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COMPARISON OF CHANGES IN THE LIVEWEIGHT AND BODY COMPOSITION OF A NEWLY DEVELOPED COCK LINE AND TETRA-H CHICKS DURING THE REARING PERIOD

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ABSTRACT - Comparison of changes in the liveweight and body composition of a newly developed cock line and TETRA-H chicks during the rearing period
The aim of this study was to follow the changes in the liveweight and in the muscle and fat tissue development of 60 chicks originated from a newly developed cock line and from the TETRA-H genotype. Changes in the body composition of these birds were examined by means of computer tomography (CT) *in vivo*. CT examinations were performed bi-weekly between 4 and 12 weeks of age. Overlapping 8 mm slice thickness measurements were performed covering the whole body of the chicken using a Siemens Somatom Emotion 6 multislice CT scanner. Using the images obtained so-called muscle and fat indices were calculated by determining the ratio of number of pixels with X-ray density values of muscle or fat to the total number of pixels with density values of muscle, water and fat, i.e. the range between -200 to +200 on the Hounsfield-scale. Based on the results, it was established that the liveweight of the chicks in the newly developed cock line was significantly higher at all examination days than that of the TETRA-H chicks. The difference between the two examined genotypes was more than 1 kg in the case of cocks and almost 1 kg in the case of pullets at 12 weeks of age. The ratio of muscle in the bird's body was higher, while the ratio of fat lower in the case of the TETRA-H chicks at the end of the experiment in both sexes. Based on the results it was concluded that the use of the new cock line for improving the liveweight and meat production of the TETRA-H chicks can cause unfavourable changes in the body composition of the TETRA-H birds, which should be taken into consideration in the breeding programme of the TETRA-H hybrid in the future.

Keywords: broiler, chicken, body composition, computer tomography

INTRODUCTION

The three-line hybrid TETRA-H was developed in the beginning of the 1980's by the Bábolna Poultry Breeding Company. Thanks for its calm temperament and balanced production it was capable of replacing the traditional free-range poultry breeds. However, out of the dual-purpose characteristics, the egg-production of these birds is the dominant one (180-200 pieces under extensive circumstances) and therefore the aim of its further development is the increase of the final liveweight and the meat production capacity. The target parameters of the development are the current results of the Redbro genotype and therefore a comparison of changes in the liveweight and body composition of TETRA-H and Redbro chicks was already done in a previous study (MILISITS et al., 2010). In the meantime a new cock line was developed from the Golden Plymouth genotype by selecting birds for weight gain and plumage colour, which is planned to use as parental line in the further development of the TETRA-H genotype.
The aim of this study was the comparison of changes in the liveweight and body composition of this newly developed cock line and TETRA-H chicks during the rearing

period by means of computer tomography (CT), which was already effectively used in a lot of former experiments in the *in vivo* examination of changes in the body composition of different animal species (ROMVÁRI et al., 1998; MILISITS et al., 1999; MILISITS et al., 2000; ANDRÁSSY-BAKA et al., 2003).

MATERIAL AND METHODS

The experiment was carried out with chicks from the newly developed cock line and TETRA-H genotype in the Test Station of the Kaposvár University, Faculty of Animal Science. Animals were reared on deep litter in pens (9.2 m² basic area), in a closed building, separated according to sex and genotype (cocks: 110 birds/pen, pullets: 129 birds/pen). Chicken were fed *ad libitum* with commercial diets during the whole experimental period (starter between days 0 and 10, growing between days 11 and 24 and finisher from the 25th day on (*Table 1*). Drinking water was also continuously available from self-drinkers.

Table 1: Composition of the diets used in the experiment

Component	Starter	Growing	Finisher
Dry matter (%)	91.4	91.3	90.0
Crude protein (%)	20.9	18.8	17.1
Crude fat (%)	5.7	6.5	6.8
Crude fibre (%)	2.4	2.7	3.0
Crude ash (%)	4.9	4.4	4.4
N-free extract (%)	57.5	58.9	58.7
Starch (%)	39.2	48.5	48.5
ME Poultry (MJ/kg dry matter)	13.64	15.54	15.27
Calcium (g/kg)	7.34	6.11	6.47
Phosphorous (g/kg)	5.70	5.80	5.40

Animals for the CT examinations – 15 according to sex in both genotypes – were chosen randomly at 4 weeks of age. These birds were then assigned individually with wing tags and they were scanned by CT at every examination days thereafter. Before the CT measurements the liveweight of these birds was always recorded.
CT examinations were carried out at the Institute of Diagnostic Imaging and Radiation Oncology of the Kaposvár University bi-weekly, between 4 and 12 weeks of age. During the measuring procedures birds were fixed with belts in a special plexi-glass container, without using any anaesthetics. Three animals were scanned simultaneously.
The CT measurements consisted of overlapping 8 mm thick slices covering the whole body using a Siemens Somatom Emotion 6 multislice CT scanner. Using the images obtained so-called muscle and fat indices were calculated by determining the ratio of number of pixels with X-ray density values of muscle or fat to the total number of pixels with density values of muscle, water and fat, i.e. the range between -200 to +200 on the Hounsfield-scale:

$$\text{Muscle index} = \Sigma(+20)\text{-}(+200) \,/\, \Sigma(-200)\text{-}(+200) \times 100$$
$$\text{Fat index} = \Sigma(-200)\text{-}(-20) \,/\, \Sigma(-200)\text{-}(+200) \times 100$$

The differences in the liveweight and in the muscle and fat indices between the examined genotypes were evaluated statistically by the Independent Samples t-test. The

statistical analysis was carried out by the SPSS statistical sofware package, version 10.0 (SPSS FOR WINDOWS, 1999).

RESULTS

Examining the changes in the liveweight during the rearing period it was established that that of the chicks in the newly developed cock line was significantly higher at all examination days in both sexes than that of the TETRA-H chicks (*Figure 1*).

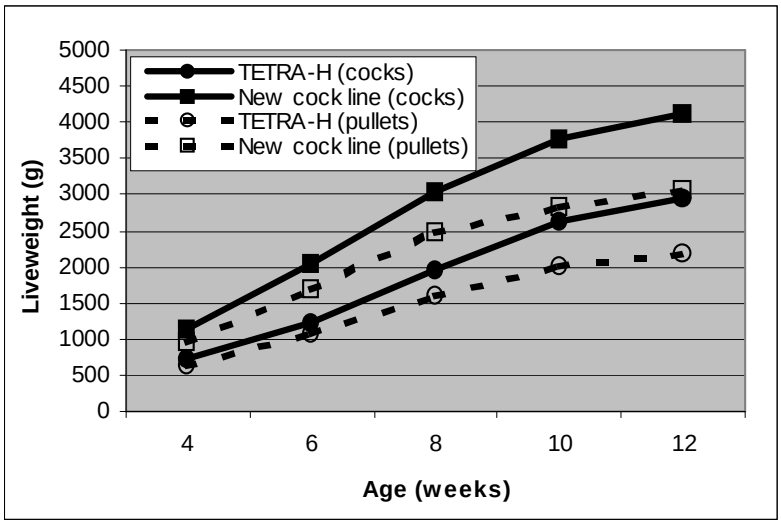

Figure 1: Changes in the liveweight of TETRA-H chicks and chicks of the newly developed cock line between 4 and 12 weeks of age

The difference between the two examined genotypes was more than 1 kg in the case of cocks (1181g) and almost 1 kg (877g) in the case of pullets at the end of the experiment. It was very interesting to see that the liveweight of cocks in the TETRA-H genotype did not reach the liveweight of pullets in the new cock line at the end of the rearing period (2950g vs. 3064g).

The ratio of muscle tissue in the bird's body was continuously increasing in the TETRA-H chicks till 8 week of age in both sexes, while it remained almost the same in the case of cocks and it decreased in the case of pullets thereafter (*Figure 2*).

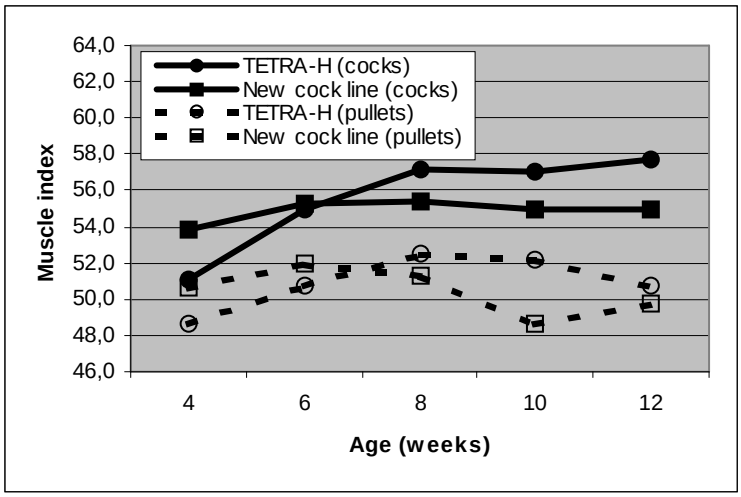

Figure 2: Changes in the muscle index of TETRA-H chicks and chicks of the newly developed cock line between 4 and 12 weeks of age

While the muscle index increased from 51.1 to 57.7 in the case of TETRA-H cocks between 4 and 12 weeks of age, it just varied between 53.8 and 55.4 in the case of chicks of the new cock line during the whole experimental period.
In the case of pullets the muscle index varied between 48.6 and 52.5 in both genotype and it reached its maximum level at 8 weeks of age in the case of the TETRA-H genotype (52.5) and two weeks earlier in the case of the new cock line (52.0).
It was also observed that in spite of the observation at 4 weeks of age, when the ratio of muscle in the body was higher in the chicks of the new cock line in both sexes, the ratio of muscle in the body was higher in the TETRA-H chicks at 12 weeks of age. The change was observed between 6 and 8 weeks of age in both sexes.
Examining changes in the body fat content it was established that its ratio in the body decreased continuously in the TETRA-H cocks during the whole experimental period (*Figure 3*).

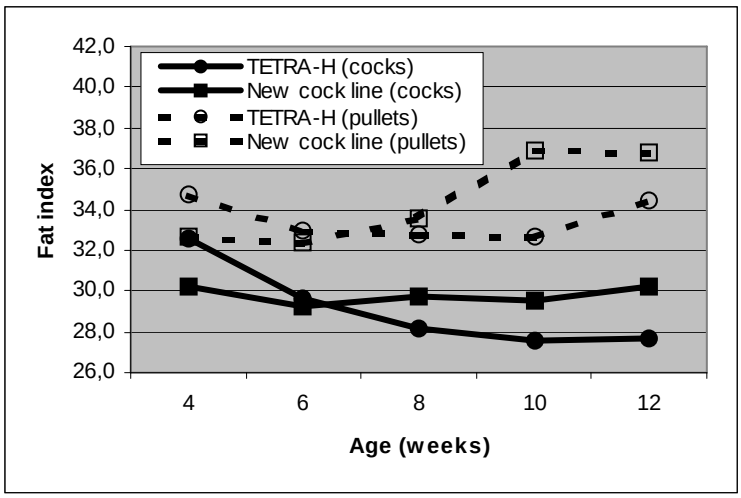

Figure 3: Changes in the fat index of TETRA-H chicks and chicks of the newly developed cock line between 4 and 12 weeks of age

In spite of this the fat index did not show any changes in the cocks of the new cock line, because its value remained always the same during the whole examined period.
In the case of the pullets the body fat content decreased till 10 weeks of age in the TETRA-H genotype, while it was increasing in the new cock line during the same time. In the last two weeks of the experiment it was increasing in the TETRA-H pullets, while it remained at the same level in the new cock line.
At the end of the experiment the fat indices were higher by more than 20% in the case of the pullets than in the case of cocks in both genotypes (21.9% in the case of the new cock line and 24.2% in the case of the TETRA-H birds).

CONCLUSIONS

Based on the results it was concluded that the liveweight of the chicks of the new cock line is significantly higher at 12 weeks of age than that of the TETRA-H chicks, but their body composition changes are more unfavourably during the whole rearing period. Therefore, while increasing the liveweight of the TETRA-H birds using this new cock line as parental line in the breeding programme, it should be taken into consideration that it is important to preserve the favourable changes in the body composition of the TETRA-H birds.

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