Wolkite University

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FOUR YEARS RETROSPECTIVE ANALYSIS ON PREVALENCE AND ASSOCIATED FACTORS OF DIABETIC KETOASIDOSIS AMONG CHILDREN HAVING TYPE 1 DIABATIC MELLITUS AT WOLKITE UNIVERSITY TEACHING AND SPECIALIZED HOSPITAL

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Dr. Kumel(Internist)

RESEARCH TO BE SUBMITTED TO SCHOOL OF MEDICINE, COLLEGE OF MEDICINE AND HEALTH SCIENCE, WOLIKITE UNIVERSITY FOR PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF MEDICINE

AUGUST, 2023 GC

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ABSTRACT

Background: Of all endocrine disorders DM affect more number of people in the world as a whole and in our country Ethiopia too. As to WHO 2023 report DM had been shown to affect 243 million people worldwide, which is further expected to double by 2030. DKA is the commonest acute complication of primarily type 1 DM occurring in 5-8 per 1000 type 1 DM patients. In Africa 26 to 29% of death in DM patients is attributed to DKA. It is also commonest complication of DM patients in Ethiopia.

Objectives: To assess prevalence and associated factors of DKA among children age ≤ 14 years having type 1 DM patients at Wolkite university teaching and specialized hospital.

Methods and materials: Institutional based analytic study design through retrospective card review was conducted from July 1, 2019GC to July 1, 2023GC at WUTSH, on childhood type 1 DM patients and checklist were filled from patient's card by data collectors and data were analyzed by SPSS_Statistics_25.0x64.

Result: 205 type 1 DM patients were included in this study where 68 (33.2%) of them was diagnosed with diabetic ketoacidosis. From symptoms Poly symptoms (polyuria and polydipsia) (32.4%), Abdominal pain (23.5%) were the leading presentations of DKA. Most of the patients RBS level of DKA patients was >300mg/ dl. About 50.0% of DKA patients had infections as a precipitating factor while insulin discontinuation accounted for about 33.8%. However, in 16.2% of cases there was no identified precipitating factor.

Conclusion and Recommendation: Diabetic ketoacidosis was highly associated with young age and the presence of precipitating factor and Co morbidities. Parents and health care providers shall emphasize pediatric diabetic patients to reduce the prevalence and frequency of DKA, give special attention to infection prevention and the use of treatments for pediatric DM patients.

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TABLE OF CONTENTS

Contents

ABSTRACT.....III
ACKNOWLEDGMENT.....IV
TABLE OF CONTENTS.....V
LIST OF TABLES.....VII
ACRONYMS.....VIII
CHAPTER ONE: INTRODUCTION.....- 1 -
1.1 Background.....- 1 -
1.2 Statement of the problem.....- 2 -
1.3 Significance of the study.....- 3 -
CHAPTER TWO: LITERATURE REVIEW.....- 5 -
2.1 Introduction.....- 5 -
2.2 Prevalence.....- 5 -
2.3 Risk factor of DKA.....- 7 -
2.3.1 Socio-demographic characteristics.....- 7 -
2.3.2 Clinical characteristics(Infection and HgA1c).....- 7 -
2.3.3 Treatment factors of DKA.....- 8 -
2.3.4 Age and Sex.....- 9 -
2.3.5 Stress.....- 9 -
2.3.6 Vomiting and dehydration.....- 9 -
2.3.7 Medications, Drugs and Alcohol.....- 9 -
CHAPTER THREE: OBJECTIVES.....- 10 -
3.1 General objectives.....- 10 -
3.2 Specific objectives.....- 10 -
CHAPTER FOUR: METHODS AND MATERIALS.....- 11 -
4.1 Study design.....- 11 -
4.2 Study area and study period.....- 11 -
4.3 Sample size sampling technique.....- 11 -
4.3.1 Sample size.....- 11 -
4.3.2 Sampling technique.....- 11 -
4.4 Population.....- 12 -
4.4.1 Source population.....- 12 -

4.4.2 Sampling population ..... - 12 -
4.4.3 Study population ..... - 12 -
4.5 Inclusion criteria ..... - 12 -
4.6 Exclusion criteria ..... - 12 -
4.7 Data collection instruments and technique ..... - 12 -
4.7.1 Data collection instrument ..... - 12 -
4.7.2 Data collection technique ..... - 12 -
4.8 Variables ..... - 12 -
4.8.1 Dependant variable ..... - 12 -
4.8.2 Independent variables ..... - 13 -
4.9 Data analysis ..... - 13 -
4.10 Data quality assurance ..... - 13 -
4.11 Ethical consideration ..... - 13 -
4.12 Dissemination of results ..... - 14 -
4.13 Operational definitions ..... - 14 -
CHAPTER FIVE: RESULTS ..... - 14 -
CHAPTER SIX: DISCUSSION ..... - 19 -
Limitations of the study ..... - 20 -
CHAPTER SEVEN: Conclusion and Recommendation ..... - 21 -
Conclusion ..... - 21 -
Recommendation ..... - 21 -
ANNEX I ..... - 22 -
DUMMY TABLES ..... - 22 -
REFERENCES ..... - 24 -
QUESIONNAIRE ..... - 26 -

FIGURES

Figure 1: Prevalence of DKA among children with Type 1 DM from Wolkite university teaching and specialized Hospital, Guragea, SNNP region, Ethiopia (July 1, 2019- July 1, 2023GC).....- 15 -

Figure 2:Age distribution DKA and non-DKA from type 1 DM in children at Wolkite university teaching and specialized Hospital, Guragea, SNNP region, Ethiopia (July 1, 2019- July 1, 2023). .....- 15 -

Figure 3: Sex distribution of Type 1 DM in children at Wolkite university teaching and specialized Hospital, Guragea, SNNP region, Ethiopia (from July 1, 2019- July 1, 2023). - 16 -

LIST OF TABLES

Table 1:Socio demographic characteristic of type 1 DM in children at Wolkite university teaching and specialized Hospital, Guragea, SNNP region, Ethiopia (July 1, 2019- July 1, 2023). .....- 17 -

Table 2: Presenting symptoms of DKA patients in children at Wolkite university teaching and specialized Hospital, Guragea, SNNP region, Ethiopia (from July 1, 2019- July 1, 2023). .....- 18 -

Table 3: The precipitating factor of DKA patients in children at Wolkite university teaching and specialized Hospital, Guragea, SNNP region, Ethiopia (from July 1, 2019- July 1, 2023).....- 18 -

Table 4:Showing association of DKA Vs Sex among children type 1 DM patients at wolkite university teaching and specialized Hospital, Guragea zone, SNNP region, Ethiopia (July 1, 2019- July 1, 2023).....- 22 -

Table 5:: Showing association of DKA Vs age among children type 1 DM patients at wolkite university teaching and specialized Hospital, Guragea zone, SNNP region, Ethiopia (July 1, 2019- July 1, 2023).....- 22 -

Table 6:: Showing association of DKA Vs place of residency, among type 1 DM patients at wolkite university teaching and specialized Hospital,Guragea zone SNNP region, Ethiopia (July 1, 2019- July 1, 2023).....- 23 -

Table 7: Showing association of DKA Vs Comorbid illness, among type 1 DM patients at wolkite University Teaching and Specialized Hospital Guragea zone, SNNP region, Ethiopia 1, July, 2019-1, July, 2023GC.....- 23 -

Table 8: Showing association of DKA Vs Precipitating Factor, among type 1 DM patients at wolkite University Teaching and Specialized Hospital Guragea zone, SNNP region, Ethiopia 1, July, 2019-1, July, 2023GC. .....- 23 -

ACRONYMS

CBE: Community based education

CVD: Cardiovascular disease

DKA: Diabetic ketoacidosis

dl- deciliter

DM: Diabetic mellitus

FBS: Fasting blood sugar

HTN: Hypertension

ISPAD - International Society of Pediatrics and Adolescent Diabetics

Mg - milligram

OGTT: Oral glucose tolerance test

OPD: Outpatient department

RBS: Random Blood Sugar

SNNP: Southern Nation and Nationality People

URTI: Upper respiratory tract infection

USA: United States of America

UTI: Urinary tract infection

WKU: Wolkite University

CHAPTER ONE: INTRODUCTION

1.1 Background

Diabetes mellitus (DM) is a common, chronic, metabolic disease characterized by hyperglycemia as a cardinal biochemical feature. Classified into 4 categories: Type 1 diabetes mellitus (T1DM) results from deficiency of insulin secretion because of pancreatic β-cell damage;

Type 2 diabetes mellitus (T2DM) is a consequence of insulin resistance occurring at the level of skeletal muscle, liver, and adipose tissue, with various degrees of β-cell impairment. The remaining are Gestational diabetes and other specific types.

T1DM is the most common endocrine-metabolic disorder of childhood and adolescence, with important consequences for physical and emotional development (1).

The diagnosis of diabetes mellitus is easily established when a patient presents with classic symptoms of hyperglycemia (thirst, polyuria, weight loss, blurry vision) and has a random blood glucose value of ≥200 mg/dl. In an asymptomatic individual can be diagnosed with either Fasting blood sugar values ≥126 mg/dl ; Two-hour plasma glucose values of ≥200 mg/dl during an oral glucose tolerance test or Hemoglobin A1C values ≥6.5 %(1).

DM is a controllable but not curable disease, so early screening of risk groups and provision of proper care and management are the cornerstone in, and otherwise it will result in early complication and further increase DM related morbidities and mortality.

Diabetic ketoacidosis (DKA) which is the major topic of this study is the most severe acute complication of type 1 diabetes mellitus, characterized by a biochemical triad of hyperglycemia, ketonuria and academia . A consensus statement from the International Society for Pediatric and Adolescent Diabetes (ISPAD) in 2014 defined the following biochemical criteria for the diagnosis of DKA [1]:Hyperglycemia – Blood glucose of

>200 mg/dl and Metabolic acidosis –Defined as a venous pH<7.3 or plasma bicarbonate <15 mEq/L and Ketosis – Determined by the presence of ketones in the blood or urine(2).

DKA is caused by a decrease or ineffective circulating insulin associated with elevations of counter regulatory hormones. It's the leading cause of morbidity and mortality in children with type 1 diabetes mellitus.
Approximately 20–40% of children with new-onset diabetes progress to DKA before diagnosis.

Infections, insulin omission; drugs, infarctions, trauma, pregnancy, stress are some of the major precipitators of DKA known so far (1, 2).
Fluid resuscitation, insulin, treatment of precipitant factor and patient education are the major strategy in the management at DKA (2).

1.2 Statement of the problem

Globally, more than 96,000 children and adolescents under 15 years of age are estimated to develop type 1 diabetes yearly. DKA which is the major acute complication of was reported to occur at a rate of 46 to 50/10,000 patients (1). In other studies from Europe and North America, the frequency of DKA as the initial presentation for type 1 diabetes mellitus is approximately 30 percent (range from 15 to 67 percent).(1)

The risk of DKA in children with established type 1 diabetes is 1 to 10 percent per patient per year [2]. Also, Diabetic ketoacidosis is a global health emergency; the prevalence was studied both in developed and developing countries.
The prevalence of DKA in sub-Saharan Africa is not well known. However, there are a few studies from Africa that showed the frequency to vary from 80–88%. In Africa the mortality rate of DKA is unacceptably high with a reported death rate of 26 to 29% in study done in Kenya, Tanzania and Ghana (4). Another study done in South Africa estimated the mortality rate of DKA to be 4.2% (5). This study had also shown the severity of DKA with high death to care ratio of 5-10%.

In Ethiopia a study done at Jimma University found DKA to be the commonest acute complication accounting for about 71% (6).

Infections, insulin discontinuation, infarction, pregnancy, trauma and others are common precipitants of DKA the details of which will be discarded in literature review.

The economic impact of DKA is also significant, USA expenses about 1 bill dollars per year for patients admitted with DKA, which is about ½ of the total cost used for DM patients or a whole. In Africa although the exact figure is unknown, DM was shown to have tremendous, economic socio cultural and other impacts of which DKA share the largest proportion (17).

DKA was totally fatal until the discovery of insulin in 1920 following which it was reduced to 29% and less than 10% by 1950 due to further improvement in other aspects of management(7).

Despite the above attempts, the mortality due to DM remains to be very high at 4.7 to 10.4% of which DKA was found to be the commonest cause of death (9,10).

All the above figure have shown DM and DKA to be persisting problem of human being, even in developed countries, where patients care and management is expected to be much better as compared to developing ones. In most of our countries set-up, decides this very few data is available on DKA in children in our country, which further strengthen the importance of this thesis (19).

1.3 Significance of the study

As it was mentioned previously DM and specially DKA, was shown to be the major problem with significant health impact.

Treatment of DKA in terms of cost, ease and other aspects is more difficult than prevention of its occurrences, so prevention should be the primary goal of management which intern require adequate information on its prevalence among DM patients, common precipitant factors and other associated factors, so as to enable different health instructors, hospital and other responsible body formulate more specific and faceable action plan against this problem that can result in better control of the desire with possible minimum cost. The significance of this study lies in its potential to contribute to the early recognition and treatment of diabetes, thereby reducing the risk factors associated with complications. By identifying the precipitating risk factors of diabetic emergencies, healthcare providers, can gain valuable insights that enable them to take proactive measures.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

DKA and its complications are the most common cause of hospitalization, mortality, and morbidity in children with established type 1 diabetes mellitus. The symptoms of DKA are excessive thirst, frequent urination, nausea and vomiting stomach pain and confusion. It is commonly triggered by illness particularly pneumonia and urinary tract infection and a problem with insulin therapy (2).

2.2 Prevalence

As to WHO 2023 report DM had been shown to affect 243 million people worldwide, which is further expected to double by 2030. Globally, a yearly estimate of 79 100 to 96 000 children under the age of 15 develop T1DM of which up 80% have already developed DKA at diagnosis of diabetes [9]. This number can reach as high as 132,600 cases if the age is extended up to 20 years. Cerebral injury is the main cause of morbidity and mortality where cerebral edema accounts for 60-90% of deaths in DKA.DKA is the commonest acute complication of primarily type 1 DM occurring in 5-8 per 1000 type 1 DM patients.

A retrospective cohort study which was conducted on youth in US population showed that DKA at the diagnosis was 25.5%. It decreased with age from 37.3% in children aged 0 to 4 years to 14.7% in those aged 15 to 19 years. And also, it was significantly higher in patients with type 1 (29.4%) rather than in those with type 2 diabetes (9.7%)(10).

A longitudinal population-based study in Italian children under 15 years of age replied that DKA frequency was 40.3%. Even there was a significant trend toward an increase in the incidence of severe DKA over time with an average increase of about 3% per year during the study period (7). A retrospective review of children aged < 15 years with newly diagnosed type 1 diabetes mellitus (T1DM) in the Auckland Region (New Zealand) in 1999–2013, showed that, 27% of had DKA at diagnosis(8). In addition, study in US youth indicated that with type 1 diabete, the prevalence of DKA was 30.2% in 2002–2003, 29.1% in 2004–2005, and 31.1% in 2008–2010 And with type 2 diabete, DKA prevalence decreased from 11.7% in 2002–2003 to 5.7% in 2008–2010 (9).

The study conducted in Bangladesh revealed that from a total of 54 DKA children admitted to Birdem general hospital, 86.6% recovered without complication and 13.4% died (36). Another study conducted in Bangladesh, Dhaka hospital also showed that from a total of 49 DKA children 88% of them improved and the remained 12% died (8). Research conducted in Karachi, Pakistan on precipitating risk factor, clinical presentation and outcome of DKA patients showed that from the total number of children with DKA 45(59.2%) of the children recovered and 13.6 % died (8).In a study at Saudi Arabia showed that about 6.5% from all cases admitted to PICU and 0.94% from total children admitted to Pediatric Department in the same period developed DKA. In another six year retrospective review at Saudi Arabia indicates the incidence of DKA was 6.2% per year (11).

A retrospective study conducted in Kenya reported that among children with DKA 6.9% of children died while 93.1% of children recovered and discharged to home (12). On the other hand study conducted in Congo showed that 12.7% of children died and the remaining 87.3% recovered (16). In addition research conducted in Nigeria depicted that 11.1% children died and the remaining 88.9% recovered from DKA (24). Another cross sectional study conducted in Ethiopia, Hawassa comprehensive specialized hospital about the occurrence and associated factors of DKA among children showed that from the total of 108 patients with DKA, 105 (97.22%) improved after treatment, whereas three (2.8%) died in hospital (5). And also retrospective observational study in Tigray showed that 95.7% of children improved and 4.3% died (9).The study conducted in Ethiopia at Black Lion Specialized Hospital , 80 % of patients from the newly diagnosed type I DM patients were DKA cases (25).

In summary as it is shown in the above paragraphs, almost all literatures have one thing in common that they have shown DKA and DM to be the major public problem despite ongoing improvements in the managements and still none of them have consistent finding concerning different asperity of DKA, even among those studies done in more or less similar set ups, where no or little variation in population, management principle and other related things is expected.

2.3 Risk factor of DKA

Factors that increase the risk that a child will have DKA at the initial presentation of type 1 diabetes include; Young age (<5 years of age and especially <2 years),Low socioeconomic status or lack of health insurance, Ethnic minority, Delayed diagnosis, Lower body mass index and Children living in countries with low prevalence of type 1 diabetes[25]. DKA can occur in any patients with DM, regardless of sex, age, economic status and other socio demographic factors but different literatures have found some variations DKA with regard to these variables.

2.3.1 Socio-demographic characteristics

A study conducted at US (10), Italy (7),Southern Iraq (26) and Austria (21) reviled younger age at diagnosis (0-4 years) were predictors of DKA. In other study conducted in New Zealand increasing age at diagnosis in children aged 2 to 14 years was associated with greater likelihood of being in DKA at presentation (7). A study conducted at Poland a 2-fold increase in DKA was noted in children under the age of 3 years (7). Area of residence was identified as predictors of DKA. A study conducted in Italian children (7), Southern Iraq (3) reviled those children from rural area was associated with DKA. Also, studies in Italy (7), Southern Iraq (3), reviled that parental educational status and family income were identified as predictors of DKA. In studies done at US (10), Benin (23) Italy reviled that family history of DM was predictors of DKA. Studies carried out at US (10), New Zealand (7) reviled that ethnicity were identified as predictors of DKA. Lack of private health insurance identified as predictors of DKA in US and a decreased risk of DKA was associated with having a usual provider of care in Canada. Gender was identified as predictor of DKA. Male gender were identified as predictors of DKA in T2DM in US(10)and female gender were more affected for DKA in Iran (26), and Austria (21).

2.3.2 Clinical characteristics(Infection and HgA1c)

A study done at US reviled that type 1 of DM was predictors of DKA. Worldwide previous of DKA was reported to be 4.6-5% out of which 75% are type 1 DM patients

(11) other study had shown DKA to occur in 20-40% of newly diagnosed type 1 DM patients, of which infection was found to accounts for 40% of the cases which is the higher figure followed by noncompliance while low socioeconomic status and omission of insulin reported to be least precipitants. This study further revealed, pneumonia, upper respiratory tract infections, and UTI to constitute major proportion in descending order (3).A study in Southern Iraq indicates presence of acute recent illness and previous DKA attacks were predictors of DKA. Infections were identified as predictors of DKA. In Saudi Arabia childhood infections were the commonest and leading precipitating factor, reported infections included upper respiratory infections, bronchopneumonia and tonsillitis. But, urinary tract infection and vaginal candidiasis were rare causes (26). In Malaysia Sepsis was recorded as the foremost cause 7 which was followed by respiratory tract infection (2). In patients in sub-Saharan Africa and north India Infections were identified as predictors of DKA. A 10 years retrospective study conducted in, Nigeria showed that 172 patients admitted because of DKA precipitated by septicemia and DKA patients precipitated by meningitis (23). A cross sectional study carried out in Ethiopia at Black Lion Hospital showed that upper respiratory tract infection and urinary tract infection being two of the most common causes of DKA(25).

On the contrary other study done in UK different figure on the same topic, suggesting Omission of insulin is major precipitant accounting for 39% followed by infection which occurs in only 15% of the cases.

In study conducted in England, Wales, U.S, Austria, and Germany reviled those children with HbA1c >7.5% were more likely to develop DKA (7). In other study at Poland higher HbA1c levels were predictors of DKA (8).

2.3.3 Treatment factors of DKA

In studies done at Saudi Arabia (26), Grand Memorial Hospital Atlanta Georgia in US (10), patients in sub-Saharan Africa (16), Saudi Arabia(26)and north India (15) identified poor compliance with omission of insulin was predictors of DKA. In the study conducted at Southern Iraq, missing insulin doses and frequency of the dose missing, number of previous DKA attacks, using of syringes or pens as a tool of insulin delivery, source of insulin supply to patients, presence of glucometer at homes and frequency of its uses

were predictors of DKA. In the study carried out in Ethiopia at Black Lion showed that the most common precipitating factor for DKA was treatment non-adherence (25).

2.3.4 Age and Sex

Research conducted at USA has shown DKA is more predilection in male with regard to sexual distribution (3:2) which is quit opposite to the previous record. Other reveled DKA to be more common under the age of 19 with no sexual predilection (18). Still other study had shown to be more prevalent in female if it is precipitated by infections.

2.3.5 Stress

Stress increases the secretion of catecholamine, cortisol, and glucagon, which promote both glucose and ketoacid production and in combination with decreased or missed insulin doses can precipitate DKA. This is most commonly observed in children and adolescents with chronic poor metabolic control. As an example, infection can precede an episode of DKA (2).

2.3.6 Vomiting and dehydration

Inter current illnesses can precipitate DKA by interrupting food intake, which is almost always accompanied by a reduction in insulin doses by families. The combined insulin insufficiency and physiologic stress can precipitate DKA(2).

2.3.7 Medications, Drugs and Alcohol

Certain medications such as corticosteroids, atypical antipsychotics, and high dose thiazides, have precipitated DKA in individuals not previously diagnosed with type 1 diabetes mellitus. In adolescents with type 1 diabetes, use of illicit drugs and alcohol may further interfere with adherence to good medical management recommendations, resulting in poor metabolic control, which increases the risk for DKA. Acute ingestion of alcohol can cause hypoglycemia (rather than DKA) by decreasing hepatic gluconeogenesis. Case reports have described recurrent DKA in individuals with hyper emesis due to cannabis use (2).

CHAPTER THREE: OBJECTIVES

3.1 General objectives

- To assess the prevalence and associated factors of DKA in children age ≤14 having type 1 DM at Wolkite university teaching and specialized Hospital.

3.2 Specific objectives

- To assess prevalence of diabetic ketoacidosis in children age ≤14 having type 1 DM at Wolkite university teaching and specialized Hospital from July 1, 2019-july 1, 2023GC.
- To assess associated factors of diabetic ketoacidosis in children age ≤14 having type 1 DM at Wolkite university teaching and specialized Hospital from July 1, 2019-july 1, 2023GC.

CHAPTER FOUR: METHODS AND MATERIALS

4.1Study design

Institutional based analytic study design data collection was conducted through retrospective card review.

4.2Study area and study period

Study was conducted from (July 1, 2019 to July,1, 2023) at Wolkite university teaching and specialized Hospital, Wolkite university teaching and specialized Hospital is located in SNNP region Gurage zone in wolkite town Gubre sub-city about 150 km to the west of Addis Ababa.

The hospital has got seven departments and specialty clinic serving 1,000,000 people in its catchments area which make the hospital first in patient burden as compared to other hospital in the region of these around 205 is DM patients on follow up in Wolkite university teaching and specialized Hospital.

4.3 Sample size sampling technique

4.3.1 Sample size

Sample size was all cards of type 1 DM patients present to the pediatric department between july1, 2019-july 2023.

4.3.2 Sampling technique

We conducted retrospective study from medical records of children age ≤14 having type 1 DM and from them we identified those with DKA visiting WUSTH between july1, 2019-july 2023.

4.4 Population

4.4.1 Source population

All cards of children type 1 DM patient's seen at Wolkite university teaching and specialized hospital.

4.4.2 Sampling population

All cards of children with type 1 DM patients seen at Wolkite university teaching and specialized hospital from July 2019- July 2023 GC.

4.4.3 Study population

All cards of children with type 1 DM patients fulfilling inclusion criteria.

4.5 Inclusion criteria

- Age ≤14(pediatric age category in our setup)
- Type 1 DM Patients
- Patient Seen in the specified period of time from (July 2019 - July 2023) G.C
- Complete information for checklist

4.6 Exclusion criteria

- Those which didn't fulfill the inclusion criteria

4.7 Data collection instruments and technique

4.7.1 Data collection instrument

- A checklist was developed by principal investigator, after reviewing different literatures.

4.7.2 Data collection technique

- Data collection was conducted by four medical intern collected necessary information using checklist.

4.8 Variables

4.8.1 Dependant variable

- Diabetic ketoacidosis

4.8.2 Independent variables

- Age
- Sex
- Infection as precipitant factor
- Family history of DM
- Insulin discontinuation
- Co morbidity
- Residency
- Maternal education
- Maternal occupation/marital status

4.9 Data analysis

- Data were coded, cleaned, entered and analyzed by using SPSS version 25.0
- Frequency with their specific percentage was calculated for each specific variable
- Chi-square and P-value were done to see the association between variables for 95% CI and P-value of 0.05.
- Data was presented by using, tables, graphs with their respective percentage and P-values.

4.10 Data quality assurance

- The completeness of data was checked by investigators by reviewing the collected data whether it contains full information or not.
- Finally the data obtained for the study were checked for its neatness, completeness, and consistency.
- Data consistency and completeness was checked throughout the data collection, data entry and analysis.

4.11 Ethical consideration

- Official letter was obtained from WKU, college of medical science and public health ethical committee
- Permission from WUSTH hospital was asked
- Unanimity was kept.

4.12 Dissemination of results

The result was submitted to Wolkite University College of medicine and health science in partial fulfillments to the doctor of medicine, wolkite university teaching and specialized Hospital and our supervisors.

4.13 Operational definitions

- DKA: Written on the patient card as DKA regardless of laboratory profile.
- Type 1 DM: written on the patients' card as type 1 regardless of how the diagnosis made.
- Urban: There from wolkite university teaching and specialized Hospital and small towns around wolkite.
- Rural: All areas outside there from urban.

CHAPTER FIVE: RESULTS

In our research a total of 216 diabetic mellitus children were seen in WUSTH from 2019-2023GC. Of these, 11 patients were excluded from the study where 4 of them had diagnosed with Type 2 DM and there were lost charts for 7 patients. Hence, 205 type 1 diabetes patients were included in this study where 68 (33.2%) of them was diagnosed with diabetic ketoacidosis (Figure **1**).From age distribution of DKA patients 11/68 (16.2%) patients were between 0-2 years of age, 15(22.1%) patients were between3-5 years of age, 18(26.5%) patients were between 6-10 years of age and 24(35.3%) patients were between 11-14 years of age (Figure 2). Children 0-5 years of age are 2.75 times [AOR=2.75(95%CI=1.078-6.988, P=0.024)] having DKA than those between 6-14years of age. Of the 205 type 1 diabetes children, 119(58.0%) were male and 86(42.0%) were females. From 68 of DKA patients 45(66.2%) were male and 23(33.8%) were female (Figure 3: Sex distribution of Type 1 DM in children at Wolkite university teaching and specialized Hospital, Guragea, SNNP region, Ethiopia (from July 1, 2019- July 1, 2023).). a chi-square test conducted at a 5% level of significance revealed statistically significant relationship between the prevalence of DKA and the gender of the patient

(Table 4). The odds of developing DKA in male children with type 1 diabetes was 1.67(AOR=1.67, 95%CI: 0.910–3.048, P=0.009) times higher than female.

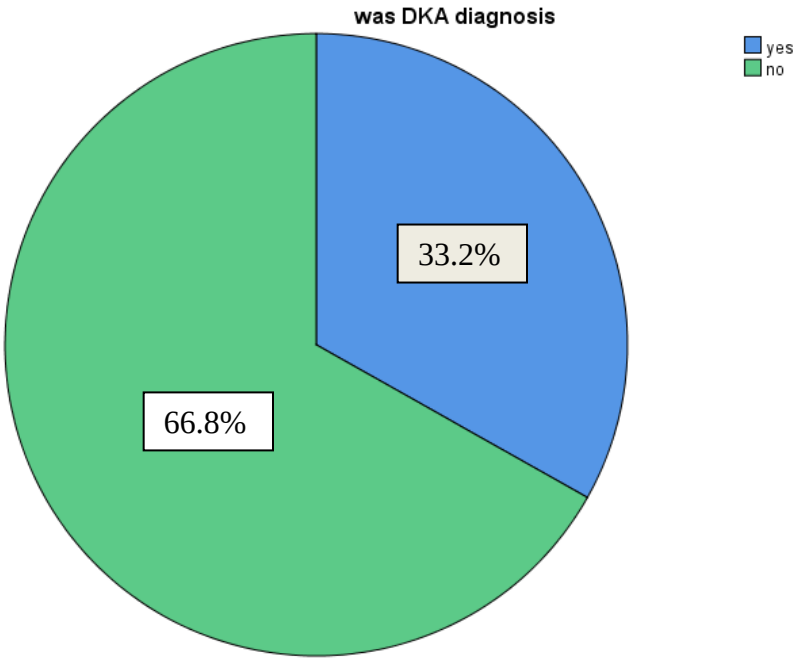


Figure 1: Prevalence of DKA among children with Type 1 DM from Wolkite university teaching and specialized Hospital, Guragea, SNNP region, Ethiopia (July 1, 2019- July 1, 2023GC).

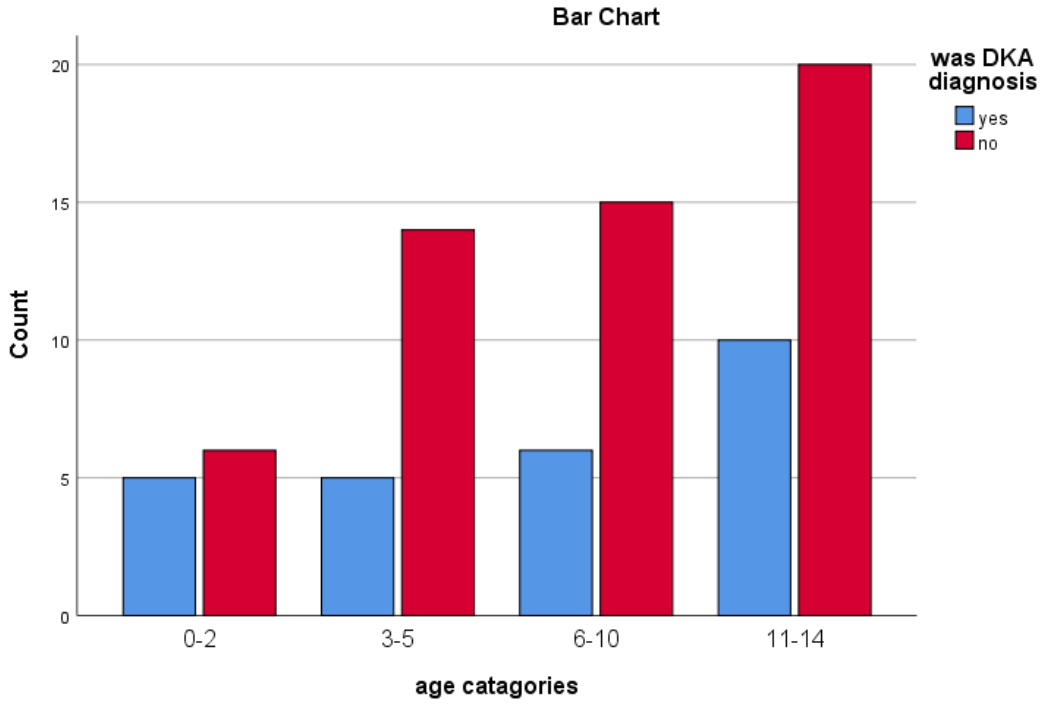


Figure 2:Age distribution DKA and non-DKA from type 1 DM in children at Wolkite university teaching and specialized Hospital, Guragea, SNNP region, Ethiopia (July 1, 2019- July 1, 2023).

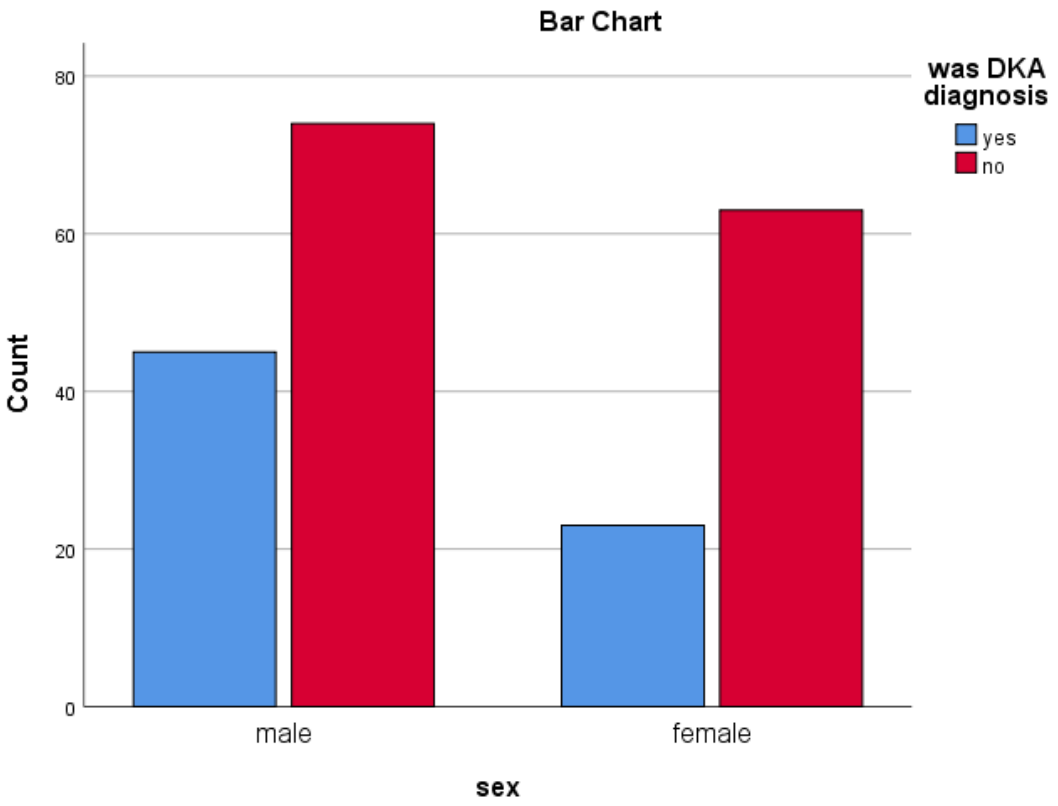


Figure 3: Sex distribution of Type 1 DM in children at Wolkite university teaching and specialized Hospital, Guragea, SNNP region, Ethiopia (from July 1, 2019- July 1, 2023).

Characteristics		Frequency	%
Sex	Male	119	58.0
	Female	86	42.0
Age	0-2	20	9.8
	3-5	53	25.9
	6-10	62	30.2
	11-14	70	34.1
Residency	Urban	73	35.6
	Rural	132	64.4
Family History	Father	8	3.9
	Mother	6	2.9
	Sibling	3	1.5
	Other	3	1.5
	No	185	90.2

Table 1:Socio demographic characteristic of type 1 DM in children at Wolkite university teaching and specialized Hospital, Guragea, SNNP region, Ethiopia (July 1, 2019- July 1, 2023).

Regarding residence, from 205 type 1 DM patients 132(64.4%) patients was from rural areas. From DKA patients 47(69.1%) patients were from rural area and 21(30.9%) patients were from urban area. A chi-square test conducted at a 5% level of significance revealed there is no statistically significant relationship between the prevalence of DKA and the residence of the patient. The odd of developing DKA in children with type 1 diabetes from rural area is 1.37 times higher than those from urban area.

First-degree family history of type 1 diabetes was positive in 20(9.8%) patients. From these, fathers 8(40%), mothers 6(30%), siblings 3(15%) and others 3(15%). Around 90.2% of patients have no family history of DM (Table 1).

Most patient duration of symptoms before presentation of DKA was presented within first day. From symptoms Poly symptoms (polyuria and polydipsia) (32.4%), Abdominal pain (23.5%) were the leading presentation of DKA (Table 2: Presenting symptoms of DKA patients in children at Wolkite university teaching and specialized Hospital, Guragea, SNNP region, Ethiopia (from July 1, 2019- July 1, 2023).). Most of the patients RBS level of DKA patients was >300mg/dl.

About 50.0% of DKA patients had infections as a precipitating factor while insulin discontinuation accounted for about 33.8%. However, in 16.2% of cases there was no identified precipitating factor (Table 3). A chi-square test conducted at a 5% level of significance revealed there is statistically significant relationship between infections as a precipitating factor of DKA. The odds of developing DKA in children with infections as a precipitating factors are 1.40 [AOR=1.40(95%CI=1.135-1.726), P=0.001] times higher than those without infection.

Symptoms	Number	%
polyuria and polydipsia	22	32.4
Vomiting	11	16.2
abdominal pain	16	23.5
weight loss	4	5.9
Other	15	22.1
Total	68	100

Table 2: Presenting symptoms of DKA patients in children at Wolkite university teaching and specialized Hospital, Guragea, SNNP region, Ethiopia (from July 1, 2019- July 1, 2023).

			Number	%
precipitating factor	Infection	34		50.0
		Pnumonia	14	
		URTI	11	
		UTI	5	
		Other	4	
	Drug discontinuation		23	33.8
	No precipitating factor		11	16.2

Table 3: The precipitating factor of DKA patients in children at Wolkite university teaching and specialized Hospital, Guragea, SNNP region, Ethiopia (from July 1, 2019-July 1, 2023).

The incidence rate of diabetic ketoacidosis was 25% among type 1DM patients with Co morbidities [Malnutrition (14.7%), Cardiac illness (2.9%) and Down syndrome (7.4%)], which is 1.5 times higher than those without comorbidities.

CHAPTER SIX: DISCUSSION

Acute complications of DM are significant contributors to mortality, and DKA has a major impact on the quality of life of the individuals and their families, accelerating micro-vascular complications and costs for families and health care. This study tried to assess prevalence of DKA and to identify factors associated with the DKA among pediatric type 1 diabetes mellitus patients. The present study showed that the prevalence of DKA among pediatric type 1 diabetes mellitus patients are 68/205patients(33.2%) which is almost comparable with research done at US(31.1%) in 2008–2010(9) and A study conducted in a referral hospital Addis Ababa, Ethiopia (35.8%)(25); However its lower prevalence than study conducted at Nigeria(77.1%)(19). In terms of factors associated with the prevalence of DKA, co morbid infection, malnutrition and treatment discontinuation were statistically significant factors. In this study, the proportion of patients with infection was 50.0%, and having co morbidity with infection (upper respiratory tract infection, pneumonia, UTI and others) increases the incidence of DKA, which is supported by the studies conducted in Egypt, Tigray, Tikur Anbessa Specialized Hospital and Jimma University Specialized Hospital(4,19).This may be because of DM results in immune dysfunction and makes the patients susceptible to infection, and increasing its virulence in the hyperglycemic environment and finally precipitating complications like DKA.(1)

Based on this study, having co morbidity with malnutrition significantly increased the frequency of DKA.

However, there were no comparable results with this finding. This may be to the fact that other studies may not include malnutrition as associated factor of DKA or might not be

significantly associated with the frequency of DKA. The possible reason may be malnutrition result in multiple organ dysfunctions. (2)

This study found that treatment discontinuation is precipitant factor for 33.8% of DKA patients which is approached to a study done at UK which suggesting Omission of insulin to be the major precipitant accounting for 39% followed by infection which occur in only 15% of the cases. This might be because when the patients discontinue their treatment, they may be faced insulin deficiency, increased insulin counter-regulatory hormones, and peripheral insulin resistance lead to hyperglycemia, dehydration, ketosis, and electrolyte imbalance, which underlie the pathophysiology of DKA(1).

Patients discontinue their treatment for various reasons, including the cost of treatment or discomfort with the daily injection.

Limitations of the study

This study had significant limitations since it is a retrospective study, there were lost charts and significant numbers of incomplete medical records regarding occupation, marital status, laboratory result and parental education as a result it was difficult to study the effects of these parameters on DKA.

Since the study was based on secondary data, some important risk factors were not available and unable to analyze them.

The definition used for DKA in this study was not according to ISPAD guidelines due to lack of laboratory.

CHAPTER SEVEN: Conclusion and Recommendation

Conclusion

In conclusion, the study revealed substantially high prevalence of diabetic ketoacidosis in children diagnosed type 1 diabetes mellitus. The results showed that approximately 33.2% of diabetic patients admitted to WUSH experienced DKA, indicating a considerable burden of this complication. Diabetic ketoacidosis was highly associated with young age (≤5years) and the presence of precipitating factor (like infection, drug omission) and Co morbidities (like malnutrition and Down syndrome).

These findings highlight the importance of prevention strategies among individuals already diagnosed with diabetes. Regular glucose monitoring, increase awareness of the disease, and patient education are recommended to reduce the incidence of DKA and subsequent hospitalizations. Early detection plays a crucial role in preventing complications, particularly in regions with limited diabetes knowledge. To ensure comprehensive care, a multidisciplinary approach involving physicians, dieticians, and physical therapists should be implemented to educate diagnosed individuals on complications prevention.

Recommendation

Based on the findings of this study, several recommendations are proposed to improve the management and prevention of diabetes complications:

1. We would strongly advise The Federal Ministry of Health has to set priorities and intervention strategies like providing training for health extension workers and awakening them to work with the patients to prevent DKA and to expand integrated diabetes services to lower-level health units, ensuring accessibility and early detection of diabetes. This proactive approach would enable timely interventions and effectively reduce the burden of complications associated with these conditions.
2. Furthermore, we recommend that WUSH and the Ministry of Health launch comprehensive public awareness creation campaigns on signs and symptoms of diabetes mellitus to detect those who are at risk of developing diabetic ketoacidosis and complications of DKA. The focus should be on educating

individuals about diabetes, its risk factors, and the critical importance of regular check-ups to detect complications at an early stage.

3. Parents and health care providers shall emphasize to pediatric diabetic patients to reduce the prevalence and frequency of DKA, give special attention to infection prevention and the use of treatments for pediatric DM patients.
4. Considering the financial challenges faced by patients with diabetes, it is essential for the Ministry of Health to seriously consider subsidizing diabetes medications and monitoring supplies. This vital step would alleviate the financial burden on individuals and improve medication adherence, leading to better health outcomes.

ANNEX I

DUMMY TABLES

Table 4:Showing association of DKA Vs Sex among children type 1 DM patients at wolkite university teaching and specialized Hospital, Guragea zone, SNNP region, Ethiopia (July 1, 2019- July 1, 2023).

Sex	Frequency		X^2	P-value	AOR(95%CI)
	DKA	No DKA			
Male	45	74	0.722	0.029	1.67(0.910-3.048)
Female	23	63			

Table 5:: Showing association of DKA Vs age among children type 1 DM patients at wolkite university teaching and specialized Hospital, Guragea zone, SNNP region, Ethiopia (July 1, 2019- July 1, 2023).

Age	Frequency		X^2	P-value
	DKA	No DKA		
0-2	11	9	1.164	0.020
3-5	15	38		
6-10	18	44		
11-14	24	46		

Table 6:: Showing association of DKA Vs place of residency, among type 1 DM patients at wolkite university teaching and specialized Hospital,Guragea zone SNNP region, Ethiopia (July 1, 2019- July 1, 2023).

Place of residency	Frequency		X^2	P-value	COR(95%CI)
	DKA	No DKA			
Urban	21	52	0.992	0.319	0.730(0.393-1.357)
Rural	47	85			

Table 7: Showing association of DKA Vs Comorbid illness, among type 1 DM patients at wolkite University Teaching and Specialized Hospital Guragea zone, SNNP region, Ethiopia 1, July, 2019-1, July, 2023GC.

Presence of comorbid illness		Frequency		X^2	P-value
		DKA	No DKA		
Yes	Malnutrition	10	22	7.636	0.054
	Cardiac illness	2	2		
	Down syndrome	5	1	2.580	0.022
No		51	112		

Table 8: Showing association of DKA Vs Precipitating Factor, among type 1 DM patients at wolkite University Teaching and Specialized Hospital Guragea zone, SNNP region, Ethiopia 1, July, 2019-1, July, 2023GC.

Precipitating factor		Frequency		X^2	P-value
		DKA	No DKA		
Yes	Infection	34	0	159.066	0.001
	Insulin omission	23	0		
No		11	137		

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QUESIONNAIRE

Format of record review from hospital cards of diabetic patients on follow up and emergency visit at wolkite university teaching and specialized Hospital from (2019-2023GC)

MRN of the chart=

1. Age….

   1,0-2 2,3-5 3,6-10 4,11-14

2. Sex…. 1, male 2, female
3. Mother/care giver education ….

   1, unable to read and write 2, read and write 3, Grade 1-8 4,9-12 5, Above 12

4. Marital status of the mother/care giver ….

   1, single 2, Married 3, separate 4, Widowed

5. Mother/care giver occupation ……

   1, Unemployed 2. Civil servant 3,Student 4,House wife 5,Daily labor 6,Merchant

6. Place of residency …

   1, urban 2, rural

7. Was DKA diagnosed …..

   1,yes 2,NO

8. Frequency of DKA

   1 2 3 4 5 6

9. Chief complaint …

   1,polyuria and polydipsia 2,vomiting 3, abdominal pain 4,weight loss 5, Other

10. Duration of symptom

    1.0-1 day 2, 2-4 day 3,5-9 day 4,>10 day

11. What was the precipitating factor …

    1, no 2,infection 3,insulin discontinue d,other

12. If infection which infection…….

    1, pneumonia 2,UTI 3, URTI 4, others

13. Last visit random blood sugar(RBS) ….

1,<70 2,71-300 3, >300

14. Last visit fasting blood sugar(FBS)…

1,<70 2,70-125 3, >125

15. Last visit urine ketone …

1,negative, 2,trace 3,+1 4,+2, 5,+3

16. Was there additional diagnosis….

1, no 2,Malnutrition 3,cardiac illness 4,Down syndrome 5, Other

17. Family history of DM …..

1,NO 2,father 3,mother 4,sibling 5, other specify

18. Last visit type of treatment given…

1, insulin 2, other specify 3, Other