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EFFECT OF CAPSICUM ANNUM ON THE SERUM ELECTROLYTE PANEL OF WISTAR ALBINO RATS INDUCED WITH ASPIRIN

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Abstract

Peptic ulcer disease remains one of the most prevalent gastrointestinal diseases and has been linked to *H. pylori* infection and the use of non-steroidal anti-inflammatory drugs. *Capsicum annum* is known for its anti-inflammatory, antioxidant, antibacterial, nutritional, and medicinal properties. This study aimed to determine the effects of aspirin on antioxidant parameters in male wistar albino rats. Twenty (25) male wistar albino rats were procured and acclimatized for 2 weeks under normal laboratory conditions and were divided into five groups containing five male rats each. Group A (blank control) was neither induced with aspirin nor treated, but was only fed with water and food. Group B (negative control) was induced with 50 mg/kg of aspirin and was not treated. Group C (positive control) was induced with 50 mg/kg of aspirin and was treated with omeprazole. Group D (low-dose Capsicum anuum) was induced with aspirin and treated with 100 mg/kg of *C. annum* extract, and group E (high-dose control) was induced with aspirin and treated with 400 mg/kg of *Capsicum annum* ethanoic extract. Ulceration and treatment were administered orally via intubation. After 4 weeks of treatment, ulceration significantly decreased the Na ion level ($p > 0.05$) in the negative control group (56.60 ±10.40) and increased when treated with both low-dose and high-dose *Capsicum annum* extract (105.40 ± 12.60, ± 9.86). Changes in other parameters were not significant in low- and high-dose treatments.

Introduction

Peptic ulcers are acid-induced lesions found in the stomach and duodenum. They are characterized by a denuded mucosa with a defect extending into the submucosa or muscularis propria (Feldman, 2016). Lesions that do not reach this depth are called erosion. Peptic ulcers are caused by a combination of factors, including H. pylori infection, NSAIDs, and lifestyle factors such as smoking and alcohol use (Cameron and James, 2021).

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Helicobacter pylori can damage the protective lining of the stomach and duodenum, making it more susceptible to acid damage, resulting in peptic ulcers.

Peptic ulcer has detrimental effects on the body as it affects the absorption and retention of electrolytes (ions) that help in body function. Some of these ions include sodium, potassium, chloride, and calcium ions (Shahverdi, 2013). Peptic ulcer damages the lining of the small intestine, leading to decreased sodium absorption, which can lead to more severe health problems. It also interferes with the body's ability to absorb and retain potassium, leading to low potassium levels in the blood (a condition known as hypokalemia) (Elamin, 2015). On the same vein, ulcer reduces the absorption rate of chloride and calcium ions, leading to their deficiency in the bloodstream. The regular use of antibiotics for the treatment of ulcers is no longer as effective as it used to be due to the development of antibiotic resistance among users.

This has led to the formulation of herbal medications, which are preferred by most individuals presently due to their efficacy and low cost compared to synthetic drugs. *Capsicum annum* is among the natural medications used for ulcer treatment.

Capsicum annum belongs to the nightshade family and is commonly known as cayenne pepper. Capsaicin, the active ingredient in cayenne pepper, can reduce the symptoms of peptic ulcers and may even prevent them from developing in the first place (Oyagbemi, 2010). Capsaicin works by reducing inflammation and promoting tissue repair.

Capsaicin has been shown to increase mucus production and protect the stomach lining from acid damage in addition to its anti-inflammatory effects. It may also help decrease the amount of acid produced by the stomach and increase blood flow to the stomach and duodenum lining. Studies have also proposed that capsaicin may help kill *Helicobacter pylori*, the bacteria that can cause peptic ulcers. Therefore, this study aimed to investigate the effects of *Capsicum annum* on the serum electrolyte panel of aspirin-induced Wistar albino rats.

Materials and Methods

Collection of plant materials

Fresh *Capsicum annum* bells were purchased from a local market in Enugu, Nigeria. The leaves were identified and authenticated by Prof. C. S. Eze Department of Applied Biology and Biotechnology, Enugu State University of Science and Technology, Emugu, Nigeria

imal Collection

Twenty-five (25) wistar albino rats were procured from the University of Nigeria, Nsukka (UNN). Rats were divided into five groups, with each group containing five albino rats. Groups A–E were labeled and acclimatized for two weeks at the Animal House of Power Tech Analytical and Scientific Research Laboratory.

Experimental protocol

Group A: The blank control group contained five rats that were neither induced with aspirin nor treated with extract. The animals received normal rat feed and water.

Group B: Negative control; this group contains rats induced with 50 mg/kg of aspirin and left untreated with any intervention.

Group C: The positive control; the rats in this group were induced with 50 mg/kg of aspirin and treated with 20 mg/kg of omeprazole (standard ulcer drug).

Group D: The low-dose extract group was induced with 50 mg/kg of aspirin and treated with 100 mg/kg of Capsicum annum.

Group E: The high-dose extract group was induced with 50 mg/kg of aspirin and treated with 400 mg/kg of Capsicum annum.

Ulcer Induction

Gastric ulceration was induced according to the procedure described by Chaiyata (2003). The rats were administered a single oral dose of aspirin (50 mg/kg body weight). They were deprived of food but had free access to water 24 h before ulcer induction.

Preparation of the plant extract

Fresh *Capsicum annum* leaves were carefully selected and dried at room temperature for approximately 2 weeks. The Soxhlet extraction method was followed according to Chaiyasit *et al.* (2009).

Method of treatment

In the various groups, treatment was done by intubation using the oral method. Group D was treated with 100 mg/kg *Capsicum annum* extract once daily, whereas group E was treated with 400 mg/kg *Capsicum annum* extract once daily.

Sample Collection

Following the completion of treatment, blood was collected from each of the rats by ocular puncture using a 5 ml syringe, and the samples were emptied into clean collection containers for serum electrolyte level determination and other biochemical analysis. Blood samples were allowed to clot and centrifuged at 1000 rpm for 10 min, and serum was collected for analysis. The rats were humanely sacrificed by decapitation and dissected to remove the liver, which was then suspended in a clean collection container containing formalin solution for preservation and homogenized. The homogeneous samples were frozen overnight to ensure maximum electrolyte release.

Analysis of antioxidant parameters

Estimation of sodium ion (Na^-)

This was determined according to the method described by Mccord and Friodivich (1969).

Estimation of potassium ion (K^+)

The potassium ion was measured using the method of Sedlak and Lindsay (1968).

Estimation of the chloride ion (Cl^-)

The Cl levels were measured using the method of Varshney and Kale (1990).

Estimation of the calcium ion (Ca^+)

The calcium ion content was also determined according to the method described by Mccord and Friodivich (1969).

Statistical Analysis

All data were expressed as mean ± SEM Statistical analysis was performed by one-way analysis of variance using Statistical Package for Social Science (SPSS) for Windows version 21. Differences between means at the 5% level ($P<0.05$) were considered statistically significant (DNMRT).

Result

As shown in Table 1, the sodium concentration level in the serum sample of the normal control significantly increased compared with the positive control, low-dose group, and high-dose group ($P<0.05$). However, the potassium concentration in the serum sample of the low dose showed no significant difference when compared with the high dose. The chloride ion concentration level in the serum sample of the blank control significantly increased compared with the positive control, low-dose, and high-dose groups ($P<0.05$). The calcium concentration in the serum sample of the low dose showed no significant difference when compared with the high dose.

Table 1: Effect of Capsicum annum on serum electrolytes of aspirin-induced rats

Groups	Serum Na^+ level (mmol/L)	Serum K^+ level (mmol/L)	Serum Cl^- (mmol/L)	Serum Ca^{2+} (mg/dL) level
A(Blank Control) (Negative control)	117.50 ± 18.50[a]	9.20 ± 2.40[a]	96.00 ± 8.60[a]	6.10 ± 1.50[a]
	56.6 ± 10.40[b]	4.10 ± 1.50[b]	36.20 ± 8.50[b]	1.80 ± 0.60[b]
C(positive control)	76.80 ± 11.60[c]	8.90 ± 2.30[a]	68.50 ± 7.00[c]	5.80 ± 2.40[a]
D (Low-dose extract)	105.40±12.60[d]	5.20 ± 2.60[b]	77.20 ± 6.50[c]	3.60 ± 0.80[c]
E (High-dose Extract)	119.15 ± 9.68[a]	8.20 ± 2.42[a]	87.00 ± 6.60[c]	5.90 ± 1.50[a]

Data are presented as mean ± SEM. Mean values with different superscript letters were significantly different ($p<0.05$).

Discussion

Capsicum annum is a well-known spice in various parts of the world. Despite its dietary importance, the folklore of its medicinal importance is well established. Findings from this work showed that the phytochemicals present in *Capsicum annum* ameliorate effects on the antioxidant parameters of Wistar albino rats, increasing the level of antioxidants in the treatment organisms. These findings are consistent with the work of Chan and Kang (2013), who reported the effectiveness of chili extract on antioxidant parameters.

From the results, *C. annum* decreased K+ levels both in the low and high doses compared with the control. This was in accordance with the results of Chen (2013), who also discovered that *C. annum* has a deleterious effect on potassium levels. The sodium level was not significantly affected, indicating that *Capsicum annum* has an antihypertensive effect because Na+ is the major extracellular electrolyte implicated in hypertension. High Na+ levels cause blood vessel contraction to increase such that a great force is required to pump blood, with consequent hypertension.

The results showed that the calcium and chloride ion concentration levels in the negative control significantly decreased compared with the blank control, and the same was applicable to the calcium ion level. This is in accordance with the findings of Han *et al.* (2016), who found that chili pepper extract had a positive effect on calcium absorption in rats, increasing calcium levels in the blood and bones. Hanan *et al*. (2008) found that chili pepper extract increased the expression of a chloride transporter in the intestines, leading to increased chloride absorption.

Conclusion

Capsicum annum, also known as red bell pepper, contains numerous phytochemicals, such as phenols, flavonoids, tannins, anthraquinone, and terpenoids. These phytochemicals have ameliorative effects on antioxidant parameters, including sodium, calcium, potassium, and chloride ion levels. Although it shows no significant difference in the level of these ions, its impact can mildly alleviate certain conditions such as ulceration.

Recommendations

Based on this study's findings, we recommend further studies to explore the dose-dependent effects of *Capsicum annuum* on serum electrolyte balance in aspirin-induced Wistar albino rats to determine optimal therapeutic concentrations. Long-term investigation is also recommended to assess potential toxicity and interactions with commonly used analgesics. Comparative studies with standard electrolyte-corrective agents are also recommended to evaluate efficacy.

Declaration

We, the authors, declare that this manuscript titled "Effect of *Capsicum annum* on the serum electrolyte panel of Wistar albino rats induced with aspirin" is original and has not been published or submitted elsewhere for publication. All data were collected and analyzed following the ethical guidelines for animal research. There are no conflicts of interest to declare, and all authors have approved the final version of the manuscript for submission.

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Conflict of Interest

The authors declare no conflict of interest regarding the manuscript titled 'Effect of *Capsicum annum* on the serum electrolyte panel of Wistar albino rats induced with aspirin

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