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The effect of some active compounds of the Aqueaus extract of Basil on some blood hematological parameters of male rats induced with Diabetes

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Abstract

Diabetes mellitus is one of the major scientific problems facing the human body due to its delayed detection at its onset. It is often referred to as the silent killer. Cardiovascular disease, renal disease, and neuropathy are among the many complications that can develop in people with diabetes. The pancreatic beta cells secrete the hormone insulin. Its regulation of metabolism is crucial for maintaining normal blood sugar levels. Due to the complications caused by chemotherapy and its high cost, medicinal herbs have been used in this field to reduce the effects of diabetes and lower blood levels. One such herb is basil. Its aqueous leaf extract is used to treat diabetes, given its content of active compounds such as flavonoids, alkaloids, saponins, and other compounds.

Forty adult male albino rats were evaluated. They weighed between 200 and 250 grams and were 10 to 12 weeks old. Four groups were formed from them. A control group, which did not receive any therapy, was the first. On the other hand, 150 mg/kg bw of alloxan was administered to the second group. The third set of subjects received alloxan injections and a monthly dosage of 250 mg/kg bw of water-based basil leaves extract. The fourth set of subjects received a single alloxan injection, along with a monthly dosage of aqueous basil leaves extract (500 mg/kg body weight). Following the injection of alloxan, the findings demonstrated a significant decline ($p < 0.05$) in the quantity of red blood cells, compressed cell volume, and hemoglobin concentration. As shown in the control group, the levels increased once more after administering the aqueous basil leaf extract. Nevertheless, in contrast to the control group, the alloxan injection resulted in a substantial increase ($p<0.05$) in the number of white blood cells. It dropped down to levels similar to the control group after the administration of the water-based basil leaves extract ($p<0.05$).

Keywords: Ocimum basilicum, aqueous extract, rats, hematological parameters

I. Introduction

Diabetes mellitus is a major public health problem affecting all living beings due to its delayed detection at its onset. It is called the silent killer (Khan *et al*., 2019). Diabetes increases the risk of other diseases such as heart disease, kidney disease, and neuropathy. This disease is characterized by hyperglycemia resulting from insulin deficiency, resistance, or both (Berbadi *et al.,* 2020).

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Beta cells in the pancreas secrete the hormone insulin. Its function in controlling metabolic rate is crucial. It converts glucose absorbed into various tissues into glycogen, fat, or both (Cryer, 2013; Saydah, 2017). Treating complications resulting from high blood sugar levels is so expensive. Therefore, the use of herbal medicines has been used to eliminate these complications (Magliano *et al*., 2019). One of the natural herbs used in this field is basil. Flavonoids, alkaloids, saponins, steroids, and others are in this plant's aqueous extract (Shahrajabian *et al.*, 2020). The extract has been extensively examined as an efficient diabetic therapy (Teofilović *et al*., 2025). Additionally, it has antioxidants. These chemicals protect the immune system, reducing the risk of diabetes-related issues, according to (Rajesh *et al.*, 2023).

(Mansi & Lahham, 2008) recorded a decrease in the number of red blood cells in diabetic rats as a result of alloxan stimulation compared to healthy rats (control). This was attributed to a decrease in the activity of the enzyme Na_K_ATP_ase in the membranes of red blood cells. This reduces their blood-filtering ability, causing anemia and capillary blood circulation issues (Kowulu *et al*., 1989). (Rao *et al*., 2003) discovered that the water-based extract's active ingredients may increase red blood cell count, restore them, and protect them from free radical damage.

Alloxan affects hemoglobin concentration and packed cell volume similarly. It lowered these levels, but the aqueous extract restored them (Mansi & Lahham, 2008). White blood cell count increased significantly in the diabetes-induced group compared to the control group.

A basil leaves aqueous extract reduced white blood cell count and returned it to normal (Sunmonu & Anthony, 2013). Therefore, this study aimed to investigate the effect of the aqueous extract of basil leaves on red blood cell counts, packed cell volume, hemoglobin concentration, and white blood cell count in rats induced with diabetes using alloxan.

II. Materials and Methods

Forty male laboratory rats, aged 12-15 weeks and weighing 200-250 grams, were used in this study. They were randomly divided into four groups as follows:

1. **Group 1** (G1): Control group members received physiological saline.

2. **Group 2** (G2): Intraperitoneal alloxan (150 mg/kg living weight) caused diabetes.

3. **Group 3** (G3): Diabetes was induced with alloxan (150 mg/kg living weight), then treated with 250 mg/kg basil leaves aqueous extract one month later.

4. **Group 4** (G4): One month following the establishment of diabetes with alloxan (150 mg/kg live weight), the animals were given an aqueous extract of basil leaves at a dosage of 500 mg/kg.

5 ml of blood was drawn from rats using sterile medical syringes after the animals were anesthetized. The blood was drawn directly from the heart. Samples were stored in anticoagulant-free vials for hematological studies. They were refrigerated until blood tests were performed on the same day. The following parameters were assessed: white blood cell count, hemoglobin concentration, packed cell volume, and red blood cell count.

Data were statistically analyzed using SPSS (version 26 2019).

III. Results and Discussion

1. Changes in Red Blood Cell Counts

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Table 1 shows that compared to the control group that was not treated, there was a significant drop ($p<0.05$) in red blood cell counts when alloxan was used to induce diabetes. This may be due to the fact that inducing diabetes leads to increased red blood cell fragility and decreased filtration capacity. The interruption of capillary circulation causes red blood cell lysis (Kowulu *et al.,* 1989). Hyperglycemia causes red blood cell membrane alterations and disintegration (Ishimura *et al*., 1998). (Rao *et al*., 2003) found that the strength of antioxidants in the active component aqueous extract led to a significant increase ($p<0.05$) in red blood cell count in the treated group. This implies the extract may protect blood from free radicals.

2. Changes in packed Cell Volume:

Table 2 reveals a significant decrease ($p<0.05$) in compressed cell volume following alloxan administration compared to the control group before treatment. Alloxan induced RBC lysis and mortality, lowering RBC count (Sunmonu & Autonomy, 2013).

When infected rats were treated with the aqueous extract, the packed cell volume increased significantly ($p<0.05$). This is due to the active ingredients in the aqueous extract and the strong antioxidants present, which led to this increase as a result of the direct relationship between the number of red blood cells and the packed cell volume. The increase in the number of red blood cells led to a return to the levels of packed cell volume (Sturkie 1986)

3. Changes in hemoglobin concentration:

The hemoglobin concentration was significantly lower ($p<0.05$) in the alloxan-induced diabetic rats compared to the untreated control group, as shown in (Table3). This decrease is due to the increased creatinine levels in diabetic patients (Mansi & Lahham, 2008; Babu *et al*., 2003). The increase in antibodies in diabetes leads to the destruction of beta cells, which results in damage to the intestinal mucosa and reduces the absorption of vitamin B12, which affects hemoglobin levels (Hillman & Ault 2002). A significant rise in hemoglobin content was seen following dosing with an aqueous extract of basil leaves (Renovaldi & Adam, 2020; Al-Snafi, 2021). This increase is due to the role the extract plays in regulating blood parameters due to its active ingredients and powerful antioxidants (Dikow *et al*., 2002).

4 . Changes in white blood cell count:

The results demonstrated that compared to the control group, rats induced with diabetes had a significantly higher white blood cell count ($p<0.05$) (Table 4). Inhibiting white blood cell migration raised circulating white blood cell numbers (Rossini *et al.,* 1993).

White blood cell levels considerably decreased ($p<0.05$) in the tables after receiving the aqueous extract (Chaudhary *et al.,* 2016). Flavonoid chemicals in the aqueous extract reduce illness incidence and inflammation (Sunmon and Authony, 2013).

IV. Conclusions

Diabetes is a serious disease. It leads to high blood sugar by reducing insulin production from the beta cells in the pancreas. This decrease in hormone secretion affects certain blood characteristics. It reduces red blood cell count, erythrocyte sedimentation rate, and hemoglobin concentration, as well as increasing white blood cell count. Some herbal remedies containing active ingredients have been used to reduce the incidence of this disease. One such herb is basil. Its aqueous extract contains several active ingredients that help control diabetes. Safe use of this extract helps the pancreas return to insulin secretion at levels close to normal by restoring pancreatic beta cells. This causes the quantity of white blood cells to rise, the concentration of hemoglobin to fall, and the size of the cells themselves to shrink. Evidence suggests that the usage of specific herbal medicines with active components can be helpful in the treatment of this illness.

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Among these plants is basil, whose extract contains many active compounds that work to restore insulin production to normal levels by regenerating beta cells in the pancreas.

treatments / Periods	G1	G2	G3	G4	treatments Mean
Before diabetes induction	a 8.35 ± 0.25 A	a 8.67 ± 0.28 A	a 8.24 ± 0.24 A	a 8.62 ± 0.29 A	a 8.17 ± 0.18
15 days after diabetes induction with alloxan	a 8.30 ± 0.45 A	b 6.82 ± 0.36 B	b 6.10 ± 0.35 BC	C 5.94 ± 0.31 C	Ab 6.79 ± 0.93
One month after diabetes induction with alloxan	a 8.35 ± 0.53 A	b 5.81 ± 0.50 B	C 5.49 ± 0.48 B	C 5.67 ± 0.49 B	b 6.33 ± 1.17
15 days after administration of the extract	a 8.27 ± 0.64 A	b 5.77 ± 0.49 C	b 6.92 ± 0.54 B	b 7.21 ± 0.56 AB	b 7.04 ± 0.89
One month after administration	a 8.32 ± 0.39 A	b 5.62 ± 0.35 C	b 7.22 ± 0.37 B	b 7.81 ± 0.36 AB	b 7.24 ± 1.17
Periods mean	8.32 ± 0.03 A	6.54 ± 1.14 B	6.79 ± 0.94 B	7.05 ± 0.05 B	

Table (1) Effect of the active ingredients of the aquatic basil leaves extract on the average red blood cell count (106 x cells/cm3) in male rats in the different treatments and the (mean ± S.E.)

Capital letters in the horizontal direction indicate significant differences ($p<0.05$) between treatments.

Lowercase letters in the vertical direction indicate significant differences ($p<0.05$) between periods.

G1: First treatment, administered physiological saline only (negative control).

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G2: Second treatment, induced diabetes using alloxan (positive control).

G3: Third treatment, induced diabetes, administered orally with 250 mg of hot aqueous basil leaves extract. Mg/kg body weight

G4: The fourth treatment induces diabetes and is administered orally with a hot aqueous extract of basil leaves at 500 mg/kg body weight

Table(2):Effect of the active ingredients of the aquatic basil leaves extract on Packed Cell Volume (%) in male rats blood in different treatments (mean+_ S.E.)

Treatments / Periods	**G1**	**G2**	**G3**	**G4**	**treatments Mean**
Before diabetes induction	a 37.91 ± 4.17 A	a 38.02 ± 4.18 A	a 37.83 ± 4.53 A	a 37.72 ± 4.47 A	a 37.87 ± 3.00
15 days after diabetes induction with alloxan	a 37.85 ± 3.41 A	C 30.49 ± 2.44 B	C 29.92 ± 2.39 B	b 30 .71 ± 2.46 B	a 32.24 ± 3.87
One month after diabetes induction with alloxan	a 37 .72 ± 3.39 A	C 30.11 ± 2.41 B	C 29.63 ± 2.39 B	b 29.25 ± 2.34 B	a 31.68 ± 3.80
15 days after administration of the extract	a 37.87 ± 3.03 A	C 30.88 ± 2.47 B	b 32.43 ± 2.59 B	b 31.75 ± 2.54 B	a 33.23 ± 3.98
One month after administration	a 37.77 ± 3.78 A	b 33.17 ± 2.98 B	b 34.25 ± 2.74 B	Ab 35.21 ± 2.82 B	a 35.1 ± 3.86

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Periods mean	37.82 ± 4.16 A	32.53 ± 3.25 B	32.81 ± 3.61 B	32.93 ± 3.62 B	

Capital letters in the horizontal direction indicate significant differences ($p<0.05$) between treatments.

Lowercase letters in the vertical direction indicate significant differences ($p<0.05$) between periods.

G1: First treatment, administered physiological saline only (negative control).

G2: Second treatment, induced diabetes using alloxan (positive control).

G3: Third treatment, induced diabetes, administered orally with 250 mg of hot aqueous basil leaves extract. Mg/kg body weight

G4: The fourth treatment induces diabetes and is administered orally with a hot aqueous extract of basil leaves at 500 mg/kg body weight

Table(3):Effect of the active ingredients of the aquatic basil leaves extract on Haemoglobin concentration(mg/dl) in male rats blood in the different treatments (mean +_ S.E.)

Treatments / Periods	**G1**	**G2**	**G3**	**G4**	**treatments Mean**
Before diabetes induction	a 11.79 ± 0.13 A	a 11. 82 ± 0.15 A	a 11.91 ± 0.22 A	a 11.87 ± 0.17 A	a 11.85 ± 0.05
15 days after diabetes induction with alloxan	a 11.70 ± 0.24 A	b 10.73 ± 0.25 B	C 9.93 ± 0.18 C	b 10.31 ± 0.20 BC	b 10.67 ± 0.76
One month after diabetes induction with alloxan	a 11.81 ± 0.27 A	b 9.82 ± 0.20 BC	b 9.84 ± 0.22 B	b 9.71 ± 0.21 C	b 9.80 ± 1.01

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15 days after administration of the extract	a 11.87 ± 0.20 A	C 9.85 ± 0.16 C	b 10.67 ± 0.19 B	b 10.85 ± 0.20 B	b 10.81 ± 0.55
One month after administration	a 11.93 ± 0.35 A	C 9.77 ± 0.36 C	b 11.12 ± 0.31 B	a 11.22 ± 0.33 B	b 11.01 ± 0.62
Periods mean	11.82 ± 0.37 A	10.40 ± 0.29 B	10.69 ± 0.30 B	10.79 ± 0.33 B	

Capital letters in the horizontal direction indicate significant differences ($p<0.05$) between treatments.

Lowercase letters in the vertical direction indicate significant differences ($p<0.05$) between periods.

G1: First treatment, administered physiological saline only (negative control).

G2: Second treatment, induced diabetes using alloxan (positive control).

G3: Third treatment, induced diabetes, administered orally with 250 mg of hot aqueous basil leaves extract. Mg/kg body weight

G4: The fourth treatment induces diabetes and is administered orally with a hot aqueous extract of basil leaves at 500 mg/kg body weight

Table (4) Effect of the active ingredients of the aquatic basil leaves extract on the white blood cell count (103 x cells/cm3) in the blood of male rats in the different treatments (mean+_ S.E.)

treatments / Periods	**G1**	**G2**	**G3**	**G4**	**treatments Mean**
Before diabetes induction	a 8.26 ± 0.74 A	b 8.31 ± 0.75 A	b 8.34 ± 0.83 A	C 7.95 ± 0.72 A	C 8.22 ± 0.74

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15 days after diabetes induction with alloxan	a 8.19 ± 0.71 B	a 13.14 ± 1.05 A	a 12.19 ± 0.97 A	a 12.63 ± 1.01 A	a 11.54 ± 1.04
One month after diabetes induction with alloxan	a 7.82 ± 0.70 A	a 13.73 ± 1.10 A	a 13. 21 ± 1.06 A	a 13.11 ± 1.05 A	a 11.97 ± 1.08
15 days after administration of the extract	a 8.41 ± 0.76 C	a 12.11 ± 0.97 A	b 9.29 ± 0.74 BC	b 10.13 ± 0.81 B	b 9.99 ± 0.90
One month after administration	a 7.97 ± 0.72 B	a 12.21 ± 0.85 A	b 6.15 ± 0.65 B	C 7.86 ± 0.63 B	C 8.56 ± 0.94
Periods mean	8.13 ± 0.89 B	11.90 ± 1.31 A	10.24 ± 1.12 AB	10.34 ± 1.13 A	

Capital letters in the horizontal direction indicate significant differences ($p<0.05$) between treatments.

Lowercase letters in the vertical direction indicate significant differences ($p<0.05$) between periods.

G1: First treatment, administered physiological saline only (negative control).

G2: Second treatment, induced diabetes using alloxan (positive control).

G3: Third treatment, induced diabetes, administered orally with 250 mg of hot aqueous basil leaves extract. Mg/kg body weight

G4: The fourth treatment induces diabetes and is administered orally with a hot aqueous extract of basil leaves at 500 mg/kg body weight

V. References

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https://jam.utq.edu.iq/index.php/main *https://doi.org/10.54174/utjagr.v13i1.323*

Anthony, U. M., Adebimpe, O. A. (2009). Hypoglycemic potential of the young leave methanolic extract of Magnifera indica in allexa-induced diabetic rats. Pakistan J. Nutrition, 8 (3), 239-241.

Babu V., Gangadevi T. and Subramoniam A. (2003). Antidiabetic activity of ethanol extract of Cassia kleinii leaf in streptozotocin-induced diabetic rats and isolation of an active fraction and toxicity evaluation of the extract. J. Pharmacol. Indian., 35:290-296

Berb, A., Rahmadika, N., Tjabjadi, A.I., and Ruslami, R. (2020). Type 2 diabetes and its impact on

the immune system. Current Diabetes Reviews, 16(5), 442–449

Chaudhary, S., Semwal, A., Kumar, H., Verma, H. C., & Kumar, A. (2016). In-vivo study of anti-hyperglycemic potential of basil seed extract (Ocimum basilicum). Biomedicine & Pharmacotherapy. Advance online publication. https://www.sciencedirect.com

Cryer, P.E. (2013). Mechanisms of hypoglycemia-associated autonomic failure in diabetes.

Eng. J. Med. 369: 362–372

Hillman, R.S., and Ault, K.A. (2002). Hematology in clinical practice. 3rd ed., McGraw-Hill, pp. 46-47

Khan, R.M.M., Chua, Z.J.Y., Tan, J.C., Yang, Y., Liao, Z.Y., and Zhao, Y. (2019). From pre-diabetes

to diabetes: diagnosis, treatments and translational research. Medicina .SS(9),546

Magliano, D.J., Islam, R.M., Barr, E.L., Gregg, E.W., Pavkov, M.G., Harding, J.L., and Shaw, J.E. (2019). Trends in incidence of total or type 2 diabetes: systematic review. BMJ, 366

Mansi, K., and Lahham, J. (2008) Effects of Artemisia Sieberi (BesserHerba-Alba) on Heart Rate and Some Hematological Values in Normal and Alloxan-Induced Diabetic Rats. Journal of Basic and Applied Sciences Vol. 4, No. 2, 57-62

Rajesh, K.; Shivanar, A.; Poornim, P.; Krithamy, P.; Kingshuk, P.; Sarah, C.; Deepti, P. and

Subarna, R. (2023). Antidengue activity of lipophilic fraction of Ocimum basilicum

Renovaldi D, Adam AK (2020) Potential of Sweet Basil (Ocimum basilicum) as a Hepatoprotector Agent for Liver Injury Related to Drugs. Muhammadiyah Medical Journal 1 63-68.

Rao GU, Kamath C, Raghothama KSP, Rao P (2003). Maternal and fetal indicators of oxidative stress in various obstetric complications. Ind. J. Clin. Biochem. 18:80-86

Saydah, SH. (2017). Medication use and selfcare practices in person with diabetes. Diabetes

in America, 3rd ed. Bethesda, MD: National Institutes of Health

Shahrajabian, M. H.; Sun, W.; Cheng, Q.,(2020): Chinese Herbal Medicine

for SARS and SARS-CoV-2 Treatment and Prevention, Encouraging

ISSN Onlin:2708-9347, ISSN Print: 2708-9339 Volume 14, Issue 2 (2025) PP 231-240

https://jam.utq.edu.iq/index.php/main *https://doi.org/10.54174/utjagr.v13i1.323*

Using Herbal Medicine for COVID-19 Outbreak. Acta Agric. Scand.

B- Soil Plant Sci. 2020. DOI: 10.1080/09064710.2020.1763448

Sturkie, P.D. (1986). Avian physiology. 4th ed. Springer Velag, New York, INC.

Sunmonu, T. and Anthony J. Afolayan (2013) Evaluation of Antidiabetic Activity and Associated Toxicity of Artemisia afra Aqueous Extract in Wistar Rats. Hindawi Publishing Corporation. Evidence-Based Complementary and Alternative Medicine Article ID 929074, 8 pages

Teofilović, B., Tomas, A., Martić, N., Stilinović, N., Ćapo, I., Grubić-Letić, N., Gligorijev, E.,

& Rašković, A. (2025). Therapeutic potential of basil (Ocimum basilicum L.) aqueous extract: Impact on glycemia and oxidative stress in normoglycemic and diabetic rats. Pharmazie, 80(1), 17–23. https://doi.org/10.1691/ph.2025.4629