Histological Changes in the Kidney of the Albino Rat Treated with Nanocomposites of Ginger Plant

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Abstract
The current study was conducted in the animal house in the College of Education for Girls / University of Kufa, and the study aimed to know the effect of nano-extract (zinc oxide) of the ginger plant on the histological composition of the kidney in male white rats whose ages ranged from (8_9) weeks and weights (150_180g), which were divided To four groups, each group consisted of 6 rats, the first group was the control group, the second group was treated with zinc oxide at a concentration of (150 mg/kg), the third group was treated with nano-extract of ginger plant at a concentration of (20 mg/kg), and the fourth group was treated with alcoholic extract of ginger plant at a concentration of (250 mg/kg) daily. For a period of 30 and 45 days, and after the end of the first experiment (30) days, half of the rats and parts of the kidney tissues were sacrificed, and after the end of the second experiment (45) days, the other half was sacrificed and sections of the kidney tissues were made. The results of the histological study of the kidneys of mice treated with nano-extract of ginger plant at a concentration of (20 mg / kg) for a period of 30 days and 45 days showed a normal structure of Bowman's capsule and its glomeruli, and there were no histological changes.
Keywords: albino rat; ginger plant; nanocomposites

1 Introduction

Human kidneys are highly complex vascular organs that play a key role in maintaining and maintaining electrolyte and acid-base balance in the organism in order to build a stable environment for cell metabolism. Thus, the kidneys filter the blood, balance solutes and transport water, while excreting metabolic wastes and vital foreign matter, and preserving nutrients (Wallace, 1998). The kidneys are also important for controlling blood pressure and vitamin D synthesis, bone mineralization, and promoting RBC growth by producing erythropoietin (Scott and Quaggin., 2015).
The kidney consists of the cortex and pulp. The functional unit of the kidney is the nephron and is responsible for most of the kidney functions (Miyoshi et al., 2018). An adult human kidney contains an average of one million nephrons. The nephron contains more than twenty unique types of cells (Yengej et al., 2020). The nephron can be functionally divided into a filtration unit, which is known as the renal corpuscle or glomerulus, and a segmented tubular uptake compartment, which can be divided into four different sections, namely the proximal tubule, loop of Henle, distal tubules and collecting duct (Scott and Quaggin, 2015).
The glomerulus is a highly specialized capillary tuft located in the proximal part of the nephron whose function is to filter incoming blood by removing excess water and metabolic waste particles to form urine (Greka and Mundel, 2012). The glomerulus contains four types of resident cells: glomerular endothelial cells (GECs), basal cells, parietal epithelial cells of Bowman's capsule, and mesangial cells (Scott and Quaggin, 2015). (The glomerular filtration barrier (GFB) consists of an
inner layer of GECs facing the lumen of the capillaries, while the podocytes are arranged on the outer layer facing the urinary capsule and both types of cells are separated by the glomerular basement membrane (Wang et al.,2017). GFB is a shape- and size-dependent selective molecular sieve that controls filtration of large particles while allowing passage of small particles and water based on size and charge (Wang et al., 2017). In this way, circulating cells (eg red blood cells) and high molecular weight proteins (eg albumin) are retained in the blood vessels, while water and small molecules (eg urea, glucose, amino acids and ions) are filtered through (Scott and Quaggin, 2015). These filter products through the septum into the glomerular capsule, also known as Bowman's capsule, and flow into the renal tubular segments (Wang et al., 2017).
Ginger is one of the important medicinal plants in terms of medical and nutritional value because it contains many effective chemical compounds responsible for providing various properties, including preventive ones. Ensaf,Saleh Abar and Jabbar Abadi Alaridhi(2019).

2 Material and Methods

Preparation of the alcoholic extract of the fruits of the ginger plant The methanolic extract was prepared according to the method (Chen et al., 2012) with

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some modifications. Nanoparticles (zinc oxide) were synthesized from ginger extract using the method (Upadhyaya et al., 2018) with some modifications.
This study was conducted on (18) adult rats of Rattus rattus, whose weight ranged between (150-180 g). The experiment was conducted in the animal house in the College of Education for Girls - University of Kufa. The animals were placed in plastic cages and the floor was covered with sawdust. The cages were clean. The animals were placed in the experimental stages under laboratory conditions in terms of ventilation and lighting: 12 hours of light: 12 hours of darkness, and a temperature of 22-28 ˚m and was given water and diet freely ad libitum throughout the stages of the experiment. The animals were presented to a veterinarian to ensure the safety of the animals before the start of the experiment.
The total number of the experiment was (48) rats. The animals were divided into three groups (n = 4). Injections under the skin for a month and a half, once a day. The first group includes (8) animals fed with water and diet only and is considered as the control group The second group was given zinc oxide at a concentration of (150 mg/kg) and the third group was given an alcoholic extract of the ginger plant at a concentration of (250 mg/kg).
After the end of the first experiment (30 days), the animals were sacrificed, and then the other half were sacrificed after the end of the experiment for a period of (45) days, where they were Where they were anesthetized by mixing Xylazine 20 mg and Ketamine 10 mg and injected, the anesthetized animals were placed on a dissection plate (cork) and fixed with staples to conduct the autopsy process to reveal the effects of of Zinc oxide with a concentration of (150 mg / kg), nano-extract with a concentration of (20 mg / kg), and an alcoholic extract with a concentration of (250 mg / kg) on the kidneys.

3 Results

The results of microscopic examination of the kidneys of animals in the control group showed a normal structure and the absence of histological changes in Bowman's capsule and its glomeruli as shown in (Fig 1). The results of the kidneys of animals that were dosed with zinc oxide at a concentration of (150 mg/kg) for a period of 30 days showed that there was a shrinkage of the glomerulus as shown in (Figure 2), while it was observed in the group of animals that were dosed at the same concentration for a period of 45 days that there was a shrinkage of the glomerulus, expansion of the urinary space, and damage to the tubules. kidneys as shown in (Figure 3). As for the animals that were dosed with the nano-extract of the ginger plant at a concentration of (20 mg / kg) for a period of 30 days, it was found that the structure of the kidneys was normal and there were no histological changes, as shown in (Figure 4). As for the animals that were dosed at the same concentration for 45 days, it was found that there was no change in the normal tissues and structure of the kidneys, as shown in (Fig. 5). As for the animals that were dosed with the alcoholic extract of the ginger plant at a concentration of (250 mg / kg) for a period of 30 and 45 days, their body was normal and there were no changes, as shown in (Fig. 6)

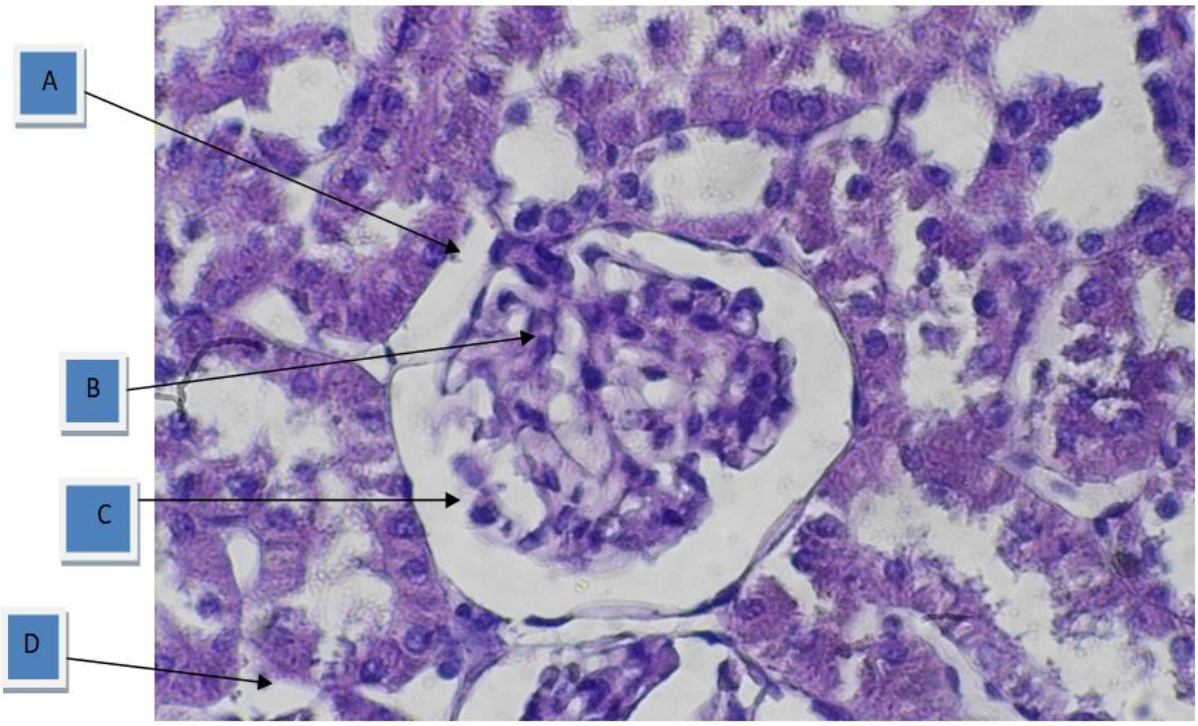

Figure (1): A cross-section of the kidney tissue in a white rat of a control group for 30 days, showing the normal structure of the kidneys. (H&E stain) (400x) A-Bowman's capsule B-glomerulus C-urinary space D-Renal tubules.

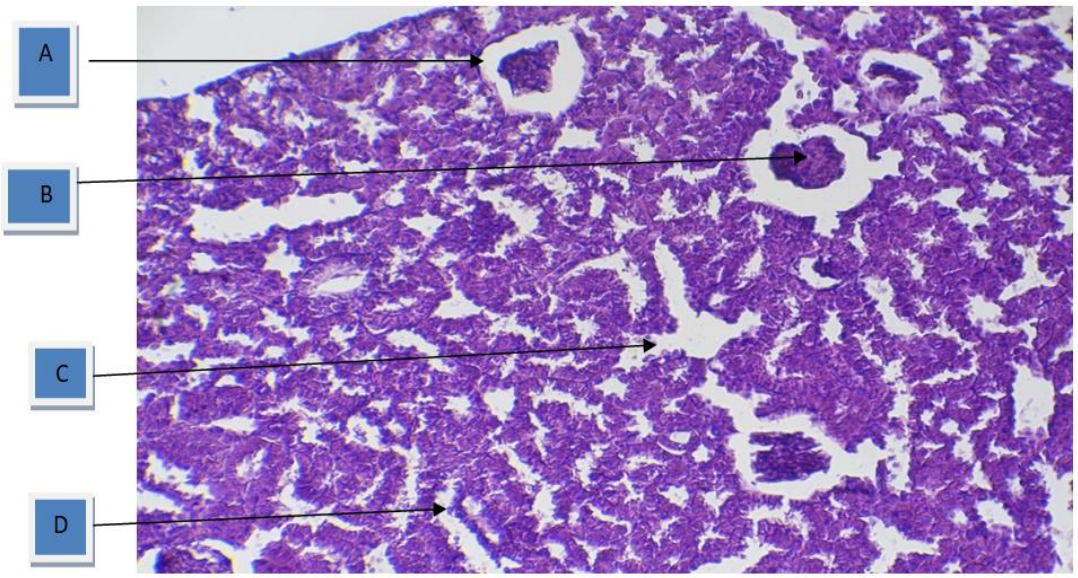

Figure (2): A cross section of the kidney tissue in the rat in the group treated with zinc oxide (at a concentration of 150 mg) for a period of 30 days, and it shows the shrinkage of the glomerulus. (H&E stain) (400x) A-Bowman's capsule B-glomerulus C-urinary space D-Renal tubules.

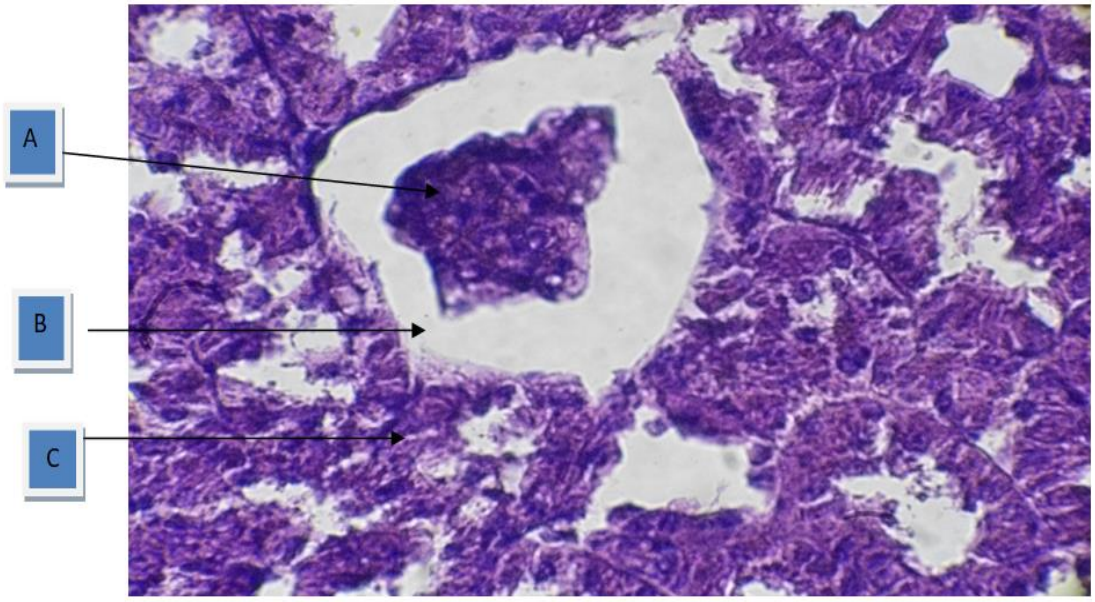

Figure (3): A cross section of the kidney tissue in the rat in the group treated with zinc oxide (at a concentration of 150 mg) for a period of 45 days. It shows shrinkage of the glomerulus, expansion of the urinary space, and damage to the renal tubules. (H&E stain) (400x) A-Bowman's capsule B- -urinary space C-Renal tubules.

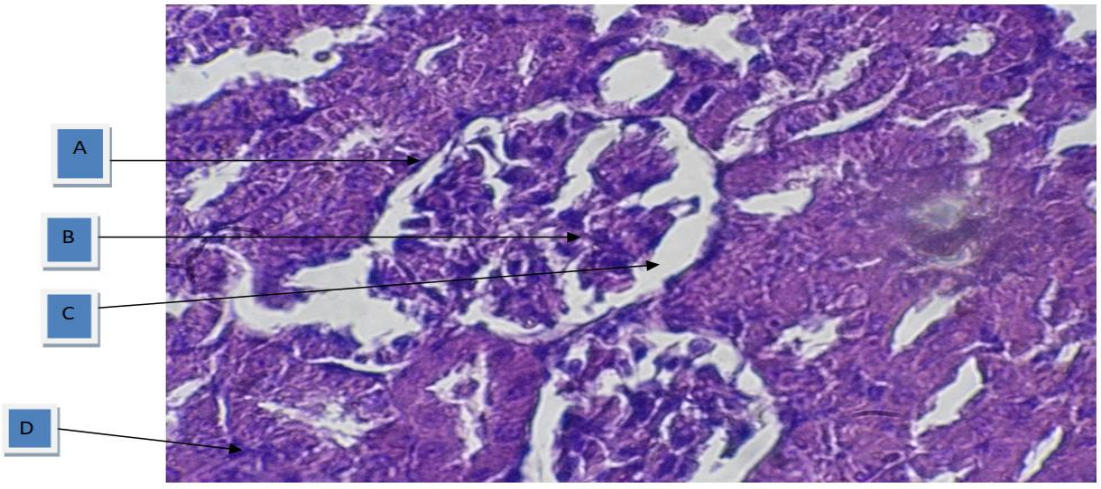

Figure (4): Across-sectional section of the kidney tissue of a group of rats treated with nano-ginger extract at a concentration of (20 mg/kg) for a period of 30 days shows the normal structure of the tissue (H&E stain) (400x) A-

Bowman's capsule B-glomerulus C-urinary space D-Renal tubules.

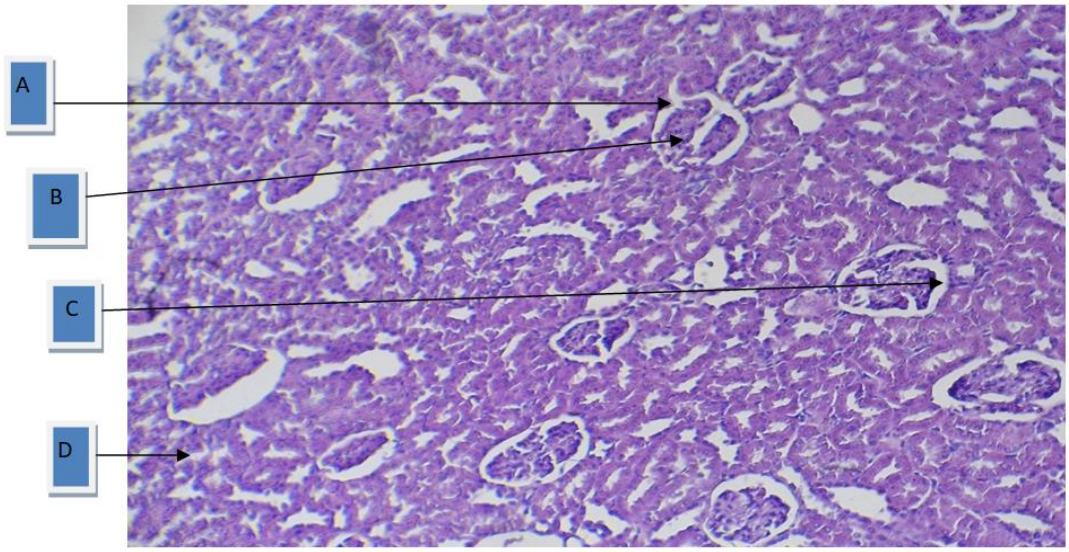

Figure (5): A cross-sectional section of the kidney tissue of a group of rats treated with nano-ginger extract at a concentration of (20 mg/kg) for a period of 45 days shows the normal structure of the tissue (H&E stain) (400x) A-Bowman's capsule B-glomerulus C-urinary space D-Renal tubules.

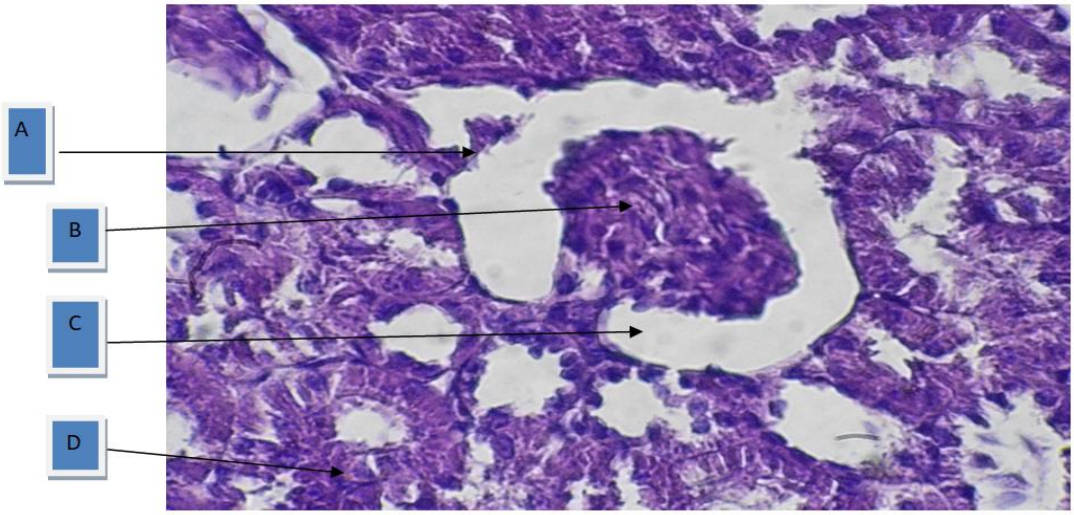

Figure (6): A cross section of the kidney tissue of a group of rats treated with alcoholic ginger extract at a concentration of (250/kg) for a period of 30 and 45days showing the normal structure of the kidneys. (H&E stain) (400x) A-Bowman's capsule B-glomerulus C-urinary space D-Renal tubules.

4 Discussion

The results of the microscopic examination of the histological sections of the organs of the white rat treated with zinc oxide at a concentration of (150 mg / kg) over the two periods of 30 days showed that there was a shrinkage in the glomerulus, and for the period of 45 days there was a shrinkage in the glomerulus and an expansion in the urinary space. As well as animals that were dosed with alcoholic ginger extract at a concentration of (250 mg / kg) for the two periods 30 days and 45 days, the structure of the kidneys is normal and there are no pathological changes, and this indicates that ginger has a protective role.

These results are consistent with the study of Ibrahim et al., (2018) where he observed shrinkage and destruction of the renal glomeruli.

The current results are consistent with the Alferah (2018) study, as it was found that dosing the rat with different concentrations of zinc oxide particles (100, 250, and 500 mg/kg) for a period of 21 days led to the emergence of inflammatory cells, necrosis of renal particles, destruction of renal tubules, destruction of Bowman's capsule, as well as the presence of acidic substances between and within the renal tubules.

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