11-1956

Consumer Rating of Broilers in Tennessee

University of Tennessee Agricultural Experiment Station

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BULLETIN NO. 255 NOVEMBER, 1956

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AGRICULTURAL EXPERIMENT STATION
THE UNIVERSITY OF TENNESSEE
KNOXVILLE

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The study reported in this bulletin is a contributing project to Regional Project SM-15, Expanding the Markets for Poultry and Poultry Products. Cooperating agencies in the project include 10 States in the Southern Region, and the Agricultural Marketing Service, U.S.D.A. The project was partly supported by funds provided by the Research and Marketing Act.

The author of this bulletin hereby acknowledges the assistance of 41 processors, 275 retail store managers, and 3,804 consumers who cooperated wholeheartedly in the survey. Appreciation is also expressed to staff members of the College of Agriculture, University of Tennessee, and others cooperating in the survey for their suggestions in the preparation of this report.

Cover photograph, courtesy of U.S.D.A.

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INTRODUCTION

Importance and Purpose of the Study

Commercial broiler production in Tennessee increased from one million birds in 1934 to over 13 million in 1955 (Appendix I). The value of broilers produced in 1955 was $9,320,000 which put this enterprise in eighth place in cash receipts from farm marketings in Tennessee. This increased production necessitated important marketing adjustments including widened market areas, and improved processing and merchandising facilities to meet the needs of increased consumption.

Data were needed on the magnitude of the market for broilers in the state. However, few data were available to indicate the per capita consumption of broilers or the important factors affecting broiler consumption and consumer acceptance. This study was conducted primarily for the purpose of obtaining such information.

The first phase of study was designed to assemble information concerning the areas of broiler production and processing in the state; the actual and potential broiler processing capacity; and, to estimate the consumer's rating of the quality of broilers processed. The second phase of the study dealt with the merchandising of broilers and consumer patterns of broiler consumption.

Method and Scope

A survey was made of the 41 broiler processing plants located in 24 counties of the state. From these firms data were secured on plant capacity, processing practices and facilities, broiler prices, and origin of and retail outlets for broilers. A survey was made of 275 retail grocery stores and poultry markets handling broilers purchased from processors located in Tennessee (Figure 1).

To determine consumer rating of the quality of broilers and to obtain poultry consumption data, mail questionnaires were used at each of the 275 retail outlets. Each questionnaire was sealed in a polyethylene bag and placed with the packaged broiler by the retail butcher or meat man. Stores selling only a small number of broilers received 100 questionnaires each, those handling a large number received 200 questionnaires each. Thirty-eight thousand mail questionnaires were distributed, from which 3,804 replies were received from consumer families, 3,611 being in Tennessee. Follow-up letters were sent to consumers who submitted incomplete questionnaires. About five percent of the consumers who returned questionnaires were personally interviewed. The surveys were conducted during the 1955 calendar year.

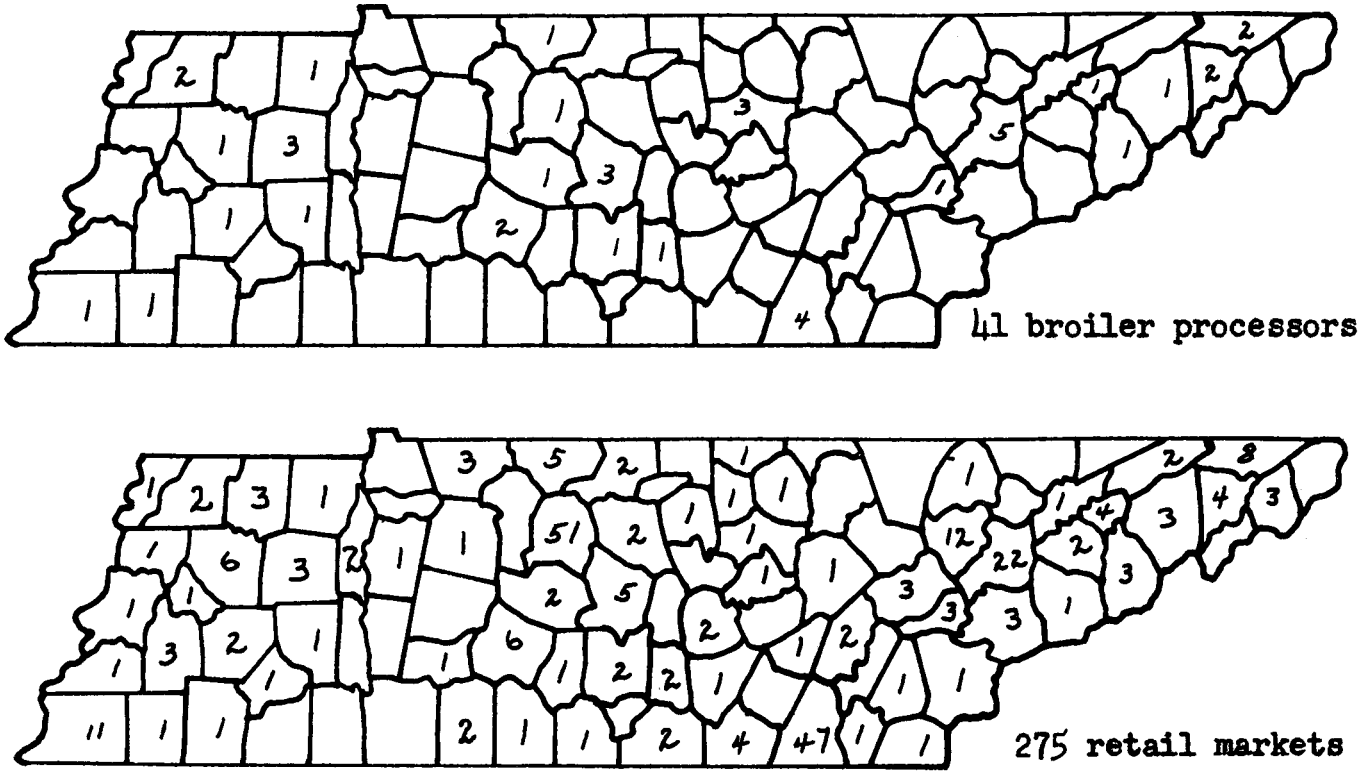


Figure 1.—Number of broiler processing firms and broiler retail markets included in the survey, by counties, Tennessee, 1955.

Characteristics of Consumer Families Studied

General family characteristics of the 3,611 Tennessee consumers who replied to the broiler questionnaire are shown in Table 1. Some comparisons of characteristics of the families studied in 1955 may be made with those of the 1950 Census of Population for the state as a whole. The 5-year difference in Census data and time of survey, however, must be taken into consideration.

Families included in the survey, compared with those of the state in general, appear to be fairly representative with regard to such factors as size of family, occupation, residence, and race. Although family income and formal education increased from 1950 to 1955, it appears that a higher rate of return of replies was received from the families with higher income and education than existed among all families of the state.

The annual per captia consumption figures of all meat and poultry for Tennessee families are compared with figures for the United States in 1955:

	Tennessee (lbs.)	United States[1] (lbs.)
All Meat	121.5	188.2
Meat, excluding poultry	89.3	162.3
All poultry	32.2	25.9
Broilers	24.1	13.4
Other poultry	8.1	12.5

The state per capita consumption figures were arrived at by adjusting the data from the consumers studied for differences in income as shown in Appendix II. As indicated above, a higher rate of return of replies was received from families of the higher income groups than for the state as a whole.

The weight per bird of broilers purchased by the consumers studied averaged 2.1 lbs. This was in agreement with an average of 2.1 lbs. for all broilers sold during the year by 275 retail grocery stores. The equivalent live weight of the broilers averaged about 2.9 lbs.

[1] **The Poultry and Egg Situation**, Agricultural Marketing Service, U.S.D.A., PES-180, November 18, 1955.

Table 1.—Characteristics of Sample of Consumers Purchasing Broilers in Tennessee in 1955, Compared with All Families in the State, 1950

ITEM	Survey 1955	State 1950*
Households, number	3,611	897,000
Number of persons per household, average	3.9	3.8
Occupation of head of household:		
Farmer (owner), percent	13.8	18.2
Farmer (tenant), percent	5.0	7.5
Other	81.2	74.3
Families residing in:		
Town or city, percent	50.1	50.7
Suburbs, percent	28.2	23.8
Country, percent	21.7	25.5
Religion of head of family:		
Protestant, percent	89.2	**
Catholic, percent	5.9	1.8
Jewish, percent	3.0	0.9
No religious preference, percent	1.9	**
Race of head of family:		
White, percent	80.7	83.9
Nonwhite, percent	19.3	16.1
Family monthly income:		
Under $200, percent	23.0	59.0
$201-$300, percent	33.6	19.0
$301-$400, percent	26.1	10.9
Over $400, percent	17.3	11.1
Formal education of household head:		
5th grade and below, percent	18.4	25.0
6th-8th grade, percent	26.9	36.3
H. S. (1-4 yrs.), percent	35.3	28.8
College (1-4 yrs.), percent	19.4	9.9
Family annual per capita consumption: (Ready-to-cook basis)		
All meat, lbs.	121.5	——
All poultry, lbs.	32.2	——
Broilers, lbs.	24.1	——
Other poultry, lbs.	8.1	——
Average weight of broiler purchased, lbs.	2.1	——
Proportion of broilers purchased fresh		
Already cut up, percent	81.3	——

*State data, except on religion, are based on the 1950 Census of Agriculture and Population. Data on Catholics are estimated from the reports to the Chancery of Catholic Churches in Tennessee. Data on Jews are estimated from the Universal Jewish Encyclopedia.

**No data available.

BROILER PRODUCTION AND PROCESSING IN TENNESSEE

Areas of Broiler Production and Processing

Broiler production in the state in 1934 was concentrated mainly in the Chattanooga area but is now fairly well scattered over the state. Leading counties in broiler raising in 1955, in the order of their importance by numbers grown, include Bradley, Hamilton, Obion, Lewis, Sumner, Scott, Knox, Rutherford, Wilson, McMinn, Cocke, and Jefferson (Figure 2).

In 1955 the number of commercial broiler producers in Tennessee was estimated at 675 with an average annual production per farm of 19,592 birds. On 18 farms in six counties the production averaged over 47,000 birds per farm.

The 41 commercial broiler processing plants are distributed in 24 counties and in general are located in or near the areas of heaviest production. In 1955 there were 17 plants in East Tennessee, 13 in Middle Tennessee, and 11 in West Tennessee. Two additional plants in Fentress and Overton counties began operation in 1956.

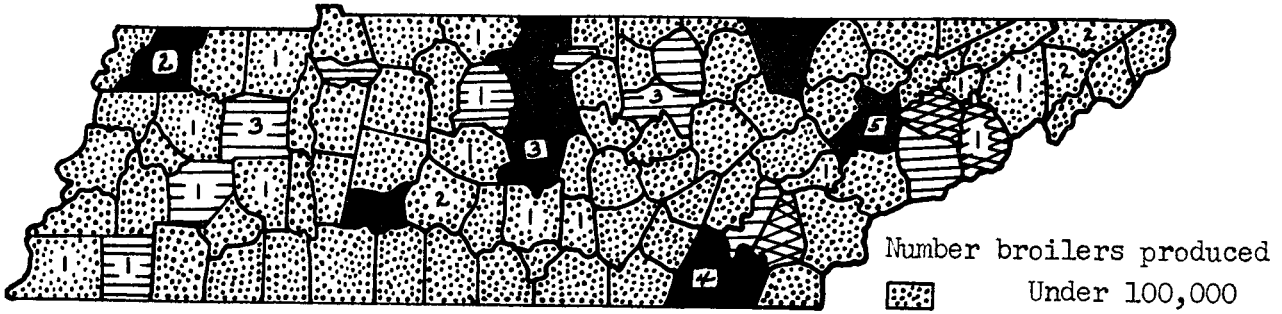
In 1955 about 21,882,000 broilers were processed by the 41 firms in Tennessee but only 8,950,000 of these were raised in the state. In this year Tennessee farm production of broilers was reported at 13,225,000 birds of which an estimated 4,275,000 were sold to processors in adjoining states.

Volume and Capacity of Poultry Processors

Poultry processed per plant ranged from an average of 31,000 birds for the 14 smallest units, to over 3,000,000 birds for the 10 largest units (Table 2). It was estimated that as an average the 41 plants operated at only 76 percent of their potential capacity on a single-shift basis. There is an opportunity for some of the plants to expand broiler capacity by working extra shifts. However, careful study must be made by each processor as to prospects for adequate supply of broilers. This appears to be particularly important in view of the fact that only 13,225,000 broilers were produced in the state in 1955, and of these an estimated 4,275,000 were sold to processors in other states.

Estimated Surplus or Deficit of Chicken Meat Production

Tennessee chicken production (excluding broilers) on a ready-to-cook basis, declined from about 66.8 million pounds in 1943 to 23.1 million pounds in 1955. During the same period broiler production increased from 3.5 to 26.8 million pounds (Appendix III). Important factors which contributed to the decline in chicken production include: (1) increased consumer demand for broilers. (2) increased egg production per layer resulting in fewer flock replacements and fewer hens for market, and (3) increased purchasing of sexed baby chicks for flock replacements resulting in a lower number of cockerels to be marketed.



Figures in each county refer to number of broiler processing plants in 1955.

Source: Reports of 41 processing plants and the 1955 Census of Agriculture.

Figure 2.—Number of broilers produced by counties, and location of broiler processing firms in Tennessee, 1955.

An estimate based on this study, is that Tennessee imported 64,182,000 pounds of broilers in 1955. In that year broiler consumption averaged 24.1 pounds per capita or the equivalent of 82,349,700 pounds of ready-to-cook broilers. Although Tennessee produced 26,846,000 pounds of broilers (Appendix III) about 4,275,000 live broilers, or the equivalent of 8,678,250 pounds dressed and drawn were sold and processed in other states.

Table 2.—Volume and Capacity of 41 Poultry Processors, Tennessee, 1955

Poultry processed annually (no.)	Firms (no.)	Poultry Processed			Poultry Capacity		
		Total (no.)	Per plant (no.)	Broilers (%)	Hourly per plant (no.)	Anual potential 8-hr. shift 300 days (no.)	Unused (%)
Under 50,000	14	437,798	31,271	70	45	1,512,000	71
50,000-149,000	10	1,096,437	109,644	59	113	2,712,000	60
150,000-299,000	7	1,527,646	218,235	80	166	2,788,800	45
300,000 and over	10	30,522,636	3,052,264	65	1539	36,936,000	17
All plants	41	33,584,517	819,135	65*	447	43,948,800	24

*21,881,600 broilers were processed by the 41 firms.

CONSUMER RATING OF BROILERS

The quality and condition in which the broiler reaches the consumer affects the welfare of the consumer and the profits made by producers, processors and retail handlers. A previous study has shown that defects resulting in the downgrading of broilers may arise with the breeder, producer, processor, handler, consumer or a combination of these.[1] Defects resulting in downgrading which may originate with the breeder or producer include poor body formation, poor fleshing, bare backs, sore breasts, breast blisters; crooked, disjointed, and broken bones; and pinfeathers. Defects which may originate with the processor include cuts and tears, flesh and skin bruises, broken bones, improper cleaning, feed left in crop, discoloration, and unpleasant odor due to improper killing and bleeding, pinfeathers, and improper packaging and refrigeration. Defects which may originate with the retailer, where the butcher cuts up the broiler, may include cuts and tears, flesh and skin bruises, broken bones, unpleasant odor, poor packaging, and improper refrigeration. Defects which may be the responsibility of the consumer include improper refrigeration, storage and cooking.

In this survey the consumers were asked to rate the broilers "excellent," "good," "fair," or "poor," according to 10 factors which include the major defects or factors affecting quality. In addition to rating the 10 factors, each consumer was asked to make any comments, favorable or otherwise, regarding the broiler purchased. None

[1] **Graded Poultry in the Consumer Market,** University of Georgia, College of Agriculture Experiment Stations, Athens and Experiment, Georgia, August 1953.

of the broilers were sold on the basis of U. S. grades. However, from the consumers' comments it is belived that the grades of "excellent," "good," "fair" and "poor" might generally correspond to the U. S. grades of A, B, C, and below grade.

Of all broilers purchased by 3,611 consumers included in the study, 34.0 percent rated excellent, 46.9 percent good, 16.4 percent fair and 2.7 percent poor (Table 3). Factors on which broilers were downgraded by consumers, in the general order of their importance were pinfeathers, presence of inedible or unwholesome material, poor fleshing, skin tears and bruises, discolorations, crooked or broken bones, unpleasant odor, and poor wrapping. The rating on general appearance of the broiler seemed to be an overall appraisal of the bird which probably took into consideration the general condition and various quality factors.

About 600 of the consumers made specific statements regarding the broiler purchased. A summary of these comments tended to indicate that the average consumer generally associates the rating of "Excellent" with what may be termed a Grade A broiler. An "excellent" broiler in consumer words appeared to be one that was normal in shape; well fleshed with full breast and meaty legs; thoroughly cleaned inside and out and free from skin bruises, tears, and crooked or broken bones; free from unpleasant odor; practically free from discolorations, pinfeathers and hair; and one that contained all the parts of the broiler, including giblets.

Table 3.—Consumer's Rating of Broilers Purchased by 3,611 Families In Tennessee, 1955

	Item	Broilers rated:			
		Excellent	Good	Fair	Poor
1.	Well fleshed (full breast, meaty legs)	66.7	29.7	3.5	0.1
2.	Freedom from crooked or broken bones	78.8	19.3	1.7	0.2
3.	Freedom from bone discolorations	73.9	24.3	1.6	0.2
4.	Freedom from skin discolorations	70.8	27.3	1.8	0.1
5.	Freedom from skin tears and bruises	68.5	29.2	2.0	0.3
6.	Freedom from pinfeathers and hair	48.8	40.5	9.7	1.0
7.	Freedom from lungs, windpipe, etc.	60.8	32.5	5.7	1.0
8.	Free from unpleasant odor	87.5	11.8	0.6	0.1
9.	Freedom from torn wrapper	89.0	10.3	0.6	0.1
10.	General appearance	72.1	27.0	0.9	—
	All ratings*	34.0	46.9	16.4	2.7

*On the basis of any one of the 10 factors, 34 percent of the broilers rated Excellent, 46.9 percent rated not below Good, 16.4 percent rated not below Fair, and 2.7 percent rated Poor.

According to comments of 600 consumers they generally associated a "Good" broiler with what may be termed a Grade B broiler or one of secondary quality. A broiler rating "Good" was one that was good in general appearance; moderately fleshed; generally free of broken or crooked bones; practically free of pinfeathers, hair, and

discolorations; well cleaned; free from unpleasant odor; and well packaged.

Broilers rating "Fair" might be classed as Grade C in quality. While such birds were considered wholesome and edible they were downgraded because of such factors as inferior appearance; numerous crooked or broken bones; scattered pinfeathers and hair, numerous skin tears, bruises and discolorations; poor cleaning; questionable odor; and inferior packages.

Broilers rating "Poor" may be classed as below grade in quality and in some cases unfit for human consumption. These birds were rated poor because of one or more of such factors as lack of fleshing; numerous defects including broken and crooked bones, pinfeathers and discolorations; the presence of feed in the crop; unusual or bad odor; and poor packaging. This category included four broilers which were returned by consumers to the store manager or place of purchase.

About 20 percent of the consumers commented that such factors as flavor, tenderness and juiciness should have been included in the quality rating of broilers. Palatability ratings were not included in the consumer survey because previous research indicates that such factors are not necessarily related to the grade or quality of the chicken. However, controlled studies indicate that broilers of low grade, compared with those of high grade, show greater loss in weight during the cooking process and may require additional time in preparation for cooking.[1]

FACTORS RELATED TO BROILER QUALITY

Most of the defects affecting quality on which consumers downgraded broilers may originate with more than one person or agency (Table 4). Because of this overlapping all persons concerned—breeder, producer, processor, retailer, consumer—have an interest in broiler quality improvement.

Table 4.—Probable Origin of Broiler Defects Related to Poor Quality and Condition, Broiler Survey, Tennessee, 1955

Broiler Defect	Probable Origin of Defect				
	Breeder	Producer	Processor	Retailer	Consumer
1. Poor fleshing	x	x	—	—	—
2. Crooked or broken bones	x	x	x	x	—
3. Skin tears and bruises	—	x	x	x	x
4. Bone discolorations	—	x	x	x	x
5. Skin discolorations	—	x	x	x	x
6. Pinfeathers	x	x	x	—	—
7. Improper cleaning*	—	—	x	—	—
8. Unpleasant odor	—	x	x	x	x
9. Poor packaging	—	—	x	x	—

*Presence of lungs, feed in crop, windpipe and inedible material.
Source: Based on the comments of two breeders, 8 producers, 41 processors, 275 retail store operators and 600 consumers.

[1] **Graded Poultry in the Consumer Market,** University of Georgia, College of Agriculture and Experiment Stations, Athens and Experiment, Georgia, August, 1953.

The broiler defects, indicated in Table 4, and the possibilities of correcting them, will be discussed separately.

Fleshing

Fleshing is considered to be one of the most important factors of quality in broilers. The large muscles of the body are located along the breast bone and on the thighs and legs of the broiler. For this reason it is particularly important that these parts be well covered with flesh. Consumers included in the survey rated the purchased broilers as to whether the bird was well fleshed; that is, had full breast and meaty legs. About 3.6 percent of the broilers were dropped in rating to fair or poor because of lack of fleshing (Table 3). The proportion of broilers rated fair or poor in fleshing ranged from none for birds processed by one plant to 23 percent by another plant.

Fleshing in a chicken is primarily a matter of breeding, feeding and management. It is closely associated with such factors as health vigor, conformation and fat covering.[1] For these reasons the area of responsibility lies primarily with the breeder and producer. Studies involving the improvement of broilers through breeding were initiated by the Poultry Department of the Tennessee Agricultural Experiment Station in 1947. Among other factors the relationship between body conformation and performance in certain crossbred and standardbred chicks was studied. It was found that chicks from certain crosses gave a higher percentage of breast meat than did the reciprocal cross of other breeds used in the trials.[2] The results of the research on the effects of breeding on broiler fleshing have been given wide dissemination to the broiler industry throughout the state.

For the farmers or firms who produced, processed and marketed their own broilers in the state, there appeared to be more incentive for producing birds of better fleshing. Eight persons or firms in 1955 produced, processed, and wholesaled about 630,500 broilers. Of a sample of 316 of these broilers, consumers rated only 0.2 percent as fair or poor in fleshing. On the other hand, 28 processors purchased all of their broilers. Of a sample of 3,295 of these broilers, consumers rated 3.2 percent as fair or poor in fleshing.

Bone Appearance

A broiler of excellent or Grade A quality is practically normal in conformation. It may have a slightly curved breast bone or other slight abnormality in the shape of the breast bone which does not interfere with the normal distribution of flesh. It may have a slightly curved back and may have one disjointed or broken bone in either a leg or a wing, if there is no evidence of a related bruise or blood clot.[3]

Consumers included in the survey rated purchased broilers as to freedom from crooked or broken bones, and bone discoloration. About

[1] Jull, Morley A., **Poultry Breeding**, John Wiley & Sons, Inc., New York City, 1952.
[2] **Improvements of Chickens Through Breeding**, Tennessee Agricultural Experiment Station, 60th Annual Report, 1947. **Poultry Breeding-Conformation and Performance**, Tennessee Agricultural Experiment Station, 63rd and 67th Annual Reports, 1950 and 1954.
[3] **Poultry Grading Manual**, Agricultural Handbook No. 31, U.S.D.A., February 1952.

1.8 percent of the broilers were rated as fair or poor in freedom from these defects (Table 3).

Crooked or disjointed bones may wholly or partly originate with the producer. However, only four of the 3,611 consumers indicated that the broilers purchased had these defects. The primary responsibility for broken bones lies with the processor or retail butcher who cuts up the bird. The proportion of broilers rated fair or poor in freedom from broken bones ranged from none for birds processed by one plant to 12.8 pecent at another plant. Much of this difference was due to the method of processing and retailing. It was observed at 16 of the 41 processing plants that if broilers had severely crooked or protruding broken bones the birds were cut up and marketed as pieces.[1] The damaged pieces where there was evidence of severe bruise or bone discoloration, were discarded.

In their comments the consumers associated bone discoloration with blood clots occuring with broken bones. Birds that were downgraded because of broken bones usually were downgraded because of bone discoloration. Bone discolorations arises primarily with the processor because of improper killing and dressing technique.[2] The proportion of broilers rated fair or poor in freedom from bone discoloration ranged from none for birds processed at one plant to 7.7 percent at another plant.

The prevention of bone discoloration appears to be partly the responsibility of the retail store operator and the consumer. The proportion of broilers rated by consumers as being fair or poor in freedom from bone discoloration increased from an average of 1.9 percent for 1,592 birds delivered daily to stores, to five percent for 101 birds delivered once a week; the proportion increased from an average of one percent for 2,061 birds eaten the same day purchased, to 4.2 percent for 704 birds stored for three or more days in the refrigerator before being consumed.[3]

If broken or discolored bones do not make any part of the carcass unfit for food the broiler may be utilized in different ways. A recent study has shown that edible chicken injured during processing can be used profitably in poultry specialties such as chicken luncheon loaves, chicken linked sausage, smoked chicken and chicken burger.[4]

Skin Appearance

Broiler skin discolorations, tears and bruises are due largely to rough handling. These defects may occur at the place of production, during transportation of the broilers from the farm to the dressing

[1] Sixteen percent of all broilers handled by 41 processing plants in 1955 were marketed as fresh parts.

[2] **Graded Poultry in the Consumer Market**, University of Georgia College of Agriculture Experiment Stations, Athens and Experiment, Georgia, August 1953.

[3] Excluding birds held in the freezer compartments of refrigerators. Broilers stored in the freezer chest of refrigerators or those stored in home freezers showed no significant change in consumer rating of bone discoloration, where the broilers were kept three or more days before eating.

[4] **Poultry Processing**, Tennessee Agricultural Experiment Station, 63rd Annual Report, Knoxville, Tennessee. 1950.

plant, or in the handling of the birds by the processor or retail store butcher.[1]

Consumers included in the survey rated purchased broilers as to freedom from skin discolorations and skin tears and bruises. From 1.9 to 2.3 percent, respectively, of the broilers were rated fair or poor because of these defects (Table 3).

The proportion of broilers rated fair or poor in freedom from skin discolorations and skin tears and bruises ranged from none for birds processed at one plant to 11 percent at another plant . Although these defects originate primarily with the producer and processor, the prevention of skin discoloration is partly the responsibility of the retail store operator and the consumer. The proportion of broilers rated by consumers as fair or poor in freedom from skin discoloation increased from an average of 1.6 percent for 1,592 birds delivered daily to retail stores, to five percent for 101 birds delivered once a week; the proportion increased from an average of 0.9 percent for 2,061 birds eaten the same day purchased, to 4.1 percent for 704 birds held for three or more days in the refrigerator before being consumed.

Pinfeathers

The presence of pinfeathers on ready-to-cook broilers was considered by many consumers as one of the leading defects in quality. Pinfeathers are of two types—those that protrude and those that do not. Vestigal feathers (hair) are also considered as a factor affecting quality. Consumers included in the survey rated purchased broilers as to fredom from pinfeathers and hair. About 11 percent of the broilers were rated as fair or poor because of this defect (Table 3).

The proportion of broilers rated as fair or poor in freedom from pinfeathers and hair ranged from none at one plant to 34 percent at another plant. Wide variation among processors in the prevalence of pinfeathers may be credited to breed, feeding practices, enviromental conditions and methods of dressing.[2] For these reasons the correction of the defect caused by pinfeathers is the responsibility of the breeder, producer, and processor, particularly the latter.

The early feathering characteristics of some breeds may reduce the degree of pinfeather downgrading in broilers and this factor is being investigated. In broiler stock being developed at the Tennessee Station studies are being made of many crosses in the development of rapid feathering broilers.[3]

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[1] **Poultry Grading Manual,** Agricultural Handbook No. 31, U.S.D.A., February 1952.

[2] Jull, Morley A., **Poultry Breeding,** John Wiley and Sons, Inc., New York City, 1952.

[3] **Poultry Research,** Tennessee Agricultural Experiment Station, 67th Annual Report, Knoxville, Tennessee, 1954.

Cleaning

The responsibility of thorough cleaning of the broiler, both inside and out and the removal of feed in the crop, rests primarily with the processor. Consumers included in the survey rated purchased broilers as to freedom from lungs, windpipe, and other inedible and unwholsome material. About six percent of the broilers were dropped to fair or poor grade because of this defect or condition (Table 3). The proportion of broilers rated as fair or poor in freedom from lungs, windpipe and inedible organs ranged from none at one plant to 26 percent at another plant.

To improve the condition and cleanliness of broilers there are State laws and regulations which apply specifically to poultry marketing and processing. One of these prohibits the movement or sale of unsound or decomposed poultry. Another prescribes regulations pertaining to the sanitation of poultry dressing and eviscerating plants.[1]

Three broiler processing plants, handling 25 percent of all broilers processed in Tennessee in 1955, operated under contracts with the Agricultural Marketing Service with respect to sanitation and inspection.[2]

Odor

Disagreeable odor in ready-to-cook broilers may be associated with unclean carcass, presence of feed in the crop, partial decomposition, unclean chill water, package material, rancid fat, and other causes.[3] Consumers included in the survey rated purchased broilers as to freedom from unpleasant odor. Only 0.7 percent of the broilers were dropped to a rating of fair or poor because of this defect (Table 3).

Of the 27 consumers rating broilers as fair or poor in freedom from unpleasant odor, 23 commented that the birds were improperly cleaned: that is, parts of the bird were dirty or bloody, parts of internal organs were present, giblets were uncleaned, feed was left in the crop, or the bird was placed in an unsanitary package. In four cases the consumers indicated that the broiler had a bad odor and the birds were returned to the place of purchase.

There was some indication that the consumer may be partly responsible for the development of unpleasant odor in broilers when the birds are held an extended period of time before consumption. The proportion of broilers rated by consumers as excellent in freedom from unpleasant odor averaged 88 percent for 2,061 birds eaten the same day purchased, compared with 85 percent for 704 birds stored for three or more days in the refrigerator before being consumed, (excluding birds held in the freezer compartment of refrigerators).

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[1] **Summary of State, County and City Laws and Regulations for Marketing Poultry,** U. S. Department of Agriculture, AMS-47, June 1955.

[2] **List of Plants Operating Under the Poultry and Poultry Products Inspection and Grading Programs,** U. S. Department of Agriculture, AMS-15, February 1956.

[3] **Poultry Grading Manual,** Agricultural Handbook No. 31, United States Department of Agriculture, February 1952.

Packaging

Consumers included in the survey rated purchased broilers as to freedom from torn wrapper. Only 29 or 0.7 percent of the broilers were dropped to a rating of fair or poor because of torn wrapper (Table 3).

Of the 29 consumers rating broilers as fair or poor in freedom from torn wrapper, 22 commented that the package appeared unclean, four indicated that fluids from the broiler leaked through the wrapper, and three stated that the wrapper had an unpleasant odor. In no case where broilers had been placed in water resistant trays or containers were they downgraded because of poor packaging.

Since most of the broilers included in the survey were cut up and packaged by retail store personnel, proper packaging was primarily their responsibility.

Broiler packaging should be adequate from the standpoint of protecting the bird from contamination and minimizing quality deterioration. Containers should be water-vapor resistant and remain intact when moistened by the product.[1]

The consumer has some responsibility with respect to the handling of wrapped broilers. If fresh chicken is to be consumed within 24 hours it may be kept in the refrigerator in its orginal body wrap. If fresh chicken is to be held for two or three days in the regrigerator it should be taken from its original body wrap and wrapped in moisture-proof paper or aluminum foil and kept at a temperature of 36 to 38°F.[2]

General Apperance

Consumers included in the survey rated purchased broilers as to general appearance. No broilers were rated poor on this factor and less than one percent of the broilers were rated fair (Table 3). From the comments of 600 consumers it appeared that in rating broilers on looks or appearance the more important factors taken into consideration included: cleanliness, degree of fleshing, freedom from skin and bone discolorations, broken bones, presence of pinfeathers, odor and wrapping. None of the broilers were downgraded in general appearance that were not dropped in grade because of one or more specific quality defects.

The general appearance rating, in addition to being an overall appraisal of the broiler, showed some relation to impulse buying. Of 761 consumers who had not planned to buy a broiler before going shopping 76 percent rated the general appearance of broilers purchased as excellent. Of the 2,850 consumers who planned to buy a broiler before going shopping 71 percent rated the general appearance of broil-

[1] **Poultry Grading Manual**, Agricultural Handbook No. 31, United States Department of Agriculture, February 1952.

[2] **Broiler-Fryer, the All-Purpose Chicken**, Consumer Information Service Pamphlet, Poultry and Egg National Board, 135 North Wabash Avenue, Chicago 1, Illinois.

ers purchased as excellent. The significant[1] difference in the above percentages indicates the need for controlled tests to evaluate the various factors releated to impulse buying of broilers.

Other Factors

Volume handled by processors. The number of birds handled by 41 processors averaged 819,000 per firm in 1955. However, 14 of the firms were relatively small, averaging under 50,000 birds (Table 2). From the consumer viewpoint the processors handling a low volume marketed as high a quality broiler as did the larger firms. No significant relationship existed between the volume of broilers handled by processors annually and the percentage rated by consumers as being excellent, good, fair and poor.

Processing time per broiler. Processing time used per broiler was related to consumer quality rating. As the length of processing time used per bird increased the percentage of broilers rated as excellent increased (Table 5).

Table 5.—Relation of Processing Time Per Broiler to Consumer's Quality Rating, 3,611 Broilers Processed by 41 Firms in Tennessee, 1955

Processing time per broiler* (minutes)	Firms (no.)	Broilers rated by consumers (no.)	Percent of broilers rated:		
			Excellent %	Good %	Fair and Poor %
Under 2	14	2,036	27.4	50.0	22.6
2 to 3	12	505	36.4	43.0	20.6
Over 3	15	1,070	45.5	42.7	11.8
All firms	41	3,611	34.0	46.9	19.1

*Includes straight-through operations from hanging and killing to cooling and ice packing the dressed and drawn bird.

Among all firms using less than three minutes of processing time per bird the consumers tended to downgrade the broilers because of pinfeathers and hair, bone defects, skin discolorations, skin tears and bruises, presence of lungs and inedible material, and poor general appearance.

There were both small and large-volume firms among the groups varying in processing time per broiler. All plants appear to be faced with the problem of reducing processing costs by decreasing processing time per broiler, and at the same time maintaining a high quality product.

One study has shown some opportunities for reductions in broiler processing costs.[2] Costs for plant overhead on a per-pound basis probably can be reduced if the plant output can be increased without installing new or additional facilities. This may be accomplished by operating near capacity and more than one shift. As shown in Table 2,

[1] Significant for 99 percent probability.

[2] Marketing Georgia Broilers Through Commercial Processing Plants, Marketing Research Report No. 83, United States Department of Agriculture, March 1955.

the 41 Tennessee plants, as an average, operated at only 76 percent of their broiler capacity on a single-shift basis.

A second possible way of reducing costs is to make adjustments in the number of persons performing different processing operations and work assignments given to each. This is of particular importance in the line method of processing. Assigning each worker regularly to limited operations permits the employee to develop great skill and high efficiency in the performance of given operations.

A third possibility lies in improvement in types of machinery and improved plant layout and facilities. Only 10 of the 41 plants in the state used the line or conveyor method of processing but these firms handled 88 percent of all broilers processed in Tennessee in 1955.

Manual versus line operation. No significant relationship existed between manual and line operation methods of processing and the consumer quality rating of broilers. Of the 41 processing plants 10 used the line method and 31 used the manual system. Plants using the manual system handled only 12 percent of all broilers processed in 1955. Annual volume of broilers per plant averaged 83,000 for the firms operating by the manual system and 1,934,000 for those using the line method.

Semi-scald versus sub-scald. Type of scalding process was related to consumer rating of broilers. Sub-scalded birds showed a higher percentage which rated excellent, than did birds processed by semi-scald system (Table 6). The higher rating of the sub-scalded birds was associated with three factors: fewer pinfeathers, greater freedom from skin discoloration, and better general appearance.

Table 6.—Relation of Method of Scald to Consumer's Quality Rating, 3,611 Broilers Processed by 41 Firms in Tennessee, 1955

Method of scald	Firms (no.)	Broilers rated by consumers (no.)	Percent of broilers rated: Excellent %	Good %	Fair and Poor %
Semi (126°-130°F.)	25	2,411	30.2	49.1	20.7
Sub (138°-142°F.)	16	1,200	41.7	42.3	16.0
All firms	41	3,611	34.0	46.9	19.1

The semi-scald method was the most common procedure in broiler dressing operations. Of the 41 firms 25 used this system and these handled 94 percent of all broilers processed in 1955. In the semi-scald procedure the birds are subjected to scald water at a temperature of 126-130°F. for a length of time that permits removal of feathers without removal of the epidermal layer of skin. The exact temperature of the scald water is governed by such factors as age and size of bird, and length of the scalding period. According to many of the processors the semi-scalded birds, compared with the sub-scalded birds, are supposed to retain more skin color and "bloom", have greater "eye appeal," and have longer "shelf life". These advantages may have existed for fresh, whole birds shipped long distances. About 58

percent of all of the broilers dressed by the semi-scald system were shipped outside the state and no consumer quality rating was available on these birds.

In the sub-scald method of dressing the temperature of the scald water is raised to 138-142°F. The higher temperature removes all of the epidermal layer of skin. This method was used by 16 small-volume processors using older types of equipment. Broilers scalded by this method tend to have a pinkish, glossy appearance and become sticky to the touch. The birds become darker in color after long exposure to the air. However, most consumers do not consider these factors very important when purchasing broilers if the bird rates high in quality factors. The results of this study indicate that sub-scalded broilers generally are acceptable to consumers, at least where they are marketed in the local area where processed.

Weight of Broiler. Weight of bird was related to the overall consumer quality rating of broilers. Higher percentages of the broilers weighing from 1¾ to 2¼ pounds were rated excellent, and lower percentages fair or poor, than for birds averaging under or over these weights (Table 7).[1] The higher average consumer ratings of the broilers in the 1¾ to 2¼ pound groups were associated with better general appearance, better fleshing, and greater freedom from bone defects, skin discolorations, skin tears and bruises, pinfeathers, inedible material and unpleasant odor.

Table 7.—Relation of Weight of Broiler to Consumer's Quality Rating, 3,611 Broilers Processed by 41 Firms, Tennessee, 1955

Weight of broilers (lbs. dressed and drawn)	Broilers		Percent of broilers rated:		
	No.	%	Excellent %	Good %	Fair or Poor %
Under 1.75	244	6.8	33.6	47.8	18.6
1.75 to 1.99	780	21.6	35.6	49.1	15.3
2.00 to 2.24	1,547	42.9	34.7	48.8	16.5
2.25 to 2.49	605	16.7	32.5	41.8	25.7
2.50 to 2.74	305	8.4	31.1	41.6	27.3
2.75 and over	130	3.6	30.3	45.1	24.6
All weights	3,611	100.0	34.0	46.9	19.1

Purchases of different size birds varied among areas and also among housewives within a given area. For the state as a whole 43 percent of the birds purchased ranged from 2 to 2¼ pounds and 65 percent from 1¾ to 2¼ pounds (Table 7). As previously indicated this range of weights fell within the groups receiving highest consumer quality rating.

While it may be difficult to improve the quality rating of broilers weighing under 1¾ and over 2¼ pounds this study indicates consid-

[1] No significant differences in percentages existed between groups averaging 1.75 to 1.99 and 2.00 to 2.24.

erable consumer demand for birds of these weights. Each consumer was asked what weight cut-up broiler he preferred. Although the average was 2.1 pounds, about 7 percent preferred birds weighing under 1¾ pounds and 28 percent preferred birds weighing over 2¼ pounds.[1] These percentages were about the same as the actual weights purchased by the housewives.

Method of Purchase. About eight percent of the broilers included in the survey were purchased whole and cut up at home by consumers. There was a significant difference in the consumer rating of broilers purchased whole and those bought already cut up or cut up by the butcher after purchase (Table 8). The higher average consumer

Table 8.—Relation of Method of Purchase of Broiler to Consumer's Rating of Quality of 3,611 Broilers Purchased in Tennessee, 1955

Method of broiler purchase	Broilers		Percent of broilers rated:		
	No.	%	Excellent %	Good %	Fair and Poor %
Fresh already cut up	2,937	81.3	32.9	47.4	19.7
Cut up by butcher after purchase	389	10.8	32.6	46.8	20.6
Purchased whole and cut up at home	285	7.9	47.0	41.4	11.6
All broilers	3,611	100.0	34.0	46.9	19.1

ratings of the broilers purchased whole and cut up at home was associated with such factors as better general appearance, better fleshing, greater freedom from bone and skin defects, fewer pinfeathers and greater freedom from inedible material. In the selection of high quality broilers it appears that it is easier for housewives to select from offerings of whole than from cut up birds. Although a better quality broiler may be selected from an offering of whole birds, most consumers prefer cut up chicken. About 92 percent of the housewives indicated a preference for cut up broilers, either previously prepared or cut up by the butcher, and the same percentage purchased birds in this manner.

[1] The consumer patterns of broiler consumption will be discussed in a later publication.

SUMMARY

Based on a survey of 3,611 families in 1955, broiler consumption in Tennessee averaged 24.1 pounds or the equivalent of 82,349,700 pounds of ready-to-cook broilers. In that year the state produced the equivalent of only 26,846,000 pounds of dressed and drawn broilers of which 8,678,250 pounds were sold and processed in other states.

Forty-one firms in the state in 1955 processed 21,881,600 broilers or the equivalent of 47,243,755 pounds, dressed and drawn. Of this production the processors reported 27,866,000 pounds as being sold outside the state. As an average, the 41 processing firms operated at only 76 percent of their broiler capacity on a single-shift basis.

The 3,611 consumers included in the study rated purchased broilers Excellent, Good, Fair or Poor, according to 10 major factors affecting quality. On the basis of any one of 10 factors, 34.0 percent of all broilers rated Excellent, 46.9 percent Good, 16.4 percent Fair, and 2.7 percent Poor. Factors on which broilers were downgraded by consumers, in the general order of their frequency, were pinfeathers, presence of inedible or unwholsome material, poor fleshing, skin tears and bruises, discolorations, crooked or broken bones, unpleasent odor, poor wrapping, and missing parts. All of the factors affecting quality on which consumers downgraded broilers, with the exception of improper cleaning, may have originated with more than one person or agency—breeder, producer, processor, retailer, and consumer.

Some of the other important findings related to the consumer quality rating included: (1) broilers produced by processors rated higher than those purchased from other sources; (2) broilers delivered daily to retail stores rated higher than those delivered weekly; (3) broilers consumed the same day purchased rated higher than those held for three or more days in the refrigerator (excluding freezer compartment) before being consumed; (4) broilers for which over three minutes of processing time was used per bird rated higher than those for which under two minutes per bird was used; (5) sub-scalded birds rated higher than those semi-scalded; (6) broilers weighing from 1¾ to 2¼ pounds rated higher than those averaging under or over these weights; and (7) broilers purchased whole and cut up at home rated higher than those purchased already cut up or cut up by the butcher after purchase.

APPENDIX I

Commercial Broiler Production in Tennessee, 1934 - 1955

Year	Production			Value		
	Number (000)	Pounds live (000)	Avg. live wt. per bird (lbs.)	Avg. price received by farmers per pound (cents)	Farm value of production (000 $)	Value per bird $
1934	1,000	2,300	2.3	17.8	410	0.41
1935	1,100	2,530	2.3	18.7	473	0.43
1936	1,200	2,760	2.3	20.9	577	0.48
1937	1,300	2,990	2.3	21.3	637	0.49
1938	1,400	3,220	2.3	21.3	686	0.49
1939	1,500	3,450	2.3	16.6	573	0.38
1940	1,650	3,960	2.4	17.8	705	0.43
1941	1,800	4,500	2.5	18.3	824	0.46
1942	2,000	4,600	2.3	23.1	1,063	0.53
1943	2,000	5,000	2.5	31.8	1,590	0.80
1944	1,600	4,000	2.5	33.7	1,348	0.84
1945	2,000	5,600	2.8	33.8	1,893	0.95
1946	1,800	4,860	2.7	37.8	1,837	1.02
1947	1,854	4,820	2.6	38.6	1,861	1.00
1948	2,596	6,490	2.5	39.0	2,531	0.97
1949	3,115	9,034	2.9	30.0	2,710	0.87
1950	3,894	10,903	2.8	27.9	3,042	0.78
1951	5,841	16,355	2.8	28.9	4,727	0.81
1952	8,762	24,534	2.8	28.5	6,992	0.80
1953	10,952	30,666	2.8	26.8	8,218	0.75
1954	11,500	33,350	2.9	21.9	7,304	0.64
1955	13,225	38,352	2.9	24.3	9,320	0.70

Source: **Annual Releases,** Federal-State Cooperative Crop Reporting Service, Nashville, Tennessee, 1934-1956.

Tennessee commercial broiler production by 1955 had increased to more than 13 times the volume of 1934, but among all states Tennessee moved from 13th in number of broilers produced in 1934 to 23rd place in 1955. The value of broilers produced in 1955 was $9,320,000 which put this enterprise in eighth place in cash receipts from farm marketings. Broilers in 1934 comprised only seven percent of the total value of all farm poultry produced in the state but the proportion increased to 54 percent in 1955. The average live weight per bird of broilers marketed since 1942 has tended to increase.

APPENDIX II.

Estimated Per Capita Consumption of Meat and Poultry in Tennessee, By Income Groups, Based on Sample of 3,611 Consumers in Tennessee, 1955

Monthly family income	Families 1955 (no.)	Population 1955 (no.)	Per capita consumption: All meat **	All poultry	Broilers	Other poultry
Families Included in the Survey						
Under $200	831	3,214	114.2	30.7	22.7	8.0
$201-$300	1,213	4,696	121.6	31.3	23.5	7.8
$301-$400	944	3,648	133.6	34.0	26.1	7.9
Over $400	623	2,418	148.4	39.6	30.3	9.3
Survey	3,611	13,976	127.6	33.3	25.2	8.1
Estimated for All Families in Tennessee						
Under $200	529,230	2,016,030	114.2	30.7	22.7	8.0
$201-$300	170,430	649,230	121.6	31.3	23.5	7.8
$301-$400	97,773	372,453	133.6	34.0	26.1	7.9
Over $400	99,567	379,287	148.4	39.6	30.3	9.3
State	897,000*	3,417,000	121.5	32.2	24.1	8.1

*Estimated from 1950 Census of Population.

**Includes all beef, pork, lamb, poultry, variety meats, cold cuts, fish and other meat.

APPENDIX III

Chicken Meat Production in Tennessee, 1934 - 1955

Year	Chicken meat produced*[1] Chickens (000 lbs.)	Broilers (Ready-to-cook basis) (000 lbs.)	Total (000 lbs.)	Population July 1 (000)[2]	Per capita chicken production (lbs.)
1934	40839	1610	42449	2784	15.2
1935	41478	1771	43249	2798	15.5
1936	42578	1932	44510	2791	15.9
1937	37369	2093	39462	2795	14.1
1938	37867	2254	40121	2821	14.2
1939	37759	2415	40174	2874	14.0
1940	34925	2772	37697	2932	12.9
1941	44275	3150	47425	2968	16.0
1942	54584	3220	57804	2929	19.7
1943	66810	3500	70310	2962	23.7
1944	54274	2800	57074	2885	19.8
1945	54316	3920	58236	2878	20.2
1946	47180	3402	50582	3064	16.5
1947	47014	3374	50388	3182	15.8
1948	45579	4543	50122	3236	15.5
1949	49182	6324	55506	3267	17.0
1950	41395	7632	49027	3314	14.8
1951	41615	11449	53064	3318	16.0
1952	38408	17174	55582	3257	17.1
1953	35618	21466	57084	3280	17.4
1954	30300	23345	53645	3362	16.0
1955	23048	26846	49894	3417	14.6

*Dressed and drawn chicken based on 70 percent of live weight. Includes chickens consumed in farm and nonfarm households. Nonfarm production is estimated at 10 percent of farm production.

Source: 1. **Annual Releases**, Federal-State Cooperative Crop Reporting Service, Nashville, Tennessee, 1934-1956.

2. **Annual Population Estimates**, U. S. Bureau of the Census, 1934-1956.

APPENDIX IV.

Definitions

1. **Household.** One or more persons living in a single dwelling unit.
2. **Size of family.** Number in family living at home.
3. **White Race.** All white people irrespective of nationality.
4. **Nonwhite Race.** All colored races.
5. **Broiler.** The term broiler generally refers to a young chicken (usually under 16 weeks of age) of either sex, that is tender-meated with soft, pliable, smooth-textured skin and flexible breastbone cartilage.
6. **Ready-to-cook broiler.** A broiler that has been bled, picked and fully drawn. The head, feet and inedible organs were removed before the bird was weighed for pricing. The giblets (liver, gizzard and heart) have been washed, trimmed and placed inside the body cavity or with the chicken, if sold cut up.
7. **Chicken parts.** Chicken which has been cut into parts such as breasts, legs, wings, backs, necks and giblets and sold separately.