

Effect of age upon digestibility of starch in chickens with different growth rate
J. Zelenka^{1*} and Z. Čerešňáková^{2, 1} Mendel University of Agriculture and Forestry, Brno,
Czech Republic, ² Research Institute of Animal Production, Nitra, Slovak Republic.
E-mail: zelenka@mendelu.cz

Abstract

Digestibility of starch was examined in slow growing laying type chickens (SG) and in fast growing broiler hybrids (FG) fed *ad libitum* on a maize-type diet. In SG chicks, the starch digestibility rapidly increased within the first days of their lives and reached the value of 0.986 already on Day 4 of life. On this level, it was maintained till the end of the experiment, which was finished at the age of 100 days. In FG chicks, which in comparison with SG birds consumed more than double quantity of feed, a high starch digestibility was observed as late as on Day 8. From Day 8 to Day 100 of age, starch digestibility slightly but highly significantly ($P < 0.01$) decreased. Average value of digestibility was at this time in broiler type chickens lower by 0.008 than in SG chickens; nevertheless, digestibility was never below 0.96. The difference was highly significant ($P < 0.001$).

Introduction

Chicks are very early adapted to starch digestion. Nitsan *et al.* (1991) found that in the pancreas maximal values for amylase were attained on Day 8. In the experiment by Akiba and Murakami (1995) activity of amylase in the intestine remained lower during the first 2 days and rose to the maximum on Day 4 or Day 5 of age. Nir *et al.* (1993) determined activities of some digestive enzymes from hatching to 14 d of age in meat- and egg-type chicks. Pancreatic digestive enzyme activities were similar in broiler and laying type chicks, but activities in the small intestinal contents were lower in meat-type chicks.

The objective of this research was to determine the influence of age on the digestibility of starch in laying and meat type chickens. To evaluate the effect of age as exactly as possible, it was necessary to carry out estimations in very short time intervals during a longer period of life.

Materials and Methods

Effect of age on the apparent digestibility of starch was studied using Isa Brown slow growing laying type cockerels (SG) and fast growing Ross meat type male chickens (FG). Data collection from the SG birds began at hatch, while data collection from the FG birds began at Day 2. Until Day 22, the digestibility was investigated in one-day balance periods and from Day 22 till Day 100 in three-day subsequent periods. Chickens were fed on a starter diet during the whole experimental period. Feed mixture included 510 g of maize and 120 g of wheat and contained 225 g crude protein, 422 g starch and 12.06 MJ nitrogen-corrected metabolizable energy per kg. The feed was supplied *ad libitum* and its consumption was recorded. The coefficients of starch digestibility were estimated using the chromic oxide indicator method. Starch content of feed and freeze-dried excreta was estimated enzymatically as described by Salomonsson *et al.* (1984).

Results and Discussion

The values of starch digestibility during the whole experimental period are plotted in Figure 1. In SG chicks, which were fed immediately after hatching, starch digestibility was 0.967 on Day 1. It is obvious that production of amylase, including that, which was accumulated during the embryonic development in the pancreas (Nir *et al.*, 1993), was sufficient for the digestion of very low amounts of consumed feed (0.8 g). On Day 2 the production of amylase was not adequate and the digestibility decreased by nearly 16 %. However, on Day 4 it reached

values, which were for digestion in SG chickens adequate. Similar results were published also by Moran (1985) and Akiba and Murakami (1995). Starch digestibility reached the level of 0.986 and remained with only very slight fluctuation practically unchanged till Day 100.

As compared with SG chicks, the feed intake in FG group was more than doubled. Production of amylase for such amounts of feed reached an adequate level as late as on the Day 8 of life. This corresponds to results published by Nitsan *et al.* (1991) who observed that in the pancreas of broilers maximal value of amylase production was attained on Day 8. Till this age synthesis and secretion of enzymes from the pancreas to the intestine was in developing stage and apparently insufficient. The starch digestibility in the *ad libitum* fed chicks probably reflects the maximal synthesis capacity of amylase at this age. Higher feed intake of broiler type chicks is reflected in a larger amount of intestinal contents and a lower amylase concentration in digesta. In the Week 2, when the capacity for enzymes synthesis is fully developed, the digestibility is no longer dependent on feed intake (Mahagma *et al.*, ex Nitsan, 1995).

From Day 8 to Day 100 the starch digestibility ranged from 0.9616 to 0.9965 and from 0.9784 to 0.9949 in FG and SG chickens, respectively. In this period, average digestibility in FG and SG birds were 0.9811 ± 0.00135 (mean \pm standard error of the mean) and 0.9889 ± 0.00066 , respectively. The difference of 0.0078 was highly significant ($P < 0.001$). Regarding the fact that in feed mixtures for poultry starch represents the main source of energy this difference is important also from the practical point of view. In our experiment with a maize-type diet the digestibility values were higher than those reported for a maize-type diet by Maisonnier *et al.* (2001a) and similar to those published by Riesenfeld *et al.* (1980), Maisonnier *et al.* (2001b), Carré *et al.* (2002) and Svihus *et al.* (2004).

Dependence of starch digestibility upon age of chickens in days estimated in 41 balance experiments was expressed by linear regression equations for day 8 to 100 (r = correlation coefficient):

$$Y_{FG} = 0.9905 - 0.000208 X; r = 0.710, P < 0.01$$

$$Y_{SG} = 0.9895 - 0.000014 X; r = 0.100, P > 0.05$$

The deviations from linearity were not significant ($P > 0.05$). The starch digestibility in FG chickens highly significantly ($P < 0.01$) linearly decreased with increasing age.

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Figure 1. Digestibility of starch

