Embryonic development and growth after long-term selection for shape of the growth curve

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The High Growth (HG) and Low Growth (LG) lines of Japanese quail have been divergently selected for the shape of the growth curve without significantly affecting mature body weight (Hyánková et al., 2001). Previous experiments showed that the change of the postnatal growth pattern has a significant impact on efficiency of meat production, and in later generations also on number, size and composition of eggs (Hyánková et al., 2001, Starosta and Hyánková, 2009). In addition, it was proved that these correlated responses resulted from a line divergence in developmental rate which was observable in early generations (9 to 13) already during the first 12 h of incubation (Hyánková et al., 2004). The aim of the present study was to verify line differences in embryonic development and growth after further 20 generations of selection.

HG and LG fertile eggs used in this study came from 14- to 18-week-old breeders of generation 31. Eggs were collected daily from 80 females/line, stored for 1 day at 12 to 15°C, and incubated in the same incubator with automatic rotation of eggs at 37.5± 0.2°C and 55% relative humidity. Embryonic development was evaluated on the basis of blastoderm diameter at 12 and 24 h, developmental stage at 24 and 42 h, somite number at 42 h of incubation, relative weight of residual yolk sac and its retraction into the body cavity at 16 d of incubation and length of incubation period. Embryonic growth was characterized by embryo weights at 4, 6, 8, 10, 12, 14 and 16 d of incubation. A total of 680 embryos per line were used.

As in early generations, the line differences in development confirmed that the LG line selected for fast growth rate immediately after hatching is developmentally accelerated in comparison with the HG line during the whole prenatal period. However, at present generation, the line developmental divergence was considerably more pronounced, especially at the end of the incubation period. A similar trend in both generations was noted also in line growth differences. Noticeable inter-generation differences were observed only at 14 and 16 d of incubation, where a higher growth acceleration of LG vs. HG embryos was probably due to a greater size of LG eggs. On the other hand, the relative comparison of HG vs. LG weights revealed that increasing developmental divergence between lines resulted in considerably greater line differences in growth rate during separate embryonic periods. Transient growth retardation of HG vs. LG embryos during periods 3-4 and 8-14 d was unambiguously greater than this growth retardation of HG embryos in early generations. This suggested that developmental delay is a key factor increasing the risk of embryo death at early and late embryonic phases.

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