DIFFERENCES IN GLUCOSE METABOLISM BETWEEN BROILER AND LAYER CHICKENS

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Recent studies from this laboratory suggest that the manipulation of glucose metabolism may result in a leaner chicken (Newman et al., 1998). The aim of this study was to investigate glucose metabolism in strains of chickens differing widely in growth rate and body composition.

Day-old broiler and layer strain chickens were reared in a brooder and fed a commercial starter diet for 3 weeks. Each strain was then randomly divided into 4 groups (n=12) and fed an isonitrogenous diet containing edible tallow (50 g/kg) for 4 weeks. Two of the 4 groups were housed in individual cages and at weekly intervals, feed intake and body weight measurements were made. At the end of week 4, a blood sample was taken from each bird prior to slaughter and the abdominal fat pad and breast muscles removed and weighed. Jugular catheterisation was performed under general anaesthesia on the remaining 2 groups during week 3. Each chicken was allowed 7 days post-surgery to recover before being infused with 2-deoxy-D-\textsuperscript{3}H glucose (2DG-\textsuperscript{3}H; 50\mu Ci). To estimate the clearance rate from plasma, sequential blood samples were taken via an indwelling catheter over a period of 1 h. The birds were then sacrificed and 2DG-\textsuperscript{3}H incorporation measured in the breast, thigh, liver and fat tissues. Plasma glucose and triglyceride concentrations were measured by enzymic analysis and plasma insulin concentrations measured by radioimmunoassay. The results are shown in the Table.

|                  | Broiler | Layer | Difference *
|------------------|---------|-------|----------------
| Final body mass (g) | 2198.8 ± 75.6 | 772.1 ± 23.9
| Breast muscle (g)  | 314.4 ± 18.0 | 72.4 ± 3.1
| Abdominal fat pad (g) | 28.6 ± 2.4 | 4.9 ± 0.7
| Glucose (mmol/L)    | 13.4 ± 1.2 | 15.9 ± 0.3
| Triglycerides (mmol/L) | 0.34 ± 0.04 | 0.56 ± 0.04
| Insulin (ng/ml)     | 0.073 ± 0.01 | 0.1077 ± 0.02

*Significantly different from broiler P<0.05.

The plasma clearance rate of 2DG-\textsuperscript{3}H from the plasma was similar for the two strains. However, there was a significant increase (P<0.05) in the uptake of 2DG-\textsuperscript{3}H into the breast muscle and the liver of the layer strain. These data and the differences in circulating insulin concentrations demonstrate a distinct difference in glucose metabolism between broiler and layer chickens. These differences reflect a greater efficiency of energy utilisation by broilers and may be a consequence of the higher energy requirement of this strain for muscle protein synthesis.

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