

EFFECTS OF HIGH DIETARY FAT ON SERUM CHOLESTEROL AND FATTY LIVER SYNDROME IN BROILERS

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ABSTRACT

The present study was designed to evaluate the effects of high dietary fat on serum cholesterol and fatty liver syndrome in broilers. For this purpose, 90 day-old chicks were divided into three equal groups A, B and C. Group A acted as control. The birds of group B were fed on diet containing vegetable fat while birds of group C were fed on diet containing animal fat. It was observed that the serum cholesterol values in chicks of groups B and C were higher than those of the control group. Furthermore, the serum cholesterol value was higher in birds of group C than group B. Grossly, the livers of birds of groups B and C were enlarged, pale in colour, soft in consistency and were having petechial haemorrhages with fat and fibrin deposits. Histopathologically, livers of groups B and C showed fatty infiltration, haemorrhages and mass of eosinophilic materials. The vacuoles coalesced to create clear space that displaced the nucleus to the periphery of the cell. It was concluded that addition of dietary fat from animal and vegetable sources in the diet of broiler chicks not only resulted in increase in serum cholesterol but also in marked macroscopic and microscopic changes in liver.

Key words: Dietary fat, serum cholesterol, fatty liver syndrome, broilers.

INTRODUCTION

Fats are important in the diet of poultry as concentrated source of energy and the essential nutrients, linoleic acid and arachidonic acid. Whatever the source of fat, it is a high-energy diet. Excessive consumption of high-energy diets combined with restricted activity is believed to result in fatty liver syndrome, a condition of disturbed metabolism leading to excessive fat deposition in the liver (Chauhan and Roy, 1996). A strong association of reticulolysis with severity of liver haemorrhage has been described in experimental birds. Rupture of intrahepatic portal veins associated with degenerative changes in the veins is also described in the same birds. Focal necrosis of hepatocytes may lead to vascular injury and haemorrhage. Excessive lipid peroxidation of unsaturated fatty acids in the liver may overwhelm cell repair mechanisms and result in tissue damage (Riddell, 1997).

The present study was designed to evaluate the effects of increased dietary fat source both from animal and vegetable origins on the deposition of fat in liver and serum cholesterol in broilers.

MATERIALS AND METHODS

Experimental design

Ninety (day-old) broiler chicks were procured from hatchery and were randomly divided into three groups A, B and C, containing 30 chicks each. Rations containing 6% of vegetable or animal fat were fed to groups B and C, respectively. Group A acted as control and was fed on no fat.

Experimental parameters

The following parameters were studied:

Serum cholesterol

Serum cholesterol values of five birds from each group were determined on 42nd day of age through Libermann Burchard Reaction (Merk, 1974) using a commercial kit (Mercko test cat No. 3312).

Pathological examination

Five birds from each group were slaughtered on day 42 and liver samples were collected. The livers were examined to record any gross changes. Organs showing significant gross lesions were processed and examined for histopathological changes (Drury and Wallington, 1980).

Statistical analysis

The data obtained were statistically analyzed by applying one way analysis of variance and Least Significant Difference test (Steel and Torrie, 1982).

RESULTS AND DISCUSSION

Our results indicated that serum cholesterol values in chicks fed on fat either from animal (115 ± 3.1 mg/100 ml) or vegetable origin (95 ± 1.4 mg/100 ml) were higher ($p < 0.05$) than that of control (85 ± 1.4 mg/100 ml). Our findings are in line with those of Olorede *et al.* (1996), who observed that urea and cholesterol were increased in chicken fed on 15% sheabutter cake or kernal cake. Our results are also favoured by the findings of Islam and Singh (1997), Peebles *et al.* (1997a) and Peebles *et al.* (1997b). In this study, the serum cholesterol values were significantly higher ($p < 0.05$) in chicks fed on animal fat as compared to those fed on vegetable fat. Asti *et al.* (1989) also reported similar findings and stated that animal fat gave the highest concentration of serum cholesterol in broilers.

In our study, the examination of liver revealed marked macroscopic and microscopic lesions in the treated groups. Grossly, the livers of treatment groups were enlarged in size, pale in colour, soft in consistency and were having petechial haemorrhages with deposition of fat and fibrin on the liver. Livers of the control group were grossly normal. These findings are in line with those of Tuncer *et al.* (1989), who reported that liver became yellowish pale, swollen and dry in chicks fed on fish oil. Chawak *et al.* (1997) reported that liver weight; liver fat content and haemorrhagic scores were higher in group fed high-energy low protein diet.

Histopathologically, liver of the treatment groups showed fatty infiltration, haemorrhages and mass of eosinophilic materials. The vacuoles coalesced to create clear space that displaced the nucleus to the periphery of the cell. There were many ruptured hepatocytes, with enclosed fat globules, which coalesced to produce so-called fatty cysts. Chawak *et al.* (1997) induced fatty liver syndrome by feeding high energy-low protein diets and observed distinct histopathological fatty changes in the liver. These findings are also supported by Reddy *et al.* (1995). Livers of the control group were microscopically normal.

From the above discussion, it can be concluded that addition of dietary fat from animal and vegetable sources in the diet of broiler chicks not only resulted in increase in serum cholesterol but also caused marked macroscopic and microscopic changes in liver.

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