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Risk Assessment at a Large Slaughterhouse in Comparison with a Small One

A Thesis Submitted by

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Abstract

The present study involves a comparison between risks associated between large and small slaughterhouses in Egypt to identify the hazards and to evaluate the risks associated for improvement. The study depended on the visual observations and Bacterial examination which include, anaerobic, *Staphylococcus aureus* and coliform counts, as well as isolation of Salmonella and *Escherichia coli* O_{157}:H_7 before and after correction using food grades acetic, benzoic and Lactic acids with three different concentrations for each (0.5%, 1 % and 1.5%) in the presence of organic matter. Initially by visual inspection it was observed that the degree of contamination was higher in large slaughterhouse while the possibilities of cross-contamination were higher in small slaughterhouse. Bacterial investigations showed that risks were higher in El-Monieb slaughterhouse than El-Warak slaughterhouse. After using of decontaminants at 1% concentration without removing of debris and organic matters, the aerobic, anaerobic, *Staphylococcus aureus* and coliform counts, Salmonellae and *E. coli* 0_{157}:H_7 were significantly reduced in both slaughterhouses with no differences between the different types of acids used. Applications of acids at critical points throughout the slaughtering process improve their effectiveness to produce meat more safe for human consumption. Using of decontaminant has reduced numbers of bacteria on carcasses when numbers were relatively higher more than relatively lower but higher concentrations of acids required for effectiveness.

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INTRODUCTION

Slaughtering of animals in Egypt challenged by severe hygienic problems which results in heavy bacterial loads on meat. Improper practices such as slaughtering on the ground following skinning and evisceration in the same place is consider a threat to food safety and consumer's health and have been implicated in many cases of foodborne illness. Pathogenic microorganisms are found in the digestive tract of healthy animals. These microorganisms are excreted in the feces and can be found on the hides and fleeces of the live animal and then can be transferred onto carcass surfaces during slaughtering and dressing **(FSA, 2002)**. Increasing the bacterial load on the carcasses and the risk of contamination with food poisoning microorganisms should be taken very seriously.

Beef may be the vehicle of foodborne diseases as a result of deficient sanitary conditions during animal slaughter. The possibilities of eliminating pathogenic microorganisms from meat have received considerable attention in the last decades **(Sofos et al., 1999)**. Intervention strategies and their effects on microorganism levels have had an impact on industry economics and also on public health matters **(Bolder, 1997)**. Bovine carcasses can be contaminated during the slaughter process through the contact with the animal's skin and hair, limbs, blood, stomach, gut contents, bile and other excretions, facilities, equipment, hands and worker's clothes **(Sofos, 2008)**. Carcass washing, chilling, storage and processing **(Koohmaraie et al., 2007)** can also contribute to the reduction of the final microbial load on beef.

Only a small fraction of the microbial flora is eliminated by the carcass washing procedure commonly practiced at slaughterhouses **(Bolton et al., 2001),** thus the preservation of meat must be guaranteed by other methods to maintain its intrinsic quality and safety. Many chemical compounds have been shown to reduce bacteria populations. **Ransom et al. (2003)** reported that chemical compounds are able to reduce the incidence of pathogens and other bacterial counts upon beef carcasses or their cuts by 1 to 3 logs. Organic acids such as acetic, citric, and lactic acid are widely used for carcass decontamination and are included among the different strategies for carcass and meat decontamination under controlled conditions at the laboratory **(Loretz et al., 2011).** The decontamination of meat can help to reduce human foodborne infections. However, process hygiene to prevent contamination should never be neglected, **Dinçer and Baysal (2004).**

Risk Analysis is a process consisting of three components: Risk Assessment, Risk Management, and Risk Communication, which has the overall objective to ensure public health protection. It was also highlighted that risk analysis has been introduced as a new approach in evaluating and controlling microbial hazards to help protecting the health of consumers and ensure fair practices in food trade. It could also facilitate the judgment of equivalence of food safety control systems **(Codex Alimentarius, 2007).**

Various intervention strategies to control foodborne pathogens have been identified and applied through the whole food chain. Physical, chemical, biological treatments applied alone or in combination have been studied and proved to reduce the number and the prevalence of bacterial contamination of meat surfaces. It can inhibit bacterial growth or extend shelf life **(Bolder,**

1997). The various treatments have their own advantages and disadvantages. The major components and prerequisites that prove that the substance intended to be used for the removal of microbial surface contamination of foods of animal origin (i) would not pose any appreciable risk to the public health (safety or chemical assessment) and (ii) would result in a significant reduction of the prevalence and the numbers of pathogenic target bacteria when compared to the control and when this reduction is at the same time of relevance to human health **(Hugas and Tsigarida, 2008).**

The present study involved a comparison between risks in large and small slaughterhouses in Egypt. The general objective is the prevention of risks in slaughterhouses which may effect on public health but where elimination of risks is not possible, the risks should be reduced and the residual risk controlled. At a later stage, the possibility of elimination of the risk, perhaps in the light of new knowledge, can be reconsidered. The specific objectives is to finally help veterinarians/personnel/employers in both slaughterhouses to identify the hazards created at work and evaluate the risks associated with these hazards and to determine what measures they should take to protect the public health and ensure the safety of their products and priorities action for improvement if further measures are found to be necessary as a result of the assessment.

The study focused on the slaughtering of cattle only aiming to improve the current slaughtering practices which may be a model for the similar institutions:

- Visual inspection of both slaughterhouses.

a) Operation description.
b) Reporting observation.

- Bacterial monitoring of livestock at different steps of processing.
  - Aerobic, anaerobic, *Staphyoccous aureus,* and coliform counts, as well as isolation of Salmonella and *Escherichia coli O157:H7*
- Determination of the Critical Control Points (CCP) Based on visuals observation and bacterial examination
- Suggestion of appropriate cost-effective corrective actions.
- Application of suggested corrective actions
- Laboratory bacterial monitoring after correction to evaluate the effect of the suggested corrective actions.
- Develop a simplified sanitary guidance for livestock slaughterhouses to be applied.

LITERATURE

A) Risk Assessment

Jaykus (1996) mentioned that Quantitative risk assessment, which is formally defined as the technical assessment of the nature and magnitude of a risk caused by a hazard. The process of Quantitative risk assessment entails four designated phases: (1) hazard identification, (2) exposure assessment, (3) dose-response assessment, and (4) risk characterization. Specific analytical tools are available to accomplish the analyses required for each phase of the Quantitative risk assessment.

Ahl and Buntain (1997) defined that hazards may be physical, artificial or naturally-occurring chemicals, organisms which cannot reproduce outside a specified life-cycle (e.g., parasites such as tapeworm in pigs) or viruses. Other microbes reproduce in the gastrointestinal tract of food animals as well as on the surface of food and in the environment. Methods of risk assessment for physical and chemical hazards have been used for many years. However, with microbial pathogens which can survive and grow on meat, in soil, water or other media, risk assessment methods are at the early stages of development. Due to the broad habitat range, the role of microbial pathogens in the food safety of meat, poultry, fruit and vegetables is important. The authors discuss the food chain, risk analysis and hazard analysis and critical control points in relation to foodborne pathogens,

and introduce general strategies for improving pathogen control on the farm.

Lammerding and Paoli (1997) stated that new challenges to the safety of the food supply require new strategies for evaluating and managing food safety risks. Changes in pathogens, food preparation, distribution, and consumption, and population immunity have the potential to adversely affect human health.

Michael et al. (1998) defined that Quantitative Risk Assessment is a methodology used to organize and analyze scientific information to estimate the probability and severity of an adverse event. Applied to microbial food safety, the methodology can also help to identify those stages in the manufacture, distribution, handling, and consumption of foods that contribute to an increased risk of foodborne illness, and help focus resources and efforts to most effectively reduce the risk of foodborne pathogens.

Berends and van Knapen (1999) discussed the outlines of a risk assessment-based system of meat safety assurance to replace the current meat inspection. Continuous evaluation of risks is the main driving force of the new system. Only then the system has the means to remain flexible and provide for the data necessary to convince trade partners. A monitoring system that keeps track of the important health hazards in the entire chain from stable to table is therefore necessary. Clear legislation provides for criteria about acceptable or unacceptable