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ANTIULCEROGENIC ACTIVITY OF CORNSILK EXTRACT OF ZEA MAYS

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ABSTRACT

Cornsilk of *Zea mays* is used in Ibibio traditional medicine for the treatment of various ailments including diabetes mellitus, malaria and gastrointestinal disorders. **Objective:** To investigate the antiulcerogenic potential of cornsilk extract of *Zea mays*. **Materials and Methods:** Ethanol cornsilk extract of *Zea mays* (170-510 mg/kg) was evaluated for antiulcerogenic activity against indomethacin, ethanol and histamine-induced ulcers in rats. **Results:** The cornsilk extract was found to possess significant ($p<0.05$) activity against indomethacin-induced ulcer. The effects of the extract against ethanol and histamine was not significant ($p>0.05$) and non dose-dependent. **Conclusion:** These results suggest that the cornsilk extract of *Zea mays* possess antiulcerogenic potential which are due to the activities of the phytochemical constituents.

KEYWORDS: *Zea mays*, cornsilk, antiulcer.

INTRODUCTION

Zea mays L. (Family- Poacae) also known as corn or maize, is a large grain plant first domesticated by indigenous peoples in Mexico about 10,000 years ago (Osagie and Eka, 1998). It is an annual grass plant cultivated for human consumption and rearing of animals. It was introduced to Nigeria in the 16th century (Osagie and Eka, 1998).

Besides its nutritive values of maize grains, the leaves, cornsilks, stalk, and inflorescence are also used in ethno-medicine for the treatment of several ailments. The corn silk is used as an antidiabetic or diuretic, and decoction of the silk is consumed for the treatment of urinary troubles and gallstones (Foster and Duke, 1990).

Traditionally corn silk was used in many parts of the world for the treatment of cystitis, gout, kidney stones, malaria, prostate hypertrophy, nephritis and heart disorders (Hashim, 2012).

Secondary metabolites like flavonoids, saponins, alkaloids, tannins, chlorogenic acid, allantoin, and phytosterols as well as flavonoids such as maysin, apigmaysin, 3-methoxymaysine and ax-4-OH-maysin have also been identified from corn silk (El-Ghorab et al., 2007). Biological activities include; antioxidative stress (Bai et al., 2010; Hu and Deng, 2011), diuresis and kaliuresis effect (Velazquez et al., 2005), hyperglycemic effect (Guo et al., 2009), nephroprotective activity (Sepehri et al., 2011), anti- fatigue (Hu et al., 2010). anti-depressant activity (Ebrahimzadeh et al., 2009), anti-hyperlipidemic activity (Kaup et al., 2011), anti-diabetic effects (Zhao et al., 2012, Sani, 2016). Anti-inflammatory activity (Wang *et al.*, 2011; Habtemariam, 1998; Kim et al., 2005), Anti-tumour (Habtemariam, 1998), Hepatoprotective (Campo et al., 2001), Antioxidant (Alam , 2011; Ebrahimzadeh et al., 2008; El-Ghorab et al., 2007; Maksimovic et al., 2003; Lui et al., 2011; Kan et al., 2011, Dong et al., 2014), anticancer (Tian et al., 2013), α- amylase inhibitory(Chen et al., 2013); antidiabetic and hypolipidemic activities (Liu, 1995; Ghada et al., 2013; Zhang et al., 2016), anticonvulsant (Okokon et al., 2018), antimalarial and antipyretic activities (Okokon et al., 2019). We report in this study the antiulcer activity of the cornsilk extract of *Zea mays.*

MATERIALS AND METHODS

Collection and identification of plant material

The cornsilk extract of *Zea mays* L. (Family- Poacae) were collected from farms in the Uyo area of Akwa Ibom State, Nigeria in May, 2018. The plant was identified by a taxonomist in the Department of Botany and Ecological Studies, University of Uyo, Uyo, Nigeria. A voucher specimen of the plant was deposited in the Faculty of Pharmacy's herbarium at the University of Uyo.

Extraction

The cornsilk were washed and shade dried for two weeks. The dried cornsilk were pulverized to powder using electric grinder. The powdered cornsilk was macerated in ethanol for 72

hours, The liquid filtrate of the extract was concentrated and evaporated to dryness in *vacuo* 40^0c using a rotary evaporator. The extract was stored in a refrigerator at -4^0c, until used for the proposed experiments.

2.3 Animals

Swiss albino male rats (145 – 170g) used for these experiments were gotten from Animal house of Department of Pharmacology and Toxicology, University of Uyo. The animals were housed in standard cages and were maintained on a standard pelleted feed (Guinea feed) and water *ad libitum*. Permission and approval for animal studies were obtained from the College of Health Sciences Animal Ethics Committee, University of Uyo.

2.4 Evaluation of antiulcer activity

Indomethacin-induced ulcer

Male adult albino rats were used for the experiment. They were randomly divided into five groups of six rats each. Food was withdrawn 24 hours and water 2h before the commencement of experiment (Alphin and Ward, 1967). Group 1 (control) received only indomethacin (Sigma, 60 mg/kg p.o. dissolved in 5% Na_2CO_3); Groups 2 - 4 were pretreated with *Zea mays* husk extract (170, 340 and 510 mg/kg p.o. respectively) dissolved in distilled water and administered as aqueous suspension; Group 5 received cimetidine (100 mg/kg p.o. dissolved in 50% Tween 80). One hour later, groups 2-5 were administered with indomethacin. Four hours after indomethacin administration, animals were killed by cervical dislocation. The stomachs were removed and opened along the greater curvature. The tissues were fixed with 10% formaldehyde in saline. Macroscopic examination was carried out with a hand lens and the presence of ulcer lesion was scored (Nwafor *et al*., 1996). Ulcer index (UI) and preventive ratio (PR) of each of the groups pretreated with extract was calculated using standard methods (Zaidi and Mukerji, 1985; Nwafor *et al*., 2000). Ulcer index represents the degree of lesion or ulceration caused by the ulcerogen, while preventive ratio is the protective potential of the extract/drug.

Ethanol-induced gastric ulceration

The procedure was similar to that used in indomethacin induced ulceration. The rats randomly assigned into five groups of six rats each based on their body weight. Food was withdrawn 24 hours and water 2h before the commencement of experiment (Alphin and Ward, 1967). Group 1 (control) received only ethanol (2.5 ml/kg p.o), Groups 2-4 were pretreated with *Zea mays* husk extract (170, 340 and 510 mg/kg p.o. respectively) dissolved

in distilled water and administered as aqueous suspension; Group 5 received propranolol (40 mg/kg p.o. dissolved in distilled water). One hour later, groups 2- 5 were administered with ethanol. Four hours after ethanol administration, animals were killed by cervical dislocation. The stomachs were removed and opened along the greater curvature. The tissues were fixed with 10% formaldehyde in saline. Macroscopic examination was carried out with a hand lens and the presence of ulcer lesion was scored (Nwafor *et al*., 2000).

Histamine-induced gastric ulceration in rats

Adult albino rats of both sexes weighing 120– 170 g were used for the experiment. They were randomized into five groups of six rats each. Food was withdrawn 24 hours and water 2 h before the commencement of experiment (Alphin and Ward, 1967). Group 1 (control) received only histamine acid phosphate (Sigma, 100 mg/kg i.p. dissolved in distilled water) (Maity *et al*., 1995); Groups 2 - 4 were pretreated with *Zea mays* husk extract (170, 340 and 510 mg/kg p.o. respectively) dissolved in distilled water and administered as aqueous suspension; Group 5 received cimetidine (100 mg/kg p.o. dissolved in 50% Tween 80), 1 hour prior to histamine administration. One hour later, groups 2-5 were administered with histamine acid phosphate (100 mg/kg, i.p). 18 hours after histamine administration, animals were killed by cervical dislocation. The stomachs were removed and opened along the greater curvature. The tissues were fixed with 10% formaldehyde in saline. Macroscopic examination was carried out with a hand lens and the presence of ulcer lesion was scored (Nwafor *et al*., 1996). Ulcer indexes (UI) and preventive ratio (PR) of each of the groups pretreated with the extract were calculated using standard methods (Zaidi and Mukerji, 1985; Nwafor *et al*., 2000).

2.5 Statistical Analysis

Data are reported as mean + standard error of the mean(SEM) and were analyzed statistically using One-way ANOVA followed by Turkey-Kramer multiple comparison. test and values of $p < 0.01$ were considered significant.

3. RESULTS

Indomethacin-induced gastric ulceration

The extract (p.o.) pretreatment on indomethacin-induced gastric ulceration showed a non dose-dependent reduction in ulcer indices in pretreated groups relative to control. These reductions were only significant ($p<0.05$) at higher doses (340 and 510 mg/kg) compared to control. The middle dose (340 mg/kg) exerted the most pronounced activity (51.37%) (Table

1). The ulcerations observed in the stomachs of the extract-pretreated groups were majorly pinpoint wounds and no severe wound was present in the stomach of the animals. Severe wounds were observed in the stomach of the animals in the control group. The standard drug, cimetidine, was the most effective with preventive ration of 96.36% (Table 1).

Ethanol-induced gastric ulceration

Pretreatment of rats with cornsilk extract offered considerable protection to the animals from ethanol–induced ulcer (Table 2). This protection was not significant ($p>0.05$) and non dose-dependent as shown in the reduction of ulcer indices relative to control. The ulcerative wounds observed in the stomachs of the extract-pretreated groups were not as severe wound as those present in the stomachs of the control animals. The standard drug, propranolol, gave a preventive ratio of 75.04% (Table 2).

Histamine–induced ulceration

Administration of the cornsilk extract exerted considerable reduction in histamine-induced gastric ulceration at lower doses (170 and 340 mg/kg) (Table 3). These reductions were not statistically significant ($p>0.05$) when compared to control. The highest dose (510 mg/kg) was observed to enhance the ulcerative activity of histamine. Animals in the extract-treated groups and control group were observed to have severe wounds in their stomachs. However, the standard drug, cimetidine produced a preventive ratio of 83.91% (Table 3).

Table 1: Effect of Ethanol Cornsilk Extract of *Zea Mays* on Indomethacin-Induced Ulcer.

TREATMENT	DOSE mg/kg	Ulcer indices	Preventive ratio
Control normal Indomethacin	60	18.16 ±1.69	-
Cimetidine	100	0.66 ±0.18[c]	96.36
Crude extract	170	15.8±0.96	12.99
	340	8.83 ± 1.09[b]	51.37
	510	13.16 ± 0.58[a]	27.53

Data are expressed as MEAN ± SEM, Significant at [a]$p < 0.05$,[b]$p<0.01$,[c]$p<0.001$, when compared to control. (n=6).

Table 2: Effect of Ethanol Cornsilk Extract of *Zea Mays* on Ethanol-Induced Ulcer.

Treatment	Dose mg/kg	Ulcer indices	Preventive ratio
Control normal	60	5.33 ±0.57	-
Propranolol	40	1.33 ±0.33[a]	75.04
Crude extract	170	4.66±0.30	12.57
	340	3.33 ± 1.66	37.52
	510	4.33 ± 0.33	18.76

Data are expressed as MEAN ± SEM, Significant at [a]$p < 0.05$, when compared to control. (n=6).

Table 3: Effect of Ethanol Cornsilk Extract of *Zea Mays* on Histamine-Induced Ulcer.

TREATMENT	DOSE mg/kg	Ulcer indices	Preventive ratio
Control normal	60	5.16 ±0.92	-
Cimetidine	100	0.83 ±0.44[c]	83.91
Crude extract	170	4.83±1.09	6.39
	340	4.00 ± 0.76	22.48
	510	8.83 ± 0.61	-71.12

Data are expressed as MEAN ± SEM, Significant at [a]$p < 0.05$,[b]$p<0.01$,[c]$p<0.001$, when compared to control. (n=6).

4. DISCUSSION

Zea mays silk is used traditionally to treat various gastrointestinal. For this reason, the antiulcer activity of the cornsilk extract was evaluated using indomethacin, ethanol and histamine–induced ulcer models. Indomethacin is known to cause ulcer especially in an empty stomach (Bhargava *et al*., 1973) and mostly on the glandular (mucosal) part of the stomach (Evbuonwa and Bolarinwa, 1990; Nwafor *et al*., 1996) by inhibiting prostaglandin synthetase through the cycloxygenase pathway (Rainsford, 1987). Prostaglandins function to protect the stomach from injury by stimulating the secretion of bicarbonate and mucus, maintaining mucosal blood flow and regulating mucosal turn over and repair (Hayllar and Bjarnason, 1995; Hiruma-Lima *et al*., 2006).

Suppression of prostaglandins synthesis by indomethacin results in increase susceptibility of the stomach to mucosal injury and gastroduodenal ulceration. The extract was observed to significantly reduce mucosal damage in the indomethacin–induced ulcer model, suggesting the possible extract mobilization and involvement of prostaglandin in the anti- ulcer effect of the extract. Administration of ethanol has been reported to cause disturbances in gastric secretion, damage to the mucosa, alterations in the permeability, gastric mucus depletion and

free radical production (Salim, 1990). This is attributed to the release of superoxide anion and hydroperoxy free radicals during metabolism of ethanol as oxygen derived free radicals has been found to be involved in the mechanism of acute and chronic ulceration in the gastric mucosa (Pihan *et al*., 1987). It was observed in this study that the extract was unable to significantly reduced ethanol induced ulcer. This may be due to weak cytoprotective effect of the extract. Ethanol is also reported to cause gastric mucosal damage by stimulating the formation of leukotriene C4 (LTC4) (Whittle *et al*., 1985). The extract probably could not cause significant suppression of lipoxygenase activity (Nwafor *et al*., 1996).

Histamine-induced ulceration is known to be mediated by enhanced gastric acid secretion as well as by vasospastic action of histamine (Cho and Pfeiffer, 1981). The extract was found to have considerable but not significant activity against histamine-induced ulcer only at lower doses (170 and 340 mg/kg). The highest dose (510 mg/kg) was found to exacerbate histamine-induced ulcer suggesting its potential in promoting gastric acid secretion and maybe vasospastic activity of histamine. Cornsilk extract has been reported to be rich in flavonoids and other phenolic compounds (Alam, 2011; Dong *et al.*, 2014). Flavonoids such as quercetin have been reported to prevent gastric mucosal lesions in various experimental models (Di Carlo *et al*., 1999; Zayachkivska, 2005) by increasing the amount of neutral glycoproteins (Di Carlo *et al*., 1999). Flavonoids have been reported to protect the gastric mucosa from damage by increasing the mucosal prostaglandin content and by inhibiting histamine secretion. The antiulcer activity observed in this study maybe due to the activities of these phenolic compounds.

5. CONCLUSION

The results of the present study show that *Zea mays* silk extract displays gastroprotective activity as demonstrated by inhibition of the formation of ulcers induced through the three different ulcer models. The most pronounced activity was observed against indomethacin-induced ulcer. This supports its use in the treatment of gastrointestinal disorders in traditional medicine.

Conflict of Interest declaration

The authors declare no conflict of interest.

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