ORIGINAL ARTICLE

Protective Effect of Methanolic Extract of *Tamarindus Indica* Leaves in Ethanol-Induced Esophageal Ulcer in Adult Wistar Rats

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ABSTRACT

Tamarind (*Tamarindus indica L.*) possess anti-ulceration, wound healing, anti-inflammatory and antipyretic properties. This makes it useful in the treatment of various clinical challenges including gastrointestinal tract diseases. The aim of this study was to determine the protective effect of methanolic extract of *Tamarindus indica* leaves on esophageal ulcers in adult Wistar rats. Twelve rats (12) with average body weights of 130 ± 20 grams (g) were divided into four groups (A, B, C and D) (n=4). Group A (control) received 0.5 ml/kg body weight (bw) of distilled water, Group B received 0.5 ml/kg bw of 80% ethanol, Group C (Low dose) received 200 mg/kg of methanolic extract of *Tamarindus indica* leaves + 0.5ml/kg of 80% Ethanol and Group D (High dose) received 300 mg/kg of methanolic extract of *Tamarindus indica* leaves + 0.5ml/kg of 80% Ethanol. All administrations were done via gastric intubation for 6 days. At the end of the experimental period sections of the esophagus were collected for histological studies. The group administered 0.5ml/kg of 80% ethanol when compared with the control group, showed ulceration along the surface margin of mucosal layers and damage to submucosal glands. The group administered high and low doses of methanolic extract of *Tamarindus indica* leaves + 0.5ml/kg of 80% ethanol when compared with the control group, revealed an intact histoarchitecture. METL was protective in the ethanol induced esophageal ulceration.

Keywords: Esophageal ulcer, *Tamarindus indica*, Ethanol.

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INTRODUCTION

Ulcers are a common gastrointestinal condition that can cause discomfort and bleeding (1,2). It is essentially an inflammatory breach in the skin or the mucus membrane lining the gastrointestinal system (3). The ulceration takes place when a healthy equilibrium is disrupted due to increased aggressiveness or decreased mucosal resilience. It might be related to habitual drug use, irregular eating habits, stress, or other risk factors. Peptic ulcers is a wide term that covers ulcers affecting the digestive system in the stomach or duodenum (4,5). There are several forms of ulcers such as mouth ulcers, esophageal ulcers, peptic ulcers, and genital ulcers, however esophageal ulcers are one of the most prevalent (affecting about 10% of the World's population) and is rare cause of upper gastrointestinal bleeding (6).

Ethanol consumption have been linked with various health problems including ulcers and neurological disturbances (7–9)

Plants have been used as traditional remedies and pharmacopeial drug from ancient times, to reduce human suffering (10,11). *Tarmarindus indica* (Tamarind, English; Icheku, Igbo; Awin, Yoruba; Tsamiya-Kurm, Hausa; Chwa, Acholi; Enkooge, Luganda; and Apeduru, Itesot) (12,13), is one of the well-cultivated and familiar plants all over the world which serves as a medicinal plant for the treatment of several diseases and serves as a nutritional plant for malnutrition. Tamarind is a huge broad-leaved, tropical tree found in regions of India and Asia (14). *Tamarindus indica* has highly essential phytochemicals including phenolic compounds, uronic acid, tartaric acid, malic acid, pectin and glucose (14,15). It contains vital elements including copper, calcium, iron, manganese, sodium, magnesium, phosphorus, potassium and zinc (16,17). *Tamarindus indica* has been utilized in Ayurveda to treat gastrointestinal, inflammatory, neurological, and digestive issues (18,19). However, there is paucity of literature on the histological changes in the esophagus following alcohol induced ulceration. More so, previous study on the effect *Tamarindus indica* on ulceration focused only on the peptic ulcer. This study aimed to assess the histo-protective ability of a methanolic extract of Tamarindus indica leaves (METL) in ethanol-induced esophageal ulcers.

MATERIALS AND METHODS

Ethical Approval

The study was authorized by the Faculty of Basic Medical Sciences Research Committee and registered as UG14ANT010.

Plant Collection and Preparation

The Tamarind leaves were collected fresh from Dawakin Tofa Local Government, along Dawakin Tofa Science College, Kano State. The plant leaves were identified at Department of Plant Biology in Bayero University, Kano with identification number BUK/HAN/0074. They were then dried for 7 days under the shade and pulverized using an electric grinder (Nima Brand; SKU:NI467HA083PYFNAFAMZ, Jumia). Methanolic extraction of the plant was done using Soxhlet Apparatus as outlined by Livingston (14).

Animal Procurement

Twelve (12) Wistar rats (both male and female) with average body weights of 130 ± 20 g, were used for the study and obtained from the department of Biological Sciences, Bayero University Kano and were acclimatized for one week (7 days) in the Department of Anatomy, Yusuf Maitama Sule University Kano (YMSK). The rats were housed in colony cages at convenient temperature and relative humidity. The rats had unrestricted access to normal pelletized grower feed and drinking water. Animals were handled in accordance with laboratory animal care and use protocols, as well as ethical principles for experimental animal research. The study was approved by the Department of Human YMSK research committee.

Experimental Design

After 7 days of acclimatization, the twelve (12) Wistar rats had their weights taken and divided into four (4) subgroups of three rats per cage.

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The LD_{50} for methanolic extract of *Tamarindus indica* leaves (METL) was ≥ 5000 as adopted from Highab *et al*. (20). 1/25 fraction of the LD_{50} value of METL was employed to obtain 200 mg/kg dosage (as low dose) while 100 mg/kg was added to make up the high dose.

Group A (control) received 0.5 ml/kg body weight (bw) of distilled water, Group B received 0.5 ml/kg bw of 80% ethanol, Group C (Low dose) received 200mg/kg of methanolic extract of *Tamarindus indica* leaves (METL) + 0.5 ml/kg of 80% Ethanol and Group D (High dose) received 300 mg/kg of METL + 0.5 ml/kg of 80% Ethanol. The various dosages for administration and protocol were adopted from Kumar *et al.*, [15]. All administrations were done via gastric intubation; methanolic extract of *Tamarindus indica* leaves (METL) was administered for 6 days to rats in the treatment groups (Group B, C & D), followed by ethanol administration on the last day. Prior to the administration of ethanol, the animals were starved and dehydrated. The animals being studied were sacrificed 45 minutes after being administered ethanol. The esophagus was dissected out, and washed with normal saline (0.9%), and the inner surfaces were examined for ulcerations [15].

Tissue Collection and Processing

The experimental animals were humanely sacrificed following chloroform inhalation. Each of the rats was fixed on the dissecting board with its ventral surface facing upward. An incision was made from the lower jaw up to the anal orifice of the rats revealing the abdominal contents. The esophagus together with the stomach was located and harvested. The samples were promptly fixed with 10% neutral buffered formalin. The tissues were grossed and prepared for regular histological analysis. Sections of the esophagus tissues were stained with Hematoxylin and Eosin (H and E) (21). The microscopic images were obtained with a light microscope (Olympus BH2) and a Nikon Digital Sight DS-L1 (Nikon Corporation, Japan).

RESULTS

The result from the histological examination of the lower part of the esophagus in the control group revealed normal histo-architecture with an intact layer (with normal mucosa, submucosa, muscularis mucosa, and adventitia/Serosa) (Figure 1). The administered 0.5ml/kg body weight of 80% ethanol showed ulceration along the surface margin of mucosal layers and damage of submucosal glands (Figure 2). The groups administered 200 mg/kg and 300 mg/kg body weight of the extract followed by 0.5ml/kg of 80% ethanol respectively revealed intact layers (Figure 3 and Figure 4).

DISCUSSION

Ulceration occurs when the natural balance is broken due to a rise in aggression or diminished mucosal resilience. It could be brought on by consistent drug use, strange eating patterns, stress, and other factors. There are numerous different forms of ulcers, including vaginal, esophageal, peptic, and oral ulcers. Because of this, esophageal ulcers are among the more prevalent forms of ulcers and an uncommon source of upper gastrointestinal hemorrhage (1,2).

The present study determined the protective effect of METL on esophageal ulcers in adult Wistar rats. The result of the present study revealed that the administration of METL was protective in ethanol-induced esophageal ulceration. This observation is in line with the finding of Kumar *et al.* (22) who discovered that *T. indica* seed extract had a dose-dependent protective effect against peptic ulcer models produced by ibuprofen, alcohol, and pylorus closure. Improvement in the histoarchitecture of the esophagus in the present can be hinged on the rich phytochemical composition of Tamarindus indica (23). Plants rich in phytochemicals such as polyphenols, flavonoids, and tannin just like *Tamarindus indica* are known to possess protective or therapeutic potential (24–27). The antioxidant activities of phytochemicals like polyphenols and flavonoids play a protective role against reactive oxygen species; hence, preserving the cellular integrity of the esophagus (23–25). Tannin present in *Tamarindus indica* interferes with the development of ulcers by causing protein accumulation and vasoconstriction (5,22,28,29). The current study's findings, however simple, provide insight into

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Tamarindus indica's protective capability during prenatal ethanol exposure.

CONCLUSION

The present study demonstrated that the methanolic extract of leaves of tamarind minimizes the histopathological changes in the esophagus induced by alcohol in adult Wistar rats. Thus, the extract possesses anti-ulcer properties and may have a potential therapeutic agent for ulceration by alcohol.

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FIGURES

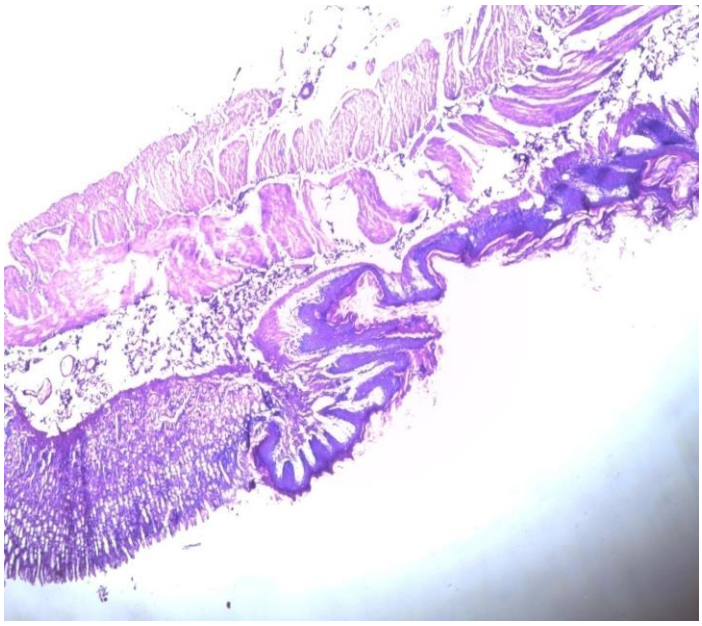

Figure 1: Photomicrograph of esophageal section from the group administered 0.5ml/kg of distilled water (H&E; X40).

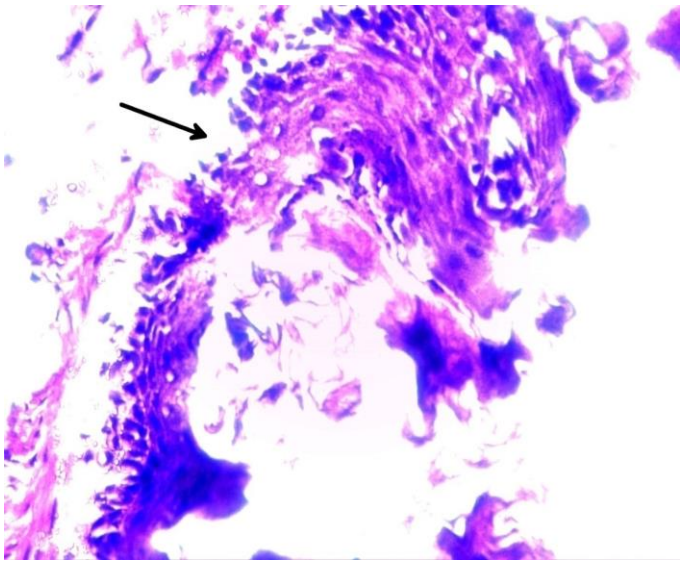

Figure 2: Photomicrograph of esophageal section from the group administered 0.5ml/kg of 80% ethanol (H&E; X40).

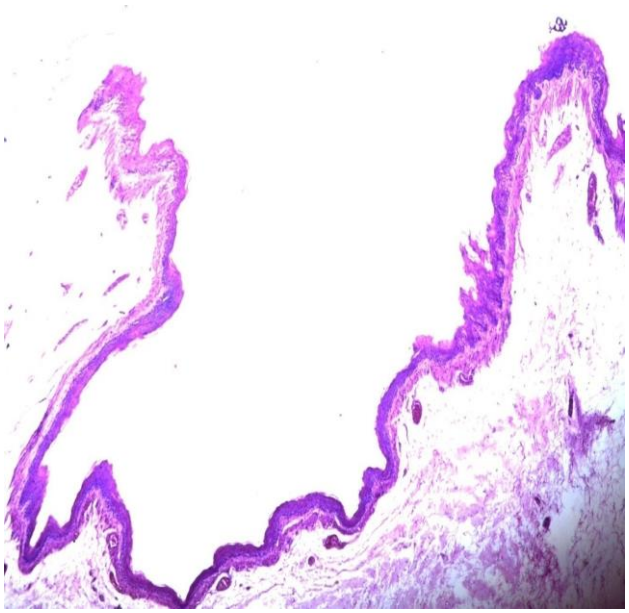

Figure 3: Photomicrograph of esophageal section from the group administered **200mg/kg** *of extract and 0.5ml/kg of distilled water (H&E; X40).*

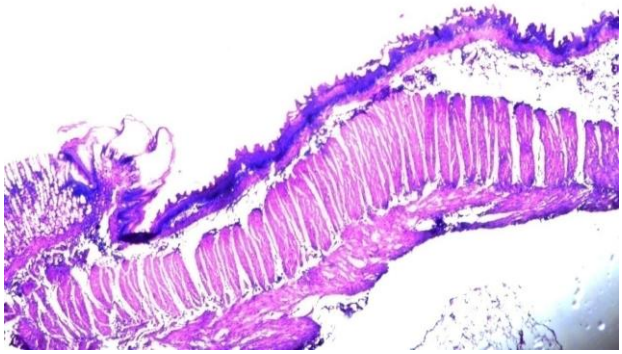

Figure 4: Photomicrograph of esophageal section from the group administered **300mg/kg** *of extract and 0.5ml/kg of distilled water (H&E; X40).*

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