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Phytochemical Composition, Antioxidant Activity, Spectroscopic (UV-Vis, FT-IR) and GC-MS Analyses of Corn Waste (Corn Cob) Extract from Ethyl Acetate, and Its Wound Healing Evaluation in Wistar Rats

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ABSTRACT

Introduction: The exploration of agricultural wastes for bioactive compounds is critical for advancing sustainable biomedical innovations. This study aimed to profile the phytochemical composition, antioxidant, and chemical composition of ethyl acetate extract of corn cob waste and then evaluate its wound healing activity in Wistar rats.

Materials and Methods: Powdered corn cob (1400 g) was extracted with ethyl acetate by maceration and concentrated with rotatory evaporator under reduced pressure. Phytochemicals (flavonoids, alkaloids, terpenoids, tannins, steroids, saponins, cardiac glycosides, anthraquinones and phenols) were examined in the ethyl acetate extract of the corn cob. Antioxidant activity was evaluated through lipid peroxidation inhibition, nitric oxide (NO) radical inhibition, hydrogen peroxide scavenging, DPPH radical scavenging, and ferric reducing antioxidant power (FRAP) assays. UV-Vis spectroscopy was used to identify chromophoric groups, FT-IR analysis elucidated functional groups, and GC-MS profiling determined the detailed chemical constituents of the extract. For in vivo assessment, 21 healthy female Wistar rats (70-130 g) were divided into three groups: povidone-iodine treated (positive control), untreated (negative control), and extract-treated (test group). Standard excision wounds (2 cm diameter) were created under ketamine–xylazine anesthesia, and treatments

applied topically once daily for 16 days. Wound contraction was monitored every four days; haematological profiles and histopathological analysis of the blood and organs of control and test rats were also looked into.

Results: Results showed highly abundant (++) flavonoids, saponins, phenols, and alkaloids (Dragendorff's, Wagner's), alongside moderate (+) terpenoids, steroids, tannins, cardiac glycosides, and anthraquinones. Concentration-dependent antioxidant analyses across multiple assays suggest notable antioxidant potential, though generally lower values than ascorbic acid. FRAP values indicated moderate ferric ion-reducing capacity (0.6045±0.0075 µg at 100 µg/mL vs. 0.6505±0.0385 µg for ascorbic acid). DPPH radical scavenging reached 75.40±0.20 % at 100 µg/mL, compared to 86.27±0.73% for the standard. Hydrogen peroxide inhibition was 65.06±0.88 % (vs. 79.34±0.22 %), nitric oxide inhibition 67.05±0.49 % (vs. 72.29±0.16 %), and lipid peroxidation inhibition 78.69±0.28 % vs. 83.67±0.22 %. These findings suggest the extract contains electron-rich and radical-quenching phytochemicals with potential for oxidative stress mitigation and wound healing applications, albeit with slightly lower potency than ascorbic acid. UV analysis across 200-800 nm revealed a strong absorption band between 324 nm and 385 nm, with the highest peak (λmax) at 359 nm and a maximum absorbance (Amax) of 3.216. FTIR spectra confirmed the presence of alkanes, alkenes, alcohol, carboxylic acids, aromatics functional groups while GC-MS identified 23 compounds, including 5,8-Dihydroxy-2,7-dimethoxy-1,4-naphthoquinone, piperidine derivatives, pentadecanoic acid, 14-methyl-, methyl ester, and phthalazine-1,4(2H,3H)-dione, 2-(2-methylphenyl), which are well known for their pharmacological and biological activities, such as antimicrobial, anti-inflammatory, and antioxidant effects. Extract-treated rats achieved complete wound closure in 15.10±0.00 days, faster than povidone-iodine (16.00±10.30 days) and untreated controls (18.32±10.50 days). No significant haematological alterations were observed. Histopathological examination revealed complete re-epithelialization, minimal inflammation, and organized collagen deposition in the extract group which is comparable to the standard treatment.

Conclusion: This study showed that ethyl acetate extract of corn cob waste contains bioactive compounds with antioxidant and wound healing properties, demonstrating safety and therapeutic potential for sustainable biomedical applications.

Keywords: Wound healing, Corn cob, Wistar rats, Ethyl acetate, Heamatology, Instrumental analysis.

1.0 INTRODUCTION

Corn (*Zea mays*) is one of the most widely cultivated cereal crops, valued for its nutritional and industrial applications [1]. It generates a large volume of agricultural wastes during its processing - one of which is the corn cob [2]. Dewi *et al*. [3] demonstrated that corn cob extracts contain measurable phenolic and flavonoid compounds with antioxidant activity, making them potential candidates for pharmaceutical applications, particularly in wound healing. Wound healing is a complex biological process that involves inflammation, tissue formation, and remodeling. Natural products have been extensively investigated for their ability to enhance this process due to their biocompatibility and minimal side effects. Rouf Shah *et al.* [4] reviewed some advances in the potential of corn and its by-products as source of human nutrition and health. Corn cob extracts, particularly those obtained using organic

solvents have been reported to contain bioactive compounds that may promote tissue regeneration and combat infections. Previous studies have highlighted the therapeutic potential of plant-derived extracts in wound healing, with various phytochemicals demonstrating antimicrobial and anti-inflammatory effects [5]. However, limited research has explored the detailed chemical composition and wound healing efficacy of corn cob extracts from ethyl acetate. This study employs UV-Visible spectroscopy, Gas Chromatography-Mass Spectrometry (GC-MS), and Fourier Transform Infrared Spectroscopy (FT-IR) to analyze the phytochemical constituents of ethyl acetate extract of corn cob. Furthermore, the wound healing potential of this extract is evaluated in Wistar rats to establish its effectiveness in tissue repair. This research provides a scientific validation for the use of corn cob extract in wound healing applications and contribute to the growing body of knowledge on natural wound healing agents.

2.0 MATERIALS AND METHODS

2.1. Sampling

Fresh corns (*Zea mays*) were purchased from the local market at Ojoo, Ibadan, Nigeria. The husks were carefully removed and the corn cob is dried at room temperature to constant weight and pulverized with a mechanical crusher.

2.2. Extract preparation

1.4 kg of the powdered corn cob was weighed in a large bottle containing 3.25 L solution of ethyl acetate. Cold extraction was carried out for five days with constant stirring after which the mixture was filtered. The filtrate was concentrated using a rotary evaporator at 4 rpm under vacuum at 40 ^{o}C. The percentage yield calculation was done using:

$$\text{Percentage yield} = \frac{W1}{Wo} \text{ x } \frac{100}{1}$$

W_o is the weight of crushed corn cob; W_1 is the weight of extract obtained after concentration

2.3. Phytochemical analysis

The extract was subjected to qualitative phytochemical tests for the presence of terpenoids, steroids, saponins, tannins, flavonoids, cardiac glycoside, phenol, anthraquinones, alkaloids (Dragendoff), alkaloids (Wagner) using the method described by Ajayi *et al.* [6], Ganga suresh *et al.* [7] and Yadav *et al.* [8]. All determinations were done in triplicates.

2.4. Evaluation of the antioxidant activity of corn cob extract

2.4.1 Ferric Reducing Antioxidant Power Assay (FRAP)

A modified version of the method by Yang and Zhai [9] was used. 0.2 mL of the extract was combined with 3.8 mL of the FRAP reagent, which comprised 10 parts of 300 mM $FeCl_3 \bullet 6H_2O$ solution. The mixture was incubated at 37 °C for 30 minutes. Absorbance increase was recorded at 593 nm. Fresh $FeSO_4$ working solutions were utilized for calibration, and the antioxidant capacity-based on the sample's ferric ion-reducing ability-was determined using a linear calibration curve.

2.4.2 Diphenylpicrylhydrazyl (DPPH) Scavenging Free Radicals

The extract was evaluated for DPPH using a modified version of the method described by Lulseged *et al.* [10]. A stock solution was prepared by dissolving 24 mg of DPPH in 100 mL

of methanol and stored in a refrigerator until use. For the working solution, the DPPH stock solution was diluted with methanol to obtain an absorbance of approximately 0.98±0.02 at 517 nm. 3 mL of the DPPH working solution was combined with 100 µL of the extract (1 mg/mL) at five different concentrations (0.2-1 mg/mL). Absorbance was recorded at 517 nm over a period of 30 minutes. The radical scavenging activity was expressed as a percentage of inhibition, calculated using the equation below. Where; $A_{control}$ is the absorbance of the control reaction and Asample is the absorbance of the sample. The test was carried out in triplicates.

$$\text{DPPH radical-scavenging activity (\%)} = \frac{A_{control} - A_{sample}}{A_{control}} \times 100$$

2.4.3 Total Phenolic Content (TPC)

The spectrophotometric method was used to determine the concentration of phenolic compounds in plant extracts (11), employing the Folin-Ciocalteu assay. 1 mL of the extract was combined with 9 mL of distilled water in a 25 mL volumetric flask. Then, 1 mL of Folin-Ciocalteu reagent was added and thoroughly mixed. After allowing the reaction to proceed for 5 minutes, 10 mL of 7 % sodium carbonate (Na_2CO_3) solution was added, and the total volume was adjusted to 25 mL with distilled water. Standard solutions of gallic acid (20, 40, 60, 80, and 100 µg/mL) were prepared following the same procedure. The samples were incubated at room temperature for 90 minutes, and absorbance was measured at 550 nm using a UV-visible spectrophotometer. The total phenolic content was quantified as milligrams of gallic acid equivalents (GAE) per gram of extract [12].

2.4.4 Total Antioxidant Capacity (TAC)

This assay is based on the reduction of molybdenum (VI) to molybdenum (V) by the analyte, leading to the generation of a green phosphate-molybdenum (V) complex under acidic conditions. The procedure outlined by Prieto *et al.* [13] was adopted for this determination. A 0.1 mL aliquot of a 100 µg sample solution was mixed with 1 mL of a reagent composed of 0.6 M H_2SO_4, 28 mM sodium phosphate, and 4 mM ammonium molybdate. The mixture was sealed and heated in a boiling water bath at 95 °C for 90 minutes. Once cooled to room temperature, the absorbance was measured at 695 nm using a UV spectrophotometer, with a blank solution serving as a reference. The blank contained 1 mL of the reagent solution along with the same volume of solvent used for the sample, incubated under identical conditions. For samples with unknown compositions, antioxidant capacity was expressed in terms of ascorbic acid equivalents [14].

2.5. Instrumental analyses of corn cob extract

2.5.1 UV-Vis Spectroscopic

The extract was analyzed using a UV-visible spectrophotometer (Perkin Elmer, USA Model: Lambda 950) with a slit width of 2nm, using a 10-mm cell at room temperature. The spectrophotometer was set to scan between 190 nm and 900 nm to record the absorption spectrum of the extract.

2.5.2 Fourier-Transform Infrared Spectroscopy (FTIR)

Ten mg of corn cob extract was placed directly on the sample holder without dilution. The sample was evenly spread to form a thin, translucent layer. The FTIR spectrophotometer was then operated across a scanning range of 4000-400 cm^{-1} with a resolution of 4 cm^{-1}. This method enabled the direct identification of functional groups in the extract by recording absorbance.

2.5.3 GC-MS

The GC-MS analysis of this corn cob extract was carried out using an Agilent 5977B GC/MSD system equipped with an Agilent 8860 auto-sampler. The system featured a Gas Chromatograph interfaced with a Mass Spectrometer and an Elite-5MS fused silica capillary column (30 m × 0.25 mm ID × 0.25 µm film thickness) composed of 5 % diphenyl and 95 % dimethyl polysiloxane. Mass detection was performed in electron ionization mode at 70 eV. Helium (99.999 % purity) was used as the carrier gas at a constant flow rate of 1 mL/min. The analysis involved injecting 1 µL of the sample with a split ratio of 10:1. The injector temperature was set at 300 °C, while the ion source was maintained at 250 °C.

2.6. Experimental animals

Twenty one 21 Wistar female albino rats, weighing 70-130 kg were selected for the study. The rats were divided into 3 groups of seven animals each and were kept in polypropylene cages and given free access to food and water *ad libitum.* The weight of each animal was taken at the beginning of the research and at 4-days interval until the research ended. Two of the cages were taken as positive and negative controls. All experimental protocols were in compliance with the University of Ibadan Ethics Committee on Research in Animals (15/0208/UI/ECRA) as well as international accepted principles for laboratory animal use and care.

2.6.1. Excision and treatment of wound

The excision wound model as described by Anusha and Nithya [15] was used to assess the wound healing activity of the ethyl acetate extract of the corn cob. Excision wound was created as per the method described by Mukherjee *et al.* [16]; the rats were shaved on the dorsum portion using depilatory cream and anesthetized using ketamine hydrochloride (50 mg/kg, i.p., body weight) [17]. An impression was made on shaved dorsal region and area of the wound to be created was marked. A full thickness excision wound with a circular area of 400 mm^2 was created along the marking using toothed forceps, a surgical blade, and pointed scissors. Rats were left undressed to the open environment. Standard ointment (povidone-iodine) and ethyl acetate extract of the corn cob were applied topically and daily to groups A and C animals respectively after the day of the operation until complete healing while group B ones were left untreated [18].

2.7. Wound healing evaluation

2.7.1. Measurement of wound contraction

In this model, wound contraction and epithelialization period were evaluated. Wound area was measured by tracing with transparent sheet using millimeter-based graph paper on days 0, 4, 8, 12, and 16 and 20 for all groups. Wound contraction was measured every 4th day until complete wound healing and represented as percentage of healing wound area [19]. Percentage of wound contraction was calculated taking the initial size of the wound as 100 % using the following formula:

$$\% \text{ wound contraction} = \frac{(\text{Intial wound area} - \text{Specific day wound area})}{\text{Intial wound area}} \times 100.$$

The number of days required for filling of the scar without any residual of the raw wound is taken as the epithelization days.

2.7.2. Assessment of Body Weight

To evaluate potential systemic toxicity and growth patterns, the body mass of each rat was monitored throughout the study. Individual weights were recorded using a calibrated digital balance on day 0 (baseline) and subsequently at four-day intervals until the termination of the experiment. Changes in body weight were compared across groups to ascertain the systemic safety of the extract [20].

2.7.3. Haematological Analysis

Baseline hematological profiling was established using blood samples obtained on day 0, followed by serial assessments at four-day intervals. Terminal sampling occurred on day 16 to evaluate the systemic impact of the treatment. Sample collection was carried out via cardiac [21] following the administration of mild anesthesia, with aliquots immediately sequestered in ethylene diamine tetra-acetic acid (EDTA) vials to maintain sample integrity. Quantitative analysis focused on erythrocytic indices, including Red Blood Cell (RBC) count, hemoglobin concentration, Packed Cell Volume (PCV), and platelet estimates. Furthermore, immune response was monitored via total White Blood Cell (WBC) counts and differential leukocyte sorting (neutrophils, lymphocytes, monocytes, eosinophils, and basophils) [22].

2.7.4. Histopathological analysis

At the conclusion of the study, all the rats were anesthetized with ketamine, and wound tissue specimens were collected, weighed and preserved in glass vials containing a 10 % formalin solution for histological analysis. Tissue sections, approximately 5 µm thick, were prepared using microtomy and stained with hematoxylin and eosin (H&E) dye for examination.

2.8. Statistical analysis

The mean value of the different groups was subjected to ANOVA test (IBM SPSS version 20). P values of ≤ 0.05 were considered significant.

3.0. RESULTS AND DISCUSSION

3.1. Phytochemical analysis

Percentage yield of the extract was found to be 1.02 %. The preliminary phytochemical analysis of the ethyl acetate extract of the corn cob showed the presence of terpenoids, steroids, saponins, tannins, flavonoids, cardiac glycoside, phenol, anthraquinones, alkaloids (Dragendoff), alkaloids (Wagner) as shown in Table 1. The qualitative phytochemical analysis of the ethyl acetate extract from corn cobs shows the presence of several bioactive compounds viz terpenoids, steroids, saponins, tannins, flavonoids, cardiac glycosides, phenols, anthraquinones, and alkaloids. Dewi *et al.* [3] discussed the phytochemical composition, antioxidant potential, and biological activities of corn cob extracts. Vitale *et al.* [23] provided an overview of current research on the phytochemistry and biological activity of medicinal plants in wound healing. Phenolic compounds, including flavonoids and tannins, are known for their antimicrobial and antioxidant activities, which are crucial in preventing infection and promoting tissue repair [23].

3.2. Instrumental analyses result of corn cob extract

3.2.1 UV-Visible Spectroscopy

The UV-Vis absorbance spectrum of the ethyl acetate extract of corn cob showed significant absorption peaks at the 200-400 nm range. The characteristic absorption bands suggest the presence of flavonoids, phenolic compounds, alkaloids, tannins, terpenoids, and steroids, which are known for their therapeutic benefits in wound healing. Ullah *et al.* [24] highlighted the therapeutic potential of important flavonoids. Flavonoids, phenolics, tannins, alkaloids, terpenoids, and steroids exhibit characteristic UV-Vis absorption around 200-400 nm, correlating with their antioxidant, anti-inflammatory, antimicrobial, and tissue-regenerative properties [23]. This promotes collagen stabilization, infection prevention, and oxidative stress reduction [24]. Fig.1.

3.2.2. FT-IR Spectroscopy

The FT-IR spectrum confirms key functional groups relevant to wound healing. A broad absorption at ~3323.9 cm^{-1} indicates O–H stretching, characteristic of phenolic compounds with antioxidant and antimicrobial properties [23]. Peaks at 2921 cm^{-1} and 2849.2 cm^{-1} suggest fatty acids, essential for cell repair and anti-inflammatory activity [25]. The 1709 cm^{-1} band signifies C=O stretching in esters and flavonoids, aiding tissue regeneration [26]. Peaks at 1603.58 cm^{-1} and 1514.9 cm^{-1} confirm flavonoids and tannins, promoting collagen synthesis [27]. Fig.2.

3.2.3. GC-MS

The GC-MS analysis of the ethyl acetate extract of corn cob revealed various bioactive compounds, as shown in the table below. The chromatogram displayed multiple peaks, each representing a distinct compound, with larger peaks indicating higher concentrations. These compounds are associated with wound healing due to their antimicrobial and antioxidant properties.1,4-Naphthalenedione,5,8-dihydroxy-2,7-dimethoxy- which shares structural similarity with naphthazarin, is a known antimicrobial agent effective against pathogens like *Staphylococcus aureus*, *Staphylococcus epidermidis*, and *Candida albicans*. Its presence suggests potential antimicrobial activity beneficial for wound healing. Also, Phenol, 2,5-bis(1,1-dimethylethyl)-, known as 2,5-di-tert-butylphenol, exhibits strong antioxidant properties [28].

3.3. Antioxidant analyses results

In vitro antioxidant evaluation of the ethyl acetate extract of corn cob compared to ascorbic acid demonstrated its free radical scavenging potential, relevant to wound healing. FRAP assay showed a concentration-dependent increase in reducing power, with the extract reaching 0.6045±0.0075 µg at 100 µg/mL, slightly lower than ascorbic acid (0.6505±0.0385 µg), indicating moderate electron-donating ability [29]. DPPH radical scavenging assay confirmed antioxidant activity, with 75.40±0.20 % inhibition at 100 µg/mL, lower than ascorbic acid (86.27±0.73 %) [30]. H_2O_2 inhibition, essential in reducing oxidative damage, reached 65.055±0.875 %, while ascorbic acid exhibited 79.34±0.22 % inhibition. The extract also showed NO scavenging activity (67.05±0.49 %) but was slightly less effective than ascorbic acid (72.29±0.16 %). Lipid peroxidation inhibition, crucial for membrane protection, was 78.69±0.28 %, compared to 83.67±0.22 % for ascorbic acid [30]. These results suggest the presence of bioactive compounds with antioxidant properties, beneficial for wound healing

[29]. The extract's lower efficacy compared to ascorbic acid may raise concerns about its standalone therapeutic potential, necessitating further optimization, bioavailability studies, and possible combination with other antioxidants [31]. Fig.3.

3.4. Wound healing activity study

3.4.1. Effect of the extract on the weight of rats

A general increase in body weight across all groups was observed, with Group A (povidone-iodine) showing the highest weight gain by day 21 (203.4±14.4 g). Group B (untreated) and Group C (ethyl acetate extract-treated) exhibited lower weight increases, reaching 127.7±9.5 g and 125.8±10.2 g, respectively. The similarity in weight progression between Groups B and C suggests that the extract did not significantly influence weight gain compared to the standard treatment. The overall trend implies that while the extract supports wound healing, it does not induce notable systemic effects on weight regulation. This is similar to the observation by Musila *et al.* [20]. Fig.4.

3.4.2. Wound contraction and epithelialisation time

The process of wound contraction is influenced by the tissue type, extent of damage, and overall health condition of the tissue [32]. In this study, Group C (treated with corn cob extract of ethyl acetate) exhibited the fastest and most effective epithelialisation time, achieving complete wound closure in 15.10±0.00 days. This was significantly faster than for those in Group A (povidone-iodine treated) and Group B (untreated), which recorded epithelialisation times of 16.00±10.30 days and 18.32±10.50 days, respectively.

The wound contraction data further support this trend, as Group C consistently showed lower wound area values across all time points compared to the other groups. By Day 16, complete wound closure was observed in Group C (0.00±0.00 mm²), while residual wound areas remained in Groups A (5.20±10.30 mm²) and B (7.30±10.50 mm²). These findings suggest that the corn cob extract of ethyl acetate contains bioactive compounds that effectively enhance tissue regeneration and accelerate the wound healing process. Additionally, the extract was well tolerated, as no adverse effects were observed, further supporting its potential as a natural wound-healing agent, Tables 2 and 3. Fig.5.

3.4.3. Haematology study

Evaluation of haematological parameters provides insight into the blood-related effects of the extract. As shown in Table 4, there were no significant alterations in the haematological indices among the treatment groups. The absence of significant differences in RBC indices suggests that the corn cob extract did not affect erythropoiesis, red blood cell morphology, or osmotic fragility. This indicates the extract's potential biocompatibility and safety for systemic use.

3.4.4. Histopathological result

Histological evaluation of treated rats showed complete re-epithelialization across all groups. Group A (povidone-iodine) exhibited well-structured connective tissue with restored skin adnexa, while Group B (untreated) displayed thickened epidermis and loosely arranged collagen, indicating slower healing. Ehrlich and Hunt [33] emphasized the critical role of collagen organization in wound contraction. Group C (ethyl acetate extract) showed effective wound closure but with immature connective tissue, suggesting ongoing remodeling. Eming *et al.* [34] discussed the mechanisms, signaling pathways, and translational aspects of wound repair and regeneration. Inflammation was minimal, and fibroplasia and neo-vascularization were comparable across groups. Table 5.

Internal organs (liver, lungs, kidneys, heart, spleen, intestine, stomach, uterus) showed no pathological lesions, confirming the extract's safety. The findings suggest that the extract promotes wound healing effectively, similar to povidone-iodine, without systemic toxicity, Table 6, Fig.6.

Conclusion

The instrumental characterization and the phytochemical screening of the corn cob extract identified several chemical compounds in corn cob extracts with biomedical applications. The ethyl acetate extract of the corn cob showed ability to scavenge free radicals, inhibit lipid peroxidation, DPPH free radical, NO % and lipid peroxidation. Histopathological and haematological assessments confirmed no systemic organ damage; the wound contraction rate and period of epithelialisation showed the wound healing activities of the extract. Overall, the group treated with the corn cob extract showed faster rate of wound contraction but however, further studies are needed to investigate their probable toxicological effects in order to optimize their potential.

Conflict of Interest

Authors declare that there are no conflicts of interest related to the publication of this article.

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Ethical Approval

This study received ethical approval from the University of Ibadan Animal Care and Use Research Ethics Committee (UI-ACUREC), with approval number UI-ACUREC/027-0125/31. All experiments involving Wistar rats followed the Committee's guidelines for the ethical care and treatment of laboratory animals.

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Table 1: Qualitative analysis result of phytochemical constituents present in corn cob extract

Phytochemicals	Ethyl acetate extract
Terpenoids	+
Steroids	+
Sarponins	++
Tannins	+
Flavonoid	++
Cardiac Glycoside	+
Phenol	++
Anthraquinones	+
Alkaloids (Dragendoff)	++
Alkaloids (Wagner)	++

++ means highly abundant; + means abundant; - means Absent

Table 2: Wound contraction of Wistar rats (mm^2)*

Day	Povidone-iodine#	Untreated#	Corn cob Extract
0	200.00±0.00^a	200.00±0.00^a	200.00±0.00^a
4	157.00±41.20^{ab}	162.00±24.74^a	131.29±31.00^b
8	84.00±12.78^{ab}	92.36±20.60^a	60.71±21.32^b
12	36.00±13.09^{ab}	40.70±24.91^a	18.30±1.95^b
16	5.20±10.30^{ab}	7.30±10.50^a	0.00±0.00^b
Epithelization Period (days)	16.00±10.30	18.32±10.50	15.10±0.00

*Letters with different alphabets in the same column are significantly different from each other at P≤0.05 # Values are shared with other experiments

Table 3: Percentage Wound Healing (%)

Day	Group A#	Group B#	Group C
0	0.0	0.00	0.000
4	21.5 ± 5.64	19.00±5.22	34.355±11.50
8	58.0±6.39	53.82±10.30	69.645±10.66
12	82.0±6.55	79.65±12.46	90.850±0.98
16	97.4±5.15	96.35±5.25	100.00±0.00

*Letters with different alphabets in the same column are significantly different from each other at P≤0.05 #The controls are used in conjunction with other experiments.

Table 4: Haematology result for control and treated groups

Parameters	Povidone-iodine	Untreated	Ethyl acetate extract
%PCV	40.25± 1.26	40.75± 2.99	39.75± 3.30
g/dL RBC	6.60± 0.39	6.76± 0.50	6.54± 0.64
Hb	1.30± 0.42	13.43± 0.93	13.05± 1.59
PT × 10^5	0.86± 0.19	1.03± 0.29	0.89± 0.17
WBC × 10^3 ηl	4.03± 0.68	3.99± 0.26	4.38± 0.60
LEU × 10^3	2.44± 0.64	2.47± 0.35	2.65± 0.40
N × 10^3	1.28± 0.12	1.24± 0.22	1.21± 0.38
E × 10^3	0.09± 0.018	0.23± 0.12	0.13± 0.054
M × 10^3	0.22± 0.077	0.17± 0.060	0.28± 0.041

WBC: White blood cell; RBC: Red blood cells; Hb: Heamoglobin; PT: Plateletes; LEU: Leukocyte count, N: Neutrophil; E: Eosinophil; M: Monocyte

*Letters with different alphabets in the same column are significantly different from each other at P≤0.05; # The controls are used in conjunction with other experiments.

Table 5: Histopathological result of healed skin wound area

Parameters	Povidone-iodine #	Untreated #	Ethyl acetate extract
Re-epithelization	+++	+++	+++
Scab formation	-	-	-
Inflammation	Minimal	Minimal	Minimal
Fibroplasia	++	+++	+++
Immature LCT	+	++	+
Dense LCT	+	+	+++
Neo-vascularization	Abs	Abs	Abs
Hyperkeratosis	-	+++	++

+: Mild; ++: Moderate; +++: Significant; -: Absent; Abs: Absent; LCT: Loose connective tissue

The controls are used in conjunction with other experiments.

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Table 6: Histopathological result of healed internal organs of experimental animals									
Group A[#]	Skin	Liver	Lungs	Spleen	Uterus	Intestine	Heart	Kidney	Stomach
	There is complete reepithelization of the wound with well-placed dense connective tissue and replacement of skin adnexa.	Hepatocytes are arranged in cords radiating from central veins, with intact sinusoids and kupffer cells scattered within. No visible lesions. Same as group A	Alveoli appear thin-walled and evenly spaced, with intact bronchioles and minimal interstitial tissue.	The spleen displays distinct white pulp with lymphoid follicles and surrounding red pulp containing splenic sinusoids and cords.	The endometrium shows normal columnar epithelium with underlying glands, while the myometrium has well-organized smooth muscle fibers.	Villi are tall and slender with intact epithelial lining and goblet cells, and the muscularis and crypts of lieberkühn are well-preserved.	Cardiac muscle fibers are striated, branched, and interspersed with intercalated discs, showing no inflammation or fibrosis.	Normal rat kidney tissue shows well-organized glomeruli with intact bowman's capsules and surrounding tubules with clear lumens.	Gastric mucosa has well-organized epithelial cells with visible gastric pits and glands; submucosa and muscularis layers appear normal.
B[#]	Markedly thickened epidermal layer especially at the center of the wound with pale staining collagen bundles in the dermis (immature/ loose connective tissue). Very minimal inflammation noticed.	No visible lesions. Same as group A	No visible lesions. Same as group A	No visible lesions. Same as group A	No visible lesions. Same as group A	No visible lesions. Same as group A	No visible lesions. Same as group A	No visible lesions. Same as group A	No visible lesions. Same as group A

C	complete reepithelization of the wound with immature/ loose connective tissue lct). Very minimal inflammation noticed.	No visible lesions. Same as group A	No visible lesions. Same as group A	No visible lesions. Same as group A	No visible lesions. Same as group A	No visible lesions. Same as group A	No visible lesions. Same as group A	No visible lesions. Same as group A	No visible lesions. Same as group A

Group A: Povidone-iodine; Group B: Negative; Group C: Ethyl acetate extract of corn cob; [#] The controls are used in conjunction with other experiments.

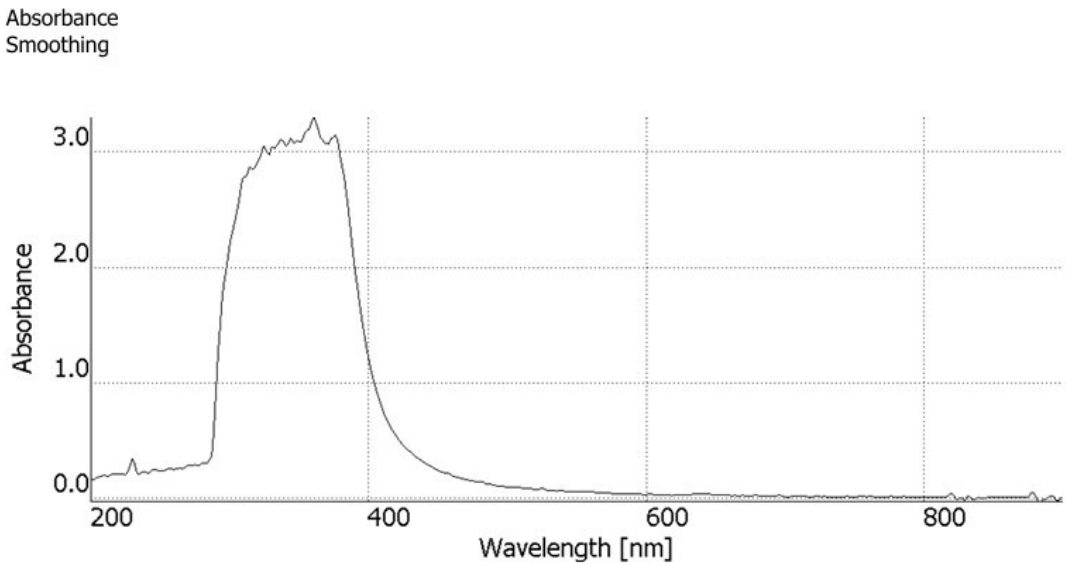

Figure 1: UV-Visible absorbance spectrum of corn cob ethyl acetate extract

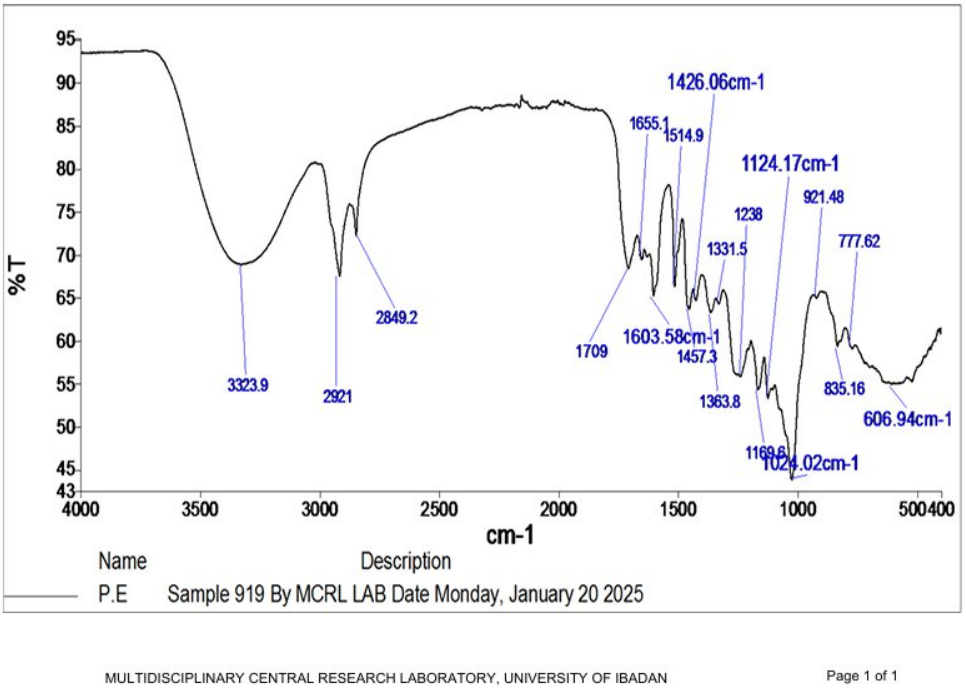

Figure 2: FTIR spectrum of corn cob ethyl acetate extract

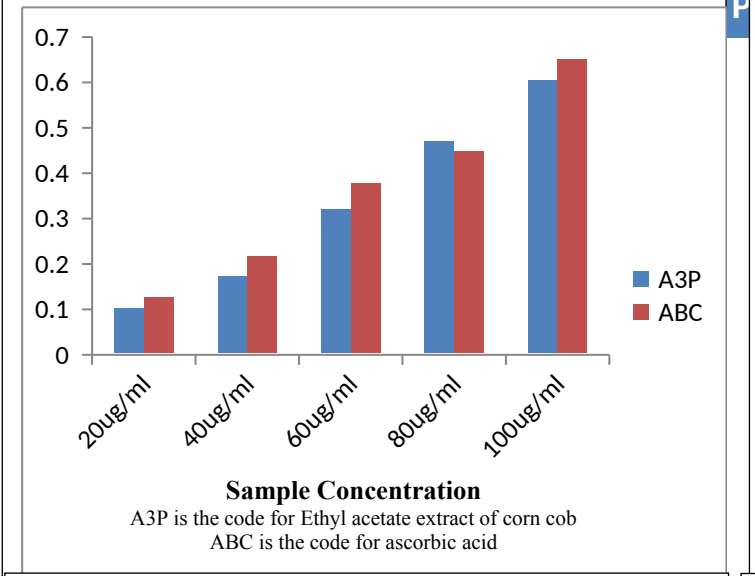

Figure 3a: Quantification of ferric reducing antioxidant power of ethyl acetate extract of corn cob against ascorbic acid.

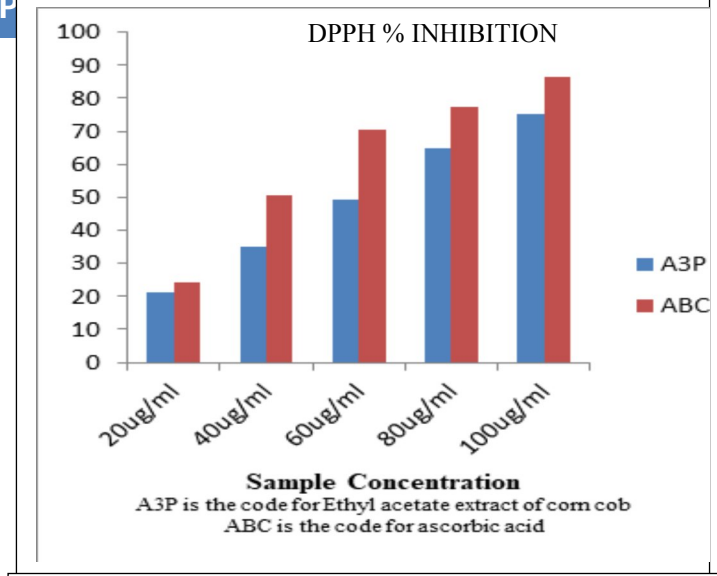

Figure 3b: Quantification of DPPH % Inhibition of ethyl acetate extract of corn cob against ascorbic acid.

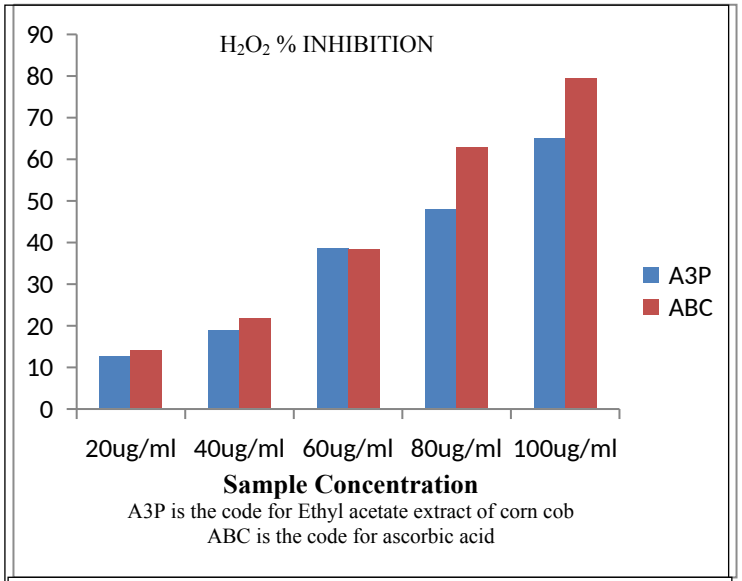

Figure 3c: Quantification of H_2O_2% Inhibition of ethyl acetate extract of corn cob against ascorbic acid.

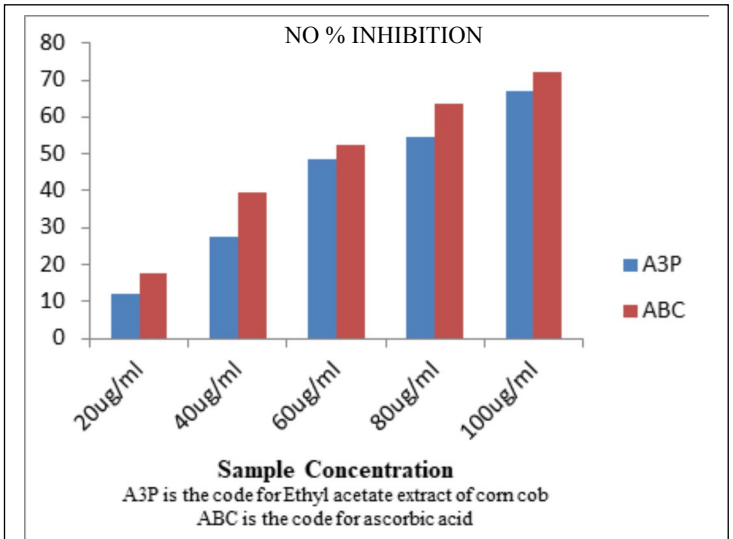

Figure 3d: Quantification of NO% Inhibition of ethyl acetate extract of corn cob against ascorbic acid.

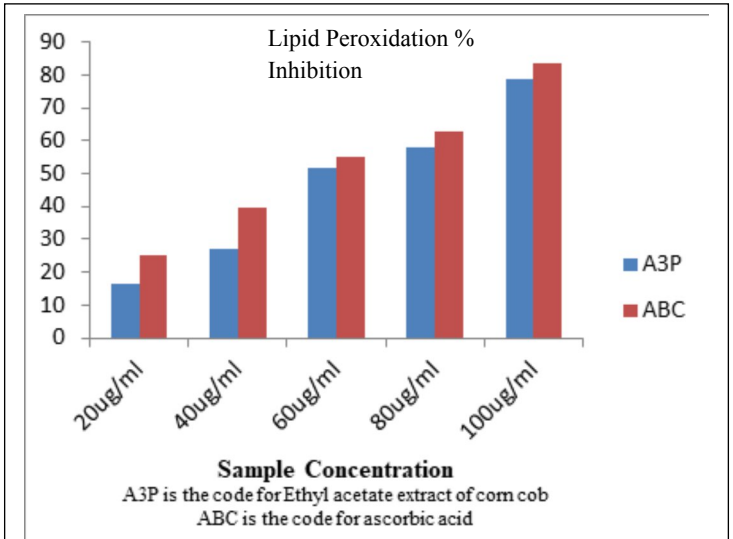

Figure 3e: Quantification of Lipid Peroxidation % Inhibition of ethyl acetate extract of corn cob against ascorbic acid.

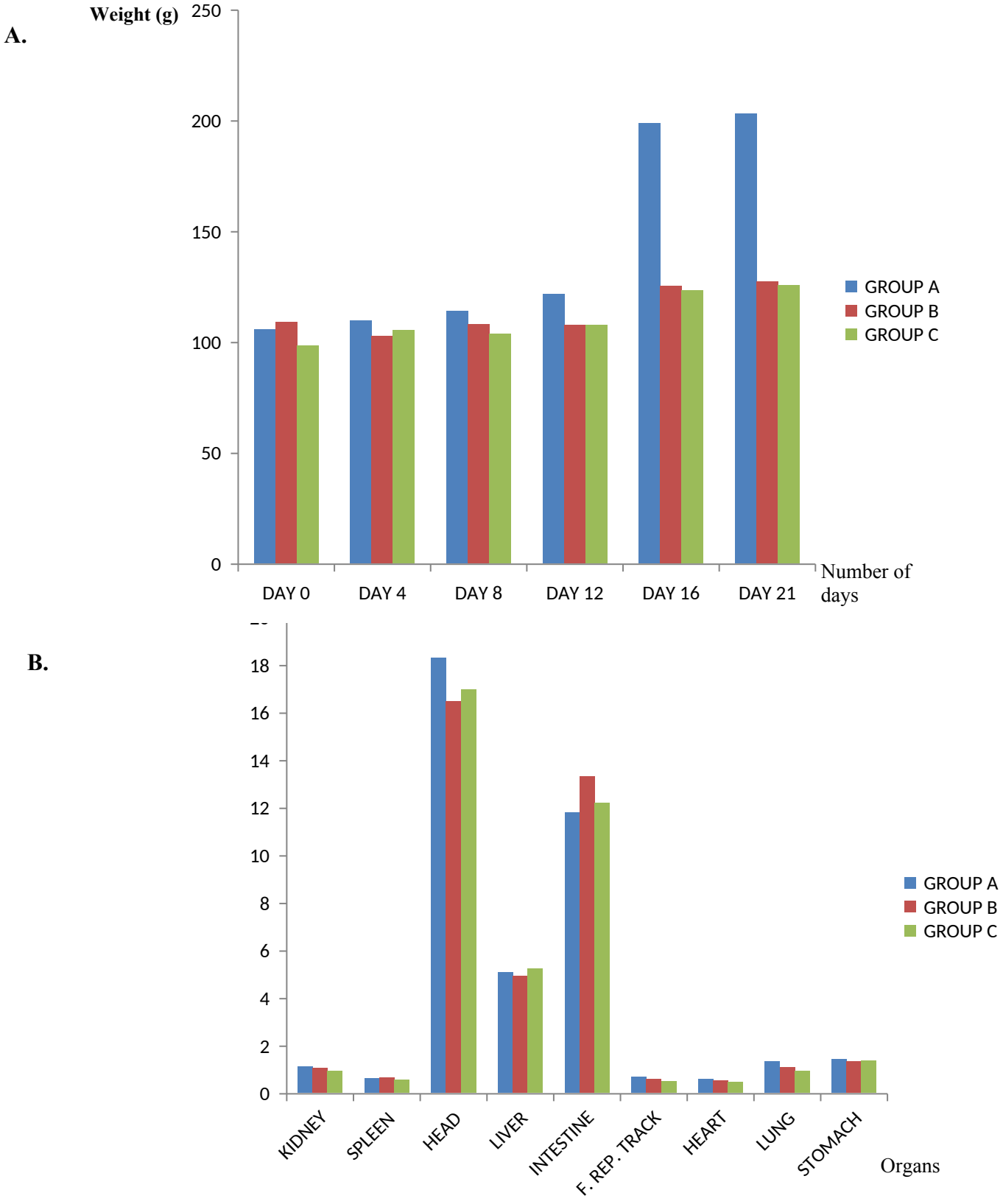

Figure 4: Evaluation of systemic safety profiles in Wistar rats. (A) Temporal changes in mean body weight (g) recorded at four-day intervals across the experimental duration. (B) Comparative wet weights of harvested internal organs upon termination of the study to assess potential toxicity. Group A represents the positive control (Povidone-iodine), Group B is the negative control (Untreated), and Group C is the test group treated with ethyl acetate corn cob extract.

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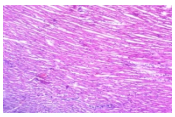
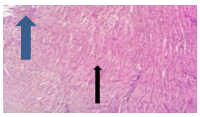
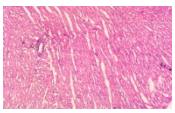
Figure 5: Wound contraction of the test and control groups



Photomicrograph of the heart (positive control) showing that the cardiac muscle fibers are striated, branched, and interspersed with

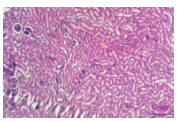


Photomicrograph of the heart (negative control) showing normal cardiac muscle fibers (blue arrow) showing no

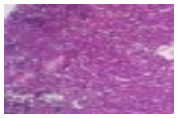


Photomicrograph of the heart for the tested group (E) (H&E x100). Normal cardiac histoarchitecture with well-arranged striated muscle fibers and

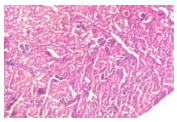
Figure 6a: Representative biopsies and histology of heart of



Positive control - Normal rat kidney tissue shows well-organized glomeruli with intact bowman's capsules and surrounding

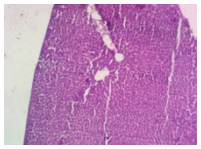


Negative control - No visible lesions. Same as the positive group. (H&E x100)



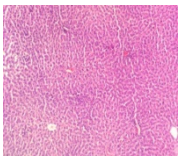
Photomicrograph of the kidney for the tested group. (H&E x100). The kidney exhibits normal glomerular and tubular structures, with intact Bowman's capsules. No signs of tubular degeneration, interstitial

Figure 6b: Representative biopsies and histology of kidney of tested and



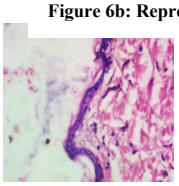
Photomicrograph of the liver of the positive group. Hepatocytes are arranged in cords radiating from central veins, with intact sinusoids and kupffer cells scattered within. No visible lesions. Same as group A.

Photomicrograph of the liver of the negative group. No visible lesions as seen in the positive group. (H&E x100)

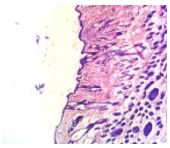


Photomicrograph of the liver for the tested group (E) (H&E x100). The liver parenchyma appears normal with hepatocytes arranged in well-defined cords. No evidence of hepatocellular degeneration, inflammation, or fibrosis, suggesting that the extract does not induce hepatotoxicity.

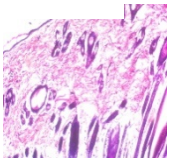
Figure 6c: Representative biopsies and histology of liver of tested and control animal groups



Photomicrograph of the skin of the positive group. There is complete reepithelization of the wound with well-placed dense connective tissue and replace ment of skin adnexa. (H&E x100)

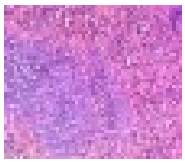


Photomicrograph of the skin of the negative group. Markedly thickened epidermal layer especially at the center of the wound. (H&E x100) with pale staining collagen bundles in the dermis (immature/ loose connective tissue. Very minimal inflammation noticed. (H&E x100)

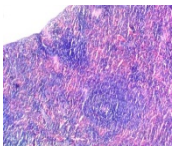


Photomicrograph of the skin for the tested group (E) (H&E x100). The epidermis is fully re-epithelialized with immature loose connective tissue. Minimal inflammation is present, and fibroplasia is evident, indicating progressive

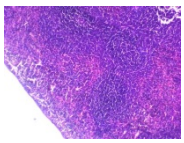
Figure 6d: Representative biopsies and histology of skin of tested and control animal groups



Photomicrograph of the spleen of the positive group. The spleen displays distinct white pulp with lymphoid follicles and surrounding red pulp containing splenic sinusoids and cords. (H&E x100)

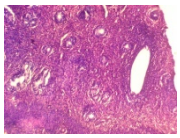


Photomicrograph of the spleen of the negative group. No visible lesions. Same as positive group. (H&E x100)

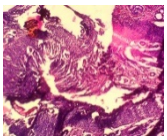


Photomicrograph of the spleen for the tested group (E) (H&E x100). The spleen maintains normal structural integrity, with preserved white and red pulp organization. No evidence of lymphoid depletion, hemorrhage, or splenic congestion, suggesting no immunotoxic effects from the extract.

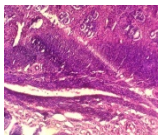
Figure 6e: Representative biopsies and histology of spleen of tested and control animal groups



Photomicrograph of the uterus for the positive control group (A) (H&E x100). The endometrium shows normal columnar epithelium with underlying glands, while the myometrium has well-organized smooth muscle fibers.

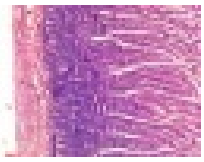


Photomicrograph of the uterus for the negative control group (B) (H&E x100). Normal histological structure of the uterus with intact epithelial lining and well-organized smooth muscle layers. No visible pathological lesions.

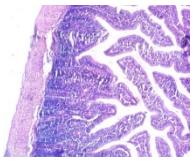


Photomicrograph of the uterus for the tested group (E) (H&E x100). The endometrial and myometrial layers appear histologically normal. No evidence of hyperplasia, inflammation, or degenerative changes, indicating that the extract

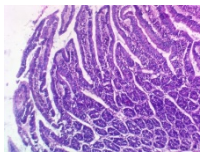
Figure 6f: Representative biopsies and histology of uterus of tested and control animal groups



Photomicrograph of the heart of the tested group. Normal heart with no visible lesion. The myocites are well arranged with no vaculation or degenerative changes. (H&E x100)

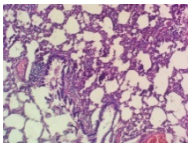


Photomicrograph of the heart of the tested group. Normal heart with no visible lesion. The myocites are well arranged with no vaculation or degenerative changes. (H&E x100)

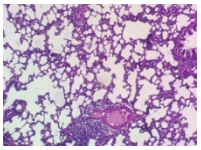


Photomicrograph of the intestine for the tested group (E) (H&E x100). Intestinal histoarchitecture remains intact, with well-defined villi, crypts, and goblet cells. No mucosal atrophy, necrosis, or inflammatory cell infiltration observed, suggesting that the extract does not compromise gastrointestinal integrity.

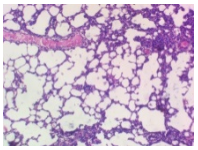
Figure 6g: Representative biopsies and histology of intestine of tested and control animal groups



Photomicrograph of the heart of the tested group. Normal heart with no visible lesion. The myocites are well arranged with no vaculation or degenerative changes.

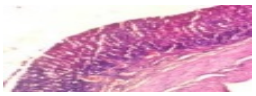


Photomicrograph of the heart of the tested group. Normal heart with no visible lesion. The myocites are well arranged with no vaculation or degenerative changes.

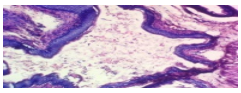


Photomicrograph of the lung for the tested group (E) (H&E x100). Lung parenchyma exhibits normal alveolar structure with no thickening of interstitial spaces. No signs of congestion, inflammation, or fibrosis, indicating that the extract does not impair pulmonary function.

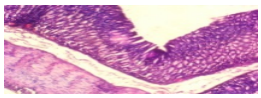
Figure 6h: Representative biopsies and histology of Lung of tested



Photomicrograph of the stomach for the positive control group (A) (H&E x100). Gastric mucosa has well-organized epithelial cells with visible gastric pits and glands; submucosa and muscularis layers appear



Photomicrograph of the stomach for the negative control group (B) (H&E x100). Normal gastric architecture with intact mucosal lining and glandular structures. No inflammatory or



Photomicrograph of the stomach for the tested group (E) (H&E x100). Gastric mucosa remains structurally intact with well-delineated epithelial and glandular components. No ulceration, erosion, or inflammatory infiltration noted, suggesting the extract does not induce

Figure 6i: Representative biopsies and histology of stomach of tested and control animal groups