

EARLY DIAGNOSIS OF LEG ABNORMALITIES IN BROILER CHICKS USING TYPE X COLLAGEN

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Leg abnormalities related to nutritional imbalances are common in broiler chickens but early diagnosis of the problem in a flock is difficult. Using an experimental diet that we have previously shown causes an increase in the incidence of tibial dyschondroplasia (TD) we investigated the possibility of using the relative proportions of Type II and Type X collagens in growth plate cartilage to diagnose the disorder.

In day-old chicks a hypertrophic cartilaginous cone is present in the growth plate region of the proximal end of the tibio-tarsus. By one week of age the cone has disappeared and the growth plate is clearly seen as an area of uniform thickness. Type X collagen has a specific function in bone mineralisation and is found in higher concentrations, relative to Type II, in the hypertrophic cone than in 25-day old birds (Bashey et al. 1989). In the cartilaginous plug characteristic of TD, Type X collagen is in greater proportions than in older birds but in lesser than in day-old chicks and this has led Bashey et al. (1989) to suggest that abnormal synthesis of Type x collagen contributes to the non-mineralisation of growth plate cartilage in TD.

Day-old broiler chicks were randomly assigned on a weight basis to six pens of 50 chicks per pen. Two pens were fed a semi-purified diet containing sulphur amino acids (SAA) at 1.5 times the requirement relative to lysine which has previously been shown to increase the incidence of TD (Rajadevan and Frankel 1990), two pens were fed a semi-purified control diet and the remaining two pens a commercial starter ration (Barastoc, Pakenham, Victoria). Birds were killed at day-old, 2, 3, 5, 7 and 14 days and blood and bone samples collected. The growth plate cartilage or the hypertrophic cone were separated from surrounding tibial tissues, homogenised in Tris-HCl, sequentially extracted with acetic acid, pepsin and dithiothreitol (DTT), and the collagens in the DTT fraction separated using SDS-PAGE gel-electrophoresis.

In day-old chicks the ratio of Type X to Type II collagen in the hypertrophic cone was 1.7. In birds fed the commercial ration the ratios at 2, 3 and 5 days were 1.04, 0.85 and 0.54 and a similar rate of decline in the ratio was seen in control birds (1.2, 0.61, 0.42; for 2, 3, 5 day old birds) whereas in the birds given the diet high in SAA a slowing of the trend could be seen by the 5th day (1.2, 0.90, 0.86; for 2, 3, 5 day old birds).

This suggests that the relative rates of synthesis of collagen types are altered by feeding excess SAA and that analysis of the collagen content has potential as a method for the early diagnosis of abnormalities in avian growth plate calcification.

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