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Hazards Analysis and Critical Control Point (HACCP) Plan for Popular Foods among Student Boarders in some Senior High Schools in Ghana

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Abstract
There is the need for improvement in the safety of food given to students in boarding schools, and this can be effective if schools consider implementing HACCP programmes. This study seeks to design a HACCP plan for popular foods among the boarders in some Senior High Schools in Ghana, specifically Accra Metropolitan Area. The study period was from June – August 2011. Purposive sampling method was used to select the schools for this study. Five schools were selected, consisting of one girls boarding school, two boys boarding schools and two unisex boarding schools. Two popular meals found among the boarders were Jollof Rice and Gari (fermented roasted cassava grits), Fried Ripe Plantain and Beans (Red Red). None of the schools had any food safety programme in place.
Keywords: HACCP, HACCP Plan, Boarding School

1. Introduction

Food safety is usually used in place of food hygiene which should not be so, due to the fact that food hygiene most often than not deals with cleanliness of food. Food safety however ensures that food is safe from purchasing of foodstuff to the final point of consuming. Food contamination may occur at any point during its journey through production, processing, distribution, and preparation (Green et al., 2005; Hennessy et al., 2004). When food is at risk of getting contaminated, the health status of the food handlers, their personal hygiene, knowledge and practice of food hygiene plays a very important role (Mead et al., 1999).

HACCP is a food safety assurance system which is internationally accepted to deal with issued associated with food poison and food borne diseases, concentrates on prevention strategies on known hazards; it focuses on the steps within a process rather than structure and layout of premises (Egan et al., 2007). HACCP is defined as an effective system based on Good Manufacturing Practices (GMP) and Standard Sanitation Operation Procedures (SSOP), for providing safe and healthy foods (Pierson & Corlett, 1992). GMP is a crucial element in food quality. It encloses all practices necessary for ensuring the safety and suitability of food from the farmer to the consumer.

Standard Operating Procedures (SOPs) can be defined as established or prescribed methods to be followed routinely for the performance of designated operations or undesignated situations (Mulat, 2003). They are specified step-by-step instructions used at every stage of a process. Food processing establishments or institutions are encouraged to have SOPs for every activity. SOPs become handy in training employees and in establishing a consistent method for conducting daily operations.

According to Unnevehr & Jensen (1998), HACCP is an effective food safety system because is designed to provide the information flow for preventive and corrective actions and can easily be established on the production lines of all kinds of foods. In addition, procedures are put in place to reduce or eliminate hazards at every stage of the process and it requires documentation and verification also.

There is no documentation on food borne disease outbreaks in Ghanaian boarding schools but poor practices of most food handlers in terms of storage, personal hygiene, food hygiene and lack of knowledge in food safety practices due to low level of education are causes for concern. The HACCP concept can therefore be used to address food safety issues, because the HACCP approach is based on hazard identification, assessment and control from raw material through to the final product; than the testing of final products (Bryan, Teufel, Riaz, Qadar & Malik, 1992). This systematic approach has been described as the most effective means of controlling food borne diseases (Ropkins & Beck, 2002).Establishments and institutions should therefore make efforts of implementing hazard analysis critical control point (HACCP) along the whole food chain (Powell, Bobadilla-Ruiz, Whitefield, Griffiths, & Luedtke, 2002).

With the above facts, there is the need to give importance to the food safety practices of kitchen staff, students and food vendors in senior high boarding schools in Ghana. Hence the aim of this study is to propose a HACCP plan for popular foods among senior high school boarders in Ghana.

1.1 Developing a HACCP Plan

HACCP is a system preferred because it enables potential risks that are likely to cause a problem to be identified

right from the start of the food preparation. When the risk is identified, procedures can be made to reduce or eliminate. The development of a HACCP plan is a logical step-by-step process. Each step builds on the information gathered from the previous step. The process works better if some preliminary steps are taken (Minnesota Food Code, 1998). The Preliminary Steps are:

- Establishing a HACCP team.
- Describe the food product and its method of distribution.
- Identify the intended use and consumers of the food.
- Develop a process flow diagram of the food.
- Verify the flow diagram in the operation (USDA, FSIS, 1997).

HACCP is a highly customized system, therefore the persons who make up the HACCP team have to be those who are directly involved in production and services such as purchasing personnel, cooks and supervisors (Kwon, 2003). Thorough investigation of hazards throughout the complete product flow is the most important starting point of a successful HACCP programme. The HACCP team reviews menus, food supplies, clientele, and other hazards that are likely to occur during the flow of food (Kwon, 2003; USDA, FNS, 2002). When hazards are identified, the subsequent steps can be easily completed to meet the needs of foodservice establishment or institution.

For a HACCP programme to be successful, lots of steps a use, thus from purchasing to service of foods: Identifying hazards and critical control points; establishing critical limits, monitoring procedures, corrective actions, verification procedures, and record-keeping procedures (Kwon, 2003). Steps involved in a HACCP programme with examples for each procedure has been described in Table 1.

Table 1. HACCP Development Procedures with Examples for each Procedure (Modified from (USDA, FNS, 2002)

HACCP Principles	Examples of Procedure
1. Identify hazards based on menu, preparation procedures, and service	a. Identify if the meal is potentially hazardous i.e. vulnerable to causing food safety problems. b. Estimate the severity of the hazard should it occur. c. Evaluate preparation, cooking, holding, chilling and reheating procedures and identify hazards that are likely to exist in each procedure. d. Establish preventive measures such as cross contamination control, good hygiene practices etc.
2. Identify critical control points(CCP)	a. Receiving, thawing and mixing of ingredients. b. Cooking and reheating prepared that has being stored. c. Cold and hot holding for food items to be served. d. Storing foods that will not be cooked further.
3. Establish critical limits for each CCP identified in the previous step	a. Minimize the time that food is in the temperature danger zone during cooking and service. b. Cooking, reheating, hot and cold holding, cooling temperatures should be maintained. c. Storage temperature must be monitored.
4. Procedures must be established to monitor CCP	a. A staff member should be assigned the responsible to monitor CCPs b. The monitoring must be recorded.
5. Establish corrective action for each violated critical limit	a. Continue cooking until temperature reaches the safe level. b. Reheat hot foods to 76°C for 15 seconds if food temperature has fallen under 60°C on the hot food table within less than 2 hours. c. Discard hot foods if holding temperature has fallen under 60°C on the hot food table, and more than 2 hours has passed since the last safe temperature recorded.
6. Establish verification procedures	a. Verify that critical limits established for CCP will be able to prevent, reduce or eliminate the identified hazard. b. Verify that the HACCP plan will work effectively.
7. Establish record keeping system	a. Records should be kept to prove that the system is working. b. Change in any procedure must be recorded. c. A staff member should be put in charge of all records and records should be readily available when needed.

In spite of the known benefits of HACCP, school heads are lagging behind in implementing HACCP programmes (Hwang, Almanza & Nelson, 2001; Giampaoli, Cluskey & Sneed, 2002; Ropkins & Beck, 2002).

2. Methodology

Descriptive method of research was employed for this study. The population for the study was senior high schools in the Accra Metropolitan Area with boarding facilities and also kitchen facilities where food is prepared for the boarders. The sampling method used was purposive. Matrons of the selected schools formed the respondents for the study. Therefore the sampling size was 15 consisting of all matrons from the five schools. One of the schools had four matrons, another two matrons and the rest three matrons each. Five senior high schools were selected as follows: one girls boarding school, two boys boarding schools and two unisex boarding schools. The selected schools were actively engaged in providing 3-square meals i.e. breakfast, lunch and dinner to students on a daily basis. In the school dinning halls, important breakfast foods served were: wheat bread, doughnut, rice porridge, wheat porridge, maize grits, roasted maize (Tom Brown) and fermented maize dough porridge (koko). Lunch in the school dining halls comprised predominantly meals based on maize, rice, cowpeas (beans), gari (fermented roasted cassava grits), yam and fish. Most of the school dining halls did not add plantain to gari and beans. The profile of meals served for dinner was similar to lunch meals except that there was a decrease in foods containing beans. All five schools had a permanently built kitchen and a separate dining hall built very close to the kitchen, where food to be served didn't have to go outside the kitchen before entering the dining hall, as was observed in all the schools. Equipments and facilities to support the preparation of meals for the student boarders included gas stoves, gas ovens, corn mill and freezers. All five schools used LPG and firewood as the most important source of fuel for food preparation. In finding out the popular foods among the boarders, matrons of the schools were asked of the popular foods among the boarders. The popular foods among the boarders was found to be gari and beans especially when ripe plantain is added (also known as red red) and jollof rice. The matrons indicated that these foods were popular because the dining halls are always filled to capacity when these foods are served. Again wastage of these foods is less. A HACCP plan has therefore been develop for these foods.

3. Results and Discussion

3.1 HACCP Plan for Jollof Rice

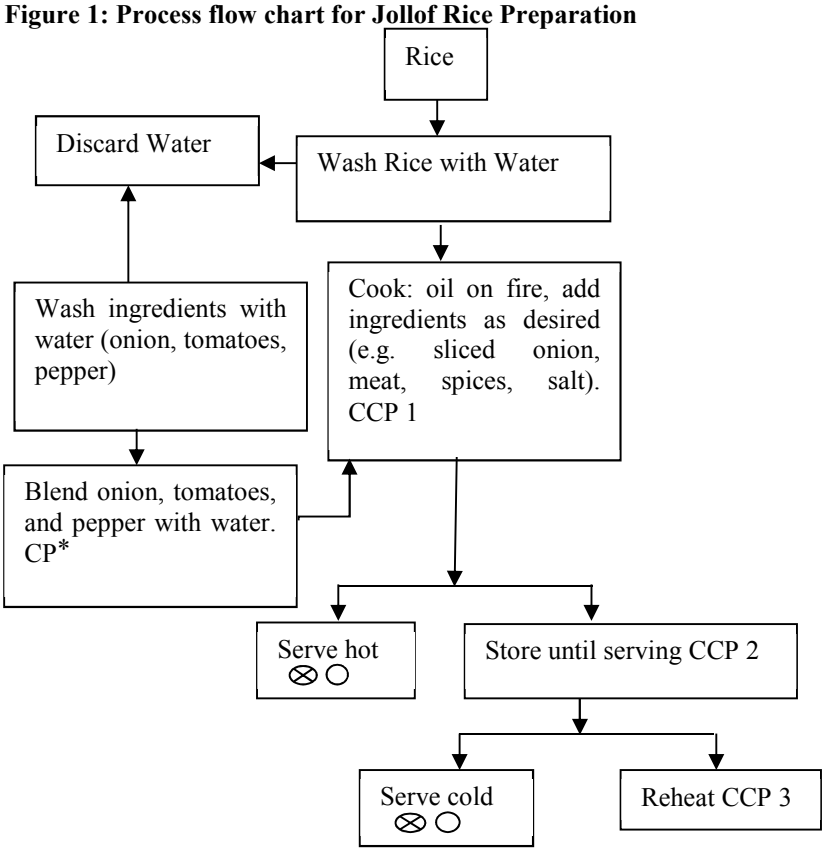
3.1.1 Product description for Jollof Rice

Product name(s)	Jollof rice
Important product	None
Characteristics	This product is ready to eat
Intended use	Eaten after cooking
Packaging	Plates or bowls
Shelf life	Not specific
Prepared	Boarding schools
Labelling instructions	Not applicable
Special distribution control	Not applicable

3.1.2 Ingredients for Jollof Rice

Rice	Oil
Plastic bowls for serving	
Tomatoes	Onions
Pepper	Salt
Spices	Water

Figure 1: Process flow chart for Jollof Rice Preparation



* Control points that must be dealt with as part of basic good manufacturing practices (GMP).

⊗ Initial contamination likely

⊕ Contamination by food handler

○ Contamination from utensils

⟠ Water probably contaminated

Table 2: HACCP Chart for Jollof Rice Preparation

Process Step	Hazard/Risk	Control Measure	CCP	Critical Limit	Monitoring	Corrective Action
Cooking	Biological: Survival of pathogens	Cook thoroughly	1	Ensure that food is thoroughly cooked	Stir food thoroughly to make sure the food is the same temperature all way through	Continue to cook
Store until serving	Biological: Multiplication of pathogens Physical: Presence of hair or sand particles	Temperature of food should be maintained	2	Ensure storage utensils are thoroughly cleaned and can maintain temperature of food until serving	Temperature of food should be checked every hour	Serve food within 4 hours
Reheat	Biological: Survival of pathogens	Check that food is piping hot all the way through	3	Ensure food is thoroughly heated	Check the internal temperature of food	Discard food within 2 hours

Source: Field Data, 2011

3.2 HACCP Plan for Gari, Ripe Plantain and Beans (Red Red)

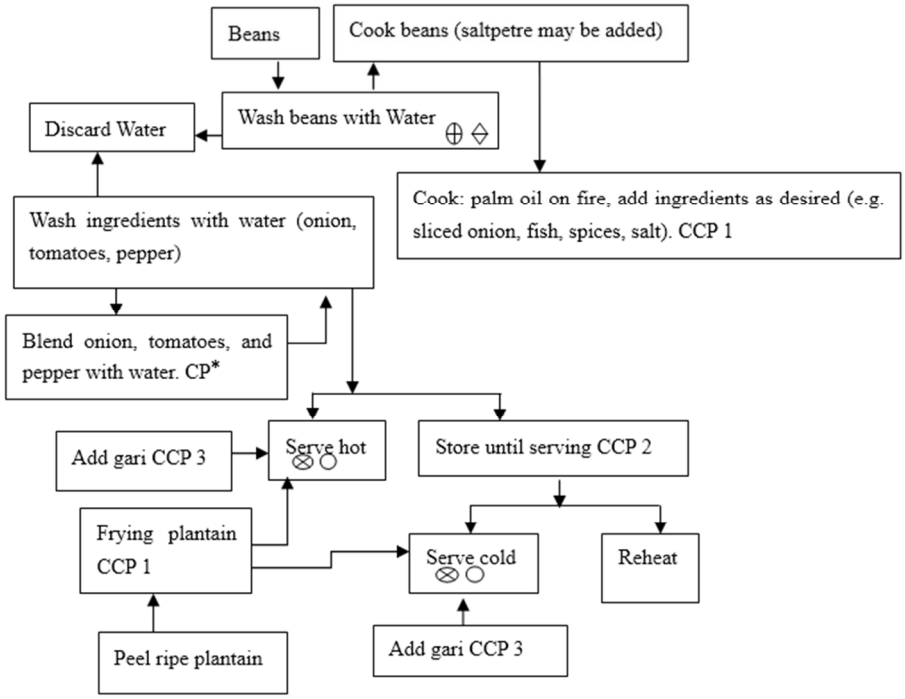
3.2.1 Product description for Red Red

Product name(s)	Gari, Ripe Plantain and Beans (Red Red)
Important product	None
Characteristics	This product is ready to eat
Intended use	Eaten after cooking
Packaging	Plates or bowls
Shelf life	Not specific
Prepared	Boarding schools
Labelling instructions	Not applicable
Special distribution control	Not applicable

3.2.2 Ingredients for Gari, Ripe Plantain and Beans (Red Red)

Beans	Palm oil
Tomatoes	Onions
Pepper	Salt
Gari	Water
Saltpetre	Ripe plantain
Plastic bowls for serving	

Figure 2: Process flow chart for Preparation of Gari and Beans (Red Red)



*Control points that must be dealt with as part of basic good manufacturing practices (GMP).

⊗ Initial contamination ⊕ Contamination by food handler

○ Contamination from utensils ◇ Water probably contaminated

Table 3: HACCP Chart for Preparation of Gari and Beans (Red Red)

Process Step	Hazard/Risk	Control Measure	CCP	Critical Limit	Monitoring	Corrective Action
Cooking/ Frying	Biological: Survival of pathogens	Cook thoroughly. Proper frying of plantain and periodically change frying oil	1	Ensure that food is thoroughly cooked. Oil should not be dark brown colour	Make sure the temperature of food maintained all way through	Continue to cook and change frying oil regularly
Store until serving	Biological: Multiplication of pathogens Physical: Presence of hair or sand particles	Temperature of food should be maintained	2	Ensure storage utensils are thoroughly cleaned and can maintain temperature of food until serving	Temperature of food should be checked every hour	Serve food within 4 hours
Adding Gari	Physical: Presence of foreign objects e.g. stones, hair, sand particles	Pick foreign objects	3	Ensure no foreign objects are present	Check all foreign objects are picked before serving	Discard if foreign objects are not easy to pick

Source: Field Data, 2011

4. Conclusion

Food has to be safe before it is accepted. The study concludes that HACCP plan helps to identify any hazards that maybe present in food at the early stage of food preparation. It is therefore important for school matrons to have a HACCP plan for foods which are prepared for the students.

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