# Comparative Study of Methanolic Extract of Banana, Ranitidine and Omeprazole on Total Acid Secretion and Gastric Ulcer Healing Effect in Albino Rats

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## ABSTRACT

**Introduction:** The commonest day to day ailment of human beings is the gastrointestinal diseases. Apart from traditional uses, there are several reports on important pharmacological actions of musa sapientum. Study aimed to compare acid secretion and ulcer healing effect of methanolic extract of banana, ranitidine, and omeprazole.

**Material and methods:** The present study was carried out on 30 albino rats for a period of 7 days. The animals were divided randomly into 5 groups of 6 animals each. Group I or control group received 3% gum acacia suspension orally for 7 days. Group II, III, IV and V received 100mg/kg of aspirin orally as a single dose the 7th day. Group III was pretreated with 100mg/kg of MSE orally for 7 days. Group IV was pretreated with 20 mg/kg omeprazole and Group V was pretreated with 150mg/kg of ranitidine orally for 7 days. After the administration of the drugs on the 7th Day, the albino rats were fasted for 24 hrs and then sacrificed after 4 hrs of pyloric ligation.

**Results:** In the control group (n=6) the values of ulcer index (µmol tyrosin/ml), free acidity (mEq/l), total acidity (mEq/l), and volume of gastric juice (ml/4 hrs) were 0.22±0.01, 53.25±2.59, 72.24±4.19 and 5.1±0.32 respectively. When compared to aspirin treated group, the MSE pretreated group (100 mg/kg) single dose orally on 7th day showed significant reduction ($p<0.01$, n=6) of ulcer index, free and total acidity (mEq/l), and volume of gastric juice (ml/4 hrs), whose values were 5.3±0.46, 71.31±4.15, 72.24±4.19 and 65.4±2.9 respectively.

**Conclusion:** The present study suggests that the methanolic extract of musa sapientum possesses significant ulceroprotective effect, which is comparable to omeprazole and ranitidine, except for gastric juice, where the effect of omeprazole was more. The observations of the present study puts forward omeprazole as a promising ulceroprotective agent, but further studies with more refined extracts and techniques on animal and human subjects are required to establish the true potential in terms of therapeutic and economic viability of this herbal plant.


**Keywords:** Methanolic Extract of Banana, Ranitidine, Omeprazole, Total Acid Secretion, Gastric Ulcer, Albino Rats

## INTRODUCTION

Peptic ulcer disease [PUD] encompassing gastric and duodenal ulcer is the most prevalent gastrointestinal disorders.[1] PUD is increased in developing countries because of migration of people from rural to urban areas. High society, consumption of high calories diet (fat diet, junk food etc.), low fibre diet and above all more stressful lifestyle aggravated the incidence of peptic diseases.[2] Recently there has been a rapid progress in the understanding of the pathogenesis of peptic ulcer. Most studies focus on newer and better drug therapy.[3] Many researchers contribute to look at a stress a possible cause in the development of ulcers.

Before the treatment of PUD, with drugs the surgery was the mainstay of treatment, but the development of drugs makes the surgery obsolete. Peptic ulcer therapy has undergone many strides over the past few years and a number of drugs are now available for treatment. The clinical evaluation of these drugs showed development of tolerance and incidence of relapse of relapse and side effects that make their efficacy arguable. This has been the rationale for the development of new antiulcer drugs, which includes herbal drugs as well.[4]

Herbal drugs have gained importance in recent years because of their easy availability, cost effectiveness and above all low side effects.[5] Musa sapientum var. Parasisiacal Linn. (plantain banana) belongs to the family musaceae. The plants are giant herbs with false aerial stems and sheathed leaves arising from a rhizome. Fruit is berry.[6] It is cultivated throughout India.[7] Apart from traditional uses, there are several reports on important pharmacological actions of musa sapientum. It has got antiulcer[8], antilithiatic activity[9], antimicrobial activity[10], hypoglycaemic activity[11], antihypertensive activity[12], antidiarrhoeal activity[13], muscle relaxant activity[14] and vasodilatory activity.[15]

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Ranitidine is a H2 receptor antagonist that inhibits acid production by reversibly competing with histamine for binding to H2 receptors on the basolateral membrane of parietal cells. Omeprazole is a proton pump inhibitor. In the present study the effect of ranitidine and MSE were comparable in relation to free acidity, total acidity, volume of gastric juice and ulcer index, ranitidine was found to be effective than MSE.

Study aimed to compare acid secretion and ulcer healing effect of methanolic extract of banana, ranitidine, and omeprazole by following parameters and to evaluate efficacy of drugs based on statistical analysis.

i. Free acidity by the method of Kulkarni SK (1999)[16]
ii. Volume of gastric juice according to Despande et al (2003)[17]
iii. Ulcer index by the method of Goyal RK (2002)[18]

## MATERIAL AND METHODS

This comparative study on the ulceroprotective effect of the fruit of Musa sapientum var. Paradisacal Linn. (plantain banana), ranitidine and omeprazole on aspirin induced gastric ulcers in albino rats, was conducted in the Department of Pharmacology, Katihar Medical College, Katihar, Bihar, India.

Drugs used in the study were methanolic extact of Musa sapientum, ranitidine, omeprazole, aspirin and vehicle3% gum acacia suspension for all preparations. The study was carried out on healthy albino rat (rattus norvegicus). Either sex of animals was used. Body weights of the selected rats were between 100-200 gms. Total numbers of rats used were 30. Standard animal diet was maintained with Bengal gram, wheat, maize and carrot in sufficient quantity daily and water was given ad libitum. All the animals were taken care of under ethical consideration.

For the preparation of methanolic extract of musa sapientum following materials were used dried powdered chips of fruit, 50% methanol, percolator and petridishes. Fresh plantain bananas were sliced and air dried at room temperature. The dried slices were grounded to a fine powder. Required amount of the powder was soaked in sufficient quantity of 50% methanol to render it evenly and distinctly moistened. It was allowed to stand for 6 hrs in an airtight container and then transferred to a percolator. The moistened powder was packed firmly in the percolator and allowed to macerate for 48 hours, before collecting the percolate. The same procedure was repeated twice. The percolate was collected in petri dishes and the alcohol allowed evaporating leaving behind a soft, brownish residue. It was scraped out and stored for the future use.

The suspension was prepared by mixing 100 mg of MSE with 5 ml of 3% gum acacia suspension. Aspirin powder was obtained from BD Pharmaceutical Works. Omeprazole powder was obtained from Dr. Reddy Laboratories. The suspension was prepared by mixing 20 mg/day of omeprazole powder in 5 ml of 3% gum acacia suspension. Ranitidine powder was obtained from Ranbaxy laboratories. The suspension was prepared by mixing 150 mg of ranitidine powder in 5 ml of 3% gum acacia suspension.

A total 30 healthy albino rats of either sex weighting 100-200 gms were divided randomly into 5 groups of 6 animals in each group.

| Groups | Treatment |
|---|---|
| Group I | 3% gum acacia 5 ml/kg p.o. |
| Group II | Aspirin 400 mg/kg p.o. as a single dose on 7$^{th}$ day |
| Group III | MSE 100 mg/kg p.o. for 7 days as aspirin 400 mg/kg p.o. on 7$^{th}$ day |
| Group IV | Omeprazole 20 mg/kg p.o. for 7 days and aspirin 400 mg/kg p.o. on 7$^{th}$ day |
| Group V | Ranitidine 150 mg/kg p.o. for 7 days and aspirin 400 mg/kg p.o. on 7$^{th}$ day |

The volumes of all the medicaments were kept constant at 5ml/kg and were administered orally. Group I or the control group received 3% gum acacia 5ml/kg orally for 7 days. After administration of aspirin the animals were fasted overnight, and had water ad libitum. The 8$^{th}$ day pyloric ligation was performed on all the rats under light anesthesia and kept for 4 hrs as described by Shay et al (1945).[19] Thereafter the rats were sacrificed by high doses of ether, and the stomach were removed and opened along the greater curvature and the contents collected in test tubes for analysis. The mucosa of the stomach was examined for ulcers and subjected to gastric mucus estimation.

The ulceroprotective effect of Musa sapientum extract in comparison to ranitidine and omeprazole was tested by

a. Free acidity by the method of Kulkarni SK (1999)[16]
b. Total acidity by the method of Kulkarni SK (1999)[16]
c. Volume of gastric juice according to Deshpande SS et al (2003)[17]
d. Ulcer index by the method of Goyal R K (2002)[18]

The acidity was calculated by the following formula and expressed in mEq/l.

Acidity= Volume of NaOH X Normality x 100/ 0.1 mEq/l

The contents of the resected stomach of the rats were taken in graduated test tubes were allowed to centrifuge at 2000 rpm for 10 mins. The supernatant fluid was measured for volume of gastric juice and expressed as ml/4 hrs. Then the juice was subjected to the biochemical tests.[17]

The method described by Goyal RK (2002)[18] was followed to measure the ulcer index. The resected stomachs of the sacrificed rats were opened along the greater curvature. The opened stomachs were given a gentle wash with a running stream of water. The stomachs were then placed on the card boards', luminal surface facing up. The ulcer index was then calculated from the glandular portion of the stomach, with the aid of a magnifying glass and measuring tape. The ulcer index was calculated was:

Ulcer index= 10/x, where x= Total mucosal surface/ total ulcerated area

Each lesion was measured along the greatest length. In case of petechiae, 5 of these were considered to be equivalent to 1 mm$^2$ of ulcer area. The total area of the glandular portion of the stomach and that of ulcerated mucosa were measured for

determination of the ulcer index.

## RESULTS

The present study was carried out in an attempt to compare the ulceroprotective effect of the methanolic extract of Musa sapientum, ranitidine, and omeprazole on aspirin induced gastric ulcers in albino rats [Fig. 1]. The results of ulcer index, free acidity, total acidity, and volume of gastric juice are tabulated in table-1.

The ulcer index was found to be 0.22±0.11 in Group I, 19.24±0.95 in group II, 5.3±0.46 in group III, 3.92±0.38 in group IV and 3.86±0.23 in group V [Table 1/Fig. 2].

The free acidity was found to be 53.25±2.59 in Group I, 98.82±2.30 in Group II, 71.31±4.1 in Group III, 72.24±4.19 in Group IV and 65.40±2.9 in Group V [Table 2].

The total acidity was found to be 126.4±3.8 in Group I, 220.2±5.8 in Group II, 154.2±2.5 in Group III, 155.1±5.19 in Group IV and 144.6±1.5 in Group V [Table 3/Fig. 3].

The gastric juice was found to be 5.1±0.32 in Group I, 8.3±0.40 in Group II, 3.1±0.12 in Group III, 3.12±0.16 in Group IV and 2.5±0.1 in Group V [Table 4].

| Group | Dose P.O. | Ulcer Index |
|---|---|---|
| I (Normal) | 5ml/kg | 0.22±0.01 |
| II (Aspirin) | 400 mg/kg | 19.24±0.95[a] |
| III (MSE) | 100 mg/kg | 5.3±0.46[b] |
| IV (Omeprazole) | 20 mg/kg | 3.92±0.38 |
| V (Ranitidine) | 150 mg/kg | 3.86±0.23[b] |
| N=6 in each group; a= p<0.01 when compared to normal control; b=p<0.01 when compared to experimental control; ANOVA followed by Dunnet's Multiple Comparison Test and Bonferroni Test.] | | |

**Table-1:** Show the effect of musa sapientum extract, omeprazole and ranitidine on the ulcer index in aspirin induced ulcers in albino rats [mean± SEM]

| Group | Dose P.O. | Ulcer Index |
|---|---|---|
| I (Normal) | 5ml/kg | 53.25±2.59 |
| II (Aspirin) | 400 mg/kg | 98.82±2.30[a] |
| III (MSE) | 100 mg/kg | 71.31±4.1[b] |
| IV (Omeprazole) | 20 mg/kg | 72.24±4.19[b] |
| V (Ranitidine) | 150 mg/kg | 65.40±2.9[b] |
| N=6 in each group; a= p<0.01 when compared to normal control; b=p<0.01 when compared to experimental control; ANOVA followed by Dunnet's Multiple Comparison Test and Bonferroni Test. | | |

**Table-2:** Effect of musa sapentum extract, omeprazole and ranitidine on the free acidity in aspirin induced ulcers in albino rats [mean± SEM]

| Group | Dose P.O. | Ulcer Index |
|---|---|---|
| I (Normal) | 5ml/kg | 126.4±3.8 |
| II (Aspirin) | 400 mg/kg | 220.2±5.8[a] |
| III (MSE) | 100 mg/kg | 154.2±2.5[b] |
| IV (Omeprazole) | 20 mg/kg | 155.1±5.19[b] |
| V (Ranitidine) | 150 mg/kg | 144.6±1.5[b] |
| N=6 in each group; a= p<0.01 when compared to normal control; b=p<0.01 when compared to experimental control; ANOVA followed by Dunnet's Multiple Comparison Test and Bonferroni Test. | | |

**Table-3:** Effect of musa sapentum extract, omeprazole and ranitidine on the total acidity in aspirin induced ulcers in albino rats [mean± SEM]

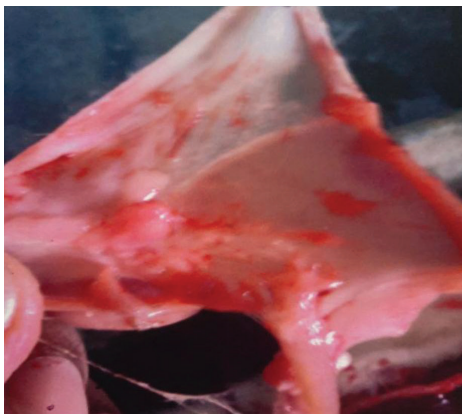

**Figure-1:** Aspirin induced ulcers in albino rats

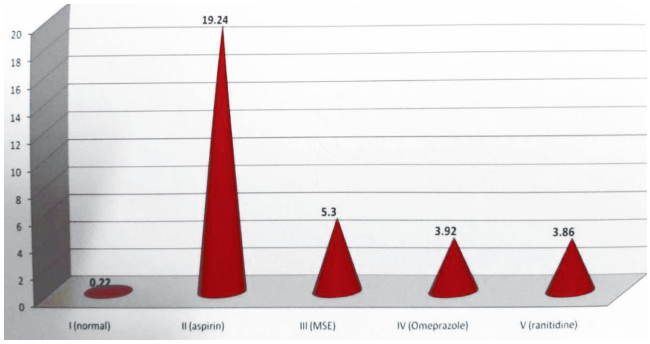


**Figure-2:** Effect of musa sapientum extract, omeprazole and ranitidine on the ulcer index in aspirin induced ulcers in albino rats

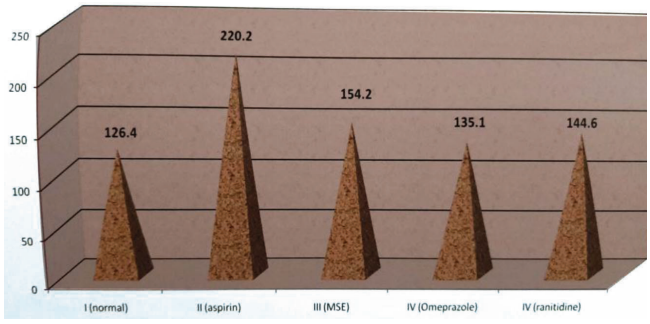


**Figure-3:** Effect of musa sapientum extract, omeprazole and ranitidine on the total acidity in aspirin induced ulcers in albino rats

| Group | Dose P.O. | Ulcer Index |
|---|---|---|
| I (Normal) | 5ml/kg | 5.1±0.32 |
| II (Aspirin) | 400 mg/kg | 8.3±0.40[a] |
| III (MSE) | 100 mg/kg | 3.1±0.12[b] |
| IV (Omeprazole) | 20 mg/kg | 3.12±0.16 |
| V (Ranitidine) | 150 mg/kg | 2.5±0.1[b] |
| N=6 in each group; a= p<0.01 when compared to normal control; b=p<0.01 when compared to experimental control; ANOVA followed by Dunnet's Multiple Comparison Test and Bonferroni Test. | | |

**Table-4:** Effect of musa sapentum extract, omeprazole and ranitidine on the volume of gastric juice in aspirin induced ulcers in albino rats [mean± SEM]

| Groups | Dose, P.O. | Ulcer Index | Free acidity (mEq/l) | Total acidity (mEq/l) | Volume of gastric juice (ml/4 hrs) |
|---|---|---|---|---|---|
| **I (Normal)** | **3% gum acacia 5ml/kg** | **0.22±0.01** | **53.25±2.59** | **126.4±3.8** | **5.1±0.32** |
| II (Aspirin) | 400 mg/kg | 19.24±0.95[a] | 98.82±2.3[a] | 220.21±5.8[a] | 8.3±0.4[a] |
| III (MSE) | 100 mg/kg | 5.3±0.46[b] | 71.31±4.15[b] | 154.2±2.5[b] | 3.1±0.12[b] |
| IV (Omeprazole) | 20 mg/kg | 3.92±0.38 | 72.24±4.19 | 3.12±0.16 | 3.12±0.16 |
| V (Ranitidine) | 150 mg/kg | 3.86±0.23[b] | 65.4±2.9[b] | 144.6±1.5[b] | 2.5±0.1[b] |

N=6 in each group; a= p<0.01 when compared to normal control; b=p<0.01 when compared to experimental control; p<0.01 when compared to ranitidine group; ANOVA followed by Dunnet's Multiple Comparison Test and Bonferroni Test.

**Table-5:** The ulceroprotective effect of musa sapentum extract, omeprazole and ranitidine in aspirin induced ulcers in albino rats (mean± SEM)

The total acidity (mEq/l) was found to be 126.4±3.8 in Group I, 220.21±5.8 in Group II, 154.2±2.5 in Group III, 3.12±0.16 in Group IV and 144.6±1.5 in Group V [Table 5].

## DISCUSSION

The gastric ulceroprotective activity of the methalonic extract of Musa sapientum var. Paradisiacal Linn or plantain banana (MSE), omeprazole and ranitidine was compared in albino rats, where ulcers were induced by aspirin. The ulcer index in the present study was measured by the method of Goyal RK (2002).[18] The ulcer index of group I or normal control group in the present study was 0.22±0.01. The ulcer index in the aspirin treated group (400 mg/kg PO single dose) was 19.24±0.95. In a study by Dutta et al (2002)[20] the ulcer index of aspirin treated group was 18.25±2.12. They administered aspirin at a dose 100 mg/kg orally 15 mins after pyloric ligation in rats. When treated with aspirin 200 mg/kg once daily for 3 days Goel RK et al (1986)[21] found the ulcer index to be 23±4. In another study by Jainu M and Devi CSS (2004)[22] with 400 mg/kg oral single dose of aspirin found the ulcer index to be 15.4±23. They sacrificed the rats 4 hrs after aspirin administration.

The ulcer index in Group III pretreated with MSE (100 mg/kg orally once daily for 7 days) was 5.30±0.46 in the present study, while in the study by Goel R K et al (1986)[21] the ulcer index was 7.4±2.1. The ulcer index in the test drug group was found to be greater in the study by Goel RK et al (1986)[21] than that of the present study. They used water suspension of the dried banana powder in the dose of 500mg/kg twice daily orally for 3 days. But in the present study methanolic extract of banana was used 100 mg/kg once daily for 7 days. The methanolic extract was found to be more ulceroprotective than the water suspension, because the extract may have the ulecroprotective active principles in greater amount.

In the present study the ulcer index of Group IV or omeprazole pretreated group (20 mg/kg orally once daily for 7 days) was 3.92±0.38. In the study of Dutta et al (2002)[20] the ulcer index was 5.09±0.01. They used omeprazole in the dose of 20 mg/kg intraperitoneally as a single dose in the rats, where ulcer were produced by aspirin 100 mg/kg orally 15 mins after pyloric ligation and were sacrificed after 7 hrs. The difference in the ulcer index in Group IV when compared to findings of Dutta et al (2002)[20] were due to difference in route of administration of drug, duration of treatment and method of ulcer production.

In the present study the ulcer index of Group V or ranitidine pretreated group (150 mg/kg orally once daily for 7 days) was 3.86±0.23. In the study by Datta M et al (2002)[23] the ulcer index was 5.09±0.01. They used ranitidine in the dose of 40 mg/kg intraperitoneally as a single dose in the rats, where ulcer were produced by aspirin 100 mg/kg orally 15 minutes after pyloric ligation and were sacrificed after 7 hrs. The differences in the ulcer index in Group V when compared to findings of Datta M et al (2002)[23] were due to difference in dose, duration of treatment and method of ulcer production.

In the present study, MSE and omeprazole both significantly reduced (p<0.01) ulcer index when compared to the aspirin treated group. The reduction in ulcer index by MSE (100 mg/kg) was comparable to omeprazole (20 mg/kg). In the present study, MSE and ranitidine both significantly reduced (p<0.01) ulcer index when compared to the aspirin treated group. The reduction in ulcer index by MSE (100 mg/kg) was comparable to ranitidine (150 mg/kg) and omeprazole (20 mg/kg).

The total acidity (mEq/L) in the present study was measured by the method of Kulkarni SK (1999)[16] and the finding in the control group was 126.4±3.8. The total acidity in the studies of Maity S et al (2003)[24] and Datta M et al (2002)[23] were 136.4±4.47 and 105.32±3.09 respectively. There was significant increase (p<0.01) in the total acidity in Group III when compared to Group I. MSE (100 mg/kg) and omeprazole (20 mg/kg) both reduced the total acidity significantly (p<0.01) when compared to aspirin treated group. The effect of MSE on total acidity was comparable to omeprazole.

There was significant increase (p<0.01) in the total acidity in Group II when compared to Group I. MSE (100 mg/kg) and ranitidine (150 mg/kg) both reduced the total acidity significantly (p<0.01) when compared to aspirin treated group. The effect of MSE on total acidity was comparable to ranitidine. The free acidity (mEq/l) in the present study was measured by the method Kulkarni SK (1999)[16] and was 53.25±2.59 in the control group. In the aspirin treated group the free acidity was 98.82±2.3, which showed significant increase (p<0.01) in comparison to the control group. MSE (100 mg/kg) and ranitidine (150 mg/Kg) significantly reduced the free acidity in comparison to Group II and their effects on free acidity were comparable.

The volume of gastric juice (ml/4 hrs) was measured as in

Despande SS et al (2003)[17] in the present study. The volume of gastric juice was 5.1±0.32 in the control group. The volume of gastric juice in the study of Despande SS et al (2003)[17] was 8.85±1.07. The volume of gastric juice was significantly increased ($p<0.01$) in the aspirin group when compared to the control group. MSE and omeprazole significantly reduced ($p<0.01$) the volume of gastric juice, when compared to the aspirin group, and their effects were comparable. It is evident from the results of the present study that the methalonic extract of musa sapientum var. Paradisiacal Linn (MSE) produces significant ulceroprotective effect in aspirin induced gastric ulcers in albino rats. The aetiology of gastric ulcers is not known in most cases, it is generally accepted that is results from an imbalance between aggressive factors and the maintenance of mucosal integrity through the endogenous defence mechanisms (Piper DW and Stiel DD).[25]

Pretreatment with MSE (100 mg/kg) orally for 7 days showed significant reduction ($p<0.01$) of the aggressive factors i.e. free acidity, total acidity and volume of gastric juice, and significant increase ($p<0.01$) in the defensive factor i.e. gastric mucus, which resulted in a decreased production of ulcers in the albino rats. Banana is rich in various flavonoids. The major components of this group of polyphenolic compounds are the flavan-3'4-diols also known as leucoanthocyanidins (Simmonds NW, 1954).[26] Flavonoids are known to exhibit anti-inflammatory, antineoplastic, and hepatoprotective activities (Havsteen B, 1983).[27] More recently they have been shown to reduce acid secretion fro gastric parietal cells (Beil W et al, 1995).[28] This shows that in the present study MSE exerted its ulceroprotective effect probably due to its flavonoid content.

Certain studies on herbal plants showed antioxidant mediated ulceroprotecive activity in experimental animals (Maity S et al, 2003[24]; Jainu M and Devi CSS, 2004[22]). The methanolic extract of banana was reported to have antioxidant mediated antiulcer activity (Goel RK et al, 2001).[29] Thus the antioxidant activity may be one of the mechanisms through which banana exerts its ulceroprotective effect. In the present study omeprazole (20 mg/kg) and ranitidine (150 mg/kg) showed significant decrease in ulcer index, volume of gastric juice, free acidity and total acidity. In the present study the effect of omeprazole and MSE were comparable in relation to free acidity, total acidity, volume of gastric juice and ulcer index, omeprazole was found to be more effective than MSE.

In the present study the effect of ranitidine and MSE were comparable in relation to free acidity, total acidity, volume of gastric juice and ulcer index, ranitidine was found to be effective than MSE.

## CONCLUSION

The methanolic extract of musa sapientum was compared with omeprazole and ranitidine for its ulceroprotective effect in comparative studies on the ulceroprotective effect of the fruit of musa sapientum var. Paradisiacal Linn. Omeprazole and ranitidine on aspirin induced gastric ulcers in albino rats. Pretreatment of albino rats with methanolic extract of musa sapientum after 100 mg/kg, omeprazole 20mg/kg and ranitidine after 150 mg/kg, both orally for 7 days showed significant ulceroprotective effect on asprin induced gastric ulcers, which was evident by significant reduction of ulcer index, free acidity, total acidity and volume of gastric juice. When compared, the methanolic extract of musa sapientum, omeprazole and ranitidine showed comparable effects on ulcer index, free acidity, total acidity and volume of gastric juice. In the case of gastric juice, omeprazole was found to be more effective than the extract.

The present study suggests that the methanolic extract of musa sapientum possesses significant ulceroprotective effect, which is comparable to omeprazole and ranitidine, except for gastric juice, where the effect of omeprazole was more. The observations of the present study puts forward omeprazole as a promising ulceroprotective agent, but further studies with more refined extracts and techniques on animal and human subjects are required to establish the true potential in terms of therapeutic and economic viability of this herbal plant.

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