CARCASS CONFORMATION AND MEAT QUALITY OF DUAL PURPOSE POULTRY IN COMPARISON TO BROILER AND LAYER GENOTYPES

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Abstract – Currently there is an ethical discussion about the practice of culling 1-day old male layer chickens. A solution to avoid this problem could be to use dual purpose genotypes in the poultry production. Therefore, the aim of this study was to compare carcass and meat quality of three dual purpose genotypes (Lohmann Dual, Mechelner and Schweizerhuhn) with broiler and layer genotypes. Concerning carcass conformation and meat quality the intensive broiler line performed best. From the dual purpose genotypes only Lohmann Dual was able to compete with an extensive-growing broiler genotype in terms of carcass and meat quality.

Key Words – carcass appearance, chick culling, fattening

I. INTRODUCTION

The production of meat and eggs is extremely specialized in the global poultry sector. Thus, poultry is bred and reared either for egg or for meat production. This system is of increasing ethical concern to the public as a large number of healthy 1-day old male layer chicken are culled due to their inability to lay eggs and their low meat accretion. Two German federal states intend prohibit this practice, other countries may follow. Therefore, either suitable dual purpose genotypes are needed which are satisfactory in both, egg and meat production, or the layer genotype males would have to be fattened. Especially in the latter alternative, the expected low feed conversion efficiency (FCR) is of concern from a world nutrition point of view. In addition, the consumers' purchase decisions will be influenced by carcass conformation both when marketed as entire carcasses (the consumers prefer a carcass with well developed breast meat [1] and a prominent keel bone is unappealing) and when breast meat is sold alone (small, flat cuts). Also a high meat quality (water-holding capacity, tenderness etc.) is of importance. Since recently, there are attempts for creating new dual purpose lines by large breeding companies, but there are also a number of ancient dual purpose breeds available which were not yet specifically selected for performance. Therefore, the aim of the present study was to determine the degree to which ancient and novel dual purpose genotypes perform in carcass and meat quality compared with broiler and layer genotypes. These results shall enable to determine how much dual purpose genotypes are superior to male layer genotypes and if they may compete at least with slower growing broiler genotypes used especially in organic farming.

II. MATERIALS AND METHODS

A total of six genotypes were compared. Three dual purpose genotypes (a novel line called Lohmann Dual, LD; the Belgian Mechelner breed, ME; the Swiss Schweizerhuhn, CH) were included in the comparison. In addition, two positive controls (the fast growing broiler line Ross PM3, C++, and the slower growing broiler line Sasso 51, C+) and a negative control (layer genotype, bred for the organic market, Lohmann Brown Plus, C–) were part of the experiment. Nine birds per genotype were either kept in pairs in cages of 0.6 m^2 or in groups in boxes of 1.7 m^2. All birds received the same intensive broiler fattening diet (calculated contents of metabolizable energy and crude protein: 13 MJ and 198 g/kg as fed). Birds from the C++ genotype were fattened for the conventional period of 35 days, the other genotypes for 63 days as prescribed for organic farming in Switzerland. Body weight (BW) was determined weekly. At slaughter, carcass, breast meat and legs were weighed, and breast meat yield (BMY) as well as leg proportion (LP) were calculated as the ratio of breast meat or leg weight of carcass weight. Breast angle was recorded as a measure of keel bone appearance on the carcass, where a small angle was equivalent to a prominent

keel bone. For determining thawing and cooking loss, the right breast muscle was weighed prior to freezing, after being thawed and after being cooked to a core temperature of 74°C in a water bath. Shear force was subsequently measured with a Volodkevich device [2] mounted on a texture analyzer (TA-HAD, Stable Micro Systems, Godalming, UK). Intramuscular fat content was determined in the homogenized left breast and left leg meat. For that purpose, skin, superficial tendons and adherent fat were removed before homogenization. In the meat homogenate, ether extract was then determined after hydrolyzation of the sample in 4 M HCl (method 319 of the Swiss Food Manual [3]). Data were subjected to ANOVA using SAS 9.3 with genotype as fixed effect. For multiple comparisons among the Least Square Means, the Tukey-Kramer option was used.

III. RESULTS AND DISCUSSION

As expected, there were large differences ($P < 0.05$) in daily body weight gains between C++ (68 g/day) and the other genotypes (38 and 34 g/day for C+ and LD, 27 g/day for ME, 20 and 19 g/day for CH and C–). Dressing percentage was lower ($P < 0.05$) for C+ and LD compared to C++ (69, 67 and 73 %, respectively). This caused differing carcass weights between C++ and LD, with intermediate values for C+ (1760, 1454 and 1677 g, respectively) even though final body weights had been similar. The carcass weights of CH and C– birds were lowest (around 800 g). The BMY was highest ($P < 0.05$) for the C++ birds followed by C+ and LD (30, 20 and 19 %, respectively), then ME, CH and C– (all 17 %). The lowest ($P < 0.05$) LP was found in C++ (30 %), C+ and CH were intermediate (33 and 34 %) and LP was highest in LD, ME and C– (36, 36 and 35 %, respectively). The BMY of the LD was only slightly higher than anticipated from the breeding company [4] whereas the LP was clearly higher in the present experiment.

The extensive broiler line C+, which is preferentially used in organic poultry production, showed the highest ($P < 0.05$) abdominal fat content, 70 g, which is almost the double amount of the next largest one (LD, 37 g). This is likely the result of the intensive fattening diet, which was suboptimal for this genotype.

The only carcasses in which no keel bone was apparent (breast angle of 180°) were those from C++. For C+ and LD there was a visible keel bone (breast angles between 115 and 100°), but this did still only moderately affect the appearance. However, carcasses of ME, CH and C– expressed a very prominent keel bone (breast angles between 70 and 80°).

Concerning the meat quality traits investigated, C++ mostly performed best. Accordingly, the lowest ($P < 0.05$) shear force of the breast meat, 8.7 N, was found in C++ birds (breast meat of all other genotypes was similar and ranged between 10.8 and 12.1 N). It is known that an increasing storage time may cause more thaw exudate [5]. Still the breast meat of C++ exhibited the smallest thawing loss (2.8 % vs. 3.3 to 5.0 % in the other genotypes) although this meat had been kept 4 weeks longer in frozen storage. However, cooking loss was highest in C++ instead (16 % vs. 8 to 12% in the other genotypes).

Even though the amount of abdominal fat and adherent fat had been largest in C+, the intramuscular fat content was found to be lower in breast meat (11 g/kg) and similar in leg meat (40 g/kg) compared to C++ (breast = 15 g/kg; leg = 40 g/kg). The numerically smallest intramuscular fat content in breast and leg meat was found in C– with 7 and 27 g/kg, respectively. The finding that layer hybrids exhibit less abdominal fat than broilers is consistent with the study by Gerken *et al.* [6].

IV. CONCLUSION

None of the dual purpose genotypes performed as well as the intensive broiler line in both growth performance and product quality, but the novel breeding line LD could largely compete in carcass conformation and meat quality with a more extensively growing broiler line. It was, however, noted that the LD carcasses were more heterogeneous in weight, appearance and quality than those of C+. The genotype CH remained only at the level of the layer genotype and ME was only slightly superior to CH and C–. This suggests LD, or potentially other hybrids [7], could be the dual purpose genotypes of choice in case 1-day old chicks may no longer be culled, whereas fattening C– would be overall preferable to fattening ancient

dual purpose breeds not specifically selected for growth and egg laying performance.

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