Current Biomedicine
p-ISSN: 2962-8490; e-ISSN: 2985-4784
https://journal.ipb.ac.id/index.php/currbiomed

Kusuma *et al.*
Vol 4 No 2, July 2026, Pp 39–44
DOI: 10.29244/currbiomed.4.2.39

Case study

OPEN ACCESS

Monitoring of blood glucose levels in a cat with diabetes mellitus: a case report

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Abstract

Background Diabetes mellitus (DM) is a chronic metabolic disorder in cats characterized by persistent hyperglycemia resulting from impaired insulin secretion, insulin resistance, or both, and is not always accompanied by pancreatic or hepatic dysfunction.

Objective This case study aimed to describe the clinical findings and therapeutic management of a cat diagnosed with diabetes mellitus with suspected hepatic and pancreatic dysfunction.

Case An 11-year-old female domestic cat named Miau Miau was presented to the Waras Satwa Veterinary Clinic, Batam, Indonesia, with diarrhea, decreased appetite, polyuria, and polydipsia.

Examination The diagnostic approach included anamnesis, physical examination, hematological evaluation, blood biochemistry analysis, and serial blood glucose monitoring using a glucometer. Persistent hyperglycemia was established based on repeated blood glucose values above the normal range (75–120 mg/dL) during the observation period. The findings revealed hyperglycemia (318 mg/dL) with increased levels of amylase, alanine aminotransferase (ALT), and total bilirubin, indicating possible involvement of the pancreas and liver.

Diagnosis and treatments The cat was diagnosed with diabetes mellitus with suspected hepatic and pancreatic dysfunction. The treatment included Moringa leaf (*Moringa oleifera*) as an adjunct therapy in oral capsule form at a dose of ±98 mg/kg body weight/day, combined with pancreatic enzyme supplementation, a hepatoprotective agent, and dietary modification to a high-protein, low-carbohydrate diet. After 14 days of hospitalization, the blood glucose levels gradually decreased to 115 mg/dL.

Conclusion This case demonstrates that diabetes mellitus in cats may be associated with pancreatic and hepatic dysfunction, as reflected by increased levels of amylase, ALT, and total bilirubin.

Keywords cat | diabetes | hepatic | hyperglycemia | pancreas.

Introduction

Diabetes mellitus (DM) is a chronic metabolic disorder in cats characterized by persistent hyperglycemia resulting from impaired insulin secretion, insulin resistance, or both conditions. The increasing population of cats, along with lifestyle patterns and high-carbohydrate diets, is suspected to contribute to the rising incidence of DM (Hendry & Mulya, 2025). Diabetes mellitus can occur in all cats; however, it is more frequently observed in older cats, neutered male cats, overweight cats, and those with low physical activity. Genetic predisposition in certain breeds also increased risk of DM. The

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majority of cases are reported in cats aged ≥7 years, accounting for approximately 82% of cases. Neutered cats dominate DM cases, representing approximately 81% (Waite *et al.,* 2025). The increased risk in neutered male cats is associated with post-castration hormonal changes that stimulate increased appetite, reduced activity, and decreased energy requirements, thereby contributing to obesity and insulin resistance (Öhlund *et al.,* 2017).

Excess body weight is a significant risk factor, overweight cats have approximately twice the risk, while obesity confers more than a fourfold increased risk of developing DM compared to cats with normal body condition (Clark & Hoenig, 2021). Spayed female cats experience similar physiological changes, although the incidence of DM is reportedly higher in males. Male cats tend to accumulate more body fat due to increased metabolic processes such as glucose oxidation, glycogenesis, and lipogenesis in response to insulin. This condition, supported by recent findings on the role of adipose tissue in reducing insulin sensitivity, leads to impaired glucose regulation and an increased risk of DM (Araujo *et al.,* 2024). The prevalence of DM in cats is estimated to range from 0.5% to 2.24%, with a higher incidence reported in breeds such as Siamese, Norwegian Forest, Burmese, Russian Blue, and Maine Coon (Pérez-López *et al.,* 2019). Currently, data on the prevalence of DM in cats in Indonesia remain limited, making it difficult to accurately determine the national incidence rate.

Insulin secreted by pancreatic β-cells plays a crucial role in maintaining glucose homeostasis by promoting glucose uptake in tissues such as the liver, muscles, and adipose tissue for utilization or storage as energy reserves (Rahman *et al.,* 2021). In cats in diabetic, impaired insulin function leads to the accumulation of glucose in the bloodstream. Chronic hyperglycemia may trigger complications such as diabetic neuropathy, ketoacidosis, hepatic lipidosis, and increased susceptibility to infections (Hendry & Mulya, 2025). Cats with DM commonly present with polyuria, polydipsia, and polyphagia, often accompanied by progressive weight loss (Morozenko *et al.,* 2022).

Early clinical signs are often overlooked by pet owners, as they may be perceived as normal changes in behavior. Hyperglycemia in cats can also occur as a stress response, complicating accurate diagnosis. Therefore, a comprehensive diagnostic approach is required, including anamnesis, physical examination, blood glucose testing, urinalysis, and measurement of fructosamine as an indicator of intermediate-term glycemic control (Fitriani *et al.,* 2016). Fructosamine is formed through the non-enzymatic binding of glucose to serum proteins, particularly albumin, reflecting the average blood glucose level over a certain period and is relatively unaffected by stress. Thus, this parameter plays an important role in distinguishing transient stress-induced hyperglycemia from persistent hyperglycemia in DM (Gusev *et al.,* 2026).

Insulin therapy remains the cornerstone of treatment for lowering blood glucose levels (Gilor *et al.,* 2021). This therapy is combined with dietary management consisting of high-protein, low-carbohydrate diets, body weight control, and regular monitoring of blood glucose levels. In clinical practice, dietary regulation may involve specialized commercial diabetic diets or controlled homemade diets. Moringa (*Moringa oleifera*) leaves have been reported to possess potential antidiabetic properties based on empirical use and recent studies. Moringa leaf herbal supplementation is administered orally in capsule form. Its hypoglycemic activity is associated with antioxidant compounds such as beta-carotene, vitamin C, and vitamin E, as well as minerals such as zinc and essential amino acids that support insulin function and activity (Pangesti *et al.,* 2024). This case study aims to describe the clinical condition of a cat with diabetes mellitus accompanied by pancreatic and hepatic dysfunction and to evaluate the therapeutic management provided.

Case

A domestic female cat named Miau Miau (**Figure 1A**), aged 11 years, with a calico coat pattern, was clinical evaluate. The cat had a body weight of 3.4 kg and a Body Condition Score (BCS) of approximately 6/9, indicating a mildly overweight condition (Öhlund *et al.,* 2018). The pa-tient was brought to Waras Satwa Veterinary Clinic with primary complaints of diarrhea, increased drinking frequen-cy, reduced appetite, and the upper respiratory signs. Ac-cording to the husbandry history, the cat was routinely fed a commercial dry diet (Whiskas®) twice daily without any specific dietary management.

Figure 1 (A) An 11 year old domestic female cat named Miau Miau, (B) Glucometer examination results showing hyperglycemia with a glucose level of 318 mg/dL.

Examination

Physical examination

The inspection findings revealed that Miau Miau's mucous membranes were pale with a yellowish tint, accompanied by nasal discharge, excessive mucus within the oral cavity, and the presence of a small ulcer at the tip of the tongue. The physiological parameters recorded included a body temperature of 39.9°C, a respiratory rate of 18 breaths/min, and heart rate of 132 beats/min.

Hematological and blood biochemistry examination

Hematological analysis demonstrated an elevated total leukocyte count (leukocytosis) exceeding the normal reference values, accompanied by an increase in white blood cells and a relative decrease in lymphocyte percentage. These findings suggest the presence of an acute inflammatory process in the lungs. Erythrocyte parameters remained within physiological limits with no indication of anemia, and slightly decreased values of RDW-CV, RDW-SD, and PCT were not considered clinically significant (**Table 1**).

Table 1 Hematological examination results of an 11 year old female cat Miau Miau

Parameter	Results	Normal Range
WBC (10^9/L)	21.43*	5.5–19.5
LYM (10^9/L)	0.99	0.8–7
MID (10^9/L)	0.49	0–1.9
GRA (10^9/L)	19.95*	2.1–15
LYM (%)	4.6*	12–45
MID (%)	2.3	2–9
GRA (%)	93.1*	35–85
RBC (10^{12}/L)	6.93	4.6–10
HGB (g/L)	112	93–153
MCHC (g/L)	320	300–380
MCH (pg)	16.2	13–21
MCV (fL)	50.4	39–52
RDWCV (%)	13.1*	14–18
RDWSD (fL)	31.5*	35–56
HCT (%)	35	28–49
PLT (109/L)	104	100–514
MPV (fL)	7.9	5–11.8
PDW (fL)	11.2	10–18
PCT (%)	0.082*	0.1–0.5
P-LCR (%)	18.5	13–43

* Increase or decrease in parameter values compared with the normal reference range; WBC: white blood cell; LYM: lymphocyte; MID: monocyte/eosinophil/basophil; GRA: granulocyte; RBC: red blood cell; HGB: hemoglobin; HCT: hematocrit; MCV: mean corpuscular volume; MCH: mean corpuscular hemoglobin; MCHC: mean corpuscular hemoglobin concentration; RDW-CV: red cell distribution width–coefficient of variation; RDW-SD: red cell distribution width–standard deviation; PLT: platelet; MPV: mean platelet volume; PDW: platelet distribution width; PCT: plateletcrit; P-LCR: platelet large cell ratio.

Blood chemistry analysis (**Table 2**) revealed elevated alanine aminotransferase (ALT) and total bilirubin levels, indicating hepatic dysfunction. Amylase levels were markedly increased, accompanied by elevated blood glucose levels consistent with hyperglycemia (318 mg/dL) (**Figure 1B**). These findings confirmed hyperglycemia and supported the diagnosis of DM with concurrent pancreatic and hepatic dysfunction.

Serial monitoring of blood glucose levels was performed using a glucometer every two days over a two-week hospitalization period to evaluate therapeutic response. The results of serial glucose monitoring are presented in **Figure 2**. Over the 14-day observation period, blood glucose levels exhibited a fluctuating but overall decreasing trend. Initial glucose concentration was 318 mg/dL, which gradually declined and ultimately reached 115 mg/dL, falling within the normal reference range (75–120 mg/dL).

Diagnosis and treatments

Based on the clinical findings and laboratory results, the cat was diagnosed with DM accompanied by pancreatic and hepatic dysfunction. Several differential diagnoses were considered based on the clinical presentation, including Feline

Table 2 Blood biochemical examination results of an 11 year old female cat Miau Miau

Parameter	Results	Normal Range
TP (g/L)	83.5	54–89
Albumin (g/L)	34.4	22–45
Globulin (g/L)	49.1	15–57
A/G	0.7	
T Bilirubin (Umol/L)	16.60*	2–15
ALT (U/L)	144*	8.2–123
ALP (U/L)	25	10–90
BUN (mmol/L)	5.58	3.6–15.5
Creatinin (Umol/L)	94	27–223
BUN/CRE	15	
CK (U/L)	289	50–450
Amylase (U/L)	1981*	200–1800
Glukosa (mmol/L)	14.54*	4.11–8.84
CHOL (mmol/L)	3.48	1.68–5.81
Kalsium (mmol/L)	2.21	1.95–2.95
Phospor (mmol/L)	1.01	1–2.74
Ca×P (mg/dL)	28	

* Increase or decrease in parameter values compared with the normal reference range; TP: total protein; A/G: albumin to globulin ratio; T bilirubin: total bilirubin; ALT: alanine aminotransferase; ALP: alkaline phosphatase; BUN: blood urea nitrogen; CRE: creatinine; BUN/CRE: blood urea nitrogen to creatinine ratio; CK: creatine kinase; CHOL: cholesterol; Ca×P: calcium–phosphorus product.

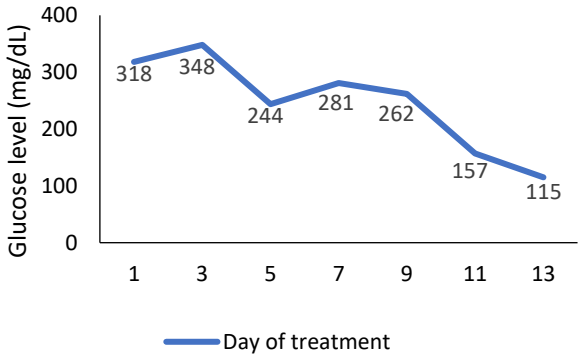

Figure 2 Glucose levels of an 11year old domestic female cat named Miau Miau.

Hepatic Lipidosis (FHL), Chronic Kidney Disease (CKD), and enteritis.

The therapeutic regimen included the administration of Moringa leaves (*Moringa oleifera*) as an antidiabetic agent, Pancresolve® to support pancreatic exocrine function, and Samylin® as hepatoprotective supportive therapy. During hospitalization, the commercial dry diet was replaced with chicken breast as part of the dietary management.

Discussion

Clinically, the patient demonstrated systemic disturbances suggestive of involvement of inflammatory processes and glucose metabolism, supported by the presence of leukocytosis as an indicator of acute inflammation. An increase in white blood cell count reflects the activation of the immune system in response to pathological stimuli such as infection, physiological stress, or ongoing metabolic disturbances. Inflammation is a defense mechanism involving vascular and cellular tissue responses to various pathogenic agents (Kaler *et al.,* 2024). This process also plays a role in influence glucose regulation through the release of proinflammatory cytokines, which can interfere with insulin action in peripheral tissues, thereby reducing insulin sensitivity and triggering insulin resistance (Gusev *et al.,* 2026). Consequently, this condition leads to decreased cellular glucose uptake and elevated glucose levels in circulation.

Hyperglycemia in this case was identified through blood chemistry analysis, with glucose levels reaching 318 mg/dL (normal range: 75–120 mg/dL), and was confirmed to be persistent through repeated glucose monitoring during hospitalization. This pattern is more consistent with DM than stress-induced hyperglycemia, which is typically transient. Patients with DM commonly exhibit elevated liver enzymes, such as ALT and AST, compared to non-diabetic individuals, reflecting hepatocellular dysfunction (Noroozi *et al.,* 2022).

In DM, particularly in association with insulin resistance and chronic hyperglycemia, hepatic function may be impaired due to decreased glucose utilization and increased intracellular lipid accumulation (Schön *et al.,* 2023). This condition promotes enhanced mobilization of fatty acids from adipose tissue, which are subsequently transported to the liver and stored as triglycerides. In cats, lipid accumulation can progress to hepatic lipidosis, particularly when accompanied by additional factors such as reduced food intake or stress (Webb, 2018). The accumulation of triglycerides within hepatocytes disrupts liver cell function and increases susceptibility to oxidative damage, ultimately contributing to hepatocellular injury. These findings are consistent with hepatic dysfunction, as indicated by elevated ALT and total bilirubin levels in blood chemistry analysis. Increased ALT levels reflects compromised hepatocyte membrane integrity, resulting in enzyme leakage into the bloodstream, whereas elevated bilirubin levels indicate impaired metabolism or excretion of bile pigments associated with hepatobiliary dysfunction (Assawarachan *et al.,* 2020; Dirksen *et al.,* 2017).

Pancreatic involvement is also a crucial aspect of the disease process. Amylase is an enzyme produced by pancreatic acinar cells that plays a role in the hydrolysis of carbohydrates into simple sugars, thereby indirectly reflecting its association with glucose metabolism (Abdulkareem *et al.,* 2024). Elevated circulating amylase levels may indicate pancreatic dysfunction. Assessment of pancreatic disorders should not rely solely on amylase levels, and lipase evaluation is necessary. The fPLI/Spec fPL (Feline Pancreatic Lipase Immunoreactivity) test is currently recognized as the most sensitive and specific method for detecting pancreatitis in cats. Rapid point-of-care tests such as SNAP fPL are widely used as initial screening tools because of their practicality and rapid results (Schnauß *et al.,* 2019). Inflammatory processes in the pancreas may lead to tissue damage affecting both digestive enzyme production and β-cell integrity, which are responsible for insulin secretion. Damage to β-cells contributes to decreased insulin production, exacerbating pre-existing hyperglycemia. Collectively, these findings indicate a disturbance in glucose regulation involving the interplay between insulin resistance, hepatic dysfunction, and possible pancreatic involvement, which remains presumptive based on elevated amylase levels. The combination of persistent hyperglycemia, hepatic biochemical alterations, and these findings supports diabetes mellitus as the underlying condition in this patient.

Moringa leaf herbal therapy was used as a supportive treatment in this case. Moringa oleifera has been reported to possess potential antidiabetic properties based on empirical evidence (Ihkwani & Wulan, 2024). Its hypoglycemic activity is associated with its nutritional content, including beta-carotene, vitamin C, and vitamin E, which function as antioxidants and help maintain insulin levels. The zinc content in Moringa leaves plays an important role in insulin production and activity in the body. Moringa also contains essential amino acids that support metabolic functions, contributing to its antidiabetic properties (Pangesti *et al.,* 2024). Several preclinical studies in animal models, particularly mice, have demonstrated that *Moringa oleifera* enhance insulin sensitivity and reduces blood glucose levels (Mthiyane *et al.,* 2022). However, these findings remain limited to experimental models, and their efficacy and safety in cats have not yet been established as evidence-based standard therapies. In this

case, Moringa was administered orally in capsule form at a dose of approximately one-third of a capsule per day (±98 mg/kg body weight) as a conservative and adjunctive therapeutic approach.

Pancresolve® as a pancreatic enzyme supplement containing a combination of lipase, protease, and amylase, was administered. This supplementation aims to support digestive function and optimize nutrient absorption, particularly in cases of suspected exocrine pancreatic insufficiency (EPI). In this case, Pancresolve® was administered orally at a dose of half a tablet once daily. Enzyme supplementation is a fundamental principle in EPI management, as it compensates for pancreatic enzyme deficiency and helps alleviate digestive and absorptive disturbances (Szkopek *et al.,* 2024). Samylin®, which contains S-adenosylmethionine (SAM-e), was administered as a hepatoprotective agent to enhance glutathione synthesis. Glutathione plays a critical role in protecting hepatocytes from oxidative stress, which may contribute to elevated ALT levels due to liver cell damage (Marchegiani *et al.,* 2020). Impaired hepatocyte function may also disrupt bilirubin metabolism and excretion. Increased glutathione levels through SAM-e supplementation are expected to stabilize ALT and bilirubin levels. In this case, Samylin® was administered orally at a dose of one tablet daily.

During hospitalization, Miau Miau was fed shredded boiled chicken breast as part of the dietary modification during therapy. The diet was provided twice daily as a high-protein, low-carbohydrate dietary approach aimed at controlling blood glucose levels in diabetic cats. Although chicken breast as a high-protein source may aid in short-term glycemic control, it does not fully meet the complete nutritional requirements of cats when given as a sole diet over the long term; therefore, a balanced dietary regimen remains necessary. The patient was hospitalized for 14 days and showed progressive clinical improvement. From day one to day three, blood glucose levels remained above 300 mg/dL with no significant decline observed. Between days five and nine, glucose levels began to decrease, remaining above 200 mg/dL. A more pronounced reduction was observed on days 11 and 13, with glucose levels reaching 115 mg/dL, which falls within the normal physiological range. Follow-up evaluation of other parameters after therapy, such as ALT and bilirubin, was not performed, as the patient's clinical condition improved, as indicated by the normalization of blood glucose levels.

Conclusion

This case demonstrates that diabetes mellitus in cats may be accompanied by impaired pancreatic and hepatic function with clinical improvement reflected by a reduction in blood glucose levels following therapy. The decrease in blood glucose levels during the treatment period indicates a favorable response to therapy however this condition cannot yet be considered a cure. Diabetes mellitus is a chronic disease that requires long term monitoring and management to maintain stable blood glucose levels. To date there is no specific therapy capable of directly restoring or regenerating pancreatic beta cells therefore management is primarily focused on disease control and the prevention of complications

Acknowledgments The authors would like to express their gratitude to Waras Satwa Veterinary Clinic Batam for the facilities clinical support and technical assistance provided during the examination and data collection process.

Funding This case report did not receive any external funding.

Conflict of interest The authors declare that there are no conflicts of interest in the preparation and publication of this case report.

Author contribution AK: Conceptualization, analysis, writing original draft, writing – review & editing; LD: Conceptualization, analysis, writing – review & editing; IR: Conceptualization, investigation, formal analysis, methodology; AS: Conceptualization, analysis, writing – review & editing; SW: Supervision.

Availability of data and materials All data are available within the manuscript

Received 4 March 2026 | **Revised** 31 May 2026
Accepted 26 June 2026 | **Published online** 1 July 2026

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