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REACTIVE CHANGES IN THE STOMACH WHEN EXPOSED TO AN ENERGY DRINK

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Abstract
The study involved administering Red Bull energy drink per os to rats weighing 180-220 grams for 10, 30, and 60 days, and the morphological changes in the stomach mucosa were investigated. Signs of hypertrophy of the glandular layer of the stomach mucosa, necrotic markers, and thickening of the mucosal layers were identified in the experimental group. These changes were more pronounced towards the end of the experiment.

Keywords: Stomach, postnatal ontogenesis, energy drink, mucosal layers.

Introduction

In today's world, energy drinks containing substances that affect the nervous system of the body are being used with great interest among young people (6,9). When energy drinks are consumed, the individual's mood improves and their ability to work increases. According to the information on global health, eight out of ten adolescents aged 13 to 17 have tried energy drinks at least once in their lives (1,5). Companies producing energy drinks promote the positive effects of these drinks on the body. However, according to literature, numerous clinical studies have shown negative consequences of consuming energy drinks (7,8,10). Information in literature indicates that energy drinks have negative effects on the nervous system, cardiovascular system, urinary system, and digestive system (2,3,4). In particular, the impact of energy drinks on the digestive system requires serious attention in practical medicine. The issues addressed in literature are not completely resolved and contradict each other. Today, the use of energy drinks among young people is of great interest and it is important to pay attention to the impact of energy drinks on the health of young people.

The purpose of the research is to identify structural changes in the wall of the stomach caused by the effects of energy drinks.

Organic materials and organic methods were used in the study. Experiments were conducted on rats weighing between 180-220 grams. The experimental animals were kept under standard laboratory conditions. All animals were free of somatic and systemic diseases. After excluding animals with any diseases, all remaining rats were divided into two groups: Group 1 consisted of 25 healthy rats, to which distilled water was administered at a dose of 10 ml/kg through an oral catheter every day. Group 2 was the experimental group, to which Red Bull energy drink was administered at a dose of 10 ml/kg through an oral catheter every day. The animals in the experimental group received the energy drink for 10, 30, and 60 days.

The rats were anesthetized with ether. After opening the abdomen, macroscopic examination of the stomach contents was performed. Following macroscopic examination, small samples were taken from all parts of the stomach, fixed in 12% formalin solution, and histological preparations were made. Histological sections of 6-8 microns were stained with hematoxylin and eosin. They were examined under a light microscope.

The obtained data were analyzed. When comparing the histological structure of the stomach mucosa of rats in the control and experimental groups after 10 days, no significant differences were observed. However, after 30 days, destructive changes were observed in the surface epithelium of the stomach in the experimental group, with edema in the mucosal layer, degenerative changes in the glandular epithelium, and some areas showing necrotic foci (see **Figure № 1**).

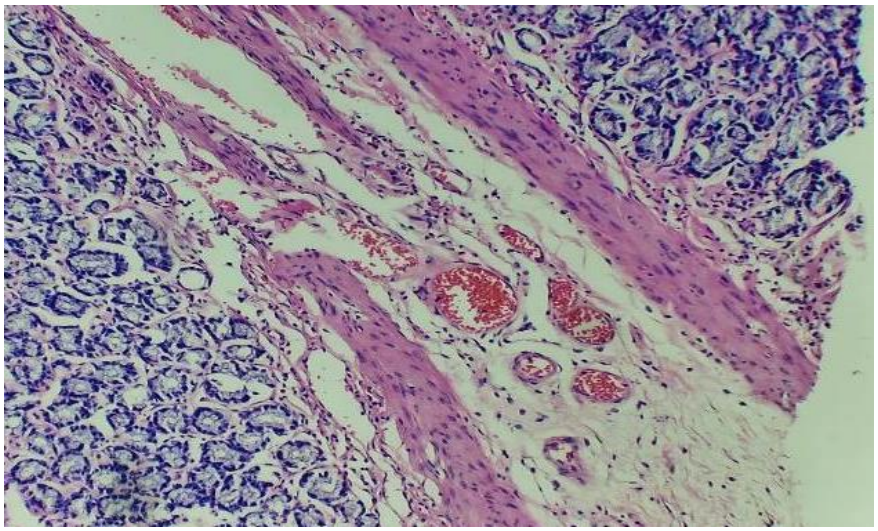

Figure № 1 White laboratory rats in the 30-day experimental group showed swelling in the mucous membrane of the stomach wall, focal degenerative changes in the covering epithelium. Staining with hematoxylin-eosin.

In the stomach mucosa of rats in the experimental group after 30 days, there were focal degenerative changes in the surface epithelium, with hypertrophy of the glandular epithelium in the proximal part of the mucosal layer. These findings may indicate an adaptive response of the organism to the energy drink consumed. When compared to the control group, the thickness of the epithelial lining in the glandular portion of the stomach mucosa significantly increased in the experimental group after 30 days, reaching an average of 69.2 ± 1.1 μm (compared to 63.6 ± 0.8 μm in the control group).

Furthermore, in the glandular portion without glands, it was observed that the single-layered epithelium thickened in the experimental group after 30 days, measuring 30.2 ± 0.3 μm in the control group and 38.3 ± 1.3 μm in the experimental group. The circular muscle layer thickness in the glandular portion without glands increased by 16% in the experimental

group compared to the control group, with an average thickness of 66.6 ± 0.2 μm in the control group and 71.2 ± 0.8 μm in the experimental group.

Additionally, the thickness of the lamina propria in the glandular portion without glands increased by 15% in the experimental group compared to the control group, with an average thickness of 75.7 ± 0.8 μm in the control group and 71.2 ± 0.8 μm in the experimental group. When comparing the thickness of the lamina propria between groups, it was found to have increased by 17% in the experimental group. (Picture № 2)

In conclusion, when evaluating the overall thickness of the lamina propria of the stomach mucosa in both the control and experimental groups, a significant increase of 18% was observed in the glandular portion without glands after 30 days. This indicates hypertrophy of the mucosal layer in all parts of the stomach mucosa when comparing the control and experimental groups, with a substantial increase of up to 25% in the thickness of the mucosal layer without glands. Therefore, when comparing the indicators of the stomach mucosa between the control and experimental groups, signs of hypertrophy of the mucosal layer were identified in all sections of the mucosa.

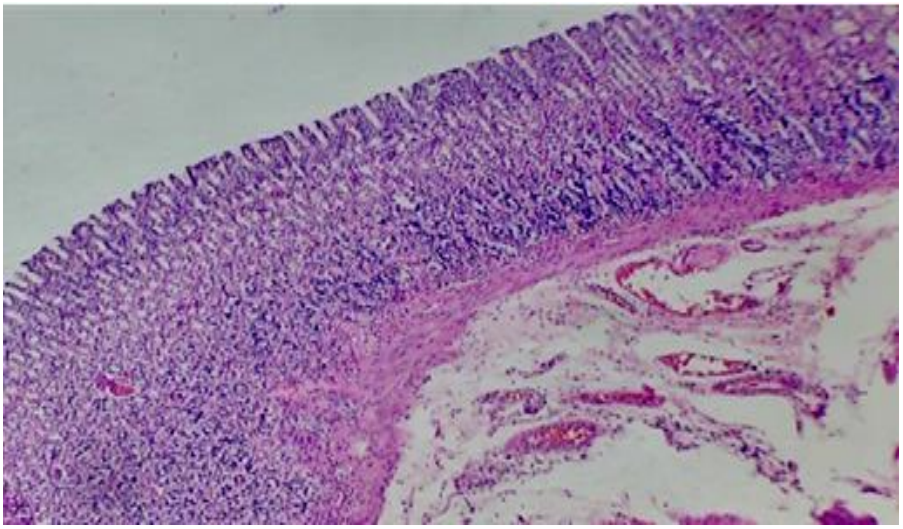

Figure № 2 Histological structure of the stomach mucosa in the experimental group of rats after a 60-day experiment on the consumption of an energy drink was analyzed. The samples were stained with hematoxylin and eosin.

It was found that the thickness of the gastric mucosa's glandular layer increased by 18% in the mucosa with glands and decreased by 16% in the gland-free area after 60 days of providing the energy drink. When comparing the overall thickness of the muscular outer layer of the stomach mucosa in the control and experimental groups, it was determined that in the gland-free area, there was a 22% increase over the 60-day period. The overall thickness of the mucosal layer did not show significant changes during this period. However, in the gland-free areas, there was a 36% increase in the overall thickness of the mucosal layer. Therefore, when comparing the indicators of the stomach mucosa between the control

and experimental groups, signs of hypertrophy of the mucosal layer were identified in all sections of the mucosa.

Furthermore, after 30 days of consuming the energy drink, it was evident that the height of the epithelial lining increased by 21% in the glandular area and by 19% in the gland-free area. The increase was consistent at 19% in both areas over the 60-day period. Similar significant changes were observed in the total thickness of the stomach mucosa, circular muscle layer, lamina propria, and muscular outer layer.

In conclusion, our findings from the histological analysis of the stomach mucosa of laboratory animals in the experimental and control groups over a 10-day period did not reveal significant differences. However, after 30 days in the experimental group, destructive changes were observed in the surface epithelium of both glandular and gland-free areas of the mucosa. Swelling was noted in the mucosal layer, along with focal degenerative changes and some necrotic foci in certain areas. When comparing the indicators of the stomach mucosa between the control and experimental groups after 60 days, signs of hypertrophy of the mucosal layer were identified in all sections of the mucosa.

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