

Sanitation Practices and Food Quality and Safety, a Case Study of High-quality Bread Industry in Calabar Municipality, Cross River State, Nigeria

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Abstract:- Poor sanitation practices have serious harm on the quality and safety of food in food industries. The problem of insanitary practices on the quality and safety food in food industries in Calabar is widely known in the developed countries like United States of American and Britain. Improper sanitation practices result to lesser number of prod-borne illness, accounting or only five thousand deaths per annum, while in the developing countries of the world, 3.8 million people die annually of diarrhoea related disease, most of whom are children, (W.H.O 2011) a research conducted by A.R. Isara et al (2009). To determine the prevalence of food contamination of food was 37.5% with salad meat pie and fried rice serving as the most contaminated food.

I. INTRODUCTION

In fully (2009), the National Agency for Food Drug Administration and Control (NAFDAC) discover these in sanitation practices that can affect quality and safety of food in food industries are:

- Improper water disposal
- Poor personal hygiene
- Improper drainage system
- Lack of portable water supply

If all these practices are not put in places, it will lead to contamination of food

Handlers which may lead to many people. Being hospitalized NAFDAC (2009). (Ewa, 2001) revealed that majority of people in Calabar Municipality patronize High Quality Bakery Industry with 80% of the respondents buying and eating at least once daily while 20% buy and eat twice daily. To determine the safety of the food served in High Quality Bakery, she found out that 16.88% complained of diarrhea after buying and eating and 11.25% had abdominal pains and only 47.87% had no remarkable discomfort all resulting from improper sanitation practice in the industry. In the realization of severely these problems of food, W.H.O and United Nation establish individual's agencies such as WHO safety programme, WHO Department of Food Safety, Zoologist and Food Borne Diseases, International Food Safety Authority Network (INFOSAN).

II. FOOD INSPECTION SERVICES UNIT

There are now food inspection in food industries, restaurant, active fast foods joints, bukafiteria etc. to monitor and enforce laid down standards and regulations in order to ensure safety and quality of food and consumption.

Therefore, it is on this ground that this research is been proposed to find out the sanitation practices that are carried out in food industries (High Quality Bakery) and the quality and the safety of the food produced or manufactured.

➤ *Specific Objectives of the Study*

- Find out whether the establishment meets a minimum standard in term of structures, facilities equipment's, utilities etc.
- Determine whether the management keeps adequate records of ill- health, customer's complaints maintain a Cole of practice for the workers and conductors regular workshop seminars.
- Find out the effects of sanitation practices such as adequate hand washing, protective clothing, prevention of cross contamination on the quality and safety of food.
- Find out the effect of adequate cleaning and sanitizing of equipment utensils and working surface on food quality and safety.
- Find out the effect of proper handling of waste and the quality and safety of food.

➤ *Research Questions*

The following research question in line with the specific objectives were also formulated to further guide the study.

- To what extent do adequate hand washing, use of protective clothing and prevention of cross contamination affects the quality and safety of food.
- To what extent do adequate cleaning and sanitizing of equipment affect the quality and safety of food?
- To what extent do proper handling of waste affect the quality and safety of food?

➤ *Research Hypothesis*

- Sanitation practice such as adequate hand washing has no significant relationship with the quality and safety of food.

- There is no significant relationship between adequate cleaning of equipment and the quality and safety of food.
- There is no significant relationship between proper handling of waste and the quality and safety of food.

III. LITERATURE REVIEW

Impact of Adequate Hand washing, Protective, Clothing And Prevention, Clothing And Prevention Of Cross Contamination In Food Industry And The Quality/ Safety Of Foods

In the 1840's the significance of hand transfer of pathogenic bacteria was recognized when Ignaz Semmelweis and Olivea Holmes (2000) asserted that physicians caused the agent of "child bed fever" on their hands. However hand washing and disinfection to prevent spread of diseases and illness was not practice. Until the later parts 1990's (Ignaz, 1990) due to the effort of pasture and lister. This knowledge has lead to studies that minimize contamination and prevent the transfer of life threatening pathogens from one individual to another, many of these studies have involved handwashing technique devise, as well as different soaps detergents and antimicrobial preparation (Lister 2000). It has also become a standard practice, in the past 15 years, for health care personnel to wear a protective to wear a protective clothing (gloves) in order to provide protection to themselves from blood transmitted disease, as well as to prevent transmission of pathogens.

It has also been established in 1940's that unwashed hands can transmit pathogens especially fecal pathogens, to food products after a worker uses the toilet, when consuming food these pathogens can cause illness and disease.

Hand washing procedure used by food handlers must be adequate to eliminate pathogenic microorganism from hand surface. The 1997 FDA food code (34) recommend the following:

- Food employees shall clean their hands and exposed portion of their arms with a cleaning components in a laboratory. That is equipped as specified by vigorously rubbing together the surface of their leathred hands and arms for at least 20 seconds and thoroughly rinsing with clean water, employees shall pay particular attention to the areas underneath the fingernails and between the fingers. FOOD CODE (34) (1997).

Oliver Wendel in 1945 confirmed that the only standard hand washing procedure for food workers to use that ensures removal of pathogens micro-organism (such as from fecal source) from finger tips is that develop and described by the Hospitality Institute of Technology and Managers. The emphasis of this hand washing procedures is the use of a fingernail brush and a large volume of a flowing water.

According to Iguaz, Semmelweisis (1996), in most food production and food services operations, food handlers receive little or no training concerning hand and fingertip washing.

Regulatory authorities only check to see if there is a hand washing sink in the food industry, if this hand washing area is supplied with soap and if they function properly. Checking operational hand washing facilities provides no verification that employee are washing their hands sufficiently to reduce fecal pathogens on their hands and fingertips to a safe level.

Moreover, as more Nigerians consumers becomes aware of the danger of pathogen transmission in food or cross contamination in food industry in the quality and safety of food, Nigerians become concerned that food handlers are not washing their hands after using the toilet or touching contaminated items, since consumers have no way of knowing if food handlers have has wash their hands.

Oluwanle (2001) confirmed that consumers demand that food handlers or food service personnel wear protective clothing (e.g.) (plastic gloves) because people assumed that if food handlers wear plastic gloves when handling food, produce are safe to consumer. He also said that this logic is based on the presumption that gloves prevent transmission of micro _organism on hands and finger tips to food or prevent cross contaminated.

However this is not the case because microorganism found on hand and finger tips contaminate both exterior and interior gloves surface. When gloves are put on, unless hands and finger tips have been washed thoroughly. Plastic gloves used in foods services operation may also have pinhole or other defect that allow microorganism from hands and finger tips to escape through the gloves surface.

Scham (1990) gave the importance of hand washing and his saying that food production worker and food handlers must be taught to use correct hands and correct fingertip washing, by management in preparation for work, however correct use of fingernails brush to wash hands and finger tips is the best way to assure removal of transient micro _organism.

Furthermore, not only is hand washing critical in food service and food protection, it is also important in homes and day care operations.

According to Lucas (2003) despite all precautions, food infections, could be prevented and controlled from subsequent contaminated by refrigerating and good personal hygiene, some of the infection such as clostridium welchi, E.coli, bacterial food infection, parasitic food infection.

Oluwande confirmed that to avoid or prevent cross contamination of food infection, adequate measure could be taken to ensure the safety wholesome and soundness of food at all stages from producers to the consumers.

World Health Organization (WHO) stated that over 11 million people worldwide are infected with typhoid fever each year.

Mr. Scott Dowell (2002) at CDC noted that the cholera epidemic in Haiti killed 1400 people, 5,000 went sick and were being medicated.

The extent of the problem is difficult to estimate particularly in developing countries but given that in excess of 2 million people (mostly children) die from diarrhea each year. A great population of this case can be attributed to be cross contamination of food. (WHO 2002).

M.S AIBOR et al (2006) stated that, the avoidance of cross contamination of a ready to eat risk food by another food either directly or by way of transmitting agent is of paramount importance, these therefore suggested the following as measures to prevent cross-contamination of food.

- Keep raw foods and cooked foods separate at all times including in storage.
- Use separate surface, utensils and other equipment for the preparation of raw and cooked foods.
- If possible, separate staff should handle raw and cooked food.
- Particular attention must be paid to the food slicing machinery because of the potential for cross contamination.
- Avoid the reheating of foods at all if possible. Foods which have to be reheated should be brought to temperature above 63°C. These also said that any person who engages in the handling of food shall, while so engaged, take all such steps as may be reasonably necessary to protect the food from risk of contamination and in particular (without prejudice to the general of the foregoing).
- Shall not so place the food as to involve any risk of contamination.
- Shall before offering any food for sale ensure that any food which is unfit for human consumption is kept apart from any other food.
- Shall not in or about any forecourt or yard, place your food lower than eighteen inches from the ground unless it is adequately protected from risk of contamination.
- Shall ensure where reasonably necessary that open food while exposed for sale or during sale or delivery is kept or is otherwise effectively screened from possible source of contamination.
- Shall not keep in any food room any animal feed unless it is in container of such materials and not so close as to prevent the risk of contaminated food in the room, but they later said that this paragraph shall not apply where

food is intended to be sold by wholesale either by sample or description.

Proper Cleaning, Sanitization of Equipment and Surface and the quality/ safety of food

Since cleaning and sanitizing may be most important aspect of a sanitation program, sufficient time should be given to outline procedures and parameters. Detailed procedures must be developed for all foods products contact surface (equipment, utensil etc.) as well as for non-product surface such as non-product portion of equipment, overhead structures shield, walls. Ceiling, lighting devices, refrigeration units, heating, ventilation and air conditioning systems, and anything else which could impact on food safety.

Cleaning frequency must be clearly defined for each process line. i.e. daily, after production runs, or more often, if necessary the type of cleaning required must also be identified.

The object of cleaning and sanitizing food contact surfaces is to remove food (nutrient) which bacteria need to grow, and to kill those bacteria which are present. It is important that the clean, sanitized equipment and surface drain, dry and stored dry so as to prevent bacteria growth. Necessary growth (Brushes etc.) must also be clean and stored in a clean sanitary manner.

Ehiri T, (2005) cleaning and sanitizing procedure must be evaluated for adequacy through evaluation and inspection procedures. Adherence to prescribed written procedures. (inspection and swab testing, direct observation of personnel) should be continuously motivated, and records maintained to evaluate long term compliance. The correct order of event for cleaning/ sanitizing of food product contact surface is:

- Rinse
- Clean
- Sanitize

Moris (2001) defines cleaning as a complete removal of food soil using appropriate detergent chemical under recommended conditions. It is important that personnel involved have a working understanding of the nature of the different types of foods and the chemistry of its removal.

Cleaning Methods: Equipment can be categorized with regard to cleaning method as follows:

- **Mechanical Cleaning:** Often referred to as clean-in-place (CIP). Require no disassembly or partial assembly.
- **Clean-out-of-place (COP):** Can be particularly disassemble and cleared in specialized (COP) pressure tanks.
- **Manual Cleaning:** Requires total disassembling and inspection.

❖ *Equipment*

Contaminated equipment is one of the major cause of food borne disease outbreaks. Thus, it is crucial that the food service facility and its equipment are properly maintained, clearly and sanitized to prevent the transmitted of food borne disease. Effective cleaning and sanitization of equipment and utensil serve these primary purposes. They:

- Reduce chance for contaminating safe foods during processing, preparation storage, and service by physically removing soil and bacteria and other micro-organism and
- Minimize the chances of transmitting disease organism to the consumer by achieving bacteriological safe eating utensils.

The task of choosing equipment designed for sanitation has been simplified by organization such as the National Sanitation Foundation (NSF) International. NSF International develops and publishes standard for sanitary equipment design. A clean and sanitary food establishment is a prerequisite to an effective food safety program.

❖ *Ware Washing Cycle*

Dsouzajohann (2009) commented pertaining to the wash cycle of food contact surface will help supervisors and managers appreciate why there is a particular order in the process.

- Equipment and utensils clean prior to use. Properly cleared and sanitized equipment should be bacteriological safe prior to use. Should contaminate be suspected, the equipment and (or utensils) should not be used, but recleared and sanitized.
- Soiled equipment and utensils. During use equipment and utensils become soiled and contaminated with bacteria.
- Scrapping, preflushing and presoaking scrapping, preflushing and presoaking as necessary are methods for removing cross amount of stubborn soil from equipment and utensils.
- Cleaning: There are two steps in cleaning processes: washing and rinsing, washing when using proper detergent, cleaners, chemicals and abrasive removes the remaining soil from equipment and utensils. This is a physical and a chemical process. The soil and bacteria as well as cleaning compounds are suspended in the wash water and rinsing removes most of the suspended sit, bacteria and cleaning compounds from the equipment and utensils.

IV. SANITIZATION

This is a process of making something seem more acceptable for usage or make some hygienic (Oxford Advance Learners (2006)

It is important to differentiate and define certain terminology:

- **Sterility:** Refers to the statistical destruction of all living organism.

- **Disinfect:** Refers to the inadequate objects and the destruction of all vegetable cells (not spores).
- **Sanitize:** Refers to the reduction of micro-organisms to levels considered safe from a public health view point.

Appropriate and approved sanitization procedure are processes and this the duration or time as well as the chemical conditions must be describes. The official disinfection (Association of Official Analyst Chemist) of sanitizing for food product contact surface is a process which reduces the contamination level by 99.999% (3 logs) in 30 sec. Moris P. (2001).

The official disinfection of non-product contact surface requires a contamination of 99.9% (3 logs) the standard test organism used are staphylococcus aureus and escherchia Coli.

A. *General Types of Sanitization*

- **Thermal Sanitization:** This involve the use of hot water or steam for a specified temperature and contact time.
- **Chemical Sanitization:** Involves the use of an approved chemical sanitizers at a specific concentration and contact time.

B. *Sanitization Procedure*

In 1986, the center for disease control (CDC) sanitizing kills the remaining pathogenic organism on the equipment and utensils. Sanitization will occur when certain specific chemicals concentration, temperature requirements and water conditions are satisfied. This conditions are crucial foe effective sanitization. Therefore precise measurements of the sanitization process are made periodically. NO RINSIN G OR ANY OTHER CLEANING PROCESS SHOULD TAKE PLACE AFTER SANITIZATION PROCESS.

➤ *Proper Handling of Waste and quality and safety of food*

The process of treating and handling of food in a way to stop or cut down spoilage to prevent the food borne illness without hampering the texture. The amount of waste stored WITHIN the premises must be restricted to be the minimum and should be restricted to the use of paper/plastic sacks or plastic bins with lids for the reception of waste in preparation area and these should be replaced as frequently as possible. Waste storage should be pounded externally in an area properly paved and drained to a trapped gully. Housing facilities are desirable. ().

The types of container provided will depend upon the needs of the particularly premises but can include plastic or galvanage bins with tight fitting lids.

According to Olufemi (2009), accumulated waste in the food industry attract flies, cockroaches, rats etc. it also produce offensive odour and make the environment filthy.

Ehiri (2005) stated clearly that the need of protecting the industrial environment from generating waste at large quality

are overlooked, not considering the impact on the environment and its health effects on human when contaminating food by pest, which is as a result of poor handling of waste in the food industry.

Moreover, more pressure on food production has inculcated the use of pesticide, herbicide etc. at least half of the food grown is discarded before and after it reaches the consumer. It was estimated by Ehiri (2005) that one third to half of landfill waste comes from the food handlers in the food industry. Food industry produces a large amount of recyclable waste materials. They also require more specialized waste containers and rollout cards, the most common type of waste include organic waste container (prepared food and its ingredient) plastics, glasses, metal, paper, card board which can be managed using a variety of Rubbermaid waste receptacles and other outdoors container. According to Olufemi (2005), proper planning can also help in effective disposal of waste materials that can be recycled. (i.e. waste could be reduced in a great amount by reducing, reusing, recycling).

V. METHODOLOGY

➤ Research Design

For the purpose of achieving the desired objectives of the study, a descriptive survey was suitable for used in this study because survey study seeks to find answer to the problem throughout the analysis of variables which are the impact of sanitation practices on food quality and safety, a case study of Hi quality bread industry in Calabar Municipality.

➤ Population of the Study

The study population comprises of workers in Hi quality bread industry in calabar Municipality. There are about one hundred and three workers in the industry but the assessable population was one hundred and one persons which form the sample population because the other workers were not in calabar factory.

➤ Sampling Techniques

The sample was done using random sampling. The procedures or techniques use for selecting the sample for this research was proportionate cluster sampling of groups like sex (gender), level of educational attainment, age (years), marital status, from this group, simple random sampling was then used to select respondents for fair representation.

➤ Sample

A sample is a specimen of a larger group having all the attributes of a larger group. One hundred and three workers form the targeted population then one hundred workers were selected from the sample size of the study.

➤ Instrument for Data Collection

The instrument used for collection of data was the questionnaire which was structured with close ended question. It is an 18 items questionnaire. The questionnaire was divided into two sections of A and B. section A has demographic information while section B has questions relating to the specific objectives of the bread industry in calabar Municipality.

➤ Validity of the Instrument

The instrument was developed personally by the researcher in simple words to enhance easy understanding and vetted by the supervisor and expert in the department for necessary corrections. Then the final draft was produced after being given face validity before the instrument used for the study.

➤ Reliability of the Instrument

To ascertain the reliability of the instrument, a trail, test-retest was carried out using 30 workers. Test-retest estimate reliability were obtained by re-administering the same test to the workers at a one week interval to measure the consistency in the response over the period.

The collected data were statistically analyzed and correlated using test-retest person moment correlation analysis which ranged from 0.85-0.96. the test-retest reliability is described in table 1.

Variable	Pretest (1) Posttest (2)	N	\bar{X}	SD	R_{xy}
Sanitation practices of hand washing	1	5	17.09	3.92	0.96
	2	5	18.65	3.34	
Adequate cleaning of equipment	1	5	16.35	3.60	0.85
	2	5	17.59	3.08	
Proper handling of waste	2	5	16.74	3.74	0.87
	2	5	18.31	3.18	

Table 1:- Test-Retest Reliability Estimate of the Research Instrument (n-30)

N= Number of items, X= Mean, SD= standard of Deviation, T_{xy} = reliability

➤ *Method of Data Collection*

The instrument was directly administered by the researcher to the respondents. The researcher explained clearly to them and they were asked to provide information freely as needed for the study. The workers filled and returned the questionnaire on a three hour interval. Correlations of scores were obtained to measure the reliability all the one hundred questionnaires administered to respondent were returned.

➤ *Method of Data Analysis*

Hypothesis-by-hypothesis data analysis was done and each was tested with contingency chi-square (X^2).

VI. PRESENTATION AND ANALYSIS OF DATA

The result of data analysis carried out on data collection is presented in this chapter, presentation was done using frequency tables. In this study, the data collected from the respondents are presented and summarized with frequencies and percentages.

Table 2 shows the description of description of respondent in terms of demographic variables. From the table out of 100 respondents 60 (100%) were male while 40 (40%) were female. The table describing level of educational attainment, showed that 70 (70%) had secondary school while 30 (30%) of the respondents had tertiary education.

The table also showed that respondents who were between the ages of 18-25 years were 60 (60%), 26-40 years were 35 (35%). finally, for marital status, married respondents were 70 (70%) while 30 (30%) were single.

Variable	No. of respondents	Percentages
SEX (GENDER)		
Male	60	60%
Female	40	40%
Total	100	100%
LEVEL OF EDUCATION ATTAINMENT		
Primary school level	0	0%
Secondary school level	70	70%
Total	100	100%
AGE (YEARS)		
18-25	60	60%
26 -40	35	35%
41 and above	5	5%
Total	100	100%
MARITAL STATUS		
Married	70	70%
Single	30	30%
Total	100	100%

Table 2:- Frequency and Percentages of Study Sample on Demographic Valuable

➤ *Analysis of Data*

In this section, each of the research hypotheses was in the null form. The result of the data analyses carried out to test the variable were also presented and data interpreted.

➤ *Hypothesis 1*

Sanitation practices such a adequate hand washing has no significant relationship with the quality and safety of food. The independent variables involves in the hypothesis is sanitation practices such as hand washing, while the dependent variable is quality and safety of food. Chi-square

X^2 analysis. Analysis was adopted to test the variable. The result the analysis is presented in table 3.

➤ *Hypothesis 2*

There is no significant relationship between adequate cleaning of equipment and the quality and safety of food. The independent variables involved in this hypothesis are adequate cleaning of equipment while the dependent variable is quality and safety of food. Chi-square X^2 analysis was adopted to test the variables. The result of the analysis is presented in table 4.

Variable	Yes	No	Total	X ² Calc. Value	d.f	X ² crit value
Cleaning of equipment promoted food safety	45	5	50			
				72	1	9.45
Cleaning of equipment does not promotes food safety	5	45	50			
Total	50	50	100	72	1	9.45

Table 4:- Result of Measure of Cleaning of Equipment and Food Safety

Critical value $X^2 = 9.45$ Calculated value $X^2 = 72$

d.f = 1

Since the calculated value of 72 was greater than the than the critical value of 9.45, then the null hypothesis which states that there is no significant relationship between adequate cleaning of equipment and the quality and the safety of food was rejected at 0.05 level of significance, hence, the alternate hypothesis was accepted. This means that adequate

cleaning of equipment promotes food safety. For details calculation of the data, see Appendix B .

➤ Hypothesis 3

There is no significant relationship between proper handling of waste and quality and safety of food. The independent variables involved in this hypothesis are proper handling of waste, while the dependent variable is quality and safety of food. Chi-square X^2 analysis was adopted to test the variables. The result of the analysis is presented in table 5.

Variable	Yes	No	Total	X ² Calc. Value	d.f	X ² crit value
Proper handling of waste promotes food safety	35	15	50			
				16	1	9.45
Proper handling of waste do not promotes food safety	15	35	50			
Total	50	50	100	16	1	9.45

Table 5:- Result of Measure of Handling Waste and Food Safety

Critical value $X^2 = 9.45$ Calculated value $X^2 = 16$

d.f = 1

Since the calculated value of 16 was greater than the than the critical value of 9.45 there is no significant relationship between proper handling of waste and quality and safety of food was rejected at 0.05 level of significance, hence, the alternate hypothesis was accepted. This means that proper handling of waste promotes food safety. For details calculation of the data

asserts that adequate prevent germs from infesting the hands and fingers thus protect food from being contaminated.

➤ Cleaning of Equipment and Food Safety

The research hypotheses revealed that there is significant relationship between adequate cleaning of the equipment and the quality and safety of food. The finding discovered in this study which proves that out of 100 respondents used as sample, 90% affirmed that cleaning of equipment promotes food safety. It is also in line with Ehiri (2005) who assert that cleaning of equipment used in manufacturing industries can contaminate food being produced, so it is desirable to clean equipments use in converting of raw materials to finished goods.

➤ Waste Handling and Food Safety

The research hypothesis revealed that there is significant relationship between proper handling of waste and food safety. The findings of this research is in line with the finding discovered in this study which proves that out of 10 respondents use as sample, 90% affirmed that proper handling of waste promotes food safety. It is also in line with Olufemi (2009) who asserts that waste attracts flies, cockroaches, rats among others, it also produce offensive odour and make the

VII. DISCUSSION OF RESULT

Result obtained from the analyzed data revealed that three working research hypotheses were adopted and analyse. The findings were as follows:

➤ Handwashing and Food Safety

The research hypothesis revealed that sanitation practices such as adequate hand washing has significant relationship with food safety. The findings of this research is in line with the findings which proves that out of 100 respondents used as sample, 80% affirmed that handwashing promotes food safety. It is also in line with Ignaz (1996) who

environment filthy. With this happens in food production environment, the food produced is bound to contaminate.

VIII. CONCLUSION

From the result of the findings, it is concluded that sanitation practices is very important in bakery industries because the various foods produced by this industries is consumed by the majority of the people. Health is very important to man. Food contaminated by improper handling of food in industries can cause the death of population.

The inference made here is that hands should be washed frequently before and after handling of food in food industries so the best practice and giving of environmental health to people will help in producing food free from contamination.

RECOMMENDATIONS

The researcher made the following recommendations:

- Environmental health education should be given to all
- Good sanitation practices should be practice in bakery
- Food should be well treated by covering it against pest and vectors etc.
- The agencies responsible for the supervision of bakery industries should carry out inspection frequently to ascertain the level of sanitation and compliance with food safety
- Legislation should be made and enforced to sanction any worker that undermine good sanitation safety.

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