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# **Bacterial Contamination of Children's Weaning Foods in Asase, North Bank, Makurdi.**

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## Abstract

The processes and procedures that contribute to contamination growth and survival of bacteria in children's weaning foods in Asase settlement North Bank, Makurdi, Benue state, Nigeria were investigated. Weaning foods including "Akamu", "Moio-moi" and Jollof rice were analyzed at different stages of preparation and handling. From the tested samples, 41.6%, 59.2% and 56.0% of "Akamu", "Moi-moi" and Jollof rice respectively were contaminated. The most frequently isolated bacteria were *S. aureus* and the coliforms. Of the 112 mothers interviewed, 50% had no refrigerators for storage of leftover foods, 6% had no sewage disposal facilities while 37% tested the temperature of the food with their bare hands prior to feeding the children. Using the Hazard Analysis Critical Control Points (HACCP), the major critical control points in the present study are cooking, preservation and reheating of food after preservation.

Keywords: weaning foods, HACCP, CCP

## **Introduction**

Epidemiological evidence shows that diarrhea is a major problem with an estimated one-in-six children under the age of 5 experiencing at least one episode every fortnight (Federal Office of Statistics, 1997). Children aged 4-24 months are at the greatest risk of developing diarrhea from contaminated food and water. After respiratory infections, diarrheal diseases are the commonest illness and have the greatest negative impact on the growth of infants and young children (Lee and Middleton, 2003; Tetteh *et al.*, 2004). Based on literature, weaning foods prepared under unhygienic conditions are frequently heavily contaminated with pathogens and may, thus, be a major factor in

causing diarrheal diseases and associated malnutrition. In particular, traditional gruels used in The Gambia for supplementing breastmilk were found to be heavily contaminated with potentially pathogenic micro-organisms, and such supplements are important factors in weaning-related diarrhea (Iroegbu *et al.*, 2000). Therefore, it appears that current efforts are not sufficient to prevent diarrheal diseases; thus, education of mothers in food-safety principles, particularly weaning foods, must also receive high priority (WHO, 2003). Educational programmes based on the hazard-analysis-critical-control-point approach, taking into consideration also sociocultural factors, should be integrated into all national

infant-feeding or food and nutrition programmes (Ehiri, 1995).

Normally breast milk is the main source of nourishment for children within their first 6 month of life. Ehiri and Prowse (1999), asserted that the dependence on breast milk reduces their exposures to food-borne pathogens and the anti infective properties of breast milk also afford some protection. Between 4 and 6 months of age, however weaning foods are given and children are thus exposed to food-borne pathogens. For example, a study of 454 children in eastern Nigeria (Blum, 1990) shows that the incidence of diarrhea was highest among children aged between 6 and 12 months; the age range which coincides with the usual

weaning period in the region. The development of sustainable strategies for controlling diarrhea among children in this region and in the country as a whole would thus constitute a significant advance in public health.

## **Materials and methods**

### **Study area**

The study was carried out in Asase settlement, North bank Makurdi of Benue state, Nigeria. The sample population comprised all mothers and their children of below 2 years of age.

### **Sample collection**

Weaning food samples were obtained from mothers who had children between 0-2years. The common foods in the area were “akamu”, “moi-moi” and jollof rice. These samples were collected at weekly intervals for 14 weeks. Raw “akamu” and “moi-moi” were also obtained from vendors.

### **Analysis of samples**

Socio demographic and environmental health data was obtained by means of a short questionnaire. In assessing bacterial contamination of weaning foods, Mortajemi (1993) stressed the need to apply the Hazard Analysis Critical Control Point (HACCP) and whether control can be applied at that point. The following steps were looked into: cooking

is a CCP, if foods are not prepared in a clean environment; preservation is CCP, if time is not controlled and if food is served without reheating; reheating is a CCP, if temperatures are not controlled; the use of contaminated ingredient is a CCP, if they are added at stages where no heat treatment is applied and purchasing food from vendors is also a CCP, if the foods are contaminated with food-borne pathogens.

Standard methods were used to test the food (Gaffa and Azoro, 2005). Depending on the time of arrival at the laboratory, samples were analyzed immediately to avoid further contamination. One gram portion of the sample was diluted in 9ml sterile diluents,



homogenized by shaking for 7 seconds and serially diluted. One ml of each sample homogenate was added to 9ml blank to yield  $10^{-1}$ ,  $10^{-2}$ ,  $10^{-3}$ ,  $10^{-4}$  and  $10^{-5}$  respectively.

Samples were plated on the surface of the following media: nutrient agar, mannitol salt agar and Luria-Bertani (LB). Inoculated plates were incubated for 24-48hr at  $37^{\circ}\text{C}$  after which they were examined for colony characters, cellular morphology and purity of culture. The suspected colonies were identified according to Bergey's manual of determinative bacteriology (2002).

To identify *S. aureus*, gram nature of the organisms were determined. Catalase and coagulase tests were also conducted for further

identification. Suspected colonies were sub-cultured on Luria-Bertani medium, incubated at 37<sup>0</sup>c for 24hr. A loopful of 24hr old culture was diluted to 1ml in LB medium and incubated at 30<sup>0</sup>c for 3hr; then shifted to 37<sup>0</sup>c for 3hrs and to 43<sup>0</sup>c for 18hr to test their sensitivity to heat. The number of colonies was then counted using direct plate count.

Similar procedure was employed for the identification of coliforms (particularly E. Coli which is often implicated in diarrhea in children). Suspected colonies from nutrient agar were sub-cultured on eosine methylene blue (EMB) agar medium (green metallic sheen colony character) and MacConkey agar medium (pale pink color colony character).

## Results

**Socio-demographic data.**The results of this study reveal the characteristics of the study population and characters of bacteria isolated from the selected weaning foods. Majority of the population representing 80% had no refrigerators for storage of leftover foods; 6% had no proper sewage disposal system while 10.7% of the mothers dipped their fingers in the food as a way of observing the temperature of food prior to feeding (Table 1). The levels of contamination of common children's weaning foods obtained from mothers is shown in table 2 where 41.6% of "akamu" samples were contaminated, 59.2% samples of jollof rice showed apparent signs of contamination and

56.0% of “moi-moi” samples analysed were also contaminated. Microbiology of the selected weaning foods revealed high bacterial counts of heat-stable *S. aureus* strains (510 cfu/g) and coliforms (250 cfu/g) mostly after preservation (Table 3).

Table 1: Availability of storage facilities, sewage disposal, and procedure for checking food temperature

	No. of Response	Percentage(%)
Refrigerator	22	20
Available	90	80

Not available	112	100
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### **Sewage disposal**

Pit latrine	75	67
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Water carriage system	30	27.0
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None	7	6.0
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### **Checking food temperature**

Taking a little	70	62.5
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portion with  
spoon

And putting  
in the mouth

Putting it in 30 26.8  
the palm

Dipping a 12 10.7  
finger in the  
food

Table 2. percentage contamination of common weaning foods in Asase

Sample source	No. of samples	No. positive	Percentage(%)
"akamu"	89	37	41.6
Jollof rice	71	42	59.2
"moi-	50	28	56.0

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**moi''**

<b>Total</b>	<b>210</b>	<b>107</b>	<b>51.0</b>
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Table 3. total bacterial count per food sample  
(cfu/g)

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<b>So</b>	<b>No.</b>	<b>s.a</b>	<b>Col</b>
<b>urc</b>	<b>of</b>	<b>ur</b>	<b>ifor</b>
<b>e</b>	<b>exa</b>	<b>eu</b>	<b>ms</b>
<b>of</b>	<b>mi</b>	<b>s</b>	
<b>sa</b>	<b>ned</b>		
<b>mp</b>	<b>foo</b>		
<b>les</b>	<b>d</b>		
<b>sa</b>	<b>sa</b>		

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**mp  
les**

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		Bef ore	Af ter	Afte r	Bef ore	Af ter	Afte r
		co oki ng	co ok in g	pres erva tion	coo kin g	co ok in g	pres evat ion
<b>"ak am u"</b>	89	47 0	41	310	216	16	250
<b>Joll of</b>	71	37 0	32	510	230	12	196

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ric  
e

“m	50	27	26	340	330	No	100
oi-		0					
mo						gr	
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						th	
						aft	
						er	
						24	
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## Discussion

The bacterial count of most weaning foods in Asase village of North Bank Makurdi, Nigeria were high probably due to lack of proper hygiene practices. Bacterial count may be low in food immediately after cooking but not when such food has been preserved for several hours (Ireogbu et al., 2000). Table 3 shows that bacterial count increases when food is preserved for many hours without reheating. Application of the hazard analysis critical control point (HACCP) strategy to the study of weaning foods is based on the promise that potential food hazards and faulty practices can be identified at an early stage in food preparations and handling, and their identification will lead to measures that prevent or reduce risks to children who are in their

prime of life (WHO, 20003). The HACCP approach determines quickly the points in food preparation, handling and serving processes that are critical while taking into account local habits and culture (Abdulsalami and Kafestein, 1994). There are also potential risks associated with methods used by mothers to taste whether foods are cooled enough to feed their children. In table 1 some mothers dipped their fingers (often unwashed) in the child's food as a way of measuring the temperature. Although there are sufficient data on risk factors for diarrhea in children, the factors that constitute priorities for intervention are yet to be resolved. The HACCP strategy endorsed by Cordex Alimentarius Commission(1993) as the most effective approach for ensuring the safety of food has the

potential to make a significant contribution and can facilitate a more pragmatic approach to developing messages that assure effective behavioural change. In the course of this research, it was observed that, plates and spoons used for serving food were not properly washed after use and this may contribute to post-cooking contamination of food. In houses where children were fed during household meal times every member of the house washed their hands (without soap) in one bowl of water before eating. This fairly common practice may contribute to food contamination in a number of ways. For example, pathogens on hands of infected persons can be transferred to those who subsequently dip their hands in the water including those feeding their children.

Cooking fuel and cooking practices are important in food hygiene since cooking and reheating temperatures are often critical control points. In situations where fuel for cooking is short supply, mothers in a bid to save energy prepare large quantities of food in advance and preserve until when needed. In the absence of facilities for preserving leftover foods, preservation and reheating become important critical control points. The potentials for contamination and growth of pathogens increase when microbiologically sensitive ingredients are added to preserve food particularly to “akamu” and consumed without adequate reheating. Weanin foods observed in the study area were often cooked to temperatures capable of destroying vegetative

forms of bacteria would therefore pose a minimum hazard to the child if consumed immediately after cooking. However, foods are typically kept either in cupboards or covered pots for an average of 6hr and often overnight (Table 1). The benefits that should accrue to the few mothers with refrigerated storage were negated by constant and often prolonged failures in power supply. Epidemiological evidence also shows that undue delay between cooking and consumption of food is a major contributing factor to most outbreaks of food-borne diseases (Brayan, 1988). This situation is particularly critical when foods are consumed without reheating and when reheating temperatures are typically below levels capable of destroying pathogens. If knowledge of food

hygiene is low, the reason for reheating food may simply be to make it warm to improve palatability, rather than to destroy the pathogen. Cooking like pasteurization can destroy non-spore forming bacteria and other spoilage organisms. It obviously alters the characteristics of food. However, heat distribution may be uneven, especially when reheating, and this may result in survival of pathogens in inadequately heated regions. The source of *S. aureus* among other sources is a human carrier who has not followed adequate hygiene procedures such as hand washing before preparing food. If the bacterium is inoculated into food that can support its growth, and the food is left at room temperature, for several hours, *S. aureus* can



grow and produce toxin. Unlike most serotoxins, it is heat-stable, so that cooking the food will not destroy it.

Purchasing ready-to-eat foods from vendors poses a considerable health risk. The reasons for this are apparent from observations on hygiene practices by vendors. Most of these foods are prepared in very poor sanitary environments, where there is prevalence of flies and the lack of facilities for food preservation suggests a high potential for contamination. St. Louis (1990) therefore maintained that foods are also subjected to repeated contaminations from the unwashed hands of vendors, and the materials used for wrapping, such as leaves, old newspapers and

reusable polythene bags may also be a source of contamination.

Some houses studied had no standard disposal facilities and the children defecated in and around the premises. In two of the houses, the children were ill with diarrhea. Even in homes with adequate sewage disposal facilities (e.g. pit latrines) the facilities were not adapted for children's use. This contributes to indiscriminate defecation in and around the premises and thus increasing the risk of handling excreta by mothers and by the children themselves. This is an important public health issue since such children are at greater risk of faecal-oral infections. Mothers may regard children's faeces as innocuous but

evidence suggest that they are as hazardous as those of adults and contain high concentration of pathogens (Uma *et al.*, 2009). Outdoor defecation by children and adults can contaminate water sources and may explain the high levels of pathogens in near by streams.

In situations of poverty and adverse environmental conditions, sustainable strategies for preventing childhood diarrhea associated with contaminated weaning foods may involve developing a protocol that permits the production of safe food in unsafe environments. Though an unclean environment poses many hazards for children's food, the hygienic quality of prepared food can be assured if basic food safety principles are

observed. When many factors contribute to food contamination, identification of critical control points (CCPs) becomes particularly important and can facilitate appropriate targeting of resources and prevention efforts. It is important to note that HACCP evaluations are of little value if the results are not used to educate mothers and food handlers to improve hygiene practices and to devise other feasible and culturally appropriate measures to promote food safety. It is hoped that the result and report of this study will contribute not to advancing current knowledge on CCPs in the preparation and handling of weaning foods, but also to the development and implementation of interventions that promote

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weaning food hygiene in the study area and similar settings.

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