
SPSS	Statistical Package for Social Sciences
WHO	World Health Organization

ABSTRACT

Background: Diabetic ketoacidosis is one of the most common fatal acute metabolic complications of diabetes mellitus. It is characterized by hyperglycemia, ketoacidosis, and ketonuria. In Africa, the prevalence of diabetic ketoacidosis has dramatically increased, affecting both genders equally in urban and rural settings. However, little is known about the risk factors of diabetic ketoacidosis in the study area. Hence, the aim of this study was to identify the risk factors that contribute to the development of diabetic ketoacidosis.

Objective: To identify the risk factors of diabetic ketoacidosis among diabetes mellitus patients in East Gojjam zone public hospitals, North West Ethiopia, 2023.

Method: Unmatched case-control study was conducted among 408 participants from March 15th to May 10th, 2023, in five randomly selected public hospitals in East Gojjam zone, North West Ethiopia. A systematic random sampling technique was used to select study participants. Primary data was collected using interviewer-administered questionnaires, and secondary data was collected with a checklist. The data was entered using Epi-Data version 3.1 and exported to SPSS version 25 for analysis. Logistic regression model was used to identify variables with significant associations at p-values < 0.05 with a 95% confidence interval.

Results: A total of 102 cases and 306 controls (ratio of 1:3) participated in this study, with a response rate of 100%. In the study, absence of regular follow-up in the diabetes clinic [AOR = 2.21, 95% CI (1.31-3.71)], not being a member of community-based health insurance [AOR = 3.30, 95% CI (1.75-6.24)], distance from the health institution that is > 5km [AOR=1.85,95% CI (1.09-3.14)], infection [AOR = 2.15, 95% CI (1.12-3.89)], and decreasing the dose of insulin [(AOR = 2.13, 95% CI 1.19–3.83)] were identified as risk factors of diabetic ketoacidosis.

Conclusion and recommendation: The study identified important risk factors for diabetic ketoacidosis. Absence of regular follow-up, not being a member of community-based health insurance, distance from the health institution, decreasing the dose of insulin and history of infection had a significant association with diabetic ketoacidosis. Therefore, healthcare providers should intervene based on the identified risk factors for diabetic ketoacidosis.

Key words: Diabetic ketoacidosis, East Gojjam Zone, Hospitals, Risk factors

1. INTRODUCTION

1.1. BACKGROUND

Diabetes mellitus (DM) is one of the most severe non-communicable chronic diseases (NCDs), and it is characterized by the presence of persistent hyperglycemia and various degrees of disruption in protein, lipid, and carbohydrate metabolism (1, 2). It is a lifelong disease defined by abnormally high blood glucose levels caused by a failure in insulin production or a decrease in insulin sensitivity and function (3). The two major types of diabetes are type-1 diabetes, caused by beta cell loss, and type-2 diabetes, caused by insulin resistance (4). According to an International Diabetes Federation (IDF) report in 2019, around 463 million people are affected by DM, and at the end of 2035, over 550 million individuals are estimated to have diabetes (5).

Diabetes is categorized as acute or chronic based on the time it takes to develop complications (6). Diabetic ketoacidosis is the most common acute complication and occurs most commonly in type 1 diabetes; however, it can also develop in patients with type 2 diabetes (7). The other complication of uncontrolled diabetes is high blood sugar, which causes severe damage to the heart, blood vessels, eyes, kidneys, and nerves (8). As a result of this problem, almost every society suffers from handicaps, decreased life expectancy, and extremely high healthcare costs (1).

Diabetes ketoacidosis is one of the most common fatal acute metabolic complications of diabetes, also known as a hyperglycemic emergency (HE) (9). It typically results from an absolute or relative lack of insulin, which is accompanied by a rise in the hormones that regulate it (10). This kind of hormonal imbalance speeds up glycogenolysis and gluconeogenesis in the liver, which causes severe hyperglycemia and Increased lipolysis raises serum-free fatty acids (11).

Risk factors for DKA Include limited adherence to established insulin treatment plans, missed insulin doses, presence of infection, undiagnosed diabetes, and any stressor on the body, such as a myocardial infarction, stroke, trauma, or substance addiction, might result in DKA (12-14).

The clinical manifestations of DKA are polyuria, polydipsia, weight loss, vomiting, dehydration, tiredness, altered mental status, Kussmaul respirations, tachycardia, electrolyte loss, acidosis,

progressive obtundation, loss of consciousness, and hypotension (15, 16). Diagnostic criteria for DKA patients included arterial pH< 7.30, serum bicarbonate concentration <18 mmol/l, blood glucose >250 mg/dl, and positive urine or serum ketones, which are established by the American Diabetes Association (17).

The goals of DKA management are to restore intravascular volume and prevent or correct electrolyte imbalances, acidosis, and hyperglycemia (18). Fluid resuscitation or repeated rehydration, electrolyte replacement, insulin therapy, and the elimination of aggravating factors are all treatments for DKA (19). Hypoglycemia is best defined as a drop in blood glucose levels that puts a patient at risk and can be prevented by early insulin dose reduction and routine blood glucose monitoring (20). If it is not improved and the blood glucose level is below 200-250 mg/dL, decrease the insulin infusion rate and add 5% or 10% dextrose to the IV fluids already being administered (21). DKA can be prevented by better access to medical services, appropriate knowledge, and effective communication with health professionals (21).

1.2. STATEMENT OF THE PROBLEM

Diabetic ketoacidosis (DKA) is a severe manifestation of uncontrolled blood sugar that can occur in people with type 1 or type 2 diabetes mellitus patients (22). Globally, the incidence of DKA among T1DM adult patients ranges from 0–56 per 1000, and eleven studies reported that prevalence with a range of 0–128 per 1000 (23). In industrialized nations, its mortality rate ranges from 2 to 5%, but in underdeveloped nations, it ranges from 6 to 24% and is 100% fatal if misdiagnosed or improperly treated(24). In developed nations including Canada, the United States, Australia, Italy, and France, the prevalence of DKA ranges from 18.6% to 43.9%, and the general mortality rate varies from 0.15% to 0.35%, but in underdeveloped nations such as India, Bangladesh, and Pakistan have a comparatively high mortality rate of 3.4% to 13.4% (25). In 2014, the DKA hospitalization rate among people with diabetes aged 45 was almost 27 times that of people aged 65 (26).

The leading causes of death due to complications of DKA differ between developed and developing nations; for example, cerebral edema is the main factor in developed nations, but sepsis, shock, cerebral edema, and renal failure are the leading factors with significant frequencies in poor nations (25). According to a study of relevant published literature from both Africa and the rest of the world, the leading causes or precipitants of DKA in patients in sub-Saharan Africa were newly diagnosed diabetes, missing insulin doses, and infections (27, 28).

In Africa, the prevalence of DKA has dramatically increased, affecting both genders equally in urban and rural settings (1). According to studies from Kenya, Tanzania, and Ghana, the mortality rate of DKA is too high in Africa, with a reported death rate of 26 to 29% (15). The patient turns to traditional healers and herbal medicine for alternative treatment because the developing country cannot afford insulin therapy (29).

Different countries have implemented various methods and preventative measures, such as diabetes self-management education, creating awareness of the pathophysiology of DKA, and adopting DKA treatment guidelines, to reduce mortality (26). However, these strategies have not been appropriately implemented in Ethiopia (15). DKA accounts for 71.1% of diabetic admissions with a mortality rate of 5.8%, and studies conducted in various hospitals in Ethiopia showed that patients frequently developed DKA (30, 31).

Even though many DKA patients were treated in Ethiopian hospitals, little is known or studied about the precipitating factors of DKA rather than the general risk factors of DM complications, specifically in the study area. There are some cross-sectional studies in northwest Ethiopia, but there is no case-control study on the risk factors of DKA among DM patients in the Amhara region of northwest Ethiopia. There is only one case-control study about determinants of DKA in northeast Ethiopia, which was done around north Wollo and Waghmira zone public hospitals.

This study tried to fill this gap by adding some variables such as; self-reported drug adherence, distance from health institutions, and community-based health insurance. The present study aims at filling the existing research gap by examining multiple risk factors such as irregular follow-up in diabetes clinics, a lack of diabetic education, alcohol drinking, discontinuing medication, the presence of comorbid diseases, type 1 diabetes mellitus, missing insulin doses, poor drug adherence, BMI, and infections, which may contribute to the development of DKA among people with DM (32, 33)

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1.3. SIGNIFICANCE OF THE STUDY

Identifying the risk factors for DKA among people with diabetes would be important for many stakeholders. Primarily for people with diabetes, this study would provide important information to create awareness about controlling their lifestyle and delaying or preventing the onset of DKA. The findings of this study would also help healthcare providers to develop trustworthy relationships and provide quality care services, which are frequently easily traced with evidence to prevent risk factors for DKA among DM patients.

This study would give great importance to the Amhara health bureau, stakeholders from government and non-governmental organizations (NGOs), hospital administrators, and local policymakers for planning on how to prevent or minimize risk factors that contribute to the development of DKA among people with diabetes. Finally, the findings of this study could provide baseline information to interested researchers who would like to conduct further research on related issues in the study area.

2. LITERATURE REVIEW

2.1. OVERVIEW OF RISK FACTORS OF DIABETIC KETOACIDOSIS

There are different studies conducted in different countries about risk factors of DKA. A study conducted in Mysuru, India showed that missing their insulin dose (20%-73%) and emotional disturbance (26.66%) were significantly associated with DKA (34). A study conducted in the largest tertiary care hospital, in Pakistan, revealed that infection (36.5%), and inadequate dose of insulin (22.5%) were identified as risk factors (13). An Indian prospective study revealed that infections (31.8%), and other factors (2.7%) were the most frequent triggering factors for DKA (34). According to a study conducted at Debre-tabor General Hospital in Ethiopia, the precipitating factors for DKA were poor adherence to anti-diabetic therapy (14.7%), and infections (13.2%) were risk factors for the development of DKA (35).

2.2. SOCIO-DEMOGRAPHIC AND ECONOMIC FACTORS

Previous studies conducted around the world found that socio-demographic variables significantly affect the onset of DKA among DM patients. A case-control study conducted in Zimbabwe (36), and another cross sectional study conducted in Northwest Ethiopia (37) showed that distance from health institution had significant association with DKA. Cross sectional studies conducted in Maryland (38), and North-West, Ethiopia (39) showed that health insurance was significantly associated with DKA. Different studies on socio-demographic characteristics and economic factors such as sex (24), income (40), educational level and occupation (41), marital status (36), and family history (27) were significantly associated with DKA, whereas residence (41) did not affect the rate of DKA.

A systematic literature review study was conducted in the United States of America (USA), Europe, Israel, and China (23), another study in South Africa, Ngwelezana Hospital (42), and southern parts of Ethiopia, Hawassa University comprehensive specialized hospital (24) showed that age was significantly associated with the DKA.

2.3. PERSONAL-RELATED FACTORS

A study conducted in Brazil (43) reported that physical inactivity was a significant risk factor for mortality due to diabetic ketoacidosis. Research in Finland (44), Tampere University Hospital (Tays), Finland (45), and Ethiopia, North Wollo and Waghimra Zone Public Hospitals (32) found that diabetic Mellitus patients who drank alcohol had a significant risk factor for developing diabetic ketoacidosis. Personal-related factors such as emotional disturbances (46), medication adherence (25) were risk factors for the occurrence of DKA.

2.4. CLINICAL RELATED FACTORS

Different studies conducted in Pakistan (13), Saudi Arabia (47), Egypt (19), Shanan Gibe Hospital, Jimma University Specialized Hospital, and Debre Tabor General Hospital, Ethiopia (35, 48, 49) showed that infection was significantly associated with the occurrence of DKA.

A study conducted in Nedjo general and Nekemte referral hospitals, West Ethiopia showed that type one diabetes mellitus patients were significantly associated with the development of DKA (31).

Different studies conducted in Israel, Soroka University Medical Center (50), Pakistan, the largest tertiary care hospital (13), Japan (51), and Jimma University Specialized Hospital, Ethiopia (49) showed that decreasing a dose of insulin was associated with the occurrence of DKA. Research findings from the USA (52), and Gurage Zone hospitals in Ethiopia (7) revealed that BMI had a significant association with DKA.

Studies conducted in different parts of Ethiopia, such as Hawassa Comprehensive Specialized Hospital (24), Shanan Gibe Hospital (48), Jimma Medical Center (53), and Jimma University Specialized Hospital (30) found that comorbidity was a risk factor for the development of DKA.

A study conducted in West Ethiopia, at Nekemte referral hospitals, showed that duration of DM was a risk factor for the occurrence of DKA (31). Medication adherence (25, 33), DM education (32), and discontinuing insulin medication (54) were risk factors for the occurrence of DKA. Studies conducted in different parts of Ethiopia found that follow-up in DM clinic was a risk a factor for the development of DKA (32, 55). A study conducted in northeast Ethiopia at Dessie Referral Hospital showed that, kinds of treatment for DM patients had risk factors for the occurrence of DKA (56).

2.5. CONCEPTUAL FRAMEWORK

This conceptual framework is adapted from different literature (25, 31, 32, 36, 37, 53)

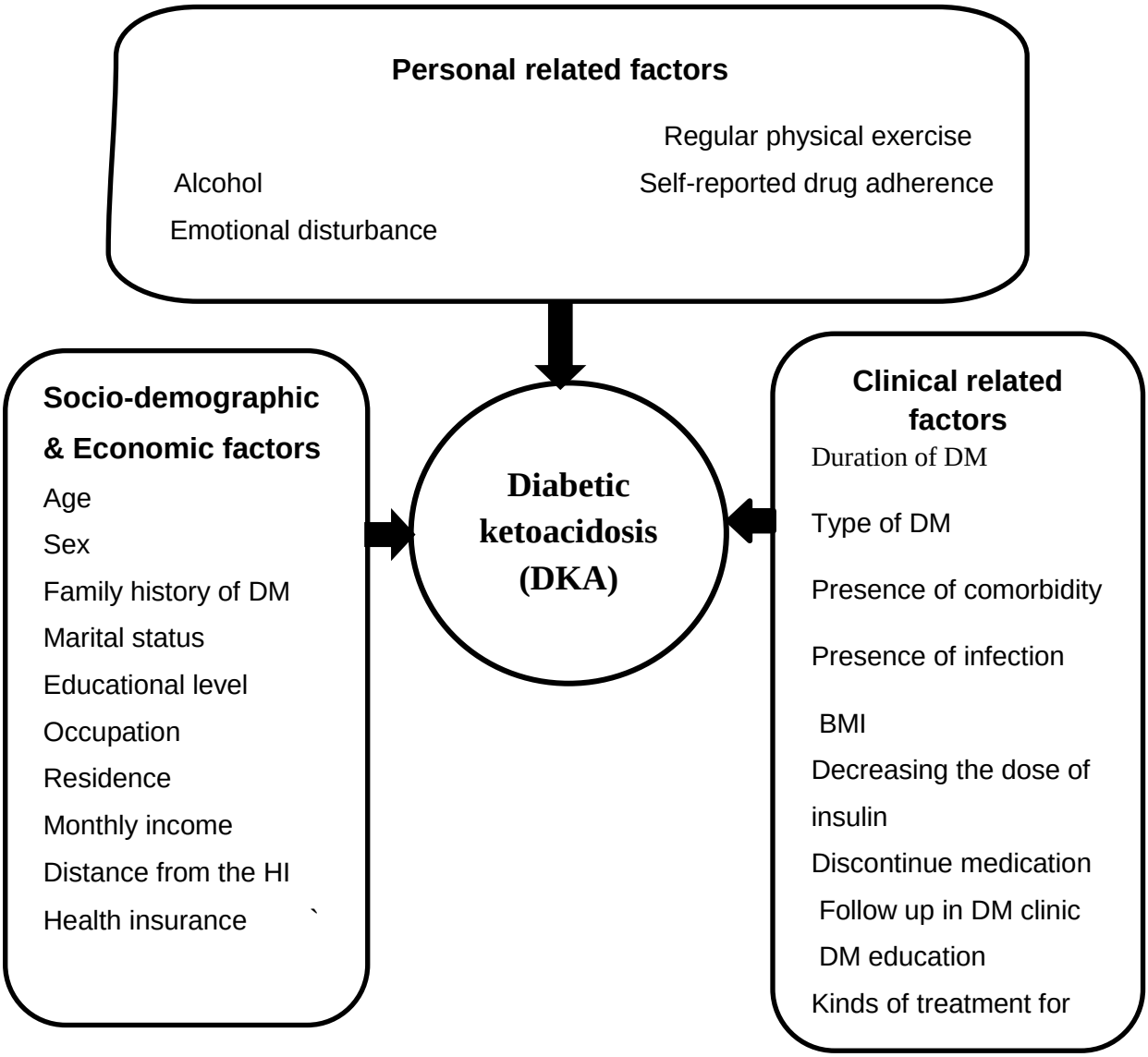


Figure 1 Conceptual framework on risk factors of DKA among DM patients in East Gojjam Zone public hospitals, North West Ethiopia, 2023.

3. OBJECTIVE OF THE STUDY

3.1. GENERAL OBJECTIVE

To identify the risk factors of diabetic ketoacidosis among adult diabetic mellitus patients in East Gojjam Zone public hospitals, North West Ethiopia, 2023.

4. METHODS AND MATERIALS

4.1. STUDY AREA

The study was conducted in East Gojjam Zone public hospitals. It is one of the 14 zones in the Amhara Region of Ethiopia. It has around 2,779,013 inhabitants, according to the zonal health department's 2022 report. It covers an area of approximately 14,010 km2 and is divided into eighteen administrative woredas, which are further subdivided into 49 urban and 392 rural Kebeles. It is located in Amhara Regional State, with the capital city of Debre Markos, 300 kilometers northwest of Addis Abeba, and 265 kilometers from Bahirdar, the capital city of Amhara National Regional State.

Based on the Amhara regional health bureau report, there are 11 public hospitals, which include one comprehensive specialized hospital Debre Markos comprehensive specialized hospital (DMCSH), and one general hospital, Shegaw Motta general hospital (SMGH), and the rest are primary hospitals, namely Bichena primary hospital (BPH), Lumamie primary hospital (LPH), Yejubie primary hospital (YPH), Dejen primary hospital (DPH), Debre Elias primary hospital (DEPH), Digo Tsion primary hospital (DTPH), Debre Work primary hospital (DWPH), Shebel Berenta primary hospital (SBPH), and Merto Lemariam hospital (MLPH). All hospitals provide general and specialized treatment and are known to be open 24 hours a day for emergency services, and each of them is expected to serve 1.5 to 5 million people. The study was conducted at five selected public hospitals: DMCSH, SMGH, LPH, YPH, and BPH.

4.2. STUDY DESIGN AND PERIOD

An institutional-based unmatched case-control study design was conducted from March 15th to May 10th, 2023.

4.3. POPULATION

4.3.1. Source of population

All adult diabetes mellitus patients who are attending in public hospitals of East Gojjam Zone

4.3.2. Study population

Case: all adult diabetes mellitus patients diagnosed with DKA in selected public hospitals who are attending during the data collection period.

Control: all adult diabetes mellitus patients who are not developing DKA in selected public hospitals who are attending during the data collection period.

4.4. ELIGIBILITY CRITERIA

4.4.1. Inclusion criteria

All DM patients above 18 years old without DKA were included in **controls** whereas DM patients who are above 18 years old diagnosed with DKA were included in **cases.**

4.4.2. Exclusion criteria

Critically and mentally ill DM patients who cannot give a response, newly diagnosed DM patients, and patients who are interviewed once but may come for the second time during data collection period were excluded from the study in both case and control groups.

4.5. SAMPLE SIZE DETERMINATION

The sample size was calculated with computer-based Epi info 7 Software Stat Cal by using double proportion formula. The following assumptions were used to select the appropriate variables of risk factors for DKA: 95% confidence interval ($Z\alpha/_2$ =1.96), power 80%, case to control ratio 1:3, and the variables had taken from studies done in Hawssa comprehensive specialized Hospital and North Wollo and Waghimra zone public hospitals which are cited below in the table 1.

Table 1: Sample size determination for risk factors of DKA among DM patients in East Gojjam Zone public hospitals, North West Ethiopia, 2023

Factors considered	Assumptions	ST	References
Alcohol drinking	CI:95% Power:80% Case to control ratio:1:3 % of exposed among cases = 25.5% % of exposed among controls= 10.8%	299	(32)
Hypertension	CI:95% Power:80% % of exposed among cases= 7.14% % non-exposed among controls= 36.08% Case to control ratio:1:3	104	(24)
Age of the patient (25-34)	CI:95% Power:80% %of exposed among cases= 39.74% % of non-exposed among controls= 17.94% Case to control ratio:1:3	192	

Age of the patient (15-24)	CI:95% Power:80% % of exposed among cases= 21.8% % of non-exposed among controls= 9.40% Case to control ratio:1:3	371	

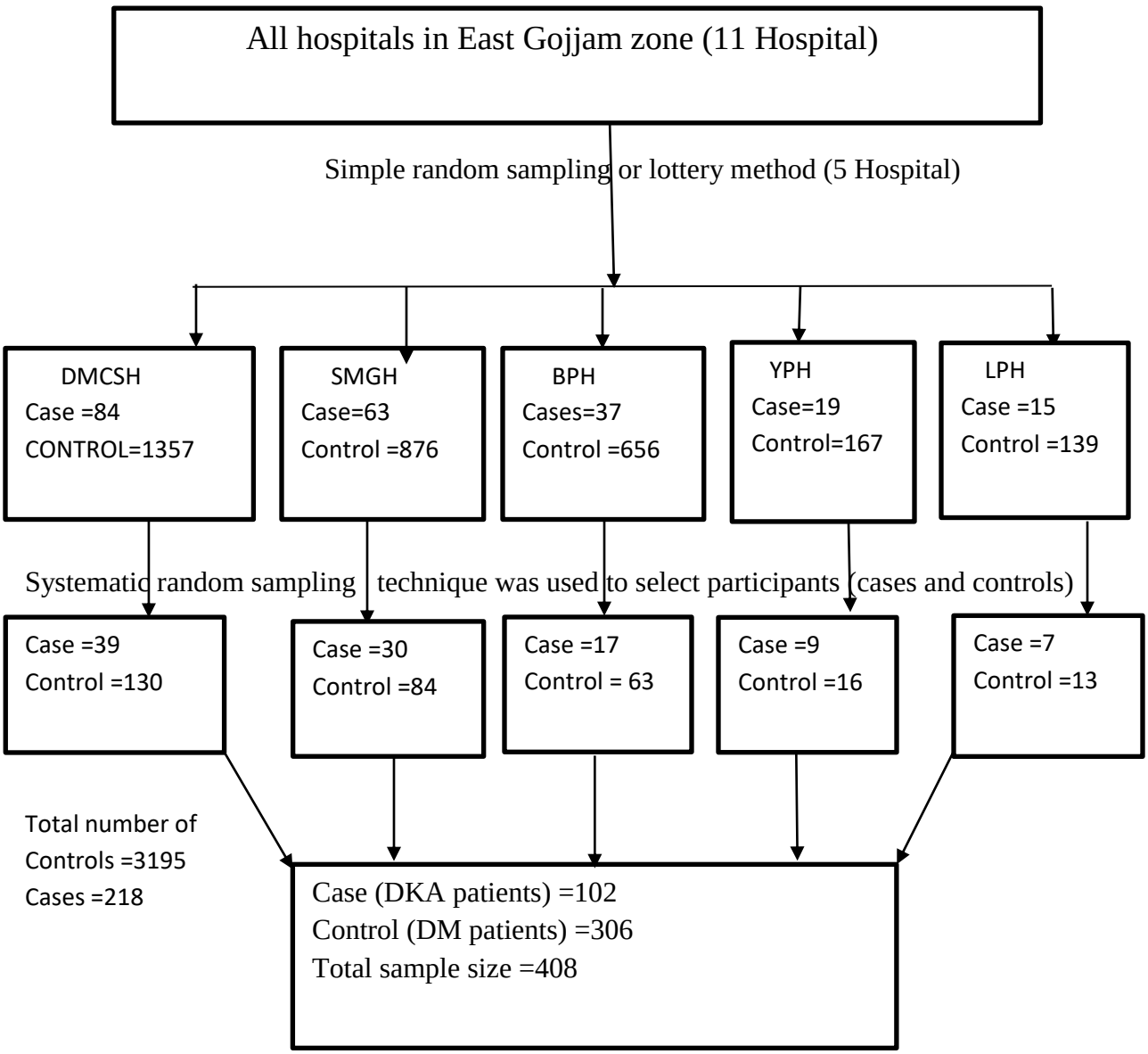
CI= Confidence Interval, ST=Total sample size

Then, by adding 10% of the sample size to the larger sample size (371), the final required sample size was 408 (102 cases and 306 controls).

4.6. SAMPLING PROCEDURE AND SAMPLING TECHNIQUE

There are eleven public hospitals in the East Gojjam zone, and five of them, namely DMCSH, SMGH, BPH, LPH, and YPH, were included in the study using a lottery method. The total sample size was proportionally allocated to the size of each hospital's patient flow. The desired sample size was enrolled using a systematic random sampling method for both cases and controls. The case notes of all DM patients who developed DKA during the study period were reviewed. As a result, the estimated number of cases and controls is presented below in the diagram, according to the last year, for the same two months as the data collection period. In selected public hospitals, the total population of DKA cases is 218 and the total population of controls is 3195.

Since systematic random sampling technique was used, the K^{th} value was calculated by dividing the source population of controls and cases by the total sample size of the control and case groups (3195/306 = 10.4 »10 for controls) and (218/102 = 2.13 »2 for cases). The first study participant was selected by using the lottery method, and then data was collected for every 10^{th} value for controls and every 2^{nd} value for cases, continuing until the desired sample was obtained.



Key

DMCSH Debre markos Comprehensive specialized Hospital
SMGH Shegaw Motta General Hospital
BPH Bichena Primary Hospital
YPH Yejubie primary Hospital
LPH Lumamie Primary Hospital

Figure 2 Schematic presentation of sampling procedure on risk factors of DKA among DM patients in East Gojjam Zone public hospitals, Northwest Ethiopia, 2023

4.7. DATA COLLECTION TOOL AND PROCEDURE

The data was collected using interviewer administered questionnaire and data extraction checklist. It was gathered through interviews with patients, as well as a review of hospital medical records of all participants. The questionnaires have three parts the socio-demographic and economic factors, personal related factors, and clinical related factors of DKA information. This tool has been used in the previous study conducted in Northeast Ethiopia (32) and some of the questionnaire part is adapted from different literature (24, 31, 36, 37). The questions were both open and close ended. Five-degree nurses as data collectors (one for each hospital) and two master-holder nurses as supervisors were selected who have experience in data collection.

The eight-item Morisky Medication Adherence Scale (MMAS-8) (57) was used to assess patients' self-reported medication adherence. It consists of eight items, with the first seven scoring (yes or no) and the eighth scoring a 5-point Likert scale. The last item gives a score between 0 and 1 in 0.25-point increments on a 5-point scale indicating the frequency with which patients forget to take drugs (never = 1, once in a while = 0.75, occasionally = 0.5, frequently = 0.25, and always = 0). Except for question 5 (reversed score), where the response "yes" was scored as "1" and "no" was rated as "0," each "no" response was rated as "1" and each "yes" response was rated as "0" (58).

The 10-item AUDIT tool was used to assess alcohol consumption level (3 items), symptoms of alcohol dependence (3 items), and problems associated with alcohol use (4 items) (59).

The short-form international physical activity questionnaire (IPAQ) was used to assess the physical activity level of study participants. Participants in the study were asked to recall their activities in the seven days preceding the interview. Screening protocol to considered as high, moderate, and low level of physical activity categories (60). The tool has been used a research conducted in Ethiopia (61).

The short-form of Problem Areas in Diabetes Scale (PAID)-5 measures of diabetes-related emotional distress was used to assess the level of emotional disturbance of diabetic patients. It is a 5-point Likert scale ranging from “not a problem” (score of 0) to “serious problem” (score of 4) (62).

4.8. STUDY VARIABLES

4.8.1. Dependent Variable

Diabetic ketoacidosis

4.8.2. Independent Variables

Socio-demographic and economic factors: Age**,** sex, marital status**,** educational level**,** occupation**,** residence, family history of DM, distance from the health institution, health insurance, and monthly income

Personal related Factors: Alcohol, emotional disturbance, Self-reported medication adherence, and regular physical activity.

Clinical related factors: Duration of DM, type of DM, BMI, presence of comorbidity, Presence of infection, type of treatment taking for DM, lack of follow up, discontinue medication**,** decreasing the dose of insulin, and diabetic education.

4.9. OPERATIONAL DEFINITIONS

Diabetic ketoacidosis: It was defined as admission blood glucose >250 mg/l and urine dipstick ketone level ≥ +2 (30).

Comorbidity: The presence of other chronic diseases in addition to diabetic mellitus (63).

Adherence to higher level of physical activity:-

Diabetic individuals was considered as having higher level of physical activity if they have done vigorous type physical activity at least **three** days (60).

Adherence to moderate physical activity:-

Engage in five or more days of moderate-intensity activity and/or walking of at least 30minutes per day (60).

Low adherence to physical activity: patients was considered as having lower adherence to physical activity if they are not meeting any of the criteria for either moderate or high levels of physical activity (60).

Infection: defined as the presence of known or suspected infection plus two or more of the following: Temperature >38 or <36 °C, HR >90, RR >24, WBC >12,000/mm3 or <4000/mm3 (64)

Body mass index: patients was considered Underweight if their BMI is less than 18.5 Kg/m2, healthy weight if their BMI is 18.5 to 24.9 Kg/m2, overweight if their BMI is from 25 to 29.9 Kg/m2, and obese if their BMI is 30Kg/m2 or higher (65).

Medication adherence: according to Morisky Medication Adherence scale – 8 (MMAS-8), patients were considered as having good adherence when he/she scores 8, medium adherence if he/she scores 6 to less than 8, and low adherence if he/she scores < 6 (66).

Emotional disturbance: The PAID-5 contains questions 3, 6, 12, 16 and 19 from the full PAID-20 scale. The scale gives a total score from 0 to 20. A score of 8 and above indicates a high level of diabetes-related distress (62).

Alcohol consumption: - according to alcohol disorder identification screening tool (AUDIT) subscales those who score 0-7 were considered as having low-risk drinking, 8- 15 as medium risk/hazardous use, 16 –19 as having high risk/harmful use, and 20 - 40 as addiction likely (59).

4.10. DATA QUALITY ASSURANCE

The questionnaires first developed in English were translated into Amharic and back-translated to English to ensure consistency by language experts. Data collectors and supervisors received one day of training on data collection tools, the objective of the study, and techniques of data collection. The principal investigator and supervisors would have made frequent checks for consistency and completeness of the collected data, and appropriate corrections would have been made on the spot. The questionnaires were pre-tested on 5% of the sample size at Finote Selam General Hospital. Questionnaires were reviewed and cross-checked for completeness, accuracy, and consistency by the supervisor and principal investigator, and corrective measures were taken before starting data collection. For instance, income was written as a categorical variable, but after the pretest, it was changed to blank space to prevent bias. The medical record number of each participant was recorded at the time of secondary data collection to prevent duplication of data. The medical record number of each participant was recorded at the time of secondary data collection to prevent duplication of data.

4.11. DATA PROCESSING AND ANALYSIS

The data were first checked for completeness, and then each completed questionnaire would be assigned a unique code. Following that, the data were entered using Epi Data version 3.1 and

then exported to SPSS version 25 for further analysis. Descriptive statistics, which are percentage and frequency for categorical variables, were computed for case and control groups separately. A binary logistic regression model was used to see the association between dependent and independent variables. Model fitness was checked using the Hosmer-Lemeshow goodness of fit test statistics, giving a p-value of 0.149. Multicollinearity between independent variables was checked using variance inflation factor (VIF) and tolerance test. No variables with VIF > 10 (maximum = 2.042) or tolerance test <0.1 (minimum = 0.490) were identified with a test. All variables with a P value ≤ 0.25 in the bivariable analysis were included in the final model of the multivariable analysis in order to control all possible confounders. In multivariable analysis, those variables with a p-value < 0.05 with a 95% confidence interval were considered significantly associated with outcome variables. The direction and strength of the statistical association were measured by the odds ratio with a 95% CI.

4.12. ETHICAL CLEARANCE

Ethical clearance was obtained from the Institutional Review Board of Bahir Dar University, College of Medicine and Health Sciences, with protocol number 761/2023. A formal letter for permission and support was written to Amhara public health institutions (APHI) from Bahirdar University and finally APHI was written to selected public hospitals. All the study participants were informed about the purpose of the study, their right to refuse. Informed consent was obtained from study subjects prior to interviewing them. Privacy and confidentiality of study participants were maintained by making the data coded and locked on a shelf before entered in to the computer. After entering the computer the data were locked by password and the data had not disclosed to any person other than principal investigator. All information collected from patients' cards was kept strictly confidential.

4.13. DISSEMINATION OF THE RESULT

The findings of this study will be submitted and presented to BDU, College of medicine and Health Sciences, department adult health nursing as a partial fulfillment of Master of Science in adult health nursing. It will be kept in BDU, College of medicine and Health Science library, and, also the finding of this result will be submitted to Amhara public health institutions and selected public hospitals. Finally, it will be published in nationally or internationally recognized journals.

5. RESULT

5.1 SOCIO-DEMOGRAPHIC AND ECONOMIC FACTORS

A total of 408 diabetic patients (102 cases and 306 controls) were included in this study, with a response rate of 100%. Among these, more than half of the participants 230 (56.4%) were males and the rest 178 (44.6%) were females. The mean age (± Standard deviation) were 42.84(SD: ± 14.5) and the majority of respondents 110 (27%) were found in the age range of 31-40 years. According to this study, 45 (44.1%) of cases and more than half of the controls 181 (59.2%) were not a members of community-based health insurance. Around half of the cases 54(52.9%) were living greater than 5km from health institutions as shown in (**Table 2**).

Table 2: Socio-demographic characteristics of study participants for risk factors of DKA among DM patients in east Gojjam Zone public hospitals, northwest Ethiopia, 2023

Variables	Category	Cases (N=102)		Controls (N=306)	
		Frequency(N)	Percentage (%)	Frequency (N)	Percentage (%)
Age group of respondents	19-30	26	25.5%	66	21.5%
	31-40	40	39.3%	70	22.9%
	41-50	15	14.7%	63	20.6%
	51-60	13	12.7%	60	19.6%
	>60	8	7.8%	47	15.4%
Sex	Male	59	57.8%	171	55.9%
	Female	43	38.2%	135	44.1%
distance	<=5km	39	38.2%	148	48.4%
	>5km	63	61.8%	158	51.6%
monthly income	</=3000	48	47.1%	135	44.1%
	>3000	54	52.9%	171	55.9%
marital status	Single	12	11.8%	18	5.9%
	Married	79	77.4%	230	75.2%
	Divorced	2	2.0%	12	3.9%
	Widowed	9	8.8%	46	15.0%
Family history of DM	Yes	70	68.6%	230	75.2%
	No	32	31.4%	76	24.8%
educational level	cannot read and write	7	6.9%	48	15.7%
	can read and write	7	6.9%	61	19.9%
	Primary	46	45.1%	86	28.1%
	Secondary	3	2.9%	18	5.9%
	college and above	39	38.2%	93	30.4%

	house wife	21	20.6%	96	31.4%
Occupation	gov't employer	7	6.9%	10	3.3%
	daily laborer	8	7.8%	25	8.2%
	Farmer	44	43.1%	118	38.5%
	Student	11	10.8%	29	9.5%
	Retired	1	1.0%	5	1.6%
	Other*	10	9.8%	23	7.5%
Residence	Urban	46	45.1%	137	44.8%
	Rural	56	54.9%	169	55.2%
Member of	Yes	57	55.9%	125	40.8%
CBHI	No	45	44.1%	181	59.2%

Other* include: merchants, driver, and NGO employer

5.2 PERSONAL RELATED FACTORS

As the finding of this study shows 89 (87.3%) of cases and 260 (85.0%) of controls had low medication adherence. According to this study, more than half 56 (54.9%) of cases and 164 (53.6%) of controls had high levels of emotional disturbance. Related to physical activity, more than two-thirds of cases 83 (81.4%) and 216 (70.6%) of controls were doing low physical activity. More than two-thirds of cases 84 (82.4%) and 264 (75.9%) of controls had low risk for alcohol dependency showed in (**Table 3**).

Table 3: Personal related factors of study participants for risk factors of DKA among DM patients in east Gojjam Zone public hospitals, northwest Ethiopia, 2023

		Cases(N=102)		Controls(N=306)	
Variables	Category	N	%	N	%
Medication adherence	low	89	87.2%	260	85%
	medium	12	11.8%	39	12.7%
	good adherence	1	1.0%	7	2.3%
Emotional disturbance	low level	46	45.1%	142	46.4%
	high level	56	54.9%	164	53.6%
physical activity	low	83	81.4%	216	70.6%
	Moderate	4	3.9%	16	5.2%
	High	15	14.7%	74	24.2%
Alcohol dependency	low risk	84	82.4%	264	86.3%
	medium risk	8	7.8%	16	5.2%
	High risk	6	5.9%	14	4.6%
	addiction likely	4	3.9%	12	3.9%

5.3 CLINICAL RELATED FACTORS

Regarding clinical-related factors 3 (2.9%) of cases and 22 (7.2%) of controls were obese, and 6 (5.9%) of cases and 31 (10.1%) of controls were underweight. More than half of the respondents of case 57 (55.9%) had no regular follow-up in DM clinic. According to this finding, more than half of cases 64(62.7%), and more than two-thirds of controls, 254 (83.0%) had infection. Additionally, 24 (23.5%) of cases and 138 (45.1%) of controls were decreasing their dose of insulin from prescribed dose. Of all participants enrolled in this study, around two-thirds of cases, 68 (66.7%), and half of controls, 152 (49.7%) were type one DM showed in (**Table 4**).

Table 4: Clinical related factors of study participants for risk factors of DKA among DM patients in east Gojjam Zone public hospitals, northwest Ethiopia, 2023

Variables	Category	Cases(N=102)		Controls(N=306)	
		N	%	N	%
Body mass index	< 18.5kg/m2	6	5.9%	31	10.1%
	18.5-24.9kg/m2	93	91.2%	253	82.7%
	25-29.9kg/m2	3	2,9%	22	7.2%
Duration of DM	1-5 years	73	71.6%	175	57.2%
	>5years	29	28.4%	131	42.8%
Regular follow up in DM clinic	Yes	45	44.1%	102	33.3%
	No	57	55.9%	204	66.7%
Received diabetic education	Yes	48	47.1%	129	42.2%
	No	54	52.9%	177	57.8%
Decreasing the dose of insulin	Yes	24	23.5%	138	45.1%
	No	78	76.5%	168	54.9%
Discontinuation of insulin/ drugs	Yes	77	75.5%	255	83.3%
	No	25	24.5%	51	16.7%
Types of DM	type one	68	66.7%	152	49.7%
	type two	34	33.3%	154	50.3%
Kinds of treatment taking for DM	oral hypoglycemic agent	28	27.5%	125	40.8%
	Insulin	66	64.7%	146	47.7%
	both insulin and oral	8	7.8%	35	11.5%
Comorbidity	Yes	32	31.4%	168	54.9%
	No	70	68.6%	138	45.1%
Presence of infection	Yes	64	62.7%	254	83%
	No	38	37.3%	52	17.0%

5.4 RISK FACTORS OF DKA AMONG DM PATIENTS

In the bivariable binary logistic regression analysis, socio-demographic and economic factors such as, age, marital status, educational level, occupation, family history of DM, distance from the HI, and community-based health insurance were found candidates for multiple variable analysis. In addition, physical activity, duration of DM, type of DM, BMI, presence of comorbidity, presence of infection, type of DM treatment, regular of follow-up in DM clinic, discontinuing medication, and decreasing the dose of insulin were found candidate to be for multiple variable analysis at p-value <0.25. All variables that were identified as candidates (at P-value<0.25) in the bivariable analysis were entered into multivariable binary logistic regressions to control confounding variables. After controlling the potential confounders, decreasing the dose of insulin, absence of regular follow-up in DM clinic, presence of infection, distance from health institution, and not being a member of CBHI were significantly associated risk factors at p-value < 0.05.

According to the findings of this study, the odds of developing diabetic ketoacidosis were 1.85 times [AOR=1.85,95% CI (1.09-3.14)] higher among diabetic people living greater than 5km from health institution as compared to diabetic people living less than or equal to 5km. The odds of having diabetic ketoacidosis were also 3.3 times [AOR = 3.30, 95 % CI (1.75-6.24)] higher among diabetic individuals who were not a member of CBHI as compared to those who were a member of CBHI.

In addition to this, the odds of diabetic people who had no regular follow-up were 2.21 times [AOR = 2.21, 95 % CI (1.31-3.71)] more likely to develop diabetic ketoacidosis compared to those who have regular follow-ups in DM clinic. Regarding infection, diabetic people who had a history of infection were 2.15 times [AOR = 2.15, 95 % CI (1.12-3.89)] more likely to develop diabetic ketoacidosis than those who have no infection. The odds of developing diabetic ketoacidosis were 2.13 times [(AOR=2.13, 95% CI (1.19-3.83)] higher among diabetic patients who were decreasing the dose of insulin compared to those who are taking their insulin properly as prescribed by the physician showed in (**Table 5**).

Table 5: Bivariable and multivariable logistic regression analysis for risk factors of DKA among DM patients in East Gojjam Zone public hospitals, Northwest Ethiopia, 2023

Variables	Category	Cases N (%)	Controls N (%)	COR (95%CI)	AOR (95%CI)	P-value
Marital status	Single	12 (11.8)	18 (5.9)	1	1	
	Married	79 (77.4)	230 (75.2)	1.94 (0.9-4.21)	1.97 (0.80-4.83)	0.14
	Divorced	2 (2.0)	12 (3.9)	4.00 (0.76-21.16)	4.90 (0.80-29.93)	0.09
	Widowed	9 (8.8)	46 (15.0)	3.41 (1.23-9.47)	2.74 (0.85-8.80)	0.09
Family history of DM	Yes	70	230 (75.2)	1.38 (0.85- 2.26)	1.53 (0.76-3.09)	0.23
	No	32 (29.6)	76 (24.8)	1	1	0.42
education level	cannot read and write	7 (6.9)	48 (15.7)	2.88 (1.20-6.91)	1.50 (0.57-3.95)	
	can read and write	7 (6.9)	61 (16.9)	3.65 (1.54-8.70)	1.70 (0.65-4.45)	0.28
	Primary	46 (45.1)	86 (28.1)	0.78 (0.47-1.32)	0.59 (0.33-1.05)	0.07
	Secondary	3 (2.9)	18 (5.9)	2.52 (0.70-9.03)	2.21 (0.57-8.57)	0.25
	college and above	39 (38.2)	93 (30.4)	1	1	
	house wife	21 (20.6)	96(31.4)	1	1	
Occupation	gov't employer	7 (6.9)	10 (3.3)	0.31 (0.11- 0.92)	0.43 (0.10-1.81)	0.25
	daily laborer	8 (7.8)	25 (8.2)	0.68 (0.27- 1.73)	0.49 (0.16-1.53)	0.22
	Farmer	44 (43.1)	118 (38.5)	0.59 (0.33- 1.05)	0.63 (0.28-1.46)	0.28
	Student	11(10.8)	29 (9.5)	0.58 (0.25- 1.34)	0.69 (0.23-2.11)	0.52
	Retired	1(1.0)	5 (1.6)	1.09 (0.12- 9.86)	1.18 (.094-14.82)	0.90
	Other	10 (9.8)	23 (7.5)	0.50 (0.21- 1.21)	0.43 (0.27-1.50)	0.20
Distance	</=5km	39 (38.2)	148 (48.4)	1	1	.
	>5km	63 (61.8)	158 (51.6)	0.66 (0.42- 1.05)	**1.85 (1.09-3.14)**	**0.02***
Member of CBHI	Yes	57(55.9)	125 (40.8)	1	1	
	No	45 (44.1)	181 (59.2)	1.83 (1.17-2.88)	**3.30 (1.75-6.24)**	**0.001***
Age group	19-30	26 (25.5)	66 (71.7)	0.43 (0.18-1.04)	2.84 (0.33-24.40)	0.34
	31-40	40 (39.3)	70 (63.6)	0.30 (0.13-0.69)	3.46 (0.46-26.17)	0.23
	41-50	15 (14.7)	63 (80.8)	0.72 (0.13-0.69)	5.65 (1.01-31.81)	0.05
	51-60	13 (12.7)	60 (82.2)	0.79 (0.28-1.83)	4.29 (1.06-17.29)	0.05
	>60	8 (7.8)	47 (85.5)	1	1	

physical	low	83 (81.4)	216 (70.6)	0.53 (0.29-0.97)	0.57 (0.27-1.21)	0.14
activity	moderate	4 (3.9)	16 (5.2)	0.81 (0.24-2.77)	0.70 (0.16-3.00)	0.63
	High	15 (14.7)	74 (24.2)	1	1	
BMI	< 18kg/m2	6 (5.9)	31 (10.1)	1	1	
	18.5-24.9kg/m2	93 (91.2)	253 (82.7)	0.53 (0.21-1.30)	0.44 (0.14-1.38)	0.16
	25-29.9kg/m2	3 (2.9)	22 (7.2)	1.42 (0.32-6.30)	0.69 (0.11-4.19)	0.69
duration of	1-5 years	73 (71.6)	175 (57.2)	1	1	
DM	>5years	29 (28.4)	131 (42.8)	1.88 (1.16-3.06)	1.58 (0.91-2.75)	0.11
Regular follow	Yes	45 (44.1)	102 (33.3)	1	1	
up in DM	No	57(55.9)	204 (66.7)	1.58 (1.0-2.50)	**2.21 (1.31-3.71)**	**0.003***
clinic						
Decreasing	Yes	24 (23.5)	138 (45.1)	2.67 (1.60-4.45)	**2.13 (1.19-3.83)**	**0.01***
the dose of	No	78 (76.5)	168(54.9)	1	1	
insulin						
Discontinuatio	Yes	77(75.5)	255 (83.3)	1.62 (0.94-2.79)	1.02 (0.4-2.61)	0.97
n of insulin	No	25 (24.5)	51 (16.7)	1	1	
/drugs						
Types of DM	type one	68 (66.7)	152 (49.7)	0.49 (0.31-0.79)	0.36 (0.09-1.40)	0.14
	type two	34 (33.3)	154 (50.3)	1	1	
DM Treatment	oral hypoglycemic agent	28 (27.5)	125 (81.7)	1	1	
	Insulin	66 (64.7)	146 (68.9)	0.49 (0.30-0.82)	1.26 (0.41-3.80)	0.69
	both insulin and oral	8 (7.8)	35 (81.4)	0.98 (0.41-2.34)	3.63 (0.79-16.73)	0.10
Comorbidity	Yes	32 (31.4)	168 (54.9)	2.66 (1.66-4.28)	1.09 (0.56-2.12)	0.81
	No	70 (68.6)	138 (45.1)	1	1	
Presence of	Yes	64 (62.7)	254 (83.0)	2.90 (1.76-4.78)	**2.15 (1.12-3.89)**	**0.01***
infection	No	38 (37.3)	52 (17.0)	1	1	

* Indicates that variables are statistically significant at P value < 0.05

6. DISCUSSION

The purpose of this study was to identify the risk factors for diabetic ketoacidosis among diabetic mellitus patients attending chronic follow-up clinics and in different wards in the East Gojjam zone of public hospitals. The identified risk factors in multivariable analysis were decreasing the dose of insulin, absence of regular follow-up in a DM clinic, the presence of infection, distance from a health institution that is >5km, and not being a member of community-based health insurance.

In this study, the odds of having diabetic ketoacidosis were 2.15 times higher among those individuals who had a history of infection compared to those diabetic individuals who had no infection. This finding is supported by studies conducted in Pakistan (13), Saudi Arabia (47), Egypt (19), Shanan Gibe Hospital, Southwest Ethiopia (48), Jimma University Specialized Hospital, and Debre Tabor General Hospital, Ethiopia (35, 49). The reason might be that infection causes a stress response in the body by increasing the amount of certain hormones, such as cortisol and adrenaline. These hormones work against the action of insulin, and, as a result, the body's production of glucose increases, which results in high blood sugar levels and causes diabetic ketoacidosis (67).

In addition to this, the body releases hormones associated with stress, like adrenaline and epinephrine, to fight the infection. These hormones have the power to increase blood sugar levels and the body's requirement for insulin. The body finds it challenging to produce enough insulin as a result of the increasing demand. When the body doesn't produce enough insulin to meet this increased need, it starts to burn fat for energy, which leads to the formation of ketones, which can poison the blood in excessive concentrations. This may lead to diabetic ketoacidosis (68).

The odds of diabetic people who were not members of community-based health insurance being 3.3 times more likely to develop diabetic ketoacidosis as compared to those who were members of health insurance. This finding is in line with a study conducted in, Maryland (38), and Ethiopia (39). This might be because those who were not members of community-based health insurance would wait longer to access health services due to socio-economic problems. Even if the patient wants to visit a healthcare institution for diagnostic and therapeutic purposes, direct payment for healthcare hinders utilization of health services (69). As a result, they develop diabetic ketoacidosis. On the contrary, diabetic individuals who have health insurance have

frequent and short-term contact with health professionals as per appointment. A study conducted in southern Ethiopia showed that members of CBHI were more likely to utilize outpatient healthcare services compared to non-members during an individual's illness. This indicates that individuals with diabetes who are members of CBHI have regular follow-ups and frequent contact with their healthcare provider. Due to this reason, they are prevented from developing DKA (70).

Regarding regular follow-ups in the DM clinic, diabetic people who did not have regular follow-ups in the DM clinic were 2.21 times more likely to develop diabetic ketoacidosis as compared to those who had regular follow-ups. This finding is supported by a study conducted in northeast Ethiopia (32) and southwest Ethiopia (55). The reason for this may be related to diabetes mellitus patients' regular visits to the diabetic clinic, where their level of blood glucose is frequently measured and monitored, further preventing the development of diabetic ketoacidosis. However, if they have no regular follow-ups in the DM clinic, they may develop diabetic ketoacidosis (71).

According to the findings of this study, the odds of developing diabetic ketoacidosis were 1.85 times higher among diabetic people living greater than 5km from health institutions as compared to diabetic people living less than or equal to 5km. This finding is in line with an institutional-based unmatched case-control study conducted in Zimbabwe (36) and Jimma, Ethiopia (37). The reason may be a lack of transportation access and the inability to pay transportation costs to access health institutions for follow-ups; due to this reason, diabetic individuals have prolonged their appointments, which leads to a shortage of diabetic drugs and may lead to diabetic ketoacidosis (72). Additionally, the distance to the health facility has an impact on the individual's ability to keep regular follow-up appointments because the long distances make it difficult to sustain frequent visits (73).

Decreasing the dose of insulin is another risk factor in this study, as the result shows the odds of developing diabetic ketoacidosis are 2.13 times higher in diabetic individuals as compared to those who have taken their dose of insulin as prescribed by the healthcare provider. This study is supported by a study conducted in Pakistan (13), Israel, Soroka University Medical Center (50), Japan (51), and Jimma University Specialized Hospital, Ethiopia (49). This is because decreasing the insulin dose can raise blood sugar levels by reducing tissue glucose uptake, increasing glucose absorption from the digestive tract, and enhancing gluconeogenesis and glycogenolysis, which lead to lipolysis and diabetic ketoacidosis (74).

7. STRENGTH AND LIMITATION OF THE STUDY

7.1. STRENGTH OF THE STUDY

Being a multicenter study was strength of this study.

7.2. LIMITATION OF THE STUDY

Since the study was hospital-based, the findings may not be generalized to the general population. In addition to this, the data were collected by health professionals, so there might be a social desirability bias.

8. CONCLUSION

The burden of risk factors for diabetic ketoacidosis among DM patients is a significant public health problem. The study tried to identify some important parameters that are possible risk factors for diabetic ketoacidosis. According to the findings, absence of regular follow-up in the DM clinic, decreased dose of insulin, not being a member of CBHI, distance from health institutions that is > 5km, and infection were risk factors for diabetic ketoacidosis. Therefore, healthcare providers should intervene on the identified risk factors of diabetic ketoacidosis to prevent the occurrence of diabetic ketoacidosis.

9. RECOMMENDATION

Based on the findings of this study, the following recommendations are forwarded:

TO AMHARA REGIONAL HEALTH BUREAU

The regional health bureau should provide community-based health insurance to the population with poor socio-economic status. In order to prevent and modify the identified risk factors for diabetic ketoacidosis in the diabetic population.

TO EAST GOJJAM ZONE PUBLIC HOSPITALS

East Gojjam Zone hospital administration shall design a strategy to incorporate or encourage a health education program about infection, the importance of regular follow-up, an appropriate dose of insulin, and the importance of being a member of CBHI. Healthcare providers are also recommended to use this finding to prevent risk factors for DKA among DM patients by creating awareness when they come for follow-up at DM clinic.

TO DIABETIC CLIENTS

People with diabetes are recommended to have frequent and regular follow-ups in the DM clinic. Diabetes individuals should take a therapeutic dose of insulin as prescribed by the physician to monitor blood glucose levels, which is important for good control and prevention of diabetic ketoacidosis.

TO RESEARCHERS

A prospective cohort study triangulated with a qualitative study design is recommended to be carried out on the incidence of diabetic ketoacidosis and related risk factors for diabetic ketoacidosis among diabetic patients

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ANNEXES

Annex I: Information Sheet (English version**)**

Good morning/afternoon, my name is ---------- and I am one of the data collectors for the Study being conducted by Yonas Wondie from Bahir Dar University, College of Medicine and Health Sciences, department of Adult health nursing. You are selected scientifically to be participant of this study if you give me consent after you have understood the following information.

The Study/Project Title: Risk factors of DKA among DM patients in East Gojjam Zone public hospitals, North West Ethiopia, 2023.

Procedure and Duration: I was interviewing DM patients who are admitted (come for follow up) in the selected public hospital using a questionnaire to provide me with pertinent data that is helpful for the study. There are ___ questions to answer where I was filling the questionnaire by interviewing the patient. The interview was taking about 15-20 minutes.

Benefit of the study: the participant was not get any direct benefit for being participant but the information obtained through this study was help full for the study population by identifying the risk factors of DKA for a better disease control. And also the result of the study might give some clues for Ethiopian public health policies and was contribute a lot in minimizing the problem of shortage of evidences related to the issue under study.

Harm of the study: the study had no harm except that participants were spending up to 15-20 minutes in the interview.

Rights of the participant: participants has full right not to participate, the participant can stop Participating in the study at any time, can skip question which she/he does not want to respond During the interview and the participant can also ask questions which are not clear.

Confidentiality: I am going to ask you a question which would help us, to gather information about the above mentioned issue. All the information which you are being asked to provide in this questionnaire would be kept strictly confidential (your personal information including your name) and the information would be used only for study purposes.

Contact Address: If there is any questions related to the study you can contact us by

Yonas Wondie (BSc)

Phone no: +251918570288, E-mail:yonasmelkamu88@gmail.com

Annex II: Informed Consent form (English version)

In undersigning this document, I am giving my consent to participate in the study. I have been informed that the purpose of this study is to identify the risk factors of DKA among DM patients in East Gojjam Zone public hospitals, North West Ethiopia, 2023. I have understood that participation in this study is entirely voluntary and my identity would not be disclosed to the third party. I have also been informed that my participation or my refusal to take part would not affect the care I receive from the hospital. I understood that participation in this study imposes no risk to me. I understood that Yonas Wondie is the contact person if I have questions about the study or about my rights as a study participant. Now I am giving my consent to participate in the study voluntarily.

Signature of the participant _____ Date____/_____/____

Data collector Name _____ Signature _____ Date____/_____/____

ANNEX III: ENGLISH VERSION QUESTIONNAIRES

S. No.	Questions	Response	remark
	Part 1: Socio- Demographic Characteristics		
101	How old are you? (age in years)	/_____/ in complete year	
102	Sex	1.Male 2.Female	
103	What is your current marital status?	1. Married 2. single 3. Divorced 4. Widowed 5. Separated	
104	Family history of DM	1.Yes 2.No	
105	What is your education level?	1. Can' t read and write 2. Can read and write 3. Primary (grade 1-8th) 4. Secondary (grade 9-12th) 5. College and above	
106	What is your current occupation?	1. House wife 2. Government employee 3. Daily laborer 4. Farmer 5. Student 6. Retired 7. Others (specify)…….	
107	What is your place of residence?	1. Urban 2. Rural	
108	Distance from the health institution	----------in meter/km	
109	What is your monthly income?	/_____/ in ETB	
110	Are you a member of health insurance?	1.Yes 2.No	

Part-2: personal related factors

	Part I: Alcohol use disorders identification test tool (AUDIT) Now I am going to ask you some question about your use of alcoholic beverage (Beer, Tella, Teji, Arekie) during this past year			
111	How often do you consume a drink containing alcohol?	0. Never 1. monthly or less 2. Monthly 3. Weekly 4. Daily or almost daily	If the answer is Never Skip to Q. 120	
112	How many drinks containing alcohol do you consume on a typical day when do you drink on a typical day when you are drinking?	0. 0 to 2 1. 3 to 4 2. 5 to 6 3. 7 to 9 4. 10 or more		
113	How often do you have six or more drinks on one occasion?	0. Never 1. Less than monthly 2. Monthly 3. Weekly 4. Daily or almost daily	Skip to 119 and 120 if the total score of 112 and 113=0	
114	Once after you had started drinking, how often have you recognized that you were not able to stop/cut down your drinking during the last year?	0. Never 1. Less than monthly 2. Monthly 3. Weekly 4. Daily or almost daily		
115	How often during the last year have you failed to do what was normally expected from you because of your drinking?	0. Never 1. Less than monthly 2. Monthly 3. Weekly 4. Daily or almost daily		

116	How often during the last year have you needed an alcoholic drink in the morning to get yourself going after a heavy drinking session?	0. Never 1. Less than monthly 2. Monthly 3. Weekly 4. Daily or almost daily		
117	How often during the last year have you had a feeling of guilt or remorse after drinking?	0. Never 1. Less than monthly 2. Monthly 3. Weekly 4. Daily or almost daily		
118	How often during the last year have you been unable to remember what happened the night before because you had been drinking	0. Never 1. Less than monthly 2. Monthly 3. Weekly 4. Daily or almost daily		
119	Have you or somebody else been injured as a result of your drinking?	0.No 2.Yes, but not in the last year 4.Yes, during the last year		
120	Has a relative or friend, doctor or other health worker been concerned about your drinking or suggested that you cut down?	0.No 2.Yes, but not in the last year 4.Yes, during the last year		

Medication adherence questioner (The 8-item Morisky Medication Adherence Scale)

Now I am going to ask you some questions about your use of medication for diabetes.

121	Do you sometimes forget your medication	1.Yes 2.NO	
122	People sometimes miss their medication for reason other than forgetting. Thinking over the past two weeks, were there any days when you did not take your medicines?	1.YES 2.NO	
123	Have you ever cut back or stopped taking your	1.YES 2.NO	

	medication without telling your doctor, because you felt worse when you took it?		
124	When you travel or leave home, do you sometimes forget to bring along your medications?	1.YES 2.NO	
125	Did you take your diabetes medications yesterday?	1.YES 2.NO	Recoded
126	When you feel like your condition is under control, do you sometimes stop taking your medicines?	1.YES 2.NO	
127	Taking medication every day is a real inconvenience for some people. Do you ever feel hassled about sticking to your treatment plan?	1.YES 2.NO	
128	How often do you have difficulty remembering to take all your medications?	1.Never/Rarely 2.Once in a while 3.sometimes 4.usually 5.all time	

Problem Areas in Diabetes Scale (PAID)-5 for emotional disturbance

129	Feeling scared when you think about living with diabetes	0. Not a problem 1. Minor problem 2. Moderate problem 3. Somewhat 4. Serious problem	
130	Feeling depressed when you think about living with diabetes	0.Not a problem 1. Minor problem 2.Moderate problem 3.Somewhat 4.Serious problem	

131	Worrying about the future and the possibility of serious complications	0.Not a problem 1. Minor problem 2.Moderate problem 3.Somewhat 4.Serious problem	
132	Feeling that diabetes is taking up too much of your mental and physical energy every day	0.Not a problem 1. Minor problem 2.Moderate problem 3.Somewhat 4.Serious problem	
133	Coping with complications of diabetes	0.Not a problem 1.Minor problem 2.Moderate problem 3.Somewhat 4.Serious problem	

Physical activity assessment by using international physical activity questionnaire (IPAQ)

	Now, think about vigorous physical activities which take hard physical effort that you did in the last 7 days. Vigorous physical make you breathe much harder than normal may include heavy lifting, digging, aerobics, or fast bicycling. Think only about those physical activities that you did for at least 10 minutes at a time		
134	During the last 7 days, on how many days did you do vigorous physical activities for at least 10 mint	1._____ days per week 2. Don't know/Not sure	If respondents answers zero (no Vigorous physical activities, refuse or does not know, skip to question 136
135	How much time did you usually spend doing vigorous physical activities on one of those days?	1._____ hours per day 2._____ minutes per day 3. Don't know/Not sure	
	Now think about activities which take moderate physical effort that you did in the last 7 days moderate physical effort and make you breathe may include carrying light loads, bicycling at a regular pace, or doubles tennis. Don't include walking again think about only those physical activities that you did for at least 10 minutes at a time.		
136	During the last 7 days, on how many days did you do moderate physical activities like? Do not include walking.	1._____days per week 2. Don't know/Not sure	If respondents answers zero (no moderate physical activities , refuse or does not know, skip to question 5
137	How much time did you usually spend doing moderate physical activities on one of those days?	1.____hours per day 2.____ minutes per day 3. Don't know/Not sure	
	Now, think about the time you spent walking in the last 7 days. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.		

138	During the last 7 days, on how many days did you walk for at least 10 minutes at a time?	1.----Days per week 2.Don,t know/Not sure	If respondents answers zero (no Vigorous physical activities, refuse or does not know, skip to question-
139	How much time did you usually spend walking on one of those days?	1.___ hours per day 2.___ minutes per day 3.Don't know/Not sure	
The last question is about the time you spent sitting on weekdays during the last 7 days. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.			
140	During the last 7 days, how much time did you spend sitting on a week day?	1.___hours per day 2.___ minutes per day 3.Don't know/Not sure	

Part Three clinical related factors			
201	Weight of the patient	/_____/ In kg	
202	Height of the patient	/_____/ in meter	
203	Follow up in DM clinic	1.Yes 2.No	
204	Received diabetic education	1.Yes 2.No	
205	Decreasing the dose of insulin	1.Yes 2.No	
206	Discontinuation insulin and/or drugs	1.Yes 2.No	

Pare Four Data extraction checklist (was taken from patient cards)

s.no	Questions	Response	Skip
301	Types of DM	1.Type 1 2.Type 2	
302	Duration of DM	_____	
303	Kinds of treatment taking for DM	1.Oral hypoglycemic agent 2.Insulin 3.Both oral and insulin	
304	Is there any comorbidity	1.Yes 2.No	If no go to no 306
305	If yes which type of comorbid illness	1.HTN	

		2.Stroke 3.Renal disease 4.Pancreatitis 5.CAD 6.Liver disease 7.CHF 8.COPD 9.Cancer 10.Other ----------	
306	Presence of infection	1.Yes 2.No	If no go no308
307	If yes which v/s derangement are there?	1.Temperature >38 or <36 °C, 2. HR >90 3.RR >24 4.WBC >12,000/mm3 or <4000/mm3	
308	Presence of DKA	1.Yes 2.No	

በባህርዳር ዩንቨርስቲ ህክምና እና ጤና ሳይንስ ኮሌጅ የአዋቂወች ጤና በነርሲነግ ትምህርት ክፍል

የጥናት የመረጃ መሰብሰብያ ቅጽ

ጤና ይስጥልኝ ስሜ----------ሲሆን በባህርዳር ዩንቨርስቲ ህክምና እና ጤና ሳይንስ ኮሌጅ የአዋቂወች ጤና በነርሲነግ ትምህርት ክፍል የ2ኛ ዲግሪ ተማሪ የሆነው ዮናስ ወንዴ ለሚሰራው ጥናት አንዱ/ዲ መረጃ ሰብሳቢ ነኝ፡፡

Annex IV የመረጃ ቅጽ

1. **የጥናቱ/የፕሮጀክት ርዕስ-** በምስራቅ ጎጃም ዞን ሰሜን ምእራብ ኢትዮጵያ የህዝብ (የመንግስት) ሆስፒታሎች ላይ የስኳር ህመምተኞችን ለ Diabetic ketoacidosis የሚዳርጉ መንስኤዎች(ስጋቶች) ለማጥናት ነው፡፡
2. **የጥናቱ ጥቅም-**ተሳታፊዎቹ በመሳተፋቸው ቀጥተኛ ጥቅም ባያገኙም በጥናቱ የተገኙት መረጃዎች ግን በተሻለ ሁኔታ ህመሙን ለመቆጣጠር እና ያሉትን ችግሮች ለይቶ ክፍተቶችን ለማጥበብ ይረዳል፡፡በተጨማሪም በዚህ ዙሪያ ያለውን መረጃ እጥረት ይቀርፋል ለውሳኔም ጥቅም ላይ ይውላል፡፡
3. **ጥናቱ ጉዳት-** ተሳታፊዎቹ መረጃ ለመስጠት ከ 15-20 ደቂቃ ከመቆየታቸው በስተቀር ጥናቱ ምንምአይነት ጉዳት የለውም፡፡
4. **የተሳታፊዎቹ መብት-** ተሳታፊዎቹ ያለመሳተፍ ፡የማቋረጥ፡የማይፈልጉትን ጥያቄ የመዝለል እንዲሁም ያልገባቸውን የመጠየቅ ሙሉ መብት አላቸው፡፡
5. **ሚስጥራዊ አጠባበቅ-** ለዚህ ጥናት የሰጡት መረጃ በሙሉ በሚስጥር የተጠበቀ ሲሆን መረጃው ለዚህ ጥናት ብቻ ይውላል፡፡

ምንም አይነት ችግር ካለ እና ስለ ጥናቱ ጥያቄ ካለወት በዚህ አድራሻ ያገኙናል ፡፡

ዮናስ ወንዴ (BSC)

ስልክ ቁጥር፡ 09 18 57 02 88

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Annex V: የስምምነት ቅፅ (Amharic version)

ይህንን ቅፅ በመፈረም ጥናቱ ላይ ለመሳተፍ ፈቃዴን እሰጣለሁ ።የጥናቱ ጥቅም-ተሳታፊዎቹ በመሳተፋቸው ቀጥተኛ ጥቅም ባያገኙም በጥናቱ የተገኙት መረጃዎች ግን በተሻለ ሁኔታ ህመሙን ለመቆጣጠር እና ያሉትን ችግሮች ለይቶ ክፍተቶችን ለማጥበብ የሚረዳ መሆኑን ተረድቻለሁ።በተጨማሪም በዚህ ዙሪያ ያለውን መረጃ እጥረት ይቀርፋል ለውሳኔም ጥቅም ላይ እንደሚውል ተረድቻለሁ። በዚህ ጥናት መሳተፌ ሙሉ በሙሉ በፈቃዴ ውስጥ የተካተተ እንደሆነና የእኔን ማንነት ለሶስተኛ ወገን እንደማይሰጥ ተረድቻለሁ።በተጨማሪም የእኔ መሳተፍ ወይም ለመሳተፍ ፈቃደኛ አለመሆኔ ከሆስፒታሉ ከማገኘው እንክብካቤ ላይ ተጽዕኖ እንደማይኖረው ተነግሮኛል። በዚህ ጥናት ውስጥ መሳተፍ በእኔ ላይ ምንም አደጋ እንደማያስከትል ተረድቻለሁ። ስለ ጥናቱ ወይም እንደ ጥናት ተሳታፊ ስለ መብቶቼ አስልመክቶ ጥያቄዎች ካሉኝ ከጥናቱ ባለቤት ከ ዮናስ ወንዴ መጠየቅ እንደምችል ተረድቻለሁ ። በዚህም መሰረት በፈቃደኝነት በጥናቱ ለመሳተፍ እስማማለሁ።

የተሳታፊው ፊርማ _____ መጠይቁ የተደረገበት ቀን _____

የጠያቂው ስም _____ ፊርማ_____ ቀን _____

Annex VI፡ የአማርኛ መጠይቆች

መለያ ቁጥር---------- የጤና ተቋሙ ስም----------

ተ.ቁ	ጥያቄዎች	ምላሽ	ምርመራ
	ክፍል አንድ፡- የግለሰብ መረጃ መጠይቅ		
101	እድሜ	----------	
102	ፆታ	1. ወንድ 2. ሴት	
103	የጋብቻ ሁኔታ	1. ያገባ/ች 2. ያላገባ/ች 3. የፈታ/ች 4. አግብቶ/ታ የሞተበት/ባት 5. የተለያየ ቦታ የሚኖሩ	
104	በቤተሰብ ውስጥ የስኳር ህመም ያለበት ሰው አለ?	1. አዎ 2. የለም	
105	የትምህርት ደረጃ	1.ማንበብ እና መፃፍ የማይችል 2.ማንበብ እና መፃፍ የሚችል 3.ከ1ኛ-8ኛ ክፍል 4.ከ9ኛ-12ኛ ክፍል 5. ኮሌጅ እና ከዚያ በላይ	
106	የስራ ሁኔታ	1.የቤት እመቤት 2.የመንግስት ሰራተኛ 3.የቀን/ጉልበት ሰራተኛ 4. አርሶ አደር 5.ተማሪ 6. ጡረታ የወጡ 7. ሌላ ካለ ይግለፁ ----------	

107	የመኖሪያ ቦታ	1.ከተማ 2.ገጠር	
108	የመኗሪያ ቦታ ከጤና ተቋም ያለው ርቀት ስንት ይሆናል?	----------ሜ/ኪ.ሜ	
109	ወርሃዊ ገቢዎ መጠን ምን ያህል ነው?	/_____/ በ ኢትዮጵያ ብር	
110	የጤና መድህን አባል ነዎት?	1.አዎ 2.አይደለሁም	

ክፍል ሁለት ግላዊ ተዛማጅ ምክንያቶች (personal related factors)

	አልኮል መጠጣትን የተመለከቱ መጠይቆች **አሁን በዚህ አመት ውስጥ ስለ አልኮል መጠጥ (ቢራ፣ ጠላ፣ ጠጂ፣ አረቂ) አጠቃቀምዎ አንዳንድ ጥያቄ ልጠይቅዎት ነው።።**		
111	አልኮልነት ያላቸዉን መጠጦች በየስንት ጊዜ ይጠጣለ?	0. በጭራሽ አልጠጣም 1. ወርሃዊ ወይም ከዚያ ያነሰ 2. በወር ከ 2 እስከ 4 ጊዜ 3. በሳምንት ከ 2 እስከ 3 ጊዜ 4. በሳምንት 4 ወይም ከዚያ በላይ ጊዜ	መልሱ በጭራሽ አልጠጣም ከሆነ ወደ ጥያቄ 120 ይለፉ
112	በአንድ መደበኛ ቀን በሚጠጡበት ጊዜ በአማካኝ ምን ያህል መለኪያ ይጠጣሉ?	0. 1 ወይም 2 1. 3 ወይም 4 2. 5 ወይም 6 3. 7 ፣ 8 ወይም 9 4. 10 ወይም ከዚያ በላይ	
113	በአንድ አጋጣሚ ስድስት ወይም ከዚያ በላይ መለኪያ መጠጦችን በየስንት ጊዜ ይጠጣሉ?	0. በጭራሽ 1. ከወር በታች 2. ወርሃዊ 3. ሳምንታዊ 4. በየቀኑ ወይም ከዚያ ባነሰ	ለጥያቄ 112 እና 113 ጠቅላላ ውጤት 0 ከሆነ ወደ 119 እና 120 ጥያቄዎች ይዝለሉ

114	በአንድ አጋጣሚ ስድስት ወይም ከዚያ በላይ መለኪያ መጠጦችን በየስንት ጊዜ ይጠጣሉ?	0. በጭራሽ 1. ከወር በታች 2. ወርሃዊ 3." ሳምንታዊ 4. በየቀኑ ወይም ከዚያ ባነሰ	
115	ባለፈው ዓመት ውስጥ በመጠጥዎ ምክንያት በመደበኛነት ከእርስዎ የሚጠበቁ ስራዎችን ማከናወን አለመቻል ምን ያህል ጊዜ አጋጥሞዎት ያውቃል?	0. በጭራሽ 1. ከወር በታች 2. ወርሃዊ 3. ሳምንታዊ 4. በየቀኑ ወይም ከዚያ ባነሰ	
116	በባለፈው ዓመት ውስጥ በጣም በመጠጣትዎ ምክንያት በማግስቱ የዕለት ሰራዎትን ለመጀመር ምን ያህል ጊዜ በጠዋት የአልኮል መጠጥ መጠጣት አስፈልጎዎት ያውቃል?	0. በጭራሽ 1. ከወር በታች 2. ወርሃዊ 3. ሳምንታዊ 4. በየቀኑ ወይም ከዚያ ባነሰ	
117	ባለፈዉ አመት ዉስጥ አልኮል በመጠጣትዎ ምክንያት የመፀፀት፣ ራስዎን የመዉቀስና የጥፋተኝነት ስሜት ምን ያህል ጊዜ ተሰምቶዎት ያዉቃል?	0. በጭራሽ 1. ከወር በታች 2. ወርሃዊ 3. ሳምንታዊ 4.በየቀኑ ወይም ከዚያ ባነሰ	
118	ባለፈው ዓመት ጠጥተው ስለነበረ ምሽት ላይ ምን እንደተፈጠረ ለማስታወስ ምን ያህል ጊዜ አልቻሉም?	0. በጭራሽ 1. ከወር በታች 2. ወርሃዊ 3. ሳምንታዊ 4. በየቀኑ ወይም ከዚያ ባነሰ	
119	በመጠጥዎ ምክንያት እርስዎ ወይም ሌላ ሰው ላይ ጉዳት ደርሶብዎት ያውቃል?	0. አያውቅም 2. አዎ ፣ ግን ባለፈው ዓመት ውስጥ አይደለም 4. አዎ ፣ ባለፈው ዓመት ውስጥ	
120	ዘመድ፣ ጓደኛ፣ ሐኪም ወይም ሌላ የጤና ባለሙያ ስለ መጠጥዎ ተጨንቆ መጠጣትዎን እንዲያቆሙ መክሮዎት ያውቃል?	0. አያውቅም 2. አዎ ፣ ግን ባለፈው ዓመት ውስጥ አይደለም 4. አዎ ፣ ባለፈው ዓመት ውስጥ	

መድኃኒትን መውሰድን የተመለከቱ መጠይቆች አሁን ለስኳር ህመም የመድሃኒት አጠቃቀምዎ አንዳንድ ጥያቄዎችን ልጠይቅዎ ነው::			
121	አንዳንድ ጊዜ የስኳር በሽታ መድኃኒትዎን መውሰድዎን ይረሳሉ?	1. አዎን 2. የለም	
122	ሰዎች አንዳንድ ጊዜ ከመርሳት ባለፈ ምክንያት መድሃኒቶቻቸውን ሳይወስዱ ይቀራሉ ። ባለፉት ሁለት ሳምንታት ውስጥ ፣ የስኳር በሽታ መድሃኒትዎን ያልወሰዱባቸው ቀኖች አሉ?	1. አዎ 2. የለም	
123	መድሃኒት በሚወስዱበት ጊዜ የከፋ የህመም ስሜት ስለተሰማዎት ለሐኪምዎ ሳይናገሩ መድሃኒትዎን ቀንሰው ወይም አቁመው ያውቃሉ?	1.አዎ 2. የለም	
124	ሲጓዙ ወይም ከቤት ሲወጡ አንዳንድ ጊዜ የስኳር በሽታ መድሃኒትዎን ይዘው መውጣትዎን ይረሳሉ?	1.አዎ 2. የለም	
125	ትናንት የስኳር ህመም መድሃኒትዎን ወስደዋል?	1.አዎ 2. የለም	
126	የስኳር ህመምዎ በቁጥጥር ስር እንደዋለ ሲሰማዎት አንዳንድ ጊዜ መድሃኒትዎን መውሰድ ያቆማሉ?	1.አዎ 2. የለም	
127	በየቀኑ መድሃኒት መውሰድ ለአንዳንድ ሰዎች እውነተኛ ምቾት ነው ። በስኳር ህመምዎ የመድሀኒት አወሳሰድ እቅድ ምክንያት ያለመመቸት/የመረበሽ ስሜት ተሰምቶዎት ያውቃል?	1.አዎን 2. የለም	
128	ሁሉንም መድሃኒቶችዎን ለመውሰድ ምን ያህል ጊዜ ለማስታወስ ይቸገራሉ?	1. በጭራሽ/አልፎ አልፎ 2. አንድ ጊዜ 3. አንዳንድ ጊዜ 4. ብዙ ጊዜ 5. ሁል ጊዜ	

ከስኳር ህመም ጋር ተያይዞ የሚመጣ የስሜት መረበሽ በተመለከተ መጠይቆች

129	ከስኳር በሽታ ጋር ስለ መኖር ሲያስቡ የፍርሃት ስሜት ይሰምዎታል ?	0. ችግር አይደለም 1. አነስተኛ ችግር 2.መካከለኛ ችግር 3. በመጠኑ 4. ከባድ ችግር	

130	ከስኳር በሽታ ጋር ስለ መኖር ሲያስቡ የመንፈስ ጭንቀት ይረብሽዎታል?	0. ችግር አይደለም 1. አነስተኛ ችግር 2.መካከለኛ ችግር 3. በመጠኑ 4. ከባድ ችግር	
131	ስለወደፊቱ መጨነቅ እና ከባድ የጎንዮሽ ችግሮች ሊኖሩ ይችላሉ ብለው ስለበው ያውቃሉ?	0. ችግር አይደለም 1. አነስተኛ ችግር 2.መካከለኛ ችግር 3. በመጠኑ 4. ከባድ ችግር	
132	የስኳር ህመም በየቀኑ ከመጠን በላይ የአእምሮ እና የአካል ጉልበት እንደሚወስድ ይሰማዎታል?	0. ችግር አይደለም 1. አነስተኛ ችግር 2.መካከለኛ ችግር 3. በመጠኑ 4. ከባድ ችግር	
133	የስኳር በሽታ የጎንዮሽ ችግሮችን እቋቋማለሁ ብለው ያስባሉ?	0. ችግር አይደለም 1. አነስተኛ ችግር 2.መካከለኛ ችግር 3. በመጠኑ 4. ከባድ ችግር	

አካላዊ እንቅስቃሴን የተመለከቱ መጠይቆች (IPAQ)

	በመቀጠል ስለሚያደርጉዋቸው የተለያዩ አካላዊ እንቅስቃሴዎች እጠይቆታለሁ። እባክዎን ራስዎን አካላዊ እንቅስቃሴ የሚያደርግ ሰው አድርገው ባይቆጥሩም ሁሉንም ተግባራት በመመልከት ጥያቄዎቹን ይመልሱ። እነዚህም በት/ቤት፣ በቤት ውስጥ ስራዎች ወይም ከቦታ ወደ ቦታ ለመሄድ የሚያደርጉአቸውን መደበኛ እንቅስቃሴዎች እና በዕረፍት ጊዜዎ ውስጥ ለመዝናኛ ወይም ለስፖርት የሚሰሯቸውን እንቅስቃሴዎች ያጠቃልላሉ።		
	ባለፉት 7 ቀናት ያከናወኗቸውን ከባድ አካላዊ ጥረት ስለሚጠይቁ ጠንካራ እንቅስቃሴዎች ሁሉ ያስቡ ። ጠንከር ያሉ እንቅስቃሴዎች ከተለመደው በጣም በከባድ ሁኔታ እንዲተነፍሱ ያደርጉዎታል። እንዲሁም ከባድ እቃ ማንሳትን እና መሸከም ፣ መቆፈርን ፣ ኤሮቢክስን ወይም በፍጥነት ብስክሌት መንዳት የመሳሰሉትን ያካትታሉ ። ታዲያ በአንድ ጊዜ ለ 10 ደቂቃ ስላከናወኗቸው አካላዊ እንቅስቃሴዎች ብቻ ያስቡ ።		
134	በአለፉት 7 ቀናት ውስጥ ለስንት ቀናት ቢያንስ ለ 10	1. በሳምንት ____ ቀናት 2. ምንም ጠንካራ አካላዊ	መልሱ ምንም ጠንካራ አካላዊ እንቅስቃሴዎችን አላደረኩም

	ደቂቃ ያህል ጠንካራ አካላዊ እንቅስቃሴዎችን አደረጉ?	እንቅስቃሴዎችን አላደረኩም	ከሆነ ወደ ጥያቄ ቁጥር 136 ይሂዱ
135	በእነዚያ ቀናት በአንዱ ቢያንስ ለ 10 ደቂቃዎች ያህል በአንድ ጊዜ ጠንካራ አካላዊ እንቅስቃሴዎችን በማድረግ ምን ያህል ጊዜ አሳልፈዋል?	1. በቀን -------- ሰዓታት 2. በቀን -------- ደቂቃ	
	ባለፉት 7 ቀናት በእግር መጓዝን ሳያካትቱ በአንድ ጊዜ ቢያንስ ለ 10 ደቂቃዎች ያከናወኗቸውን መጠነኛ አካላዊ ጥረት ስለሚወስዱ እንቅስቃሴዎች አሁን ያስቡ ። መጠነኛ አካላዊ እንቅስቃሴዎች ቀላል ሸክሞችን መሸከም ፣ በመደበኛ ፍጥነት ብስክሌት መንዳት ወይም ቴኒስ መጫወት የመሳሰሉት ሲሆኑ ከተለመደው በተወሰነ ደረጃ በከባድ እንዲተነፍሱ ያደርጉዎታል ።		
136	በአለፉት 7 ቀናት ውስጥ ለስንት ቀናት ቢያንስ ለ 10 ደቂቃ ያህል መጠነኛ አካላዊ እንቅስቃሴዎች አደረጉ?	1. በሳምንት _____ ቀናት 2. ምንም መጠነኛ አካላዊ እንቅስቃሴዎችአላደረኩም	መልሱ ምንም መጠነኛ አካላዊ እንቅስቃሴዎች አላደረኩም ከሆነ ወደ ጥያቄ ቁጥር 138 ይሂዱ
137	በእነዚያ ቀናት በአንዱ ላይ መጠነኛ አካላዊ እንቅስቃሴዎችን በማድረግ ምን ያህል ሰአት አሳልፈዋል?	1. በቀን -------- ሰዓታት 2. በቀን -------- ደቂቃ	
	አሁን ባለፉት 7 ቀናት ውስጥ በእግር በመራመድ ያሳለፉትን ጊዜ ያስቡ ። ይህ በሥራ፣ በቤት ውስጥ ፣ ከቦታ ወደ ቦታ ለመጓጓዝን ፣ ለመዝናናት ፣ ለስፖርት ፣ ለአካል ብቃት እንቅስቃሴ ወይም ለመዝናናት ብቻ ሊያደርጉዋቸው የሚችሉትን ማንኛውንም የእግር ጉዞዎች ያጠቃልላል ።		
138	በአለፉት 7 ቀናት ውስጥ ለስንት ቀናት ቢያንስ የ10 ደቂቃ የእግር ጉዞ አደረጉ?	1. በሳምንት _____ ቀናት 2. ምንም መጠነኛ አካላዊ እንቅስቃሴዎች አላደረኩም	መልሱ ምንም የእግር ጉዞ አላደረኩም ከሆነ ወደ ጥያቄ ቁጥር 140 ይሂዱ
139	በእነዚያ ቀናት በአንዱ ላይ የእግር ጉዞ በማድረግ ምን ያህል ሰአት አሳልፈዋል?	1. በቀን -------- ሰዓታት 2. በቀን -------- ደቂቃ	
አሁን ባለፉት 7 የስራ ቀናት ውስጥ ቁጭ ብለው ያሳለፉትን ጊዜ ያስቡ ። በሥራ ፣ በቤት ውስጥ ፣ በትምህርት እና በእረፍት ያሳለፉትን ጊዜን ያጠቃልላል። ። ይህ ጓደኞችን ለመጎብኘት ፣ በማንበብ ወይም በመቀመጥ ወይም ቴሌቪዥን ለመመልከት፣ በመተኛት ያሳለፉትን ጊዜም ሊያካትት ይችላል ።			
140	በአለፉት 7 ቀናት ውስጥ ምን ያህል ሰአት ቁጭ በማለት አሳልፈዋል?	1. በቀን -------- ሰዓታት 2. በቀን -------- ደቂቃ	

ክፍል ሶስት ከ ክሊኒካል ምክንያቶች ጋር ተያያዥነት ያላቸው መጠይቆች			
201	የክብደት መጠን	/_____/ በ ኪ.ግ	

202	የቁመት መጠን	/_____/ በ ሜ	
203	የስኳር ህመምዎን ለመታየት እና ህክምና ለማግኘት አዘውትረው ሐኪምዎን ይጎበኛሉ?	1.አዎ 2.የለም	
204	የስኳር ህመምዎን ለመታየት እና ህክምና ለማግኘት ሐኪምዎን በሚጎበኙ ጊዜ ስለ ስኳር ህመም የጤና ትምህርት ወይም ምክር ተሰጥቶዎታል?	1.አዎ 2.የለም	
205	ከታዘዘው የኢንሱሊን መጠን በታች ይወስዳሉ?	1.አዎ 2.የለም	
206	ኢንሱሊን እና/ወይም መድሃኒት አቋርጠው ያውቃሉ?	1.አዎ 2.የለም	

Pare Four Data extraction checklist (was taken from patient cards)

s.no	Questions	Response	Remark
301	Types of DM	1.Type 1 2.Type 2	
302	Duration of DM	_____	
303	Kinds of treatment taking for DM	1.Oral hypoglycemic agent 2.Insulin 3.Both oral and insulin	
304	Is there any comorbidity	1.Yes 2.No	If no go to no 306
305	If yes which type of comorbid illness	1.HTN 2.Stroke 3.Renal disease 4.Pancreatitis 5.CAD 6.Liver disease 7.CHF 8.COPD 9.Cancer 10.Other ----------	
306	Presence of infection	1.Yes 2.No	If no go no308
307	If yes which v/s derangement are there?	1.Temperature >38 or <36 °C, 2. HR >90 3.RR >24 4.WBC >12,000/mm3 or <4000/mm3	
308	Presence of DKA	1.Yes 2.No	