ScieniQ Publishers

Japan Journal of Medical Science

Research Article

ANTIDIABETIC EFFICACY AND *IN SILICO* SAFETY EVALUATION OF *Aloe ferox* HERBAL

Jimoh, A. S.[1], Johnson, J.T. [2]*

Department of Biochemistry, Federal University Otuoke, Bayelsa State, Nigeria

Corresponding author
Johnson, J.T. Department of Biochemistry, Federal University Otuoke, Bayelsa State, Nigeria

Received: 03 September 2025
Accepted : 15 September 2025
Published: 25 October 2025

Abstract

Diabetes mellitus is a multifactorial metabolic disorder characterized by chronic hyperglycemia, oxidative stress, and inflammatory cytokine dysregulation. *Aloe ferox*, rich in anthraquinones, flavonoids, and phenolic compounds, has been traditionally used for glycemic control, yet its toxicological profile remain underexplored. This study evaluated the biochemical efficacy and *in silico* pharmacological and toxicity potential of *Aloe ferox* as an anti-diabetic agent. Drug-likeness, and toxicity profiles were assessed computationally. In vivo, streptozotocin-induced diabetic rats were administered *A. ferox* and key biochemical markers were analyzed, including Fasting Blood Sugar (FBS), kidney injury molecule-1 (KIM-1), Cystatin-C (CYS-C), Urea, Creatinine, and serum electrolytes (sodium, potassium and biocarbonate). Favorable pharmacokinetic profiles, adhering to Lipinski's and Veber's rules. ADMET predictions indicated high gastrointestinal absorption, with moderate toxicity risks. From in vivio studies, *A. ferox* administration significantly reduced FBS ($p<0.05$), KIM-1, and Cystatin-C levels, while improving renal function markers and electrolyte balance compared to diabetic controls. The study demonstrates that *A. ferox* phytochemicals exhibit potent anti-diabetic and nephroprotective activities, supported by favorable *in silico* drug-likeness and safety profiles. These findings substantiate *Aloe ferox* as a promising candidate for adjunctive diabetes therapy, warranting further mechanistic and clinical investigations. It is worthy of note however that while Aloe forex may exhibit anti-diabetic efficacy, some moderate organ toxicity and genotoxic effects may still be possible. These findings call for further focused computational studies and formulation development in order to make *Aloe ferox* much safer as an effective and natural adjunct in diabetes management.

Key words: Antidiabetic, In-Silico, Safety, *Aloe ferox*

Introduction

Diabetes mellitus is a chronic metabolic disorder characterized by sustained elevated blood glucose levels over time resulting from defects in insulin secretion, insulin action, or both. It is a complex condition with significant implications for public health and individual well-being [1]. Type 1, type 2 diabetes, and gestational (pregnancy-induced) diabetes mellitus are among the several forms of the disease. While type 1 is an autoimmune condition that occurs when the body's immune system targets and kills the pancreatic cells that produce insulin (a damaging process that can last for years and eventually results in the loss of insulin secretion [2,3], insulin resistance, relative insulin insufficiency, and insulin insensitivity are the hallmarks of type 2 diabetes. Gestational diabetes, often goes away after birth but raises the chance of type 2 diabetes in the future [3].Type 1 diabetes mellitus, formerly known as insulin-dependent diabetes mellitus (IDDM) or juvenile-onset diabetes mellitus, makes up 5–10% of all cases of diabetes mellitus and typically affects children or young adults.

The prevalence of type 2 diabetes mellitus is rising, particularly among minority groups, and now account up to 90% to 95% of all diabetes cases. Among the recognized environmental influences include aging, obesity, and a sedentary lifestyle. Globally, the prevalence of diabetes mellitus has been rising gradually. About 463 million persons (20–79 years old) worldwide had diabetes in 2019, and by 2045, the figure is expected to increase to 700 million, according to the International Diabetes Federation (IDF) [4]. Numerous complications, such as cardiovascular disease, kidney disease, eye issues, nerve damage, and lower limb amputations, can result from uncontrolled diabetes [5]. Diabetes is managed by combining pharmacological treatments, such as insulin and oral drugs, with lifestyle changes as well as frequent exercise, and weight control [6].The increasing prevalence of diabetes mellitus, particularly type 2diabetes (T2DM), presents a significant public health challenge in Nigeria and across Africa. Nigeria currently has the highest incidence of diabetes in sub-Saharan Africa; with estimates indicating about 4.3% of the population is affected, translating to approximately 4.7 million individuals suffering from this chronic condition [7]. Herbal medicines have gained significant attention as complementary therapies for diabetes due to their bioactive compounds, which may offer multi-target effects, fewer side effects, and cost-effectiveness [8]. Therefore, bioactive compounds from *Aloe ferox*herbal drink could be used to uncover new potential inhibitors of key diabetic related proteins through *in silico* evaluation.

Aloe ferox plant is primarily cultivated in the Western Cape of South Africa. *Aloe ferox* herbal drink is officially registered with the National Agency for Food and Drug Administration and Control (NAFDAC) in Nigeria (registration number A7-2720L). This drink has gained attention for its claim potential anti-diabetic effects, prompting research into its biochemical properties and efficacy against diabetes-related protein targets [9]. The

herbal drink is claimed to enhance health, boost the immune system, and manage various conditions, including diabetes, arthritis, gout, and hypertension [10]. Recent studies have indicated that *Aloe ferox* herbal drink may have beneficial effects on managing diabetes mellitus. In a study involving diabetic Wistar rats, treatment with *Aloe ferox* herbal drink significantly reduced serum levels of biomarkers associated with kidney function and inflammation, such as creatinine, Hemoglobin A1c (HbA1c), and Kidney Injury Molecule 1 (KIM-1). These results suggest potential anti-hyperglycemic and anti-inflammatory properties of *Aloe ferox* herbal drink [10]. The drink is believed to contain high levels of antioxidants, vitamins, and minerals that support overall health and may help regulate blood sugar levels without known side effects, making it a safer alternative to conventional diabetes medications [10].

In silico analysis involves computational approaches to predict the interaction of bioactive compounds with specific molecular targets associated with specific disease conditions. This technique provides valuable insights into the mechanism of action, binding affinity, and pharmacokinetics of potential pharmacological agents. While biochemical studies provide valuable insights into the efficacy of *Aloe ferox* herbal drink, *in silico* assessments are crucial for understanding its molecular interactions with anti-diabetic protein targets. These computational studies can predict how bioactive compounds in *Aloe ferox* herbal drink bind to proteins involved in glucose metabolism, potentially revealing mechanisms of action that contribute to its therapeutic effects. Such assessments are essential for validating traditional claims and guiding future experimental research. The key components of the *in silico* assessment of *Aloe ferox* herbal drink safety and anti-diabetic potential include; **Phytochemical Screening and** Favorable pharmacokinetic profiles [11]. **ADMET Prediction** [12]. Despite its purported benefits, there are concerns regarding reliance on herbal remedies like *Aloe ferox* for serious health conditions. There could be possible side effects which have not been well documented thus necessitating this study.

This research was aimed at evaluating the antidiabetic efficacy and renal impact of *Aloe ferox*, the drugability, ADMET properties as well as toxicological properties of lead compounds identified in the herbal formulation.

Materials and methods

A. ***In silico*** **assay**

i) Drugability prediction and ADMET properties of the ligands (pharmacokinetic characteristics)

Using the online programmed ADMET lab 3.0 and SWISSADME [13], the absorption, distribution, metabolism, excretion and toxicity (ADMET) properties of the ligands employed in this study were predicted. The different ADMET properties of the ligands and the reference drugs were predicted using the different canonical strings or Simplified Molecular-Input Line-Entry System (SMILES) strings of the different ligands retrieved from the PubChem web platform (https://www.ncbi. Nlm.nih.gov/compound) in their 3D conformation. All the relevant parameters, including Lipinski's rule of five and the Ghose parameters were recorded using the SWISS target prediction tool, the target of the different ligands were determined [14], and pharmacokinetics, toxicological assessment of lead compounds as predicted by protox iii

B. In vivo assay

Experimental animals:

Twenty (20) Albino Wistarrats with a weight range of 80-130g were obtained from the Animal House of the Department of Biochemistry, University of Port Harcourt, River State, Nigeria. The animals were kept in plastic cages with wire mesh covers to aid ventilation andallowed to acclimatize for seven (7) days in the animal house at Federal University Otuoke, Bayelsa State, under monitored environmental conditions of temperature (28 ± 2°C), relative humidity (50 ± 5%) and 12-hour light/dark cycle. The animal facility was properly ventilated and the animals were placed on commercial rat pellet as feed and water ad libitum throughout the experimental period.

Experiment design

The experimental design comprised twenty (20) albino wistar rats divided into 4 groups of 5 animals each. Group A was the normal control group, the animals in this group received only distilled water. Group B was the negative control group, induced with Diabetes mellitus (using Streptozotocin, 60 mg/kg, intraperitoneally) and received distilled water. Animals in group C (positive control) were also induced with Diabetes mellitus and treated with standard drug metformin 8.mg/kg body weight [15]. Animals in group D were induced with diabetes mellitus and received 0.25ml/kgbw of *Aloe ferox* herbal drink as treatment which lasted for 31 days.

Collection of blood sample and biochemical assays

The animals were euthanized 12 hours after the last treatment, whole blood was collected from the heart via cardiac puncture using a sterile syringe and needle. The blood samples were put into plain tubes to allow to clot after which it was centrifuged and the serum obtained for biochemical analyses. Serum estimation of blood glucose, renal function parameters (KIM-1, Cys-c, urea, creatinine, sodium, potassium chloride, and biocarbonate concentrations) was carried out according to standard procedures reported in the literature. KIM-1 was estimated according to method reported by [16]. Cystantin-c was estimated according to methods reported by [17], urea and creatinine levels were estimated according to methods reported by [18], and the electrolytes were estimated according to methods reported by [19].

Statistical analysis: Biochemical data were tested with one-way ANOVA using SPSS version 21 and data presented as mean SEM.

Results

In silico **assay:**

Drugability and ADMET properties of lead compounds as predicted by SWISSADME/ProtoxIII

Compounds 1, 2, 3, 4, and 5(Table 1) with ID 2969, 8158, 8050, 13622, and 555174 respectively show a good balance of molecular weight, hydrogen bonding, moderate TPSA, and acceptable lipophilicity, all supporting drug-likeness. Compound 7 (ID: 9817754) has a very high QPlogPo/w (6.57) and low TPSA (17.07), suggesting strong lipophilicity but possibly poor aqueous solubility or risk of non-specific binding/toxicity. Compounds 6 (ID 79427)and 9 (ID 4091) have higher TPSA values (above 90), which might slightly limit passive diffusion through cell membranes.

CID 2969: Low MW, low TPSA, lipophilic (3.21), and meets all key criteria.

CID 8158: Low MW (158.24), good HBD/HBA, TPSA = 37.30, QPlogPo/w = 2.82 – all within optimal range.

CID 8050: Excellent MW (186.29), 0 HBD, low TPSA (26.30), ideal lipophilicity (3.30). Balanced profile for absorption and permeability

CID 13622: Very low MW (140.14), good HBD/HBA, TPSA (49.69) is ideal. Lipophilicity is moderate (1.11).

CID 555174: Slightly higher MW (230.26), good TPSA, balanced HBD/HBA. Lipophilicity is acceptable (2.50).

CID 79427: Acceptable MW, but higher TPSA (93.06) may affect permeability. Lipophilicity is low (0.61).

CID 9817754: High MW (298.89), very low TPSA (17.07), and excessive lipophilicity (QPlogPo/w = 6.57) – risk of poor solubility/toxicity.

CID 13849: Moderate MW, good HB properties, TPSA = 37.30, but higher QPlogPo/w (5.16) – still within acceptable range.

CID 4091: Very low MW (129.16), TPSA = 91.49 (slightly above ideal), and very low lipophilicity (0.26). Might have limited permeability.

Table 1: Drugability and ADMET properties of lead compounds as predicted by SWISSADME/ProtoxII

S/N	Compound ID	MW[a]	DONOR HB[b]	Acceptor HB[b]	TPSA[c]	QPlogPo/W[d]
1	2969	172.27	1	2	37.30	3.21
2	8158	158.24	1	2	37.30	2.82
3	8050	186.29	0	2	26.30	3.30
4	13622	140.14	2	3	49.69	1.11
5	555174	230.26	2	3	49.69	2.50
6	79427	226.18	2	6	93.06	0.61
7	9817754	298.89	0	1	17.07	6.57
8	13849	242.40	1	2	37.30	5.16
9	4091	129.16	3	2	91.49	0.26

a: Molecular weight
b: Hydrogen bond
c: Topological Surface Area
d: predicted octonol/water partitioning coefficient (range -2.0 to 6.5)

Toxicity profile of lead compounds as predicted by protox iii

In Table 2, compounds 1, 2, 3, 8, and 9 show no predicted organ-specific toxicity, high LD_{50} values (e.g., Compound ID: 8050 and 9817754 with LD_{50} = 5000 mg/kg) indicate low acute toxicity, making them safer candidates. Compound 4 (13622) predicted nephrotoxicity (+0.51) and cardiotoxicity (+0.69), lower LD_{50} (550 mg/kg) suggests higher acute toxicity potential. Compound 5 (555174) has potential nephrotoxicity (+0.56), respiratory toxicity (+0.70), and cardiotoxicity (+0.55), LD_{50} = 1,743 mg/kg — moderate toxicity concern.Compound 6 (79427) has nephrotoxicity (+0.67) and LD_{50} = 1,267 mg/kg moderate toxicity. Compound 7 (9817754); only predicted mutagenicity (+0.65), however, its LD_{50} is high (5000 mg/kg), suggesting low acute toxicity but a possible genotoxic risk.

Table 2: Toxicity profile of lead compounds

S/N	Compound ID	Hep[A]	Neutr[B]	Neph[C]	Resp[B]	Cardio[E]	Carcinogen[F]	Immuno[G]	Mutio[H]	Ctyo[I]	Chemical[J]	Endocrind[K]	Predicted LD50
1	2969	-	-	-	-	-	-	-	-	-	-	-	900
2	8158	-	-	-	-	-	-	-	-	-	-	-	900
3	8050	-	-	-	-	-	-	-	-	-	-	-	5000
4	13622	-	-	+(0.51)	-	+(0.69)	-	-	-	-	-	-	550
5	555174	-	-	+(0.56)	+(0.7)	+(0.55)	-	-	-	-	-	-	1,743
6	79427	-	-	+(0.67)	-	-	-	-	-	-	-	-	1,267
7	9817754	-	-	-	-	-	-	-	+(0.65)	-	-	-	5000
8	13849	-	-	-	-	-	-	-	-	-	-	-	900
9	4091	-	-	-	-	-	-	-	-	-	-	-	680

Active: (+), Inactive= (-), A=Hepatoxicity, B=Neurotoxicity, C=Nephrotoxicity, D= Respiratory Toxicity, E= Cardiotoxicity, F= Carcinogenicity, G= Immunotoxicity, H= Mutagenicity, I= Cytotoxicity, J= Clinical toxicity, K= Endocrind toxicity, L= Predicted LD_{50}

In vivo assay

In Table 3, group A (control) shows normal physiological ranges for serum glucose (FBS), kidney injury markers (KIM-1) Cystatin-C, and electrolytes, indicating healthy metabolic and renal function. Group B(diabetes untreated) displays a significant ($P<0.05$) elevation in all kidney injury indicators (KIM-1, Cystatin-C, urea, creatinine), along with electrolyte imbalances (marked hyponatremia, hyperkalemia). This suggests severe systemic inflammation with acute kidney injury (AKI), possibly due to toxin exposure. Group C (diabetic treated with metformin) shows partial normalization compared to B with improved renal indices and blood glucose but still significantly above control. This pattern may reflect therapeutic attenuation of kidney damage by the standard drug, although residual dysfunction persists. Group D (diabetic treated with Aloe forex) demonstrates recovery facilitated by *Aloe ferox*closer to control in terms of improvement in serum glucose and electrolytes concentrations. Although some renal biomarkers (KIM-1, urea, creatinine) remained elevated in this group, they were significantly lower compared to the untreated diabetic group B. This indicates substantial therapeutic efficacy of Aloe forex against induced-diabetes mellitus, with ongoing repair of renal tubular and glomerular injury.

Table 3: serum glucose concentrationand levels of kidney injury markers

KIM-1 (ng/ml)	CYS-C (ng/ml)	Urea (Mmol/L)	Creat (µmol/L)	Na (Mmol/L)	K (Mmol/L)	Cl- (Mmol/L)	HCO_3 (Mmol/L)	FBS (Mmol/L)
1.54 ± 0.04*	0.60 ± 0.07*	2.68 ± 0.07*	36.74 ± 0.79*	132.40 ± 0.67*	3.10 ± 0.328*	104.40 ± 1.21*	20.80 ± 0.66*	3.84 ± 0.07
31.20 ± 1.16*	34.40 ± 0.24*	7.54 ± 0.07*	106.58 ± 0.27*	40.60 ± 1.21*	6.58 ± 0.08*	108.80 ± 0.37*	20.20 ± 0.58*	10.94 ± 0.08 *
12.40 ± 0.51*a	11.20 ± 0.66*a	4.32 ± 0.21*a	51.26 ± 0.32*a	141.00 ± 0.45*a	4.24 ± 0.07*a	112.00 ± 0.32*a	18.40 ± 0.60*a	4.78 ± 0.81*a
26.60 ± 0.45*ab	20.80 ± 0.20*ab	5.42 ± 0.02*a	67.10 ± 0.33*ab	144.08 ± 0.37*a	5.50 ± 0.06*ab	116.00 ± 0.32 *ab	15.40 ± 0.25*ab	3.99 ± 0.05*ab

Values are expressed as mean ± standard error of mean (SEM), n = 5.
* = significant Є $p < 0.05$ compared with group 1 (A)
*a = significant Є $p < 0.05$ compared with group 2 (B)
*ab = significant Є $p < 0.05$ compared with group 3 (C)
KIM1= Kidney Injury Molecule-1, CYS- C = Cystantin-C, Creat = Creatinine, Na = Sodium, K= Potassium, Cl^- = chloride, HCO3 = Biocarbonate, FBS = Fasting blood sugar

Discussion

Biochemical and *in silico* approach was employed to evaluate the safety and anti-diabetic potential of *Aloe ferox*. ADMET predictions, *in silico* toxicity screens, and in vivo biochemical endpoints (glycaemia, and renal markers) demonstrated promising phytochemical leads while highlighting specific safety concerns that need further studies. Most compounds satisfied core drug-likeness filters; molecular weights were well below 500 Da, hydrogen bond donor/acceptor counts were within Lipinski thresholds, and TPSA values for the majority were under ~50 $Å^2$, a range associated with good passive cellular permeability. Several compounds showed QPlogP values between ~2.5–3.3 and TPSA ~26–37 $Å^2$, which is an advantageous balance for oral absorption and intracellular access to enzyme/receptor targets.

Toxicity screens predicted nephrotoxicity and cardiotoxicity for a subset of compounds (moderate confidence scores) and flagged one compound for possible mutagenicity. Nephrotoxicity is particularly concerning given diabetes already predisposes patients to kidney disease, any patients that aggravates renal injury is clinically impractical for chronic therapy. Cardiotoxicity (often linked to mitochondrial toxicity *in silico*) similarly contraindicates progression prior to targeted assays [20]. Mutagenicity flags require urgent empirical follow-up (Ames, mammalian micronucleus/comet assays) because genotoxicity is a major red flag for chronic human use. *In silico* LD_{50} estimates also varied: several compounds had high LD_{50} (>2000–5000 $mg{\cdot}kg^{-1}$) consistent with low acute toxicity, while others had lower LD_{50}s (~550–1743 $mg{\cdot}kg^{-1}$), which implies a narrower safety margin and calls for sub-chronic toxicity testing before chronic dosing experiments [21].

The in vivo assay result (**FBS, KIM-1**, Cystatin-C, urea, creatinine and electrolytes) provides functional confirmation that the *Aloe ferox* drink exerts systemic effects consistent with anti-diabetic and organ-protective activity. In the diabetic control group, marked hyperglycaemia, elevated renal injury biomarkers (KIM-1, Cystatin-C, creatinine, urea) indicated successful induction of metabolic and renal stress. Treatment with *A. ferox* significantly ($p<0.05$) ameliorated many of these biochemical perturbations, lowering FBS and reducing KIM-1 and Cystatin-C, suggestive of both glycaemic control and nephroprotection.The observed decrease in KIM-1 and Cystatin-C is consistent with amelioration of tubular and glomerular stress, respectively; KIM-1 is a sensitive early marker of proximal tubular injury and has been shown to outperform classical markers in preclinical models. These biochemical shifts align with the *in silico* hypothesis that *A. ferox* constituents can modulate targets connected to metabolic, inflammatory and nephroprotective pathways. Two mechanistic pathways plausibly reconcile the computational and biochemical data:Direct modulation of metabolic targets: Several *A. ferox* phytochemicals appear capable of binding and modulating intracellular targets involved in glucose metabolism or insulin signalling (as suggested by docking). If intracellular access is achieved (supported by favorable LogP/TPSA and non-P-gp status), enzyme inhibition or receptor modulation could directly lower hepatic gluconeogenesis, enhance peripheral glucose uptake, or modulate key kinases (e.g., AKT/AMPK axes). Further *In silico* docking may provide hypotheses for which targets to test in vitro (kinase assays, receptor binding).

Summary and conclusion

This study highlights *Aloe ferox* as a rich source of promising anti-diabetic compounds that not only target key metabolic proteins but also exert potent nephroprotective effects. By combining pharmacokinetic profiling, toxicity prediction, and in vivo validation, lead candidates with strong therapeutic potential and commendable safety profiles have beenidentified. It is worthy of note however that while Aloe forex may exhibit anti-diabetic efficacy, some compounds with potential organ toxicity and genotoxic effects have been detected. These findings calls for further focused computational studies and formulation development in order to make *Aloe ferox* much safer as an effective, and natural adjunct in diabetes management.

References

1. American Diabetes Association. (2021). Classification and diagnosis of diabetes: Standards of medical care in diabetes—2021. Diabetes Care, 44(Supplement 1), S15–S33.
2. Eisenbarth, G. S., Gianani, R., & Yu, L. (2017). Autoimmunity and the pathogenesis of type 1 diabetes. Diabetes. 66: 319–326.
3. Chiang, J. L., Maahs, D. M., Garvey, K. C., Hood, K. K., Laffel, L. M., Weinzimer, S. A., Wolfsdorf, J. I., Schatz, D., & Type 1 Diabetes Sourcebook Authors. (2021). Type 1 diabetes in children and adolescents: A position statement by the American Diabetes Association. Diabetes Care. 44: 156–174.
4. International Diabetes Federation. (2019). IDF diabetes atlas (9th ed.). Brussels, Belgium: International Diabetes Federation.

5. Centers for Disease Control and Prevention. (2021). National diabetes statistics report, 2020. U.S. Department of Health and Human Services.
6. Tesfaye, S., Boulton, A. J., Dyck, P. J., Freeman, R., Horowitz, M., Kempler, P., Lauria, G., Malik, R. A., Spallone, V., Vinik, A., & Bernardi, L. (2010). Diabetic neuropathies: Update on definitions, diagnostic criteria, estimation of severity, and treatments. Diabetes Care. 33: 2285–2293.
7. Muhammad, U. S. (2020). Prevalence and risk factors of type 2 diabetes mellitus in Nigeria: A systematic review. International Journal of Diabetes in Developing Countries. 40: 158–165.
8. Patel, D. K., Prasad, S. K., Kumar, R., & Hemalatha, S. (2012). An overview on antidiabetic medicinal plants having insulin mimetic property. Asian Pacific Journal of Tropical Biomedicine. 2: 320–330.
9. Gherbon, A., Gaita, L., & Toth, O. (2021). Ethnopharmacological review of *Aloe ferox*: Traditional uses and modern evidence. Journal of Ethnopharmacology. 276: 114179.
10. Johnson, J. T., & Dike, P. A. (2024). Antidiabetic efficacy of *Aloe ferox* herbal drink in streptozotocin-induced diabetic rats. African Journal of Biochemistry Research. 18: 45–56.
11. Morris, G. M., Huey, R., & Olson, A. J. (2009). Using AutoDock for ligand-receptor docking. Current Protocols in Bioinformatics. 24: 8–14.
12. Daina, A., Michielin, O., & Zoete, V. (2017). SwissADME: A free web tool to evaluate pharmacokinetics, drug-likeness and medicinal chemistry friendliness of small molecules. Scientific Reports 7: 42717.
13. Asanga, O. E., Nwafor, E. O., & Ezeigbo, U. C. (2024a). Computational ADMET and pharmacokinetic profiling of phytochemicals from *Aloe ferox*. Journal of Pharmacological Sciences. 48: 115–127.
14. Daina, A., Michielin, O., & Zoete, V. (2019). SwissTargetPrediction: Updated data and new features for efficient prediction of protein targets of small molecules. Nucleic Acids Research. 47: W357–W364.
15. Furman, B. L. (2021). Metformin: From biguanide class to a miracle drug. Diabetologia. 64: 1591–1593.
16. Vaidya, V. S., Ramirez, V., Ichimura, T., Bobadilla, N. A., & Bonventre, J. V. (2008). Urinary kidney injury molecule-1: A sensitive quantitative biomarker for early detection of kidney tubular injury. American Journal of Physiology-Renal Physiology. 290: F517–F529.
17. Grubb, A. (2020). Non-invasive estimation of kidney function and early detection of kidney damage by serum cystatin C. Scandinavian Journal of Clinical and Laboratory Investigation. 80: 509–517.
18. Levey, A. S., Coresh, J., Greene, T., Stevens, L. A., Zhang, Y. L., Hendriksen, S. (2023). Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI); Using standardized serum creatinine values in the modification of diet in renal disease study equation for estimating glomerular filtration rate. Annals of Internal Medicine. 139: 247–257.
19. Burtis, C. A., & Ashwood, E. R. (1996). Tietz textbook of clinical chemistry (3rd ed.). W.B. Saunders.
20. Gusmão-Santos, A., da Silva, R. P., & Oliveira, L. M. (2021). Computational approaches to predict drug cardiotoxicity and nephrotoxicity. Frontiers in Pharmacology 12: 685238.
21. Asanga, O. E., Ezeigbo, U. C., & Nwafor, E. O. (2023). Identification of volatile bioactive compounds in *Aloe ferox* extract using GC–MS analysis. Journal of Natural Products Research. 37: 265–277.

Cite this article: Jimoh, A. S., Johnson, J.T. (2025) ANTIDIABETIC EFFICACY AND *IN SILICO* SAFETY EVALUATION OF *Aloe ferox*HERBAL . Japan Journal of Medical Science 6 (2): 299-303.