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Magnitude and Associated Factors of Diabetic Ketoacidosis Among Type-I Diabetes Patients Who Visited Menelik-Ii Referral Hospital in Addis Ababa, 2022

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Abstract Background: Diabetic Ketoacidosis is the most common complication type 1 Diabetes Mellitus ‘patients in Ethiopia and throughout the world. Its mortality rate ranges from 2 to 5 percent in developed countries and 6 to 24 percent in developing countries. If it misdiagnosed or mistreated, it is 100% fatal. In some studies, it has been reported that DKA can be present in 25% to 30% of type 1 diabetes cases at onset and from 4 to 29% in youth with type-2 diabetes. **Objective:** To assess the Magnitude and Associated factors of Diabetic Ketoacidosis among type I diabetes patients who vested ted Menelik-II referral hospital in Addis Ababa, 2022.**Methods and Mmaterials**: A retrospective research was done at the institution. Medical records served as data. Data was entered into Epi info version 7 from the check list and exported to SPSS version 21 for analysis. Descriptive statistical approaches were used to analyze the data. Simple frequency, percentage, graphs, and tables were used to display the findings. The record of the study subjects was selected using a systemic random selection technique from total type I DM cases visited at MRH from 6/2020-6/2022) until the calculated sample size ix 'attainable. The data collector was a trained health professional who works at the hospital. **RESULT**: There were 220 study participants ranging in age from 12 to 90 years. The majority of the participants were men. The prevalence of DKA was 52.5%, and 44.5% of the 220 study participants had a history of type I diabetes. 58.3% of patients with a family history of DKA developed it. In total, 36.4% of the 220 participants had chronic diseases. DKA was diagnosed in 25.2% of individuals with chronic diseases. **CONCLUSION:** DKA was found in 52.5% of type I diabetes individuals in this study. According to the study, diabetic ketoacidosis is more common among men.

Keywords: *MAGNITUDE, ASSOCIATED, FACTORS, DIABETIC KETOACIDOSIS*

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1. Introduction

1.1. Back Ground

Diabetes mellitus is the commonest metabolic diseases all over the world. The worldwide prevalence of DM has risen dramatically over the past two decades, from an estimated 30 million cases in 1985 to 177 million in 2000. Based on current trends, above 360 million individuals will have diabetes by the year 2030. In the United States, the Centers for Disease Control and Prevention (CDC) estimated that 20.8 million persons, or 7% of the population, had diabetes in 2005 and around 30% of individuals with diabetes were undiagnosed. In Africa 7 million individual had diabetes in 2000 and this number increase to 18.2 million on 2030. Worldwide estimates project that in 2030 the greatest number of individuals with diabetes will be 45–64 years of age [1].

WHO estimates the number of cases of diabetics in Ethiopia to be about 800,000 in 2000 and projected that it would increase to about 1.8 million by the year 2030 [2]. About 3% of admissions to medical wards in Ethiopian hospital are due to diabetes mellitus [3].

Diabetes mellitus leads to acute and chronic complications. The acute complications include diabetic ketoacidosis (DKA), hyperosmolar hyperglycemic state (HHS), and hypoglycemia during treatment. The chronic complications are neuropathy, nephropathy, retinopathy, ischemic heart disease, myocardial infarction, stroke, peripheral arterial disease, impotence and so on [4].

Diabetic ketoacidosis is potentially fatal metabolic disorder present mostly in accident and emergency departments [5]. It is a life threating complication of diabetes. DKA is the body's response to cellular starvation due to insulin deficiency and counter regulatory or catabolic hormone excess. Insulin is the only anabolic hormone produced by the endocrine pancreas and is responsible for the metabolism and storage of carbohydrate, fat and protein. Counter regulatory hormones (include glucagon, catecholamine, cortisol and growth hormone) released in response to low insulin and responsible for degradation of fat and protein to produce glucose. The lack of insulin and excess of counter regulatory hormone result hyperglycemia (due to underutilization of glucose and excess production respectively), osmotic diuresis, pre-renal azotemia, ketone formation and metabolic acidosis [6,7]. Peoples suffering from diabetic ketoacidosis (DKA) usually have severe dehydration and significant alterations of the body's blood chemistry. Diabetic ketoacidosis (DKA) occurs commonly in people who have type 1 diabetes. However, people who have type 2 diabetes may also develop diabetic ketoacidosis [8]. The most mentioned events that trigger the state of diabetic ketoacidosis in DM patients are: An illness (40%), Some common illnesses that cause DKA are pneumonia and urinary tract infections. Inadequate insulin therapy (25%) and newly diagnosed or previously unknown diabetes (15%). Various other causes like Stress, Heavy use of concentrated carbohydrate, Physical or emotional trauma, Alcohol or drug abuse and Surgery contribute to DKA. However, there are no identifiable causes for 5 to 10% cases [8]. Diabetic ketoacidosis is treated by administering fluids, electrolytes and insulin. Swelling in the brain (cerebral edema), Low blood sugar (hypoglycemia), Blood acidity, dehydration and potassium level disturbance are major complication of DKA, However, these complications are prevented by early diagnosis and with lifesaving treatment [9].

In the United States of America DKA accounts for 24 percent of all diabetic admission and has an incidence among diabetic 15 episodes per 1000 patients. Europe also has comparable incidence. Between 20 and 30 percent of DKA cases occur in patients with new onset of diabetes [10].

In Ethiopia, based on May 1979 study, the mortality because of DKA was 9.1%. Socioeconomic factors particularly the cost and unavailability of insulin supplies were major obstacles of ketoacidosis in Ethiopia patients [11]. Mortality in DKA results mainly from sepsis or pulmonary and cardiovascular complications in the elderly where fatal cerebral edema in children and young adults (less than 28 years) [12]. Over all, both DKA and DKA related death rate were 34% in 1996. The highest death rates were among persons aged 75 years and older, followed by persons aged less than 45 years. Among race-sex groups, DKA death rates were highest among black males, followed by black females and then by whites. In 1996, DKA death rate for black males was almost twice that for white males [10].

The mortality rate for DKA ranges from 2 to 5 percent in developed countries and 6 to 24 percent in developing countries. If it misdiagnosed or mistreated it is 100% fatal and in places like Ethiopia where medical services are less developed, the risk of dying from DKA is greater [13,14,15].

In developing countries like Ethiopia, due to widespread poverty of individuals the healthcare systems are scarce and the few available centers are unable to adequately maintain a reliable system of insulin supply and exhaustively investigate their hospitalized patients. Consequently, there is little guarantee of successful outcomes. Poor people may also have sub-optimal nutrition, caused or worsened by diabetes, specially, at first presentation to hospital. Intensive insulin therapy in such individuals mimics re-feeding syndrome, an acute anabolic state whose outcome may be unfavorable during the period of treatment of diabetic ketoacidosis [16].

DKA in the Ethiopian care setup has not been well documented [3]. Many patients with diabetes keep dying from DKA every year [17]. With the current trend of transition from communicable to non-communicable disease, it is projected that the latter will equal or even exceed the former in developing nations, thus culminating in double burden [18,19].

1.2. Statement of the Problem

For large areas of the World, particularly in Africa and South East Asia, there are few data or none at all, on the frequency of DKA in type 1 DM. The magnitude of DKA in type 1 DM in Africa from few pocket studies is much higher than the developing countries.

In Ethiopia like other African countries the magnitude and associated factors of DKA in newly diagnosed type 1 DM is not well studied. Without the knowledge of the magnitude and associated risk factors of DKA in type 1 DM preventable associated risk factors will not be handled

and this leads to increase magnitude of DKA in type 1 DM. Several studies were conducted on diabetes mellitus and its complication, but few studies were done on the prevalence and factors associated with DKA among Ethiopian patients. As a result of this information's are scant to promote better health service to prevent mortality due to DKA in Ethiopia.

1.3. Significances of the Study

Use of standard DKA management guidelines has been associated with improved out comes (59, 60). Auditing clinical practice against a treatment guideline will help to assesses the areas of challenge in providing standard DKA care (61, 62). The study also determined the capacity of the health care providers and the system they are working in, thus interrogating the system. Discovering challenges in management will form the basis for quality improvement interventions. Therefore, identifying common factors associated with DKA and burden, support for the readiness of health facilities to make appropriate prevention and evaluation of the causes of DKA, this study tried to make all these possible. This study will also help researchers as input for other studies, which was conducted on the related subject matter in the future time.

Even though many DKA patients was seen in emergency unit of Ethiopian hospitals and health facilities, little is known or very little study is done about precipitating factors and clinical laboratory features of DKA among Ethiopian patients and information is scant to promote better health service to prevent mortality due to DKA. Knowledge about precipitating factors and clinical-laboratory features of DKA will give insight about uniform approach of diagnosis. The information gained from this study will be step towards for supporting and promoting early management, planning and prevention of DKA. The finding of this study may be used as a base line data for those who are interested in carrying out further study.

2. Literature Review

2.1. Introduction

Diabetic ketoacidosis (DKA) is characterized by the triad of hyperglycemia, ketosis, and metabolic acidosis. This results from a relative or absolute deficiency of insulin and an excess of counter-regulatory hormones including glucagon, cortisol, catecholamines, and growth hormones leading to hyperglycemia, glycosuria, dehydration, and hyperosmolarity of varying severity (Table 1) [20,21]. Glycosuria induces an osmotic diuresis, which results in significant deficits in fluid and electrolytes including sodium, potassium, calcium, magnesium, chloride, and phosphate [22]. Dehydration and hyperglycemia results in hypertonicity and an efflux of water from the intracellular space to the hypertonic extracellular space. There is also a potassium efflux from the intracellular space, aggravated by acidosis, lack of effective insulin action, and breakdown of intracellular proteins [22].

Table 1 Definition of severity of diabetic ketoacidosis (DKA)

	Mild DKA	Moderate DKA	Severe DKA
Arterial PH	7.25-7.3	7.0-<7.24	<7.0
Serum bicarbonate(mmol/L)	15-18	10-<15	<10
Anion gap	>10	>12	>10
Mental status	Alert	Alert/drowsy	Stupor/coma

The likelihood of ketoacidosis occurring at the onset of diabetes varies considerably (between 15% and 67%) from one country to another [23]. Studies have shown that in parts of the world where the prevalence of T1DM is low, symptoms of diabetes may be less familiar to medical practitioners, as a consequence more DKA occurs as the initial presentation of diabetes [24]. The same is true where access to medical care is limited. Observational studies from African countries suggest that the frequency is high but the exact figures are scarce. However, the report of a few studies from Africa indicated that the frequency varied from 80% to 88% [25,26,27]. The reason for DKA at onset of newly-diagnosed diabetes is multifactorial [28]. The management of DKA, in itself, imposes a significant economic burden on the patient and his family, particularly in developing countries [29,30]. DKA is the most frequent cause of diabetes-related death in children with the mortality rate ranging between 6% and 24% in developing countries [31,32]. Diabetic ketoacidosis more often complicates type 1 rather than type 2 diabetes mellitus and carries the risk of significant morbidity and mortality [20,33,34]. Despite evolving practice, there are increasing numbers of hospital admissions for DKA and hyperosmolar hyperglycemic state (HHS) [20,35,36]. DKA is associated with mortality rates as high as 5–9% in the elderly and in patients with severe comorbidities [20,37]. Though mortality from DKA is more often attributable to severe underlying illness and comorbidities [20], DKA itself is a hypercoagulable state resulting in potentially fatal complications including stroke, myocardial infarction, and disseminated intravascular coagulation [38,39]. Management involves rehydration, correction of electrolyte derangements; particularly hypokalemia, administration of insulin, correction of metabolic acidosis, and treatment of precipitants such as infection, pancreatitis, trauma, and myocardial infarction [40,41,42]. Complications of DKA management include pulmonary venous congestion and severe electrolyte imbalance. Cerebral oedema represents a major potential complication, although this has largely been demonstrated in children.

2.2. Prevalence of DKA

The prevalence of diabetic ketoacidosis among DM patients in this study was 40%. It is close to former studies conducted in Italy (40.3%) [43] and Collared university (38.6%) [44]. However, low prevalence has been reported in the previous studies conducted in Cambridge University (18–22%) [45], Nigeria (12.2%) [46], and England (22.5–23.9%). The variation might be due to the socio-cultural differences in health seeking behavior, a change in feeding and overall life style emanating from increasing urbanization and economic development in the region. In

this study the prevalence of DKA in type 1 DM and type 2 DM was 28.7% and 11.28% respectively. The current finding was in line with studies conducted in Colorado American university [47], prevalence of DKA in type 1 diabetes and type 2 was 25–30% and 4–29% respectively. In our study, among newly diagnosed DM case, 53.85% of cases present with DKA. The variation might be due to socioeconomic status, race/ethnicity variation. In the current study the prevalence of DKA among acute complications of diabetes is 77%. The finding was higher than the previous studies done in Dessie (68.3%) [48]. The variation might be due to the different study design used and different socio-demographic characteristics of clients. In the study younger age was significantly associated with DKA, the finding was in line with studies conducted in Jima referral hospital [48], Colorado University (47) and findings in four countries England, Wales, Austria, US and Germany [49]. Cambridge University indicated that age had significantly associated with diabetic ketoacidosis [50]. In this study being male and being younger age group were significantly associated with DKA, similar to previous finding in Italy [43]. Ketosis-prone diabetes mellitus (KPDM) was more frequent in men compared to women and in obese compared to non-obese participants. Gender differences in KPDM may be associated with a different impact of obesity in men and women. Although multiple factors (e.g., ethnic minority, lack of health insurance, lower body mass index, preceding infection, delayed treatment) affect the risk of developing DKA among children and young adults, intervention is possible between symptom onset and development of DKA [50].

2.3. Associated Factors with DKA

A systematic review on 40 studies in 31 countries on the associated factors of DKA found out different risk factors. In this systematic review the effect of age was reported in 32 studies. These studies showed that children<2 years old had three times the risk of presenting in diabetic ketoacidosis compared to children aged ≥ 2 years significantly. Twenty-one studies reported the effect of sex on the frequency of diabetic ketoacidosis, of which only one study showed the significant effect of sex on DKA. In this systematic review the effect of family history on DKA was reported by six studies. Although having a first degree relative with type1 diabetes decreased the frequency of diabetic ketoacidosis in three studies it did not predict a diagnosis of new onset diabetes before [51].

The others associated risk factors reported by this systematic review were parental consanguinity, educational status, family structure, ethnicity, health insurance status, residence, family income, occupational status, delayed diagnosis(>24hours), diagnostic error, number of medical consultations before diagnosis, preceding illness (51).

The systematic review done in 65 countries revealed that latitude and background incidence of type 1 DM was significantly associated with frequency of DKA. The frequency of DKA decreases with the higher background incidence of DM. There were no significant associations with study size, period of study design or method of case identification [52].

In a study conducted in Austria girls were significantly at higher risk of developing DKA than boys and the frequency of DKA found to be negatively associated with age at onset of DKA .In the same population based survey from 3331 patients under 15 years one female patient with age of 14.3 years died due to cerebral edema (53) and another cross sectional study in Iran girls were presented more frequently (60%) with DKA than did boys but the difference was not statistically significant (p=0.58).No death were recorded among the study populations[54].

The frequency of DKA was significantly higher in under 2 children than the other group in a study done in Italy. Of whom 9.4% of the patients had first degree relatives with diabetes. DKA occur in less frequency in children who have first degree relatives with type 1 than children who do not have first degree relatives with type 1 diabetes. First degree relatives and age at onset of DKA found to have a significant association with DKA [55].

In a study in America the overall frequency was higher in the 0 to 4 years of age group (39%) and lowest in 15-to-19-year age group (23%). The same study household income showed a significant association with DKA, the odds of children with low household income had a higher risk of developing DKA than children with high house hold income. Gender and Educational status did not show significant association in developing DKA [56]. A study in Bennin indicated as socioeconomic status and first-degree relatives with DM got a significant relation on developing DKA [57]. In a study conducted at Tikur Anbesa one fourth of the cases had family history of DM, 81.2% were from Addis Ababa and nearby town. Significant number of children (53.5%) had families who joined secondary and higher education. In this study average monthly income and level of education did not show significant association with DKA. In 44.6% of patients the precipitating factor for DKA was infection. Over all the study revealed around 7 deaths with 6% case fatality rate. Of these deaths one of the patients died because of cerebral edema [58].

Understanding factors associated with DKA has the potential of improving our knowledge of the disease, enhancing the development of patient, professional- and population-based interventions to reduce the proportion of children whose first presentation is DKA. The purpose of the present study was to determine the frequency of DKA at diagnosis of new cases of T1DM and to describe the clinical characteristics of ketoacidosis among these patients.

3. Objectives

3.1. General Objective

√ To assess the Magnitude and Associated factors of Diabetic Ketoacidosis among type-I diabetes patients who visited Menelik-II referral hospital in Addis Ababa, 2022.

3.2. Specific Objectives

- √ To assess magnitude and associated factors of DKA in type 1 DM patients.
- √ To assess occurrence of DKA In type 1 DM adult patients
- √ To determine associated factors that causes DKA in type 1 DM adult patients.

4. Methods and Materials

4.1. Study Area and Study Period

The study is conducted at Menelik-II referral hospital in Addis Ababa, Ethiopia from May, 2022 –August, 2022. It is the first hospital in Ethiopia established by Emperor Menelik-II in 1902 E.C. The hospital gives health service for more than 200,000 patients per month. The study were conducted from May 2022 –July 2022. And study period will be medical records, which are recorded in the past two years.

4.2. Study Design

A Retrospective investigation is being undertaken at an institution among individuals with type 1 diabetes.

4.3. Source and Study Population

The source population included all type 1 diabetes patients with medical records at Menelik II referral hospital. Patients with type 1 diabetes who have had a follow-up at Menelik II referral hospital in the last two years will be included in the study.

4.4. Sampling and Sample Size Determination

Sampling procedure

During the time frame indicated, all available type 1 diabetes patients' medical records were evaluated. This study takes into account two years of medical records (from 6/2020 to 6/2022).

4.5. Study Variables

4.5.1. Dependent Variable

Cases of Diabetic ketoacidosis in type 1 Diabetes Mellitus patients

4.5.2. Independent Variables

- Family history of DM
- **Individual factors**

Obesity

Chronic illness

- **Socio-demographic factors**

Age

sex

Educational status

Marital status

Economic status

4.6. Inclusion and Exclusion Criteria

4.6.1. Inclusion Criteria

Those who were attending at Menelik II referral hospital in the past two years.

4.6.2 Exclusion Criteria

- √ Records of type 2 DM patients.
- √ Incomplete type 1 DM medical record.
- √ Lost medical records.
- √ Medical records which are recorded before two years back.

4.7. Operational Definition

Dka patients: diabetic patients with urine ketone positive, blood sugar level >250mg/dl, PH level <7.3

4.8. Data Collection Tool and Procedure

A checklist is used to collect information from a diabetic patient's medical record. The checklist has been adopted and modified from many related studies. The tool's reliability was determined based on the pretest analysis results, and content validity was ensured by comparing the study's results to other similar studies. To ensure consistency, the English version checklist was translated into Amharic and then back into English. Finally, record review was performed to collect information on DKA patients' diagnoses, pre-existing medical or co-morbid disorders.

4.9. Data Quality Management

All investigators and data collectors have been trained on the study's aims and data collection methodologies. To ensure data quality, a supervisor verifies the completeness and consistency of the checklist filled out by the data collectors. The data was checked by the primary investigator prior to the data analysis stage to ensure that it was comprehensive.

Following data collection, each response was examined for any potential instrument-related issues. Finally, a corrective action was performed. Each check list was manually cleaned up after being reviewed for completeness, missing numbers, and improbable responses to confirm the data's legitimacy. The information was coded and placed into Epi-data.

4.10. Data Entry and Analysis

SPSS was used to evaluate the data that was exported. We compute descriptive statistics and logistic regression. In the bivariate logistic regression, all variables were included, and a variable with a p-value of 0.25 was chosen for multivariate logistic regression to control confiding factors. The crude odds ratio (COR) and adjusted odds ratio (AOR) are examined using a 95% confidence interval, and a p-value of 0.25 is considered statistically significant.

4.11.Ethical Consideration

The study has received written clearance from the college, and the administrator of the hospital has been notified of the study's purpose. The check list was made anonymous to protect confidentiality. Personal identifying of respondents was not requested; therefore, data was recorded as confidential and processed anonymously. The reporting mechanism is now secure and operational.

4.12. Plans for Dissemination of Findings

Final finding of the study is submitted to kea-med college department of public health. It also well be presented in scientific conferences.

5. Result

1. Socio-demographic characteristics

The study age was ranged from 12 to 90 years. The mean age of the study participants was 38.37 and the median age of the study participants was 35.00 (12-90 years). The majority of patients were in the age group of 30-34 years (33), and most of the participants were male. (Table 1)

2. Prevalence of DKA

A total of 220 records of type I DM cases was gathered and reviewed. out of 220 records, the prevalence of DKA was 115(52.3%). Male patients account for 73(56.2%) and female patients accounts for 42(46.7%) of the DKA cases. (Table 2)

3. Family history of type I DM patients

Among 220 study participants 98 (44.5%) of them had history of type I DM. And out of 98 (44.5%), 67 (58.3%) had developed DKA.

Table 2. Family history among type I DM patients and prevalence of DKA in patients who had family history in MRH, Addis Ababa, Ethiopia

		Diabetic ketoacidosis		Total
		Yes	No	
Family history	Yes	67(58.3%)	31(29.5%)	98 (44.5%)
	No	48(41.7%)	74(70.5%)	122 (55.5%)

6. Chronic illness

Among 220 study participants of type I DM patients 80(36.4%) of them had different chronic illness. From patients who had chronic illnesses 29 (25.2%) were diagnosed with DKA.

Table 3. Chronic illness among type I DM patients and prevalence of DKA in patients who had chronic illnesses in MRH, Addis Ababa, Ethiopia.

		Diabetic ketoacidosis		Total
		Yes	No	
Chronic illness	Yes	29(36.2%)	51(62.0%)	80 (100%)
	No	86(63.8%)	54(38.0%)	140 (100%)

Table 4. Socio-demographic characteristics of DKA among type I DM patients of MRH, Addis Ababa, Ethiopia.

Variables	Frequency	Percent
Age in years		
10-14	3	1.4
15-19	15	6.8
20-24	25	11.4
25-29	27	12.3
30-34	33	15.0
35-39	29	13.2
40-44	23	10.52
45-49	17	7.7
50-54	10	4.5
55-59	12	5.5
>=60	26	11.7
Sex		
Male	130	59.1
Female	90	40.9

Table 5. Prevalence of DKA among type I DM patients at MRH, Addis Ababa, Ethiopia.

Variable	DKA	
	Yes [n, %]	No [n, %]
Age		
10-14	3(2.6)	0(0.00)
15-19	12(10.4)	3(2.9)
20-24	13(11.3)	12(11.4)
25-29	17(14.8)	10(9.5)
30-34	21(18.3)	12(11.4)
35-39	14((12.2)	15(14.3)
40-44	11(9.6)	12(11.4)
45-49	7(6.1)	10(9.5)
50-54	4(3.5)	6(5.7)
55-59	7(6.1)	5(4.8)
>=60	6(5.2)	20(19.0)
Sex		
Male	73(56.2)	57(43.8)
Female	42(46.7)	48(53.3)
History of chronic illness		
Yes	29(36.2)	51(63.8)
No	86(61.4)	54(38.6)
Family history		
Yes	67(58.3)	31(29.5)
No	48(41.7)	74(70.5)

7. Discussion

This retrospective study conducted at MRH discusses the prevalence and risk factors for DKA. A total of 220 type I DM case records were acquired and evaluated. The prevalence of DKA was 52.3% in 220 records. It is comparable to previous research conducted in Saudi Arabia (54.4%). However, prior research conducted at Collared University (38.6%) found a low frequency, while Hawassa University Comprehensive Specialized Hospital (58.46%) found a high prevalence. The variation could be related to socio-cultural changes in health seeking behavior, a change in feeding, and an overall shift in

lifestyle as a result of the region's expanding urbanization and economic development.

There are interventions to reduce DKA prevalence in our country. Health care providers should take the time to explain in depth the causes, complications, and prevention/control through health and self-care measures to prevent complications and eventual death, and a multidisciplinary approach that includes ophthalmologists, medical practitioners, optometrist nurses, dieticians, and other health team members should be advocated to help these diabetic patients live heal. Our study found that age is the most important determinant in the occurrence of DKA, hence raising awareness among individuals (particularly young age groups).

8. Conclusion

DKA was found in 52.3% of type I diabetes participants in this study. The study discovered that diabetic ketoacidosis is more common in males and young adults, especially those aged 30-34 years.

9. Strength and Limitations of the Study

9.1. Strength of the Study

- The data collectors were principal investigators.
- The study area were governmental referral hospital, in which it gives service for the entire country.
- Gives an insight for researchers especially for retrospective study.

9.2. Limitations of the Study

Our study has numerous limitations that should be considered. First, this is a retrospective single-center study, therefore generalizing the findings to all patients with MRH should be done with caution. Second, the study's statistical power is limited by its tiny sample size. Furthermore, we removed key information that could benefit our thesis, such as linked factors with DKA that we must obtain from the checklist due to incompleteness and information not found in the medical records.

Recommendations

- he Federal Ministry of Health should implement well-organized and structured education/counseling programs for diabetic patients as soon as possible (in addition to current facilities). It would be advantageous to build a diabetic clinic, information, and excellence center to meet the basic demands of patient-specific education on diabetes and its management.
- Outreach activities should be set up in schools, civic centers, and other rural communities. It is critical to raise awareness about preventative actions before becoming unwell in order to increase public awareness of the importance of disease prevention and early diagnosis.
- Exercise and self-care monitoring programs should be designed to prepare them to properly monitor their blood glucose levels and control their food.
- Furthermore, this study reveals that socio-cultural views, literacy, language, and religion are all interconnected factors related with diabetes prevalence. Brochures, pamphlets, and other materials should be prepared in multiple languages. Diabetes education initiatives should include religious, community, and other prominent leaders, as well as celebrities.
- Poor documentation will make it difficult for researchers to obtain the proper data at the right time and take the appropriate action, hence it is essential that health professionals and others be educated on excellent documentation practices.
- Studies in a similar context, but with a broader scope and a much larger sample size, are recommended to confirm the findings of this study and to evaluate diabetic knowledge among private and government health institutions, as well as among rural diabetics and health care providers in other provinces, so that comparative conclusions can be drawn. This will help to educate patients and health care staff about diabetes and the necessity of understanding treatment and management options.

Acronyms and Abbreviations

ADA- American Diabetes Association: **DKA**- Diabetic ketoacidosis

DM- Diabetes Mellitus: **Epi-Data-** Epidemiological Data

FPG- Fasting Plasma Glucose: IDF- International Diabetes Federation

KPDM- Ketosis Prone-linked Diabetes Mellitus.: **MRH-** Menelik Referral Hospital

OGTT- Oral Glucose Tolerance Test: **PLPG**- Post Load Plasma Glucose

RBG- Random Blood Glucose: **SPSS-** Stastical Package for Social Science

T1DM- Type 1 Diabetes Mellitus: **T2DM**- Type 2 Diabetes Mellitus

UK- United Kingdom: **US-** United States: **WHO**- World Health Organization

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