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Histological Changes of The Effect of Different Doses of Vitamin D3 On the Duodenum, Jejunum, And Colon in Female Albino Rats

Vian Ihsan Kasro[1], Doaa A. Abdulwahab[2]

[1,2]University of Diyala /College of Science

ABSTRACT: The objective of this study was to investigate the effects of varying doses of vitamin D3 on the duodenum, jejunum, and colon of female albino rats. Female albino rats received oral administration of vitamin D3 at concentrations of 5,000 IU, 7,500 IU, and 10,000 IU over a period of six weeks. Histological examination of most treatment groups revealed symptoms such as infiltration of inflammatory cells in the submucosal region and villi, along with edema and congestion.

KEYWORD: Vitamin D3, duodenum, jejunum, colon and rats

INTRODUCTION

Calcium absorption in the intestine is dependent on vitamin D3. Vitamin D3 is the first organ targeted by the mucous membrane of the small intestine, stimulating the intestinal absorption of calcium, and its greatest activity is in the jejunum and ileum (1,2). An overdose of vitamin D3 can lead to hypervitaminosis D, or vitamin D toxicity, which, although rare in both humans and animals, results in a significant elevation of calcium levels in the blood. This condition can cause the deposition of calcium salts in soft tissues. Symptoms observed in rats experiencing vitamin D3 toxicity are similar to those found in humans (3).

There is a scarcity of studies examining the tissue effects resulting from excessive use or high daily doses of vitamin D3 in both humans and various animal and the extent of their effect without consulting a doctor, this study was designed to identify the tissue effects resulting from excessive use of vitamin D3

MATERIALS AND METHODS

Drug Used and Experimental Design :Use drops of the dietary supplement vitamin D3 (cholecalciferol) in three concentrations [5000 IU, 7500 IU, 10000 IU] that were used in the research experiments. These concentrations were given orally using a stomach cannula daily for six weeks.

Experimental animals: This study involved 32 female albino mice, aged 6 to 8 weeks, with an average weight of approximately 200-250 grams. The mice were divided into four groups based on the concentrations of vitamin D3 administered: 5,000 IU, 7,500 IU, and 10,000 IU, along with a control group. Each group included (8) animals that were dosed with (0.5) ml of vitamin D3 for (6) weeks orally, with the exception of the control group, which took (0.5) ml of oil only.

Histological study: The animals were sacrificed by anesthetizing them with chloroform. Then it was dissected by cutting its abdomen longitudinally, and the intestines (duodenum, jejunum, and colon) were extracted and preserved completely in aqueous Bowen's solution for 22-24 hours. Then Histological study: The specimens were then transferred to 70% alcohol until the histological sections were prepared. The procedure of Bancroft and stevens (4) was followed. For histological sections. A light microscope with camera was used to examine and photograph the selected microscopic slides at different magnification powers to fit the needs of the current study.

THE RESULTS AND DISCUSSION

Histological changes:

Histological structure of duodenum, jejunum and colon in control group

Microscopic examination of histological sections of the intestine in rats from the control group revealed that the intestinal wall comprises four distinct layers: the mucosa, submucosa, muscularis, and serosa. The mucous layer consists of villi, between which are confined the crypts containing the intestinal glands. The villi are covered by a layer of simple columnar epithelial tissue, which is interspersed with goblet cells, as in Figure (1).

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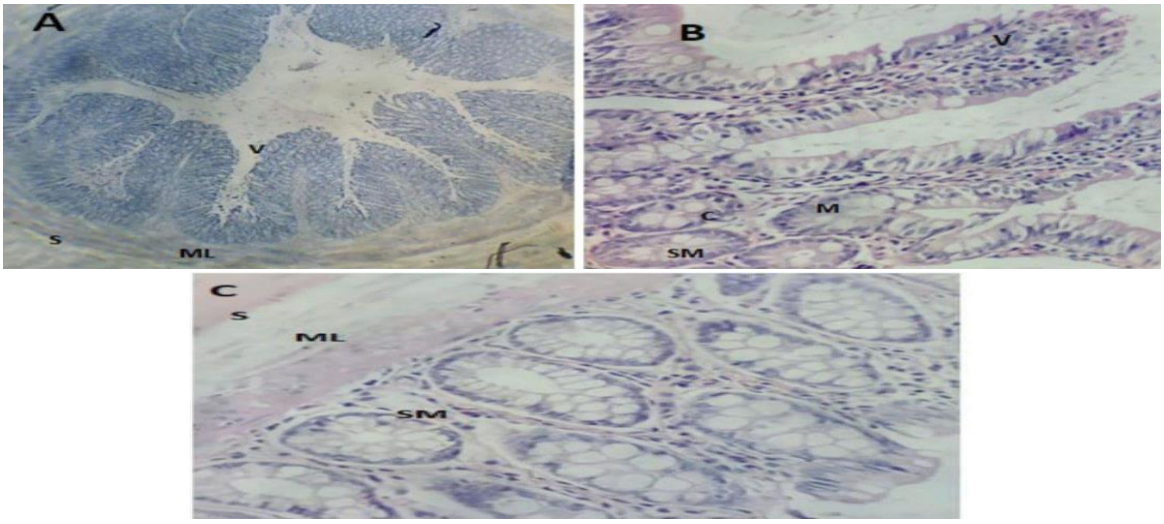

Figure 1: - (A) H&E staining (10x) of a transverse section of rat duodenum tissue in the control group displays villi (V), the serosa layer (S), and the muscularis layer (ML).
- (B) H&E staining (40x) of a transverse section of rat jejunum tissue in the control group illustrates villi (V), the mucosa layer (M), the submucosa layer (SM), and crypts (C).
- (C) H&E staining (40x) of a transverse section of rat colon tissue in the control group shows the serosa layer (S), the muscularis layer (ML), and the submucosa layer (SM).2-

Histological changes observed in rat duodenum, jejunum, and colon tissues treated with a concentration of 5,000 IU of vitamin D3 for six weeks include edema (ED), congestion (CO), infiltration of inflammatory cells (IN), and broadening of villi (BR), as illustrated in Figure 2.

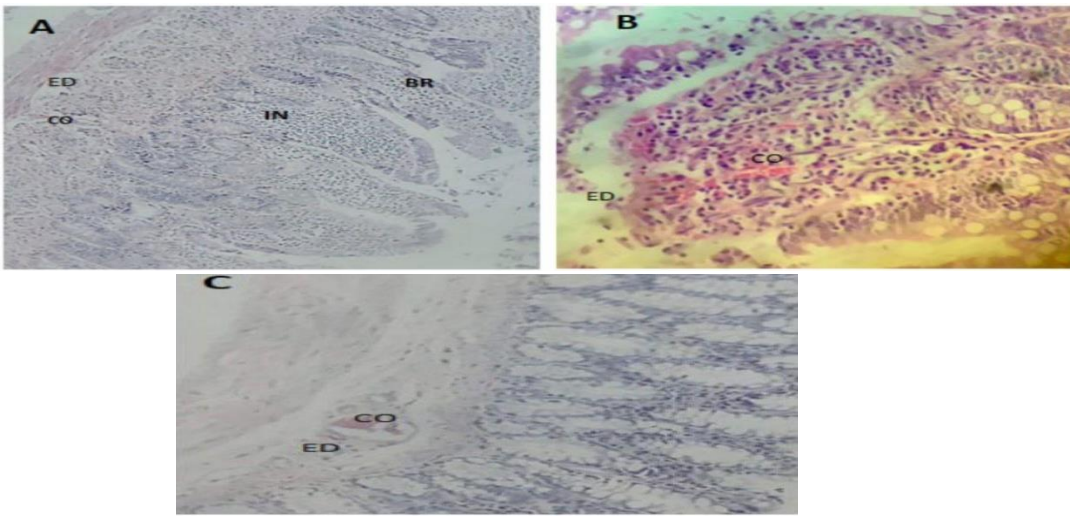

Figure 2: - (A) Cross-section of rat duodenum tissue treated with 5,000 IU of vitamin D3 for six weeks displays edema (ED), congestion (CO), infiltration of inflammatory cells (IN), and broadening of villi (BR), as shown by hematoxylin and eosin (H&E) staining at 40x magnification.
- (B) Cross-section of rat jejunum tissue subjected to a 5,000 IU dose of vitamin D3 over six weeks reveals congestion (CO), edema (ED), and an increase in intraepithelial lymphocytes, as observed under H&E staining at 40x magnification.
- (C) Longitudinal section of rat colon tissue following a six-week treatment with 5,000 IU of vitamin D3 demonstrates edema (ED) and congestion (CO), as visualized through H&E staining at 40x magnification.

3- Figure (3) shows histological changes of rat duodenum, jejunum and colon tissue treated with a concentration of 7500IU of vitamin D3 for six weeks, which shows extensive chronic inflammatory cells (IN), edema (ED) and congestion.

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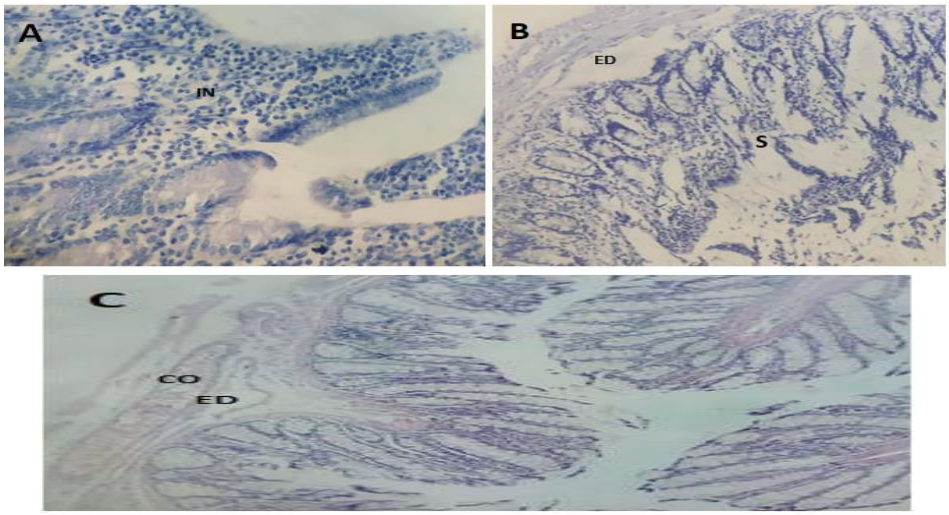

Figure 3: - (A) H&E staining (40x) of a transverse section of rat duodenum tissue treated with 7,500 IU of vitamin D3 for six weeks reveals extensive chronic inflammatory cell infiltration (IN).
- (B) H&E staining (40x) of a transverse section of rat jejunum tissue subjected to a 7,500 IU dose of vitamin D3 for six weeks demonstrates edema (ED) and sloughing of villi.
- (C) H&E staining (40x) of a longitudinal section of rat colon tissue treated with 7,500 IU of vitamin D3 for six weeks indicates edema (ED) and congestion (CO).

Figure 4: Histological changes observed in rat duodenum, jejunum, and colon tissues treated with a concentration of 10,000 IU of vitamin D3 for six weeks include edema (ED), congestion (CO), crypt hyperplasia, and villi shortening.

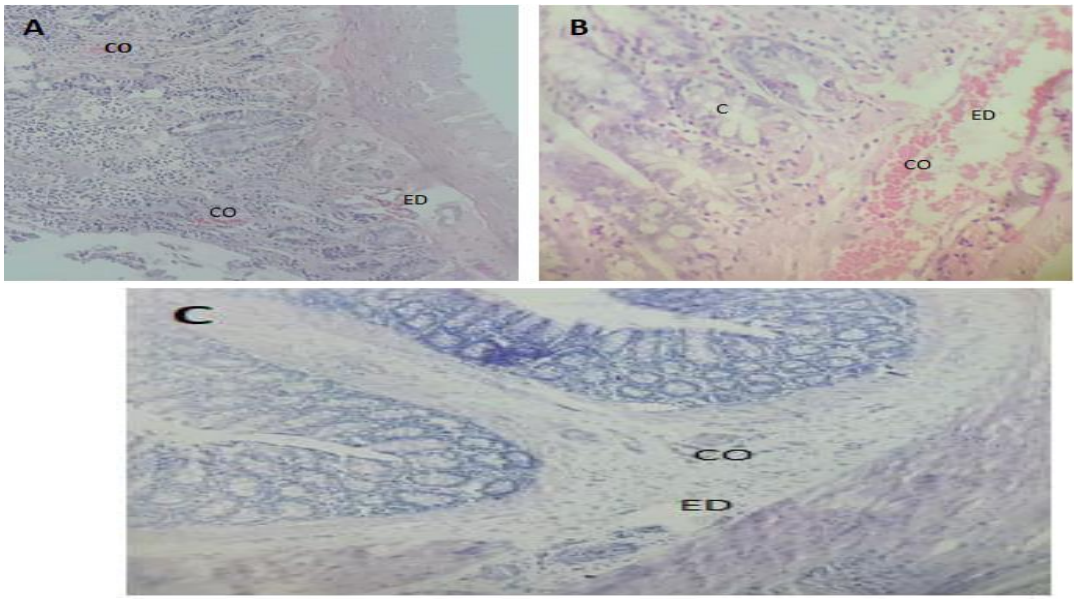

Figure (4) : (A) Hematoxylin and eosin (H&E) staining of rat duodenum tissue exposed to a 10,000 IU dose of vitamin D3 over a six week period shows edema (ED) and congestion (CO) at 40x magnification.
- (B) H&E staining at 40x magnification of rat jejunum tissue treated similarly with 10,000 IU of vitamin D3 for six weeks shows edema (ED), congestion (CO), crypt hyperplasia, and villi shortening.
- (C) Longitudinal section of rat colon tissue after a six-week regimen of 10,000 IU vitamin D3 treatment, viewed through H&E staining at 40x magnification shows edema (ED) and congestion (CO).

In the current study, we are trying to show the effect of high doses of vitamin D3 on the tissue of the duodenum, jejunum, and colon. Our current study has shown the occurrence of several histopathological changes. Including the occurrence of infiltration of inflammatory cells in the submucosal area and villi in most of the groups treated with vitamin D3, and this is consistent with the

study (5) Ghaly et.al. 2018 h. Cellular infiltration also accompanies edema in the intestine. Capillary filtration results in the exudation of interstitial fluid into the intestinal lumen, a process known as secretory filtration (6). This phenomenon can impact the absorptive function of the mucosa in the small intestine and is thought to occur due to the formation of large channels between the mucous cells at the apex of the villi when interstitial fluid pressure exceeds 5 mm Hg. Vitamin D3 causes acute inflammation that leads to changes in blood flow inside the vessels, as relaxation and expansion occur in those vessels, which leads to blood pooling inside them, and this is called blood congestion (7,8).

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