

## Effect of Brassica Oleracea Var. Capitata Juice Extract on Indomethacin-Induced Gastric Ulcer

\*<sup>1</sup>Uloneme Godwin Chinedu., <sup>2</sup>Nwokike Genevieve I.,  
<sup>2</sup>Nwagwu Adamma S., <sup>2</sup>Uloneme Chinwe E., and <sup>3</sup>Alagwu Emmanuel A.

- <sup>1.</sup> Department of Anatomy and Neurobiology, Faculty of Basic Medical Sciences, Imo State University, Owerri, Nigeria.
- <sup>2.</sup> Department of Nursing Sciences, Faculty Of Health Sciences, Imo State University, Owerri, Nigeria
- <sup>3.</sup> Department of Physiology, Faculty of Basic Medical Sciences, Imo State University, Owerri, Nigeria.

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### ABSTRACT

*Brassica Oleracea Var. Capitata (cabbage) is a vegetable widely consumed in almost every part of the world, and believed to be anti-ulcerogenic in function. In this study that was carried out in the Department of Anatomy and Neurobiology, Faculty of Basic Medical Sciences, Imo State University, Owerri, Nigeria, sixteen adult male wistar rats weighing between 160 and 180g were randomly separated in well-ventilated cages labeled A,B,C and D respectively, with each cage containing four rats. The group A rats which constituted the control received only the normal rat chow and water, and were not exposed to any test substance. The group B rats in addition to receiving normal feeding were administered with 250mg/kg/body weight of juice extract of Brassica Oleracea Var. Capitata by 9am daily for two weeks and then left to continue only on normal feed and water for another two weeks. The group C rats that were placed on same feed diet (normal rat chow) as A and B were in addition, made to receive 30mg/kg/body weight of indomethacin drug orally by 9am daily for two weeks, and then left to continue only on rat chow and water. The group D rats were in the first two weeks of normal feeding administered 30mg/kg/body weight of indomethacin by 9am daily; and in another two weeks, administered 250mg/kg/body weight of juice extract of Brassica Oleracea Var. Capitata. At the end of twenty eight days of treatment, the respective animal groups were sacrificed for histological and histopathological studies. The results showed that indomethacin actually induced gastric ulceration in the rats treated with 30mg/kg/body weight of indomethacin as seen in plate III. However, the juice extract of Brassica Oleracea Var. Capitata administered to the group D rats earlier inflicted with gastric ulcer was able to check and control the ulcer even as far as producing healing affects on the hitherto severely damaged gastric mucosa of the rats.*

**KEYWORDS:** *Brassica Oleracea Var. Capitata, Indomethacin, Gastric Ulcer, Helicobacter pylori, Wistar rats, Cabbage.*

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### I. INTRODUCTION

Generally speaking, an ulcer is a sore that develops on the walls of the esophagus, the stomach, the small intestine or the skin. A gastric ulcer therefore, is a sore that develops on the walls or lining of the stomach. Gastric ulcer, believed to be the most common disorder of the upper gastro-intestinal tract is said to have a prevalence rate of about 2.4% in North America (Boron et al, 2009<sup>[1]</sup>). Its annual incidence rate according to Sharma et al (2009)<sup>[2]</sup> is between 0.10% and 0.19%. Del Valle et al (2001)<sup>[3]</sup> and Lai et al, (2010)<sup>[4]</sup> in their respective works stated that 22.5% of patients with gastro-intestinal disorders in China have gastric ulcer, and that the prevalence rate of gastric ulcer in this part of the world is as high as 6.07%. As a matter of fact, it has been shown that higher incidence of gastric ulcer is usually recorded among habitual smokers and people that indulge in the use of non-steroidal anti-inflammatory drugs (Mertz et al 1991)<sup>[5]</sup>. Huge alcohol consumers are also highly predisposed to high incidence of gastric ulcer (Gomez et al 2004)<sup>[6]</sup>. As a result of ill-equipped diagnostic facilities and poorly developed diagnostic skills, our own part of the world (South-Eastern Nigeria), lacks authenticated and reliable records on the incidence and prevalence of gastric ulcer among the populace, in addition to the fact that most people living in the rural areas most times, prefer blind treatment of symptoms of gastrointestinal disorders with locally sourced herbs or plant products such as *Brassica Oleracea Var. Capitata* juice extract. In so doing, the necessary laboratory investigations and tests to confirm presence of helicobacter Pylori, and a possible imbalance between endogenous aggressive factors such as hydrochloric acid, reactive oxygen species, refluxed bile, pepsin, leukotrienes and the cytoprotective factors like function of the mucus-bicarbonate barrier, surface active phospholipids, prostaglandins, non-enzymatic and enzymatic antioxidants and

mucosal blood flow (Burler et al 2002)<sup>[7]</sup>, that play major roles in the formation of gastric ulcers might not be actualized.

Burler et al (2002)<sup>[8]</sup> and Berglindh et al (1997)<sup>[9]</sup> believe that stressful lifestyle, alcohol consumption, use of steroidal and non-steroidal anti-inflammatory drugs, low socio-economic status, smoking and *Helicobacter pylori* infections are among the predisposing factors to gastric ulcers. Drugs that stimulate gastric acid and pepsin secretions are also considered culprits (Tsukimi et al, 2010)<sup>[10]</sup> and Oluwole et al (2011)<sup>[11]</sup>.

Gastric ulceration could therefore be described as a sore or benign lesion on the lining or mucosa of the stomach when exposed to the above mentioned factors (Komatsu 1997)<sup>[12]</sup>.

In most cases, gastric ulcer presents with perforated stomach wall which leads to bleeding and a possible death if not managed properly and so accounts for about 15% mortality out of every 15,000 complications annually worldwide (Schriner 2005)<sup>[13]</sup>. *Brassica Oleracea Var. Capitata*, commonly known as cabbage in South - Eastern Nigeria is grown in slopes and cultivated as vegetables. Although many types of cabbages like the red cabbage, green cabbage, white cabbage with round, flattened, conical or oblong heads are known, most widely cultivated is the conical shaped cabbage which is used in this study. The spherical cluster of immature leaves is about the only part of the plant generally eaten by people, and it is consumed raw or cooked (Oates et al, 2014)<sup>[14]</sup>. In his work, Panplona-Roga (2004)<sup>[15]</sup> was able to isolate the major nutritional constituents of cabbage which include Vitamins, Minerals, proteins, carbohydrate, fat and fibre among others. The phytochemical components, according to Steinmetz et al, (1996)<sup>[16]</sup> include phenolic compounds, glutamine, isothiocyanates, dithiolthiones and flavonoids. It also contains thiocyanates, glucoiberin, indole-3-carbinol, progoitrin, and oxazolidinethione (Raloff, 2000)<sup>[17]</sup>. Pharmacological activities of *Brassica Oleracea Var. Capitata* are believed to include cancer prevention (Pearl et al, 2014)<sup>[18]</sup>, inhibiting proliferation of prostrate adenocarcinoma (Moore et al, 2013)<sup>[19]</sup> and (Allen et al, 2009)<sup>[20]</sup>, treatment of neural disorders (Andreson 2013)<sup>[21]</sup>, treatment of asthma (Holzer et al 2014)<sup>[22]</sup>, among others. For these believed pharmacological properties of *Brassica Oleracea Var. Capitata*, the plant is consumed indiscriminately by both old and young in this part of the world and hence, the reason for this study to investigate the effect of the juice extract of *Brassica Oleracea Var. Capitata* on indomethacin-induced gastric ulcer in male wistar rats.

## II. MATERIALS AND METHODS

**2.1 Materials:** the materials used to achieve a successful execution of the study include juice extract of *Brassica Oleracea Var. Capitata*, male wistar rats, indomethacin (30mg), cages, distilled water, electronic weighing balance, oral canula, cotton wool, dissecting kit, hand gloves, beakers, measuring cylinder, filter paper, syringes, diethyl ether, and feed.

### 2.2 Experimental animals

Sixteen adult male wistar rats weighing between 160 and 180g were used for the study that lasted for about six weeks. The rats which were raised in the animal house of Anatomy and Neurobiology department of Imo State University, Owerri Campus were isolated from others and made to have free access to water and sufficient feed in properly ventilated cages labeled A, B, C and D respectively, with each cage containing four rats randomly selected.

### 2.3: Preparation of *Brassica Oleracea var. Capitata* juice extract.

The *Brassica Oleracea Var. Capitata* (cabbage) samples were procured from a local market in Owerri, Imo State, Nigeria and washed properly with clean water before crushing about 100g of it with 500mls of water. The solution formed was left to stand for about 48 hours. It was then filtered and the filtrate was stored in a cooling system.

### 2.4 Gastric Ulcer Induction:

Groups C and D rats were each administered 30mg/kg/body weight of indomethacin once daily (9am) for two weeks, some two hours before the animals were fed with the normal rat chow. The rats were subjected to this routine treatment for this period of two weeks under strict surveillance for strange physical or abnormal behavioral manifestations. The administration of 30mg/kg/body weight of indomethacin was meant to induce gastric ulceration in groups C and D rats.

### 2.5: Measurement Of Ulcer Index:

This is a risk measure or technical analysis indicator designed to measure volatility, though in downward direction. So with the help of a hand lens, scoring criteria for the ulcer were established, and the mean ulcer score for each rat was expressed as ulcer index.

### **2.6 Exposure Of The Rats To Test Substance (*Brassica Oleracea Var. Capitata* juice extract)**

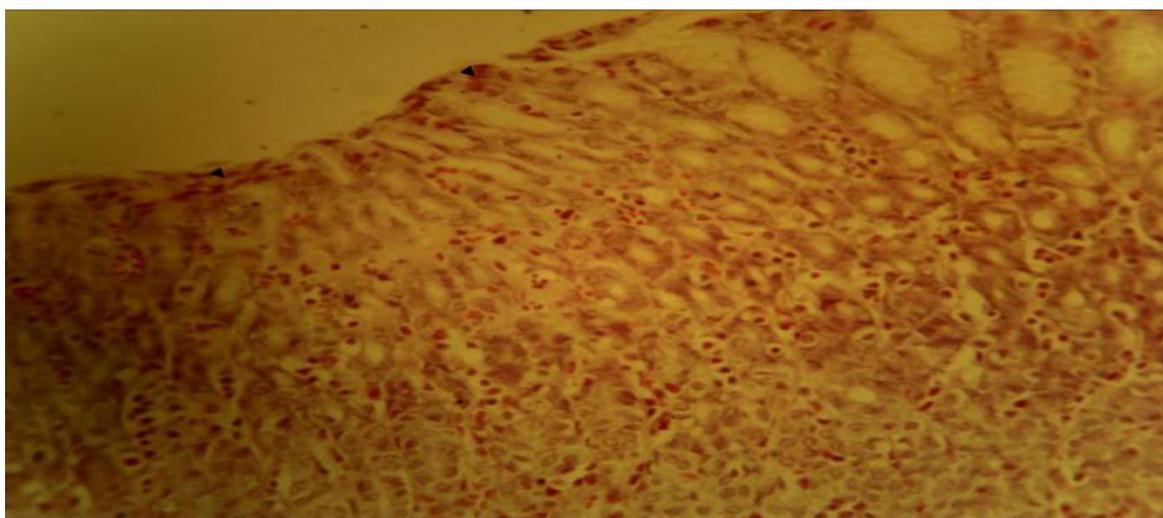
The group A (control) rats were given normal rat chow and water daily for four weeks while group B rats were administered 250mg/kg/body weight of *Brassica Oleracea Var. Capitata* (cabbage) juice extract daily (9am), for two weeks. The group C rats received 30mg/kg/body weight of indomethacin by 9am daily for two weeks for the purpose of inducing a gastric ulcer. Group D rats were also made to receive 30mg/kg/body weight of indomethacin by 9am daily also for two weeks. Subsequently, the group D rats were given 250mg/kg/body weight of *Brassica Oleracea Var. Capitata* (cabbage) juice extract daily for another two weeks.

### **2.7 Sacrificing Of The Rats And Harvesting Of The Organ Of Interest (Stomach).**

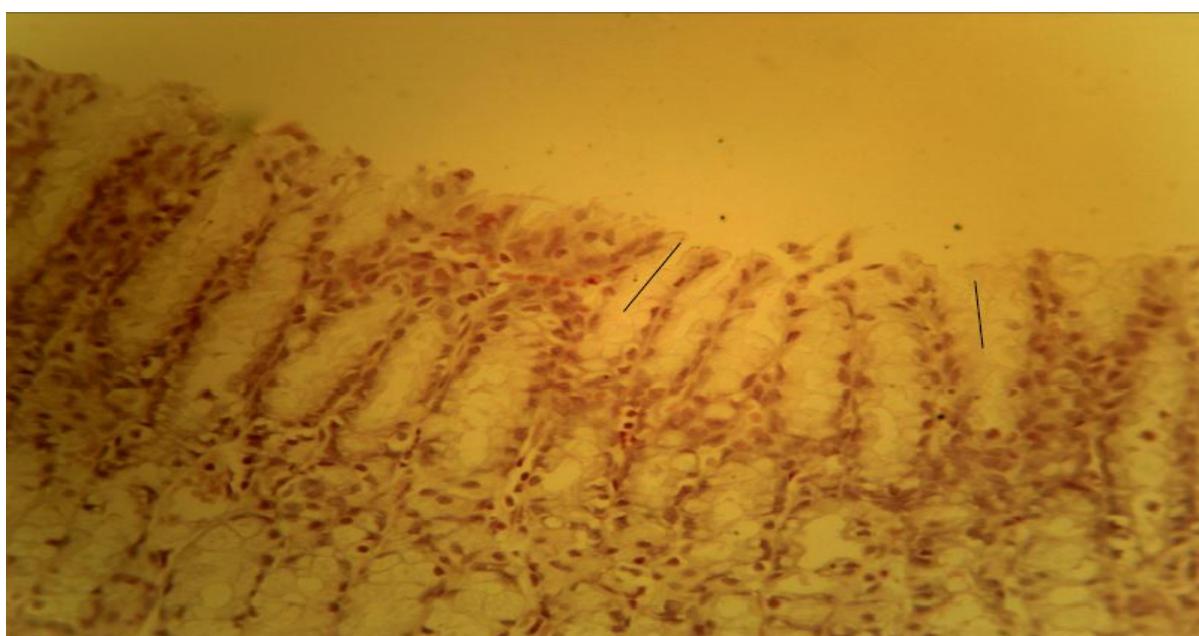
At the end of the treatments, the rats were sacrificed and their stomach harvested, weighed and preserved for histological processing and investigation.

## **III. RESULTS**

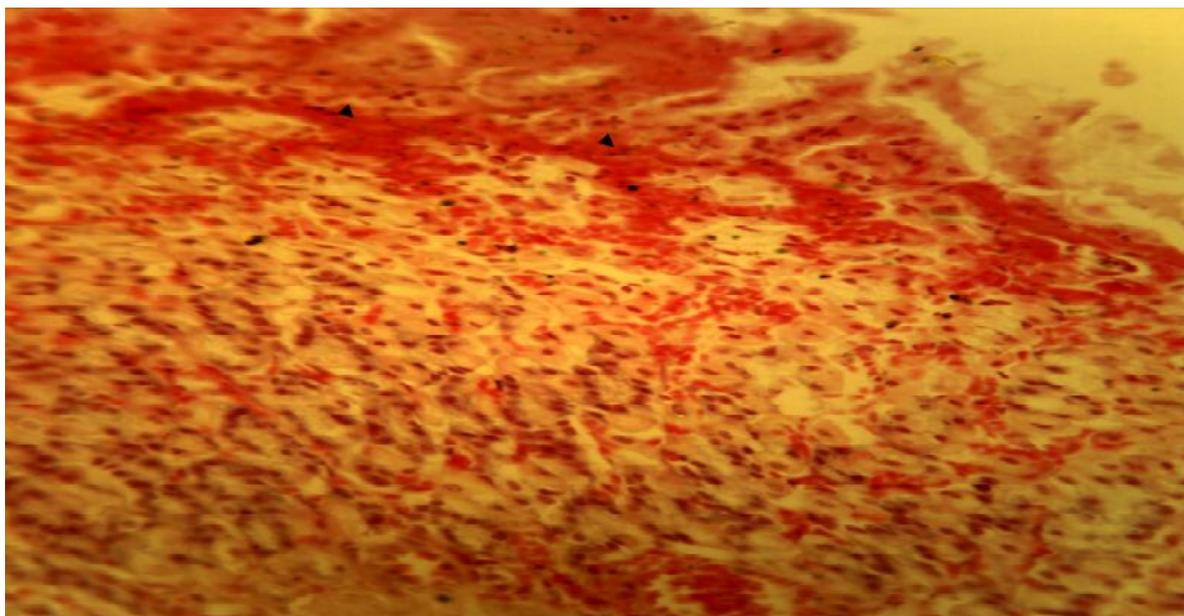
### **Plates Showing Histological And Histopathological Findings.**



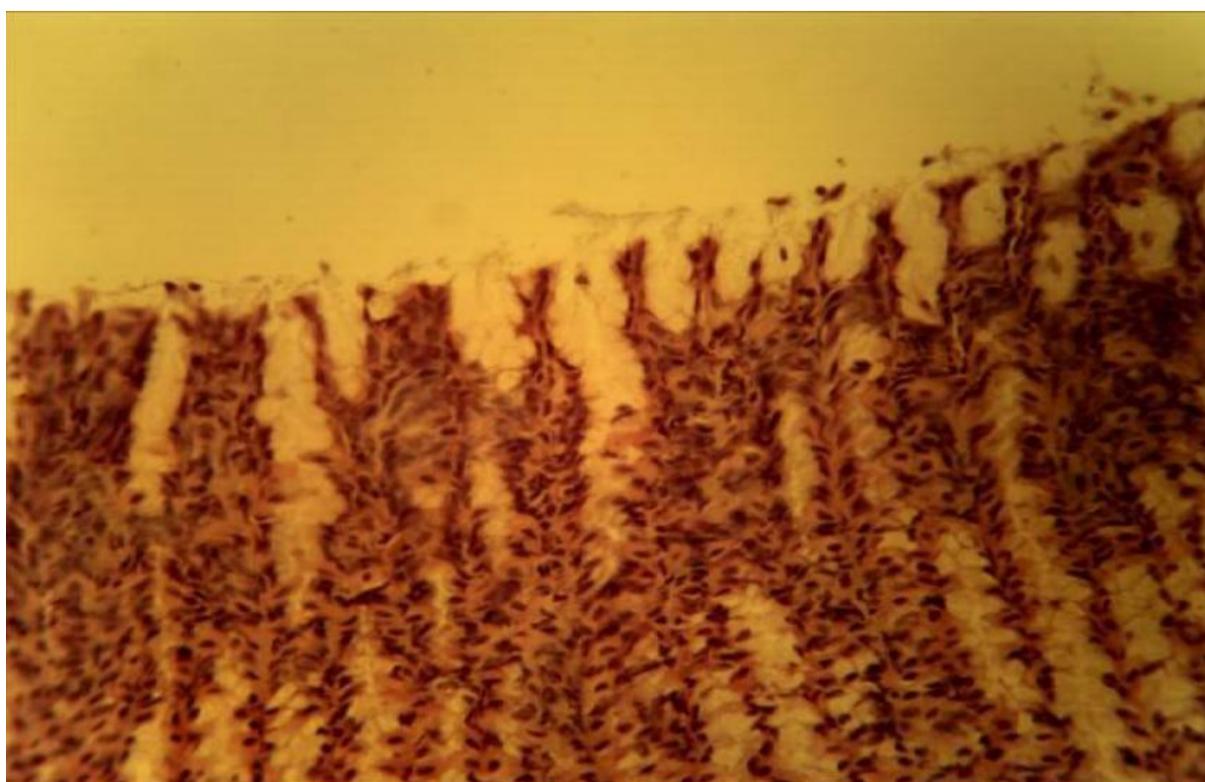
**PLATE I (x400).** Photomicrograph section of the Stomach of Group A rats showing a normal gastric epithelium.



**PLATE II (X400):** Photomicrograph section of the stomach of group B rats administered 250mg/kg/body weight of Cabbage juice extract only, for 2 weeks shows a gastric epithelium that appears oedematous but still retains apparently normal histologic features.



**PLATE III (x400).** A Photomicrograph section of the Stomach of Group C rats administered 30mg/kg/body weight of indomethacin for 2 weeks, showing severe erosive epithelial mucosa with oedema of the sub mucosal area.



**Plate IV (x400).** A Photomicrograph section of the Stomach of Group D rats administered 30mg/kg/body weight of indomethacin for first 2 weeks and then 250mg/kg/body weight of Cabbage juice extract for another 2 weeks shows a recovering stomach.

#### **IV. DISCUSSION**

The result of the study shows a pronounced protective or healing effect of *Brassica Oleracea Var. Capitata* (cabbage) juice extract on gastric ulceration induced by indomethacin in adult male wistar rats. The extensiveness of the study and its results have provided grounds to align with the assertions of some researchers that products of *Brassica Oleracea Var. Capitata* possess anti ulcer properties (Alonso, 1998)<sup>[23]</sup> and (Chen, 1995)<sup>[24]</sup>, and should therefore be harnessed pharmacologically for the purpose of treating ulcers, especially

ulcers affecting gastrointestinal tract. With the administration of 30mg/kg/body weight of indomethacin to groups C and D rats, gastric ulceration was actually induced in them as demonstrated by presence of gastric mucosal lesions which according to the method of assessment elaborated by Ohara, et al (1995)<sup>[25]</sup> corresponds to score grade 4, depicting many linear ulcer of marked size. On the other hand, toxicity experimentation of *Brassica Oleracea Var. Capitata* carried out in the course of the study showed that the juice extract had no lethal effect on the adult male wister rats at least up to an oral dose of 500mg/kg/body weight; and so, administration of 250mg/kg/body weight to the rats was quite safe and produced protective and antiulcerative activities required to heal the group D rats that received it following two weeks of infliction of gastric ulcer.

A representative photomicrograph section of the stomach of group A (plate 1) presents the normal structural histologic features of the stomach, showing an intact gastric mucosa, muscularis mucoa and submucosa.

The group B rats (administered only 250mg/kg/body weight of the juice extract) photomicrograph section presents a normal microanatomy of the stomach featuristically similar to that of group A (control) rats. This means that consumption of *Brassica Oleracea Var. Capitata* products, especially the juice extract might not be harmful to the stomach and possibly to the entire body at large. This assertion could be supported by the fact that physical and behavioral manifestations of group A (control) and B rats were the same, and nothing strange or abnormal was observed. The photomicrograph representative of the group C rats (plate III) administered 30mg/kg/body weight of indomathacin for two weeks to induce gastric ulceration presents a severely damaged gastric mucosa where the epithelium, lamina propria, and the muscularis mucosa all appear elusive. Some trace of oedema accompanied with severe haemorrhage could be observed on the submucosal region. The presence of ulcerated and necrotized gastric mucosa observed in the stomach sections of the group C rats treated with 30mg/kg/body weight of indomathacin is an indication that gastric ulceration was induced in the rats, and this, by implication means that abuse of the drug, indomathacin could lead to gastric ulceration in man, and so its usage should strictly be by the doctor's prescription and with close monitoring. However, Repetto and Laid, (2002)<sup>[26]</sup> believe that intracellular antioxidants such as glutathione and tocopherol protect the gastric mucosa from indomethacin-induced mucosal damage.

The photomicrograph representative of the group D rats (plate iv) treated initially with 30mg/kg/body weight of indomathacin for two weeks to induce gastric ulceration and then treated afterwards with 250mg/kg/body weight of *Brassica Oleracea Var. Capitata* Juice extract presents histologic features on the recuperative stage. Mild erosive gastric mucosa could be observed and a little trace of seemingly disappearing submucosal oedema could be decoded. This result means the juice extract of *Brassica Oleracea Var. Capitata* (cabbage) may have the pharmacological property and propensity to effect healing on gastrointestinal tract ulcers, especially that of the stomach.

Since *Brassica Oleracea Var. Capitata* (cabbage) is readily available, urging the general populace to consume it more often to check, control and possibly heal gastric ulcers might be recommended, especially people living in rural areas with no easy access to doctors or medical facilities for diagnosis and rapid response treatment.

## V. CONCLUSION

Oral administration of 30mg/kg/body weight of indomethacin to adult male wistar rats on daily basis for a period of two weeks could induce gastric mucosal lesions, bleeding and necrotic features visibly present when the stomach section is investigated microscopically. However, high levels of healing and recuperation could be achieved by administering 250mg/kg/body weight of *Brassica Var. Oleracea capitata* (cabbage) juice extract to the rats afflicted with gastric ulceration.

## STATEMENT OF ETHICAL APPROVAL

All procedures involved in the handling and sacrificing of the animals conform to the ethical standards and regulations approved by the university animal research committee.

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