

INFLUENCE OF PRE-SLAUGHTERING FACTORS ON CARCASS AND POULTRY MEAT QUALITY PRODUCED IN AN INTEGRATED SISTEM

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Abstract

The aim of this paper is to study some factors influencing poultry meat quality before slaughtering (raising management, diet, catching and loading, transport and unloading) and to analyze quality and shares of different carcass parts in ROSS 308 hybrids raised and slaughtered in an industrial farming environment. 50 females and 50 males were designed for this purpose. Birds were randomly chosen from a slaughtering group of 50 days of age. Parameters which were on sex separately analyzed were live weight, defects due to handling, slaughtering output, breast and legs meat output and fat percentage from carcass. Experimental data were statistically processed determining: average, standard average deviation, variation coefficient. Results obtained in males and females separately, were compared with standard ROSS 308 hybrid by Student test. Revealed deficiencies (significant differences between experimental and standard flock's live weight, high proportion of carcass faults) are leading to the conclusion that production management, house microclimate, handling methods and chicks transport are having significant shortcomings, but with no influence on slaughtering output.

Key words: quality factors, slaughtering, poultry, meat

INTRODUCTION

Quality and quality control are the most frequent terms used in our days, but their understanding depends on the context in which they are used. In poultry production, quality and quality control requires good management throughout the production chain, aimed, on one hand to improve performance and therefore increase profitability, and on the other hand the development of products according to standard limits. People involved in meat production must realize that the main purpose of the entire production system is to serve the consumer.

This paper aims to study the main factors that influence the quality of poultry before slaughter, reflected in the quality and weight of various components in the carcass of hybrid ROSS 308, grown and slaughtered in commercial farm conditions. Among the pre-slaughter factors that influence poultry meat quality we find: catching and loading

chickens in cages, putting them in transport-vehicles, the transport itself and climate conditions from inside and outside, as well as the time to destination.

Since in the near future consumers will be more sensitive to issues of quality poultry, it is desirable to improve permanently the quality aspects of housing and poultry meat, by implementing a customer information system from the production line for optimizing its quality and uniformity. Improved quality is possible only when in all stages of meat production is incorporated quality control methods and when these methods are simple and practical.

A production line is composed of the following steps:

Manufacturer of hybrid (genetic) - producer of eggs for hatching - incubation - poultry meat farms - nutrition (mixed fodder factory) - veterinary services - slaughter - processing - packaging - distribution - sales.

Since in the production line for poultry, producers of hybrid (genetic) play a very important role, we propose to study hybrid ROSS 308, one of the most productive and

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worldwide spread. Companies that produce hybrids are always searching to improve the production line and have a great influence on nutritional quality, sensorial and other indicators, such as: the ratio meat/bone, ratio white meat/red meat (% chest meat), and the amount of carcass fat. Also, broilers conformation is a combination of muscle and bone development. Growth uniformity can be obtained by selecting gender in the first day of hatching, and growing roosters and chicks separately. Good coverage with feathers, strong skeleton. Genetic improvement

companies should aim continuously to produce birds free of diseases such as: MG, MS, EDS, Salmonella, etc. Results obtained from experiments were compared to standard hybrid performance.

Final product quality is influenced by several factors acting before slaughter, during slaughter and processing up to the final product. Throughout the production chain factors that lead to a certain quality of meat are shown in table 1.

Table 1 The quality of poultry meat produced in an integrated system

TYPE OF FARM	TIPE OF OPERATIONS	OBJECTIVES
Reproduction	Poultry management Collecting eggs Storing eggs Egg transport	Making good quality eggs for incubating
Incubation	Incubating the eggs	Producing high quality chickens
Growing farm	Collecting and handling of chicks Chicks transport First period in chicks life Growing management Depopulation Transport	Keeping good quality chickens Increase appetite Development of immune functions Optimal development of the skeleton and cardiovascular system
Slaughter-house	Slaughter Distribution Sale	Optimal carcass quality

Following [2] pre-slaughter factors affecting poultry meat quality can be divided into two categories: long-term effect and those who have short term effect. Long-term factors acting throughout the life of the bird, such as genetics, physiology, and disease management. Long-term factors: broiler growth management has an important influence on muscle growth, composition and its development. Factors affecting short-term quality of the meat are the ones who work during the last 24 hours of bird life. The most important pre-slaughter factors on short term are: diet (elimination of feed), catching, transporting and loading chickens, their transportation and unloading at the slaughterhouse, influence factors for: carcass hygiene, carcass yield, carcass and meat quality and percents of dead at arrival.

1. Bowel elimination. Before catching and loading there is an 8-12 hours feed-withdrawal to allow evacuation of intestinal

contents. This reduces the frequency of faecal contamination of carcasses, which can occur during slaughter. Time of food-withdrawal should be considered, the total time the birds are deprived of feed before processing, including time without food on the farm, during transport and unloading time. Birds lose 0.18% of body weight per hour during the diet, up to a maximum of 0.42% [4]. In the first 4-6 hours, weight loss is due to stomach cleaning, so does not affect performance. After 6 hours have losses of moisture and nutrients, which influence the yield [9]. The length of the period in which the digestive tract is empty is influenced by environmental conditions in the shelter (temperature, light) and management practices affecting feeding patterns of birds. Long period of feed withdrawal lowers the level of glycogen and ph muscle.

2. Catching and loading. Carefully handling birds to reduce injuries, was

reported as a crucial element in reducing mortality and carcass defects (bleeding, bruising, fractures). Areas most affected are the chest, wings and legs.

3. Carriage. During transportation, birds are exposed to a variety of potential stress factors, including the transport temperature, acceleration, vibration, impacts, deprivation of food and water, noise [3]. Transportation of broilers result in an average mortality of 0.3 - 0.4% and the death rate increases with duration of transport [5], [6], [7].

4. Unloading. On arrival at the slaughterhouse, crates are unloaded and kept in a safe area. Studies show that keeping birds at different temperatures may influence meat quality. There are reports of lower pH in birds kept at higher temperatures compared to chickens kept in cooler areas [1].

MATERIAL AND METHODS

This study was conducted on 50 days old broilers, Ross 308, raised in a single housing, with permanent bedding. Experimental plan to assess the quality of meat and its influential factors before slaughter and slaughter yield provided the killing of 50 males and 50 females, randomly selected from a batch of 20,000 heads. Birds were selected from the same production house to meet a key criterion: the same growing conditions. Broilers came from parents aged 31-32 weeks, average fertility of 93.6% and 88.9% rate of hatching. During their growth recorded a mortality of 9%.

Feed-withdrawal before slaughter was 11 hours, between 8 and 12 hours is recommended. Loading chickens in cages and in the means of transport was done manually and the density was 171.8 cm²/body weight, with 11.8 cm²/body weight

over the legislation [10]. The distance between farm and slaughterhouse was 5 km, and during transport mortality was 0.1%. At the slaughterhouse, the chickens were weighed separately by gender, and then each carcass was weighed, after each stage of processing on the slaughter line. Defects were identified in each housing part, resulted the percentage of each type of fault.

The following indicators were calculated separately for each gender: cutting yields, meat-bone ratio and carcass fat %. Experimental data were processed statistically determining the arithmetic mean (x), variance (s²), the standard deviation of the mean (sx), coefficient of variation (v%), Student test.

Slaughter yield of cocks and pullets was calculated using the following formula: Efficiency R% = (Cc + St + Co) x 100 / I. + GTE + P + S + V + PN.

In which: C.c. = hot meat obtained; St = finishing waist (2% of hot meat), Co = seizures, I = industrialized (raw weight - dead weight), GTE = Crop, trachea, oesophagus (2% in industrialized countries), P = feathers (5% in industrialized countries), S. = blood (1% in industrialized countries), V = viscera, PN = Bad products (4% in industrialized).

The results were compared with standard hybrid ROSS 308, 50 days old at slaughter. It was also weighed separately the fat storage and fat from the viscera and offal (gizzards), determining the composition of the carcass weight of these deposits.

RESULTS AND DISCUSSIONS

The average weight of live and slaughter statistical parameters of the batch being shown in table 2. There is a lot better uniformity of both males and females.

Table 2 The average weight and statistical parameters (g)

TYPE	Male		Female	
	$\bar{X} \pm s_{\bar{X}}$	cv%	$\bar{X} \pm s_{\bar{X}}$	cv%
ROSS 308 STANDARD	3634 ± 0.028 aaa	8	3061 ± 0.021 bbb	8
ROSS 308 EXPERIMENT	3047 ± 0.035 aaa	8.20	2544 ± 0.028 bbb	7.84

Note 1: Values sharing the same letter are significant and values having three letters are highly significant

Average performance increase of 50 days old chickens selected for the experiment led to a weight of 3047 ± 0.035 g male and 2544 ± 0.028 g in female. Body weight of females was 16.5% lower than males.

Note significant differences between standard weight and weight of the experimental group. It is known that body weight influences the composition of meat, so that birds have a small weight of dry matter and low fat but high in minerals and

protein. Also, the uniformity of the lot is not only a quantitative indicator of production, but may indirectly influence the quality of housing, especially commercial aspect, the possibilities of adjustment the equipment during slaughter process is hampered.

Carcass defects due to the method of growth, during 0-50 days and time manipulation of catching and loading, transport and unloading, are presented in table 3.

Table 3 Carcass defects from handling

Defects	Roosters (%)	Chickens (%)
- Chest wounds	24	20
- Contusion	82	48
- Skin scratches	10	0
- Bone deformities	0	6
- Skin defects (blisters, pustules, oedema, abscess)	18	22
- Dislocation or broken bones	28	18

Influence of growth on meat quality was determined after the percentage of chest injuries: 24% in males and 20% in females, less prone to this due to lower body weight.

Chicken proportion was 82% contusion in males and 48% in females. Contusions registered were due to growth conditions about 35%, 40% to the loading team and the remaining 25% occurred during transport, unloading and clinging.

Catching, loading, transporting and unloading weaker chickens at the slaughterhouse, raised the % of chicken with bruising to 82% in males and 48% in females, the % of chickens with scratches on the skin: 10% in males and 90% in females,

the percentage of birds with dislocation or broken bones - 28% in males and 18% in females. Large proportion of chest wounds, bruises and broken bones, show a slow and poor handling of poultry for slaughter, probably favoured by the heavy weight at slaughter age.

In the above formula introducing the results of the cocks and chickens, slaughter yield was 73.36% and 73.21%. It can be concluded that efficiency does not vary by sex and is not significantly different from baseline values at the same age than hybrid males 73.71% and 72.19% in females.

Chest weight and that of boneless legs are presented in table 4.

Table 4 The weight of the flesh in 50 days old chickens and roosters

TYPE		Standard ROSS 308		Experimental ROSS 308	
		x ± s x (kg)	cv%	x ± s x (kg)	cv%
Chest meat	roosters	0.724 ± 0.008	8	0.690 ± 0.011	9.28
	chickens	0.555 ± 0.006	8.0	0.557 ± 0.010	12.74
Legs meat	roosters	0.582 ± 0.006 a	8.0	0.490 ± 0.005 a	8.0
	chickens	0.555 ± 0.006 bb	8.0	0.425 ± 0.006 bb	10.11

Note 2: Values having the same letter are significant and values having one letter are significant and values having two letters are highly significant.

Boneless thighs, the experiment had a weight of 7.22% less than standard, $540 \text{ g} \pm 0.007 \text{ g}$ to males and 13.3% lower, $425 \text{ g} \pm 0.006 \text{ g}$ for females, compared to 582 g in

males and $490 \pm 0.006 \text{ g} \pm 0.005 \text{ g}$ in females in the standard group. Testing differences show a significant difference in males and females separately for standard material.

Among the factors before slaughter, broiler growth has a significant effect on muscle growth, composition and its development. Thus, the experimental group, the management of chickens during growth of the chest provided a weight significantly different from the standard weight and a significantly lower leg in males and females significantly less distinct.

From the above results can be seen that the chickens have 0.5% fatter on the gizzards and organs than the roosters. In terms of fat percentage deposits are similar in the two sexes. It is known that between the carcass and the total fat in the caudal store is a correlation of 0.76. So the amount of fat in the carcass is very important in terms of

certain aspects of meat quality, especially in connection with: colour, tenderness and flavour.

Also in specialized literature [8] there is a classification of quality depending on the proportion of internal fat, related to carcass weight, namely:

- Poultry quality I - 4.4% internal fat
- Poultry quality II - 2.1% internal fat
- Poultry quality III - 0.9% internal fat

The data presented in table 5 can help determine total fat carcasses at the experimental group: the roosters 1.34% and the chicks, 1.8% fat deposits, which can lead to a downgrading of carcasses towards a lower category.

Table 5 The share of fat deposits in the average carcass weight at the two sexes

Roosters		Chickens	
The fat in gizzard and organs %	Caudal deposit of fat %	The fat in gizzard and organs %	Caudal deposits of fat %
0.6	0.74	1.1	0.7

CONCLUSIONS

The average weight of live chickens at 50 days selected for the experiment was 3047 ± 0.035 g for males and 2544 ± 0.028 g for females. Performance achieved by the offspring of the experiment is below standard performance of the hybrid at the same age (50 days) meaning 3634 g in males and 3061 g in females. Testing the significance of differences using Student test shows that the differences are very significant. Note that the uniformity of experimental groups, which achieved a coefficient of variation of 8.2% in males and 7.84% in females.

The most important pre-slaughter factors were: growing technology 0-50 days, catching and loading chickens, transport and unloading at the slaughterhouse. The influence of these factors on meat quality was measured by the percentage of chest wounds of 24% in males and 20% in females, the percentage of chicken with contusions, 82% males and 48% in females, the percentage of carcasses with scratches skin, 10% in males and 0% in females, the percentage of birds with broken bones or dislocation, 2.8% in males and 18% in females.

Chest wounds high proportion at the end of the growth cycle shows deficiencies in ensuring a proper environment that led to damage bedding.

The large number of bruises and broken bones shows a wrong handling of birds for slaughtering, due to an older age of the live poultry at slaughtering.

Slaughter yield obtained in the experiment, the entire batch was by 73.36% to 73.32%, males and females. The values obtained are close to standard values at the same age, respectively 73.71% and 72.19% in males and females.

General recommendation that can be done following results refers to the compliance technology growth and handling of poultry before slaughter and slaughter compliance technology to minimize the negative effect of factors that influence meat quality, before slaughter and during slaughter. It shows that the main factors influencing meat quality prior to slaughter are related to the implement of technology to increase accuracy, methods of catching and transport conditions of poultry.

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