

Microbiological Control in Poultry Meat Processing

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When processing poultry, assume the raw product (bird) is contaminated. This approach differs from the control program for production. Pathogenic organisms of concern in production are primarily disease causing agents in poultry. The organisms of concern in processing are disease causing agents in humans and are not generally the same pathogens, even where *Salmonella* is concerned. The primary objective of control programs in processing poultry meat is to maintain the high product quality consumers desire and expect.

It is generally accepted that the physical quality of a raw food product cannot be improved by processing, for example, an inferior incoming product cannot be altered by processing to become a superior final product. However, it is possible to improve the

microbiological quality of a poultry product as a result of bacterial reductions occurring during normal processing functions. It must be emphasized that the control of microorganisms in processing is achieved as part of a total microbiological control program, not just pathogens alone.

Microbiological Concepts in Poultry Processing

The primary problem is that the bird is the major source of microbial organisms when it enters the processing plant. Currently, there is not a procedure to eviscerate the poultry aseptically. Unfortunately, the organisms are not visible at inspection. Identifying processing functions that contribute to reductions or increases in bacterial numbers is essential. The influence of processing systems on mesophilic bacterial concentrations (Aerobic Plate Count) obtained from broiler carcasses (Figure 1) illustrates that

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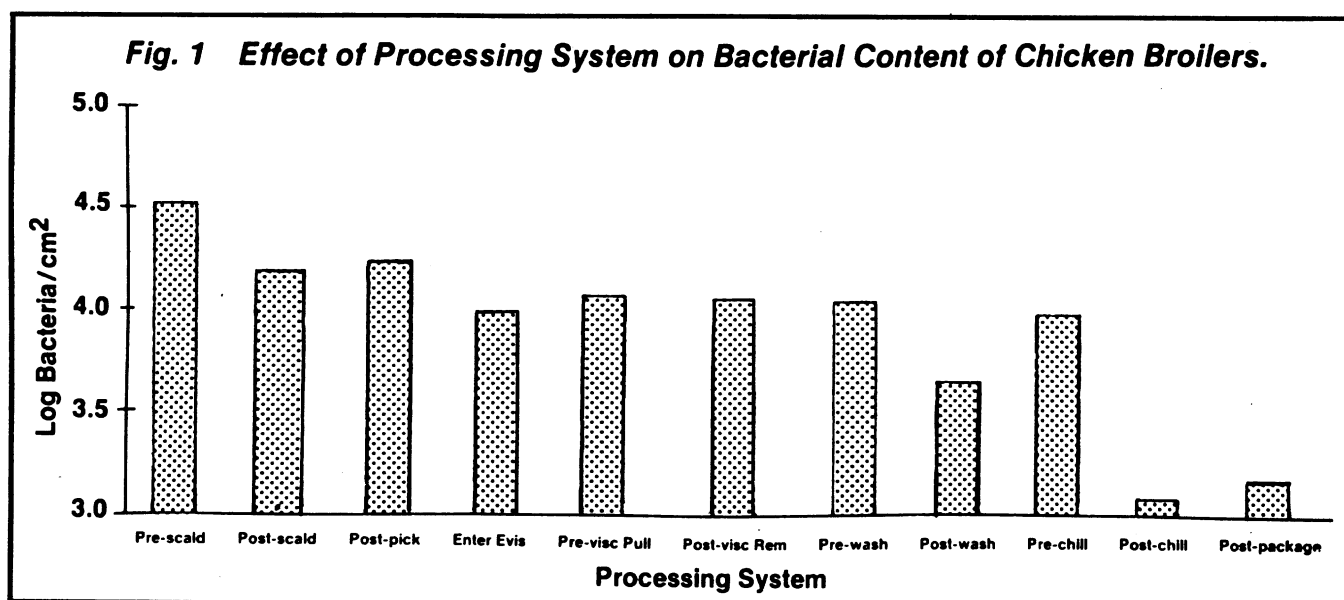
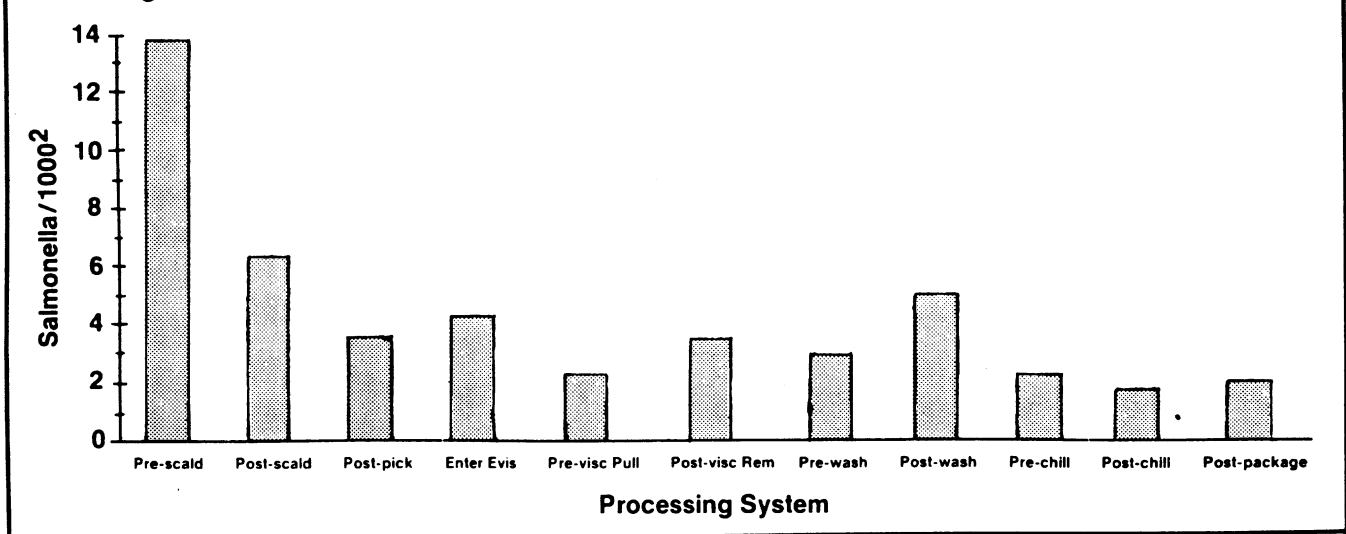


Fig. 2 Effect of Processing System on Salmonella Bacterial Content of Turkeys.



bacterial populations are reduced during scalding, washing and chilling procedures. The hot water used in scalding and the cold water used in chilling, acting in conjunction with the agitation in both of these systems, cause a cleansing effect by removing surface bacteria. Processing systems that require manual handling generally result in bacterial increases. Similar effects have been reported for pathogenic concentrations including *Salmonella* and *Staphylococcus aureus* on broiler carcasses.

Salmonella concentrations obtained from turkey carcasses (Figure 2) reveal that *Salmonella* is present on the live bird sampled prior to scalding. The processing functions where water is utilized, including scalding, picking, washing and chilling, all tend to reduce the number of *Salmonella*, as was noted for the total mesophilic and *Salmonella* bacterial population in broilers. Processing systems requiring manual handling, such as transfer to evisceration, showed increases.

Contamination Prevention

The key concept throughout the processing operation is to limit or prevent contamination of products containing low bacterial numbers, or in the case of pathogens, no *Salmonella*. Contact with products containing high bacterial numbers and possibly *Salmonella* should be avoided. The main source of cross-contamination during poultry processing is *people*. Even though high water use operations serve to lower the concentration of bacteria on the

carcass, the potential for cross-contamination between carcasses exists due to the common contact in scalding and chilling. Mechanized process functions, including picking, hock cutting, head removal, vent cutting, evisceration, preen gland removal and lung removal, offer potential sites for cross-contamination of the carcass if sanitation practices are not strictly adhered to. The mechanized equipment utilized in processing operations is usually sprayed continuously with chlorinated water (20 PPM) during processing. In addition, the equipment is rinsed down during breaks and lunch and thoroughly sanitized in the routine clean up at the end of the processing shift.

Processing systems utilizing manual labor are required to have hand-wash nozzles for use by the worker. The USDA inspection station is equipped with hand-wash nozzles to aid in preventing cross-contamination. The inspection process also contributes to the control program through the identification and isolation of carcasses which contain fecal contamination.

The switch from manual to mechanized processing procedures, such as evisceration, has been suggested as a factor in increased microbiological contamination of poultry products. However, work conducted at Texas A&M University indicates that the switch from manual to mechanical evisceration has not been associated with an increase in fecal contamination, as measured by presumptive coliform concentration (Figure 3). Fecal contamination has been considered a primary source of *Salmonella* on poultry products.

Effective Employee Training

Many processing functions in poultry plants are now mechanized, but there are still some manual operations that can contribute to increased bacterial contamination. Effective training of line employees concerning sanitation, appropriate use of gloves, handwashing routines and a general attitude of sanitation awareness is an integral part of the microbiological control program. The primary emphasis in employee training and supervision must be the reduction or elimination of potential fecal contamination early in the processing procedure. Maintenance of peak quality during all stages of processing is important.

Anti-Microbial Systems

In addition to these control programs, the use of approved anti-microbial compounds or processes in certain systems has been employed to some extent. For example, the use of chlorination in wash and chill waters increases effectiveness in the control program. The use of 9 PPM in chill water has reduced Salmonella populations by as much as 25 percent. Chlorine dioxide and certain acid compounds (sorbate, acetic, etc.) have been investigated as potential aids in controlling microbial contamination both in scalding and chilling. Although these compounds are effective to some extent, they do not solve the problem because they are quickly neutralized upon contact with organic materials other than bacteria. In the chill water, for example, the organic matter such as blood and tissue particles readily bind with the residual chlorine, thereby rendering it

ineffective in controlling bacterial organisms. Other potential control measures, such as irradiation and chemical sprays or dips are not currently utilized and generally have met consumer resistance to use in food products. Another alternative in reducing bacterial content is to remove the skin from poultry. Research has indicated that greater than 90 percent of the bacterial contamination is associated with the skin surface. However, this is not attractive to the processor because of the reduction in saleable product.

Packaging Systems

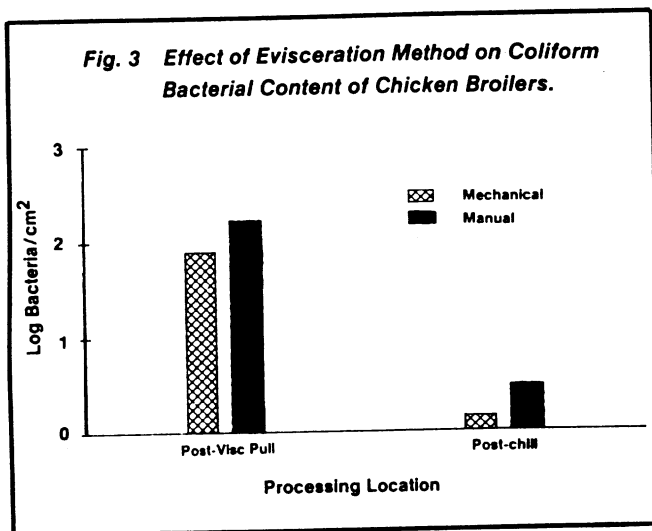
The development of poultry packaging systems has been influenced by two primary concerns. The length of storage, or shelf-life, of the product in the marketing chain is of vital concern from a business perspective. The product safety concern, or public health aspect, is important from the standpoint of the integrity and quality perception of the company in the mind of the consumer.

The packaging systems that currently offer the greatest efficiency in meeting these two objectives rely very heavily on temperature control and proper handling techniques. Since completely eliminating pathogenic microorganisms is not possible, effort should be directed at preventing or minimizing any increase in bacterial numbers.

Although the standard *ice-pack* system, which has been utilized for years, has served the industry well in the beginning of refrigerated transportation, it is no longer acceptable for retail distribution to home consumer markets. The ice-pack system is a bulk transport system which requires extensive handling and offers the potential for cross-contamination at the retail level.

The preferred method of packaging for the retail home consumer is the *chill-pack* system. The switch to this system has provided two major advantages for the home consumer market. The product is presented in an individual package, preventing potential cross-contamination of pathogenic organisms, and it offers greater control of both shelf-life and public safety concerns as a result of the lowered storage temperature requirements (28° F) while remaining a "non-frozen" product.

Bulk-packaging systems, which are desirable for food service distribution systems, are best served by IQF (individually quick frozen) or similar types of



systems. This system eliminates any shelf-life considerations and effectively limits the growth of pathogenic organisms. The IQF system is superior to the ice-pack system in which one Salmonella contaminated carcass can contaminate other previously uncontaminated carcasses. There is some use of modified atmospheric environments, CO₂ for example, which offer extended shelf-life but may still result in cross-contamination. The possibility may exist that a gas, or combination of gases, can selectively eliminate specific pathogens.

In summary, effective microbiological control programs in processing poultry include three primary components:

- 1) Identification and enhancement of processing functions which result in reductions of pathogenic and other microbiological contaminants;
- 2) Identification and elimination or control of

processing functions which result in increased populations of pathogens and other microbiological contaminants; and

- 3) Avoiding cross-contamination of products containing no pathogens with those containing pathogens, regardless of whether the product is raw or cooked.

Implementation of the *Total Control Program* concept is dependent on effective education programs that will insure all personnel have complete awareness of the sanitation principles necessary for control of pathogens and other microbiological contaminants. A total commitment to the control effort, as well as a cooperative spirit, will be required on the part of the poultry processing/marketing firms, the various research institutions and the state and federal regulatory agencies to insure continued improvement in the microbiological control program.

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