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RESEARCH ARTICLE

Prevalence of hyperglycaemic crisis among diabetes mellitus patients in Ethiopia, systematic review and meta-analysis

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Introduction: One of the most severe and potentially life-threatening acute metabolic complications of diabetes mellitus is hyperglycaemic crises. The two most common types are diabetic ketoacidosis (DKA) and hyperosmolar hyperglycaemic state (HHS). Because these crises often recur, patients experiencing them face a high risk of overall mortality. This study aimed to evaluate the prevalence of hyperglycaemic crises among diabetic patients in Ethiopia.
Methods: Several databases were searched to retrieve available articles. The data were extracted and sorted in Microsoft Excel and exported to Stata/MP 17.0 for analysis. A weighted inverse variance random-effects model with a 95% confidence interval was used to pool the data. Egger's test and Cochrane I^2 statistics were used to evaluate heterogeneity and publication bias, respectively. To determine the cause of heterogeneity, subgroup analysis was performed.
Result: The pooled prevalence of hyperglycaemic crisis was 45.37% (95% CI 35.24–55.51). Research conducted in the Tigray region revealed the highest prevalence of hyperglycaemic crises: 72.64% (95% CI 60.88–84.40). Hyperglycaemic crisis was more prevalent among Type 2 diabetes (T2DM) patients at 64.6% (56.82–72.39). DKA accounts for 40.77% (95 CI 27.97–53.57) of hyperglycaemic cases, while HHS accounts for only 0.8.56% (95 CI 03.13–13.98) of cases. The most commonly identified risk factor for hyperglycaemic crisis is poor glycaemic control (40.53%, 95% CI 31.72–49.34), followed by poor medication adherence (33.55%, 95% CI 13.34–53.75).
Conclusion: Ethiopia encounters a notably higher burden from hyperglycaemic crises. Individuals with Type 2 diabetes mellitus often face such crises, largely due to factors like inadequate medication adherence and suboptimal glycaemic control. Early identification and management of diabetes can substantially reduce the likelihood of these crises. Furthermore, ongoing follow-up is essential to track medication adherence and monitor blood glucose levels.

Keywords: diabetes mellitus, diabetic ketoacidosis, Ethiopia, hyperglycaemic crisis, hyperosmolar hyperglycaemic state, risk factors

Introduction

One of the most serious acute metabolic consequences of diabetes mellitus is hyperglycaemic crises. It is a potentially fatal yet avoidable consequence of diabetes mellitus. Diabetic ketoacidosis (DKA) and hyperosmolar hyperglycaemic state (HHS) are the two most prevalent hyperglycaemic crises.[1] Patients with hyperglycaemic crisis are at high risk for all-cause mortality due to likely recurrence.[2] Among all patients, nearly 10% of deaths are caused by DKA.[3] It has resulted from a deficiency of circulating insulin and increased levels of the counter-regulatory hormones (glucagon, catecholamines, cortisol, and growth hormone). Mostly, DKA is caused by the new onset of diabetes (Type 1 DM), omission of insulin injections, interruption of insulin delivery, and inadequate management of an infection.[4]

Adolescent females with type 1 DM had the greatest incidence rates of DKA hospitalisations. In contrast, the risk of DKA in people with type 2 DM rises with age, and adult males are more likely to experience it. Regardless of the type of DM, DKA incidence rates have been rising over the last few years. High rates of admission to intensive care units, extended hospital stays, and high death rates, particularly in older diabetic patients, all demonstrate the impact of DKA.[5] According to the findings of a single study, DKA accounts for 48.7% of all diabetic emergencies followed by uncomplicated hyperglycaemia (22.8%).[6] The most frequent acute DM consequence is HHS, particularly in cases of type 2 DM, which is more prevalent in older DM patients. Patients are frequently disoriented at admission and are diagnosed with acute hyperglycaemia, deep dehydration, and high serum osmolality.[7] The most dangerous type of hyperglycaemic emergency is called an HHS, in which patients worsen even when there is not much ketoacidosis.[8] Even if the incidence of HHS is low, its mortality rate is up to 20%.[9]

Over the past 10 years, there has been an increase in hospitalisations for hyperglycaemic crises. Between 2004 and 2013, there were 5 540 reports of hyperglycaemic crises per year. A statistical analysis showed a rising tendency of hospitalisations for hyperglycaemic crises in the future.[10] Upon their initial admission, 1 211 patients met the verified criteria for a hyperglycaemic crisis. Of these individuals, 27% had mixed characteristics of DKA and HHS, 38% had isolated DKA, and 35% had isolated HHS. Compared with DKA or HHS alone, the combined hyperglycaemic condition (DKA-HHS) has a greater death rate. Furthermore, there is a substantial correlation between severe hypokalaemia and severe hypoglycaemia and the mortality rate from hyperglycaemic crises.[11]

The type of DM (type 2 DM), medical history of chronic illness (stroke), and residency (rural residents) are all associated with

the severity and mortality of hyperglycaemic crises.[12] Although rates of hyperglycaemic crisis and other diabetic complications have decreased nationally, current findings from monitoring systems raise concerns about the possibility that these reductions in complication rates may stop. It is alarming that the fatality rates from hyperglycaemic crises are rising among young people. Determining the causes of the rise could aid in focusing efforts to stop this problem.[13] Additionally, the high prevalence of infection and the large proportion of patients who return with hyperglycaemia crises may indicate that community-based diabetes programmes need to be addressed. In order to avoid a hyperglycaemic crisis, long-term healthcare plans must be established.

To address issues related to hyperglycaemic crises in Ethiopia, various individual studies have explored the prevalence and risk factors of diabetes mellitus (DM), including its types and complications. However, the evidence on the burden of hyperglycaemic crises remains unclear and incomplete. This systematic review aims to clarify this by focusing on the burden of hyperglycaemic crises in relation to DM types, risk factors, medication adherence, and glycaemic control levels. It also includes recent, previously unreviewed studies to provide updated insights into the current state of hyperglycaemic crises in Ethiopia. The goal of this review is to compile data from different studies conducted across various regions and times in Ethiopia to determine the overall prevalence of hyperglycaemic crises.

Method and materials

The study protocols

The Preferred Reporting Items for Systematic Review and Meta-analysis (PRISMA) guideline for reporting the findings was used and may be found as a supplementary file (Table S1).[14]

Databases and search strategy

In this systematic review and meta-analysis, various databases, including HINARI, Embase, Scopus, PubMed/MEDLINE, Google Scholar, African Journals Online (AJOL), and both published and unpublished articles from the Ethiopian University repository were searched. The search covered articles from July 1, 2010, to January 30, 2024. All studies that reported on hyperglycaemic crises among diabetes mellitus patients in Ethiopia were included. The search terms used included: "hyperglycaemic crisis", "complications of diabetes mellitus", "acute complications of diabetes mellitus", "burden of hyperglycaemic crisis", "types of diabetes mellitus", "diabetic ketoacidosis", "DKA", "hyperosmolar hyperglycaemic state", "HHS", "hyperglycaemic hyperosmolar nonketotic syndrome", "HHNS", "glycemic control", "poor glycemic control", "treatment outcome", "hyperglycaemic mortality", "risk factors", "determinant factors", "predictors", "incidence", "prevalence", "associated factors", and "Ethiopia", using the Boolean operators "AND" and "OR" (Table 1).

Screening and eligibility of the studies

All retrieved articles were exported into EndNote reference software version 8 (Thomson Reuters, Stamford, CT, USA) citation manager to sort and remove possible duplications. Three authors (AG, MG, and AW) independently evaluated each study by relevance, title, and abstracts using predetermined inclusion criteria. All the authors assessed the eligibility of the articles included for final analysis by critically reviewing the full text of the selected articles. On the extraction sheet, the first author's name, study year, publication year, region where the studies were conducted, sample size, study design, risk factors, proportion of hyperglycaemic crisis, glycaemic control level, and type of hyperglycaemic crisis were extracted. Any form of discrepancy raised between the authors during the process was resolved through discussion. In this review, all studies done on the prevalence of hyperglycaemic crisis among diabetes mellitus patients in Ethiopia were included. Articles without full text, case reports, trials, interventional studies, and review articles were excluded from the study. In addition, articles of low quality were excluded from the final analysis after measuring the qualities of each study using NOS measurement.

Outcome measurement of the study

In this systematic review and meta-analysis, hyperglycaemic crisis was measured using its acute complications, which are DKA and HHS. Thus, to be hyperglycaemic crisis, a diabetes mellitus patient must have either DKA or HHS or both. The criteria used to differentiate between diabetic ketoacidosis (DKA) and hyperosmolar hyperglycaemic state (HHS) are as follows: For DKA, the criteria include hyperglycaemia (blood glucose levels > 250 mg/dl or 13.9 mmol/l), ketonaemia/ketonuria (presence of ketones in blood or urine), and acidosis (blood pH < 7.3 and/or bicarbonate level < 18 mEq/l). For HHS, the criteria are severe hyperglycaemia (blood glucose levels >600 mg/dl or 33.3 mmol/l), hyperosmolarity (serum osmolality > 320 mOsm/kg), and absence of significant ketoacidosis (blood pH > 7.3 and bicarbonate level > 18 mEq/l, with minimal or no ketonaemia/ketonuria).

Table 1: Searches on different databases for the burden of hyperglycaemic crisis in Ethiopia

Databases	Search terms	Number of studies
MEDLINE/ PubMed	"Burden" OR "incidence" OR "prevalence" OR "predictors" AND "hyperglycemic crisis" OR "diabetic ketoacidosis" OR "DKA" OR "hyperosmolar hyperglycemic state" OR "HHS" OR "hyperglycemic hyperosmolar non-ketosis syndrome" OR "HHNS" OR "glycemic control" OR "poor glycemic control" AND "treatment outcome" OR "hyperglycemic mortality" OR "hyperglycemic complications" OR "hyperglycemic acute complications" AND "risk factors" OR "determinant factors" OR "associated factors" AND "Ethiopia"	6 654
Google Scholar	"Burden" OR "incidence" OR "prevalence" OR "predictors" AND "hyperglycemic crisis" OR "diabetic ketoacidosis" OR "DKA" OR "hyperosmolar hyperglycemic state" OR "HHS" OR "hyperglycemic hyperosmolar non-ketosis syndrome" OR "HHNS" OR "glycemic control" OR "poor glycemic control" AND "treatment outcome" OR "hyperglycemic mortality" OR "hyperglycemic complications" OR "hyperglycemic acute complications" AND "risk factors" OR "determinant factors" OR "associated factors" AND "Ethiopia"	17 600
Other databases		4
Total retrieved articles		24 258
Included studies		14

Quality assessment

The qualities of the studies were assessed using the Newcastle Ottawa Scale (NOS).[15] The representativeness of the sample, the methodological quality of the study, ascertainment of exposure or risks, comparability of the study, and the assessment of outcome and statistical tests were the major assessment measures to declare the quality of the studies. Then, studies scored on a scale of ≥ 7 out of 10 were considered as achieving high quality. All authors independently assessed and determined the qualities of the studies for consideration and inclusion in the analysis.

Data processing and analysis

The overall prevalence of hyperglycaemic crisis, level of glycaemic control, risk factors of hyperglycaemic crisis, and types of hyperglycaemic crisis among diabetes mellitus patients in Ethiopia were pooled using a weighted inverse variance random-effects model at 95% CI.[16] The data were extracted and cleaned using Microsoft Excel spreadsheets (Microsoft Corp, Redmond, WA, USA) and exported to Stata/MP version 17 software (StataCorp LLC, College Station, TX, USA) for analysis. The heterogeneity of the studies was assessed using the Cochrane Q test and I^2 with its corresponding *p*-value.[17] To examine the source of heterogeneity, subgroup analysis by study year, publication year, region where the studies were conducted, study design, and sample size was done. In addition, a sensitivity analysis was executed to investigate the presence of an influential study. Furthermore, the presence of publication bias was evaluated by using Egger's test and funnel plot.[18] Finally, a statistical test with a *p*-value of less than 0.05 was considered statistically significant.

Results

A total of 24 258 articles were retrieved from different databases to assess the pooled prevalence of the hyperglycaemic crisis in Ethiopia. After critical reviewing, 24 244 articles were excluded due to duplication by title and abstract, inability to get the full text, and inability to fulfil the inclusion criteria. Finally, 14 articles that fulfilled the inclusion criteria were included in the analysis (Figure 1).

Characteristics of the studies and study participants

Fourteen studies, which were conducted in different regions of Ethiopia from 2010 to 2023 with a total of 4 659 study participants, were included to investigate the pooled prevalence of hyperglycaemic crisis among diabetes mellitus patients. Of these studies, six were conducted in Amhara region,[19–24] four were in SNNP,[25–28] two were in Tigray,[12, 29] and the remaining two were in Oromia.[30, 31] The sample size ranged from 89 to 589. Of the included studies, seven were cross-sectional, five were retrospective follow-up, and two were case-control on design (Table 2).

Prevalence of hyperglycaemic crisis

The overall pooled prevalence of hyperglycaemic crisis among diabetes mellitus patients in Ethiopia was 45.37% (95% CI 35.24–55.51) (Figure 2).

Heterogeneity and publication bias

In this systematic review and meta-analysis, the heterogeneity within the studies is high ($I^2 = 98.3\%$, $p < 0.001$). The visual inspection of the funnel plot showing the symmetrical distribution of the included studies and Egger's test was not statistically significant ($p = 0.887$), which suggests the absence of publication bias (Figure 3).

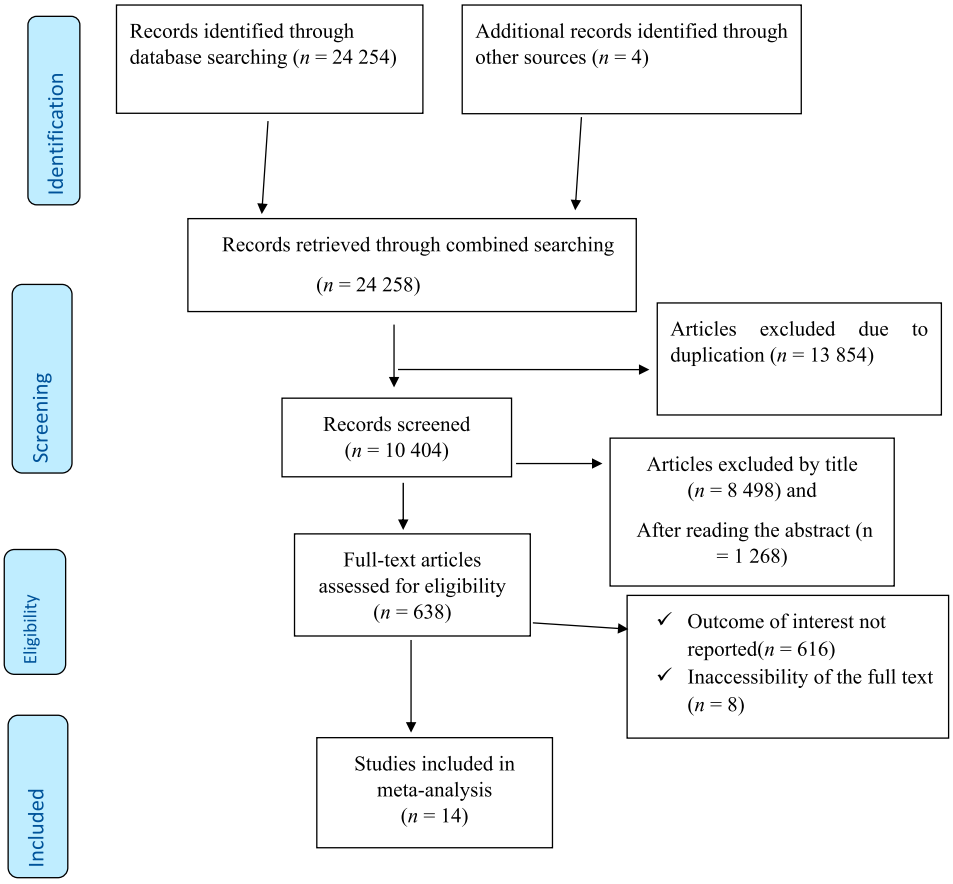

Figure 1: PRISMA flowchart of selection for systematic review and meta-analysis on the prevalence of hyperglycaemic crisis among diabetes mellitus patients in Ethiopia.

Table 2: Characteristics of included studies on burden of hyperglycaemic crisis among diabetes mellitus patients in Ethiopia

Author	Publication year	Region	Study design	Sample size	HGC	Type of HGC		Types of DM		Risk factors (%)				Poor medication adherence	Poor glycaemic control
						DKA	HHS	Type I	Type II	Overweight	Alcohol	Smoking	Poor physical exercise		
Kefale et al.	2016	Oromia	Cross-sectional	89	38.2	33.7	4.5	25.8	74.2						
Getie et al.	2021	Amhara	Case control	408	25.0	25.0		32.6	67.4	39.0	14.5	0.98	62.3	55.9	
Eskezia et al.	2020	SNNP	Cross-sectional	421	38.0	38.0		100.0	0.0						
Abejew et al.	2015	Amhara	Cross-sectional	216	59.7			31.0	69.0					69.4	
Kidie et al.	2022	Amhara	Retrospective follow-up	389	48.3	48.3									39.3
Kidanie et al.	2023	Amhara	Case control	204	33.8			57.8	42.2					12.3	61.8
Gebre et al.	2019	SNNP	Cross-sectional	338	20.4	14.2	6.2	47.3	52.7	10.1		11.54			36.4
Beyene et al.	2021	SNNP	Cross-sectional	422	51.2	46.2	5.0	33.9	66.1		4.3	1.90	61.1	3.8	
Assefa et al.	2020	Amhara	Retrospective follow-up	354	58.5	58.5									
Hadgu et al.	2022	Tigray	Retrospective follow-up	328	78.7	78.7		100.0	0.0						
Negera et al.	2023	Oromia	Cross-sectional	348	25.6	19.5	6.0	19.3	80.7						29.3
G/medhin et al.	2022	Tigray	Retrospective follow-up	589	66.7	45.5	21.2	51.4	48.6						
Abate et al.	2023	Amhara	Retrospective follow-up	453	32.5			30.0	70.0					17.7	47.0
Ahmed et al.	2023	SNNP	Cross-sectional	100	59.0			24.0	76.0					43.0	29.0

HGC: hyperglycaemic crisis.

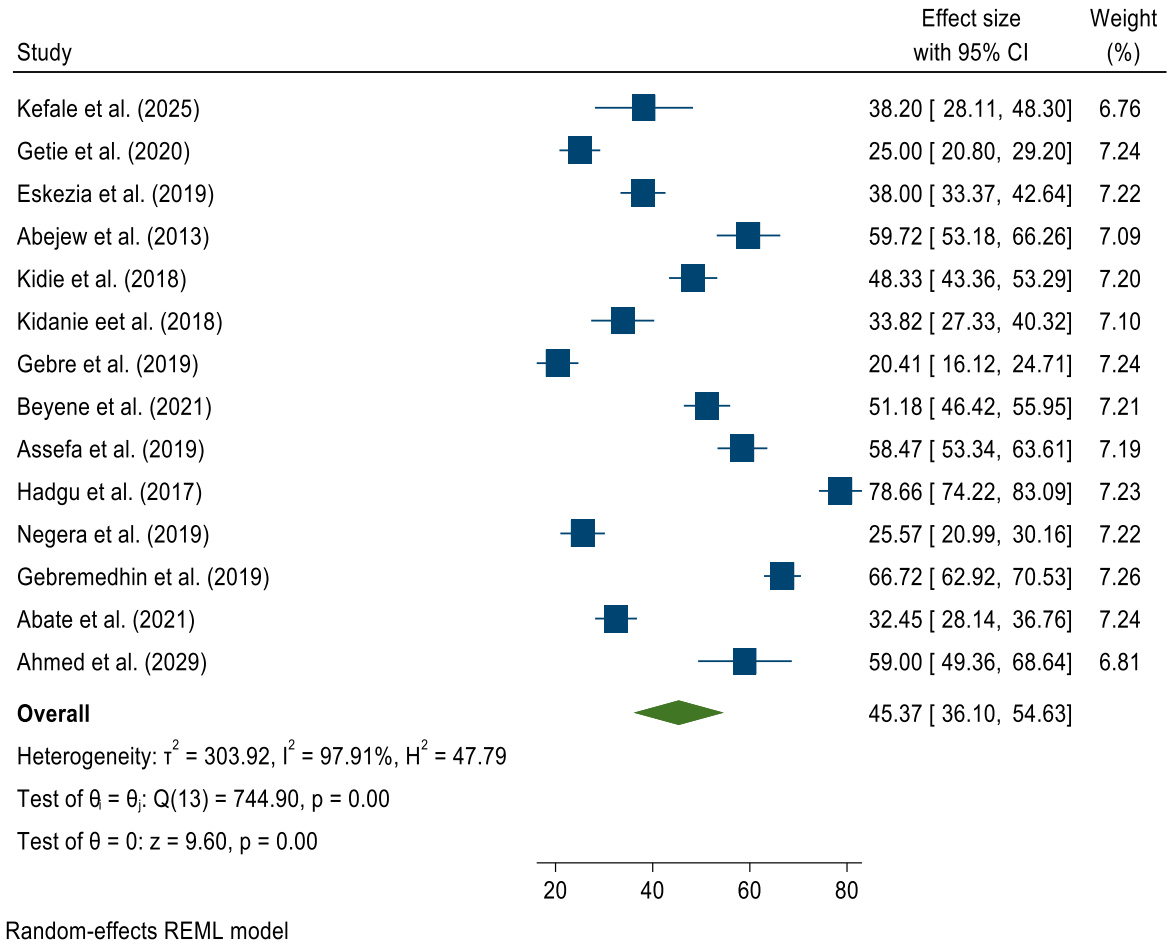

Figure 2: Forest plot of the pooled prevalence of hyperglycaemic crisis among diabetes mellitus patients in Ethiopia.

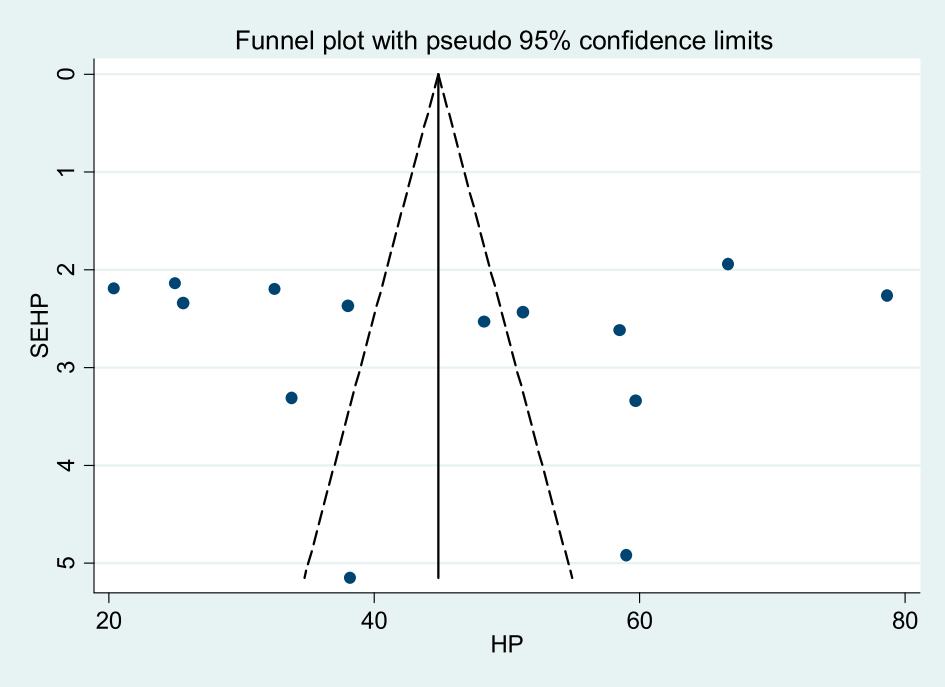

Figure 3: Funnel plot with 95% confidence limits of the pooled prevalence of hyperglycaemic crisis among diabetes mellitus patients in Ethiopia.

Table 3: Sub-group analysis on hyperglycaemic crisis among diabetes mellitus patients in Ethiopia

Variables	Subgroup	Studies (*n*)	Prevalence (95%CI)	I^2 (%)	*p*-value
Region	Amhara	6	46,52 (35.08–57.97)	95.6	< 0.001
	SNNP	4	41.85 (25.80–57.90)	97.3	< 0.001
	Oromia	2	27.81 (22.22–33.39)	65.5	0.055
	Tigray	2	72.64 (60.88–84.40)	93.8	< 0.001
Study year	Before 2020	11	47.90 (35.69–60.12)	98.3	< 0.001
	After 2020	3	36.20 (21.38–51.01)	97.0	< 0.001
Publication year	Before 2020	3	46.99 (35.82–68.16)	98.0	< 0.001
	After 2020	11	39.37(12.76–65.98)	98.0	< 0.001
Sample size	< 350	7	45.03 (25.92–64.14)	98.7	< 0.001
	> 350	7	45.74 (33.98–57.49)	97.9	< 0.001
Study design	Cross-sectional	7	41.52 (29.85–53.18)	96.7	< 0.001
	Retrospective follow-up	5	56.95 (41.02–72.88)	98.4	< 0.001
	Case-control	2	29.04 (20.44–37.63)	79.9	0.026

SNNP: Southern Nation Nationalities and Peoples.

Sub-group analysis

In this review, sub-group analysis was performed using study year, publication year, region where the studies were done, study design, and sample size. Thus, the highest pooled prevalence of hyperglycaemic crisis was reported among studies done in Tigray region at 72.64% (95% CI 60.88–84.40). Similarly, the highest prevalence of hyperglycaemic crisis was reported among studies conducted before 2020 at 47.90% (95% CI 35.69–60.12). Regarding study design, the highest pooled prevalence was reported among studies with a study design of retrospective follow-up at 56.95% (95% CI 41.02–72.88) (Table 3).

Sensitivity analysis

In this systematic review and meta-analysis, a leave one-point sensitivity analysis conducted using the random-effects model suggested that none of the points were estimates outside of the overall 95% confidence interval, confirming that there is no influential study (Table 4).

Table 4: Sensitivity analysis on hyperglycaemic crisis among diabetes mellitus patients in Ethiopia

Study omitted	Publication year	Estimate prevalence	(95% CI)
Kefale et al.	2016	45.90	35.30–56.50
Getie et al.	2021	46.96	36.56–57.36
Eskezia et al.	2020	45.95	34.99–56.91
Abejew et al.	2015	44.28	33.65–54.91
Kidie et al.	2022	45.15	34.20–56.10
Kidanie et al.	2023	46.26	35.56–56.96
Gebre et al.	2019	47.32	37.28–57.35
Beyene et al.	2021	44.92	33.98–55.87
Assefa et al.	2020	44.36	33.64–55.10
Hadgu et al.	2022	42.76	33.69–51.84
Negera et al.	2023	46.91	36.43–57.39
Gebremedhin et al.	2022	43.70	33.59–53.82
Abate et al.	2023	46.38	35.54–57.22
Ahmed et al.	2023	44.38	33.80–54.94
Overall		45.37	35.24–55.51

Proportion of hyperglycaemic crises based on types of diabetes mellitus and risk factors of hyperglycaemic crisis

This systematic review and meta-analysis examined various types of diabetes mellitus, hyperglycaemic crises, and their associated risk factors. It found that hyperglycaemic crises were more prevalent among patients with Type 2 diabetes mellitus at 64.61% (95% CI 56.82–72.39) compared with those with Type 1 diabetes mellitus, who had a prevalence of 35.39% (95% CI 27.61–43.18). Among patients experiencing hyperglycaemic crises, DKA was responsible for 40.77% of cases (95% CI 27.97–53.57), while HHS accounted for only 8.56% (95% CI 3.13–13.98). The most frequently identified risk factor for hyperglycaemic crises was poor glycaemic control, observed in 40.53% of cases (95% CI 31.72–49.34), followed by poor medication adherence, which was noted in 33.55% of cases (95% CI 13.34–53.75) (Table 5).

Discussion

A hyperglycaemic crisis is a metabolic emergency associated with uncontrolled diabetes mellitus that may result in significant morbidity or death. This study aimed to assess the pooled prevalence of hyperglycaemic crisis, types of DM, types of hyperglycaemic crisis, and risk factors of hyperglycaemic crisis among DM patients in Ethiopia. The overall pooled prevalence of hyperglycaemic crisis among diabetes mellitus patients in Ethiopia was 45.37% (95% CI 35.24–55.51). This is much higher than the studies conducted in Colombia (2%),[32] the USA (3.4%),[33] and China (24.5%).[34] This significant discrepancy could be attributed to variations in the study environment, as this research was conducted in Ethiopia, a low-income country with distinct risk factors and ongoing civil conflicts in various regions.

In subgroup analysis, there is a variation in the prevalence of hyperglycaemic crises within the regions. Accordingly, the highest prevalence is reported among studies conducted in the Tigray region, followed by the Amhara region at 72.64% (95% CI 60.88–84.40) and 46.52% (95% CI 35.08–57.97), respectively. This could be attributed to the political instability caused by the civil war in the Tigray region and much of the Amhara region, which disrupted access to medications, follow-up care, and other essential services for diabetic patients. Similarly, the prevalence of hyperglycaemic crisis was higher among studies conducted before 2020 (47.90%, 95% CI 35.69–60.12) than

Table 5: Proportion of hyperglycaemic crises based on type, types of diabetes mellitus, and risk factors of hyperglycaemic crisis among diabetes mellitus patients in Ethiopia

Variables	Variables	Studies (*n*)	Prevalence (95%CI)	I^2 (%)	*p*-value
Type of DM	Type I	12	35.39 (27.61–43.18)	95.5	< 0.001
	Type II	12	64.61 (56.82–72.39)	95.5	< 0.001
Type of HGC	DKA	10	40.77 (27.97–53.57)	98.70	< 0.001
	HHS	5	08.56 (03.13–13.98)	94.80	0.002
Risk factors	Overweight	2	24.50 (03.83–52.82)	99.0	0.090
	Alcohol drinking	2	09.30 (0.67–19.30)	96.2	0.068
	Cigarette smoking	3	04.28 (0.62–07.93)	94.1	0.022
	Poor medication adherence	6	33.55 (13.34–53.75)	99.3	0.001
	Poor glycaemic control	6	40.53 (31.72–49.34)	93.5	< 0.001

after 2020 (36.20%, 95% CI 21.38–51.01). This is due to technological advancements, greater access to services, a well-trained healthcare workforce, and rising public awareness each year, all of which contribute to reducing the burden of diseases. In addition, there is also a variation in the prevalence of hyperglycaemic crises among the study designs. The highest prevalence was reported among studies conducted with a study design of retrospective follow-up (56.95%, 95% CI 41.02–72.88). One possible explanation is that retrospective follow-up studies relied on secondary data and may have included patients diagnosed in earlier years, when technology was less advanced. Nevertheless, there is no notable difference in hyperglycaemic crisis rates across different sample size categories, suggesting that all the studies included had a sufficient and representative sample size.

The results of this study also showed that the prevalence of hyperglycaemic crisis is more common among patients with type 2 DM (64.61%, 95% CI 56.82–72.39) than type 1 DM (35.39%, 95% CI 27.61–43.18). The reason behind this is that patients with type 2 DM are commonly diagnosed at a later stage, after the disease progresses. This result is supported by different studies.[35–37]

Diabetic ketoacidosis was the most common type of hyperglycaemic crisis, accounting for 40.77% (95% CI 27.97–53.57). This is because patients with diabetes mellitus face metabolic disturbance, in which the secretion of insulin is limited and the counterpart hormone (glucagon) is increased, resulting in lipid breakdown, which is supported by the International Textbook of Diabetes Mellitus.[38]

This systematic review and meta-analysis identify several common risk factors for hyperglycaemic crises, including inadequate physical activity, cigarette smoking, alcohol consumption, poor medication adherence, and suboptimal glycaemic control. Among these, poor glycaemic control is the most prevalent risk factor for hyperglycaemic crises in Ethiopia, with poor medication adherence being the next most common factor.

Strengths and limitations of the study

A comprehensive literature review with a clear focus on a specific patient population and condition, the use of robust statistical methods to analysis pooled data, and detailed subgroup analysis to identify sources of heterogeneity and regional differences were the strengths of the study. However, significant heterogeneity among included studies, which might affect the reliability of pooled estimates, limited studies conducted in Ethiopia, which may not be generalisable to other settings, were the limitations of the study. In addition, the presence of potential publication bias and the exclusion of non-English studies were also considered limitations.

Conclusion and recommendations

In Ethiopia, the incidence of hyperglycaemic crises is relatively high, with notable regional differences, particularly with the highest rates reported in the Tigray region. Hyperglycaemic crises are frequently observed among patients with type 2 diabetes, with diabetic ketoacidosis being a common form. Contributing factors include inadequate glycaemic control and poor adherence to medication. To reduce the risk of hyperglycaemic crises, early detection and treatment of diabetes are crucial. Additionally, ongoing follow-up is necessary to ensure adherence to medication and to monitor blood glucose levels. To improve diabetes care in Ethiopia, it is crucial to enhance healthcare infrastructure by increasing the availability of diagnostic tools and medications in both urban and rural areas. Implementing nationwide diabetes education programmes for healthcare providers and the public can raise awareness regarding prevention, early detection, and effective management. Strengthening primary healthcare systems to integrate diabetes care, coupled with regular training for healthcare professionals on the latest diabetes treatment protocols, can ensure better patient outcomes. Additionally, fostering community support groups and leveraging technology for remote monitoring and consultations can further support diabetes patients, ultimately improving the overall quality of diabetes care in Ethiopia.

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