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Effects of High Fat Diet Induced obesity on Histopathology of Liver in Albino rats.

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ABSTRACT

High-fat (HF) diet feeding can induce obesity and metabolic disorders in Albino rats that resemble the human metabolic syndrome. By this purpose 12 Wistar Albino rats were divided into 2 groups each consist of 6 Animals. 1. Normal diet fed group for 8 weeks, 2. High fatty diet fed group for 8 weeks. We observed the fat deposition in and around the hepatocytes, Mononuclear in filtration in the liver parenchyma, dilatation of blood vessels, Binucleated hepatocytes and Necrosis in high fat diet fed group. it was observed that fat-rich diet (30%) had caused a liver damage. According to previous literature High-carbohydrate diet leads to hyperglycemia, and hyperglycemia leads to fast insulin secretion, hyperinsulinemia, insulin and leptin resistance. As a result of this, fat deposition in the hepatocytes, the increase in lipid peroxidation, as an indicator of hepatocellular injury. We think that our light microscopical finding would contribute clarifying the histopathological mechanism of Liver and obesity. Electron Microscopic studies need to be done to evaluate the cellular mechanisms.

Keywords: Liver, High Fat Diet, Mononuclear in filtration, Binucleated Hepatocytes.

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INTRODUCTION

Obesity is considered a major epidemic of the 21st century and is one of the most common, complex and chronic disease of today. Fatty diet is a significant factor causing obesity. Obesity is associated with many chronic disorders such as Non-Alcoholic Fatty Liver Disease (NAFLD). Approximately, More than 1.2 billion people are overweight in the world and at least 300 million of them are obese. According to the World Health Organization, obesity is one of the most preventable ten diseases. Obesity is considered as associated with imbalance between energy intake and expenditure. Previous, studies stated that genetic, physiological and Psychological factors play a role in the etiology of obesity (1). Obesity leads to many important complications such as diabetes and coronary heart disease, sleep apnea, diseases of the gallbladder and liver (2). Ramos et al. thought that obesity should be a low-grade inflammatory disease because most of the obese patients had shown increased levels of interleukin-6 and tumour necrosis factor-alpha, both markers of inflammation (3)(4).

MATERIALS AND METHODS

All animals were obtained from the Basaveshwara Medical College, Hospital and Research Centre Animal House. A total of 12 adult albino rats of Wistar strain weighing 165-215 grams were used for the present study. The rats were maintained in laboratory under controlled environmental conditions (12 h light/dark cycle and room temperature (22-240 C), humidity (50+5%) Rats were housed in polypropylene cages and given food and water ad libitum. The animals were fed with standard rat pellet diet commercially available manufactured by National Institute of Nutrition., Hyderabad and clean drinking water ad libitum. The rats were divided into two groups each consists of 6 animals. The control group was fed with Isocaloric diet (15-20% Fat) and the experimental group (30% High fat diet) were fed for 8 weeks. All the animals were sacrificed after a 12 hrs of fasting from the last day of experimental study and preserved in the 10% formalin for 48 hours. The specimens were processed for routine histopathological examination to study the histopathological changes in liver of obese Albino rats fed on High fat Diet. All the animals were maintained as per the national guidelines and protocols approved by Institutional animal ethical committee of Basaveshwara Medical College and Hospital 04/06/2015 & BMCH / IAEC / 01 Anat / 2015.

RESULTS

In the Control Group, We observed the Hexagonal Hepatic lobules with central vein, and portal triad under low magnification. (Figure – 1),(p – 28) Kupffer cells, Central vein, radiating cords of polyhedral hepatocytes and sinusoids under High magnification. (Figure - 2).(p-30). In the experimental (High fat diet fed) group, Under Low magnification Deposition of Adipocytes in the liver parenchyma with fat lobules seen (Figure -3) (172), Under High Magnification we have seen Damaged, Binucleated and macro vesicular fat accumulation (Figure – 4). (p 149) We also observed the vasodilatation, mononuclear infiltration under Low Magnification (Figure – 5, 95) and High Magnifications Figure – 6, 100) and Necrotic Foci under High magnification (Figures – 7). (p 159)

Figure 1: Control Group, showing the Hexagonal Hepatic lobules with central vein, and portal triad under low magnification (10x).

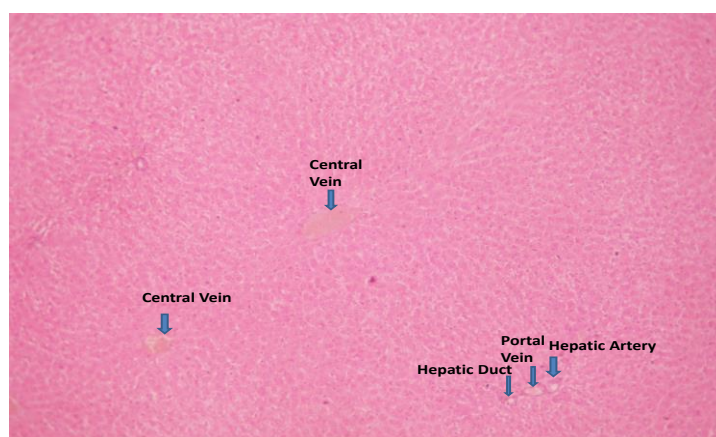


Figure 2: Animals fed with normal diet (Isocaloric) showing the Kupffer cells, Central vein, radiating cords of polyhedral hepatocytes and sinusoids under High magnification (40x).

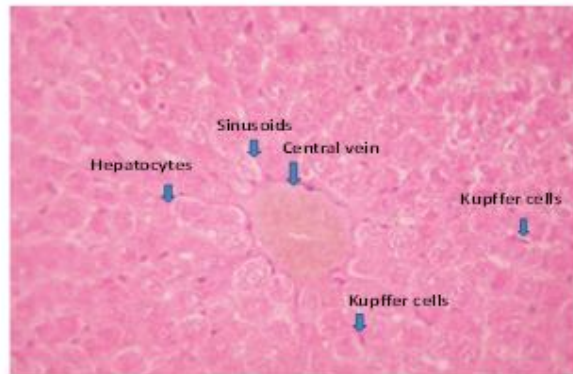


Figure 3: Animals fed with High fat diet (Hyperlipidemic), Showing Deposition of fat in the liver parenchyma with fat lobules under Low magnification (10x).

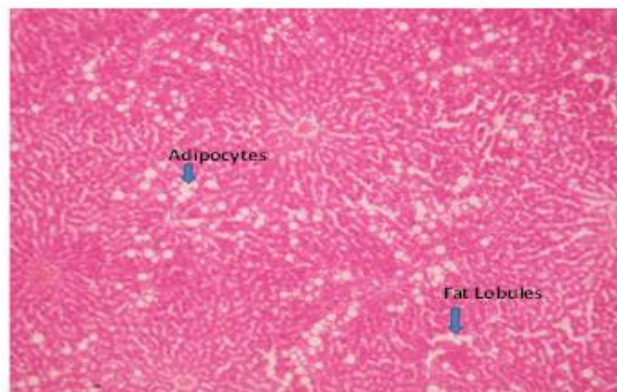


Figure 4: Animals fed with High fat diet (Hyperlipidemic), Showing the cell damaged, Binucleated and Macro vesicular Hepatocytes under High Magnification (40x).

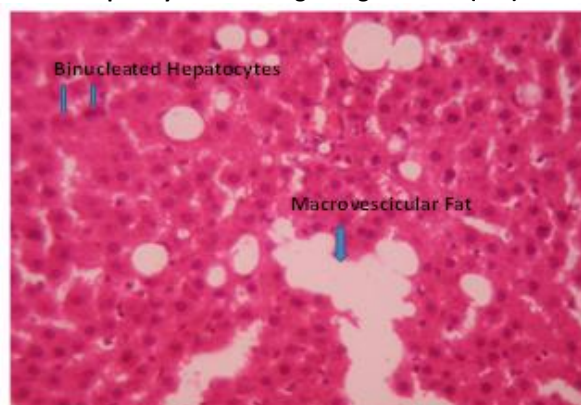


Figure 5: Animals fed with High Fat diet (Hyperlipidemic), Showing the vasodilatation, mononuclear infiltration Under Low Magnification (10x)

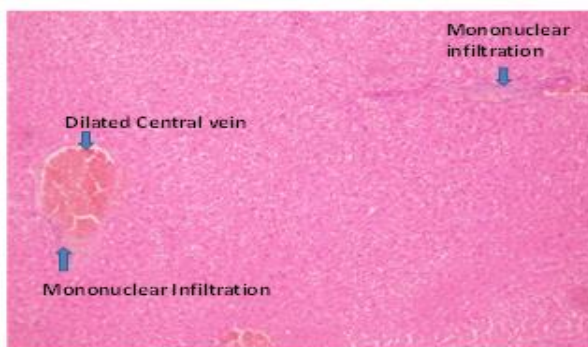


Figure 6: Animals fed with High Fat diet (Hyperlipidemic), Showing the vasodilatation, mononuclear infiltration Under High Magnification (40x)

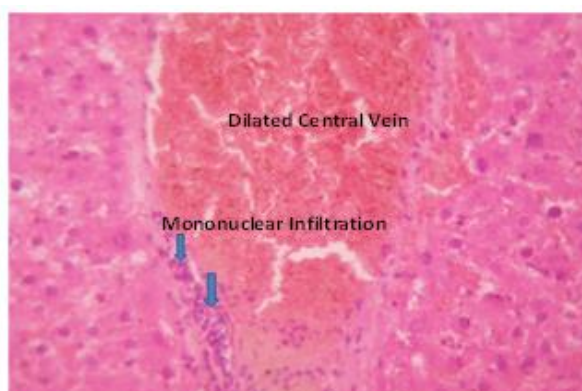
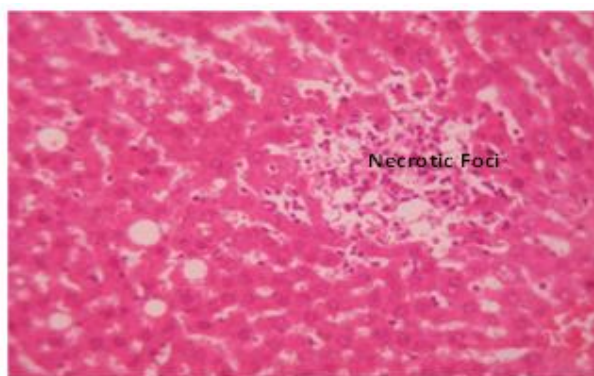


Figure 7: Animals fed with High Fat diet (Hyperlipidemic), Showing the Necrotic Foci under High magnification (40x).



DISCUSSION

High Fatty diet (30%) or more of energy from fat produces obesity in rats and mice, as a result of increased Energy intake and storage (5). In this research, we evidence for the role of dietary fat in regulating energy balance and promoting the development of obesity. In our study there was a significant change in the histopathology and deposition of fat in the liver, in the long term fat fed group. This is in agreement with the previous literature; there was an increased adipose tissue, glucose intolerance, elevation of circulating serum lipids (6). we also observed mononuclear infiltration, vasodilatation, increasing number of binucleated hepatocytes and Necrotic Foci in the liver, This was due to result of oxidative damage in hepatocellular proteins, Abraham P.et al. have mentioned the same in their study or necrotic changes in hepatocytes(7). We determined that necrotic foci were progressed towards the end of the study. We found that vascular dilatation was gradually increasing, in both sinusoids and large vessels, light microscopically. As proved in this study, we

are suggesting that feeding with fatty diet causes vascular dilatation, macro vesicular fat accumulation and necrosis. to our knowledge these findings was not reported before in the literatures. In our opinion; the progressive increase in the dilatation level during the course of the experiment, was due to the continuous effect of fat-rich feeding. We detected mononuclear cell infiltrations in both between hepatocytes plates and in around the portal triad. About underlying reason of this condition some researchers claim this inflammation area, either in foci or diffuse form, occurs due to cytokine release resulting from fatty feeding (8). Besides, some researchers suggest that inflammation occurs as a response to hepatocytes damage (9). Also these researchers observed mixed inflammation cells in lobular parenchyma.(10, 11). But we observed only mononuclear cells in inflammation areas. We thought that these mononuclear cell infiltrations especially in portal area indicated chronic inflammation in lobules and around the vessels. In our opinion, the reason of these focal infiltrations in animals being fed by fatty diets would be the fatty content of the blood incoming to liver which first passes from portal area. Therefore, it was a predictable result that, fatty degeneration would first be detected in portal area. Moreover, this degeneration may point that liver damage could widen from around of lobules towards central area. But MacDonald et al. reported that degeneration first begins in hepatocytes of third zone (12).

CONCLUSION

There are some studies on effects of high fat diet on liver cell damage, fat deposition and also on kidney and reproductive organs. But very few literatures are available on effects of High fat diet induced obesity on mononuclear infiltration, vasodilatation, increasing number of binucleated hepatocytes and Necrotic Foci in the liver. The present study reveals histopathological knowledge of mononuclear infiltration, increasing number of binucleated hepatocytes and Necrotic foci in the liver of albino rats on long term feeding of high fat diet.

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