



ISSN: 0976-3031

Available Online at <http://www.recentscientific.com>

CODEN: IJRSFP (USA)

International Journal of Recent Scientific Research
Vol. 9, Issue, 12(E), pp. 30162-30165, December, 2018

**International Journal of
Recent Scientific
Research**

DOI: 10.24327/IJRSR

Research article

HACCP CHECKLIST SCORES AT CRITICAL CONTROL POINTS BY MEAT HANDLERS IN IMO STATE, NIGERIA

***Azumamah, Y.C¹, Amadi, A.N², Iro, O.K³, Azumamah, E.C⁴ and Amadi, C.O.A²**

¹Department of Optometry, Federal University of Technology, Owerri, Nigeria

²Department of Public Health, Federal University of Technology, Owerri, Nigeria

³Department of Environmental Health Science, Abia state University Uturu, Nigeria

⁴Department of Medicine, Queens Hospital Burton, United Kingdom

DOI: <http://dx.doi.org/10.24327/ijrsr.2018.0912.3000>

ARTICLE INFO

Article History:

Received 15th September, 2018

Received in revised form 7th
October, 2018

Accepted 13th November, 2018

Published online 28th December, 2018

Key Words:

HACCP, Meat handlers, Critical Control Points, Transportation, Personal hygiene

ABSTRACT

Hazard Analysis and Critical Control Points (HACCP) is widely accepted as a standard for which food and food products are subjected to high standards by the handlers to ensure safety for the consumers. This study was conducted to investigate the HACCP checklist scores by meat handlers at critical control points using a harmonized checklist. A total of 156 meat handlers from 10 different markets in Imo State, Nigeria were used for this study. Scores were awarded based on observations and information obtained from the meat handlers on meat transportation, meat storage, personal hygiene of the meat handlers, sanitation, pest control, waste disposal and staff training of the meat handlers. The mean percentage scores obtained for meat transportation was 24.55 ± 5.97 ; for meat storage, 22.36 ± 6.24 ; for personal hygiene, 27.93 ± 4.81 ; for sanitation, 21.42 ± 6.70 ; for pest control, 23.80 ± 5.46 ; for waste disposal, 27.11 ± 4.95 ; and for staff training, 26.78 ± 5.62 . The meat handlers at all the markets in the state had very low HACCP scores at all the control points. Data analysis with SPSS version 21 using the one-way at 0.05 level of significance and 95% confidence interval showed no significant difference ($P > 0.05$) in the mean HACCP scores at the critical control points. The meat handlers were advised to undergo proper training on meat safety and comply with HACCP standard operating procedures.

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INTRODUCTION

Hazard Analysis and Critical Control Points (HACCP) is a systematic preventive approach to food safety from biological, chemical, and physical hazards in production processes that can cause the finished product to be unsafe, and designs measurements to reduce these risks to a safe level¹. HACCP is widely accepted as a standard for which food and food products are subjected to high standards by the handlers to ensure safety for the consumers. An adequate hygiene practice by the food handlers is very important in HACCP because contamination of food products is high among the handlers since many of them do not comply to HACCP guidelines². During storage and transportation and food products, contaminations have also been known to occur and all these are critical points in HACCP where standards need to be enforced to avoid contamination of the food product. When food handlers comply with HACCP guidelines, the consumers are protected as the final food sold to the consumer is safe for consumption and hence, the prevention of food-borne illnesses.

HACCP is based on the following seven principles¹: conduct a hazard analysis; identify critical control points; establish critical limits for each critical control point; establish critical control point monitoring requirements; establish corrective actions; establish procedures for ensuring the HACCP system is working as intended; and establish record keeping procedures.

A critical control point (CCP) is defined as a step at which control can be applied and is essential to prevent or eliminate a food safety hazard or reduce it to an acceptable level³. These steps can include food storage, transportation, distribution, cutting, hygiene practices of the food handlers, pest control, sanitation and cleanliness, etc. At any of these points, the potential hazards that are likely to cause illness or injury in the absence of their control must be addressed. Complete and accurate identification of CCPs is fundamental to controlling meat safety hazards³. At any step where hazards can either be prevented, eliminated, or reduced to barest minimum acceptable levels, there should be critical control points located

*Corresponding author: **Azumamah, Y.C**

Department of Optometry, Federal University of Technology, Owerri, Nigeria

there. In industries where production of food products occur, CCPs may include the testing of ingredients for chemical residues, testing of metals and machineries involved in the production process for contaminants, thermal processing, and chilling. CCPs must be carefully developed and documented. In addition, they must be used only for purposes of product safety. The CCPs in the production process will ensure that adequate control measures are established and that every stage of the process is addressed in terms of requirements for food safety. Different facilities preparing similar food items can differ in the hazards identified and the CCPs established⁴. This can be due to differences in each facility's layout, equipment, selection of ingredients, processes employed, etc.

After identifying the control points, critical limits are established. A critical limit is a maximum or minimum value to which a biological, chemical or physical parameter must be controlled at a CCP to prevent, eliminate or reduce to an acceptable level the occurrence of a food safety hazard⁵. A critical limit is used to distinguish between safe and unsafe operating conditions at a CCP. Each CCP will have one or more control measures to assure that the identified hazards are prevented, eliminated or reduced to acceptable levels. Each control measure has one or more associated critical limits. A lot of factors can influence the critical limits which will be set. Some of these factors can include the time of the day, the temperature, humidity, moisture level and other environmental factors which may influence the potential severity of the hazard identified at a specific control point^{6,7}. Critical limits must be scientifically based. For each CCP, there is at least one criterion for food safety that is to be met. As such, one does not just allocate values to each of the critical limits, but expert analysis of the severity of the illness of which the hazards at that point can produce. The critical limits and criteria for food safety may therefore be derived from sources such as regulatory standards and guidelines, literature surveys, experimental results, and experts⁸.

Experimental Section

A total of 156 meat handlers from 10 different markets spread across the 3 senatorial zones of Imo State, Southeastern Nigeria were used for this study. The multistage sampling technique was adopted to obtain the samples for the study. The first stage was cluster sampling used to select the 3 senatorial zones of the State which are Owerri, Okigwe and Orlu. Simple random sampling was then used to select the markets and meat handlers in the 3 zones that were used for this study. A harmonized HACCP checklist designed by the research team which involved Public Health and Environmental Health Professionals were used to collect data. Observations and information was obtained from the meat handlers on meat transportation, meat storage, personal hygiene of the meat handlers, sanitation, pest control, waste disposal and staff training of the meat handlers. These were the critical control points identified for this study. Scores were awarded for each question or observation based on the critical limits set by the research team. Percentage scores were then awarded to the meat handlers for each of the control points established. Data was uploaded into the statistical package for social sciences (SPSS) version 21 software and the one-way ANOVA was used to compare the mean HACCP values at the control points at 0.05 level of significance and 95% confidence interval.

RESULT AND DISCUSSION

From the data obtained from the checklist, the minimum percentage score on meat transportation was 17%; the maximum score, 35%; the mean, 24.55% and the standard deviation, 5.97% as shown in Table 1. On meat storage, the minimum score was 15%; the maximum score, 39%; the mean, 22.36% and the standard deviation, 6.24%. On personal hygiene, the minimum score was 19%; the maximum score, 34%; the mean, 27.93% and the standard deviation, 4.81%. On sanitation, the minimum score was 14%; the maximum score, 38%; the mean, 21.42% and the standard deviation, 6.70%. On pest control, the minimum score was 20%; the maximum score, 37%; the mean, 23.80% and the standard deviation, 5.46%. On waste disposal, the minimum score was 21%; the maximum score, 34%; the mean, 27.11% and the standard deviation, 4.95%. On staff training, the minimum score was 18%; the maximum score, 36%; the mean, 26.78% and the standard deviation, 5.62%. Figures 1 and 2 showed a comparison of maximum values and mean values respectively at the critical control points. Data analysis with SPSS version 21 using the one-way at 0.05 level of significance and 95% confidence interval showed no significant difference ($P > 0.05$) in the mean HACCP scores at the critical control points.

Table 1 Statistical data on percentage HACCP scores at critical control points

Control Point	n	Min.	Max.	Mean	S.D
Meat Transportation	156	17	35	24.55	5.97
Meat Storage	156	15	39	22.36	6.24
Personal Hygiene	156	19	34	27.93	4.81
Sanitation	156	14	38	21.42	6.70
Pest Control	156	20	37	23.80	5.46
Waste Disposal	156	21	34	27.11	4.95
Staff Training	156	18	36	26.78	5.62

n- Number; Min- Minimum value; Max- Maximum value; S.D- Standard Deviation

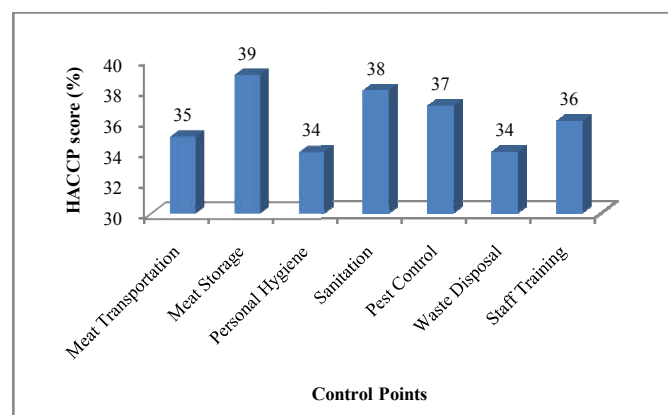


Figure 1 Comparison of maximum percentage HACCP scores at critical control points

Very low HACCP scores were recorded at all the control points in all the markets that were visited in this study. The facilities needed by the meat handlers for proper transportation of meat was absent which made the meat vulnerable to infection. According to International HACCP Alliance¹, meat is to be transported at temperatures of 4°C or below. However meat handlers transport meat carcasses from the slaughter house to the various markets using taxi cabs or pick-up trucks which do not have refrigerators nor are they clean and well sanitized.

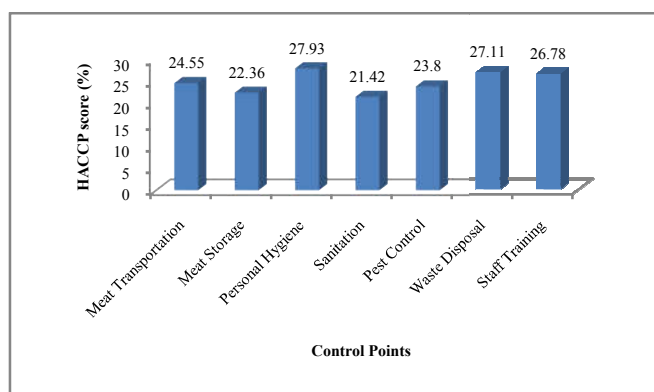


Figure 2 Comparison of mean percentage HACCP scores at critical control points

There were no storage facilities at the markets or slaughter houses and the meat handlers do not have thermometers for checking the meat temperature. They simply kill the cattle at the slaughter houses, transport them in make-shift vehicles and sell them to the public in the market places without any regard for standard operating procedures. The situation was the same in all the markets visited. When meat is not transported and stored according to safety standards, the quality of the meat is compromised. This was reported in various studies⁹⁻¹² on meat transportation and storage.

This lack of adequate transport and storage facilities for the meat carcasses can result in high microbial load of the meat samples. This was observed in a study by Azuamah, *et al.*¹³ to determine the bacteriological qualities of meat sold in to the public in markets located in Aba metropolis, Nigeria. The personal hygiene practices of the meat handlers was a major source of concern as the meat handlers failed to meet the basic standards of personal hygiene during the handling of meat. Most of the meat handlers do not wear proper clothing such as aprons and hair restraints when handling meat. Their fingers were dirty, some had open cuts and wounds on their hands and they did not practice regular hand washing with soap and potable water. By touching their hands on dirty contact surfaces, they can transfer microorganisms to the meat. Also by coughing and sneezing with their bare hands, microorganisms can be transferred to the meat as they handle the meat without using gloves. Several studies¹⁴⁻¹⁷ have reported the occurrence of meat borne diseases attributed to the poor personal hygiene of meat handlers. Azuamah, *et al.*¹⁸ carried out a study on personal hygiene and external eye infections and found *Staphylococcus aureus*, *Staphylococcus Epidermidis* and *Pseudomonas aeruginosa* as the predominant bacteria present in the infections. This is similar to the open wounds seen on the meat handlers and if infected can be a source of cross-contamination of the meat carcasses.

The cleanliness and sanitary conditions of the workplace of the meat handlers was also found to be below standard. This was reflected in the HACCP scores for sanitation seen among the meat handlers. Their work tables and work surfaces were not kept clean; there were no cleaning procedures that were kept in place for the cleaning of the premises, equipment and utensils. All these factors can be attributed as possible sources of contamination of the meat carcasses. Wambui, *et al.*¹⁹ did a study to determine the good hygiene practices among meat handlers and reported a poor level of cleanliness and sanitary practices among the meat handlers. He also found that the level

of hand washing and equipment handling practices were inadequate.

Pest control is very vital to the protection of meat from insects that act as vectors for the transmission of bacterial organisms. In a situation where there is pest infestation as was seen in the market places and slaughter houses, bacteria such as *E. coli* will easily be transferred from fecal matter to the meat carcasses. Waste matter around the meat handler's workplace will attract flies and other insects that could act as vectors for bacterial contamination of meat. Shimelis, *et al.*²⁰ reported lack of adequate waste disposal as one of the major causes of pest infestation at slaughter houses. One of the major reasons why meat handlers in this study scored very poorly in the HACCP checklist can be attributed to lack of basic training in meat safety. None of the meat handlers interviewed in this study was aware of HACCP and many of them did not have knowledge of the basic rules of which meat handlers must adhere to in order to ensure meat safety. Similar studies^{21,22} have reported lack of awareness and training of meat handlers to meat safety standards as a major cause of meat contamination at market places, slaughter houses and abattoirs. The fact that the meat handlers lacked proper formal education reflected on their inability to appreciate that meat safety is very important in ensuring that consumers are protected from meat-borne diseases. At every stage of meat safety, standard operating procedures are laid out by which meat handlers are expected to adhere to.

CONCLUSION

In conclusion, the meat handlers were not adhering to standards in compliance to HACCP and they lacked basic training on meat safety. They were advised to undergo proper training on meat safety and comply with HACCP standard operating procedures for the handling of meat.

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How to cite this article:

Azuamah, Y.C *et al.* 2018, HACCP Checklist Scores at Critical Control Points by Meat Handlers in Imo State, Nigeria. *Int J Recent Sci Res.* 9(12), pp. 30162-30165. DOI: <http://dx.doi.org/10.24327/ijrsr.2018.0912.3000>
