Recovery time of diabetic ketoacidosis in Africa: Systematic review and meta-analysis

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ABSTRACT

Background: Diabetes mellitus is a long-term metabolic disease marked by consistently elevated blood glucose levels. Diabetic ketoacidosis is the medical consequence of diabetes mellitus that has the highest attributed fatality rate. Socioeconomically differences affect how long it takes to recover from diabetic ketoacidosis. A few research were carried out in Africa to demonstrate how long diabetic ketoacidosis takes to recover. However, the pooled median recovery time and predictors of diabetic ketoacidosis have not been studied in Africa. Thus, determine the pooled median recovery time and predictors of diabetic ketoacidosis in Africa was the aim of this systematic review and meta-analysis.

Methods: To find available publications, a number of databases were analyzed, including PubMed, Science Direct, Cochrane, Hinari, Google Scholar, grey literature, and articles from various university repository sites. Microsoft Excel version 13 was used to extract and sort the data before exporting it to STATA/MP 17.0 for analysis. The quality of each study was evaluated using the Newcastle-Ottawa Scale. A 95 percent confidence interval Der Simonian random-effects model was employed to investigate the pooled recovery time of diabetic ketoacidosis. Publication bias and heterogeneity were assessed using the Egger's test and I^2. Both meta-regression and subgroup analysis were used to determine the potential source of heterogeneity. Statistical significance was defined as P-values below 0.05.

Result: The pooled median recovery time for diabetic ketoacidosis in Africa was 38 h (95 percent CI: 33–43 h), according to this comprehensive review and meta-analysis. Significant heterogeneity is evident when looking at the Galbraith plot with I2 = 100 % (p < 0.001). Research conducted after 2020 revealed that diabetic ketoacidosis has a long recovery time of 40 h (95 percent CI: 3–77 h). However, research with fewer than 300 participants showed that diabetic ketoacidosis recovered more quickly: 18 h (95 percent confidence interval: 12–24 h).

Conclusion: Among patients with diabetic ketoacidosis in Africa, the pooled median recovery time was lengthy. The recovery time from diabetic ketoacidosis was influenced by a number of factors, including the severity of the diabetic ketoacidosis, the delay in starting therapy, and the length of time the patient had diabetes mellitus, and elevated blood glucose levels. Diabetic ketoacidosis recovery time can be shortened by altering these factors.

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1. Introduction

A chronic metabolic condition characterized by persistently high blood glucose levels is diabetes mellitus (DM) [1]. This occurs because of the body's inability to produce enough insulin, the cells' poor reaction to the insulin that is produced, or sometimes both [1,2]. A higher risk of stroke, cardiovascular disease, kidney failure, eyesight loss, nerve damage (neuropathy), foot ulcer, and other major long-term issues might result from diabetes mellitus effects on blood vessels, especially the body's large and small blood vessels. And it can also result in a number of short-term consequences, such as diabetic ketoacidosis, hyperosmolar hyperglycemia, and hypoglycemia [1,3].

Diabetic ketoacidosis is a serious and potentially fatal complication of diabetes that primarily affects people with type 1 diabetes, while people with type 2 diabetes can also get it infrequently [4]. It arises when the body breaks down fat for energy instead of using glucose because it lacks enough insulin [4,5]. This process releases acidic molecules into the bloodstream known as ketones, which can accumulate and cause acidosis and other catastrophic health problems [6,7].

The medical consequence of diabetes mellitus with the greatest attributable death rate is diabetic ketoacidosis [8]. Among individuals with diabetes mellitus, the incidence of diabetic ketoacidosis was 263 per 1000 person-years worldwide [9]. Diabetic ketoacidosis death rates vary according on the severity of the illness [10]. In people aged 20 years or older, the mean in-hospital mortality rate is 3.9 % [11]. The death rate may be much greater in extreme problems, particularly those involving coma [12]. In general, based on several factors, diabetic ketoacidosis death rates can range from 1.2 % to higher percentages [13, 14].

The effective treatment of diabetic ketoacidosis requires timely diagnosis, comprehensive clinical and biochemical evaluation, and effective care [15]. When blood glucose is less than 200 mg/dL and the following criteria are satisfied, diabetic ketoacidosis is recovered: serum bicarbonate level $\geq$15 mEq/L, venous pH > 7.3, blood ketones <0.6 mmol/L, and estimated anion gap $\leq$ of 12 mEq/L [15,16]. Previous studies showed that using standardized protocol for diabetic ketoacidosis management improves diabetic ketoacidosis recovery [16]. Patients with diabetic ketoacidosis should recover completely in a day if they receive the right care. Prolonged recovery from diabetic ketoacidosis can lead to thromboembolic problems, death, cerebral oedema, cardiac arrhythmia, renal failure, coma, lung oedema with respiratory failure, hypoglycemia and hypokalaemia, and thromboembolic complications [17].

Timely detection and treatment of diabetic ketoacidosis lowers the risk of thromboembolic effects, metabolic acidosis, hypophosphatemia, cardiac arrhythmia, hyperchloremia, renal failure, and coma in addition to reducing hypoglycemia and hypokalaemia. Consequently, hospital bed occupancy, length of stay, and the amount of material and human resources needed to manage illness and its complications are all reduced [18,19].

Different studies showed that duration of diabetic ketoacidosis, the duration of diabetes mellitus, comorbidities, the severity of diabetic ketoacidosis, and biochemical markers like blood glucose, serum creatinine, and serum electrolytes all influence how long it takes to recover from diabetic ketoacidosis [19]. With appropriate management patients with diabetic ketoacidosis may recover in 10–36 h depending on its severity [20]. To improve recovery and lower mortality, several nations have adopted or established diabetic ketoacidosis treatment standards, diabetic self-management, education, and other preventative strategies [20].

Different studies conducted in different country showed that regional variation on median recovery time of diabetic ketoacidosis [21,22]. The recovery time for diabetic ketoacidosis varies by geography, according to studies done in different countries [18,21,22]. Africa carried out a few studies to show how long diabetic ketoacidosis takes to recover. Nevertheless, no study on the pooled median recovery and predictors of

diabetic ketoacidosis have been conducted in Africa. Therefore, the findings of this systematic review and meta-analysis provide a comprehensive picture of data about diabetic ketoacidosis recovery time at the African level by examining the available single studies conducted in different regions of the continent. Thus, the aim of this systematic review and meta-analysis was to determine the pooled median recovery time and predictors of diabetic ketoacidosis in Africa.

2. Methods

2.1. Study design

Systematic review and meta-analysis.

2.2. Study setting

The major studies included in this systematic review and meta-analysis were carried out among hospitalized diabetic ketoacidosis patients in Africa (South Africa, Kenya, Egypt, and Ethiopia). Because there was so little research's on the recovery time of diabetic ketoacidosis, only five articles were included in this systematic review and meta-analysis.

2.3. Population

All age group of patients with diabetic ketoacidosis.

2.4. Condition

The median recovery time and predictors of diabetic ketoacidosis.

2.5. Outcomes

The primary outcome of this study was pooled median recovery time of diabetic ketoacidosis and the secondary outcome was predictors of recovery time of diabetic ketoacidosis.

2.6. Reporting and registration protocol

The pooled median recovery time and predictors of diabetic ketoacidosis among individuals with diabetes mellitus were estimated by a systematic review and meta-analysis. The PROSPERO database (CRD42025630344) has the protocol for this manuscript registered. According to the Preferred Reporting Items for Systematic Review and Meta-analysis (PRISMA-2020) reporting guideline (S-F1), the results of this systematic review and meta-analysis were reported.

2.7. Databases and search strategies

Many databases were assessed, such as PubMed, Science direct, Hinari, Cochrane, Google Scholar, grey literature, and both published and unpublished articles from different repository sites. The authors searched the relevant articles conducted on recovery time of diabetic ketoacidosis from January 1st, 2015 to December last, 2024. The references of the articles retrieved were also searched to avoid missing any article from different sources. Boolean operators AND combine the keywords Recovery, Time, Diabetic ketoacidosis. The searching term "((Recovery) AND (Time)) AND (Diabetic Ketoacidosis)" were applied on different databases to search articles (S-F2).

2.8. Screening and eligibility of the studies

The "EndNote reference software version 8 citation manager' was used to export all of the articles in order to clean, organize, and eliminate any potential duplications. Each paper was independently examined and assessed by six authors (TL, AS, TK, SB, YA, and TKW) using

predefined inclusion criteria based on its title, abstract and relevance. After that, each author (TL, AS, TK, SB, YA, JC, BA, MT, DM, TKW, BM, and DHT) carefully assessed each article's eligibility (inclusion & exclusion). Research on the recovery time of diabetic ketoacidosis in Africa, undertaken between January 1, 2015, and December 30, 2024, was included in both published and unpublished works. Using the Newcastle-Ottawa Scale (NOS) assessment tool (S-F3), all studies were evaluated. Therefore, the study comprised studies that had a true evaluation of outcome, a valid statistical test, exposure ascertainment, and a limited non-response rate. Interventional studies, trials, meta-analyses and systematic reviews, qualitative research, narrative reviews, full-text articles, case reports, and policy comments were not included, though. Moreover, low-quality studies were eliminated from the final analysis following the NOS assessment, which evaluated each study's characteristics. During the process, the authors discussed and resolved any disagreements that came up.

2.9. Data extraction

The data was extracted using a Microsoft Excel-2013 spreadsheet and then the data checked for its completeness and consistence before exported to STATA for analysis. The following information was extracted: the last name of the first author, study year, sample size, study nation, study design, sample size, median recovery time of diabetic ketoacidosis, hazards ratio (HR) with 95 % CI, success, failure, and NOS scale (Table 2). After individually extracting the data and cross-checking it for inconsistencies, the six authors (JC, BA, MT, DM, BM, and DHT) discussed and resolved the data.

2.10. Outcome measurement

Recovery time for patients with diabetic ketoacidosis was the outcome variable in this extensive systematic review and meta-analysis. A patient is diagnosed with diabetic ketoacidosis if their blood glucose level is more than 250 mg/dL, their pH is below 7.35, and they have moderate ketonemia (>3 mmol) or a positive urine ketone test result. Diabetic ketoacidosis recovery time is the number of hours that pass between the initial vascular filling used to treat diabetic ketoacidosis in the intensive care unit or emergency room and diabetic ketoacidosis recovery.

2.11. Operational definition

Diabetic ketoacidosis: is an acute life-threatening complication of diabetes mellitus characterized by the triad of hyperglycemia, acidosis, and ketone body in urine analysis that occurs in the presence of very low levels of insulin action [23,24].

2.12. Quality assessment

The results are taken from the extraction sheet by five authors (TL, AS, TK, SB, and YA), and they have been confirmed by the remaining five authors (JC, BA, MT, DM, and DH). Statistical testing, assessment of exposure or risks, comparability, methodological quality, sample representativeness, and statistical testing were the criteria used to assess each study's quality using the Newcastle-Ottawa Scale (NOS). In the final analysis, studies with a score of at least seven or more were considered to be included (Table 2). To decide which research should be considered and included in the analysis, each author conducted their own independent evaluation of the available studies.

2.13. Data processing and analysis

Before being exported to STATA/MP 17.0 for analysis, the data were extracted, sorted, and cleaned in a Microsoft Excel spreadsheet. The pooled median recovery time and CI were estimated using a DerSimonian–Laird random-effects model at a 95 % CI. The predictors of diabetic ketoacidosis among patients in Africa were estimated using a DerSimonian–Laird random-effects model and an inverse-variance fixed model at a 95 % confidence interval (CI). The graphical Galbraith plot and the statistical I^2 with its associated p-value were used to evaluate the studies' heterogeneity. A sensitivity analysis was also conducted to examine the potential for an influential study. Additionally, Egger's test (a statistical technique) and a funnel plot (a graphical tool) were utilized for publication bias.

3. Result

3.1. Selection of articles

Following several database searches, 1379 articles were discovered. The existence of duplication led to the exclusion of 1077 of these articles. After critically assessing each article's abstract and title, 241 papers were also eliminated from the analysis. 53 studies were also disqualified because they did not meet the inclusion criteria and were considered irrelevant. The inability to obtain the complete text of three articles led to their removal as well. After that, the final analysis included five papers (Fig. 1).

3.2. Characteristics of the studies and study participants

In this systematic review and meta-analysis, five articles with 1103 study participants were included. The studies were conducted in different country of Africa from January/1/2015 until December 30/2024. Of these studies, two were conducted before 2020 and three were done after 2020. Two studies were carried out in Ethiopia [18,25], one conducted in Kenya [26], one done in South Africa [21] and one conducted in Egypt [22]. The sample size ranged from 42 to 452. In design, all studies were retrospective follow up (Table 1).

3.3. Meta-analysis

3.3.1. Pooled median recovery time of diabetic ketoacidosis

This systematic review and meta-analysis showed that, the pooled median recovery time of diabetic ketoacidosis among patient with diabetic ketoacidosis in Africa was 38 h (95 % CI: 33–43 h) (Figure-2).

3.4. Heterogeneity

Visual examination of the Galbraith plot reveals the presence of significant heterogeneity (I^2 100 %, p < 0.001) (Figure-3).

3.5. Subgroup analysis

To identify the source of heterogeneity, sub-group analysis was carried out using the study year, sample size, published and unpublished articles, and the nation where the studies were conducted. According to studies done in Ethiopia, diabetic ketoacidosis patients needed 48 h to recover (95 % CI: 1–95 h). Unpublished studies showed that the recovery period from diabetic ketoacidosis was 52 h (95 % CI 30–73 h). Similarly, studies published after 2020 revealed that diabetic ketoacidosis had a lengthy recovery time of 40 h (95 percent CI: 3–77 h). Research with fewer than 300 participants showed that diabetic ketoacidosis recovered more quickly, taking 18 h (95 percent CI: 12–24 h) (Table 2).

3.6. Publication bias

The asymmetrical distribution of the included papers was evident in the funnel plot, which further demonstrated the likelihood of publication bias. The Egger's test yielded a statistically significant result (p < 0.001). A trim and fill analysis was conducted in order to control for
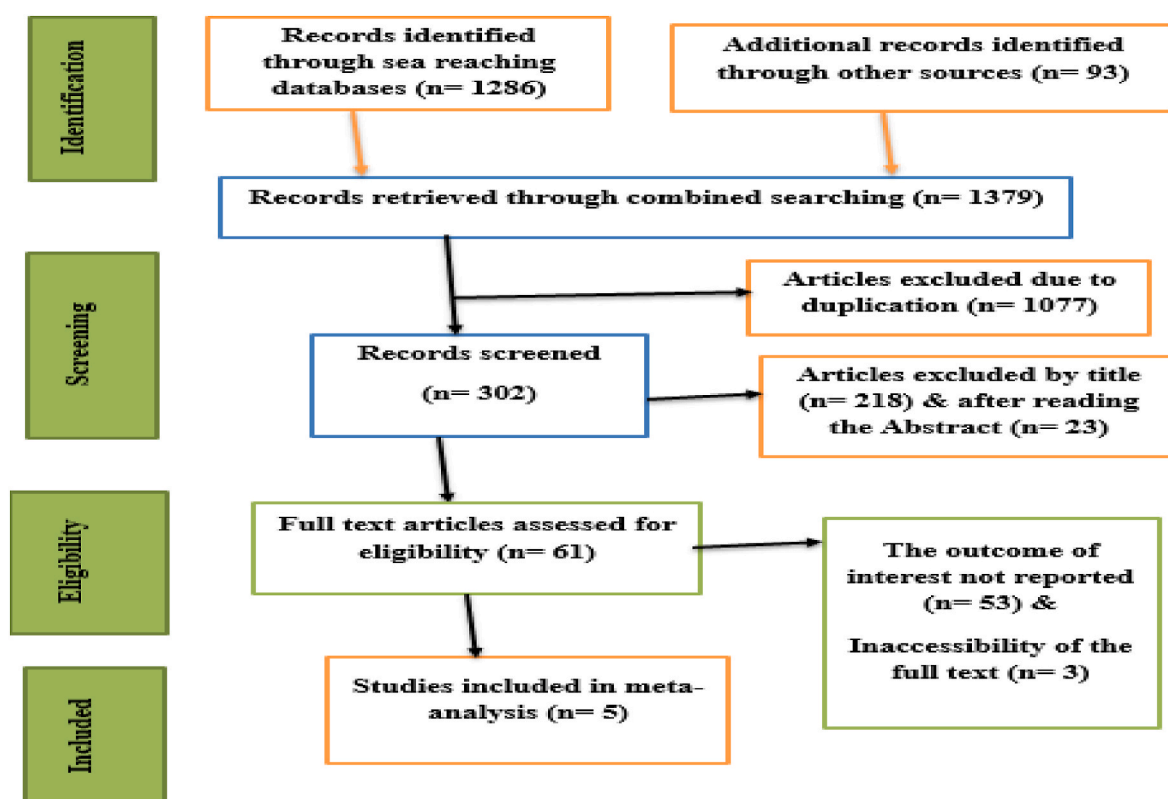
Fig. 1. PRISMA flow chart of selection of articles for systematic review and meta-analysis of recovery time of diabetic ketoacidosis in Africa.

Table 1
Characteristics of included studies on recovery time of diabetic ketoacidosis in the Africa.

Author	Study year	Country	Study design	Sample size	Median recovery time of DKA	NOS
Temesgen et al.	2022	Ethiopia	Retrospective follow up	452	24	7
Tefera et al.	2023	Ethiopia	Retrospective follow up	391	72	7
Kerubo et al.	2018	Kenya	Prospective follow up	42	59	6
Sabry et al.	2024	Egypt	Retrospective follow up	150	15	8
Thomas et al.	2019	South Africa	Prospective follow up	68	21	7

Table 2
Sub-group analysis on the pooled recovery time of diabetic ketoacidosis in the Africa.

Variables	Subgroup	Studies (n)	Median recovery time of DKA	I2 in percent	P - value
Country	Ethiopia	2	48	99	<0.001
	Other African country	3	32	100	<0.001
Study year	Before 2020	2	37	99	<0.001
	After 2020	3	40	100	<0.001
Sample size	More than 300	3	52	100	<0.001
	Less than 300	2	18	99	<0.001
Researches	Published	3	52	99	<0.001
	Unpublished	2	18	100	<0.001

publication bias. Following trim and fill analysis, the bias-adjusted median recovery time for diabetic ketoacidosis was 38 h (95 % CI: 33–43 h). No different result was found by trim and fill analysis, this showed that the publication bias didn't influence the result (median recovery time of diabetic ketoacidosis).

3.7. Meta regression

We computed a meta-regression analysis to detect the possible source of heterogeneity. Accordingly, meta-regression using the moderator like country where the studies were done, published and unpublished article, sample size and study year was done. The result of this meta-regression showed that the country where study conducted had a coefficient of −16.30, a standard error of 4.68, and p-value of 0.001. The publication of the research had the coefficient of −33.90, standard error of 3.95, and the p-value of 0.001. Study year had a co-efficient of 3.02, a standard error of 24.61, and a P value of 0.902. The sample size had the coefficient of 33.91, standard error of 3.95, and p value of 0.001. Therefore, country, publication status and sample size were the sources of publication bias, because of their each p-value was 0.05.

3.8. Sensitivity analysis

A leave-one-point sensitivity analysis conducted using the random-effects model revealed that all of the points were estimates near to the overall 95 % confidence interval (33–43), indicating there was no exaggerated influential study (Figure-4).
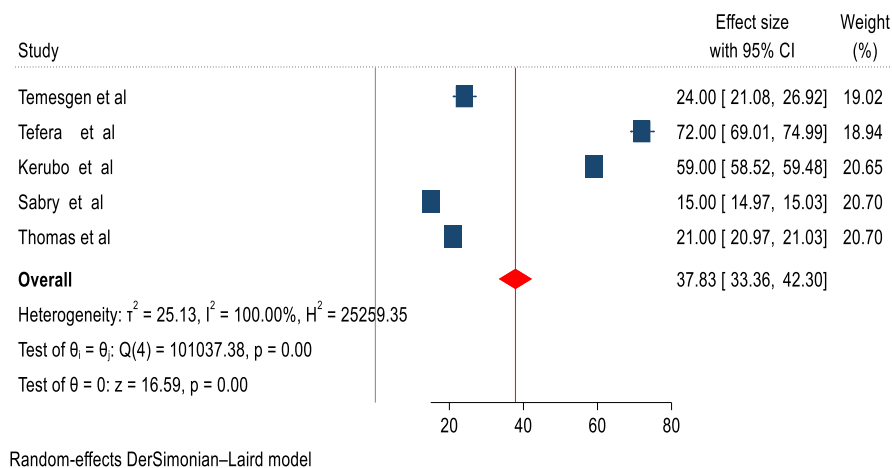
Study		Effect size with 95% CI	Weight (%)
Temesgen et al		24.00 [21.08, 26.92]	19.02
Tefera et al		72.00 [69.01, 74.99]	18.94
Kerubo et al		59.00 [58.52, 59.48]	20.65
Sabry et al		15.00 [14.97, 15.03]	20.70
Thomas et al		21.00 [20.97, 21.03]	20.70
Overall		37.83 [33.36, 42.30]	

Heterogeneity: $\tau^2 = 25.13$, $I^2 = 100.00\%$, $H^2 = 25259.35$

Test of $\theta_i = \theta_j$: Q(4) = 101037.38, p = 0.00

Test of $\theta = 0$: z = 16.59, p = 0.00

Random-effects DerSimonian–Laird model

Fig. 2. Forest plot showing the pooled median recovery time of diabetic ketoacidosis in Africa.
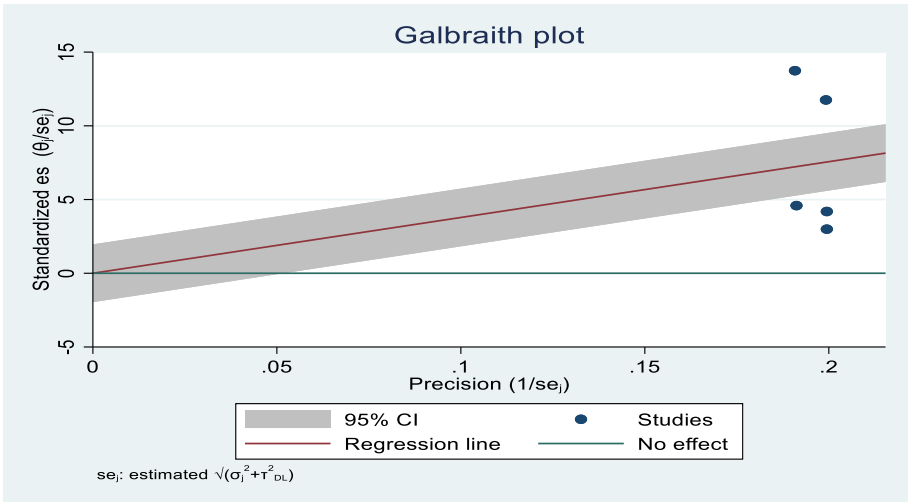
Fig. 3. Galbraith plot showing heterogeneity of median recovery time of diabetic ketoacidosis in Africa.
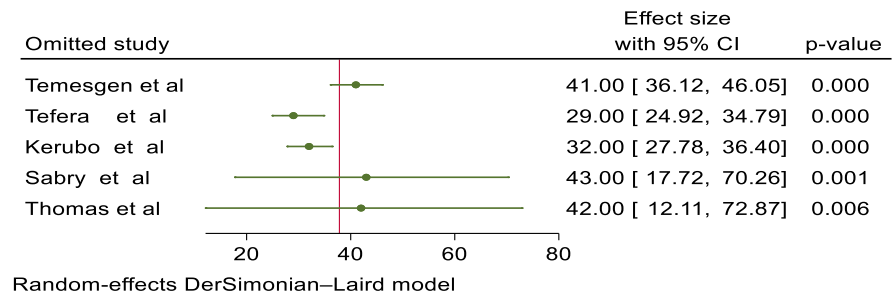
Omitted study		Effect size with 95% CI	p-value
Temesgen et al		41.00 [36.12, 46.05]	0.000
Tefera et al		29.00 [24.92, 34.79]	0.000
Kerubo et al		32.00 [27.78, 36.40]	0.000
Sabry et al		43.00 [17.72, 70.26]	0.001
Thomas et al		42.00 [12.11, 72.87]	0.006

Random-effects DerSimonian–Laird model

Fig. 4. Sensitivity analysis results of median recovery time of diabetic ketoacidosis.

3.9. Predictors of recovery time of diabetic ketoacidosis

Patients with severe diabetic ketoacidosis recovered from their condition 74 % more slowly than those with mild ketoacidosis (PHR = 0.26, 95 % CI: 0.17–0.35). Compared to patients who stayed with diabetic ketoacidosis for less than 24 h before receiving treatment, those who stayed with the condition for more than 24 h had a 44 % shorter recovery time from the diabetic ketoacidosis (PHR = 0.56, 95 % CI: 0.33–0.80).

The recovery time from diabetic ketoacidosis was 37 % longer for patients with high random blood sugar levels (>500 mg/dl) than for those with low random blood sugar levels (≤500 mg/dl) (PHR = 0.63, 95 % CI 0.51–0.76). Patients with diabetic ketoacidosis who had diabetes mellitus for more than five years experienced a 56 % longer recovery period from their condition than those who had diabetes mellitus for five years or less (PHR = 0.48, 95 % CI: 0.33–0.64). Two primary studies with 843 patients with diabetic ketoacidosis were included in this area of factor analysis (Table 3).

Table 3
Predictors associated with recovery time of diabetic ketoacidosis.

Predictors	Number of studies	Sample size	AHR (95 % CI)	P-value	I² (%)	Heterogeneity test (p-value)	Egger test (p-value)	Model used
Severity of DKA	Two	843	0.26 (0.17–0.35)	<0.001	42.54 %	0.19	0.19	Fixed model
Duration of DKA before starting of treatment	Two	843	0.56 (0.33–0.80)	<0.001	64.19 %	0.09	0.54	Random model
High random blood sugar level (>500 mg/dl)	Two	843	0.63 (0.51–0.76)	<0.001	0 %	0.85	0.85	Fixed Model
Duration of DM	Two	843	0.48 (0.33–0.64)	<0.001	66 %	0.08	0.10	Random model

4. Discussion

Although this meta-analysis provides useful information about the recovery period from diabetic ketoacidosis in the populations under study, it is constrained by the small sample size (n = 5 studies) and the fact that only data from Ethiopia, Kenya, Egypt, and South Africa were included. As a result, the results might not accurately reflect the wide range of socioeconomic circumstances, healthcare options, and diabetes prevalence found throughout the African continent. Extrapolating our findings across the continent is difficult because of the considerable variation in medical resources, economic stability, cultural practices, and diabetes incidence throughout Africa. Recovery times and diabetes treatment are probably impacted by these various factors [27,28].

Therefore, it is important to recognize that the results of this meta-analysis are most directly applicable to environments that have similar features with the nations that were included. These include areas with comparable access to diabetes education, insulin and other drug availability, dietary trends, and socioeconomic factors that impact access to healthcare. We strongly advise against extending these findings to other African nations without properly taking the local circumstances into account. To increase the generalizability and comprehensiveness of the body of data, future research should place a high priority on broadening the geographic reach of diabetic ketoacidosis recovery studies in Africa through partnerships and primary research in under-represented areas.

This meta-analysis's biggest drawback is the high level of heterogeneity seen in all of the studies included (I2 = 100 %, p < 0.001). A significant amount of the variability cannot be explained, even with our best efforts to find causes of heterogeneity using subgroup analysis and meta-regression on variables including study year, sample size, publication status, and research country. Our pooled effect estimate interpreted carefully due to this ongoing heterogeneity.

The pooled median recovery time for diabetic ketoacidosis patients in Africa was 38 h (95 percent CI: 33–43 h), according to this systematic review and meta-analysis. According to this pooled median recovery time of diabetic ketoacidosis data, the recovery time from diabetic ketosis was longer than the 24-h suggested recovery period. According to international medical guidelines, people with diabetic ketoacidosis diabetic ketoacidosis should recover in about 24 h with the right intervention. This implies that within a day after beginning treatment, the majority of patients should notice a noticeable improvement in their ketone and blood sugar levels [15].

The results of this research are nearly in agreement with those of a South African study that was part of this systematic review and meta-analysis [21]. When compared to research done in Thailand [29] and Australia [30], the results lasted longer. Conversely, it is quicker than a Kenyan research [31]. Since studies indicate that insulin pump therapy has a better clinical outcome than injectable therapy, the variation in the conventional treatment regimen may be the explanation of this differences [32,33]. Low socioeconomic difference could also be the cause, as low educational attainment raises the risk of severe diabetic ketoacidosis, which requires a longer recovery period [33,34].

Patient with sever diabetic ketoacidosis had delayed recovery time of diabetic ketoacidosis than patient with mild diabetic ketoacidosis. The recovery time from severe diabetic ketoacidosis is considerably longer than that of mild or moderate diabetic ketoacidosis [34]. This is because the metabolic imbalance and associated consequences are more severe in those with severe diabetic ketoacidosis. Bicarbonate, blood pH, and blood glucose levels are frequently used to gauge the severity of diabetic ketoacidosis; lower bicarbonate and pH values indicate more severe acidosis, which prolongs recovery [22,34].

The recovery time from diabetic ketoacidosis was longer for patients who stayed with the condition for longer (>24 h) before starting treatment than for those who stayed for shorter (<24 h) before starting treatment. Chronic metabolic abnormalities such as severe dehydration, electrolyte imbalances, and acidosis, which become more ingrained the longer diabetic ketoacidosis persists, can account for this delay [35]. Evidences showed that patients with diabetic ketoacidosis durations longer than 97 h recovered much more slowly than those with shorter durations, and prompt treatment is essential to improving recovery outcomes [16,22].

Patients with diabetic ketoacidosis who had high random blood sugar levels (>500 mg/dl) recovered from their condition more slowly than those who had low random blood sugar levels. Because high glucose concentrations cause greater osmotic diuresis, which leads to more severe electrolyte imbalances and dehydration that take longer to correct with treatment, patients with diabetic ketoacidosis who have a high random blood sugar level (>500 mg/dL) would generally recover more slowly than those with lower blood sugar levels [16]. Therefore, a diabetic ketoacidosis patient with a very high random blood sugar level would need more intensive fluid resuscitation and electrolyte replacement, potentially extending their recovery time compared to a patient with a lower blood sugar level [4,14].

Patients with diabetes mellitus who had been in diabetic ketoacidosis for more than five years recovered from the condition more slowly than those who had been in diabetic ketoacidosis for five years or less. Diabetic ketoacidosis usually takes longer to recover from in patients with diabetes mellitus who have had the condition for more than five years than in those who have had it for less than five years. The reason for this is that long-term diabetes can lead to consequences including increased insulin resistance and advanced vascular damage, which make it harder for the body to regulate blood sugar and reverse the metabolic acidosis associated with diabetic ketoacidosis [36]. In order to recover from diabetic ketoacidosis, a patient with a longer history of diabetes could need more intense therapy and lengthier hospital stays than a patient with a shorter history [36,37].

4.1. Strength and limitation of the study

A comprehensive review of the literature that is specifically focused on a particular condition, the analysis of pooled data using reliable statistical techniques, and a thorough subgroup analysis to pinpoint the sources of heterogeneity.

The reliability of pooled estimates and this research conclusion may be impacted by the notable heterogeneity across included studies, and the small number of studies carried out in Africa may make them non-generalizable. Another constraint that was taken into consideration was the possibility of publishing bias.

5. Conclusion and Recommendation

This pooled median recovery time of diabetic ketoacidosis result showed that the recovery time of diabetic ketosis was prolonged as compared to the recommended one, which was 24 h. International medical guidelines state that with appropriate therapy, diabetic ketoacidosis should be recovered in around 24 h. The pronged median recovery time of diabetic ketoacidosis was reported in Ethiopia, while the fastest recovery time of diabetic ketoacidosis was reported in Egypt. As a result, early treatment and control of high blood sugar are advisable to faster the recovery time of diabetic ketoacidosis.

CRediT authorship contribution statement

Tadios Lidetu: Writing – review & editing, Software, Formal analysis, Data curation, Conceptualization. **Simon Birhanu:** Writing – review & editing, Conceptualization. **Addisu Simachew Asgai:** Writing – review & editing. **Tsegaamlak Kumelachew Derse:** Methodology. **Yideg Abinew:** Conceptualization. **Moges Tadesse:** Methodology. **Desalegn Mitiku:** Conceptualization. **Jemberu Chane:** Formal analysis, Conceptualization. **Banchamilak Adane:** Validation, Software. **Tadele Kassahun Wudu:** Validation, Software, Conceptualization. **Betelhem Mekonnen:** Data curation, Conceptualization. **Desiyalew Habtamu Tamiru:** Methodology, Data curation.

Ethical issues

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Human ethics and consent to participate declarations

Not applicable.

Clinical trial number declarations

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Consent for publication

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Competing interest

The authors declare that there are no competing interests.

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ABBREVIATIONS

CI	Confidence Interval
DKA	Diabetic Keto-Acidosis
DM	Diabetes Millitus
NOS	Newcastle-Ottawa Scale
PHR	Pooled Hazards Ratio

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