Nationwide Sponge Microbiological Baseline Data Collection Program: Goose

September – November 1997

FOREWORD

This publication is a compilation of data obtained from the Nationwide Sponge Microbiological Baseline Data Collection Program for Geese for the three months from September – November 1997. The program was initiated by the Food Safety and Inspection Service (FSIS) to estimate the prevalence and levels of bacteria of public health concern on goose carcasses as currently produced. The program was designed through consultation with various staffs in the Agency. The Biosciences Division (formerly the Microbiology Division) in conjunction with the Data Analysis and Statistical Support Staff (formerly the Evaluation and Analysis Division) coordinated the conduct of the program, provided data analysis and prepared this report. The microbiological analyses were conducted by the FSIS Field Service Laboratory at Alameda, CA. Sample collection was the responsibility of the FSIS Inspectors-in-Charge without whose cooperation this program could not have been accomplished.

NATIONWIDE SPONGE MICROBIOLOGICAL BASELINE DATA COLLECTION PROGRAM: GOOSE SEPTEMBER – NOVEMBER 1997

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NATIONWIDE SPONGE MICROBIOLOGICAL BASELINE DATA COLLECTION PROGRAM: GOOSE SEPTEMBER – NOVEMBER 1997

EXECUTIVE SUMMARY

From September to November 1997, goose carcass sponge samples were collected at establishments operating under Federal inspection. These samples were analyzed to estimate the prevalence of *Salmonella* and the prevalence and levels of generic *Escherichia coli* on goose carcasses as currently produced. The establishments in the program are responsible for 97.3% of all geese slaughtered in the U.S. under Federal inspection. Samples from 102 goose carcasses were analyzed qualitatively for *Salmonella*, a pathogen often associated with human illnesses as determined by foodborne illness reports. Samples from 102 different carcasses were analyzed quantitatively for generic *Escherichia coli*, an indicator of general hygiene or process control. The weighted estimates of national prevalence for *Salmonella* and generic *E. coli* in geese were found to be 13.7% and 96.5%, respectively. Generic *E. coli* of 10 or fewer colony forming units (cfu) per cm^2 were found on 84.4% of the carcass sponge samples and 100 or fewer cfu/cm^2 were found on 100% of the carcass sponge samples. Generic *E. coli* strains are generally considered nonpathogenic.

INTRODUCTION

The Food Safety and Inspection Service (FSIS) is the Federal agency responsible for enforcing the Federal Meat Inspection Act, the Poultry Products Inspection Act and the Egg Products Inspection Act. These Acts empower the Agency to review facilities for evidence of insanitation, to inspect final products for evidence of adulteration and to review labels to assure proper product labeling. The Acts stipulate the penalties that the Agency can impose to assure compliance. The Inspection of food animals at the time of slaughter has historically focused on identifying symptoms of disease conditions that make the carcass of the animal or parts of the carcass unfit for human food. Many human pathogens, however, reside harmlessly on the hide, feathers or skin of healthy animals or in their digestive tracts, just as they often reside on the skin and hair of humans, causing no symptoms of disease. Bacteria are not detectable by visual inspection. Bacteria of many types are, in fact, natural and unavoidable residents of all warm blooded animals, including humans. The slaughter procedures that have developed over the years, as well as recently implemented antimicrobial interventions (e.g. trisodium phosphate, organic acid rinses, steam vacuuming, steam pasteurization, antimicrobial sprays) for various species, reduce the levels of many pathogenic microorganisms, but do not completely eliminate them. Because the production of raw meat and poultry does not include a procedure, such as cooking, that can be designed to kill remaining bacteria, any microorganism naturally found on these animals, including human pathogens, could be present on the final raw product. This fact has long been recognized by the Agency and by scientific experts worldwide.

Raw meat and poultry, because they are not cooked or similarly processed, cannot be expected to be as free of pathogenic bacteria as is expected in cooked products. Even when produced under ideal conditions, carcasses from normal healthy geese can contain a variety of bacteria, including pathogens. Refrigerated raw poultry will eventually undergo microbial spoilage even if produced from the carcasses of normal, healthy animals, fabricated under good manufacturing conditions, and properly refrigerated. If poultry is not properly cooked, held, cooled, and stored, the pathogens present could cause foodborne illness if the product is consumed.

OBJECTIVES

This non-regulatory program had three primary objectives:

1. To collect data by sponge sampling that provide a microbiological profile of geese carcasses for generic *E. coli* and *Salmonella*.

2. To develop, using the sponge sampling method, generic *E. coli* and *Salmonella* guidelines in support of the Pathogen Reduction/Hazard Analysis Critical Control Point (PR/HACCP) Regulation of July 25, 1996[1]. (The use of sponge sampling for the collection of microbiological data from carcasses is an acceptable non-destructive sampling alternative that alleviates many of the problems associated with excision or whole-bird rinse sampling procedures previously used to establish other slaughter species baselines.)

3. To use the information and knowledge gained from this program as a reference for further investigations and evaluation of new prevention programs.

Program Design Relative to Objectives:

The Nationwide Sponge Microbiological Baseline Data Collection Program: Goose focused on establishing a limited microbiological baseline for goose production. These results on the presence and quantity of selected microorganisms are expressed as a national average relative to slaughter volume. The data obtained provide a *Salmonella* and generic *E. coli* profile of geese as currently produced under Federal inspection. This approach is similar to the FSIS Nationwide Microbiological Baseline Data Collection Programs for steers and heifers[2], cows and bulls[3], broilers[4], market hogs[5], and young turkeys[6].

PROGRAM DESIGN

Establishments Included in the Sampling Frame:

At the time of sampling frame development there were eight (8) establishments that slaughtered geese under Federal inspection. These establishments slaughtered approximately 250,000 geese per year. Of these establishments, only the two that slaughtered more than 5,000 geese per year were included in the sampling frame. These two establishments accounted for approximately 97% of all geese slaughtered in FY 1997. The remaining establishments were not included in the sampling frame because their limited production would have added significant logistical difficulty without providing appreciable additional information.

Sample Design:

There were many factors considered in designing this sampling program. Among these were the size and variability of the population, the nature and number of bacteria to be investigated, the practical costs of sampling, competing program demands, and the type of information sought. Specifically in regard to geese sampling, considerations were also necessary due to the limited number of slaughter plants producing a relatively small total volume of product only during a short, seasonal period of time in the year, usually from September – November. Both sampling and non-sampling errors can affect the reliability of results and, thus, had to be considered in designing this program. Sample errors occur because observations are derived from a portion rather than from the entire population; non-sampling errors can be attributed to many sources inherent in the collection of samples, laboratory analysis and processing of data. Both types of errors were considered in determining the sample size.

Random samples of goose carcasses per microorganism were requested during the time frame of the study (September 15 – November 15 for one plant and October 1 – 31 for the second plant). Samples were requested from each of these two establishments approximately proportional to their individual goose slaughter totals from the period of July 1996 through June 1997. Of these, laboratory results were actually obtained for a total of 102 goose carcass sponge samples for each microorganism. Some samples were not collected for various reasons, such as the establishment did not slaughter on a particular day. Other samples were collected but not analyzed in the laboratory if they became compromised during shipment (e.g., by an open package, invalid receiving temperature or delayed shipment).

The data of this program were weighted by plant slaughter totals to provide a national estimate. This weighting was necessary since the number of analyzed samples from each plant was not proportional to the original weights in the sample design. The weights applied to the data are based on plant slaughter totals for August through November 1997. This time period accounts for virtually all geese slaughtered in the two plants included in the program.

Data Limitations:

The program was designed to provide estimates of national prevalences and levels for generic *E. coli* and *Salmonella* on goose carcasses. The data obtained provide an indication of these organisms which might be present on federally inspected goose carcasses.

The program was not designed to provide microbiological information on individual establishments. In order to obtain such information, one would need to collect a large number of samples from each establishment over a period of time.

Sampling Location Within the Establishment:

To accomplish the objectives of this program, data must be derived from a significant point in the production process. Key factors in the microbial profile of geese are the slaughter and evisceration processes conducted under Federal inspection. To evaluate these processes, samples must be taken before any additional processing. Further processing, handling and distribution will introduce variables that will interfere with the interpretation of the data intended to describe slaughter and evisceration processes. For this reason, carcasses were selected from the drip line after the chill tank, the end point in slaughter and evisceration.

Sample Collection and Description:

Samples were aseptically collected by FSIS Inspectors-in-Charge following the procedures described in "FSIS Goose Microbiological Baseline Study: Procedures for Sponge Sample Collection and Shipment – Final 9/9/97" and instructions provided on computer-generated sample request forms. A sterile sponge, hydrated with 10 ml of cold, sterile Buffered Peptone Water (BPW) was used to swab, within a sterile, 5 X 10 cm, plastic template, a 100 cm^2 skin surface area composite. The composite included one midback site (50 cm^2) and one thigh site (50 cm^2) from each goose carcass. One sponge sample was collected from one goose carcass for *Salmonella* analysis, and a separate sponge sample was collected from a second goose carcass for generic *E. coli* analysis at the same sampling period. The individually bagged, sponge samples were then placed in an insulated shipper with chilled gel-ice packs capable of maintaining refrigeration temperatures and shipped the same day as sample collection to the designated laboratory via an overnight delivery service. Samples were collected Monday through Friday during slaughter operations. Samples collected and shipped on Fridays were labeled specifying "For Saturday Delivery" on the shipping box. Only samples received at the laboratory the day after sample collection, with a sample receipt temperature of 0 to 10°C (inclusive), were analyzed. Samples received outside of those constraints were discarded. Only one analysis, either for *Salmonella* or generic *E. coli*, was performed on each individual sponge of the paired sponge samples.

Selection of Organisms:

A discussion of the choice of organisms to be used in establishing microbiological guidelines is found in the study entitled "An Evaluation of the Role of Microbiological Criteria for Foods and Food Ingredients" published by the Subcommittee on Microbiological Criteria of the National Research Council, National Academy of Sciences[(7)]. That rationale was reviewed and assessed for applicability and incorporation into this program as it was also used in previous FSIS baseline sampling programs.

For the purposes of the goose sponge sampling program, two microorganisms were selected for analysis. One was selected from a group of organisms most often associated with human illness as determined by foodborne illness reports[8] [9] or certain pathogens of concern because of the severity of the illness they produce in humans:

- *Salmonella*

The other organism was selected from groups of bacteria that are thought to be of value as indicators of general hygiene or process control:

- Generic *Escherichia coli*

Analytical Methods:

To the sponge designated for *Salmonella* analysis, an additional 50 ml BPW was added to bring the total volume to 60 ml. The sponge with BPW was stomached in the original bag for two minutes. The procedure used for qualitative *Salmonella* analysis was the same as that described in Appendix E of the July 25, 1996 PR/HACCP Regulation[1].

To the sponge designated for generic *E. coli* analysis, an additional 15 ml BPW was added to bring the total volume to 25 ml. The sponge with BPW was stomached in the original bag for two minutes and then analyzed according to the procedure for quantitative, generic *E. coli* analysis described in Chapter 3, Section 3.5c. of the Microbiology Laboratory Guidebook[10] employing rehydratable Petrifilm™. Appropriate dilutions were made to obtain an end point and Petrifilm™ was inoculated in duplicate for each dilution. After determining the average Petrifilm™ count, it was multiplied by the appropriate dilution factor, and then divided by 4 to obtain the count on a cfu/cm^2 basis.

RESULTS

The results of this sponge sampling microbiological baseline data collection program for geese, are presented in the tables found in this report. Table 1 presents the prevalence, or frequency of occurrence, of the selected microorganisms from slaughtered goose carcass surfaces. An estimated national prevalence of 96.5% was found for generic *E. coli* in 102 sampled carcasses and a corresponding national prevalence of 13.7% was found for *Salmonella* in 102 sampled carcasses.

Table 2 presents the mean level of generic *E. coli* quantitatively recovered from goose carcasses that tested positive for this organism. The mean level in this table is expressed as both the $\log_{10}$ mean and the geometric mean; the geometric mean is the antilog of the $\log_{10}$ mean. The geometric mean of viable, generic *E. coli* recovered from sampled goose carcasses in this program was 1.97 colony forming units per square centimeter (cfu/cm^2).

Table 3 shows the frequency with which the positive samples enumerated for generic *E. coli* fall within the specified ranges. All of the 102 goose carcasses analyzed had 100 or fewer and 84.4% had 10 or fewer cfu/cm^2 generic *E. coli* on their surfaces.

DISCUSSION

This report presents the primary goal of the program: a limited microbial profile of goose carcasses, as produced under Federal inspection, in regard to the prevalence of *Salmonella* and the prevalence and quantitation of generic *E. coli* as determined by nondestructive sponge sampling.

The basic findings of this baseline program, limited to two surveyed microorganisms and a limited number of sampled goose carcasses, revealed prevalences of *Salmonella* (13.7%) and generic *E. coli* (96.5%) with a relatively low mean number of generic *E. coli* on the carcass surface (1.97 cfu/cm^2). Limitations on this program were partially due to the fact that geese are a minor slaughter class numerically compared to cattle, swine and turkeys. Also, geese are seasonally slaughtered, usually only during the months of September – November. Not withstanding these limitations, the data provided from this baseline study are still very useful for establishment of generic *E. coli* and *Salmonella* guidelines in slaughtered geese using the sponge sampling technique.

The presence of pathogenic bacteria on the surface of goose carcasses, even though of low prevalence, emphasizes the need for proper refrigeration,

handling, and cooking of goose carcasses or products throughout the food chain. In addition, special care must also be taken to avoid cross contamination of other ready-to-eat food products with raw goose products and in the cleaning and disinfection of food preparation work surfaces after handling raw goose carcasses. However, the prevalence of *Salmonella* and levels of generic *E. coli* enumerated on goose carcasses suggest that recommended cooking temperatures would render products produced from these carcasses safe, as long as the carcasses and the products produced from them, are maintained at refrigeration temperatures throughout subsequent distribution, storage, processing, marketing and preparation for consumption.

Table 1. Prevalence of Generic *Escherichia coli* and *Salmonella* from Goose Carcass Sponge Samples

Microorganism	Samples Analyzed	Prevalence[1]	SE[1, 2]
INDICATOR ORGANISM			
Generic *Escherichia coli*	102	96.5	1.8
PATHOGENIC ORGANISM			
Salmonella	102	13.7	3.4

[1] Weighted by plant 1997 slaughter totals.

[2] Standard error of prevalence using the binomial distribution.

Source: Nationwide Sponge Microbiological Baseline Data Collection Program: Goose (September - November 1997)

Table 2. Mean Level of Generic *Escherichia coli* (per cm^2) from Goose Carcass Sponge Samples

Microorganism	Number of Samples Quantified	Number of Samples Positive	Levels of Positives[1, 2]			
			Log_{10}		Geometric Mean	
			Mean	SE[3]	Mean	95% CI[4]
INDICATOR ORGANISM						
Generic *Escherichia coli*	102	99	0.30	0.07	1.97	(1.47, 2.66)

1 Includes only positive samples.

2 Weighted by plant 1997 slaughter totals.

3 Standard error of the mean log of positive samples.

4 Confidence Interval.

Source: Nationwide Sponge Microbiological Baseline Data Collection Program: Goose (September - November 1997)

Table 3. Generic *Escherichia coli* Distribution (per cm^2) from Goose Carcass Sponge Samples

Range, cfu/cm^2	Percent of Total[1]	Cumulative Percent[1]
0 [2]	3.5	3.5
0.01 - 1	37.5	41.0
1.01 - 10	43.4	84.4
10.01 - 100	15.6	100.0
TOTALS	100.0	-

[1] Weighted by plant 1997 slaughter totals.

[2] Negative by method (Limit of detection = 0.125 cfu/cm^2).

Source: Nationwide Sponge Microbiological Baseline Data Collection Program: Goose (September - November 1997)

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