AJPMHS GLOBAL RESEARCH NETWORK

AMERICAN Journal of Pediatric Medicine and Health Sciences
Volume 02, Issue 02, 2024 ISSN (E): 2993-2149

Histopathological Changes in Structure of Kidney Under the Consumption of Energy Drinks in Rats

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Abstract: The study aims to assess the impact of various doses of ZIP on kidney of rats. Forty five rats were assigned to three groups (15 animals/group). Control group (1) received standard diet and water, group 2 and group 3 received daily oral doses of 10 ml/kg/rat and 20 ml/kg/rat of the energy drink (ZIP) respectively for 30 days. Under light microscope no tissue changes were seen in kidney of control group. In group 2 ZIP causes vacuolar degeneration as well as coagulative necrosis of renal epithelium, vascular congestion in the glomeruli and in the interstitial part of the kidney.

In group 3 ZIP leads to more atrophic glomeruli, massive necrosis of renal tubular epithelium, marked vascular dilatation and congestion in the interstitial tissue and degenerative changes of the renal tubular epithelium.

It is concluded that administration of red bull to rats for 30 days will affect the histological structure of kidney and this effect is a dose dependent.

Keywords: Energy drink ,Kidney, ZIP ,tubular epithelium

Introduction

Energy drinks are most commonly consumed worldwide particularly by adults aging 20-30 years and less due to their ability to boast mental and physical performance (1). There are many kinds of energy drinks such as 18+ flash, ZIP and burn, all these beverages mainly contain caffeine, additionally taurine, carbohydrates, B group vitamins, amino acids and minerals (2).

Although these ingredients are responsible for the desired effects of energy drinks (like increasing the level of energy, enhancement of physical activity, decrease of mental exhaustion and improvement in the mood, but they can also cause negative effects (3).

Consumption of caffeinated energy drink may induce nephrotoxicity (4), hematological disorders (5), hepatitis and pancreatitis (6). Furthermore, the high sugar content results in obesity and diabetes (7), whereas the disturbances in the homeostasis of the non-essential amino acid taurine which is another component of energy drinks may affect brain, heart and even skeletal system of human (8). Recently they found that allergic disorders are associated with energy drink consumption (9). Since the intake of energy drinks became a phenomenon throughout the world and because of their negative effects to human health, there is an

increasing interest for conducting experimental studies, as well as, researches in order to evaluate and understand their impact on different body organs.

One of these studies is the present study which is aimed to assess the impact of different doses of ZIP on kidney of rats.

Materials and methods of research.

Chemicals. The energy drink used in this work was the ZIP. It was purchased from the local markets in Bukhara as a form of 330 ml cans.

Animals. Forty five adult rats weighing 200 ± 20 mg and aging 3-4 months .They were kept in the experimental room under suitable circumstances. Acclimatization of rats was for two week before proceeding the experiment and they were on free access to standard diet and water.

Experimental design. Rats were assigned to 3 groups, 15 animals for each and as follows, group one served as control group, on standard diet and water. Group two treated at dose of 10 ml/ kg/ rat of ZIP (This volume is equivalent to 3 cans of ZIP consumed by adult human weighing 70-75 kg). Group three treated at dose of 20 ml/ kg/ rat of ZIP. The beverage was given daily through oral route via intragastric gavage to all animals of group 2 and 3 for 30 days (10-15). After completing the experimental period each animal was sacrificed by decapitation.

Kidney was excised and the specimens were fixed in the buffered neutral formalin (10%) for more than 24 hours. Tissue processing were accomplished using standard methods and the tissue sections were colored using microscope.

Results. The histological structure of kidney sections in control group appeared to be normal without any morphological changes. In group 2 renal sections revealed vacuolar degeneration of renal tubular epithelium, vascular congestion in the glomeruli as well as in the interstitial space and coagulative necrosis of renal tubular epithelium, additionally, atrophic glomeruli with widened urinary space and degenerative changes of renal tubular epithelium were also noticed . In group 3 there were more atrophic glomeruli, massive coagulative necrosis of renal tubular epithelium , in addition to, markedly dilated and congested blood vessels in the interstitial space and degenerative changes of the renal tubular epithelium were observed.

Discussion. In concurrence with the increasing ingestion of energy drinks in the last years, several researches were accomplished showing, as well as, explaining their toxic effects on different organs of the body (11). In the present experimental study daily oral administration of 10 ml/ kg/ day /rat of ZIP for 30 days resulted in renal damage represented by vacuolar degeneration and coagulativenecrosis of renal tubular epithelium, vascular congestion of glomeruli and in the interstitial spaces, besides atrophy of glomeruli. With increasing the dose to 20 ml/ kg the histological changes in the kidney sections became so obvious and severe, there were more atrophic glomeruli, massive cogaulative necrosis of renal tubular epithelium, marked congestion and dilatation of the blood vessels and degeneration of renal tubular epithelium. Moreover, in human, cases of kidney injuries were reported following the consumption of these drinks. Thus it is indicated that energy drinks are nephrotoxic on chronic consumption and their toxicity is a dose dependent.

The exact mechanism of renal damage is unknown. The ingredients of energy drinks are blamed to be the cause. ZIP is composed of caffeine, glucose, taurine, maltodextrin, vitamins B2, B6, B12, ,inositol, carbonated water, sucrose, glucose, citric acid, pantothenic acid and sugar. Caffeine elevates blood pressure thereafter increasing the blood pressure of afferent arterioles of glomerular tuft with subsequent glomerular damage. Also caffeine as suggested by Khayyat et al. (4) inhibits A2A adenosine

receptors leading to elevation of creatinine, urea, as well as, uric acid and this will produce interstitial inflammation and renal damage. Oxidative stress will cause degeneration and desquamation in renal tissue [12-14]

Conclusion. It is concluded that administration of ZIP to rats for 30 days will affect the histological structure of kidney and this effect is releted to dose. So attention and alertness is very important when this beverage is consumed for prolonged periods. Further researches are recommended in order to evaluate the effects of prolonged use of energy drinks on other body organs and to discover the exact mechanism of their effect in order to find the preventive measures in future.

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