



## Organic constituents and antiulcer activity of petroleum spirit extract of unripe plantain (*Musa paradisiaca*) peels

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### ABSTRACT

*Musa paradisiaca* (plantain) is an edible food crop and an African medicinal plant. The fruit is consumed, boiled, roasted, fried or as plantain flour. It is used against ulcer, diabetes and as antimicrobial agent. The study is aimed to identify the constituents and the antiulcer activity of the petroleum spirit extract of unripe fruit peel was evaluated. Air dried unripe plantain peel was ground. The ground peel was soaked in petroleum spirit for 24 h and filtered. The filtrate was allowed to evaporate at laboratory temperature to get the petroleum spirit extract. The constituents were separated by gas chromatography and identified by mass spectrometry. The extract was used to test for such ulcer parameters like gastric acid output, gastric mucus output and ulcer score etc. The extract contains sixteen organic compounds and the study shows that it is effective in control of stomach ulcer, which could have possible application to control the stomach ulcer.

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**Capsule Summary:** The petroleum spirit extract of unripe plantain peels controls peptic ulcer and contains sixteen organic compounds which are responsible for its biological activity.

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### INTRODUCTION

*Musa paradisiaca* (plantain) is a domesticated tropical plant mainly cultivated for food. It is also employed in herbal medicine. The unripe fruit peel is a source of antioxidant and dietary fibre (Arun et al., 2015). The fruit peel aqueous extract has strong antifungal properties (Okorondu et al., 2012). The aqueous extract of unripe plantain peel also has strong antiulcer effect on male Wistar (albino) rats. The peel is also richer in cellulose than the inner part (Enenchukwu et al., 2014, Keticu, 1973 and Ikpeazu et al., 2017). It is used against diarrhea, dysentery, intestinal lesions in ulcerative colitis, diabetes, anemia, gout and hypertension (Iman and

Akter 2001, Laranyo et al., 2016). The *Musa paradisiaca* has various bioactive compounds "phytochemicals" such as flavonoids, phenolics, vitamins and proteins and due to presence, these bioactive compounds, the *Musa paradisiaca* showed promising antioxidants activity (Rai et al., 2021).

Earlier works reported on the antiulcer property of plantain peel is mainly on its aqueous extracts. To the best of our knowledge there is no report on the antiulcer activity of its petroleum spirit extract and its constituent organic compounds except for the work of Morah and Peter (2022) which is on the chloroform extract. The present study is aimed to identify the constituents of the petroleum spirit extract and then, their activity against stomach ulcer was evaluated, which has not been reported previously.

## MATERIAL AND METHODS

Unripe fruit of *Musa paradisiaca* (plantain) was obtained from the Pharmacology Departmental farm, University of Calabar and authenticated by the Herbarium Unit, Botany Department of the University of Calabar. The fruits were rinsed with distilled water and peeled. The peels were air dried in the open laboratory for two weeks and ground. The ground peel (215 g) was soaked in petroleum spirit (40-60 °C) for 24 h and filtered. The filtrate was allowed to evaporate at room temperature to give the petroleum spirit extract (36.8 g).

The constituents of the extract were separated by gas chromatography while the individual constituents were identified by mass spectrometric analysis (Morah and Bisong, 2021). The crude drug was administered to the rats by oral gavage as follows;

Group I: The control group was fed with normal saline and animal feed.

Group II: 40 mgkg<sup>-1</sup> of body weight of aspirin was given in the morning with fasting. Animal feed and water was given in the evening.

Group III: 40 mgkg<sup>-1</sup> of body weight of aspirin was given in the morning with fasting and 40mgkg<sup>-1</sup> of extract in the evening with feed and water.

Group IV: 40 mgkg<sup>-1</sup> of body weight of aspirin was given in the morning with fasting and 40mg kg<sup>-1</sup> of cimetidine in the evening with animal feed and water.

The body weight changes are obtained by noting the difference between the initial body weight of the rats and the weight after seven days. The difference in feed weight kept for the rat and the weight left after 24 hours is the food intake. The difference between water supplied to the animal in the cage and what is left after 24 hours is the water intake. Ulcer score and index was obtained by the method of Jimmey and Ntong (2020).

Adherent mucus was determined by method of Tan et al. (2006). The gastric juice was collected by method of Shay et al. (1954) and its secretion determined according to methods of Gosh and Schild (1958) and Ibu et al. (1986). Proteolytic activity of gastric secretion was achieved by the method of Hawk et al. (1960).

## RESULTS AND DISCUSSION

Table 1 shows that the petroleum spirit extract contains sixteen organic compounds which include hexadecanoic acid ethyl ester (31.45%); mesitylene (14.66%) hexadecane, 1,1-bis (dodecycloxy), (10.60%); 9,10-secocholesta-5,7,10(19)-triene-1,3-diol-25-[trimethylsilyl]-oxyl, 3b, 5Z,7E) - (0.98%); carveol (5.13%); oleic acid (1.76%); and 11,14 - octadecanoic acid methyl ester (4.01%) etc. Oleic acid and carveol are reported to have antiulcer effect (Crowell *et al.*, 1992, Sosa and Baji 2016, Vigayabaskar et al. 2018). A number of the other

constituents have antimicrobial and anti-inflammatory activities which may also assist in ulcer management. Also, these findings are in line with previous studies that the *Musa paradisiaca* is various bioactive and the extract showed promising bioactivities in various studies reported before. The bioactive/components reported in the *Musa paradisiaca* extract includes polyphenols (hydroxyl benzoic acid, phenolic acids as gallic acid, gentisic acid, protocatechuic acid, vanillin, caffeic acid, vanillic acid, syringic acid, p-coumaric acid, ferulic acid, chlorogenic acid, sinapic acid and catechol. Also, flavonoids as catechin, quercetin, rutin, and epicatechin have been reported in *Musa paradisiaca* (Gadelha et al., 2021). Based on present investigation and previous findings, the *Musa paradisiaca* is a potent source of bioactive compounds.


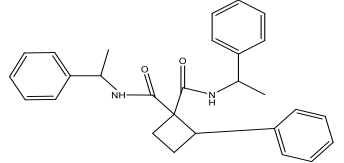
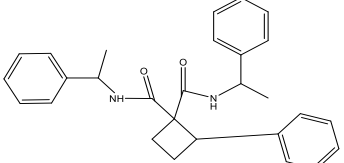
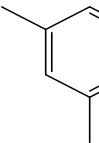

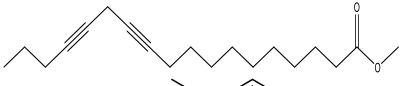
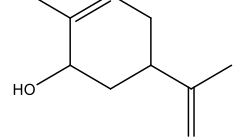
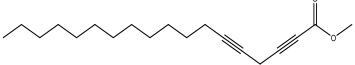
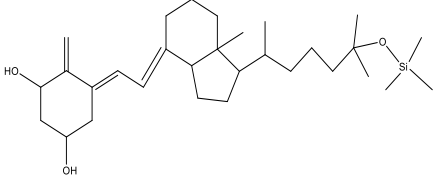
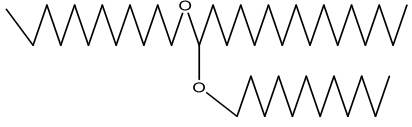
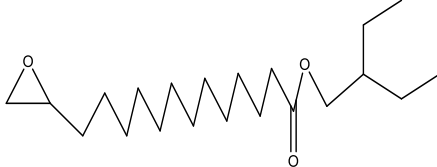
### Antiulcer activity

The result shows that rats treated with the extract has LD<sub>50</sub> of 65±12.57 mgkg<sup>-1</sup> body weight. The mean body weight change in control, aspirin only, aspirin and 40 mgkg<sup>-1</sup> of petroleum spirit extract and 60mgkg<sup>-1</sup> of cimetidine is 2±0.57, 10.3±2.97, 12.2±3.52 and 11.8±3.41, respectively. This shows that there is much weight loss in animals treated with drugs compared to the control. This is because aspirin activates an enzyme that promotes burning of fat leading to weight loss (Hawley *et al.*, 2012). The mean food intake in the control, aspirin only 2012, aspirin and 40 mgkg<sup>-1</sup> extract is 45±0.09, 27.1±2.06 and 30.2±0.55 g, respectively. This shows that the mean food intake is lowered with intake of the petroleum spirit extract (Wexler 2014).


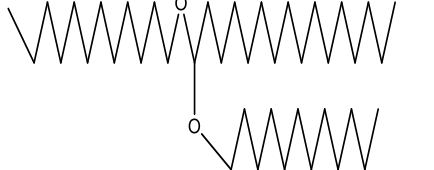
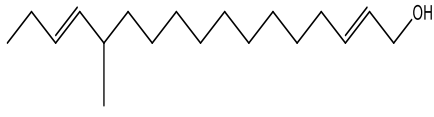
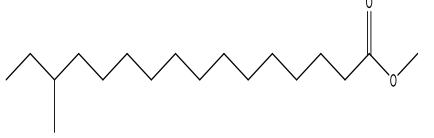

The mean basal gastric acid output in the control, aspirin and 40 mgkg<sup>-1</sup> of the extract is 4.21±0.00, 4.26±0.03, and 4.23±0.19 mM dm<sup>-3</sup> h<sup>-1</sup> respectively showing a slight increase in basal acid output. The acid output increases on addition of histamine. This is because histamine stimulates acid output. Upon treatment with cimetidine, a H<sub>2</sub>-receptor antagonist, there is reduction in gastric secretion. This is in accord with the work of Mekonnen et al. (2020). The gastric mucus output in the control, aspirin only, aspirin and 40mgkg<sup>-1</sup> of the extract were 0.02±0.00, 0.01±0.00 and 0.02±0.007. The work shows an increase in mucus output and ulcer score/index compared with the control. It therefore controls ulcer as increase in mucus secretion is known to suppress ulcer (Bakar et al., 2021, Isam et al., 2012).

The work clearly shows that the petroleum spirit extract of unripe *Musa paradisiaca* fruit peel has antiulcer activity. The identified carveol and oleic acid are known antiulcer agents and are partly responsible for its observed antiulcer activity. One may be tempted to believe that only the major constituents are responsible for this biological activity but the minor constituents are known to modulate the biological activities of major constituents through antagonistic, additive and synergistic effects (Morah and Inuka 2021).

**Table 1:** GC-MS analysis of petroleum spirit extract of *Musa paradisiaca*

S/N	RT (min)	Name of Compounds	RMM	% comp.	Base peak	Molecular Formula	Structures
1	6.050	9-octadecenamide	281	1.500	59	C <sub>18</sub> H <sub>35</sub> ON	
2	7.508	1,1-cyclobutanedicarboxamide, 2-phenyl-N,N'-bis(1-phenylethyl)	426	1.953	105	C <sub>28</sub> H <sub>30</sub> O <sub>2</sub> N <sub>2</sub>	
3	7.864	1,1-cyclobutanedicarboxamide, 2-phenyl-N,N'-bis(phenylethyl)-	426	5.894	105	C <sub>28</sub> H <sub>30</sub> O <sub>2</sub> N <sub>2</sub>	
4	8.815	Mesitylene	120	14.667	105	C <sub>9</sub> H <sub>12</sub>	
5	9.203	2-Hexadecanol	242	3.309	57	C <sub>16</sub> H <sub>34</sub> O	
6	9.947	11,14-octadecadiynoic acid, methyl ester	290	4.054	105	C <sub>19</sub> H <sub>30</sub> O <sub>2</sub>	
7	11.542	Carveol	152	5.130	119	C <sub>10</sub> H <sub>16</sub> O	
8	12.268	2,5-octadecadiynoic acid, methyl ester	290	4.028	119	C <sub>19</sub> H <sub>30</sub> O <sub>2</sub>	
9	18.592	9,10-secocholesta-5,7,10(19)-triene-1,3-diol,25-[(trimethylsilyl)oxy]-, (3b, 5Z, 7E)-	488	0.982	131	C <sub>30</sub> H <sub>52</sub> O <sub>3</sub> Si	
10	26.668	Hexadecane, bis(dodecyloxy)-	594	1.215	57	C <sub>40</sub> H <sub>82</sub> O <sub>2</sub>	
11	27.737	Oxiraneundecanoic acid, 3-pentyl-methyl ester, cis	312	1.669	74	C <sub>19</sub> H <sub>36</sub> O <sub>3</sub>	

**Table 1:** Continue...

12	29.583	Oleic acid	282	1.760	55	C <sub>18</sub> H <sub>34</sub> O <sub>2</sub>	
13	35.287	Hexadecane, bis(dodecyloxy)-	1,1- 594	10.604	57	C <sub>40</sub> H <sub>82</sub> O <sub>2</sub>	
14	35.775	12-methyl-E,E-2,13-octadecadien-1-ol	280	5.321	55	C <sub>19</sub> H <sub>36</sub> O	
15	37.083	Hexadecanoic acid, 14-methyl-, methyl ester	284	6.466	74	C <sub>18</sub> H <sub>36</sub> O <sub>2</sub>	
16	37.633	Hexadecanoic acid, ethyl ester	284	31.449	88	C <sub>18</sub> H <sub>36</sub> O <sub>2</sub>	

S/N = serial number, RT = retention time, RMM = relative molecular mass, % comp= composition

## CONCLUSIONS

Unripe *Musa paradisiaca* fruit petroleum spirit extract contains sixteen organic compounds, two of which are known antiulcer agents. Some of these compounds have anti-inflammatory and antimicrobial activity. The antiulcer activity of the extract was confirmed through such ulcer parameters like gastric acid secretion, and gastric mucus output etc. The authors recommend the use of unripe plantain peels for control of stomach ulcer.

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