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Xylopia aethiopica reduces the rate of bile secretion and increases biliary bicarbonate concentration in albino rats

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ABSTRACT

The effect of xylopia aethiopica on bile secretion and electrolytes was studied. Twenty one albino rats were randomly distributed into 3 groups n=7. Group 1 was gavaged with a high dose (0.25ml/g) of xylopia aethiopica extract. Group 2 was gavaged with a low dose (0.1ml/g) of xylopia aethiopica extract while the group 3 (Control) received 0.1ml/kg of normal saline. Extract administration was done by orogastric feeding for a period of 28 days. All animals were allowed access to food and water at will. At the end of feeding period, the rate of bile secretion and it electrolyte concentration was determined using standard methods. Results obtained showed that xylopia aethiopica extract has a dose dependent decrease in the rate of bile secretion, increased biliary potassium and bicarbonate ions concentration, decreased chloride ion concentration, and a decrease sodium ion concentration in the low dose treated group compared with control (P<0.01). Therefore, administration of aqueous extract of xylopia aethiopica may alter fat emulsification and absorption but may prevent duodenal ulceration due to the high bicarbonate content; hence it can be useful in the management or prevention of duodenal ulcers but should not be administered to patients with a known etiology of steatorrhoea.

Keywords: Bile, electrolytes, *xylopia aethiopica*

INTRODUCTION

Man's quest for survival has led to discovery of many plants that are of medicinal value even before the advent of orthodox medicine. One of such plants is *xylopia aethiopica* [1]. *xylopia aethiopica* is a local medicinal plant of the family annonaceae. It is commonly known as Negro pepper, 'uda' by the igbos, 'Erunji' in Yoruba, 'Atta' in efik/Ibibio, 'kimbara' by Fulani/hausa [2]. *Xylopia aethiopica* has a wide array of applications. The odoriferous roots of the plant are used in West Africa in tinctures, it is administered orally to expel worms and other parasitic animals from the intestine as well as in teeth rinsing and mouth wash [3]. The dried fruits are used as spices and in the preparation of local soups 'obeata' and 'isi-ewu' as commonly used in the South West and South Eastern parts of Nigeria [2]. *Xylopia aethiopica* has been reported to possess anti-fungal [4], antibacterial [5] and anti-malarial effects [6] properties. A combination of its aqueous and ethanolic extracts has also been reported to have potent spasmolytic properties on smooth muscles of rat's uterus [7]. Fruit extract of *Xylopia aethiopica* have been well-known to be helpful in management of other medical conditions ranging from malaria [6] to dysentery and other forms of dysmotility [8]. It has also been known to increase sperm count and steroid hormones [9]. In view of the multifaceted use of *xylopia aethiopica* particularly in orthodox medicine, it is therefore pertinent to know its possible effect on the hepathobiliary system.

MATERIALS AND METHODS

Preparation of the aqueous extract:
Fresh leaves of *xylopia aethiopica* were collected from the department of zoology and environmental biology, University of Calabar. The leaves were identified as *xylopia aethiopica* by the chief herbarium, department of Botany, University of Calabar and the aqueous leaf extracts of was prepared following the method used by Obembe *et al*, [10][11].

Animal care:
Twenty one **(**21) adult albino rats weighing 200-250g were randomly assigned into 3 groups (control, low dose and high dose treated groups, n=7). Each animal per group was housed in metabolic cages under standard laboratory conditions in the department of physiology, University of Calabar at room temperature of 25 ± 2^0C where they could observe 12hours dark/light cycle throughout the duration of the experiment. Their beddings were changed regularly and were fed with normal rat chow and water daily. Extract administration commences after one week of acclimatization with the aid of an orogastric cannula and lasted for 28 days.

Collection of Biliary secretion
Biliary secretion and bile electrolyte concentration was determined following the method described by Obembe *et al*., [13] and Vickers *et al.*, [14] as used by Udo *et al.*, [15].

Determination of Biliary electrolytes:
Sodium and potassium ion concentration in the bile were determined using a corning flame photometer method as described by Obembe *et al*., [12]. Biliary concentration of bicarbonate was determined following the modified method of Forrester *et al*.,[15]. While biliary chloride concentration was determined following the method of Kolthoft *et al*., [16].

Statistical analysis
The results were analysed for statistical significance by one way ANOVA using the SPSS statistical program and Post Hoc test between groups using MS excel program. All data were expressed as mean± SEM. P values < 0.05 were considered significant.

RESULTS

Effect of *Xylopia aethiopica* on the rate of biliary secretion
The mean rates of biliary secretion in the control, low dose and high dose treated groups were 0.96 ± 0.004, 0.68 ± 0.11 and 0.63 ± 0.07 respectively. The rate of flow in the high dose was significantly lower (P<0.01) compare the control group. However, there was no significant difference when compared with the low dose (Fig. 1)

The mean sodium ion concentration in the control, low dose and high dose treated groups was 141.2 ± 0.97 mmol/ L, 135.6 ± 0.97mmol/L and 142 ± 0.84 mmol/L. The low dose group was significantly lower (p<0.01) compared with control and the high dose groups (Fig. 2).

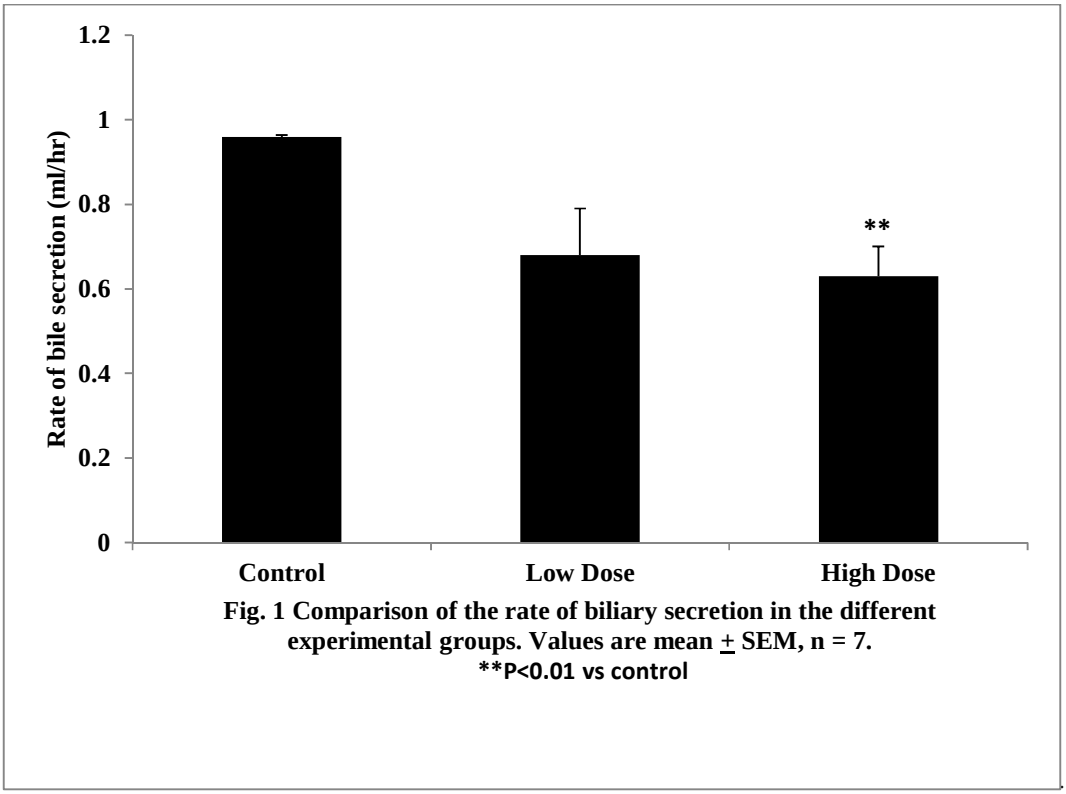

Fig. 1 Comparison of the rate of biliary secretion in the different experimental groups. Values are mean ± SEM, n = 7.
****P<0.01 vs control**

Effects of *Xylopia aethiopica* on sodium ion concentration in bile

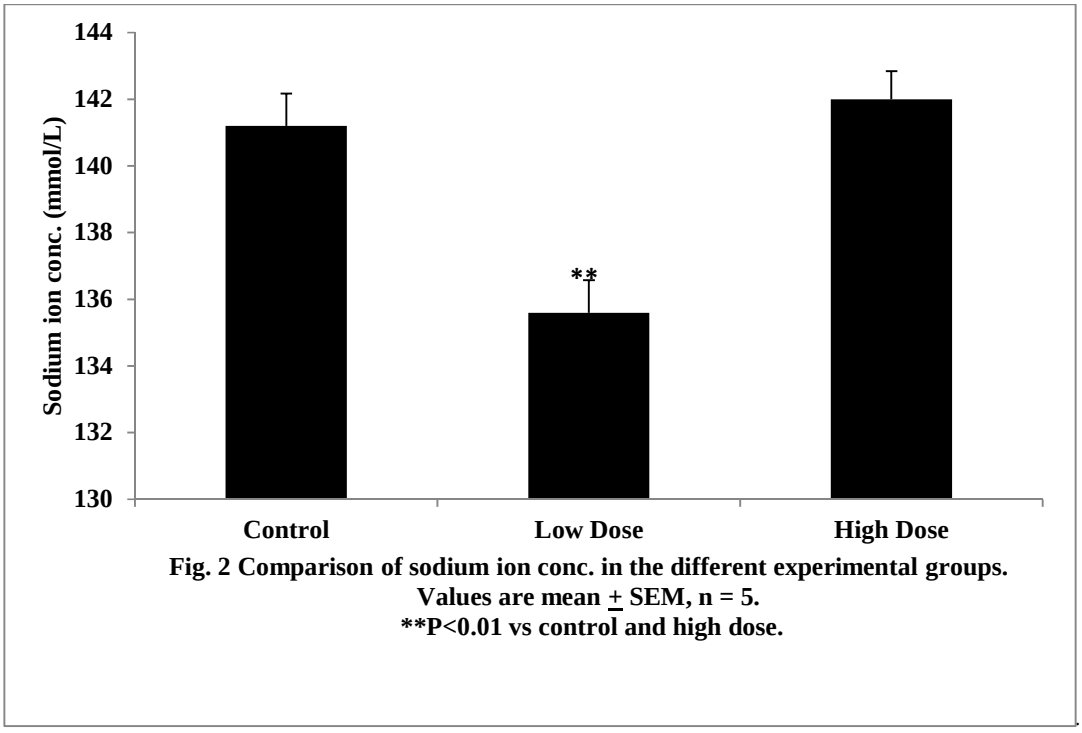

Fig. 2 Comparison of sodium ion conc. in the different experimental groups. Values are mean ± SEM, n = 5.
****P<0.01 vs control and high dose.**

Effect of *xylopia aethiopica* on Potassium ion concerntration in bile

The mean potassium concentration in the control, low dose and high dose groups was 3.6 ± 0.05mmol/L, 4.04 ± 0.02mmol/L and 4.36 ± 0.07mmol/L. The low dose group was significantly higher ($p<0.01$) compared with control, while the high dose group was significantly higher ($p<0.001$) compared with control (Fig 3).

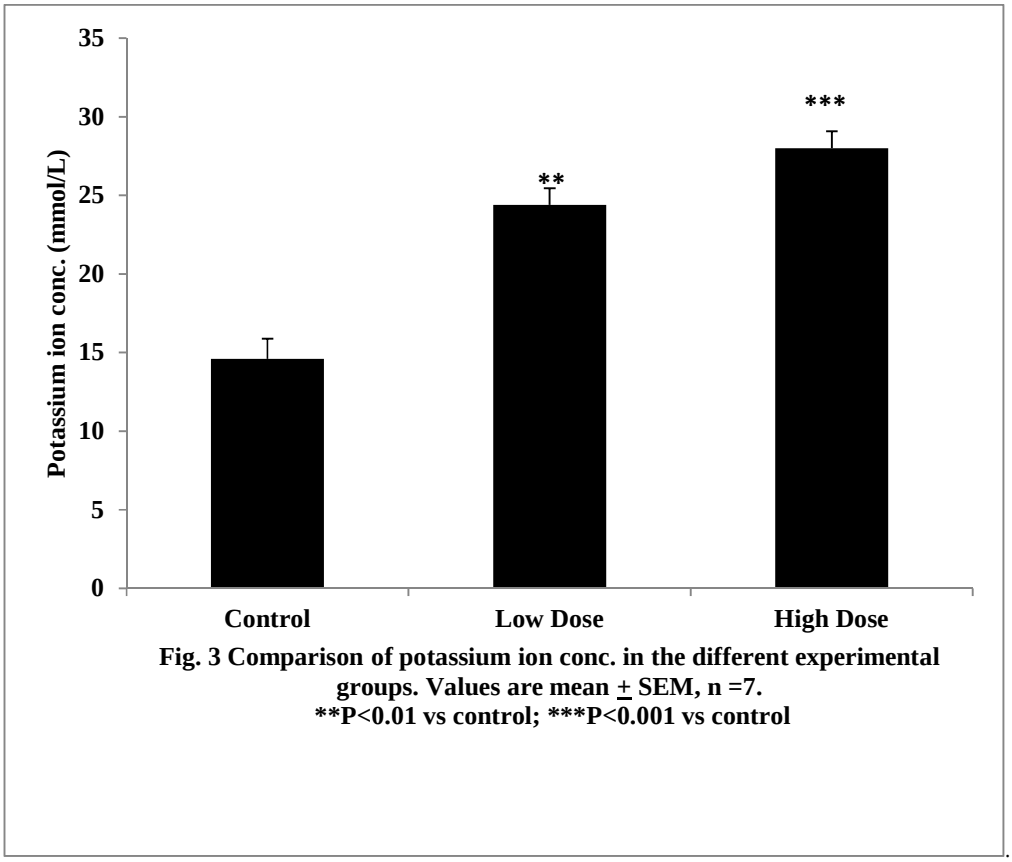

Fig. 3 Comparison of potassium ion conc. in the different experimental groups. Values are mean ± SEM, n =7.
****P<0.01 vs control; ***P<0.001 vs control**

Effect of *Xylopia aethiopica* on chloride ion concerntration in bile

The mean chloride ion concentration in bile for the control, low dose and high dose groups was 103.6 ± 0.74mmol/L, 112.4± 1.6mmol/L and 100.8 ± 0.48 mmol/L respectively. The low dose group was significantly higher ($p<0.01$) compared with control, while the high dose group was significantly lower ($p<0.05$) and ($p<0.001$) compared with control and low dose treated group respectively. (Fig 4).

The mean bicarbonate ion concentration in bile in the control, low dose and high dose groups was 14.6 ± 1.29mmol/L, 24.4 ±1.05 mmol/L and 28.0 ± 1.09 mmol/L. The low dose group was significantly higher ($p<0.001$) compared with the control group, while the high dose group was also significantly higher ($p<0.001$; $p<0.05$) compared with the control and low dose groups respectively (Fig.5).

Fig. 4 Comparison of chloride ion conc. in the different experimental groups.
Values are mean ± SEM, n = 7.
****P<0.01 vs control; *P<0.05 vs control, c=P<0.001 vs low dose.**

Effect of *xylopia aethiopica* on bicarbonate ion secretion in bile

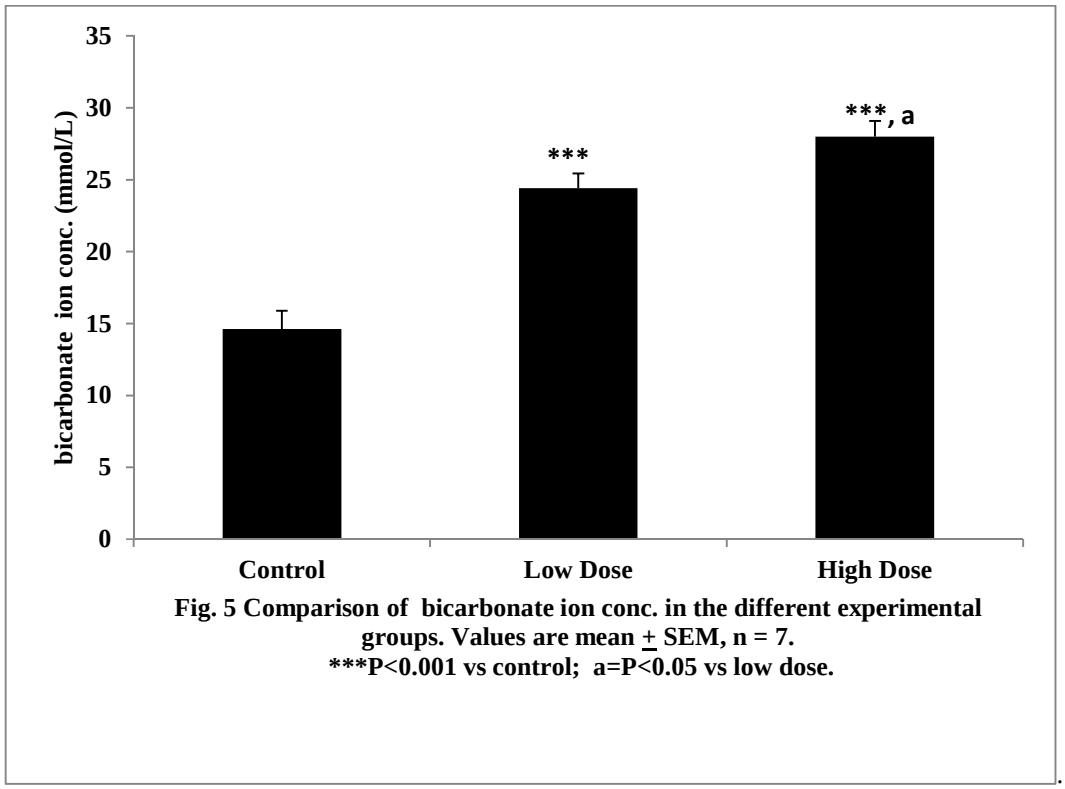

Fig. 5 Comparison of bicarbonate ion conc. in the different experimental groups. Values are mean ± SEM, n = 7.
*****P<0.001 vs control; a=P<0.05 vs low dose.**

DISCUSSION

The effect of *xylopia aethiopica* on biliary secretion and electrolytes in albino wistar rats was studied. The results observed after 28 days of administration of the extract showed a dose dependent significant decrease in biliary secretion across the experimental groups. There was a significant increase in chloride ion concentration in the low dose treated group and a significant decrease in sodium ion concentration in the low dose treated group. Conversely, there was a dose dependent increase in bicarbonate and potassium ion concentration in the groups treated with low and high dose of *xylopia aethiopica* compared with control.

Bile is an exceptional and very important aqueous secretion of the liver that is formed by the hepatocytes and modified downstream by absorptive and secretory properties of the bile duct epithelium. Bile acid formation and secretion serves the intestinal digestion of lipids and absorption of lipid-soluble nutrients. In addition, unessential and potentially poisonous material is disposed of in bile, including cholesterol, bilirubin, and an abundance of xenobiotics such as drugs and environmental chemicals as well as their metabolites. An alteration in the process of biliary synthesis as well as its secretion will lead to an impaired gastrointestinal metabolism of fats which may result to steatorrhoea. Biliary secretion was observed to be reduced in our study and this may be as a result of altered hepatic function thereby accounting for the decrease in its synthetic function [12][17]. This is in agreement with a previous study by Okwari *et al*., [18] where authors reported that *xylopia aethiopica* reduced bile secretion in rats. Also, *Xylopia aethiopica* has been reported to contain polyunsaturated lipids as one of its phytochemical constituents, which are necessary for the formation of prostaglandins [19]. Prostaglandins have been reported to decrease bile secretion in rats in vivo and in vitro [20].

Electrolytes are a major constituent of body fluids that play vital role in the regulation of the body's homeostasis. Although electrolytes leave the body largely through the kidneys by way of the urine, they also leave through the skin and as well as the through bile. However, stern vomiting and diarrhea can result into a huge loss of electrolytes from the body, resulting into an array of metabolic disturbances and electrolyte imbalances. Hence the concentrations of electrolytes in body fluids must be maintained within specific limits, as even a little variation outside these limits lead to serious consequences. In our study, the dose dependent increase in the concentration of potassium (K^+) and bicarbonate (HCO_3^-) observed following treatments with *xylopia aethiopica* could be useful as bicarbonate have been known to curb the harsh acidic condition in the duodenum and avert factors that may bring about duodenal ulceration following gastric emptying [21]. Although the exact mechanism for this action is imprecise, Archibong *et al*., [22] had earlier reported that *xylopia aethiopica* may be beneficial in treating gastric ulcers since it increases gastric mucous output. It is possible that *xylopia aethiopica* has a secretin-like activity or stimulates the secretion of secretin leading to the stimulation and the release of bile and gastric mucous rich in bicarbonate ion [17].

In conclusion, although chronic administration of *xylopia aethiopica* reduces bile secretion which may lead to poor gastrointestinal fat metabolism, it encourages bicarbonate outputs which on the order hand, might aid in checking against duodenal ulceration. Hence it use should be properly guided as it may bring about abnormal conditions like steatorrhoea.

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