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ASSESSMENT OF ERYTHROPOIETIN, COMPLETE BLOOD COUNT AND COAGULATORY EFFECT OF *CADABA FARINOSA* IN EXPERIMENTAL GASTRIC ULCER

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ABSTRACT

Gastric ulcers are a common gastrointestinal disorder resulting from disruption of the gastric mucosal barrier, often due to Helicobacter pylori infection, NSAID use, and other aggressive factors. This study evaluated the effect of Cadaba farinosa leaf extract on PTTK and full blood count in aspirin-induced gastric ulcer in Adult Wistar rats. Thirty adult Wistar rats were randomly divided into six groups: negative control, positive control (ulcer only), three treatment groups receiving graded doses of C. farinosa extract (250, 500, and 1000 mg/kg), and a standard drug group (omeprazole, 20 mg/kg). Gastric ulcers were induced using aspirin. After 14 days of treatment, blood samples were analyzed for full blood count using hematology auto analyzer, and coagulation status was assessed using Partial Thromboplastin Time with Kaolin (PTTK). The positive control group showed reduced RBC (6.8 $\pm$ 0.3 x 10^6/uL), Hb (13.5 $\pm$ g/dl), and platelets (290 $\pm$ 15 x 10^3/uL), alongside prolonged PTTK (35 $\pm$ 0.2 Seconds), indicating anemia, thrombocytopenia, and impaired coagulation. Treatment with C. farinosa significantly improved hematological indices and normalized clotting times in a dose-dependent manner. The medium dose (500 mg/kg) produced the greatest effect, with increases in Hb (+1.0 g/dL), platelets (+30 $\times 10^3/\mu L$), and a reduction in clotting time (–5.0 sec) compared to untreated ulcer-induced adult wistar rats. The high dose was less effective, suggesting a biphasic response, while omeprazole showed similar normalization effects. Cadaba farinosa demonstrated hematoprotective and coagulatory benefits in ulcer-induced adult wistar rats, supporting its ethnomedicinal use in managing gastrointestinal and bleeding disorders. The extract improved anemia-related parameters, normalized platelet counts, and restored clotting balance, with the medium dose showing optimal therapeutic effect.

Keywords: Cadaba farinosa, gastric ulcer, clotting time, full blood count, hematology

Introduction

Gastric ulcers are a frequently encountered medical condition that contribute significantly to healthcare burden and resource utilization. They are a break in the mucosal barrier of the

stomach lining that penetrates through the muscularis mucosa and are greater than 5mm in diameter [1]. It is important to understand this disease process is both preventable and treatable. Patients may be treated differently depending on the etiology of their gastric ulcer [2]. The body has natural ways to protect the stomach mucosa from the harmful acidic environment that is the gastric lumen. When alterations occur to these defenses, it can lead to changes in the gastric mucosa which will eventually cause erosion and then ulceration [3]. Gastric mucosa protection is via prostaglandins, mucous, growth factors, and adequate blood flow. Known damaging factors of this barrier include smoking, hydrochloric acid, ischemia, NSAID medications, hypoxia, alcohol, and *Helicobacter pylori* infection [3, 11,12].

The most common etiologies of gastric ulcers include a bacterial infection with *Helicobacter pylori* and gastric prostaglandin loss associated with non-steroidal anti-inflammatory medications. Less common etiologies include hypergastrinemia (Zollinger-Ellison syndrome), viral infections such as CMV, chemotherapy and radiation, gastric outlet obstruction, gastric infiltrative disorders such as malignancy, cigarette smoking, and Crohn disease[4]. The common factor in all of these etiologies is that they promote a breakdown in the mucosal barrier and expose the gastric mucosa to the damaging effects of acid.

NSAID medications are the other most common etiology causing gastric ulcers. Patients who use these medications have a relative risk of four for developing gastric ulcers when compared to people who don't [4] There are multiple mechanisms by which NSAID medications lead to ulceration. The drugs themselves are weak acids when they become exposed to gastric acid. They remain in the epithelial cells and lead to increased cellular permeability, which leads to physical cellular injury. The primary mechanism of NSAID-induced ulceration is the decrease in prostaglandin synthesis [5]. NSAIDs inhibit the cyclooxygenase-1 enzyme, which usually increases prostaglandin synthesis, which in turn leads to gastric bicarbonate secretion, mucus barrier formation, increased mucosal blood flow, and accelerated epithelial cell restitution and repair after injury or cell death[6]. NSAID medications allow the gastric mucosa to become more vulnerable to gastric acid and pepsin damage. Overall, the most harmful physiological damage results from the decrease in gastric blood flow and the mild ischemia it causes in the gastric mucosa. [2]

Overall, the pathophysiology of gastric ulcer development depends on the etiology, but they all lead to the loss or damage of the gastric mucosal integrity. Despite the widespread use of conventional therapies for gastric ulcers, side effects and drug resistance remain significant issues. Furthermore, little is known about the systemic haematological effects of *cadaba farinosa,* particularly in the context of ulcer treatment. This study seeks to evaluate its influence

on clotting time and full blood count in ulcer-induced adult wistar rats, thereby expanding the pharmacological profile of the plant.

MATERIAL AND METHOD

Experimental Design

This study included a randomized, experimental controlled animal study plan, targeted at evaluating the haematological and coagulatory effects and anti-ulcerogenic effects of *Cadaba farinosa* extract, on aspirin induced gastric ulcer in wistar rats. The plan allowed for controlled inducement of gastric ulcer and assessment of treatment effects.

The rats used for the main ulcer treatment was further divided into:

Group I: (positive control): Positive control (feed + water)

Group II: (negative control): Ulcer control (feed + water)

Group III: (low dose): Ulcer + low dose treatment (feed + water + 250mg/kg)

Group IV: (medium dose): Ulcer + medium dose treatment (feed + water + 500mg/kg)

Group V: (high dose): Ulcer + high dose treatment (feed + water + 1000mg/kg)

Group VI: (standard): Ulcer + standard drug (feed + water + omeprazole)

Ethical Considerations

Ethical approval was gained from the Ethical Committee for the use of laboratory animals, Bingham University, Karu.

Plants collection

The leaves were collected from its natural habitat at the Faculty of Pharmaceutical Science, Usman Danfodiyo University, Sokoto, the plant was checked and validated and delivered for the extraction process.

Plants extraction

The leaves were air dried, powdered and was extracted thoroughly with 70% methanol, over several days, using the cold maceration method with occasional shaking. Crude ethanol leaf extract (CEE) of *Cadaba farinosa*. The plant extract was the transported back to Bingham University, Nasarawa.

Acute toxicity (LD_{50}) using five rats.

The lethal dose was done using the UP and DOWN method. The acute toxicity of the *Cadaba farinosa* stem bark extract (methanolic) was done using the Organization for Economic Cooperation and Development guideline 425 (OECD guideline 425) Up and Down procedure. Healthy wistar adult rats were used; they were fasted for 12hours before administration. One of the rats was randomly selected and orally administered 5000mg/kg of the extract. It was then

observed after 30 minutes for any physical changes and toxicity. After 24hours, the rat was observed again. Based on survival, the remainder were dosed according to the Up and Down procedure.

Phase two: anti-ulcer experiment using thirty rats.

Table 2: Experimental Design

Group	No. of animals	Treatments administered	Treatment duration
Normal control A & B Replicate	5	Distilled water	14 days
Gastric ulcer	5	Aspirin 500mg	14 days
Gastro-therapeutic low dose	5	Gastric ulcer + Cf(250mg/0.2ml)	14 days
Gastro-therapeutic medium dose	5	Gastric ulcer + Cf (500mg/0.2ml)	14 days
Gastro-therapeutic high dose	5	Gastric ulcer + Cf (1000mg/0.2ml)	14 days
Standard ulcer drug	5	Gastric ulcer + Omeprazole(20mg/kg)	14 days.

Blood sample collection

Blood sample was collected via cardiac puncture for haematological analysis using standard methods.

Full Blood Count (FBC) Procedure

The Full Blood Count (FBC) was reportedly performed using an automated hematology analyzer that operates through electrical impedance and optical flow cytometry[7]. In this technique, EDTA-anticoagulated whole blood was used to measure parameters such as red blood cells (RBCs), white blood cells (WBCs), platelets (PLTs), hemoglobin (Hb), and other indices[8].

Partial Thromboplastin Time with Kaolin (PTTK) Procedure

The PTTK test was reportedly carried out to evaluate the intrinsic pathway of coagulation. The procedure involved the activation of Factor XII using kaolin, along with cephalin (phospholipid) and calcium chloride, and clotting time was recorded [8,9,10].

RESULTS

Table 2: Descriptive Statistics for Haematological parameters across Experimental Groups

Parameter	Group (n=5)	Mean ± SD	F-value	p-value
WBC ($\times 10^3/\mu L$)	Negative ctrl	6.1 ± 0.3	4.01	0.009
	Positive ctrl	5.8 ± 0.4		
	Low Dose	6.3 ± 0.5		
	Medium Dose	6.5 ± 0.2**		
	High Dose	6.0 ± 0.4		
	Standard	6.2 ± 0.3		
RBC ($\times 10^6/\mu L$)	Negative ctrl	7.0 ± 0.2	3.11	0.027
	Positive ctrl	6.8 ± 0.3		
	Low Dose	6.9 ± 0.2		
	Medium Dose	7.1 ± 0.3**		
	High Dose	6.7 ± 0.4		
	Standard	7.0 ± 0.2		
Hb (g/dl)	Negative ctrl	14.0 ± 0.5	5.87	< 0.001
	Positive ctrl	13.5 ± 0.6		
	Low Dose	14.2 ± 0.4		
	Medium Dose	14.5 ± 0.3		
	High Dose	13.8 ± 0.5		
	Standard	14.3 ± 0.4		
PLT ($\times 10^3/\mu L$)	Negative Ctrl	300 ± 20	2.78	0.041
	Positive Ctrl	290 ± 15		
	Low Dose	310 ± 20		
	Medium Dose	320 ± 30**		
	High Dose	295 ± 20		
	Standard	305 ± 15		

Note: SD = Standard Deviation. For each parameter, a significant ANOVA p-value ($p < 0.05$) indicates a statistically significant difference in means across the groups

Table 2 presents a dual analysis, combining both descriptive and inferential statistics, to evaluate the effects of different treatments on haematological parameters in an experimental study. It first displays the mean values and standard deviations for White Blood Cells (WBC), Red Blood Cells (RBC), Hemoglobin (Hb), and Platelets (PLT) across six groups, including negative and positive controls, three dose levels of an experimental treatment, and a standard treatment group. The descriptive data show clear variations among groups, with the Medium Dose group consistently exhibiting the highest mean values for all parameters, suggesting a potential positive effect on haematological recovery. The positive control group shows the lowest values, indicating the expected detrimental effect of the induced condition.

The inferential component, represented by the— ANOVA results, provides statistical evidence for these observed differences. The F-values and associated p-values indicate whether the variations between group means are statistically significant. For WBC, the p-value of 0.009 confirms a significant difference among groups, though the effect is less pronounced than for other parameters. Similarly, RBC shows a significant difference with a p-value of 0.027. The most robust statistical evidence is found for Hemoglobin, with a highly significant p-value of less than 0.001, indicating strong treatment effects. Platelet counts also show significant differences with a p-value of 0.041.

Table 3 Partial Thromboplastin Time (PTTK) Across Experimental Groups

Experimental Group	Mean Clotting Time (seconds)	Standard Deviation	95% Confidence Interval
Negative Control	28.0	1.5	26.3 – 29.7
Positive Control	35.0	0.2	34.7 – 35.3
Low Dose	32.0	1.8	29.9 – 34.1
Medium Dose	30.0	1.2	28.5 – 31.5
High Dose	33.0	1.5	31.2 – 34.8
Standard	29.0	1.0	27.8 – 30.2

Table 3 presents the descriptive statistics for the Partial Thromboplastin Time (PTTK) results across the six experimental groups, each consisting of five rats. The values are reported in seconds, which measure the time taken for blood to clot. The Negative Control group, which represents healthy rats without induced ulcers, showed the shortest mean clotting time of 28.0

seconds, with relatively low variability (SD = 1.5). The Positive Control group, consisting of ulcer-induced rats that received no treatment, displayed a markedly prolonged mean clotting time of 35.0 seconds—the highest among all groups—with very little variation (SD = 0.2), underscoring the consistency of the ulcer model in impair coagulation. Among the treatment groups, the Medium Dose of *Cadaba farinosa* yielded a mean clotting time of 30.0 seconds, which is closest to the healthy Negative Control and notably lower than the Positive Control. The Standard group treated with Omeprazole also showed effective normalization of clotting time, with a mean of 29.0 seconds. The Low Dose and High Dose groups demonstrated intermediate results (32.0 and 33.0 seconds, respectively), suggesting a non-linear dose-response relationship. The 95% Confidence Intervals provide an estimate of the range within which the true population mean is likely to fall. The narrow interval for the Positive Control (34.7 – 35.3) indicates high precision, while wider intervals for other groups reflect greater variability within those samples.

Table 4: PTTK and Haematological Parameters Between Treatment Groups and Positive Control

Group	Δ PTTK (seconds)	Δ WBC ($\times 10^3/\mu L$)	Δ RBC ($\times 10^6/\mu L$)	Δ Hb (g/dL)	Δ PLT ($\times 10^3/\mu L$)
Negative Control	-7.00	+0.3	+0.2	+0.5	+10
Low Dose	-3.00	+0.5	+0.1	+0.7	+20
Medium Dose	-5.00	+0.7	+0.3	+1.0	+30
High Dose	-2.00	+0.2	-0.1	+0.3	+5
Standard	-6.00	+0.4	+0.2	+0.8	+15

Table 4 provides a critical comparative analysis by calculating the mean differences (Δ) in key parameters between each treatment group and the Positive Control. This calculation effectively quantifies the magnitude of each treatment's effect in reversing the impairments caused by gastric ulcer induction. The Positive Control, representing the diseased, untreated state, serves as the baseline (Δ = 0 for all parameters), against which all other groups are measured.

The data reveals a clear and compelling efficacy of the Medium Dose of *Cadaba farinosa* this

group demonstrates the most substantial improvement across the majority of parameters. It shows a large reduction in the pathologically prolonged Partial Thromboplastin Time (PTTK) (Δ = -5.00 seconds), indicating a potent normalization of coagulation. Furthermore, it exhibits the greatest increase in White Blood Cell count (Δ = +0.7 $\times 10^3/\mu L$), Red Blood Cell count (Δ = +0.3 $\times 10^6/\mu L$), Hemoglobin concentration (Δ = +1.0 g/dL), and Platelet count (Δ = +30 $\times 10^3/\mu L$) compared to the Positive Control. This consistent pattern across both coagulatory and haematological systems highlights the comprehensive restorative action of the medium dose.
The Standard drug (Omeprazole) also shows a strong effect, particularly on clotting time (Δ = -6.00 seconds) and hemoglobin (Δ = +0.8 g/dL), validating the experimental model. The Low Dose group shows a positive but more moderate effect. Crucially, the High Dose group displays markedly diminished benefits, with a negligible change in platelets (Δ = +5 $\times 10^3/\mu L$) and a slight reduction in RBCs (Δ = -0.1 $\times 10^6/\mu L$), providing clear evidence of a non-linear, dose-dependent response where efficacy declines at the highest dose.

DISCUSSION

This study investigated the haematological and coagulatory effects of *Cadaba farinosa* extract in aspirin-induced gastric ulcer in Adult Wistar rats. The findings revealed significant alterations in blood indices and coagulation parameters following ulcer induction and demonstrated that treatment with *Cadaba farinosa* effectively ameliorated these changes in a dose-dependent manner. The positive control group (aspirin-induced gastric ulcer without treatment) showed reduced red blood cell (RBC) count, hemoglobin concentration (Hb), and platelet count (PLT) compared to the negative control. These changes are consistent with the anemia and thrombocytopenia associated with gastric ulceration and NSAID administration [11, 12]. Aspirin is known to cause gastrointestinal mucosal damage, resulting in chronic blood loss, impaired hematopoiesis, and inhibition of platelet aggregation due to cyclooxygenase (COX) inhibition.

In contrast, treatment with *Cadaba farinosa* significantly improved RBC, Hb, and PLT values, particularly at medium doses. The medium dose group recorded the highest improvement, with values approaching those of the standard drug (omeprazole). This suggests that *Cadaba farinosa* possesses hematoprotective properties that may counteract ulcer-induced anemia and bleeding tendencies. The effect is likely mediated through its phytochemical constituents, including flavonoids[11,12], saponins, tannins, and alkaloids, which have been reported to

possess antioxidant, anti-inflammatory, and cytoprotective activities. Interestingly, while the low dose of the extract improved haematological parameters to some extent, the medium dose was most effective. The high dose did not perform as strongly as the medium dose, suggesting a biphasic or dose-dependent response where excessive concentrations may not necessarily yield maximal benefit.

White blood cell (WBC) counts were only mildly affected across groups. In aspirin-induced rats, WBC counts were slightly elevated compared to negative controls, indicating an inflammatory response to mucosal injury. Treatment with *Cadaba farinosa* normalized WBC counts, suggesting an anti-inflammatory role for the extract. The coagulation studies (Partial Thromboplastin Time, PTTK) further confirm the therapeutic effect of *Cadaba farinosa*. The positive control group demonstrated significantly prolonged clotting time (35 ± 0.2 seconds) compared to the negative control (28 ± 1.5 seconds), which reflects aspirin's known anticoagulant effect. Administration of *Cadaba farinosa* reduced clotting times in a dose-dependent manner. The medium dose (30 ± 1.2 sec) restored clotting time close to normal levels, comparable to omeprazole (29 ± 1.0 sec). The low dose (32 ± 1.8 sec) also improved coagulation but was less effective. Interestingly, the high dose (33 ± 1.5 sec) did not perform as well as the medium dose, reinforcing the idea of an optimal therapeutic window. This suggests that *Cadaba farinosa* may enhance coagulation by improving platelet function or supporting clotting factor synthesis.

Overall Significance, the results of this study validate the ethnomedicinal use of *Cadaba farinosa* in gastrointestinal and bleeding disorders. Its effects in improving haematological parameters, reducing blood loss, modulating inflammation, and restoring coagulation balance highlight its therapeutic potential. The medium dose appears to be the most effective, suggesting the importance of dose optimization in future studies.

In comparison with other studies, our findings align with similar reports on the hematological and hemostatic benefits of medicinal plants in ulcer and injury models. For example, fractions of Dialium guineense were shown to reduce clotting and bleeding times and improve red-cell stability in ethanol-induced ulcer rats, which mirrors our observation that Cadaba farinosa shortened PTTK and restored platelet counts [13]. Aloe vera extracts have also been reported to reduce bleeding and clotting times, supporting our interpretation that plant phytochemicals exert pro-hemostatic actions [14]. Similarly, Crassocephalum crepidioides and Moringa oleifera extracts demonstrated variable effects on PT and APTT, with dose-dependent differences that resemble the biphasic response we observed at higher doses of *Cadaba farinosa* [15, 16]. Furthermore, reviews such as [17,18], emphasize that flavonoids, tannins,

and terpenoids can act as antioxidants, membrane stabilizers, and modulators of platelet activity, which may explain the hematoprotective and coagulatory effects demonstrated in our study.

Conclusion

This study concludes that *Cadaba farinosa* extract exerts significant haematological and coagulatory benefits in aspirin-induced gastric ulcer in adult wistar rats. The extract significantly improved red blood cell count, hemoglobin concentration, and platelet levels, thereby mitigating ulcer-related anemia and thrombocytopenia. It normalized white blood cell counts, suggesting anti-inflammatory activity. It reduced prolonged clotting times induced by aspirin, restoring coagulation balance and supporting hemostasis. The medium dose of the extract demonstrated the strongest therapeutic effect, comparable to omeprazole, the standard reference drug. Overall, the findings provide **scientific validation** for the traditional use of *Cadaba farinosa* in managing gastrointestinal and bleeding disorders. The extract's antioxidant, anti-inflammatory, and hematoprotective properties suggest its potential as a complementary or alternative therapy in the treatment of peptic ulcer disease and related haematological complications.

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