MANIPULATION OF GLUCOSE METABOLISM IN THE BROILER CHICKEN WITH DIETARY FATTY ACIDS

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Dietary (n-3) polyunsaturated fatty acids have been shown to influence glucose metabolism in rodents and in man. Luo et al., (1996) demonstrated increased rates of glucose oxidation in adipocytes from rats fed dietary n-3 polyunsaturated fat, while in man n-3 fatty acids significantly increased glucose utilisation (Waldhäust et al., 1989). This preliminary study was designed to establish dietary (n-3) polyunsaturated fatty acids can influence whether glucose metabolism in broilers.

Two diets were prepared containing tallow, a source of saturated fatty acids (80 g/kg), and fish oil, a source of (n-3) polyunsaturated fatty acids (80 g/kg). These two diets had similar determined AME values and were isonitrogenous. Broiler chickens (30 days old) were randomly divided into 2 groups (n=10) and were fed the diets for 5 weeks. Jugular catheterisation was performed under general anaesthesia during week 4. The broilers were allowed 7 days post surgery to recover before sampling blood every 2 h for 8 h. Plasma glucose and triglyceride concentrations were measured by enzymic analysis. To estimate the glucose clearance rate from plasma and glucose incorporation into tissues, 2-deoxy-D-3H glucose (2DG-3H) was infused into each chicken (50 μCi) at the end of the study. Sequential blood samples were then taken via the indwelling catheter over a period of 1 h.

The mean plasma glucose concentrations over the 8 h period were elevated, but not significantly, in the broilers fed the fish oil diet (12.83±0.59 mmol/L, vs. 12.07±0.56 mmol/L). The mean plasma triglyceride concentrations were lower in broilers fed the fish oil, but again not significantly (1.97±0.21 mmol mmol/L vs. 2.15±0.16 mmol/L). The rate of 2DG-3H clearance from the plasma of broilers fed fish oil was significantly greater (P<0.05) than for the broilers fed tallow. The 2DG-3H was cleared after 15 min in the broilers fed fish oil compared to 30 min for the broilers fed tallow. There was a greater rate of 2DG-3H uptake into the breast and thigh muscles of the broilers fed fish oil compared to broilers fed tallow (breast muscle 4100 cpm/g tissue, and 2500 cpm/g tissue respectively; thigh muscle 4700 cpm/g tissue and 2900 cpm/g tissue respectively). The uptake of 2DG-3H into the liver was greater in the broilers fed tallow compared to those fed fish oil (9100 cpm/g tissue and 7300 cpm/g tissue). There was no difference between the two dietary groups in the uptake of 2DG-3H into the abdominal fat pad.

These data suggest that the type of fat in broiler diets can influence glucose metabolism. The inclusion of fish oil in place of tallow increases the rate at which glucose is cleared from blood and also increases the rate of glucose uptake into muscle tissue.

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