

# Food Safety Knowledge, Attitude and Hygiene Practices of Orange Fleshed Sweetpotato Puree Handlers in Kenya

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# BACKGROUND



- Food safety refers to production, handling, preparation and storing food in ways that prevent foodborne illnesses.
- Inappropriate food handling practices and inadequate food safety knowledge leads to food spoilage and outbreaks of foodborne diseases.
- OFSP puree is highly susceptible to contamination from food handlers and processing environment.

# Puree Processing Stages



OFSP puree is a versatile functional food ingredient **rich in provitamin A carotenoid, dietary fiber and minerals.**



# What was the Problem?



- There was lack of information on food safety knowledge, attitude and practices of OFSP puree handlers in Kenya.
- The level of compliance to Good Manufacturing Practices and microbial contamination in puree processing was still unknown.
- There was a need to investigate and generate data for addressing food safety challenges in OFSP puree processing.

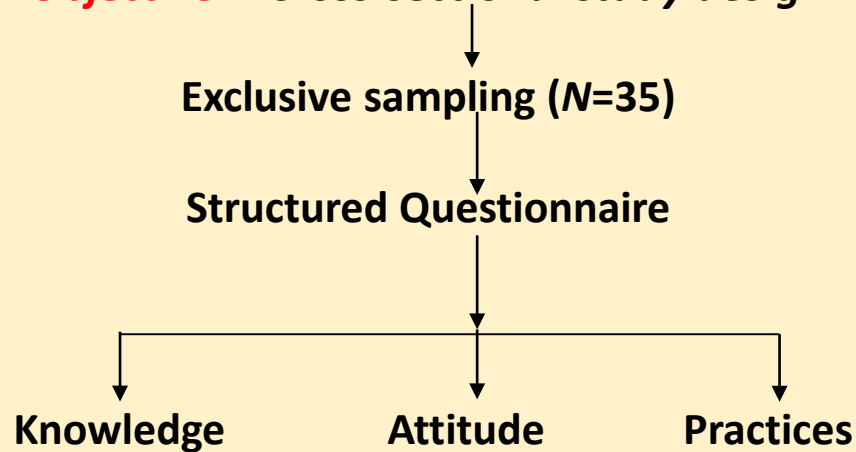
# STUDY OBJECTIVES



1. To determine the level of food safety knowledge, attitude and practices (KAP) of OFSP puree handlers.
2. To determine the level of compliance to Good Manufacturing Practices and microbial contamination in OFSP puree processing.
3. To assess the impact of food safety training on OFSP puree handlers' knowledge and practices and on microbial quality OFSP puree processing.

# METHODOLOGY

## *Objective 1-Cross-sectional study design*



- Percentage scores above 80% were classified as **High Level of Knowledge**, **Positive for attitude** and **Good/Appropriate** for practices.

# METHODOLOGY....

## *Objective 2- Cross-sectional analytical study design*

GMP Assessment-Observation, Interviews & GMP checklist

*Buildings, Equipment, Personnel, Sanitary & Process Control*

*Classified as Good or Needs Improvement*

Microbial Sampling and Analysis (**Environmental Sampling**)

*Equipment, Personnel, Floors, Walls, Water, OFSP samples*

*TVC, Yeast & Molds, Coliforms, Enterobacteriaceae, E.coli, S.aureus*

# ENVIRONMENTAL SAMPLING AT THE PUREE FACTORY



**Sampling OFSP puree handler**



**Sampling the puree machine**

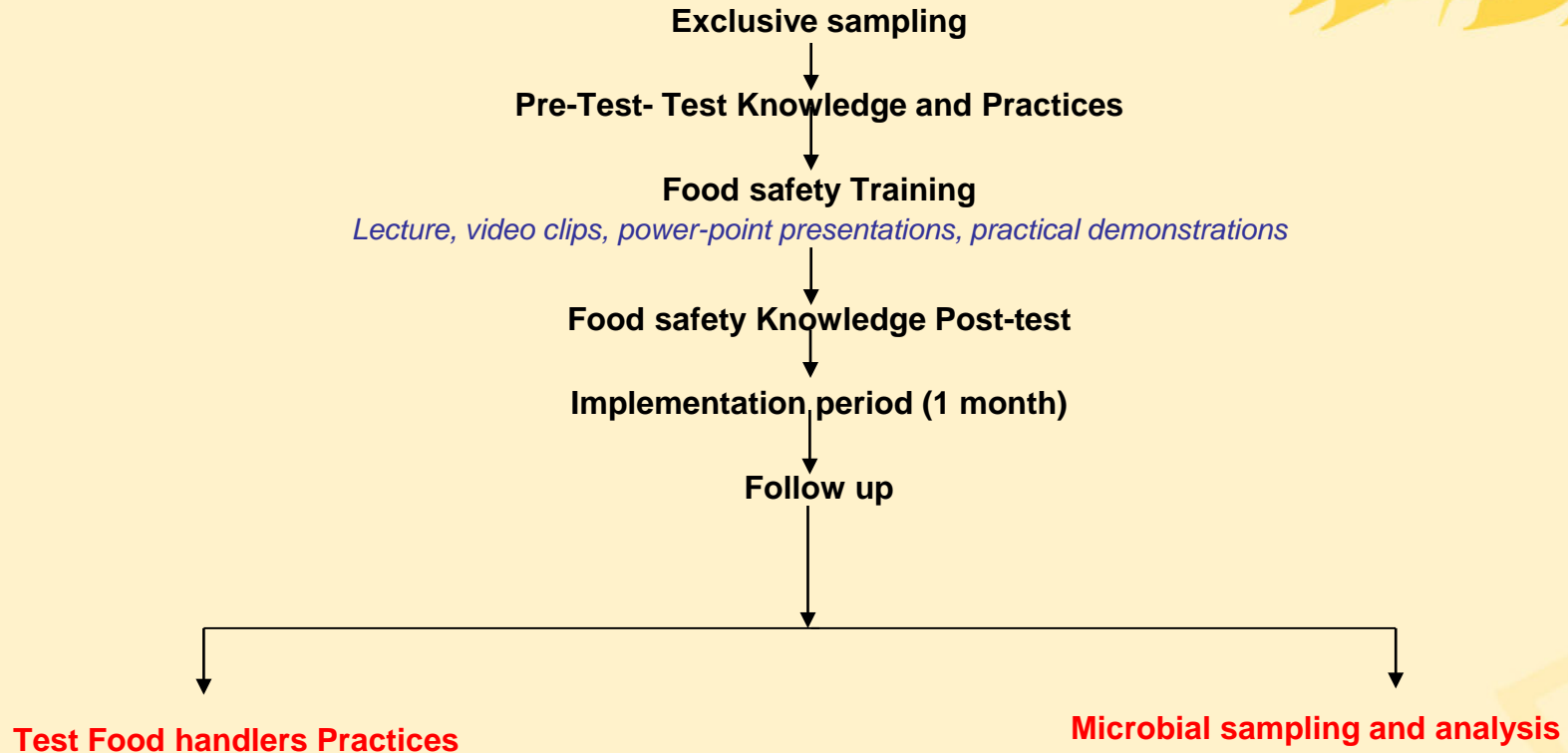
**Environmental sampling identifies harborage niches for microorganisms in food processing environments.**



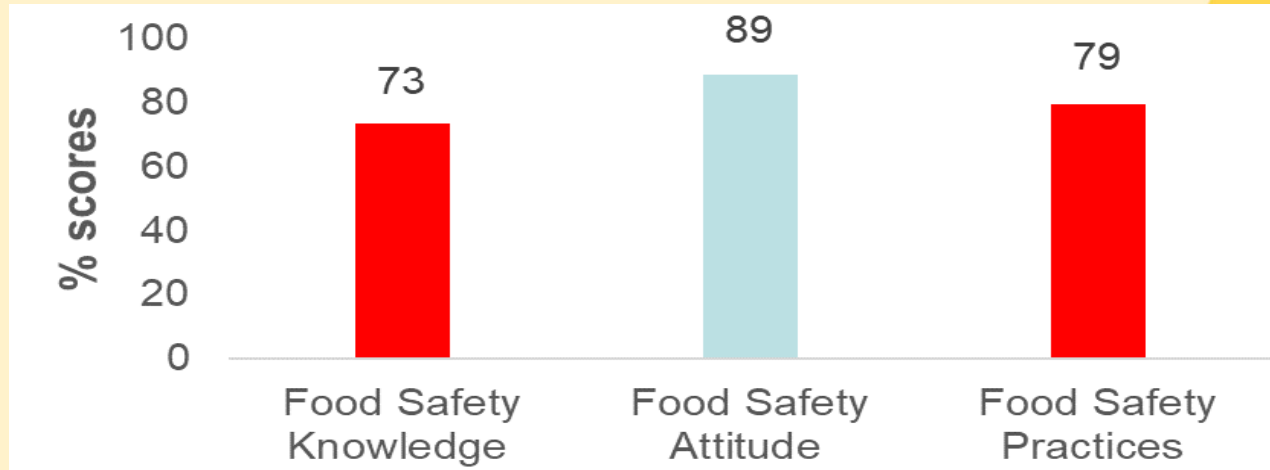
# METHODOLOGY....



**Objective 3**-One Group Pre-test and Post-test analytical study design

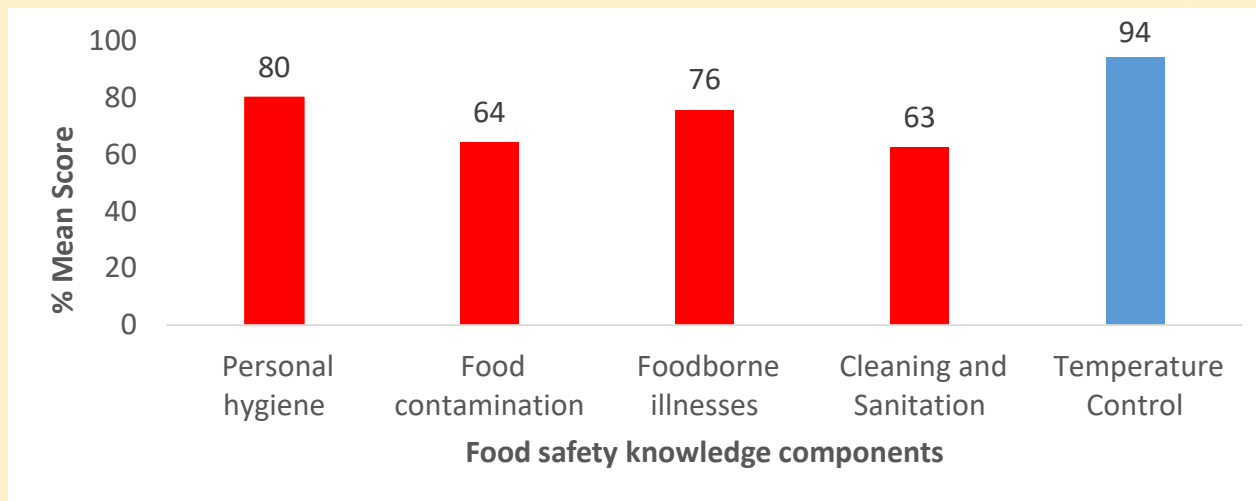


# RESULTS



- OFSP puree handlers had **low level of food safety knowledge and practices.**
- Possible causes of **escalated OFSP puree spoilage.**
- Possibilities of contamination with pathogens: **increased health risks to the consumer.**

# RESULTS...



- **OFSP puree handlers displayed poor understanding on **personal hygiene**, **food contamination**, **foodborne illnesses**, **cleaning** and **sanitation**.**
- **These areas required to be strengthened through food safety training.**

# Further KAP Analysis



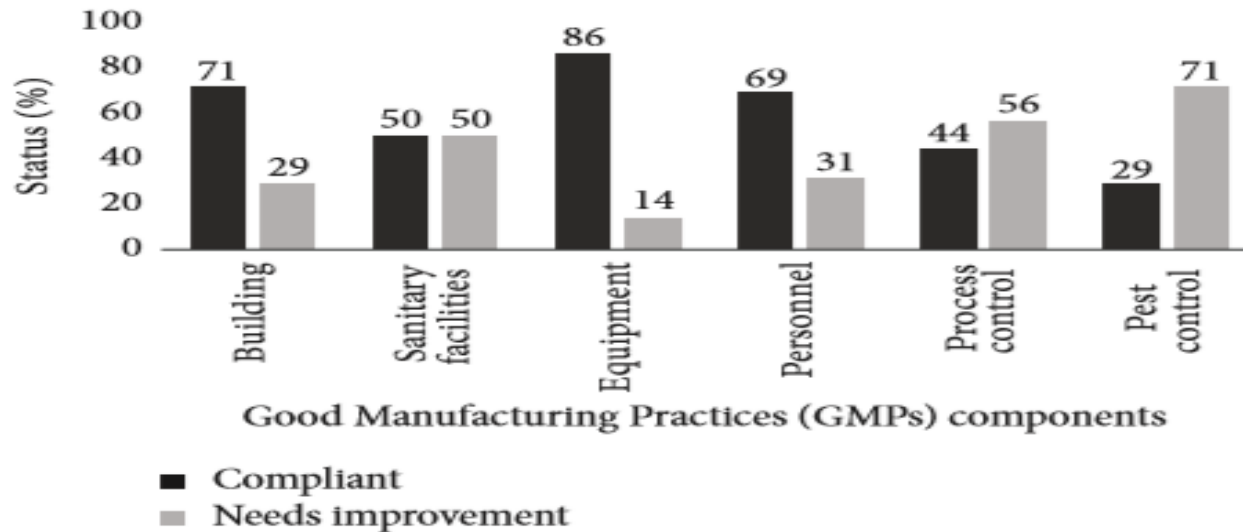
## *Correlation among KAP of OFSP puree handlers*

| Level               | Pearson Correlation | <i>p</i> value |
|---------------------|---------------------|----------------|
| Knowledge-Attitude  | 0.11                | 0.5            |
| Attitude-Practices  | 0.40*               | 0.01           |
| Knowledge-Practices | 0.35*               | 0.04           |

- **Increasing food safety knowledge improves food handling practices of OFSP puree handlers.**
- **Positive behavioral changes of OFSP puree handlers could improve food safety practices.**
- **OFSP puree handlers with a training in food safety had better knowledge, positive attitude and better practices ( $p < 0.05$ )**



## Objective 2- Overall Compliance to GMPs in OFSP Puree Plant

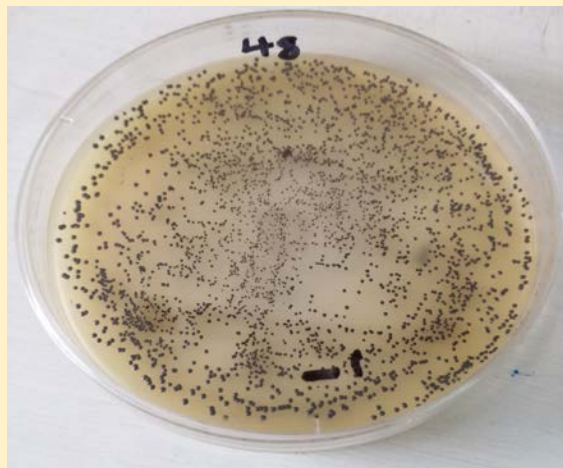


- Several areas needed improvement to enhance food safety.

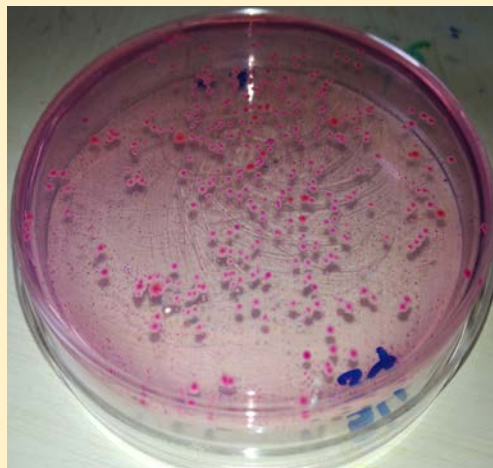
# Level of Microbial Contamination in OFSP Puree Processing Plant



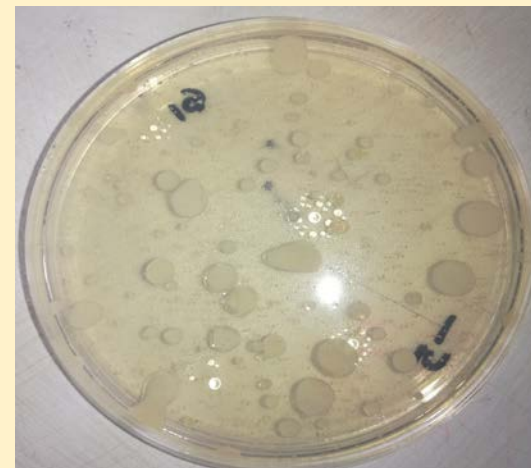
- **Microbial counts on >90 % of all equipment surfaces, walls and drains floors were above  $10^5$  CFU/cm<sup>2</sup>.**
  - **inappropriate cleaning and sanitation of these surfaces.**
- **The high counts impaired OFSP puree quality.**



**S. aureus**



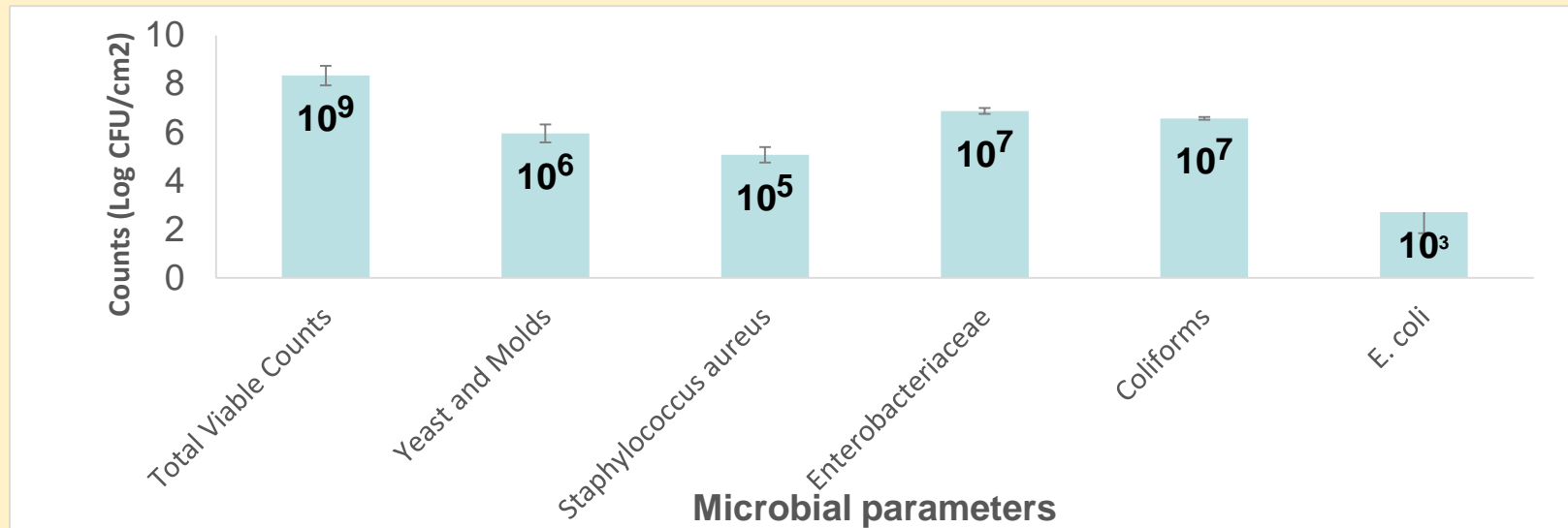
**Yeast & Molds**



**Total Viable Counts**

# Microbial Contamination.....

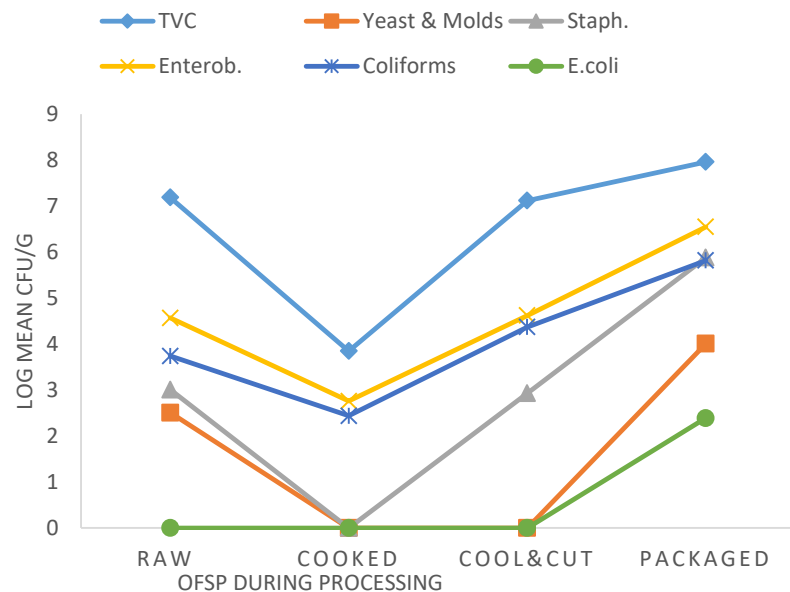
## *Microbial load on OFSP puree handler's hands*



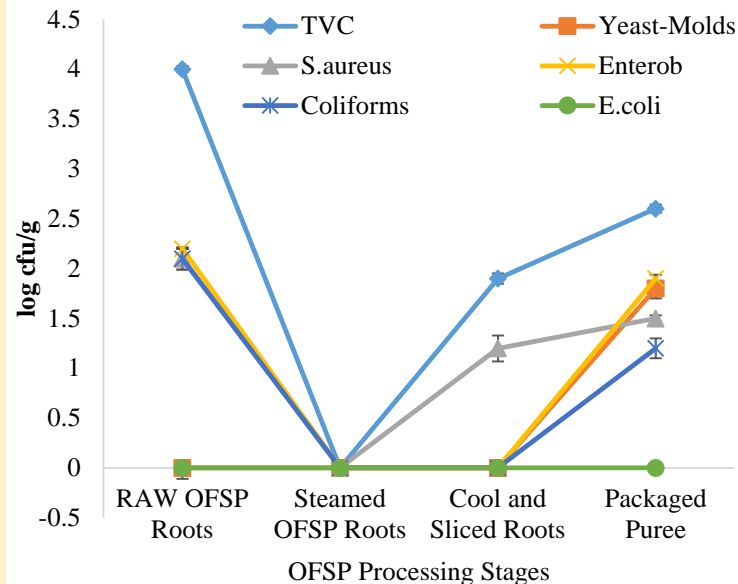
- **OFSP puree handlers were not practicing proper hand washing hygiene.**

# Microbial levels in OFSP puree

## Baseline-Before Training



## After Food Safety Training



- OFSP was **highly contaminated**:-accelerated spoilage & potential pathogens.
- Sources: **Water, equipment and personnel**

- Training improved knowledge & food hygiene practices.
- Enhanced bacteriological safety and quality of OFSP puree.
- Counts were within the legal acceptable limits for safety and quality.



# Research Outputs



## Publication 1

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### Food Safety Knowledge, Attitude and Practices of Orange Fleshed Sweetpotato Puree Handlers in Kenya

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#### Abstract

Orange Fleshed Sweetpotato (OFSP) puree is a nutritious food ingredient for promoting Vitamin A intake in processed food products in Sub-Saharan Africa (SSA). OFSP puree handlers play an important role in ensuring production of consistently safe and quality OFSP puree and related processed products. Lack of or insufficient knowledge on food safety coupled with poor practices by food handlers are major causes of foodborne illnesses and deterioration in food quality along the food chain. The current study assessed levels of food safety knowledge, attitude and hygiene practices (KAP) of OFSP puree handlers in Kenya. A cross-sectional study using a self-administered structured questionnaire was conducted among 35 OFSP puree handlers chosen by exhaustive sampling during the period of July and August 2016. The mean percentage scores for knowledge, attitude, practices and overall KAP were 73, 89, 80 and 81, respectively. OFSP puree handlers in this study had low level of knowledge on personal hygiene, food contamination, foodborne illnesses, cleaning and sanitation with mean scores of 80, 64, 76 and 63%, respectively. Training had a significant impact on knowledge ( $p=0.020$ ), attitude ( $p=0.050$ ), practices ( $p=0.006$ ) and overall KAP ( $p=0.001$ ) with majority of the OFSP puree handlers (63%) having received a training on food safety. A significant moderate positive correlation existed between knowledge and practices ( $r=0.358$ ,  $p=0.035$ ) and attitude and practices ( $r=0.42$ ,  $p=0.013$ ). As per adjusted linear regression analysis, food safety practices significantly ( $p=0.045$ ) increased by 0.32% with one percent increase in knowledge and by 0.38% ( $p=0.018$ ) with one percent increase in attitude. OFSP puree handlers had low level of knowledge and practices but demonstrated a positive attitude on food safety. Frequent food safety training is needed to improve knowledge and hygienic practices of OFSP puree handlers.

**Keywords:** Food handlers, Foodborne illnesses, Contamination, Personal hygiene

Published in Journal of Food  
Science & Quality Management

## Publication 2

### Research Article

### Good Manufacturing Practices and Microbial Contamination Sources in Orange Fleshed Sweet Potato Puree Processing Plant in Kenya

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Limited information exists on the status of hygiene and probable sources of microbial contamination in Orange Fleshed Sweet Potato (OFSP) puree processing. The current study is aimed at determining the level of compliance to Good Manufacturing Practices (GMPs), hygiene, and microbial quality in OFSP puree processing plant in Kenya. Intensive observation and interviews using a structured GMPs checklist, environmental sampling, and microbial analysis by standard microbiological methods were used in data collection. The results indicated low level of compliance to GMPs with an overall compliance score of 58%. Microbial counts on food equipment surfaces, installations, and personnel hands and in packaged OFSP puree were above the recommended microbial safety and quality legal limits. Steaming significantly ( $P < 0.05$ ) reduced microbial load in OFSP cooked roots but the counts significantly ( $P < 0.05$ ) increased in the puree due to postprocessing contamination. Total counts, yeasts and molds, Enterobacteriaceae, total coliforms, and *E. coli* and *S. aureus* counts in OFSP puree were 8.0, 4.0, 6.6, 5.8, 4.8, and 5.9 log<sub>10</sub> cfu/g, respectively. In conclusion, equipment surfaces, personnel hands, and processing water were major sources of contamination in OFSP puree processing and handling. Plant hygiene inspection, environmental monitoring, and food safety trainings are recommended to improve hygiene, microbial quality, and safety of OFSP puree.

Published in International Journal  
of Food Science

# Research Outputs



## Paper No. 3-Manuscript Stage

## MSc. Thesis

### Impact of Food Safety Training in Orange Fleshed Sweetpotato Puree Processing in Kenya

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#### Abstract

Food handlers play important roles in ensuring food safety along the food chain. Inadequate food safety knowledge and practices by Orange Fleshed Sweetpotato (OFSP) puree handlers; low level of compliance to Good Manufacturing Practices and high microbial contamination level are major food safety challenges facing OFSP puree processing in Kenya. Food safety training can be an essential tool for enhancing food safety in food processing environments. The current study was aimed at assessing the effect of training on food safety knowledge and practices of food handlers and in control of microbial contamination in OFSP puree processing plant in Kenya. Pre- and Post-training assessments using One Group Pre-Test Post-Test Design was conducted to assess OFSP puree handler's knowledge and practices on food safety. Environmental and OFSP samples were collected and analyzed for total counts (TVC), yeast and molds (YM), Enterobacteriaceae (EB), total coliforms (TC), Escherichia coli (EC) and Staphylococcus aureus. Overall food safety knowledge and practices of OFSP puree handlers significantly ( $p<0.05$ ) improved after training. Poor knowledge scores were displayed on aspects of cross contamination, cleaning and sanitation but significantly ( $p<0.05$ ) improved after training. In comparison with baseline results, microbial counts on equipment surfaces, installations, personnel hands and in OFSP puree significantly ( $p<0.05$ ) declined to acceptable levels for food processing after food safety training. TVC, YM, EB, TC, and EC counts in OFSP puree were 2.6, 1.8, 1.5, 1.9 and 1.2 cfu/g respectively. The findings from this study indicate that training can be a powerful tool for improving food handler's knowledge and practices as well as enhancing microbial quality of processed foods if necessary food safety support resources are provided.

**Keywords:** Food handlers, Food safety, Practices, Contamination

### FOOD SAFETY KNOWLEDGE AND HYGIENE PRACTICES AMONG ORANGE FLESHED SWEETPOTATO (OFSP) PUREE HANDLERS: MICROBIAL CONTAMINATION IN PUREE PROCESSING COMPANY IN KENYA AND IMPACT OF TRAINING

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