Alqalam Journal of Medical and Applied Sciences. 2026;9(2):397-402
https://doi.org/10.54361/ajmas.269213

Original article

Effect of Gum Arabic on Hematological Parameters in Alloxan-induced Diabetic Mice

Mahmoud Elderbi[1]*, Ashref Elburi[2], Arwa Ibrahim[1], Muatasembellah Buzreiba[3]

[1]*Department of Pharmacology, Faculty of Medicine-Almarj, Benghazi University, Libya*
[2]*Department of Pharmacology, Faculty of Medicine, Benghazi University, Benghazi, Libya*
[3]*Department of Pharmacology and Toxicology, Faculty of Pharmacy, Benghazi University, Benghazi, Libya*
Corresponding email. *mahmoud.elderbi@uob.edu.ly*

Abstract
This study evaluated the antihyperglycemic effects of gum arabic (GA) and its impact on hematological parameters in alloxan-induced diabetic mice. Swiss albino mice (n=40) were divided into normal control (C),10% GA-treated only group (GA), diabetic Alloxan-induced diabetic group (AX), and alloxan and GA-treated group (AXGA). Diabetes was induced via intraperitoneal alloxan (200 mg/kg), justified by established protocols for reproducible hyperglycemia. Body weight, fasting blood glucose (FBG), and hematological indices (White blood cells, red blood Cells and platelet indices) were assessed over 30 days. Data were analyzed using one-way ANOVA with a significance value of $p<0.05$. Alloxan-treated mice cause a dramatic increase in FBG to 436±37.55mg/dl vs 130.00±7.74mg/dl in control mice ($p<0.05$). The FBG in GA-treated mice was increased to 156.67±8.04mg/dl, but was insignificant compared to the control. However, GA treatment in diabetic mice (AX+GA) significantly reduced FBG to 146±10.01mg/dl compared to untreated diabetic mice and restored body weight compared to the AX group. Hematological changes included reduced WBC Number and lymphocyte percentages (to 5.22×10^3 /µL and 51.7% compared with control, respectively) and lowered Hb (11.5±0.8 vs. 13.2±1.0 g/dL in C, $p<0.05$). Gum Arabic demonstrates significant antihyperglycemic effects in alloxan-induced diabetic mice. It also exhibits modulatory effects on hematological parameters, suggesting potential anti-inflammatory properties. These findings support the traditional use of GA and highlight its potential as an adjunct therapy for diabetes management.
Keywords. Gum Arabic, Alloxan, Diabetes Mellitus, Hematological Parameters, Antihyperglycemic.

Introduction

Diabetes Mellitus (DM) is a global metabolic epidemic disease characterized by chronic hyperglycemia, leading to severe complications affecting multiple organ systems [1]. According to the World Health Organization (WHO), the global diabetes prevalence among adults rose from 7% to 14% between 1990 and 2022, and approximately 589 million adults aged 20-79 years are living with diabetes globally in 2024 [2,3]. Oxidative stress plays a crucial part in diabetic pathogenesis via the increase in the ratio of oxidants/antioxidants, resulting in damage to biological macromolecules such as proteins, which generates more reactive oxygen species and progressive cellular damage [4].

Globally, Gum Arabic (GA) treatment originates from its potency in the treatment of many complaints and their complications as well, in addition to its safety and economic low cost. GA has diverse effects, such as antimicrobial, anti-hepatotoxic, anti-ulcer, anti-inflammatory, anti-oxidant, anti-mutagenic, and anti-cancer properties [5]. GA is a complex polysaccharide exudate from *Acacia senegal* and related species. It is classified as a soluble dietary fiber and recognized generally as being safe by the FDA [6]. Beyond its widespread use in the food and pharmaceutical industries as an emulsifier, GA has been used as a traditional herb for treating inflammation, renal conditions, and other disorders [7].

Alloxan is a well-established method for inducing type-1 diabetes in laboratory animals like rats. It selectively destroys pancreatic β-cells, creating a state of hyperglycemia and oxidative stress [8]. Although GA's effects on blood glucose and lipids are experimentally configured to some extent, its comprehensive impact on hematological parameters in diabetes is indistinctive. This study aims to observe the effects of GA on body weight, blood glucose, and hematological indices in both normal and alloxan-induced diabetic mice.

Materials and Methods

Chemicals and Reagents

Gum Arabic was obtained as raw tears (Hashab type) from a local folk shop in Benghazi, milled into a fine powder, and prepared as a 10% (w/v) aqueous solution. Alloxan monohydrate was purchased from Alfa Aesar (USA). All diagnostic kits for hematological analysis were of analytical grade.

Experimental animals

Forty male Swiss albino mice (SWR strain), weighing 20-35 g, were obtained from the research lab at the Department of Pharmacology, Faculty of Medicine, University of Benghazi. Animals were housed under standard conditions (22 ± 1°C, 12-hour light/dark cycle) with free access to standard pellet diet and water. The study protocol was approved by the Institutional Ethics Committee of Benghazi University.

Received*: 08-12-2025 -* ***Accepted****: 04-02-2026 -* ***Published****: 10-02-2026*

Induction of Diabetes

Diabetes was induced in 14-hour fasted mice via a single intraperitoneal injection of freshly prepared alloxan (200 mg/kg of mouse body weight in normal saline, pH 4.5). 48-hours post-injected, mice with fasting blood glucose (FBG) levels exceeding 200 mg/dl were considered diabetic and included in the study.

Experimental Design

The mice were randomly assigned to four groups (n=10): Group I (Control, C): Received water for 30 days, Group II (GA): Received 10% GA in drinking water for 30 days, Group III (AX): Received a single dose of alloxan (diabetic control (AX) and Group IV (AX+GA): Diabetic mice treated with 10% GA in drinking water for 30 days.

Sample Collection and Analysis

At the end of the 30-day treatment period, blood was collected from the retro-orbital plexus using a heparinized capillary tube. FBG and Body Weight were measured at baseline and end of study, and blood glucose was measured using an electronic glucometer (Accu-Chek®, Roche Diabetes Care GmbH, Germany) Hematological Analysis: A complete blood count (CBC), including total number of WBC, number and percentage of both lymphocytes and granulocytes, total number of RBC, hemoglobin (Hb), hematocrit (Hct), mean corpuscular hemoglobin (MCH), Mean corpuscular hemoglobin concentration (MCHC) and platelets indices (total number and Mean Platelet Volume, MPV), were performed using an automated hematology analyzer (UniCel DxH 800, Beckman Coulter, USA).

Statistical Analysis

All data were expressed as Mean ± SEM. Statistical significance was determined using one-way Analysis of Variance (ANOVA) followed by post-hoc tests, using SPSS (v26). A *p*-value of < 0.05 was considered statistically significant.

Results

Body Weight and Blood Glucose

The diabetic (AX) group showed a significant reduction in final body weight (21.83 ± 2.06 g) compared to the control group (29.83 ± 1.45 g, p<0.05). Treatment with GA (AX+GA) restored body weight to control levels (30.83 ± 1.58 g, p<0.05 vs. AX) (Table 1).

Table 1. Change In Body Weight of Mice for Different Groups

Groups		**Body weight(g) Mean± SEM**
No treatment, control	C	29.83±1.45
Mice treated with GA only for 30 days	GA	30.83±1.58
Animals treated with alloxan only (diabetic animals)	AX	21.83±2.06*
Alloxan-induced toxicity(diabetic) treated with GA for 30 days	AX+GA	30.83±1.58**

**Sig. Alloxan-Induced Diabetic mice (AX) compared with the Control group (C). ** Sig. AX+GA compared with Alloxan-Induced Diabetic mice (AX) (P < 0.05)*

Table 2. Effect of alloxan and gum arabic on FBG For Different groups

Groups	**FBG (mg/dl) Mean± SEM**
C	130.00±7.74
GA	156.67±8.04
AX	436.67±37.55*
AX+GA	146.00±10.01**

Sig. Alloxan-Induced Diabetic mice (AX) compared with the control group (C). (P < 0.05). Sig. AX+GA compared with Alloxan-Induced Diabetic mice (AX) (P < 0.05).*

Table 2 shows the effect of GA and Alloxan on FBG level in different groups. Alloxan induced severe hyperglycemia (FBG: 436.67 ± 37.55 mg/dl vs. Control: 130.00 ± 7.74 mg/dl, p<0.05). GA treatment in diabetic mice significantly reduced FBG to near-normal levels (146.00 ± 10.01 mg/dl, p<0.05 vs. AX). GA alone had no significant effect on FBG in non-diabetic mice.

Received*: 08-12-2025 -* ***Accepted****: 04-02-2026 -* ***Published****: 10-02-2026*

https://doi.org/10.54361/ajmas.269213

Hematological Parameters

WBC Indices: GA treatment (in both GA and AX+GA groups) led to a significant decrease in total WBC count and lymphocyte percentage, with a concomitant increase in granulocyte percentage, indicating an immunomodulatory effect (Figure 1, Tables 3 and 4)

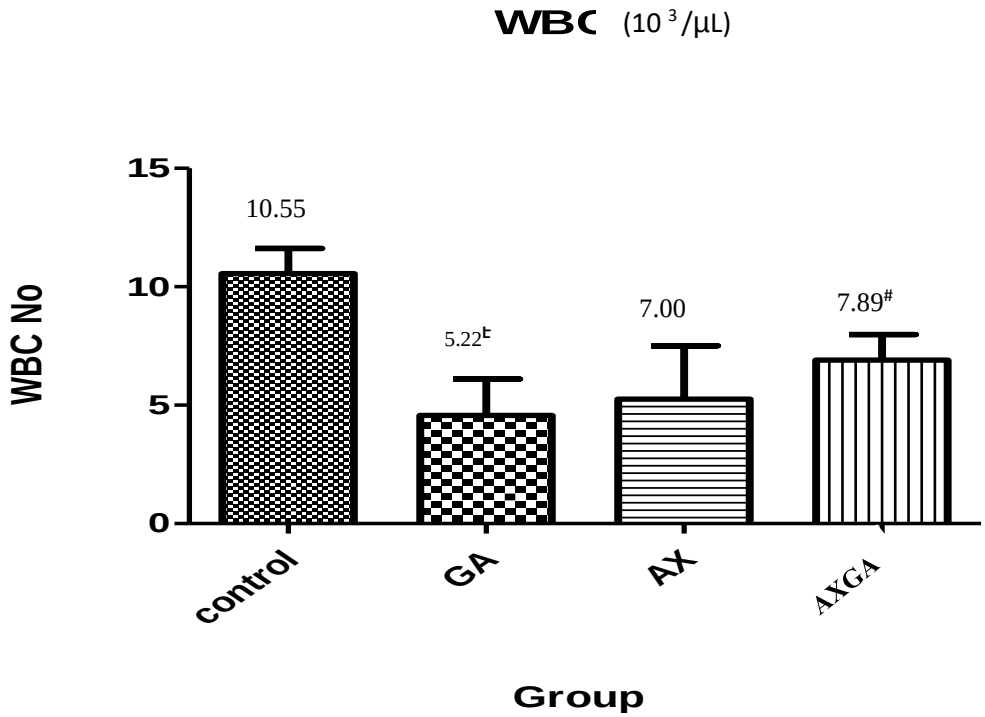

Figure 1. Change in the total number of WBC for different groups

ᵗSig. GA-Treated group compared with the Control group(C). # sig. AX+GA compared with the GA-Treated group

Table 3. Change In Number and Percentage of Lymphocytes for different Groups

Groups	No (10 ³ /µL) Mean± SEM	Lymphocytes (%) Mean± SEM
C	8.95±0.90	84.90±1.48
GA	2.88±1.20ᵗ	51.70±11.97ᵗ
AX	5.67±2.61	74.50±7.55
AX+GA	6.66±0.418	84.37±1.19#

ᵗsig. The GA-Treated group compared with the Control group (C) (P < 0.05). # sig. AX+GA compared with the GA-Treated group. (P < 0.05)

Table 4. Change In Number and Percentage of Granulocytes for Different Groups

Groups	No (10 ³ /µL) Mean± SEM	Granulocytes (%) Mean± SEM
C	0.48±0.07	4.51±0.37
GA	1.48±1.11ᵗ	27.07±10.22ᵗ
AX	0.58± 0.21	9.68±3.77
AX+GA	0.390± 0.07	4.84±0.71#

ᵗsig. GA-Treated group compared with Control group (c) (P < 0.05). # sig. AX+GA compared with GA-Treated group (P < 0.05).

RBC Indices: The RBC count remained unchanged across groups (Figure 2). However, GA treatment significantly reduced hemoglobin and hematocrit levels in both GA-treated groups (Table 5). A significant decrease in MCH was also observed in the GA-only group (Table 6).

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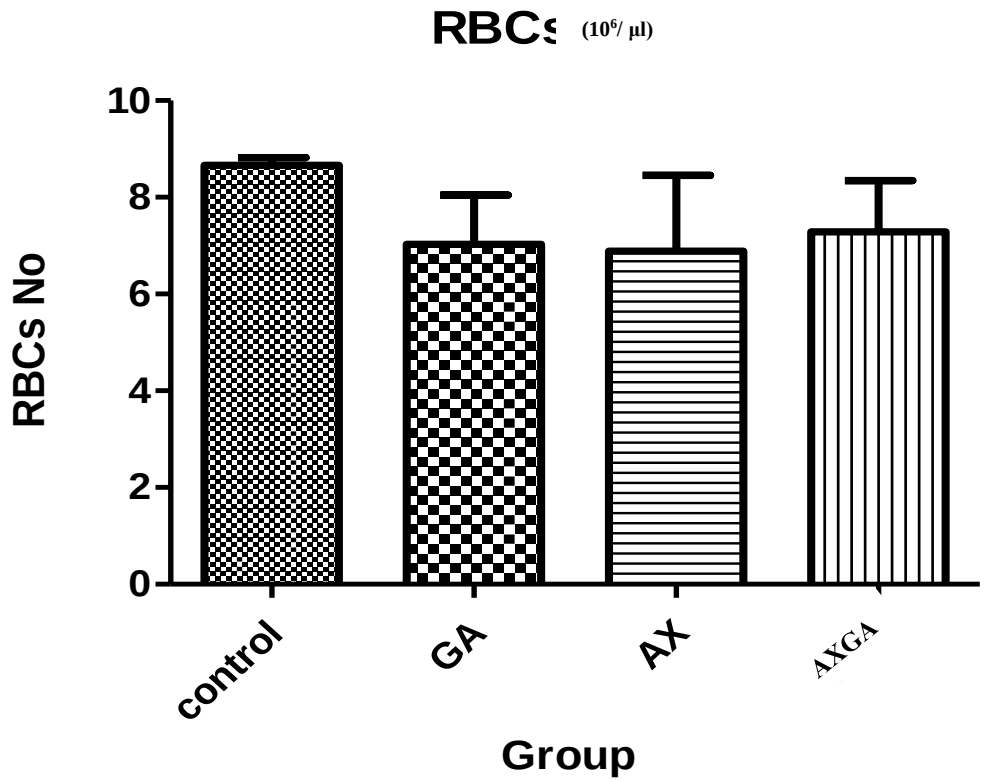

Figure 2. Effect Of GA on the Total Number of RBCs For Different Groups

Table 5. Effect Of GA And Alloxan on Hemoglobin and Hematocrit for Different Groups

Groups	Hemoglobin (mg/dl) Mean± SEM	Hematocrit (%) Mean± SEM
C	13.11±0.16	48.38±0.68
GA	10.93±0.61ᵗ	42.07±2.07ᵗ
AX	12.13±0.72	47.28±3.58
AX+GA	10.00±1.09**	38.27±3.42**

*** Sig. AX+GA compared with Alloxan-Induced mice (AX) (P < 0.05). ᵗSig. The GA-Treated group compared with the Control group (C) (P < 0.05).*

Table 6. Effect of GA and Alloxan on MCH & MCHC for different Groups

Groups	MCH(Pg) Mean± SEM	MCHC (%) Mean± SEM
C	15.15±0.32	27.13±0.39
GA	13.56±0.48ᵗ	25.96±0.55
AX	14.35±0.64	25.75±0.46
AX+GA	13.97±0.34	25.90±0.69

ᵗSig. GA-Treated group compared with the Control group (C) (P < 0.05).

Platelet indices: the count was unaffected (Figure 3), but Mean Platelet Volume (MPV) was significantly increased in the AX+GA group compared to the diabetic control (Table 7)

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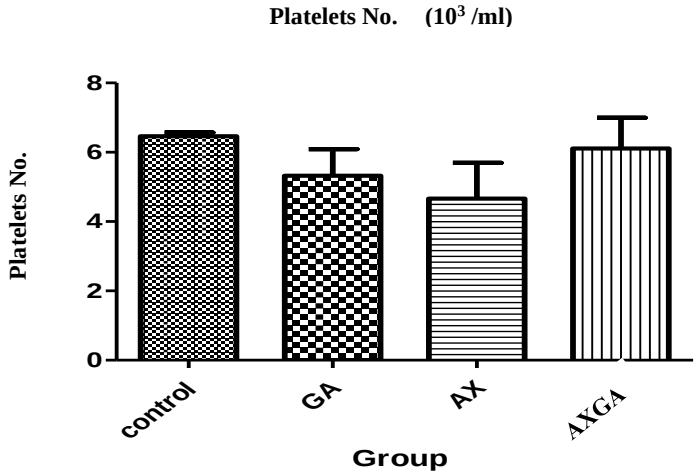

Figure 3. Effect Of GA And Alloxan on the Number of Platelets in Different Groups

Table 7. Effect Of GA And Alloxan on MPV For Different Groups

Groups	MPV (fL) Mean± SEM
C	6.46±0.11
GA	6.09±0.11
AX	6.22±0.25
AX+GA	6.99±0.14**

*** Sig. AX+GA compared with alloxan-induced mice AX(P < 0.05)*

Discussion

The effect of GA on the body weight of healthy normal rodents was demonstrated in many studies. Eyibo *et al* (2018) found that administration of different doses of Gum Arabic (GA) for nine weeks caused a significant decrease in the body weight of rats (5.88-11.77%). This weight reduction is attributed to the high fiber content of GA, which can displace available calories and nutrients, and may also suppress appetite, leading to weight loss in the rats.[11]. However, in our study, there is no change in body weight of normal healthy mice because of the short duration of GA treatment (4weeks). Alloxan is a urea derivative that selectively destroys the insulin-producing β-cells in pancreatic islets, causing their necrosis. This method is extensively employed to induce experimental diabetes in various animal species [12, 13]. This study demonstrates that Gum Arabic supplementation exerts significant beneficial effects in alloxan-induced diabetic mice. The most important findings are the potent anti-hyperglycemic activity and the restoration of diabetes-induced weight loss.

The ability of GA to significantly lower blood glucose and restore body weight in diabetic mice was demonstrated in several studies, and its mechanism of action may involve several routes, such as improving insulin sensitivity, reducing intestinal glucose absorption, and or protecting residual β-cells from oxidative stress [8,9,10]. The blood glucose-lowering property of GA may be attributed to its inhibition of the absorption of glucose in the intestine mediated by the abundance of sodium-glucose transporter 1 (SGLT1) in the enterocyte of the intestine in these experimental mice [14].

Hematological parameters like red blood cells (RBC), white blood cells (WBC), and platelet indices provide an important insight into inflammation, oxidative stress, and vascular risks in diabetic patients. These markers help predict complications and monitor disease progression beyond glycemic control [15]. The observed hematological changes are particularly noteworthy; the reduction in total WBC and lymphocyte count by GA. This suggests a potential anti-inflammatory or immunomodulatory role, since chronic inflammation is a key feature of diabetes and its complications [14]. The reduction in hemoglobin and hematocrit values, while not indicating severe anemia, warrants further investigation to determine whether it results from hemodilution or subtle effects on erythropoiesis.

Limitations

This study was conducted over 30 days; longer-term studies with different GA concentrations are needed to confirm the sustained effects of GA. The precise molecular mechanisms behind its antihyperglycemic and immunomodulatory actions also require further elucidation.

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Conclusion

This study provides robust experimental evidence that Gum Arabic is effective in controlling hyperglycemia in alloxan-induced diabetic mice. Its modulatory effects on hematological parameters further indicate its role in mitigating diabetes-associated inflammation. GA presents itself as a promising and safe natural adjuvant for diabetes management. Further clinical trials are needed to translate these findings into human applications.

Acknowledgment

The authors would like to thank all the faculty members of the Department of Pharmacology, Faculty of Medicine, Benghazi University.

Conflict of interest. Nil

References

1. Ahmed AA, Fedail JS, Musa HH, Musa TH. Gum Arabic extracts protect against hepatic oxidative stress in alloxan-induced diabetes in rats. Pathophysiology. 2015 Dec;22(4):189-94.
2. Al-Majed AA, Al-Zohairy MA, Khorshid OA. Gum Arabic reduces oxidative stress and inflammation in streptozotocin-induced diabetic rats. Metab Syndr Relat Disord. 2003 Mar;1(1):29-35.
3. Babiker R, Elmusharaf K, Keogh MB, Saeed AM. Effects of Gum Arabic ingestion on body mass index and body fat percentage in healthy adult females: a randomized placebo-controlled clinical trial. J Nutr Nutr. 2012;5(3):216-23.
4. Badreldin HA, Alrashood ST, Alkharty KM. Some biological properties of Gum Arabic: a review. J Food Agric Environ. 2009;7(2):5-10.
5. Donath MY, Shoelson SE. Type 2 diabetes as an inflammatory disease. Nat Rev Immunol. 2011 Feb;11(2):98-107.
6. Etuk EU. Animal models for studying diabetes mellitus. Agric Biol J N Am. 2010;1(2):130-4.
7. Food and Drug Administration (US). Code of Federal Regulations, Title 21, Sec. 184.1330. Gum Arabic. 2021 Apr 1 [cited 2024 May 15]. Available from: https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/CFRSearch.cfm?fr=184.1330
8. Genitsaridi I, Salpea P, Salim A, Sajjadi SF, Tomic D, James S, et al. IDF Diabetes Atlas: Global, regional and country-level diabetes prevalence estimates for 2021 and projections for 2045. Diabetes Res Clin Pract. 2022 Jan;183:109119.
9. Nasir O, Babiker R, Salim AM, Al-Saeed A. Protective effect of gum Arabic supplementation for type 2 diabetes mellitus and its complications. Int J Multidiscip Curr Res. 2016;4:288-94.
10. Obaid SS. The medical uses of Gum Acacia-Gum Arabic (GA) in human. Acad J Res Sci Publ. 2020;1(10).
11. Eyibo A, Istifanus G, Blessing O, Bogolnaan A, Denkok Y. Determination of the effect of gum arabic on body weight and some biochemical parameters on Albino Wistar Rat. European Journal of Nutrition & Food Safety. 2018 Jan 18;8(1):14-9.
12. Etuk EU. Animals models for studying diabetes mellitus. Agric Biol JN Am. 2010 May 12;1(2):130-4.
13. Iranloye BO, Arikawe AP, Rotimi G, Sogbade AO. Anti-diabetic and anti-oxidant effects of Zingiber officinale on alloxan-induced and insulin-resistant diabetic male rats. Nigerian journal of physiological sciences. 2011;26(1).
14. Roglic G. WHO Global report on diabetes: a summary. Int J Noncommun Dis. 2016;1(1):3-8.
15. Obeagu EI. Red blood cells as biomarkers and mediators in complications of diabetes mellitus: A review. Medicine. 2024 Feb 23;103(8):e37265.

Received: *08-12-2025* - ***Accepted***: *04-02-2026* - ***Published***: *10-02-2026*