BROILER CARCASS QUALITY

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Summary

Live production practices have a major influence on quality of birds in the processing plant. Field observations indicate that operational and financial constraints often placed for “least-cost production” under commercial conditions hinder or limit the implementation of flock management programs for optimum carcass quality. Traditional whole carcass quality attributes, as reported by the Agricultural Marketing Service (AMS, 1999), are summarized in this review from 1986 to date. This historical data clearly points out the improvements (i.e., conformation, breast bruises and trims), as well as losses in certain quality attributes (i.e., processing defects, skin cuts and tears, wing fractures and trims). Scabby-hip syndrome and cellulitis are two important and interrelated skin quality factors that are reviewed within the context of carcass downgrading.

Introduction

The growth and expansion of the broiler industry has been phenomenal world-wide, especially during the last decade. In addition to vertical integration, advances in live production (breeding, nutrition, flock management and health programs) and processing (automation) have provided an economic advantage for poultry as compared to other meat sources. Increases in poultry meat consumption can not be solely attributed to its low cost. Product diversification and wholesomeness has also contributed to increases in broiler meat consumption from 24 lb. in 1960 to 77 lb. In 1996 (Fletcher, 1996). Today, market forms and distribution of broilers reflect changes in consumer demand for ready-to-cook (rtc) and ready-to-eat (rte) products. Cut-up parts and further-processed products now accounts for 46% and 36% of over 8 billion broilers marketed in the US, respectively.

In spite of all the scientific and technological advancements, losses in the form of mortality and dead-on-arrivals (DOA’s) during live production, and whole carcass and parts condemnations during processing continue. This presentation will review the nature and extent of defects associated with broiler carcasses since 1986, with an emphasis on skin quality.
Carcass condemnations and trim losses

Broiler production exceeded 8 billion in 1998, with an average live weight of 4.86 lb. (USDA, 1999). During this period, ante-mortem (primarily DOA’s) and post-mortem condemnations were 0.55% and 1.69%, respectively, of total broilers processed. Nearly one-half of post-mortem condemnations were due to whole carcass losses associated with flock health during live production (septicemia/toxemia, airsacculitis, leukosis, synovitis, tumors and cellulitis) and plant operation (cadavers, overscalding, and mutilation contamination). The remaining losses are attributed to parts condemnations arising from trimming of localized infections (airsacculitis, gall, and cellulitis salvage) and various trimmable carcass defects. Bruises and hemorrhages, discolorations, breast blisters, skin lesions (sores, scabs, inflammations), broken and dislocated bones, and extraneous contamination (gall and retained yolk) are the primary lesions that must be trimmed prior to chilling to meet the rtc requirements in broilers. These lesions are either trimmed online or at an approved off-line salvage area during processing.

The Agricultural Marketing Service (AMS) is a branch of the USDA responsible for voluntary carcass grading service available to the processors in the US. To be eligible for grading, carcasses first must pass inspection and meet the rtc criteria imposed by the Food Safety and Inspection Service (FSIS) of the USDA. According to AMS (1999), in the 100+ plants utilizing the grading services in 1998, 58% of the broiler carcasses were classified as Grade-A, with 15% of the carcasses not meeting the rtc requirements (i.e., no grade assigned). Processing defects (i.e., excessive feathers and remnants of viscera remaining on the carcass) were the primary reason for no-grade classification. Primary causes of undergrades, which averaged 27%, are summarized in Figure 1. Bruises and hemorrhages, trims (wings, drum, and skin), and broken/dislocated bones were the major defects observed post-chill.

From a historical perspective, carcass defects commonly associated with downgrading have been consistent. An evaluation of the AMS reports indicates that the proportion of undergrades, which peaked in 1990, have been declining. Figures 2 and 3 summarizes the trends in individual carcass defects since 1986. Downgrading due to conformation, bruising (breast, drum, thigh and wing), and breast trims declined, whereas that due to wing trims and no-grade increased. It should be pointed out that, since grading is performed after chilling, carcasses would have already been trimmed to comply with the rtc requirements. Hence, increases in wing trim incidence would reflect removal certain defects (i.e., bruises, gall contamination, and broken/dislocated bones) and consequently a drop in their incidence post-chill.

Skin quality

Optimum carcass quality in broilers require intact skin free of sores, scabs, scratches, tears and other defects that require trimming (i.e., cellulitis, tumors, and extraneous material contamination). Skin lesions have been a recurring problem, especially with the wide-spread use of slow feathering strains or strain-crosses of broilers. Besides genetics,
flock environment and management, nutritional and feeding programs, flock health, bird handling, and processing conditions have also been identified as contributing factors to skin integrity (Bilgili, 1990; 1997). Skin quality is primarily determined during grow-out and later altered during processing, depending upon the scalding and picking conditions (Fletcher and Thomason, 1980; Sams et al., 1990; Bilgili et al., 1991).

Scabby-hip syndrome, characterized by narrow scab-covered scratches or circular dry crusted scabs between feather follicles in pelvic back and hips, results from toe scratches inflicted as broilers climb on one another (Page, 1974; Harris, 1977; Hargis et al., 1989). Scabby-skin is thickened and discolored, and easily torn during processing. Late or marginal feather cover, either due to use of slow-feathering strains (male broilers) or nutrition-feeding program associated feathering problems certainly contribute to the incidence and severity of this problem. Leeson and Sumers (1997) and Hess et al., (1999) recently reviewed the nutritional factors, including methionine and cystine levels, vitamin and mineral deficiencies, thyroid function and mycotoxin exposure, involved in feathering problems. Flock environment and management probably has the greatest influence on skin quality in broilers. High bird placement densities, especially when calculated as pounds per square foot, correlate directly with the incidence of scabby hips and scratches in broilers (Proudfoot et al., 1979; Proudfoot and Hulan, 1985; Frankenhuys et al., 1991; Bilgili et al., 1991; Bilgili and Hess, 1995). Other management factors, such as house environment, partial house brooding, feeder and drinker space, bird migration, restricted lighting and feeding programs, and feed outages have also been correlated, under commercial conditions, with skin sores and scabs in broilers (Bilgili and Horton, 1995).

Cellulitis or infectious process (IP) is inflammation of the subcutaneous tissue of broilers, usually with E. coli, through loss in skin integrity. IP has become a leading condemnation category in recent years (Morris, 1994; Norton and Bilgili, 1996). Carcasses exhibiting discrete and localized lesions can be trimmed through USDA approved on-line or off-line salvage programs, whereas those carcasses with diffuse lesions indicative of a systemic infection are condemned. Serotypes of E. coli isolated have been shown to differ in their ability to reproduce IP lesions, as compared to fecal or airsacculitis isolates (Peighambari et al., 1995a,b). Recent research data with cellulitis induction models indicate that IP develops as a result of loss in skin integrity during grow-out (Johnson et al. 1996; Norton et al., 1997), and that lesions can be seen as early as 12-18 hours after challenge with E. coli. Research conducted both in Canada (Elfadil et al., 1996a,b) and in the US (Bilgili and Horton, 1995; 1996) identified management factors similar to those responsible for scabby-hip condition in broilers. Other skin conditions, such as the oily bird syndrome and skin tearing, were recently reviewed by Bilgili (1997b) and will not be discussed here.

"Value-adding" through cut-up and further processing of whole carcasses, no doubt, decreased the emphasis on traditional quality attributes. However, economic losses due to poor carcass quality are beyond just a drop in market grade, but include losses in efficiency, yield, and product wholesomeness in the plant as well. Carcass, and especially
skin quality of broilers are expected to suffer in production systems operated to produce maximum pounds at lowest cost. As market weights continue to increase and sex-separate rearing gains popularity in further-processing oriented production systems, skin quality is expected suffer with the use of slow-feathering strains and strain-crosses of broilers.

References


Questions

Randy Chick: Does impact of bird density relate to feeder space availability?
Response: Certainly. The impact of high bird density in the house goes beyond just limiting the physical space available to the bird, but also include reducing feed and water access, and increasing pressure on house environment and litter quality as well.

Randy Chick: What criteria cited by the speaker would be advocated as the most important selection parameter for geneticists?
Response: In my personal opinion, the feathering rate and skin integrity are the two most important and also interrelated parameters that should be considered in selection programs.

Morteza Sadjadi: What are your thoughts about mechanical harvesting machines?
Response: Various types of hands-off or automatic catching systems have been developed, but their commercial application have been limited in the past. Mechanical harvesters introduced had the speed desired commercially to catch chickens and in most cases carcass quality was improved compared to manual catching. However, most of them lacked the durability to withstand the rigors of commercial use.
Figure 1. Causes of broiler downgrades (1998).

* Carcasses that do not meet the ready-to-cook criteria
AMS/USDA

* Carcasses that do not meet the ready-to-cook criteria
AMS, 1997

TOTAL UNDERGRADES

YEAR

PERCENT

50
45
40
35
30
86 87 88 89 90 91 92 93 94 95 96 97 98

THIGH 6%
BREAST 21%
DRUM 33%
WING 41%

OIL GLANDS 17%
EXCESS FEATHERS 27%
LONG FEATHERS 42%

NO-GRADE* 15%
A GRADE 68%
UNDERGRADES 27%

NO-GRADE* 15%
A GRADE 58%
DISCOLORATIONS 9%
BREADED TRIMS 0%
LEGG TRIMS 0%
BROOD/BLOD BONES 13%
EXPOSED FLESH 19%
WING TRIMS 26%
BRUISING 27%

OTHERS 74%
BRUISING 26%

A GRADE 58%
UNDERGRADES 27%
NO-GRADE* 15%
Figure 2. Trends in downgrading defects from 1986 to 1998.
Figure 3. Trends in downgrading defects from 1986 to 1998.