SAFETY OF READY-TO-EAT FOODS IN HIGHWAY TOURIST STOPOVER FOOD SERVICE ESTABLISHMENTS IN UGANDA

Abstract

In Uganda, highway tourist stop-over food service establishments (HTSFE) are frequented by tourists to and from upcountry destinations. Their setup and operations are, therefore, critical in ensuring food safety. In Uganda, the HTSFE had previously not been profiled, and their operations were poorly documented. This study assessed the safety of Ready-To-Eat (RTE) foods in highway tourist stopover food service establishments (HTSFE) in Uganda, focusing on profiling them, evaluating food safety knowledge, attitudes, and practices of food handlers, and analyzing the microbiological quality and aflatoxin levels of RTE foods and the potential carcinogenic risk.

The study adopted a cross-sectional design involving the collection of quantitative data from managers (n = 30) of HTSFE establishments. An interviewer-administered questionnaire and an observational checklist were used to collect data. The research also explored food handlers' food safety knowledge, attitudes, and practices, using a structural equation model. Data was collected using a self-administered structured questionnaire. The study further evaluated the microbiological quality of 100 samples of Ready-To-Eat (RTE) foods in highway tourist stop-over food service establishments in Uganda, following International Standards Organisation protocols. The RTE foods included fresh fruit juice, vegetable salads, fried eggs, and vegetables wrapped in a chapati (Rolex), beef samosas, roasted chicken, and roasted beef. The samples were examined for the presence of *Enterobacteriaceae*, fungi, presumptive *Escherichia coli*, *Staphylococcus* spp., *Salmonella* spp., and Total Plate Count (TPC).

Based on the food safety compliance scores, none of the HTSFE belonged to grade A, and the rest were as follows: B (36.6%), C (30%), and Non-graded (33.3%). Most of the HTSFE were located in Western (47.6%) and Eastern Uganda (36.7%). None of the HTSFE had a food safety management system. A substantial number (58.6%) were inspected by the Uganda Tourism Board (UTB) in addition to either the local council or the city council. Approximately half of the food handlers had adequate knowledge of food safety and good practices. Food safety knowledge significantly affected practices ($\beta = 0.37$ $p < 0.05$), while attitude insignificantly and negatively affected practices ($\beta = -0.04$ $p > 0.05$).

Overall, the microbiological criteria set for RTE foods by the Uganda National Bureau of Standards (UNBS) and East African Community (EAC) were violated in 40% of the food samples tested. All fresh fruit juice exceeded specifications for TPC and fungi. Some of the vegetable salads (44.4%), Rolex (25%), beef samosas (75%), roasted chicken (80%), and roasted beef (38.5% conformed to the specifications for *Staphylococcus* spp. All the Rolex and beef samosas conformed to the specifications for E. coli. Some of the fresh fruit juice (13%), vegetable salad (38.9%), roasted chicken (50%), and roasted beef (38.5%) conformed to the

standard specifications for E. coli. All the beef samosas conformed to the specifications for *Enterobacteriaceae*. *Salmonella* spp. were not detected in any of the food samples. There was a significant difference ($p < 0.05$) in the microbiological quality of RTE from the different grades of HTSFE. RTE food samples from grade B HTSFE presented with better microbiological quality.

All groundnut sauce samples had quantifiable levels of total aflatoxins (TAFs) ranging from 20.64 - 193.7 µg/kg and AFB1 ranging from 12.82 – 53.95 µg/kg well above the regulatory limits. Similarly, all posho samples had TAFs (13.79 – 95.98 µg/kg) above the regulatory limit. Only 15.6% of the posho samples were within the regulatory limit for AFB1. There was no significant difference ($p > 0.05$) in total aflatoxin concentration and AFB1 in food samples from the different grades of HTSFE. The estimated dietary intake (EDI) for AFB1 ranged between 26.15 and 45.43 ng/kg bw/day resulting from the consumption of groundnut sauce and posho respectively, while the margin of exposure was 15.29 (groundnut sauce) and 8.8 (posho). The derived risk of developing primary liver cancer was 1.0208 and 0.5876 cases per 100,000 people per year from posho and groundnut sauce consumption, respectively.

This study emphasized the importance of letter-grading of HTSFE, implementation of food safety management systems, regulatory enforcement, consideration of the microbiological quality of RTE foods in the grading criteria, sensitization of all stakeholders in the food value chain on proper food handling, and better training of food handlers to ensure the safety of RTE foods in Uganda's HTSFE, contributing to consumer protection and sustainable tourism.

Keywords: Food safety, Ready-To-Eat foods, Highway tourist stop-over food service establishments, Letter-grading, Microbiological quality, Aflatoxins, Uganda