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USE OF HACCP FOR CONTROL *SALMONELLA* SAFETY IN MEAT AND MEAT FOOD

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ABSTRACT

The present study was carried out from 400 samples removed from the lines in commercial processing plants and slaughterhouses at different stages of CCPs such as slaughtering, flaying, empting interior, washing and colding for raw meat, selecting raw ingredients, spicing, bagging, cooking, colding and rebagging for roast beef, selecting raw ingredients such as raw meat ,raw materials and spices, blending, fermenting, making dry and bagging for sausages fermentive meat at different slaughterhouses and plants during 2009:10 to report the effect of processing steps in an effective HACCP program on microbial populations ,including *Salmonella* in Tehran .

Salmonella was isolated from samples of chicken ,beef, veal, mutton, roast beef and sausages fermentive meat collected at slaughterhouses and plants. The isolates were characterized by biochemical reactions and serotyping. Eighty isolates of *Salmonella* were obtained with an overall prevalence of 20%. Seventy percent of strains (56 cases of 80 samples)were isolated in CCP2 and 30% of strains (24 cases of 80 samples) were isolated in CCP1.During one year of HACCP implementation in this study to control *Salmonella* contamination overall bacterial populations decreased due to processing .In this study flaying and empting interior stages were the most important points of contamination (CCP2).

However, the national incidence of poultry product contamination with Salmonella has declined since adoption of the Hazard Analysis and Critical Control Point (HACCP) food safety program .Further reductions in carcasses contamination may require other approaches such as the adaptation of on-farm pathogen reduction strategies .

This study successfully determined inprocessing Salmonella population ,thus providing important information that can aid in developing new and effective control strategies for reducing the level and incidence of Salmonella contamination of meats in processing plants.

KEY WORDS: *Food safety ,HACCP ,Hazard Analysis Critical Control Points ,Salmonella, Tehran ,Iran .*

ABBREVIATION KEY: *CCP =Critical Control Point, HACCP = Hazard Analysis Critical Control Points ,FSIS = Food Safety Inspection Service*

INTRODUCTION

Food-borne diseases caused by non-typhoid *Salmonella* represent an important public health problem worldwide so nearly 1.4 million cases of Salmonellosis occur each year in the United States (Angulo et al., 2000). Current regulatory efforts by the Food Safety Inspection Service (FSIS) are concentrated on implementing Hazard Analysis Critical Control Point (HACCP) systems for food safety at postharvest facilities ,such as poultry plants (USDA, FSIS, 1996). In addition, there is considerable discussion about extending regulatory, HACCP-type programs to the farm as the site where primary microbial infection of food animals occurs .In theory ,management practices identified as on-farm Critical Control Points for food borne pathogens could be modified to reduce the number of bacteria entering the processing (slaughter)facility (i.e.,preharvest food safety).

The HACCP system, as applied to food safety ,originated in the 1960s .It was developed jointly by the Pillsbury Company ,the U.S. Army, and the National Aeronautics and Space Administration (NASA) with the objective of ensuring the safety of food being developed for the manned space program. The starting point was Failure Mode and Effect Analysis ,an engineering system that looks at the process in its entirely (component and manufacturing stages) and seeks to identify what can go wrong. The HACCP system has become the universally accepted strategy for ensuring food safety (National Advisory Committee on Microbial Criterio for Foods, 1997).

Briefly, HACCP is a systematic approach to the identification ,evaluation ,and control of food safety hazards based on the following seven principles :

Principle 1:Conduct a hazard analysis (including five preparatory steps).

Principle 2:Determine the Critical Control Points (CCPs).

Principle 3:Establish critical limit(s).

Principle 4:Establish a system to monitor control of the CCP.

Principle 5:Establish the corrective action to be taken when monitoring indicates that particular CCP is not under control .

Principle 6:Establish procedures for verification to confirm that the HACCP system is working effectively.

Principle 7: Establish documentation concerning all procedures and records appropriate to these principles and their application.

A Critical Control Points (CCP) is defined as a step (in the treatment process) at which control can be used to prevent or eliminate a hazard ,or reduce it to an acceptable level. The CCPs depend on the type of sludge treatment being used and the configuration of the works. Stressours used to inactivate pathogens include heat, pH, time, and moister content .Each CCP requires defining a monitoring program to assess whether the CCP is under control. Ideally, this should make use of continuous, real-time measurements. This minimizes the requirement to additional sampling and analysis, but more importantly is allows for early warning what process conditions are moving out of specification.

We isolated and characterized *Salmonella* strains from meat products removed from the lines in commercial processing plants and slaughterhouses at different stages of CCPs in Tehran with use of methods described by Feingold and Baron (1990) and determined the most important points of contamination.

MATERIALS & METHODS

Four hundred samples of meat (100 samples of chicken, 100 of beef, veal, mutton ,100 of roast beef and 100 of sausage fermentive meat) were collected at different stages of CCPs such as slaughtering ,flaying ,empting interior ,washing and colding for raw meat ,selecting raw ingredient, spicing, bagging, cooking, colding and rebagging for roast beef ,selecting raw ingredient such as raw meat, raw materials and spices ,blending ,fermenting ,making dry and bagging for sausages fermentive meat at different slaughterhouses and plants in Tehran between September and August 2009:10 .At each sample site ,five carcasses were removed from the line ,using new clean latex gloves for each .Carcasses were placed individually into sterile plastic bags that were sealed and covered with ice .After collection of all carcasses ,the samples were transported to the lab and held on ice until analyzed (within 2hr of collection).

Selenite F Broth (SFB) was used as a selective enrichment broth for primary isolation of *Salmonella* .Brilliant Green Agar (BGA) and *Salmonella - Shigella* Agar (SSA) were used as selective medium for primary isolation and MacConkey`s Lactose Agar (MLA) was used for purification of suspected colonies .Characterization and preliminary of suspected *Salmonella* cultures were made on the basis of morphology ,characteristics and biochemical reactions (Glynn et al., 1998). The isolated strains of *Salmonella* were serotyped at Razi Vaccine and Serum Research Institute in Iran .

RESULTS

Results for one year of HACCP implementation in *Salmonella* testing program from September 2009 ,through August 2010 ,in Tehran ,are available for six product classes: chicken ,beef ,veal ,mutton ,roast beef and sausage fermentive meat .

During one tear of HACCP implementation ,*Salmonella* samples were collected from different slaughterhouses and plants producing one of these products .*Salmonella* prevalence for these products were lower after one year of HACCP implementation than in baseline studies conducted befor HACCP implementation (Table 1).

Table 1 : *Salmonella* prevalence after 12 months of testing

Salmonella serotypes	Autumn	Winter	Spring	Summer
S.adelaide	2		1	
S.agona	1	1		
S.abortus ovis	1		1	
S.abortus bovis		2		
S.derby	1			
S.dublin	1		1	
S.enteritidis	5	2	2	1
S.havana	3			1
S.heidelberg	2	1		1
S.indiana		2		
S.infantis	3	2	2	1
S.kentucky		2		
S.montevideo	1		1	
S.new port	2	1		
S.saint paul		2	1	
S.senftenberg	1	1	2	
S.typhimurium	4	3	4	1
S.thompson	5	4	3	1
S.worthington		1		
Total	32	24	18	6

Results indicate that *Salmonella*, found on 37 percent of carcasses in pre-HACCP baseline studies, was found on 7 percent of carcasses after the first year of HACCP implementation. For these product classes combined ,100% of the slaughterhouses and plants with complete data sets met their respective *Salmonella* performance standard .In this study flaying and emptying interior stages were the most important points of contamination (CCP2) .Seventy percent of strains (56 cases of 80 samples) were isolated in CCP2 and 30 percent of strains (24 cases of 80 samples) were isolated in CCP1 .

DISCUSSIONS

Our observation indicate that *Salmonella* ,found on 37 % of meat in pre-HACCP baseline studies ,was found on 7 % of meat carcasses after one year of HACCP implementation (Table) .Recent results of the Food Safety Inspection Service (FSIS)(1998-1999) For the first year of the plant *Salmonella* testing program from January 26, 1998, through January 25, 1999, indicate that *Salmonella*, found on 20 percent of broiler carcasses in pre-HACCP baseline studies, was found on 10.9% of broiler carcasses after the first year of HACCP implementation .For swine ,*Salmonella* was found on 8.7% of carcasses in pre-HACCP baseline studies ,and 6.5% of carcasses after HACCP implementation .In ground beef ,*Salmonella* was found in 7.5% of samples in pre-HACCP baseline studies ,and 4.8% of samples after HACCP implementation .In ground turkey ,*Salmonella* was found in 49.9% of samples in pre-HACCP baseline studies ,and 36.4% of samples after HACCP implementation .Although the HACCP concept was originally developed for use in food-processing plants (The Pillsbury Company 1973), it is applicable for food preparation in homes. (WHO 1997,1993b; Codex 1993; Bryan 1992), and can be applied to ensure the safety of foods The strategy can be used to identify food-borne hazards (microbial, physical, and chemical), to assess related risks, and to facilitate the design of effective preventive mechanisms (Moy et al, 1997). In conclusion, we found that raw meats were often contaminated with

Salmonella. The contamination was dependent on the type of meat. The presence of *Salmonella* in meat products remains a significant public health concern. Our data confirm that raw meats may be vehicles for transmitting food-borne diseases. To diminish *Salmonella* contamination rates in retail meats ,it is critical that risk reduction strategies are used throughout the food chain. These strategies include on-farm practices that reduce pathogen carriage, increased hygiene at both slaughter and meat processing, continued implementation of HACCP system, and increased consumer education efforts. Additionally, consumption of undercooked meat products and cross-contamination during food handling and preparation must be avoided t ensure food safety and home and in the food service industry. Further research focusing on effective prevention of food-borne illness is essential for developing intervention and mitigation strategies to reduce the presence of food-borne bacterial pathogens in meat products .The idea of using HACCP data to inform food safety education is of paramount importance in situation of extreme poverty ,and where adequate food-borne disease surveillance may be lacking (Ehnid.H, 2008). Thus in addition to other social and environmental interventions ,data generated can be used to inform health and social authorities, train public health personnel ,and design culturally appropriate food hygiene promotion interventions (Jansan. A, 2007). As Abdulsalam and Kaferstien (1994) observed ,this approach has the potential for promoting food hygiene in primary health care, but has yet to be fully exploited.

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