Risk Assessment and Economic Evaluation of HACCP in Hog Slaughter and Processing

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Summary and Implications

New federal regulations focus control at the processing plant level. This project examines the microbial reductions and costs associated with the use of a HACCP system in large pork slaughter and processing plants. Based on survey and test results from large plants and data gathered from manufacturer sources, costs of individual technologies to reduce microbial contamination range from $0.03 to $0.20 per carcass for hogs; on-going HACCP-related costs were an additional $0.14 per carcass, and in total 1–2% of processing costs. The cost effectiveness of specific food safety controls will depend on product control throughout the production process.

Introduction

New federal regulations focus control at the processing plant level. This project is designed to evaluate the microbial reductions and costs associated with the use of a HACCP system in large pork slaughter and processing plants. The objectives are to measure the efficiency of HACCP systems in achieving lower microbial counts in pork processing, to measure the marginal costs associated with different levels of pathogen reduction in pork processing, and to determine implications for mandated HACCP adoption on industry costs. The study considers specific control points or technologies that are used to reduce, control, or monitor levels of microorganisms during the production process in large pork slaughter and processing plants in the upper Midwest.

Materials and Methods

HACCP is one approach to improving food safety that helps firms decide where to intervene during processing for control of pathogens. Because control of existing processing may be inadequate to reduce microbial contamination to desired levels, firms may consider additional interventions. We examine four pathogen reduction technologies in pork processing: carcass rinses, sanitizing sprays, steam vacuums and a hot water pasteurizer.

Cost data. We estimated the cost of individual technologies based on data from input supply firms and local (representative) costs of electricity, water, and labor, and drew estimates of pathogen reduction from selected meat science studies. These results were extended by collecting in-plant data. Several large processing plants were contacted about providing data on costs incurred in implementing HACCP regulations and additional antimicrobial controls. A questionnaire on costs was developed. Two firms, with information representing four large processing plants, provided information on the costs of HACCP implementation and operation. In addition, firms allowed collection of in-plant microbial samples.

Microbial data. Initial information on effectiveness on control technologies came from published studies. Additional data were collected in-plant from participating firms by sampling for *Salmonella*, *E.coli*, and total plate count (TPC). The sampling took place over the period June 1997 through February 1999, with samples obtained from one prerinse site and two post evisceration sites: prerinse and postrinse. Both plants used acetic acid rinses. For both plants, the prerinse samples were obtained after the last carcass processing before the rinses.

In total, there were 886 observations for *Salmonella*, 824 observations for *E. coli* and 830 observations for TPC. Samples were collected with FSIS procedures. The samples were collected with sponges from three carcass locations (shoulder, mid-line, and ham) from a 100 cm^2 area at each location. All samples were collected during the morning shift and sent to the Iowa State University Veterinary College laboratories for testing.

Methods. First, a simple optimization model was used to find the least-cost combinations to achieve multiple pathogen reduction targets based on available data from published studies of the various technologies and data available on costs of using the technologies. Next, was analysis of the plant samples. Statistical analysis was used to determine which variables had a statistically significant effect on the in-plant microbial levels, or prevalence, holding the effects of other variables constant

Results and Discussion

Analysis of the plant samples showed that observed conditions varied considerably. In part, this can be attributed to differences in processing technologies used. Some antimicrobial treatments reduced microbial contamination of carcasses. However, there were differences across plants in the effectiveness of controls. Other variables, such as day of the week, had a significant impact on the product contamination levels.

There is strong support for the fact that the cost function for reduced microbial levels is upward sloping in pork processing. Some interventions or combinations of interventions are more cost-effective than others.

Based on survey results of the firms and data gathered from manufacturer sources, costs of individual technologies to reduce pathogens are in the range of $0.03 to $0.20 per carcass for hogs. Total costs associated with on-going, recurring costs of HACCP (training, administrative, CCP and plant costs of testing, and process modification) were estimated to be $0.1394 per carcass.

Firms have invested significant resources in implementing HACCP and introducing new antimicrobial controls, such as rinses. The effectiveness of these technologies and controls needs careful plant level study of the microbial levels throughout the production process. The cost effectiveness of specific technologies is likely to depend on product control throughout the process.

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References

Helen H. Jensen, Laurian J. Unnevehr, and Miguel I. Gomez. 1998. Costs of improving food safety in the meat sector." J. Agric. Appl. Econ. 30: 83-94.

Helen Jensen and Laurian Unnevehr. 1999. HACCP in pork processing: Costs and benefits. *In* L. J. Unnevehr (ed.), Economics of HACCP: New Studies of Costs and Benefits. Eagan Press (in press).