

**Nationwide Sponge Microbiological
Baseline Data Collection Program:
Young Turkeys**

July 1997 – June 1998

FOREWORD

This publication is a compilation of data obtained from the Nationwide Sponge Microbiological Baseline Data Collection Program for Young Turkeys for the twelve months from July 1997 – June 1998. 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 young turkey carcasses as currently produced. The program was designed through consultation with various staffs in the Agency. The Bioscience 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: YOUNG TURKEYS
JULY 1997 – JUNE 1998**

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EXECUTIVE SUMMARY

From July 1997 through June 1998, sponge samples from young turkey carcasses 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 young turkey carcasses as currently produced. Establishments that slaughtered young turkeys under Federal inspection during the sample selection period were included in the sampling frame. Samples from 1,394 young turkey carcasses were analyzed qualitatively for *Salmonella*, a pathogen often associated with human illness as determined by foodborne illness reports. Samples from 1,394 different carcasses were analyzed quantitatively for generic *E. coli*, an indicator of general hygiene or process control. The estimates of national prevalence for *Salmonella* and generic *E. coli* for young turkeys were 19.6% and 92.7%, respectively. Generic *E. coli* of 10 or fewer colony forming units (cfu) per cm² were found on 83.4% of the carcass sponge samples and 100 or fewer cfu/cm² were found on 97.1% of the carcass sponge samples. Generic *E. coli* 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 tracks, 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 species 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 products, 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 young turkeys contain a variety of bacteria, including some 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 young turkey 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: Young Turkeys focused on establishing a new microbiological baseline for young turkey 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 an updated *Salmonella* and generic *E. coli* profile of young turkeys as currently produced under Federal inspection. This approach is similar to the previous FSIS Nationwide Microbiological Baseline Data Collection Programs for young turkeys⁽²⁾, steers and heifers⁽³⁾, cows and bulls⁽⁴⁾, broilers⁽⁵⁾ and market hogs⁽⁶⁾.

PROGRAM DESIGN

Establishments Included in the Sampling Frame:

All establishments that slaughtered young turkeys under Federal inspection during the sample selection period were included in the sampling frame. There were approximately 65 establishments in this category, which slaughtered about 287 million young turkeys. Young turkey production accounted for approximately 99% of all turkey production within federally inspected plants. Old breeder turkeys and fryer-roaster turkeys accounted for the remaining 1% of production.

Sample Design:

In order to approximate a random sample, the selection was performed in two stages. The first stage was to randomly select an establishment from the sampling frame, and the second was to randomly select the young turkey carcass sample. Establishments were selected with probabilities in proportion to their total number of birds slaughtered. Establishments that have a large percentage of slaughtered birds had a greater chance of being selected, and

could also be selected more than once. This procedure gave all young turkeys slaughtered an approximately equal chance of being selected.

It was determined that a sample size of about 1,200 samples per microorganism would ensure reasonable levels of precision for yearly estimates given the expected prevalence for the bacteria included in this study. To achieve this number (1,200) of samples, about 1,896 samples were requested during the 52 week time frame of the study. Also, to account for unequal production during the year, approximately 39 birds were selected per week during May-November, and 33 birds per week were selected during December-April. Of the birds requested, laboratory results were obtained for 1,396 young turkey carcasses for each microorganism. Some samples were not collected for various reasons, such as the establishment did not slaughter that particular week. Other samples were collected but not analyzed if they became compromised during shipment (e.g., open package, invalid temperature, delayed shipment, etc.).

Data Limitations:

The program was designed to provide estimates of national prevalences and levels for generic *E. coli* and *Salmonella* on young turkey carcasses. The data obtained provide information about these organisms that might be present on inspected turkey 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 young turkeys are the slaughter and evisceration processes conducted under Federal inspection. To evaluate these processes, sample carcasses 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 Turkey Microbiological Baseline Study: Procedures for Sponge Sample Collection and Shipment – Final 6/19/97" (procedures subsequently described in FSIS Directive 10,230.5 [2/4/98]), and instructions provided on computer-generated sample collection 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 cm² skin surface composite. The composite included one midback site (50 cm²) and one thigh site (50 cm²) from each young turkey carcass. One sponge sample was collected from one young turkey carcass for *Salmonella* analysis, and a separate sponge sample was collected from a second young turkey 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 those constraints were discarded. Only one analysis, either for *Salmonella* or for 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 incorporation into this program as it was also used in previous FSIS baseline sampling programs.

For the purposes of the young turkey 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 *E. 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 Regulations⁽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/cm² basis.

RESULTS

The results of this sponge sampling microbiological baseline data collection program for young turkeys, are presented in the tables found in this report. Table 1 presents the prevalence, or frequency of occurrence, of the selected microorganisms from slaughtered young turkey carcass surfaces. An estimated national prevalence of 92.7% was found for generic *E. coli* in 1,396 sampled carcasses and a corresponding national prevalence of 19.6% was found for *Salmonella* in 1,396 sampled carcasses.

Table 2 presents the mean level of generic *E. coli* quantitatively recovered from young turkey carcasses that tested positive for this organism. The mean levels in this table are expressed as both the log₁₀ mean and the geometric mean; the geometric mean is the antilog of the log₁₀ mean. The geometric mean of viable generic *E. coli* recovered from sampled young turkey carcasses in this program was 2.46 colony forming units per square centimeter (cfu/cm²).

Table 3 shows the frequency with which the positive samples enumerated for generic *E. coli* fall within the specified ranges. Cumulatively, 97.1% had 100 or fewer and 83.4% had 10 or fewer cfu/cm² generic *E. coli* on their surfaces.

DISCUSSION

This report presents the primary goal of the program: an updated, limited microbial profile of young turkey 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 non-destructive sponge sampling.

The basic findings of this baseline program, limited to two surveyed micro-

organisms, revealed a prevalence of both *Salmonella* (19.6%) and generic *E. coli* (92.7%) with a mean number of generic *E. coli* on the carcass surface (2.46 cfu/cm²). The data provided from this baseline study are very useful for establishment of generic *E. coli* and *Salmonella* guidelines in slaughtered young turkeys using sponge sampling techniques.

The presence of pathogenic bacteria on the surface of young turkey carcasses emphasizes the need for proper refrigeration, handling and cooking of turkey 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 turkey products and in cleaning and disinfection of food preparation work surfaces after handling raw turkey products. However, the prevalence of *Salmonella* and levels of generic *E. coli* enumerated on young turkey carcasses suggest that recommended cooking temperatures would render product 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 Young Turkey Carcass Sponge Samples

Microorganism	Samples Analyzed	Number Positive	Prevalence	SE¹
<u>INDICATOR ORGANISM</u>				
<i>Generic Escherichia coli</i>	1396	1294	92.7	0.7
<u>PATHOGENIC ORGANISM</u>				
<i>Salmonella</i>	1396	273	19.6	1.1

¹ Standard error of prevalence using the binomial distribution.

Source: Nationwide Sponge Microbiological Baseline Data Collection Program: Young Turkeys (July 1997 - June 1998)

Table 2. Mean Level of Generic *Escherichia coli* (per cm²) from Young Turkey Carcass Sponge Samples

Microorganism	Number of Samples Quantified	Number of Samples Positive	Levels of Positives ¹			
			Log ₁₀		Geometric Mean	
			Mean	SE ²	Mean	95% CI ³
INDICATOR ORGANISM						
Generic <i>Escherichia coli</i>	1396	1294	0.39	0.02	2.46	(2.24, 2.70)

¹ Includes only positive samples.

² Standard error of the mean log of positive samples.

³ Confidence Interval.

Source: Nationwide Sponge Microbiological Baseline Data Collection Program: Young Turkeys (July 1997 - June 1998)

Table 3. Generic *Escherichia coli* Distribution (per cm²) from Young Turkey Carcass Sponge Samples

Range, cfu/cm²	Number of Samples	Percent of Total	Cumulative Number	Cumulative Percent
0 ¹	102	7.3	102	7.3
0.01 - 1	480	34.4	582	41.7
1.01 - 10	582	41.7	1164	83.4
10.01 - 100	191	13.7	1355	97.1
100.01 - 1,000	28	2.0	1383	99.1
1,000.01 - 10,000	12	0.9	1395	99.9
10,000.01 - 100,000	1	0.1	1396	100.0
TOTALS	1396	100.0	-	-

¹ Negative by method (Limit of detection = 0.125 cfu/cm²).

Source: Nationwide Sponge Microbiological Baseline Data Collection Program:
Young Turkeys (July 1997 - June 1998)

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