COMPARISON OF CHARACTERISTIC COMPONENTS FROM CHICKENS OF DIFFERENT GENOTYPE KEPT IN "INTENSIVE" AND "EXTENSIVE" FARMING SYSTEM

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Keywords: Meat quality, nutritive value, chicken genotypes, farming systems.

Background

There is a permanent requirement to produce a better quality of meat for direct consumption one hand, and as basic material for the meat industry, the other hand.

Quality means in this respect: 1/ Better organoleptic characteristics: colour, flavour, tenderness. 2/ Improved technofunctional properties (e.g. water-binding and emulsifying capacity, including stability against lipid peroxidation. 3/ Better nutritive value, higher nutrient concentration in an available form. 4/ Altered composition for protecting human health meaning a decreased liability for lipid peroxidation.

In order to solve these problems as the first step the effect of so-called "extensive" and "intensive" farming systems were examined on the meat characteristics of Broiler (Arbor Acres) and Transylvanian-naked-neck chickens. Broiler production is increasing throughout the world and processing yield and deboned meat yields are becoming important because of the growing market demands caused by the demographic explosion.

Objectives

Chickens from two different genotypes (Broiler and Transylvanian naked-neck) were used for determining nutrients, water-holding capacity and lipid peroxidation characteristics. Male and female chickens of the first strain and male of the second strain were received from the Breeding and Feeding Research Institute for Small Animals, Gödöllő, Hungary.

The chickens were kept in "extensive" and "intensive" farming systems. In the "intensive" farming system the chickens were placed in a closed area of a big building and the chickens were fed with adequate diet until 52 days.

In the "extensive" farming system, the chickens were placed in a bigger building with higher ceiling and the chickens were fed in the first week with the same diet as the other group followed by a grower diet of seeds (maize, barley, rye), and some other products of agriculture and green forage until 117 days.

The cuts of chickens used in these experiments were chest and legs.

Methods

Moisture, crude fat and protein were measured according to the analytical manual of AOAC.

Water holding capacity was determined according to Hamm [1].

Cholesterol content was determined after the separation on GLC.

Determination of fatty acid composition was determined by GLC by the methylated form.

The activity of superoxide dismutase (SOD) was measured photometrically at 480 nm by the inhibition of adrenaline autooxidation as described by Sun and Zigman [2].

Thiobarbituric-acid-reactive substances (TBARS) were determined by Ramanathan and Das [3] and the results were given as malondialdehyde (MDA) ng/g meat. The determination of iron, zinc and copper were carried out by AAS technique after dry-ashing (Perkin-Elmer Manual) [12].

Conjugated dienes were assayed at 233 nm in extract of 2 g samples in 10 cm^3 isooctane as described in AOAC.

Thiamine (Vitamin B_1) was evaluated by a microbiological assay (György and Pearson) [5].

Riboflavin (vitamin B_2) was assayed by HPLC technique (Barna & Dworschák) [6].

For statistical evaluation, a two-tailed student's-test and analysis of variance were used where appropriate

Results and discussion

The Broiler chickens kept "intensively" have higher body mass and also the muscles weight of chest and leg of male and female Broiler chickens were much larger than those kept in "extensive" way. There was no significant difference in the muscle weights of Transylvanian-naked-neck genotype among the two different farming systems.

The legs of Broiler chickens kept "extensively" had significantly higher water holding capacity than those of "intensive" system.

It was found that the protein content of Broiler legs kept "extensively" was significantly higher, than that of the other group.

The crude fat content of both genotypes kept "intensively" was significantly much higher than those of "extensive" system. Only the chest samples of Transylvanian chickens make an exception. The results may be due to the more intensive physical activity caused by the latter system.

Regarding to the fatty acid composition, myristic and palmitic ratio which can be regarded as risk factor in atherogenic processes was significantly higher in the Broiler meats samples kept in "intensive" system.

Cholesterol levels did not show any significant differences between the animals from the two keeping practices. However in the leg samples from the "intensive" group, a strong tendence for elevation of cholesterol concentrations was observed which might be due to the firmer membranes in the tissues.
As for the lipid degradation products the amounts of conjugated dienes were found much smaller in the leg and also significantly lower in chest meat of Broiler chickens and leg meat of Transylvanian-naked-neck animals kept in "extensive" farming system as compared to the samples of the other system. There were found a good correlation between the conjugated diene level and the fat concentration ($r = 0.82$) in the legs and chests of Broilers.
TBARS formed from lipid peroxidation were lower in the meat kept in extensive way, especially in leg samples although the differences did not prove to be significant in all cases. The results are in good agreement with the data of Dworschák et al [7] who carried out an experiments with pigs of various keeping practices.
The elevated lipid peroxidation processes could be explained by the higher fat contents in animals kept "intensively".
As for the enzymic defence system, there was no significant differences in SOD activities in the chickens kept intensive and extensive farming systems.

In all cases iron and zinc levels were higher and many times significantly in the meat of both genotypes kept "extensively" as compared to the "intensive" farming system. The reasons of these results can be explained by the different diets one hand, and the stronger metal-binding capacity of the proteins in the muscles kept "extensive" way, the other hand.
The higher nutritive value of animals from the former farming system can be emphasized by the fact that trace elements are in a special good available form in meats.
As for the vitamins, it can be seen that there was a highly significant elevation of thiamine content in Broiler and Transylvanian chickens kept "extensively". There was only a significant difference in riboflavin content in the leg parts of Broilers in favour of the "extensive" way.

Conclusion

"Extensive" and "intensive" farming systems had different influence on characteristics of the meats from the two chicken's genotypes of Broiler and Transylvanian-nacked-neck.
"Extensive" farming system resulted generally meats richer in proteins, some vitamines (B_1, B_2) and essential trace elements (Fe, Zn) showing a higher nutritive value as compared to the other keeping way. As for technofunctional properties "extensive" system was superior regarding to a higher WBC in leg of Broiler chickens connected probably with the elevated protein and zinc content.
However "intensive" farming systems produced much higher quantity of meat and proved more economic especially for Broiler chickens but this was coupled with the loss of numerous qualitative characteristics.

Transylvanian-naked-neck chickens were less influenced by keeping ways.

The lower values for the characteristics of lipid peroxidation in the meat derived from the "extensive" farming system prognose a longer shelf life in meat products and also healthier basic materials. Less intensive lipid peroxidation can be associated with the low fat content because superoxide dismutase activity gave no difference between the two keeping systems.
Results from chickens correspond with those gained from pigs at the similar experiments of Dworschák et al [7].

References

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