#1305

# NUTRITION PAPER OF THE MONTH

*May 2001*

## Critical Control Points of Complementary Food Preparation and Handling in Eastern Nigeria

*Ehiri, J.E., Azubuike, M.C., Ubbaonu, C.N., Anyanwu, E.C., Ibe, K.M. & Ogbonna, M.O.*
*Bulletin of the World Health Organization 2001. 79(5): 423-435*

Food hygiene and safety has been largely a neglected factor in diarrhea and growth management. Few studies have been done looking at the factors affecting food contamination and nutritional outcomes. This study used the Hazard Analysis Critical Control Point (HACCP) approach to investigate process and procedures that could reduce microbiological contamination of foods. This paper identified several critical control points in Nigeria affected contamination – purchase of raw contaminated ingredients, storing food at ambient temperatures, and inadequate reheating of food. This paper offers a schematic view of how the different foods were prepared, when contamination was likely to be introduced, and therefore, identifying potential intervention areas.

***UNICEF NYHQ***
***Nutrition Section, PD***

# Critical control points of complementary food preparation and handling in eastern Nigeria

John E. Ehiri,[1] Marcel C. Azubuike,[2] Collins N. Ubbaonu,[3] Ebere C. Anyanwu,[4] Kasimir M. Ibe,[5] & Michael O. Ogbonna[6]

**Objective** To investigate microbial contamination and critical control points (CCPs) in the preparation and handling of complementary foods in 120 households in Imo state, Nigeria.

**Methods** The Hazard Analysis Critical Control Point (HACCP) approach was used to investigate processes and procedures that contributed to microbial contamination, growth and survival, and to identify points where controls could be applied to prevent or eliminate these microbiological hazards or reduce them to acceptable levels. Food samples were collected and tested microbiologically at different stages of preparation and handling.

**Findings** During cooking, all foods attained temperatures capable of destroying vegetative forms of food-borne pathogens. However, the risk of contamination increased by storage of food at ambient temperature, by using insufficiently high temperatures to reheat the food, and by adding contaminated ingredients such as dried ground crayfish and soybean powder at stages where no further heat treatment was applied. The purchasing of contaminated raw foodstuffs and ingredients, particularly raw akamu, from vendors in open markets is also a CCP.

**Conclusion** Although an unsafe 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 CCPs becomes particularly important and can facilitate appropriate targeting of resources and prevention efforts.

**Keywords** Diarrhea, Infantile/etiology; Infant food/microbiology; Food contamination/analysis; Water microbiology; Food handling; Food hygiene; Risk assessment; Task performance and analysis; Nigeria (*source: MeSH*).

**Mots clés** Diarrhée, infantile/étiologie; Aliments pour nourrisson/microbiologie; Contamination alimentaire/analyse; Microbiologie eau; Traitement aliments; Hygiène alimentaire; Evaluation risque; Analyse performance; Nigéria (*source: INSERM*).

**Palabras clave** Diarrea, infantil/etiología; Alimentos infantiles/microbiología; Contaminación de alimentos/análisis; Microbiología del agua; Manipulación de alimentos; Higiene alimentaria; Medición del riesgo; Análisis del desempeño de tareas; Nigeria (*fuente: BIREME*).

*Bulletin of the World Health Organization*, 2001, **79**: 423–433.

*Voir page 431 le résumé en français. En la página 432 figura un resumen en español.*

## Introduction

Measures of child health are useful indicators of the health of a nation, particularly for Nigeria where children constitute about 45% of the total population (*1*). The country's infant mortality rate of 114 per 1000 live births is among the highest in sub-Saharan Africa and mortality among children under five years of age is as high as 300 per 1000 live births in some parts of the country (*2*). Epidemiological evidence shows that diarrhoea is a major problem, with an estimated one-in-six children under the age of five years experiencing at least one episode every fortnight (*1*). Children aged 4–24 months are at the greatest risk of developing diarrhoea from contaminated food and water. Normally, breast milk is the main source of nourishment for children within their first months of life. The dependence on breast milk reduces their exposure to food-borne pathogens, and the anti-infective properties of breast milk also afford some protection. Between 4 and 6 months of age, however, complementary foods are given, and children are thus exposed to food-borne pathogens (*3*). For example, a study of 454 children in eastern Nigeria (*4*) showed that the incidence of diarrhoea

[1] Lecturer in International Health and Director of Studies, Master of Community Health Programme, Division of International Health, Liverpool School of Tropical Medicine, Pembroke Place, Liverpool, L3 5QA, England (tel: (+44) 151 708 9393; fax: (+44) 151 707 1702). Correspondence should be addressed to this author.

[2] Primary Care Unit, School of Postgraduate Medicine, University of Warwick, Coventry, England.

[3] Head, Department of Food Science and Technology, Federal University of Technology, Imo State, Nigeria.

[4] Research Associate, Department of Toxicology, Texas Southern University, Houston, TX, USA.

[5] Senior Lecturer in Environmental Science, School of Science, Federal University of Technology, Imo State, Nigeria.

[6] Consultant Sociologist, Ifako Saw-mill, Bariga, Lagos, Nigeria.

Ref. No. **99-0261**

handling the child's food. The educational level of either parent (whichever had the higher level) or of the caregiver was recorded. The usual ways of preparing, serving, and storing food by the mother or caregiver were noted in detail, and they were asked to explain each step in the process. Based on information obtained on-site, a flow diagram of each process was prepared to provide a clear, simple, and complete description of all steps in the process. In addition, a random sample of four markets that served parts of the study communities were visited to observe the hygiene practices of vendors.

### Collection of samples

Samples of the children's foods were collected aseptically, before and after cooking, and after storage at room temperature (for an average storage time of six hours). Raw food samples were obtained from vendors in local markets. The samples were put in plastic sterile containers with tight-fitting lids. Hot food samples from households were cooled immediately in an insulated plastic box containing ice-blocks and were kept there until transported to the laboratory. Sterile digital thermocouples were used to measure food temperature at three points: immediately after cooking, after storage at room temperature for an average of six hours, and immediately after reheating. In total 360 samples were collected and analysed. Each food or water sample collected was recorded in the field notebook and labelled at the point of collection.

### Analysis of samples

Standard methods were used to test food (*15*) and water samples (*16*). Depending on the time of arrival at the laboratory, the samples were either analysed immediately, or kept in a refrigerator till the following day. To test for the presence of faecal coliforms, *Escherichia coli*, or *Enterococcus faecalis* in food, a 25 g portion of the sample (or the whole sample if it was < 25 g) was diluted 1:10 in sterile 0.1% buffered peptone water, homogenized using a Waring blender, and serially diluted as required. Water samples from taps, boreholes, streams, and springs were also collected and tested. Faecal coliforms were detected using the membrane filtration technique, after incubating the samples at 44 °C for 24 hours. To detect *Enterococcus faecalis*, samples were incubated on azide medium at 37 °C for 24–48 hours and counted.

### Determination of critical control points

To determine whether a step or procedure was a CCP, we considered whether control could be applied at that point, and whether a loss of control could result in a potential hazard. For example, storage is a CCP if the storage time is not controlled and if food is served without reheating. Equally, reheating is a CCP if temperatures are not controlled. The use of contaminated ingredients is a CCP if they are added at stages where no heat treatment, or other processes capable of destroying vegetative pathogens, are applied. Purchasing foodstuffs and ingredients from vendors is also a CCP if the foods are contaminated with food-borne pathogens, or are consumed without further processing or proper heat treatment.

## Results

### Characteristics of the study population

The mean age of the 120 children was 15 months. The characteristics of the 120 study households are shown in Table 1. The mean number of people in each household was 7, ranging from 3 to 15. A majority (65%; $n$ = 78) of the 120 children in the households studied were girls. There was no significant difference between mean age of girls (15.65 months) and that of boys (14.17 months). Households in urban settings were more likely to have facilities for the refrigerated storage of perishable and leftover foods than those in the rural settings ($\chi^2$ = 25; degrees of freedom (df) = 1; $P$ <0.0001), due to the wider availability of electricity in urban centres. Similarly, households in which the parent/caregiver was educated to post-secondary school level were more likely to have refrigeration facilities than those where the parent/caregiver had a lower level of educational attainment ($\chi^2$ = 29.2; df = 3; $P$ < 0.0001). Common cooking fuels were firewood, bottled gas, and kerosene.

People in the small number of households ($n$ = 5; 4%) with no standard sewage disposal systems defecated in nearby bushes and surroundings. Children's faeces were observed in 20 (17%) of the study premises and four of these were households with no standard sewage disposal facilities. Handwashing with soap during preparation and handling of children's foods was observed in only five of the study households.

### Temperature of foods

The mean temperatures of cooked, stored, and reheated foods were 89 °C, 39 °C, and 53 °C, respectively. Although cooking temperatures reached levels capable of destroying many vegetative forms of food-borne pathogens, a marked concentration of organisms persisted in the food after cooking (Table 2). These may represent the group of heat-stable enterotoxigenic strains that have often been implicated in diarrhoea (*17*). Table 3 presents a summary of the hazards, CCPs, control measures, and monitoring requirements associated with the preparation and handling of the foods analysed.

### Drinking-water quality

Water samples were analysed to provide an indication of the level of contamination of drinking water. According to WHO guidelines, chlorinated water should contain no coliforms (*18*). However, 84% of the tap water samples did not meet this standard and

Table 2. **Microbial quality[a] of complementary foods at different stages of preparation and handling**

| Organism | Akamu $n = 73$ | | | Jollof rice $n = 52$ | | | Moi-moi $n = 60$ | | | Agidi $n = 48$ | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Before cooking | After cooking | After storage[b] | Before cooking | After cooking | After storage[b] | Before cooking | After cooking | After storage[b] | Before cooking | After cooking | After storage[b] |
| Faecal coliforms | 600 | 20 | 850 | 400 | 26 | 550 | 350 | 40 | 340 | 250 | 27 | 450 |
| *Escherichia coli* | 260 | 10 | 30 | 200 | 0 | 400 | 420 | 9 | 417 | 400 | 6 | 380 |
| *Enterococcus faecalis* | 670 | 81 | 1300 | 300 | 32 | 710 | 270 | 22 | 970 | 410 | 15 | 730 |

[a] Measured as the number of organisms per gram of complementary food.

[b] Storage for an average of six hours.

site: http://www.who.int/bulletin)). While on display in markets, all complementary foods are exposed to dust and flies, and are constant handled with unwashed hands and serving spoons.

## Discussion

### HACCP data

Application of the HACCP strategy to the study of complementary foods is based on the premise that potential food hazards and faulty practices can be identified at an early stage in food preparation and handling, and that their identification will lead to measures that prevent or reduce risks to children (*20*). The HACCP approach determines quickly and relatively cheaply the points in the food preparing/handling/serving processes that are critical to safety, while taking into account local habits and culture (*21*). Although there are sufficient data on risk factors for diarrhoea in children, the factors that constitute priorities for intervention have yet to be resolved. The HACCP strategy has the potential to make a significant contribution and can facilitate a more pragmatic approach to developing messages that assure effective behaviour change (*3*).

Using HACCP data to promote complementary food hygiene is of paramount importance in situations of extreme poverty and where adequate surveillance of food-borne diseases may be lacking (*22*). The data can be used to inform health and social authorities, train public health personnel, and design culturally appropriate hygiene interventions (*23*). However, as Abdulsalam & Kaferstein observed, the approach has yet to be fully exploited (*21*). In 1993, the Codex Alimentarius Commission endorsed the HACCP system as the most cost-effective approach for ensuring the safety of food (*12*).

### Socioeconomic status

The relationship between household socioeconomic characteristics and childhood diarrhoea has been amply demonstrated in the literature (*24, 25*). For example, using educational level of the parent/caregiver and availability of household amenities as proxies for socioeconomic status, it is apparent that most of the households were relatively poor. In 16% ($n = 20$) of the households, the parents/caregivers had no school education, and in 38% ($n = 46$) of households they had only attended primary school. This has significant implications for child health in general (*26*) and for food-hygiene behaviour in particular (*27*). Education is also related to employment and income (*28, 29*), which influence access to household amenities and facilities, including those related to food hygiene and environmental health (*26*).

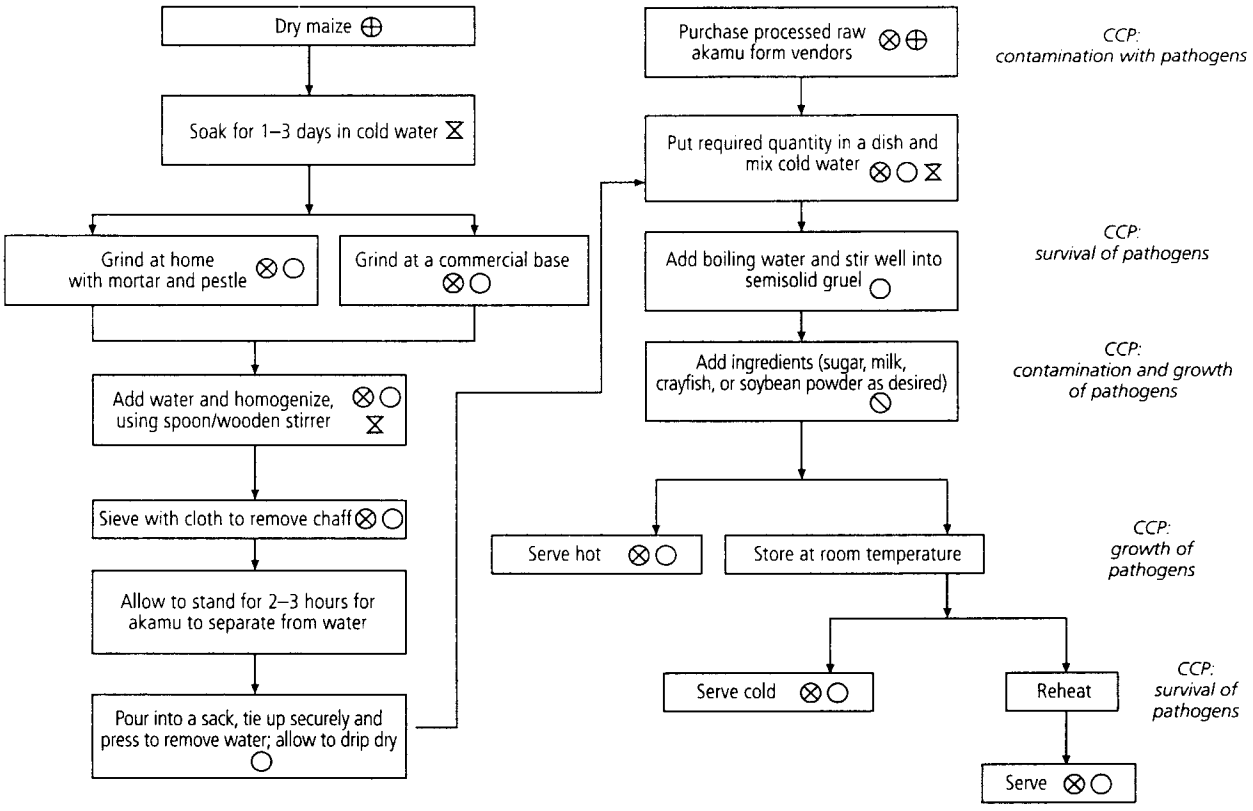
### Household sewage disposal

In all five households we studied that had no standard sewage disposal facilities the children defecated in and around the premises; in two of the households the children were ill with diarrhoea. Even in homes with adequate sewage disposal facilities (e.g. pit latrines), the facilities were not adapted for children's use. This contributed to indiscriminate defecation in and around the premises, and thus increased the risk of handling excreta by parents and caregivers, and by the children themselves. This behaviour reflected the children's limited knowledge of hygiene, and is an important public health issue, since such children are at greater risk of faecal–oral infections. Households may regard children's faeces as innocuous (*30*), but evidence suggests that they are as hazardous as those of adults and may contain high concentrations of pathogens (*31*). Outdoor defecation by children and adults can contaminate water sources and may explain the high levels of pathogens in nearby streams.

### Water quality

While high counts of faecal coliforms in water usually indicate heavy and recent pollution, their absence does not guarantee that the water is free from faecal contamination, since coliforms die rapidly in water. Of greater public health concern is the level of contamination with *Enterococcus faecalis*, because the latter do not multiply readily in water, they die less rapidly than faecal coliforms, and tend to persist even after chlorination (*18*). As a result, the presence of *Enterococcus faecalis* in water sources is an indication that the water sources are being polluted by faeces at a distant location (*32*). Although not investigated in this study, inadequate supply of chemicals owing to lack of financial resources and poor maintenance of

Fig. 1. **Flow diagram of akamu preparation and handling**




*CCP* = critical control point.
⊕ initial contamination likely.
⊗ contamination by food handler.
○ contamination from utensils.
⊘ contamination of raw ingredients.
⧖ water for processing probably contaminated.

WHO 01 52

equipment are likely to be important determinants of the quality of tap water in many developing countries. It should also be noted that in many of these countries the primary challenge is the lack of water, rather than its quality (*33*).

All study households in the urban areas admitted that taps often go dry for several weeks and that they rely on water purchased from water vendors when this happens. Although this study did not examine the microbial quality of water sold by vendors, studies in southern Nigeria (*34*) and in neighbouring Ghana (*31*) showed very high levels of contamination. In addition, lack of water for operating sewage systems in homes often increased the potential for fly breeding and for handling excreta (*35*).

## Cooking fuel

Cooking fuel and cooking practices are important in food hygiene since cooking and reheating temperatures are often CCPs. In situations where fuel for cooking is short supply, households may, in a bid to save energy, prepare large quantities of food in advance and then store it until needed. In the absence of facilities for monitoring food temperature and for properly storing leftover foods, storage and reheating become important CCPs. The potential for contamination and growth of pathogens increases when microbiologically sensitive ingredients are added to stored food, particularly to akamu, and consumed without adequate reheating.

## Food-hygiene behaviour

In a few households ($n$ = 13), the plates and spoons used for serving food were not properly washed after previous use, and this may contribute to post-cooking contamination of the food. In the 65 households where children were fed during household meal times, all household members 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 present on hands of infected household members can be transferred to those who subsequently dip their hands in the water, including those feeding children (*36*). There are also potential health risks associated with methods used by

and handling in the home may be negated if foods and ingredients purchased from vendors are already contaminated. For example, even though cooking may destroy vegetative pathogens in foodstuffs, it may not eliminate toxins or spores. Furthermore, even though vended foods may not be blamed for a major burden of childhood diarrhoea, a positive association between consumption of vended food and diarrhoea morbidity has been demonstrated in West Africa (*31*), and this underscores the need for the development and promotion of healthy marketplace initiatives currently supported by WHO (*40*).

Table 5. **Microbial quality[a] of foodstuff and ingredients**

| Organism | Soybean powder $n = 17$ | Raw akamu[b] $n = 8$ | Ground crayfish $n = 60$ |
|---|---|---|---|
| | Mean (range) | Mean (range) | Mean (range) |
| Faecal coliforms | 200 (5–410) | 400 (40–900) | 75 (0–31) |
| *Escherichia coli* | 80 (0–180) | 100 (12–380) | 120 (5–120) |
| *Enterococcus faecalis* | 250 (10–450) | 600 (75–1100) | 93 (6–240) |

[a] Measured as the number of organisms per gram of foodstuff and ingredient.

[b] From market vendors.

## Storage of cooked foods

Complementary foods observed in the study communities were often cooked to temperatures capable of destroying vegetative pathogens and would therefore pose a minimal hazard to the child if consumed immediately after cooking. However, foods were typically stored either in cupboards or covered pots for an average of six hours, and often overnight. The benefits that should accrue to the few households with refrigerated storage were negated by constant and often prolonged failures in the power supply: in only 8 of the 45 households with a refrigerator was power available at the time of the study visit.

Epidemiological evidence also shows that undue delay between cooking and consumption of food is a major contributing factor to most outbreaks of foodborne diseases (*41–44*). This situation is particularly critical when foods are consumed without reheating and when reheating temperatures are typically well below levels capable of destroying pathogens. If knowledge of food hygiene is low, the reasons for reheating food may simply be to make it warm and improve palatability, rather than to destroy pathogens.

## Implications of the study

In situations of poverty and adverse environmental conditions, sustainable strategies for preventing diarrhoea associated with contaminated complementary foods may involve developing a protocol that permits the production of safe food in unsafe environments. Though a polluted environment poses many hazards for children's food, the hygienic quality of prepared food can be assured if basic food safety principles are observed (*45*). When many factors contribute to food contamination, identification of 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 food handlers to improve hygiene practices and to devise other feasible and culturally appropriate measures to promote food safety. It is hoped that this report will contribute not only to advancing current knowledge about CCPs in the preparation and handling of children's foods, but also to the development and implementation of interventions that promote complementary food hygiene in the region studied and in similar settings. ■

## Acknowledgements

This study was financed by the Thrasher Research Fund. The authors are grateful to the Fund's research administrators, reviewers, and consultants for their cooperation and valuable contributions in the design stages of the study. We are equally grateful to all primary health care workers and members of households that participated in the study. The comments of Dr A. Oyo-ita of the Department of Community Health, University of Calabar, Nigeria, on an earlier draft of this paper are also gratefully acknowledged.

**Conflicts of interest:** none declared.

## Résumé

### Points de contrôle critiques dans la préparation et la manipulation des aliments de complément dans l'est du Nigéria

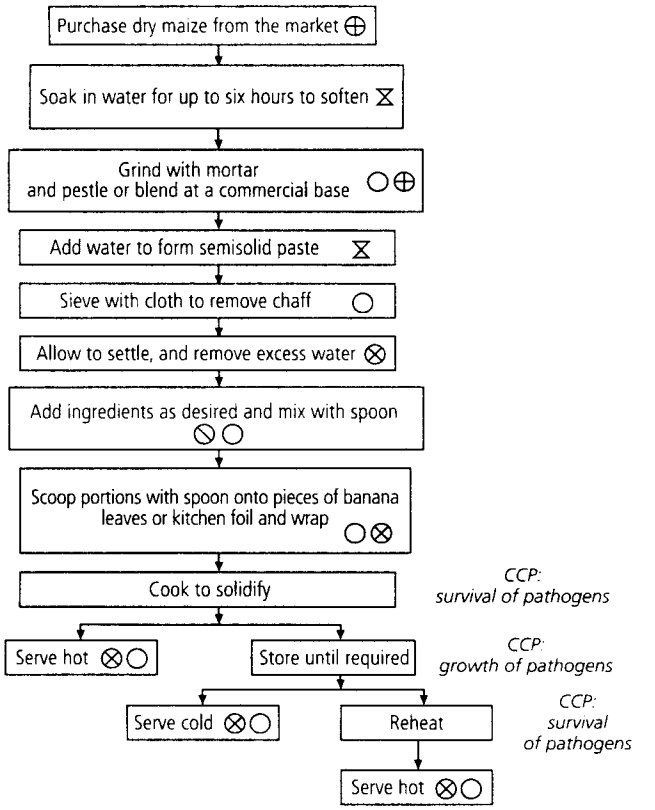
**Objectif** Etudier la contamination microbienne et les points de contrôle critiques (PCC) dans la préparation et la manipulation des aliments de complément dans 120 ménages de l'Etat d'Imo au Nigéria.

**Méthodes** L'approche HACCP (analyse des risques – maîtrise des points critiques) a été utilisée pour rechercher les procédés et modes opératoires qui contribuent à la contamination microbienne ainsi qu'au développement et à la survie des germes, et identifier les points où des contrôles pourraient être exercés afin de prévenir ou éliminer ces risques microbiologiques ou de les réduire à des niveaux acceptables. Des échantillons d'aliments ont été recueillis et soumis à des analyses microbiologiques à divers stades de leur préparation et de leur manipulation.

**Résultats** Pendant la cuisson, tous les aliments atteignaient une température capable de détruire les formes végétatives des agents pathogènes transmis par

17. **Gorbach SL et al.** Traveller's diarrhoea and toxigenic *Escherichia coli*. *New England Journal of Medicine*, 1975, **292**: 933–936.
18. *Guidelines for drinking-water quality*. Geneva, World Health Organization, 1984.
19. *Fermentation: assessment and research*. Report of a Joint FAO/WHO workshop on fermentation as a household technology to improve the food safety, in collaboration with the Department of Health, Republic of South Africa, Pretoria, South Africa, 11–15 December, 1996. Geneva, World Health Organization, 1996 (unpublished document WHO/FNU/96.1).
20. **Bryan FL.** Hazard analysis critical control point approach: epidemiological rationale and application to food service operations. *Journal of Environmental Health*, 1981, **44**: 7–14.
21. **Abdulsalam M, Kaferstein FK.** Food safety in primary health care. *World Health Forum*, 1994, **15**: 393–399.
22. **Ehiri JE.** Food safety control in developing countries: does HACCP matter? *Science, Technology and Development Journal*, 1995, **13** (2): 250–265.
23. **Michanie S, Bryan, FL.** Spin-off from space travel. *World Health*, 1987, **8**: 26–27.
24. **Alam N.** Predictors of diarrhoea in young Bangladeshi children. *Journal of Tropical Paediatrics*, 1995, **41** (5): 278–280.
25. **Ketema L, Lulseged S.** Persistent diarrhoea: socio-demographic and clinical profile of 264 children seen at a referral hospital in Addis Ababa. *Ethiopian Medical Journal*, 1997, **35** (3): 161–168.
26. **Ehiri JE.** Infant and child mortality in Nigeria: the role of socio-economic factors [Dissertation]. Swansea, University of Wales, 1993.
27. **Ekanem EE et al.** Food hygiene behaviour and childhood diarrhoea in Lagos, Nigeria -- a case control study. *Journal of Diarrhoeal Diseases Research*, 1991, **9** (3): 219–226.
28. **Togunde OR.** Determinants of women's employment in urban Nigeria: the impact of socio-economic factors. *Journal of Asian and African Studies*, 1999, **34** (3): 279–297.
29. **Cerrutti M.** Intermittent employment among married women: a comparative study of Buenos Aires and Mexico. *Journal of Comparative Family Studies*, 2000, **31** (1): 19–45.
30. **Traore E et al.** Child defecation behaviour, stool disposal practices and childhood diarrhoea: results from a case-control study. *Journal of Epidemiology and Community Health*, 1994, **48**: 270–275.
31. **Benneh G et al.** *Environmental problems and the urban household in the Greater Accra Metropolitan Area (GAMA), Ghana*. Stockholm, Environment Institute, 1993: 54–60.
32. **Kenner EE.** Faecal streptococcus indicators. In: Berg G, ed. *Indicators of viruses in water and food*. Ann Arbor, MI, Ann Arbor Science Publishers, 1978.
33. **Cairncross S.** Water Supply and the Urban Poor. In: Hardoy JE, Cairncross S, Satterthwaite D, eds. *The poor die young: housing and health in third world cities*. London, Earthscan, 1990: 109–126.
34. **Oyemade A.** Environmental and personal hygiene practices: risk factors for diarrhoea among children of Nigerian market women. *Journal of Diarrhoeal Diseases Research*, 1998, **16** (4): 241–247.
35. **Gilman RH et al.** Water cost and availability — key determinants of family hygiene in a Peruvian shantytown. *American Journal of Public Health*, 1993, **83** (11): 1554–1558
36. **Schmitt R et al.** Hazards and critical control points of food preparation in homes in which persons had diarrhoea in Zambia. *Journal of Food Protection*, 1997, **60** (2): 161–171.
37. *Strengthening primary health care at the local government level*. Lagos, Federal Ministry of Health, 1989.
38. **Dawson, R, Liamrangsi S, Boccas F.** *Street foods in Bangkok. Food Nutrition and Agriculture 17/18*. Rome, Food and Agricultural Organization, 1996 (available at http://www.fao.org/WAICENT/INFO/ECONOMICS/ESN/fna17-e/sum-e.htm).
39. **Canet C, N'Diaye C.** *Street food in Africa. Food Nutrition and Agriculture 17/18*. Rome, Food and Agricultural Organization, 1996 (available at http://www.fao.org/WAICENT/INFO/ECONOMICS/ESN/fna17-e/sum-e.htm).
40. *Healthy cities: health market places programme*. Geneva, World Health Organization, 1999 (Division of Health Promotion, unpublished document, available at http://www.who.int/hpr/cities/approach/markets.html).
41. **Bryan FL.** Risks of practices, procedures and processes that lead to outbreaks of food-borne diseases. *Journal of Food Protection*, 1988, **51**: 663–673.
42. **Roberts D.** Factors contributing to outbreaks of food poisoning in England and Wales 1970–1979. *Journal of Hygiene*, 1982, **89**: 491–498.
43. **Davey GR.** Food poisoning in New South Wales, 1977–84. *Food Technology Australia*, 1985, **37**: 453–456.
44. **St Louis ME et al.** Epidemic cholera in West Africa: the role of food handling and high-risk foods. *American Journal of Epidemiology*, 1990, **131**: 719–729.
45. *Facts about infant feeding*. Geneva, World Health Organization, 1993 (Joint Newsletter of the Division of Diarrhoea and Acute Respiratory Disease Control, Maternal and Child Health and Family Planning Programme, The Food Safety Unit and the Special Programme of Research, Development and Research Training in Human Reproduction. Vol. 3).

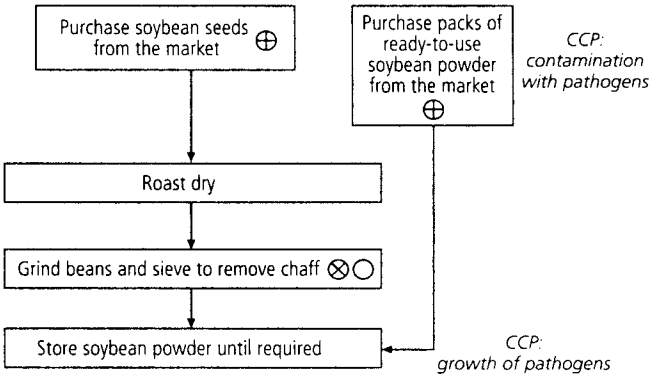
Annex Fig. 4. **Flow diagram of agidi preparation and handling**




*CCP* = critical control point.
⊕ initial contamination likely.
⊗ contamination by food handler.
○ contamination from utensils.
⊘ contamination of raw ingredients.
⧖ water for processing probably contaminated.

WHO 01.55

Annex Fig. 5. **Flow diagram of soybean powder preparation**




*CCP* = critical control point.
⊕ initial contamination likely.
⊗ contamination by food handler.
○ contamination from utensils.

WHO 01.56