

Chapter 7

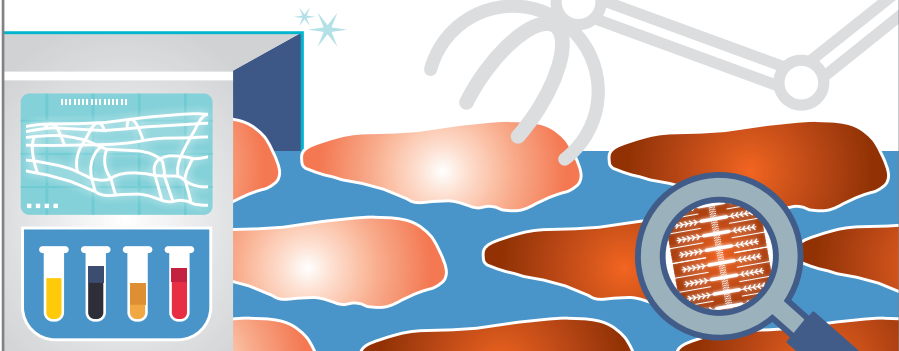
INSPECTION AND GRADING



The Science of Poultry and Meat Processing

Shai Barbut PhD

University of Guelph



Chapters

1. AUTOMATION
2. GLOBAL PERSPECTIVE
3. STRUCTURE* AND MUSCLE PHYSIOLOGY
4. LIVE BIRD HANDLING*
5. PRIMARY PROCESSING OF POULTRY*
6. HACCP IN PRIMARY PROCESSING*
7. INSPECTION AND GRADING*
8. STUNNING*
9. PORTIONING, DEBONING AND FRESH MEAT COMPOSITION*
10. FURTHER PROCESSING – EQUIPMENT
11. HEAT PROCESSING, COOLING AND PRESERVATION METHODS
12. HACCP IN COOKED MEAT OPERATIONS
13. PRINCIPLES OF MEAT PROCESSING
14. BATTERING AND BREADING – PRODUCTION UNDER HACCP
15. MICROBIOLOGY AND SANITATION
16. EVALUATING TEXTURE AND SENSORY ATTRIBUTES
17. EVALUATING WATER/FAT BINDING AND COLOUR
18. WASTE TREATMENT AND BY-PRODUCTS

* Topics focussing on poultry. Rest of the chapters are related to both red meat and poultry.

Preface

The aim of The Science of Poultry and Meat Processing book is to provide students and industry personnel with a comprehensive view of the modernized primary poultry meat industry and further processing of both red meat and poultry. An emphasis is placed on basic concepts as well as recent advancements such as automation (e.g. increasing poultry line speed from 3,000 to 13,000 birds per hour over the last 40 years) and food safety (e.g. HACCP in primary and the further processing areas). The book also includes chapters explaining basic muscle biology, protein gelation, heat and mass transfer, microbiology, as well as meat colour and texture to help the reader understand the underlying scientific concepts of meat processing. The Science of Poultry and Meat Processing book is based on over two decades of university teaching experiences, and is designed to be used as a course textbook by students, as well as a resource for professionals working in the food industry. The book is available online, at no cost, to any interested learner. Using this format has also allowed me to include many colour pictures, illustrations and graphs to help the reader.

The book is dedicated to my past and current students who have inspired me to learn more and conduct challenging research projects. I see this as an opportunity to give back to the field that I have received so much from as a student and as a faculty member. Looking back, I have learned a great deal from my MSc and PhD advisor, Dr. A. Maurer, who was the student of Dr. R. Baker - the father of poultry processing in North America. I would also like to thank Dr. H. Swatland with whom I worked for almost 20 years, for the many challenging scientific discussions.

Writing The Science of Poultry and Meat Processing book was a long process, which also included having all chapters peer reviewed. I appreciate the help of my colleagues, but I still take responsibility for any inaccuracy in the book. If you have comments or **suggestions**, I would appreciate hearing from you (sbarbut@uoguelph.ca), as I am planning to revise and update a few chapters on a yearly basis.

I would like to thank the many people who have helped me during the writing process. To Deb Drake who entered all of the material for the book, to Mary Anne Smith who assisted in editing, and to ArtWorks Media for the design and desktop publishing of the book. I greatly appreciate the help of my colleagues who reviewed chapters and provided useful discussions. They include Mark B., Ori B., Sarge B., Gregoy B., Joseph C., Mike D., Hans G., Theo H., Melvin H., Myra H., Walter K., Roland K., Anneke L., Massimo M., Johan M., Erik P., Robert R., Uwe T., Rachel T., Jos V., Keith W., and Richard Z. I would also like to thank my family for their love and support during the entire process.

About the Author

Shai Barbut is a professor in the Department of Food Science at the University of Guelph in Ontario, Canada. He received his MSc and PhD at the University of Wisconsin in meat science and food science. He specializes in primary and further processing of poultry and red meat. His research focuses on factors affecting the quality of meat, as well as protein gelation with an emphasis on structure / function relationships, rheological properties and food safety aspects. He has published over two hundred peer reviewed research papers and is the author of the Poultry Products Processing – An Industry Guide textbook. He is a fellow of the Institute of Food Technologists and has received awards from the Meat Science Association, Poultry Science Association, and the Canadian Institute of Food Science and Technology. He is involved in a number of government committees as well as academic and industrial research projects.

© 2015 Shai Barbut

This work is licensed under the Creative Commons licenses noted below. To view a copy of these detailed licenses, visit creativecommons.org. Briefly, this license allows you to download the work and share with others as long as you credit the copyright owner.

You can't change the content in any way or use it commercially. Other than as provided by these licenses, no part of this book may be reproduced, transmitted, or displayed by any electronic or mechanical means without the prior written permission of the copyright owner, except in the case of brief quotations embodied in critical reviews and certain other non-commercial uses permitted by copyright law.



Effective July 1, 2015, this book will be subject to a CC-BY-NC-ND license. This book contains information from authentic and highly regarded sources and a wide variety of references are listed. Reasonable efforts have been made to publish reliable data and information, but the author cannot assume responsibility for the validity of all materials or for the consequences of their use.

Library and Archives Canada Cataloguing in Publication

Barbut, Shai, author

The science of poultry and meat processing / Shai Barbut, PhD.

Includes bibliographical references and index.

Issued in print and electronic formats.

ISBN 978-0-88955-625-6 (bound).

ISBN 978-0-88955-626-3 (pdf).

1. Poultry--Processing. 2. Meat industry and trade. I. Title.

TS1968.B37 2016 664'.93

C2015-903906-1 C2015-903907-X

INSPECTION AND GRADING

7.1 Introduction

Most countries have a mandatory inspection system for meat producing animals to ensure that meat sold to the public is safe and will not transfer disease. However, this has not always been the case. Some of the earliest documented rules and regulations for meat inspection are found in the Bible (e.g., no consumption of dead animals) but the regulations were not always enforced. In Europe, the sale of sick animals to the meat trade was prohibited in the 12th century. In 1906, Upton Sinclair revealed serious sanitation problems in Chicago meat plants in his book, “The Jungle”, which later resulted in passing the Meat Inspection Act in the USA. The act enforced mandatory inspection of red meat animals. At the time, poultry was not included in the Act as it was considered a small back yard industry. Poultry was not included until 1924, when there was a major avian influenza outbreak in New York State.

Inspection is commonly carried out by a designated government agency, so there is little, if any, room for deviation that might compromise the public interest. The process commonly includes both ante and postmortem inspections (described later). In areas where live animals are sold directly to the consumer, individual animal inspection is not common. However, if disease outbreak information surfaces, the government will increase monitoring and inspection. In several countries where wet markets are popular, governments are trying to create more regulated environments. Over the past decade avian influenza outbreaks have resulted in canceling and/or more inspection of wet markets.

This chapter discusses poultry (e.g., broiler, turkey, duck) inspection and provides examples of national regulations, though US regulations are discussed as the primary example. The chapter also includes material on grading which may not be mandatory in some countries but is most often done to facilitate trade. The classification system of the major poultry species is also provided at the end of the chapter.

7.2 Setting up an Inspection Station

The postmortem inspection station is very important in ensuring that only healthy and uncontaminated (e.g., from gut spill) animals enter the food chain. Thus, the station should provide optimum working conditions for the inspector and his/her helpers (Fig. 7.2.1). Below are the requirements for a federally inspected US plant, but the exact station requirements for other countries can be found in their national regulations.

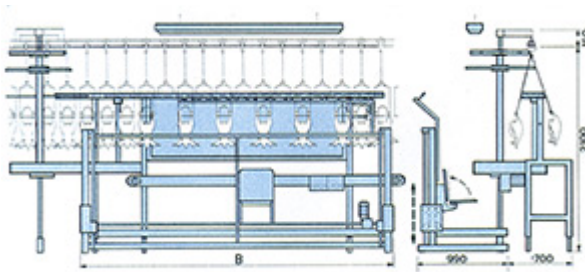


Figure 7.2.1 An illustration of an inspection station showing area for inspector to stand, clear view of poultry passing by (including a mirror at the back) and a holding rack.

Space: the exact amount of space required for the inspector and helper can vary depending upon the inspection method (to be discussed in the next section on line speed).

Lighting: lighting requirements vary depending on the inspection method. The minimum lighting requirements are as follows:

- a. Traditional inspection – 50 foot-candles
- b. Streamlined Inspection System (SIS) – 200 foot-candles
- c. New Enhanced Line Speed (NELS) – 200 foot-candles
- d. New Turkey Inspection System (NTIS) – 200 foot-candles

Other important factors are the quality and direction of the light. In addition, light should not change the colour of the inspected carcasses and should be shadow-free.

Hand-washing facilities: water for hand washing with a minimum temperature of 65°F must be available to the inspectors working at the postmortem inspection station.

Condemned containers: generally, there are two types of condemned containers at the postmortem inspection station. One is for parts and the other is for whole carcasses. These containers must be leak-proof and properly marked, indicating “U.S. Condemned Product” in legible letters that are at least two inches high. The parts/whole carcasses should be disposed of by an approved method (e.g., incineration, denaturation by chemicals and dyes, steam; parts condemned due to the presence of chemical/biological residues must be buried or burned).

Holder for inspection form: the plant uses this device to hold the lot tally sheet or FSIS Form 6000-16 (USDA, 1999) so that it is conveniently located for the plant helper to record dispositions as instructed by the USDA postmortem inspector.

Hangback racks: the primary purpose of the hangback rack is to retain questionable carcasses for veterinary review and disposition. The racks can also be used for carcasses designated as salvage, improper presentation, etc.

Other facility requirements: an adjustable platform is required at each inspection station, and re inspection stations must be provided at both the pre-chill and post-chill locations.

Overall, plant management should make every effort to minimize contamination of the carcass opening when preparing for evisceration. Most processors use the modified J-cut, although the bar-cut is also used.

Sanitation and consistency are important for a properly drawn carcass. Traditionally in a manual operation and in some automated lines, the viscera is completely withdrawn, left suspended by natural attachments and arranged consistently to the left or right side of the carcass. However, today a number of poultry slaughtering plants use automatic equipment that completely detaches the viscera and put it on another line. The equipment is often complex and requires careful adjustment for consistency (including synchronization) and properly handling the carcasses. It is the responsibility of plant management to ensure that the machinery is working properly at all times (e.g., when changing flock size, weight).

Depending on the facilities and local preferences, the plant may use one of several methods for suspending carcasses on the shackle line such as two-point suspension for broilers or three-point suspension for turkeys. Carcasses must be presented at the postmortem inspection station shackled in a consistent manner. On lines that have more than one inspector the shackles must be identified. They may be colour coded or mechanically separated (as in the case of “selectmatic” devices that “kick out” carcasses automatically). The latter helps reduce fatigue by taking “the search factor” out of postmortem inspection.

7.3 Inspection

Inspection is commonly done by specially trained government personnel who are responsible for ensuring that only wholesome fresh poultry and poultry products that are fit for human consumption reach the marketplace. Governmental control over inspection helps guarantee that inspectors are not influenced by marketing pressure. This is essential in many public health matters where an independent body should decide, approve, and later enforce the regulations. Personnel usually include licensed inspectors who may be veterinarians or other specially trained individuals.

Poultry inspection is usually divided into different sections. In the US system, the activities are divided into eight areas (USDA, 1987, 2014) that include:

- a. Inspection of live birds prior to slaughter (ante mortem) – done by observing the birds in the crates/containers, or while being removed from the crates and suspended on the shackle line. The inspector looks for signs of disease and other abnormal situations such as edema, skin lesions, diarrhea, and respiratory problems. Birds that are dead on arrival (DOA) are automatically condemned. The inspector decides whether the birds pass the inspection, are suspected of illness, or are condemned. Suspected flocks are separated from healthy flocks and slaughtered (usually separately at the end of the day, so more attention can be given to each bird).
- b. Inspection after slaughter (post-mortem) – identifies and removes all potential disease conditions that might affect human health. There are many details for this area of inspection, some of which are discussed later in the chapter.
- c. Condemnation and disposition – deals with conditions requiring condemnation; discussed in more detail later in the chapter.
- d. Sanitary slaughter and dressing inspection – minimizes/prevents fecal contamination resulting from gut spillage on the carcass and/or smearing on edible meat parts/surfaces. This is one of the most important points in sanitary slaughter and dressing operations. Contaminated carcasses are removed from the line (at the inspection station; Fig. 7.2.1) and are either condemned or sent for reprocessing. The latter operation can include trimming of certain parts, washing with water containing 20 ppm chlorine (in Canada tripolyphosphate), vacuuming, or a combination of these intervention methods.

- e. Chilling of poultry – the government requires that carcasses are cooled within a certain period of time to minimize the chance of pathogen proliferation. The time to reach an internal deep muscle temperature of 4.4°C depends on carcass size: 4 hr for a 4 lb broiler, 6 hr for 4-8 lb broiler, and 8 hr for 8 lb broiler or turkey (unless cooked or frozen right away). Giblets should be chilled to 4.4°C or below within 2 hrs. The inspector also checks water absorption during water chilling. The percent allowed is also based on carcass weight (see more information in Chapter 5).
- f. General plant sanitation – inspector monitors the plant to make sure it is clean prior to starting work (i.e., there are effective cleaning and sanitation procedures) and during working hours. Today most plants operate under HACCP (Barbut and Pronk, 2013; also see Chapter 6) and use prerequisite programs such as the Sanitation Standard Operating Procedures (SSOP). Such a program is divided into different sections that usually include building structure, premises, processing equipment, personnel facilities, water supply, waste handling, coolers and freezers, training of personnel, and pest control programs.
- g. Carcass re-inspection of ready to cook (RTC) poultry –plant personnel and inspector(s) re-inspect the birds after chilling to make sure they have been properly processed (e.g., all viscera and feathers removed). These inspections include pre-chill and post-chill monitoring and it is common that plant quality control personnel check 10 samples every hr, while the inspector will run two tests per shift (or more if warranted).
- h. Monitoring residues – products for human consumption are also monitored for prohibited drugs and chemicals. These residues could result from accidental exposure or an improper use of antibiotics, pesticides, herbicides, etc.

Overall, the inspection process is designed to prevent diseased animals from entering the food supply and to minimize the chance of transferring zoonotic diseases to humans. In addition, the inspector ensures that the processed product is handled, packaged, and labeled in accordance with the regulations. If necessary, the local inspector usually has the authority to stop the line and condemn a part or the entire lot.

Birds that have passed inspection receive a stamp/legend (Fig. 7.3.1) that signifies they have been examined by a qualified inspector and are wholesome and fit for human consumption.

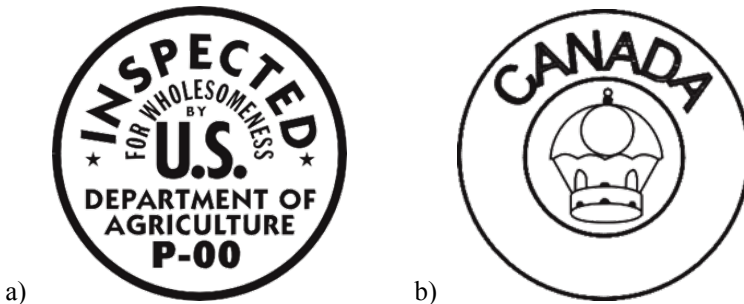


Figure 7.3.1 Inspection shields: (a) U.S. Inspected, see plant number at bottom; (b) Canadian inspection shield.

7.3.1 Antemortem Inspection

The inspector examines birds that arrive at the processing plant either while they are still on the truck or while they are being unloaded. At this point the health and condition of the birds is monitored. If the whole flock shows a problem (e.g., diarrhea), the inspector can inform the plant to slow down the line speed and/or can condemn the flock so it will not be processed. In some countries where, for example, *Salmonella* monitoring is done on the farm prior to shipment, the inspector will evaluate the results and decide whether to postpone processing the flock until the end of the day (i.e., to prevent cross contamination with other flocks). Many companies will inform the inspector beforehand if they expect problems and will ship the flock towards the end of the day. The inspector will also monitor the rate of DOA and if an animal welfare problem is suspected an investigation and/or a fine can be imposed.

7.3.2 Postmortem Inspection

Postmortem inspections are performed by specially trained personnel who can recognize, evaluate, and make decisions about various disease conditions and abnormalities. The decision must be based on scientific principles and the evaluation criteria applied in a uniform manner. In the US, for example, every single bird is inspected in a federally inspected plant. It is the responsibility of the plant to prepare the carcasses for easy presentation on the line. If this does not occur, the inspector will instruct the plant to reduce line speed. Plant employees are usually positioned before the inspection station and are responsible for good and consistent presentation. This is important after the mechanical de feathering

and evisceration processes, where problems in presentation can be encountered (e.g., presence feathers, viscera not correctly removed). The inspector examines the carcass (inside and outside) along with its internal organs. The organs may be attached or, in newer lines, detached and presented on a separate moving line. In the latter case both lines must be synchronized. Such a system reduces the chance of carcass contamination by gut content. It also improves presentation, as the long section of gut does not interfere with the view of the internal organs. There is usually a mirror positioned at the station so the inspector can easily see the back of the moving carcass. The government inspector usually is aided by plant employee who is designated as a helper. This person helps the inspector by trimming and/or marking parts to be trimmed at the plant's final trimming station, by removing condemned birds from the line, by removing questionable birds from the line and putting them on a special rack for further inspection, by separating/marking carcasses contaminated with fecal material, and by helping record causes of contamination.

7.3.3 Condemnation and Disposition

Dispositions are made on carcasses based on the stage of disease development and the resolution of the disease or processes at the time of slaughter. If a disease process exists in the live animal, the pathogenesis of the disease stops at the time of slaughter but the lesions will remain. The inspector's responsibility is to evaluate and interpret the pathological lesions present after the animal is slaughtered and prepared for postmortem inspection. The inspector classifies carcasses as inspection passed, trimmed/salvaged/washed passed, retained for disposition by a veterinarian, or condemned. Examples of condemnation criteria found in the USDA/FSIS Tally Sheet (USDA, 1987, 1998) are provided below.

(1) Tuberculosis. Avian tuberculosis (TB) is caused by the bacterium *Mycobacterium avium* and usually is a chronic, slowly developing disease. It has largely been eradicated in domestic poultry in the United States, but is still found occasionally in mature birds.

Birds with TB develop a wasting condition characterized by loss of weight and diarrhea. At postmortem examination, their carcasses are typically emaciated. Gray to yellow, firm nodules (tubercles) are often scattered along the intestines and may be found in various organs, especially in the liver and spleen. Lungs generally have no gross lesions, although, in advanced cases, any organ or tissue can be involved. Avian tuberculosis can infect humans but is not considered to be a serious threat to people with healthy immune systems. One definitive lesion is all that is required to condemn a poultry carcass for tuberculosis (see also Lohren, 2012).

(2) Leukosis. This condemn category includes several neoplastic diseases caused by various viruses. All of them produce tumors in domestic poultry and present similar gross lesions. The age and species of bird affected by leukotic tumors suggests that a viral agent is involved. However, only a presumptive diagnosis can be made based on this information, because there is considerable overlap. The most common manifestations of the leukosis complex are as follows: a. Marek's disease, which is an important disease found only in chickens less than six months of age; b. lymphoid leukosis, which is most common in semi-mature and mature chickens; c. reticuloendotheliosis, which occasionally produces liver and spleen tumors in turkeys and, rarely, runting disease in chickens; and d. lymphoproliferative disease, which affects turkeys, producing a greatly enlarged spleen as well as tumors in other organs. There is no evidence that viruses of the leukosis complex are pathogenic for humans. One definitive lesion is all that is needed to justify condemnation of the carcass. Definitive means a lesion that can be defended grossly as a lesion of leukosis.

(3) Septicemia/toxemia. Septicemia is a disease state caused by pathogenic (disease-producing) microorganisms in the blood that have produced systemic change within the bird. Systemic change affects the body as a whole rather than localized portions of it. In septicemia, the normal functions of the bird's organ systems are disrupted. The cells of the body deteriorate. This deterioration may be very rapid when highly virulent microorganisms are the cause, or it may be more gradual if less virulent ones are involved. In some cases, the changes produced by the septicemia will overwhelm the bird and result in its death. In other cases, the bird's immune system will overcome the causative organism before irreversible damage occurs, and it will recover. Septicemia is manifested by a group of clinical signs, not all of which will be present in a single carcass. Therefore, judgment plays an important part in correct dispositions for this condemn category. Septicemic carcasses frequently have petechial (pinpoint) hemorrhages on the heart, liver, kidneys, muscles, and serous membranes. Blood-tinged exudates are often present in the body cavity. The liver and spleen are often swollen and hyperemic (contain an excess of blood), because they remove most of the bacteria from the circulating blood. Kidneys may appear swollen and congested. The skin of septicemic birds may be hyperemic. Depending upon the cause and duration of septicemia, carcasses at the time of slaughter may be hyperemic, cyanotic, anemic, dehydrated, and edematous or exhibit some combination of these signs. No single carcass will show all of these signs. Septicemia/toxemia is commonly referred to as sep/tox. If a carcass shows systemic change, it is condemned. This category is a catchall for those carcasses that have septicemia, toxemia, or a combination of septicemia-toxemia (see also Lohren, 2012).

(4) Synovitis. Synovitis may be caused by a number of organisms, most often members of the genus *Mycoplasma*. Injury and nutritional deficiencies can also lead to synovitis. The result is acute or chronic inflammation of the membranes lining one or more joints and tendon sheaths. Joints are often noticeably swollen and may contain exudate of variable amounts and consistency. The liver, kidneys, and spleen may be swollen, and the liver is sometimes stained green from bile stasis. Lesions vary depending upon whether or not the condition has been confined to the joints without affecting the overall health of the bird or has overwhelmed the bird's defense mechanisms and caused systemic changes. A carcass that has synovitis and also shows signs of sep/tox or systemic change is condemned. In other words, a carcass with synovitis is not condemned unless it also shows systemic change.

(5) Tumors. Several types of tumors besides those of the leukosis complex (described above) affect domestic poultry. Some of the more common ones include squamous cell carcinomas, adenocarcinomas, leiomyomas, and fibromas.

Squamous cell carcinomas are skin tumors found in young chickens. Adenocarcinomas generally are located on abdominal organs and are common in older birds. Leiomyomas are most often identified in the oviduct of fowl and fibromas may develop in any connective tissue and are also more common in older birds. Numerous other types of tumors occur in domestic poultry but at a low frequency. There is no evidence that any of these types of tumors are a health threat to humans. Condemn a carcass for tumors if there is "gross evidence" of metastasis present. The general rule is as follows: one tumor - trim and pass; two or more tumors - condemn if there is evidence of metastasis. Exclude leukosis from the tumor category. Leukosis is in a separate category.

(6) Bruises. If bruises are the reason for systemic change in a carcass, then the carcass is condemned and recorded under the bruises category.

(7) Cadaver. Poultry that die from causes other than slaughter are condemned under the cadaver category. Generally, the bird is not dead at the time of entering the scald tank, but upon submersion into the scald water, it drowns.

(8) Contamination. Carcasses that are contaminated to the extent that valid inspection cannot be made are condemned. An example would be a carcass contaminated with bile or feces to the extent that the inspector cannot determine whether the carcass is wholesome. Carcasses that fall into open sewers or evisceration troughs are condemned under the contamination category.

(9) Overscald. Carcasses that are cooked are condemned. Many times, these carcasses will also be machine-mutilated by picking machines.

(10) Airsacculitis. Numerous microorganisms can produce airsacculitis, inflammation of air sacs. Often, more than one infectious agent is identified in an outbreak. Members of the genus *Mycoplasma* are frequently involved. Birds are more susceptible to infections of the air sacs when they are under stress. Vaccination, other disease, poor nutrition, insanitary conditions, and poor ventilation may all be contributing factors. The lesions of airsacculitis can be acute or chronic. Their appearance can range from slight clouding of air sac membranes and small amounts of watery exudate to thickened, opaque membranes and large amounts of thick, white-to-cream coloured and/or cheesy exudates. The exudates can be confined to the air sacs and their diverticula, or they may be found in other areas if the air sac membranes are ruptured. Pneumonia, pericarditis, and perihepatitis might be present. In some cases, all portions of the respiratory tract (nasal passages, sinuses, trachea, bronchi, lungs, and air sacs and their diverticula) are affected. In other cases, little involvement beyond the air sacs is evident. One organism that can cause airsacculitis in birds, *Chlamydia psittaci*, can cause disease in humans. Outbreaks of this disease are sporadic and generally occur in turkeys rather than chickens. The turkey industry watches for any evidence of chlamydiosis so infected flocks generally are identified and treated before slaughter. However, inspectors must stay alert for any poultry that show signs suspicious for this disease. Carcasses are condemned if airsacculitis occurs in conjunction with systemic change. An airsacculitis condemnation is also justified by the presence of extensive airsacculitis. In the latter instance, the amount of exudate present prevents a valid evaluation of the wholesomeness of the carcass. If the exudate cannot be effectively removed, the carcass is also condemned.

(11) Other. There are several other subgroups:

- a. Inflammatory process: if the condition is generalized, the carcass is condemned.
- b. Plant rejects: if the plant elects to reject a carcass for inspection, it is condemned.
- c. Carcasses condemned because there are no viscera available to inspect: disposition of no-viscera carcasses is determined by the veterinarian in charge and is based upon flock incidence of disease.
- d. Xanthomatosis: if the condition is generalized, the carcass is condemned.
- e. Parasites: if the infestation is generalized, the carcass is condemned.

Only condemnation of carcass parts is required for some localized conditions. If there is an unwholesome portion or part that can be effectively removed, the remainder of the carcass would be considered wholesome. Some organs or parts that may be condemned because of localized conditions without condemning the whole carcass are as follows:

a. Livers: livers that have fatty degeneration are condemned. Livers that have extensive petechiae or hemorrhaging must be condemned. A liver that is inflamed, has an abscess, has a necrotic area, or is affected with necrosis, is condemned. Cirrhotic livers, livers that have a single non-leukotic tumor or livers with cysts are also condemned. Discolourations in the liver due to a biliary system disorder or postmortem changes result in the liver being condemned. Livers are condemned if there has been contamination from intestinal content or noxious materials.

b. Kidneys: when there is renal or splenic pathology or hepatic lesions that cause liver condemnation, the kidneys must be removed. Pathological conditions requiring condemnation of all viscera also require the kidneys to be removed. Anytime there is airsacculitis, the kidneys must be removed when the carcass or its posterior portion is salvaged.

c. Fractures: a fracture with no associated hemorrhage need not be trimmed and can be passed. But a fracture with a hemorrhage of the affected part must be trimmed. A compound fracture, one in which the skin is broken, requires trimming, whether there is hemorrhage present or not.

d. Luxations: a luxation is a simple disjointment with no skin broken and no hemorrhage. The condition need not be trimmed. Hemorrhage extending into the musculature requires trimming or slitting/washing out. Simple redness of skin does not require any action.

To maintain a good production rate, one properly trained plant employee should be designated for each inspector as the inspector's helper in doing the following:

- a. Remove condemned birds or parts from the line and place them in the designated U.S. condemn containers.
- b. Remove retained carcasses from the line and place them in the appropriate area of the retain rack, designated for veterinary review.
- c. Remove from the line carcasses designated for approved off-line salvage and place them in the appropriate area of the retain rack.
- d. Record condemned carcasses in the appropriate blocks of the inspector's worksheet (FSIS Form 6000-16) as directed by the inspector.

- e. Mark carcasses, at the inspector's direction, for trim or salvage.
- f. Trim abnormalities.
- g. Assist as much as possible to allow the inspector to devote full attention to postmortem inspection. The inspector and the helper must work as a team. The inspector may use various methods to give directions to the helper. In some cases, hand signals are given, but in other situations, directions are given by voice.

As mentioned in the opening section, inspection also includes looking into sanitary slaughter conditions in the plant, plant sanitation in general, and the chilling system (to assure plant is meeting temperature reduction in time). The inspector is also responsible for checking/monitoring residue levels (drugs, and chemicals such as pesticides).

7.4 Line Speeds

The number of inspectors assigned to a line depends on line speed. Countries have different requirements that also depend on the relative emphasis on ante mortem and postmortem inspection (e.g., some countries require single bird postmortem inspection while others are inspecting by lot unless there is a disease condition within the flock). In the US, single bird inspection is required (Bilgili, 2010). There are five main categories:

- a. Traditional system – 35 birds per min (bpm) with one inspector per line
- b. Streamline Inspection System (SIS) – 70 bpm with two inspectors per line (each checks alternate birds; shackles are marked with different colours)
- c. New Enhanced Line Speed (NELS) – 91 bpm with three inspectors (each checks every third bird)
- d. New Turkey Inspection System (NTIS) – 82 bpm of heavy birds (> 7kg) and 102 bpm of lighter turkeys
- e. New system approved for two specific automated lines (i.e., Nu-tech by Stork, and Maestro by Meyn) – 140 bpm with four inspectors. The system can also examine 105 bpm when three inspectors are present.

FSIS does not require line speed adjustments due to the number of feathers on carcasses presented for postmortem inspection. Plant management is responsible for line speed adjustments related to ready-to-cook poultry.

FSIS uses the following considerations to decide if line speed adjustment is needed:

- a. Bird's class and the size of the poultry in the class
- b. Disease incidence
- c. Presentation errors (viscera on the wrong side)
- d. Plant personnel's ability to complete eviscerating procedures with minimal contamination
- e. Physical limitations of inspectors
- f. Plant facilities

Maximum line speeds are only permitted on the eviscerating line when optimal conditions exist. When less than optimal conditions are present (e.g., disease condition, high incidences of gut spillage, poor presentation), a line speed adjustment is required. The inspector in charge is responsible for directing plant management to reduce the line speed to permit adequate inspection and insure a smooth flow of product. The new Modernization of Poultry Slaughter Inspection Rule (USDA, 2014) maintains the same line speed as before (see above) but now requires that all poultry companies take measures to prevent *Salmonella* and *Campylobacter* contamination, rather than addressing contamination after it occurs.

7.5 Grading

Grading of meat is important in establishing a common language between sellers and buyers (e.g., local or international). Grades are also often used by producers to promote a brand name and their own product. Grading today is usually done on a voluntary basis, after birds have passed the mandatory inspection. The grade standards, developed by each country or trading community, are applied to a specific kind and class of poultry. However, some general criteria are considered in assessing most poultry. Factors such as overall conformation, presence of feathers/pinfeathers, discoloration, and missing parts are fairly universal criteria applied to all kinds of poultry.

Grading can be done by government-licensed graders or a private agency working under government regulations (i.e., various countries have privatized the grading system in order to reduce cost). The development of national standards that are accepted by all participants (e.g., producers, processors, consumers) is accomplished more easily and better monitored by a central body that is agreeable to all potential local and/or international buyers. In most places, grading is fee

for service. Examples of grading stamps are shown in Figure 7.5.1. The general standards used for grading ready to cook poultry in the United States are provided below. The description in the text below refers to Grade A chicken. Additional information is provided in Table 7.5.1a for Grade A poultry, in Table 7.5.2 for Grade B, and Table 7.5.3 for Grade C (USDA, 1998).



a)



b)

Figure 7.5.1 Grade stamps: (a) U.S. Grade A; (b) Canada stamp – grade letter is included (after grading) below “CANADA”.

Table 7.5.1. Summary of specifications for standards of A-quality for individual carcasses and parts used in the United States (USDA, 1998).

A Quality						
Conformation: Breastbone Back Legs and Wings		Normal Slight curve or dent Slight curve Normal				
Fleshing:		Well fleshed, considering kind and class				
Fat Covering:		Well-developed layer—especially between heavy feather tracts				
Defeathering: Free of protruding feathers and hairs		Turkeys		Ducks and Geese^a		All Other Poultry
		(feathers less than 3/4 in.)		(feathers less than 1/2 in.)		(feathers less than 1/2 in.)
		Carcass	Parts	Carcass	Parts	Carcass
		4	2	8	4	4 2
Exposed Flesh:^b Weight Range		Carcass		Large Carcass Parts^c (halves, front and rear halves)		Other Parts^c
Minimum	Maximum	Breast & Legs	Elsewhere	Breast & Legs	Elsewhere	
None	2 lbs.	1/4 in.	1 in.	1/4 in.	1/2 in.	1/4 in.
Over 2 lbs.	6 lbs.	1/4 in.	1 1/2 in.	1/4 in.	3/4 in.	1/4 in.
Over 6 lbs.	16 lbs.	1/2 in.	2 in.	1/2 in.	1 in.	1/2 in.
Over 16 lbs.	None	1/2 in.	3 in.	1/2 in.	1 1/2 in.	1/2 in.
Discolourations: Carcass		Lightly Shaded			Moderately Shaded^d	
		Breast & Legs	Elsewhere	Hock of Leg	Elsewhere	
None	2 lbs.	3/4 in.	1 1/4 in.	1/4 in.	5/8 in.	
Over 2 lbs.	6 lbs.	1 in.	2 in.	1/2 in.	1 in.	
Over 6 lbs.	16 lbs.	1 1/2 in.	2 1/2 in.	3/4 in.	1 1/4 in.	
Over 16 lbs.	None	2 in.	3 in.	1 in.	1 1/2 in.	
Discolourations: Large Carcass Parts (halves, front and rear halves)		Lightly Shaded			Moderately Shaded^d	
		Breast & Legs	Elsewhere	Hock of Leg	Elsewhere	
None	2 lbs.	1/2 in.	1 in.	1/4 in.	1/2 in.	
Over 2 lbs.	6 lbs.	3/4 in.	1 1/2 in.	3/8 in.	3/4 in.	
Over 6 lbs.	16 lbs.	1 in.	2 in.	1/2 in.	1 in.	
Over 16 lbs.	None	1 1/4 in.	2 1/2 in.	5/8 in.	1 1/4 in.	
Discolourations: Other Parts		Lightly Shaded			Moderately Shaded^d	
None	2 lbs.	1/2 in.			1/4 in.	
Over 2 lbs.	6 lbs.	3/4			3/8 in.	
Over 6 lbs.	16 lbs.	1			1/2 in.	
Over 16 lbs.	None	1 1/4			5/8 in.	

A Quality	
Disjointed and Broken Bones:	Carcass—one disjointed and no broken bones. Parts—thighs with back portion, legs or leg quarters may have femurs disjointed from the hip joint. Other parts—none.
Missing Parts:	Wing tips and tail. In ducks and geese, the parts of the wing beyond the second joint may be removed if removed at the joint, and both wings are so treated. The tail may be removed at the base.
Freezing Defects:	Slight darkening on back and drumstick. Overall bright appearance. Occasional pockmarks due to drying. Occasional small areas of clear, pinkish- or reddish-coloured ice.
<p>^aHair or down is permitted on the carcass or part, provided the hair or down is less than 3/16 inch in length and is scattered so that the carcass or part has a clean appearance, especially on the breast and legs.</p> <p>^bMaximum aggregate area of all exposed flesh. In addition, the carcass or part may have cuts or tears that do not expand or significantly expose flesh, provided the aggregate length of all such cuts and tears does not exceed a length tolerance equal to the permitted dimensions listed above.</p> <p>^cFor all parts, trimming of skin along the edge is allowed, provided at least 75% of the normal skin cover associated with the part remains attached, and the remaining skin uniformly covers the outer surface and does not detract from the appearance of the part.</p> <p>^dModerately shaded discolourations and discolourations due to flesh bruising are free of clots and limited to areas other than the breast and legs except for the area adjacent to the hock.</p>	

Table 7.5.2 Summary of specifications for standards of B-quality for individual carcasses and parts used in the United States (USDA, 1998).

B Quality							
Conformation: <i>Breastbone</i> <i>Back</i> <i>Legs and Wings</i>		Moderate deformities Moderately dented, curved or crooked Moderately crooked Moderately misshaped					
Fleshing:		Moderately fleshed, considering kind and class					
Fat Covering:		Sufficient fat layer—especially on breast and legs					
Defeathering: A few scattered protruding feathers and hairs		Turkeys (feathers less than 3/4 in.)		Ducks and Geese^a (feathers less than 1/2 in.)		All Other Poultry (feathers less than 1/2 in.)	
		Carcass	Parts	Carcass	Parts	Carcass	Parts
		6	3	10	5	6	3
Exposed Flesh:		Carcass			Parts		
Weight Range							
Minimum	Maximum						
None	2 lbs.	No part on the carcass (wings, legs, entire back or entire breast) has more than one-third of the flesh exposed			No more than one-third of the flesh normally covered by skin exposed		
Over 2 lbs.	6 lbs.						
Over 6 lbs.	16 lbs.						
Over 16 lbs.	None						

B Quality			
Discolourations:^b Carcass		Carcass Lightly or Moderately Shaded Discolourations	
		Breast and Legs	Elsewhere
None	2 lbs.	1 1/4 in.	2 1/4 in.
Over 2 lbs.	6 lbs.	2 in.	3 in.
Over 6 lbs.	16 lbs.	2 1/2 in.	4 in.
Over 16 lbs.	None	3 in.	5 in.
Discolourations:^b Large Carcass Parts (halves, front and rear halves)		Large Carcass Parts Lightly or Moderately Shaded Discolourations	
		Breast and Legs	Elsewhere
None	2 lbs.	1 in.	1 1/4 in.
Over 2 lbs.	6 lbs.	1 1/2 in.	1 3/4 in.
Over 6 lbs.	16 lbs.	2 in.	2 1/2 in.
Over 16 lbs.	None	2 1/2 in.	3 in.
Discolourations:^b Other Parts		Other Parts Lightly or Moderately Shaded Discolourations	
		Breasts, Legs and Parts	
None	2 lbs.	3/4 in.	
Over 2 lbs.	6 lbs.	1 in.	
Over 6 lbs.	16 lbs.	1 1/2 in.	
Over 16 lbs.	None	1 3/4 in.	
Disjointed and Broken Bones:		Carcass—two disjointed and no broken bones, or one disjointed and one nonprotruding broken bone. Parts— may be disjointed, no broken bones; wing beyond second joint may be removed at a joint.	
Missing Parts:		Wing tips, second wing joint and tail.	
Trimming:		Carcass	Parts
		Slight trimming of the carcass is permitted provided the meat yield of any part on the carcass is not appreciably affected. The back may be trimmed in an area not wider than the base of the tail to the area halfway between the base of the tail and the hip joints.	A moderate amount of meat may be trimmed around the edge of a part to remove defects.
Freezing Defects:		May lack brightness. Few pockmarks due to drying. Moderate areas showing a layer of clear, pinkish or reddish coloured ice.	
^a Hair or down is permitted on the carcass or part, provided the hair or down is less than 3/16 inch in length and is scattered so that the carcass or part has a clean appearance, especially on the breast and legs. ^b Discolourations due to flesh bruising shall be free of clots and may not exceed one-half the total aggregate area of permitted discoloration			

Table 7.5.3 Summary of specifications for standards of C-quality for individual carcasses and parts used in the United States (USDA, 1998)

C Quality							
Conformation: <i>Breastbone</i> <i>Back</i> <i>Legs and Wings</i>		Abnormal Seriously curved or crooked Seriously crooked Misshapen					
Fleshing:		Poorly fleshed					
Fat Covering:		Lacking in fat covering over all parts of carcass					
Defeathering: Scattering of protruding feathers and hairs		Turkeys (feathers less than 3/4 in.)		Ducks and Geese^a (feathers less than 1/2 in.)		All Other Poultry (feathers less than 1/2 in)	
		Carcass	Parts	Carcass	Parts	Carcass	Parts
		8	4	12	6	8	4
Exposed Flesh: Weight Range		Carcass			Parts		
Minimum	Maximum						
None	2 lbs.	No limit					
Over 2 lbs.	6 lbs.						
Over 6 lbs.	16 lbs.						
Over 16 lbs.	None						
Discolourations:		Carcass					
Carcass		Breast and Legs			Elsewhere		
None	2 lbs.	No limit on size, number of areas or intensity of discolourations and flesh bruises if such areas do not render any part of the carcass unfit for food.					
Over 2 lbs.	6 lbs.						
Over 6 lbs.	16 lbs.						
Over 16 lbs.	None						
Discolourations: Parts (includes large carcass parts)		Parts Breasts, Legs and Parts					
None	2 lbs.	No limit on size, number of areas or intensity of discolourations and flesh bruises if such areas do not render any part unfit for food.					
Over 2 lbs.	6 lbs.						
Over 6 lbs.	16 lbs.						
Over 16 lbs.	None						
Disjointed and Broken Bones:		No limit					
		Carcass			Parts		
Missing Parts:		Wing tips, wings and tails. Backs shall include all meat and skin from pelvic bones, except that the meat contained in the ilium (oyster) may be removed. The vertebral ribs and scapula with meat and skin and the backbone located anterior (forward) if ilia bones may also be removed (front half of back).					

C Quality	
Trimming:	Trimming of the breast and legs is permitted but not to the extent that the normal meat yield is materially affected. The back may be trimmed in an area not wider than the base of the tail and extending from the tail to the area between the hip joints.
Freezing Defects:	Numerous pockmarks and large dried areas.
^a Hair or down is permitted on the carcass or part, provided the hair or down is less than 3/16 inch in length and is scattered so that the carcass or part has a clean appearance, especially on the breast and legs.	

The major criteria for Grade A are as follows:

a. Conformation: the carcass or part is free of deformities that detract from its appearance or that affect the normal distribution of flesh. Slight deformities, such as slightly curved or dented breastbones and slightly curved backs, may be present.

b. Fleshing: the carcass has a well-developed covering of flesh, considering the kind, class, and part. The breast is moderately long and deep, and has sufficient flesh to give it a rounded appearance, with the flesh carrying well up to the crest of the breastbone along its entire length (see Fig. 7.5.2). The leg is well fleshed and moderately thick and wide at the knee and hip joint area, and has a well-rounded, plump appearance with the flesh carrying well down toward the hock and upward to the hip joint area. The drumstick is well fleshed and moderately thick and wide at the knee joint and has a well-rounded, plump appearance with the flesh carrying well down toward the hock. The thigh is well to moderately fleshed. The wing is well to moderately fleshed.

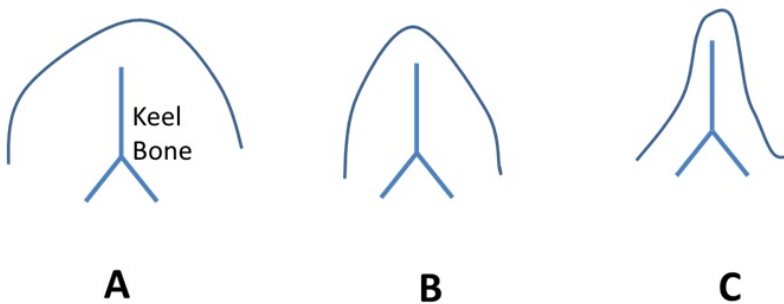


Figure 7.5.2 Illustration of poultry breast area (cross section) showing variation in the amount of flesh covering the breastbone. Drawing on the left shows an example of Grade A. A= well fleshed; B=fairly well fleshed; C poorly fleshed.

c. Fat covering: the carcass or part, considering the kind, class and part, has a well-developed layer of fat in the skin. The fat is well distributed so that there is a noticeable amount of fat in the skin in the areas between the heavy feather tracts.

d. Defeathering: the carcass or part shall have a clean appearance, especially on the breast and legs, and shall be free of protruding feathers. A carcass or part shall be considered free from protruding feathers when it complies with the tolerances specified in Table 7.5.1. (Note: for Grades B and C specifications, see Tables 7.5.2 and 7.5.3, respectively).

e. Discolouration: the requirements contained in this section are applicable to discolourations of the skin and flesh of poultry and the flesh of skinless poultry. The carcass, parts derived from the carcass, or large carcass parts may have slight discolourations, provided the discolourations do not detract from the appearance of the product.

The carcass may have lightly shaded areas of discolouration, provided the aggregate area of all discolourations does not exceed an area equivalent to the area of a circle of the diameter specified in Table 7.5.1. Evidence of incomplete bleeding, such as more than an occasional slightly reddened feather follicle, is not permitted.

The carcass may have moderately shaded areas of discolouration and discolourations due to flesh bruising, provided the following:

- a. They are not on the breast or legs, except for the area adjacent to the hock joint.
- b. They are free of clots.
- c. They may not exceed an aggregate area equivalent to the area of a circle of the diameter specified in Table 7.5.1.

Parts, other than large carcass parts, may have lightly shaded areas of discolouration, provided the aggregate area of all discolourations does not exceed an area equivalent to the area of a circle of the diameter specified in Table 7.5.1. Evidence of incomplete bleeding, such as more than an occasional slightly reddened feather follicle, is not permitted. Parts, other than large carcass parts, may have moderately shaded areas of discolouration and discolourations due to flesh bruising, provided the following:

- a. They are not on the breast or legs, except for the area adjacent to the hock joint.

- b. They are free of clots.
- c. They may not exceed an aggregate area equivalent to the area of a circle of the diameter specified in Table 7.5.1.

Large carcass parts, specifically halves, front halves, or rear halves, may have lightly shaded areas of discoloration, provided the aggregate area of all discolorations does not exceed an area equivalent to the area of a circle of the diameter specified in Table 7.5.1. Large carcass parts, specifically halves, front halves, or rear halves, may have moderately shaded areas of discoloration and discolorations due to flesh bruising, provided the following:

- a. They are not on the breast or legs, except for the area adjacent to the hock joint.
- b. They are free of clots.
- c. They may not exceed an aggregate area equivalent to the area of a circle of the diameter specified in Table 7.5.1.
- d. Disjointed/broken bones and missing parts: parts are free of broken bones. Parts are free of disjointed bones except that thighs with back portions, legs, or leg quarters may have the femur disjointed from the hip joint. The carcass is free of broken bones and has not more than one disjointed bone.

The wing tips may be removed at the joint, and in the case of ducks and geese, the parts of the wing beyond the second joint may be removed, if removed at the joint and both wings are so treated. The tail may be removed at the base. Cartilage separated from the breastbone is not considered a disjointed or broken bone.

g. Exposed flesh: the requirements contained in this section are applicable to exposed flesh resulting from cuts, tears, and missing skin.

Large carcass parts, specifically halves, front halves or rear halves, may have exposed flesh due to cuts, tears, and missing skin, provided the aggregate area of all exposed flesh does not exceed an area equivalent to the area of a circle of the diameter specified in Table 7.5.1.

The carcass may have exposed flesh due to cuts, tears, and missing skin, provided the aggregate area of all exposed flesh does not exceed an area equivalent to that of a circle of the diameter specified in Table 7.5.1.

For all parts, trimming of the skin along the edge is allowed, provided that at least

75% of the normal skin cover associated with the part remains attached and further provided that the remaining skin uniformly covers the outer surface in a manner that does not detract from the appearance of the part.

Other parts may have exposed flesh due to cuts, tears, and missing skin, provided the aggregate area of all exposed flesh does not exceed an area equivalent to that of a circle of the diameter specified in Table 7.5.1. In addition, the carcass or part may have cuts or tears that do not expand or significantly expose flesh, provided the aggregate length of all such cuts and tears does not exceed a length tolerance using the dimensions listed in Table 7.5.1.

h. Freezing defects: with respect to consumer packaged poultry, parts, or specified poultry food products, the carcass, part, or specified poultry food product is practically free from defects that result from handling or occur during freezing or storage. The following defects are permitted if they, alone or in combination, detract only very slightly from the appearance of the carcass, part or specified poultry food product:

- a. Slight darkening over the back and drumsticks, provided the frozen bird or part has a generally bright appearance occasional pockmarks due to drying of the inner layer of skin (derma); however, none may exceed the area of a circle 1/8 inch in diameter for poultry weighing 6 pounds or less and 1/4 inch in diameter for poultry weighing over 6 pounds.
- b. Occasional small areas of clear, pinkish or reddish coloured skin.
- c. Occasional small areas of dehydration, white to light gray in colour, on the flesh of skinless carcasses, parts or specified poultry food products not to exceed the permitted aggregate area for discolourations as provided in Table 7.5.1. Note: A-quality poultry backs shall meet all applicable provisions of this section pertaining to parts and shall include the meat contained on the ilium (oyster), pelvic meat and skin and vertebral ribs and scapula with meat and skin.

An internal, in-plant system for deboned meat and/or parts can sometimes be used and may include the following:

- a. Presence of bruises and/or blood clots
- b. Presence of bones and cartilage
- c. Other factors

Another example is from the British Grading Guide (DEFRA, 2011). According to the Guide, poultry cuts and carcasses can be graded as either A or B, according

to conformation and appearance. The definition starts with Class B and indicates that the minimum standards for a whole bird to be graded as B are that the carcass is:

- a. Intact, taking into account presentation as described in the Regulations.
- b. Clean, free from any visible foreign matter, dirt or blood.
- c. Free from any foreign smell.
- d. Free of visible blood stains unless small and unobtrusive.
- e. Free of protruding broken bones.
- f. Free of severe bruising.
- g. For fresh poultry, there should be no trace of the carcass having been frozen.

In addition to the points mentioned above, the following conditions apply to the Class A carcasses:

- a. Must have good conformation.
- b. The flesh must be plump.
- c. The breast must be well developed (described as broad, long and fleshy).
- d. The legs should be fleshy.
- e. On chickens, young ducks or ducklings, and turkeys there should be a thin regular layer of fat on the breast, back, and thighs.
- f. On cocks, hens, ducks, and young geese, a thicker layer of fat is permissible.
- g. On geese, a moderate to thick fat layer shall be present all over the carcass.
- h. A few small feathers, stubs (quill ends) and hairs (filoplumes) may be present on the breast, legs, back, foot joints, and wing tips.
- i. In the case of boiling fowl, ducks, turkeys, and geese, a few feathers may also be present on other parts.
- j. Some damage, bruising and discolouration is allowed, provided that it is small and unobtrusive, and not present on the breast or legs.
- k. Wing tips may be missing.
- l. A slight redness in wing tips and follicles is allowed.
- m. For frozen or quick-frozen poultry there should be no traces of freezer burn (freezer burn is the local or area-type irreversible drying up of skin and/or flesh which may produce changes: in the original colour (usually paler); or in smell (rancid); or in flavour (flavourless); or in texture (dry, spongy) on the breast or legs. Small unobtrusive traces of freezer burn are allowed on other parts of the carcass.

In recent years a grading system based on meat quality attributes, such as water-holding capacity and texture, has been discussed for use by the industry. Such a system is of interest to further processors who are looking for meat that will hold added moisture (high quality protein) and not fall apart during cooking (good texture) regardless of skin tears or missing parts (Barbut, 1998).

7.6 Poultry Classification

Different species of poultry (e.g., chicken, turkey, duck) can be divided into classes. The following are the various classes of poultry used in the United States (USDA, 1998).

7.6.1 Chicken Classifications

a. Rock Cornish game hen or Cornish game hen – is a young immature chicken (usually less than five weeks of age), of either sex with a ready to cook weight of not more than two pounds, that was bred from a Cornish chicken or the progeny of a Cornish chicken crossed with another breed of chicken.

b. Rock Cornish fryer, roaster, or hen – is the progeny of a cross between a purebred Cornish and a purebred Rock chicken, without regard to the weight of the carcass involved; however, the term “fryer,” “roaster” or “hen” shall apply only if the carcasses are from birds with ages and characteristics that qualify them for such designation under paragraphs (c) and (d) of this section.

c. Broiler or fryer – is a young chicken (usually under 10 weeks of age), of either sex, that is tender-meated with soft, pliable, smooth-textured skin and flexible breastbone cartilage.

d. Roaster or roasting chicken – is a young chicken (usually less than 12 weeks of age), of either sex, that is tender-meated with soft, pliable, smooth-textured skin and breastbone cartilage that may be somewhat less flexible than that of a broiler or fryer.

e. Capon – is a surgically unsexed male chicken (usually under four months of age) that is tender-meated with soft, pliable, smooth-textured skin.

f. Hen, fowl, or baking or stewing chicken – is a mature female chicken (usually more than 10 months of age) with meat less tender than that of a roaster or roasting chicken and a nonflexible breastbone tip.

g. Cock or rooster – is a mature male chicken with coarse skin, toughened and darkened meat, and hardened breastbone tip.

7.6.2 Turkey Classifications

a. Fryer-roaster turkey – is a young immature turkey (usually under 12 weeks of age), of either sex, that is tender-meated with soft, pliable, smooth-textured skin and flexible breastbone cartilage.

b. Young turkey – is a turkey (usually under six months of age) that is tender-meated with soft, pliable smooth-textured skin and breastbone cartilage that is somewhat less flexible than that of a fryer- roaster turkey. Sex designation is optional.

c. Yearling turkey – is a fully matured turkey (usually under 15 months of age) that is reasonably tender-meated with reasonably smooth-textured skin. Sex designation is optional.

d. Mature turkey or old turkey (hen or tom) – is an old turkey of either sex (usually in excess of 15 months of age) with coarse skin and toughened flesh.

Note: for labeling purposes, the designation of sex within the class name is optional, and the two classes of young turkeys may be grouped and designated as “young turkeys.”

7.6.3 Duck Classifications

a. Broiler duckling or fryer duckling – is a young duck (usually under eight weeks of age), of either sex, that is tender-meated and has a soft bill and a soft windpipe.

b. Roaster duckling – is a young duck (usually under 16 weeks of age), of either sex, that is tender-meated and has a bill that is not completely hardened and a windpipe that is easily dented.

c. Mature duck or old duck – is a duck (usually over six months of age), of either sex, with toughened flesh, hardened bill and hardened windpipe.

7.6.4 Goose Classifications

- a. Young goose** – A young goose may be of either sex, is tender-meated and has a windpipe that is easily dented.
- b. Mature goose or old goose** – A mature goose or old goose may be of either sex and has toughened flesh and a hardened windpipe.

7.6.5 Guinea Fowl Classifications

- a. Young guinea** – is tender-meated and has flexible breastbone cartilage.
- b. Mature guinea or old guinea** – may be of either sex and has toughened flesh and a hardened breastbone.

7.6.6 Pigeon Classifications

- a. Squab** – is a young, immature pigeon of either sex that is extra tender-meated.
- b. Pigeon** – is a mature pigeon of either sex, with coarse skin and toughened flesh.

References

- Barbut, S. 1998. Estimating the magnitude of the PSE problem in poultry. *J. Muscle Foods* 9:35.
- Barbut, S. and I. Pronk. 2013. HACCP. Poultry and egg processing using HACCP programs. In: *Food Safety Management*. Lelieveld, H. and Y. Motarjemi (Eds). Elsevier Pub., San Diego, CA, USA.
- Bilgili, S. 2010. Poultry meat inspection and grading. In: *Poultry Meat Processing*. Owen, C., C. Alvarado and A. Sams (Eds). CRC Press, New York, NY, USA.
- DEFRA. 2011. Poultry Meat Quality Guide. Department of Food, Environment and Rural Affairs. London, UK. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69331/pb13457-poultrymeat-quality-guide.pdf. Accessed April 2014.
- Löhren, U. 2012. Overview on current practices of poultry slaughtering and poultry meat inspection. European Food Safety Authority Supporting Publication 2012:EN-298. <http://www.efsa.europa.eu/en/search/doc/298e.pdf>. Accessed January 2015.
- USDA. 2014. Modernization of Poultry Slaughter Inspection: Final Rule. <http://www.fsis.usda.gov/wps/wcm/connect/fb8c866a-a9b7-4b0d-81c9-f190c4a8d4d/2011-0012F.htm?MOD=AJPERES>. Accessed January 2015.
- USDA. 1999. Poultry Postmortem Inspection #703c & 904. United States Department of Agriculture, Washington, D.C., USA.
- USDA. 1998. Classes, Standards and Grades for Poultry #70.220. Handbook No. 31. United States Department of Agriculture, Washington, D.C., USA.
- USDA. 1987. Meat and Poultry Inspection Manual. Food Safety Inspection Service. United States Department of Agriculture, Washington, D.C., USA.