Evaluation of the safety of domestic food preparation in Malaysia

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Food-handling practices were studied in 119 and 158 households, respectively, in an urban and a rural community in Peninsular Malaysia. Hazard analyses, including microbiological analysis of foods, were carried out in two households in each community and in a house that prepared food for distribution in the urban area. Kitchen hygiene was generally acceptable, although rated "poor" in some instances in the rural area. Food prepared for lunch was usually sufficient for dinner also, the leftover items being stored at ambient temperature until required. In the house that prepared food for distribution, breakfast was prepared during the evening, stored at ambient temperature overnight, and reheated before sale the next morning. There was a local preference for cooking food at temperatures close to boiling point; this reduced the numbers of vegetative cells but not those of spores. In some stored foods the populations of Staphylococcus aureus, Bacillus cereus *and mesophilic aerobic bacteria increased, the last-mentioned reaching spoilage levels. Reheating reduced the populations of proliferating bacteria in most foods to acceptable levels but would not have destroyed heat-resistant enterotoxins. Because of their importance in combating acute bacterial foodborne disease, the control of the temperature and time factors during the cooking and storage of food should receive special attention in education on health and food safety.*

Introduction

Foodborne illness, one of the most widespread kinds of disease (*1*), remains uncontrolled in both developed and developing countries. Its etiology, impact on public health, and epidemiology vary and the problems associated with it in developed countries can be expected to emerge also in developing countries.

In developing countries, where family income is low, the household remains a major source of human food. Food is prepared in domestic kitchens for home consumption and for sale through the informal food distribution sector. Culturally acceptable education on safe food-handling practices is therefore important to prevent foodborne illness. In order to achieve this it is necessary to identify unsatisfactory practices and the sociocultural factors that influence them.[a]

The "hazard analysis critical control point" approach to the control of food quality has been widely applied in the food manufacturing industry (*2*). It involves the systematic identification of hazards during the production process, the identification of critical control points for these hazards, and the design of procedures for the specific control and the monitoring of such points. This approach is also applicable to domestic food preparation where, however, it has been less frequently employed (*3–5*). The critical points that have been identified to control the preparation of unsafe food are the targets for food safety education programmes aimed at preventing foodborne illness. The present article describes the food-handling practices identified when this approach was adopted to analyse the preparation of some common foods for domestic consumption and for sale through the informal street food sector.

Studied were the general domestic food management, food-handling practices, and some sociocultural factors associated with food-handling in a rural

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[a] *Health education in food safety.* Unpublished WHO document EHE/FOS/88.7, 1987.

and an urban community in Kelantan, north-east Peninsular Malaysia, in order to identify practices and behaviours that could be used in a food safety education programme. The analyses were specifically designed to target critical control points for dealing with contamination by and proliferation of foodborne bacteria that commonly cause illness, e.g., *Escherichia coli*, *Staphylococcus aureus*, *Bacillus cereus*, *Clostridium perfringens* and *Vibrio parahaemolyticus*.

Materials and methods

Study sites

The study was performed in both an urban community, *Kampung* (*Kg*) Langgar, and a rural community, *Kg* Tujoh, in Kelantan State in the north-east of Peninsular Malaysia, where visits were made to 119 households (315 adults) and 158 households (594 adults), respectively. Compared with Langgar, the rural community had larger households, lower household incomes, main care-givers who had lower education levels and poorer access to amenities for good food hygiene, i.e., clean water, sanitation, cooking fuel, and refrigeration.

Cooking area hygiene

Cooking area hygiene was assessed by observation during the interview with the key respondent in each household, when a standard checklist of questions was used to avoid differences between interviewers. Observations were scored as 1 or 0 (corresponding to "yes" and "no", respectively) for a separate kitchen, an unclean cooking stove, food scraps, an unclean floor, uncovered food, no waste container, and evidence of the presence of animals or birds. Scores of 0–2, 3–4 and 5–7 were categorized as "good", "acceptable", and "poor", respectively.

Hazard analysis

The hazard analysis critical control point approach was used to assess the preparation of midday meals in two households (1 and 2) in *Kg* Langgar and in two households (4 and 5) in *Kg* Tujoh, and that of *nasi bunkus* (breakfast food) in a third household (*3*), also in *Kg* Langgar, that sold food via street vendors in this community. Each household had 10–12 occupants. All the households were supplied with treated town water and had access to a pour–flush toilet; cooking was carried out using a gas stove in all but household 4, which had a wood-burning stove. Only household 3 had a refrigerator, although there was also one in a coffee shop owned by and close to household 2, and fresh food, e.g., uncooked meat, was sometimes stored here.

The communities were approached through local leaders and householders using methods described previously (*2–5*). The food handlers were requested to prepare food in their usual way and were given no specific instructions. The researcher was accompanied by an interpreter so that all communication was in the local dialect of Bahasa Malaysia. In most instances, both remained in the household while food was being prepared and stored, observing and recording the procedures employed and the behaviour of the food handlers; food temperatures were measured and samples were collected for bacteriological analysis. However, when *nasi bunkus* was being prepared, the observers were unable to stay on the premises during the entire evening. In instances when rice, fish, or meat were the main ingredients, main samples were collected; for meals that consisted of numerous ingredients, the composite food was sampled after cooking.

Bacteriological analysis

Food samples were collected under sterile conditions in plastic containers using knives and spoons and were immediately placed on ice in a cooler box for transport to the laboratory, where they were stored at 4 °C for testing on the day of collection or at –20 °C for testing later.

A 30-g portion, or the whole sample if it was smaller, was diluted 1:10 in sterile 0.1% buffered peptone water,[b] homogenized using a Waring blender, and further diluted as required. Foods were tested quantitatively for total mesophilic aerobic bacteria, coliforms, *E. coli*, coagulase-positive staphylococci, *B. cereus*, *C. perfringens* and *V. parahaemolyticus* (seafood only). The isolation and identification methods used were those contained in the Standards Association of Australia, AS1766,[c] with the following exceptions, where a different method or a modification had to be used in a laboratory with minimal facilities: for *E. coli*, the Anderson-Baird Parker membrane method; for staphylococci, the Staphyslide latex slide coagulase test;[d] for *B. cereus*, polymixin egg yolk mannitol agar;[b] for *C. perfringens*, tryptone sulfite cycloserine agar;[b] and coliform bacteria, Petrifilm VRB plates.[e]

[b] Oxoid Ltd, Basingstoke, England.
[c] Australian Standard 1766: *Food microbiology*. Sydney, Standards Australia, 1991.
[d] BioMérieux Laboratory Reagents and Instruments, Marcy-l'Étoile, France.
[e] Mauri Foods, Burns Philp & Co. Ltd, Australia.

The criteria used for the acceptability of the bacterial quality of food samples were the standards outlined in Malaysia's Food Act. For ready-to-eat foods these are as follows: mesophilic aerobic bacteria, $<3.0 \times 10^5$ per g; coliforms, <50 per g; *S. aureus*, <100 per g; *B. cereus*, <100 per g; and *C. perfringens*, <100 per g.

Results

Cooking area hygiene

All the food preparation areas in the 119 households in the urban *kampung* were satisfactory (96%, "good"; 4%, "acceptable"). In the 158 households in the rural area, 88% of food preparation areas were satisfactory (49%, "good"; 39%, "acceptable") and 11% were "poor".

Hazard analysis

Flow diagrams, showing hazards and critical control points, were prepared for each meal whose preparation was observed. Examples are shown for the preparation and storage of boiled rice (Fig. 1), which was used in all households and for the fish ball soup prepared in household 1 (Fig. 2). The bacterial counts in food samples are shown in Table 1. The time and temperature relationship of food during preparation and storage was a major critical control point in all households (Table 2).

Household 1. In household 1 the preparation of boiled rice, fried fish and fish ball soup began at 12:00 and lunch was served at 14:00. Other food was covered and stored at ambient temperature until it was reheated for dinner at 20:00. Raw fish was purchased from an itinerant hawker who carried it at ambient temperature. The fried fish reached a maximum temperature of 82 °C for 15 minutes and was then transferred to a plate and left under ambient conditions, where the temperature decreased from 80 °C to 33 °C over 60 minutes. The fish balls were prepared from ground raw fish, added to soup, and boiled at 99 °C for 15 minutes (Fig. 3). The soup was then left on the stove with no heat for 135 minutes, where the temperature dropped from 98 °C to 40 °C. The raw fish had 60 coliforms/g, whereas the fried fish and fish ball soup contained only 10 and <10 coliforms/g, respectively.

Household 2. In household 2 the food prepared included rice, fried fish, eggplant curry and boiled fish, all of which were served for lunch. Leftover eggplant curry and boiled fish were covered and stored at room temperature, subsequently to be reheated before consumption at dinner. Cooking commenced at 13:00 and lunch and dinner were served at 14:30 and 20:00, respectively. The rice was boiled in JKR water (town water supply) at 102 °C for 15 minutes and was then left on the stove with no heat, its internal temperature dropping from 99 °C to 31 °C during storage for 5 hours. The raw rice had a high count of coliforms and *B. cereus*; boiling reduced the coliform count significantly but not that of *B. cereus* (Table 1). After the boiled rice had been held at 31.4 °C for 3 hours after lunch, the coliform and *S. aureus* counts had increased, while the *B. cereus* count had decreased slightly. During preparation for dinner the rice was reheated to a temperature of 71 °C for 15 minutes; this reduced the bacterial

Fig. 1. **Hazard analysis and critical control points for preparation of boiled rice in all study households.**

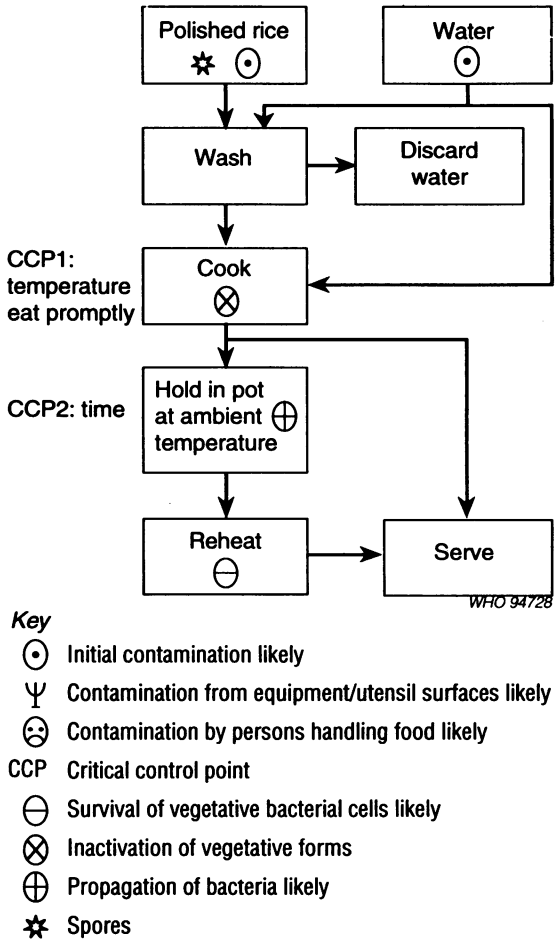
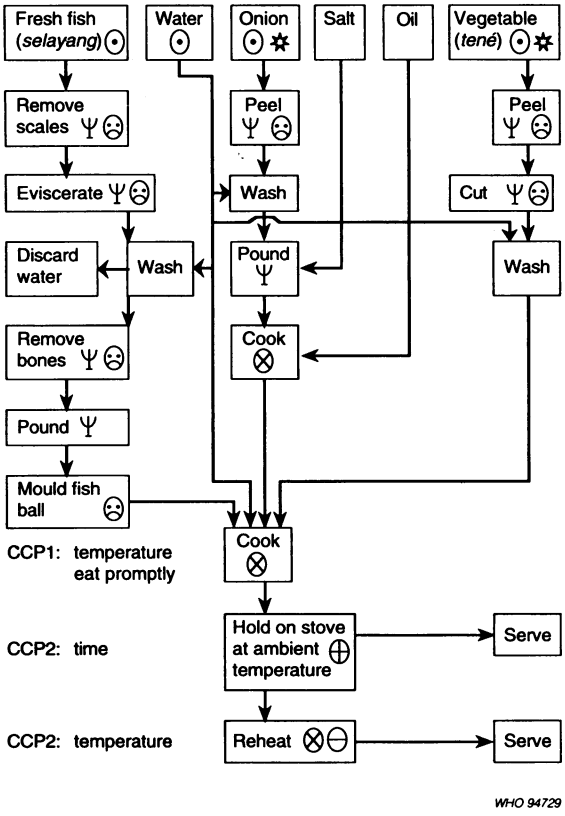


Fig. 2. **Hazard analysis and critical control points for the preparation of fish ball soup in household 2** (see Fig. 1 for explanation of symbols).



counts to levels similar to those present after the initial boiling. When served for lunch, eggplant curry had acceptable bacterial counts, except for mesophilic aerobic bacteria. After storage at room temperature (31 °C) the *B. cereus* count increased (Table 1). After reheating the curry to 60.2 °C and serving for dinner, the mesophilic aerobic bacteria and *B. cereus* counts decreased and contamination with coliforms was detected.

Household 3. In household 3 the food prepared included *nasi lemak*, *nasi berlauk*, and *nasi kerabu*, which are common breakfast dishes consisting of boiled rice with various combinations of fish, meat curry, vegetables, and sauces. The food was prepared between 22:00 and 24:00, reheated at 5:00 the following morning and sold between 6:00 and 10:00 at roadside food stalls. It was estimated that more than 300 servings were sold daily in the *kampung*. It was not possible to remain in the house during the entire food-handling period. The preparation of *nasi berlauk*, a fish or beef curry with boiled rice, was observed. The rice was prepared in a similar manner to that indicated above. The fish and beef curries were boiled at 99.0 °C and 96.8 °C, respectively, for up to 45 minutes; after overnight storage at room temperature, the curry temperatures were 33 °C and 28 °C, respectively. Following cooking in the evening, the curries, except for the beef curry, had acceptable bacterial levels. After overnight storage at ambient temperature for 5–7 hours, the mesophilic aerobic bacteria had increased approximately tenfold. Following reheating and storage at a roadside food stall for a further 5 hours, the counts were acceptable but the count of *B. cereus* had increased a hundredfold in the beef curry.

Household 4. In household 4 the meals prepared included rice, *siakap puteh* (fried sea perch) and *sayur air* (boiled fish and vegetables). Preparation began at 12:50 and lunch was served at 13:50. The leftovers from lunch were served at the evening meal, but it was not possible to make any observations in this regard. Food samples were collected after lunch, covered, and stored in the laboratory for 4 hours at the ambient temperature recorded in the household. During cooking, the rice, *sayur air*, and fried fish reached 86.9 °C, 97 °C, and 89 °C, respectively. Fish caught in the *kampung* were fried on the morning they were caught, while market fish that had been caught several days before were used for the preparation of *sayur air*. The local fish had 60 coliforms/g initially and <10/g after frying, and there was no increase on holding. The market fish had elevated mesophilic aerobic bacteria, coliform, and *B. cereus* counts, which were reduced during cooking and the preparation of *sayur air*; however, the mesophilic aerobic bacteria increased to 1.2×10^9/g after holding for 4 hours.

Household 5. The adult residents of household 5 worked in nearby tobacco fields, returning at midday to prepare lunch, which was consumed between 14:00 and 16:00; the leftovers were usually consumed at 22:00 when they returned from the fields. Boiled rice, fish soup, and *kukus masam manis* (sweet-and-sour steamed fish) were prepared during the visit. No samples were available. The rice was cooked at a maximum temperature of 94 °C for 30 minutes over a wood fire; this reduced the mesophilic aerobic bacteria and *B. cereus* counts to acceptable levels at the time of serving. The raw fish, purchased from local hawkers, was imported and had a mesophilic aerobic bacterial count of 7.0×10^6/g. The fish soup and *kukus masam manis* had acceptable bacterial counts after cooking for

Table 1: **Bacteriological quality of food sampled during hazard analysis in the urban and rural study areas, Malaysia**

Food item	Time sampled	Temperature (°C)	Mesophilic aerobic bacteria (× 10^5/g)	Coliforms (per g)	*S. aureus* (× 10^2/g)	*B. cereus* (× 10^2/g)
Urban — household 1						
Raw fish	12:00	28.0	<3.0	60	<1.0	<1.0
Minced fish for fish ball soup	12:00	30.0	<3.0	60	<1.0	<1.0
Fried fish	13:00	80.0	<3.0	10	<1.0	<1.0
Fish ball soup	12:45	98.0	<3.0	<10	<1.0	<1.0
Raw rice	11:30	—[a]	—[a]	10	<1.0	<1.0
Boiled rice	12:30	99.0	<3.0	10	<1.0	<1.0
Urban — household 2						
Eggplant curry[b]	15:30	48.2	8.5	20	<1.0	<1.0
Eggplant curry[c]	18:00	31.0	4.0	10	<1.0	2.0
Eggplant curry[d]	18.45	60.2	1.3	3.0×10^3	<1.0	1.0
Raw rice	13:00	—[a]	>3.0	$>2.5 \times 10^6$	<1.0	12.0
Boiled rice[b]	15:00	71.6	<3.0	3.1×10^2	<1.0	14.0
Boiled rice[c]	18:35	31.4	5.6	3.3×10^3	2.0	4.0
Boiled rice[d]	18:45	71.0	<3.0	<10	<1.0	<1.0
Urban — household 3						
Fish curry[b]	23:00	87.0	<3.0	—[a]	<1.0	<1.0
Fish curry[c]	05:00	33.0	9.0	—[a]	<1.0	<1.0
Fish curry[d]	10:30	41.0	<30.0	—[a]	<1.0	<1.0
Beef curry[b]	24:00	78.0	$>3.0 \times 10^2$	—[a]	<1.0	<1.0
Beef curry[c]	05:30	28.0	6.8×10^2	—[a]	<1.0	<1.0
Beef curry[d]	10:30	30.0	<30.0	—[a]	<1.0	2.0
Rural — household 4						
Raw rice	10:00	32.0	<3.0	1.1×10^2	<1.0	<1.0
Boiled rice	11:00	—[a]	<3.0	<10	<1.0	<1.0
Raw fish for *sayur air*	12:50	24.0	29.0	3.0×10^3	<1.0	1.7
Sayur air[b]	14:00	58.0	<3.0	<10	<1.0	<1.0
Sayur air[c]	18:00	30.0	1.2×10^4	<10	<1.0	<1.0
Raw fish for frying	12:00	32.0	1.6	60	<1.0	<1.0
Fried fish[e]	12:30	—[a]	<3.0	<10	<1.0	<1.0
Fried fish[c]	16:00	30.0	<3.0	<10	<1.0	<1.0
Rural — household 5						
Raw rice	12:35	33.0	30.0	—[a]	<1.0	1.0
Boiled rice[e]	14:00	86.0	<3.0	—[a]	<1.0	<1.0
Raw fish for *kukus masam manis* and soup	12:00	33.0	70.0	<10	<1.0	<1.0
Kukus masam manis[e]	14:10	74.5	<3.0	<10	<1.0	<1.0
Fish soup[e]	14:00	50.6	<3.0	<10	<1.0	<1.0

[a] Not tested.
[b] Food sampled after cooking.
[c] Food sampled after holding.
[d] Food sampled after reheating.
[e] Food sampled at serving.

approximately 10 minutes at 94 °C and for 20 minutes at 83–88 °C, respectively, and after standing at room temperature for 1 hour.

Discussion and conclusions

The communities had access to various amenities allowing the practice of safe food hygiene — adequate quantities of safe water, safe sanitation, and gas or wood for cooking. The hygiene standard in the food preparation areas was acceptable in most of the kitchens in both communities, although overall the urban kitchens were rated higher than the rural kitchens.

Personal hygiene was not specifically studied. This is a sensitive matter and responses would have

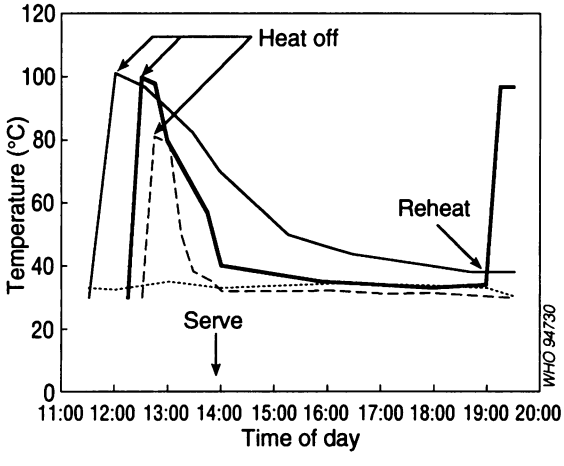
Table 2: **Temperature of food during cooking and storage and temperature duration recorded during hazard analysis**

Food item	T_{max} [a]	Time at T_{max} (min)	Time at <60 °C (min)	Time at >70 °C (min)	Temperature attained on reheating (°C)
Household 1					
Rice	102	—[b]	5.5	140	—
Fried fish	82	15	6.2	25	—
Fish ball soup	99	15	5	60	96
Household 2					
Rice	102	15	3.3	76	71
Curry	97	15	3.5	104	60.2
Fried fish	97	15	4.4	24	64
Household 3					
Rice	86.9	—	—	63	—
Sayur air	97	10	—	21	—
Fried fish	89	—[c]	—	—[c]	—
Household 4					
Rice	94.7	30	0	116	—
Fish soup	94	10	84.5	27	—
Kukus masam manis	86	20	0	29	—

[a] T_{max} = maximum temperature.
[b] Not relevant.
[c] Not tested.

required verification, something that was not possible. The personal hygiene of food handlers is important during food preparation. However, since all the food observed was cooked, its contamination by food handlers after cooking was the more important hazard. The opportunity for contamination by food handlers before the first serving appeared limited, since most of the foods were semisolid or liquid and were served with clean utensils from the cooking pot to individual plates before being eaten by hand. Contamination from utensils was possible during serving but not from storage containers, since leftovers were generally stored in the original cooking pots. In household 2 there was evidence of contamination of the eggplant curry, in which a marked increase in coliforms was detected after reheating; this probably originated on the utensils used to stir the food. Hazards associated with poor personal hygiene were thus not highlighted, although it is emphasized that such hazards are important, especially in the handling of snacks and other foods that are not heated again before consumption.

Fig. 3. **Internal temperature of food during preparation and storage in household 2.**



Based on the local food standards for ready-to-eat foods we conclude that three of the five domestic kitchens studied served one or two meals of unacceptable microbiological quality. In two instances, curries were unacceptable after primary cooking, storage, and reheating. In household 2, boiled rice had unacceptable bacterial counts after cooking while, in household 4, *sayur air* had unacceptable counts after storage. Failure to meet the standards was mainly attributable to high mesophilic aerobic bacterial counts and, less markedly, to high counts of *B. cereus*, *S. aureus*, and coliforms. Although some of the foods were of unacceptable microbiological quality, there were no obvious organoleptic changes.

The practices shown to affect the bacterial counts of the majority of the foods were cooking, storage and reheating. There was a preference in both communities for food cooked in liquids that were close to boiling point, and the temperatures and durations of cooking were sufficient to bring about significant reductions in the numbers of vegetative cells of most bacterial contaminants. Thus the counts of aerobic mesophiles, coliforms, and *B. cereus* in raw fish were reduced to acceptable levels when it was fried, steamed, or boiled. The boiling of rice reduced the bacterial counts to acceptable levels except in household 2. In this household the raw rice had high levels of aerobic mesophilic bacteria, coliforms, and *B. cereus*, of which, after cooking, the mesophilic bacteria were sufficiently reduced, but the coliforms, although reduced by a factor exceeding 10^4, remained above the acceptable level; the numbers of *B. cereus* were little changed, perhaps because of the net effect of thermal destruction of vegetative cells of *B. cereus* on the uncooked rice and of the simultaneous thermal shock of heat-resistant spores and their resultant outgrowth. Since the cooking was generally found to be satisfactory, the immediate consumption of freshly cooked food should present little hazard from foodborne bacteria requiring large infective doses. The main food eaten raw was fruit, which was more likely to present hazards in the form of low-infective-dose foodborne diseases such as typhoid fever, shigellosis, and viral diseases.

In all the households it was common practice to prepare sufficient food late in the morning for both lunch and dinner. This resulted in the prolonged storage of cooked food at ambient temperature, even where there was access to a refrigerator. The ambient temperature in the food-storage areas averaged 30.5 °C and the duration of storage for seven of the eight observations was 3.3–6.2 hours. The foods and the environmental conditions were ideal for the proliferation of most foodborne pathogens and spoilage bacteria. The counts of mesophilic aerobic bacteria on curries and boiled rice increased during storage, and those in *sayur air* increased to 1.2×10^9/g, approaching spoilage levels. Counts of *B. cereus* and *S. aureus* increased in curries and rice, respectively. No tests were performed to detect the enterotoxins derived from these bacteria, but conditions were suitable for their production.

Stored food was not always reheated before serving. When precooked stored food was reheated, the process was less effective than initial cooking in reducing bacterial loads, since the tempeatures reached and the duration of heating were too low. This was related to local preferences, since very hot food was not acceptable and eating with the hands was common. Reheating was effective in reducing the numbers of bacteria in most of the foods studied; however, it would not have been sufficient to destroy heat-resistant enterotoxins, e.g., staphylococcal enterotoxins and the emetic enterotoxin of *B. cereus*, which could have been produced in the presence of higher numbers of these bacteria.

A critical control point is a practice or procedure at or by which a preventive or control measure can eliminate, prevent, or minimize a hazard (*2*). Our observations and hazard analyses identified the following common critical control points for the food preparations: temperature and the period of holding at a given temperature during cooking, storage, and reheating. Adequate cooking eliminates or reduces the numbers of bacterial pathogens, and storage conditions that retard bacterial growth prevent the proliferation of surviving pathogens or post-cooking contaminants. These findings are similar to those identified in other hazard analysis studies of domestic circumstances in tropical countries (*3–5*).

The inclusion of critical control points in health education messages requires that practical monitoring processes be devised to ensure effectiveness. Cooking temperatures for semisolid or liquid food can be monitored by ensuring that the cooking liquid boils and simmers and that minimum times for cooking are specified. The preference for well-cooked staple food in the study communities was advantageous, since the required controls provided a culturally acceptable product except when contamination of the raw ingredients was excessive. Solid foods were generally fried in hot oil, which should also eliminate pathogenic vegetative cells. The monitoring of food storage mainly involves the control of the time of storage at ambient temperature. In our study, growth was detected at storage times $\geq$ 3.5. hours; further work is required to determine safe storage times either in the home or at street vending stalls for the common foods consumed in these communities and kept under local environmental conditions.

The critical control points identified are recommended as targets for behavioural changes and health education messages. However, behaviours specific to the study communities need to be considered before any intervention takes place. Studies on the perceptions of foodborne disease in the communities and on attitudes to food storage will appear later.

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Résumé

Evaluation de la salubrité de la préparation domestique des aliments en Malaisie

Les cuisines domestiques sont une source importante d'aliments dans les communautés à faible revenu et les aliments sont destinés tant à la consommation des familles qu'à la vente dans le secteur alimentaire parallèle. Il est d'une importance capitale pour la santé publique de manipuler les aliments en préservant leur salubrité. L'éducation sur la salubrité des aliments doit reposer sur l'identification de points de contrôle essentiels et sur la mise en œuvre de mesures de lutte culturellement appropriées.

Une étude visant à repérer les pratiques relatives à la manipulation des aliments constituant un danger de toxi-infection alimentaire bactérienne aiguë a été réalisée dans 277 foyers du nord-est de la péninsule malaysienne, tant en milieu rural qu'en milieu urbain. L'hygiène des cuisines domestiques a été évaluée par observation, grâce à une liste de contrôle standardisée. L'analyse des risques a été effectuée dans deux foyers au sein de chaque communauté, ainsi que dans un établissement produisant des aliments destinés à la distribution par des vendeurs des rues en secteur urbain. Les observations ont porté sur la manipulation des aliments à tous les stades de leur préparation et de leur conservation jusqu'à leur consommation; la température a été mesurée et des échantillons prélevés. La présence de germes alimentaires courants et de germes indicateurs a été recherchée dans les aliments.

L'hygiène des cuisines est en général acceptable, bien que médiocre dans certaines cuisines en milieu rural. Une pratique courante observée dans les deux communautés consiste à préparer aux environs de midi une quantité suffisante d'aliments pour le déjeuner et le repas du soir, le reste étant conservé à température ambiante jusqu'à consommation. Dans le cas de l'établissement fabriquant des aliments destinés à la vente, le petit déjeuner est préparé le soir, conservé à température ambiante pendant la nuit, et réchauffé avant de le mettre en vente le lendemain matin.

On remarque une prédilection pour la cuisson à température proche de l'ébullition, ce qui diminue le nombre de germes à l'état végétatif, mais pas celui des spores. Pendant la période de conservation prolongée entre la cuisson et la consommation ou le réchauffage, les populations de bactéries aérobies mésophiles, *Staphylococcus aureus* et *Bacillus cereus* se développent dans certains aliments, la quantité de bactéries aérobies mésophiles atteignant dans quelques cas une abondance telle que les aliments sont impropres à la consommation. Le réchauffage à plus de 60 °C ramène à un niveau acceptable le nombre de bactéries qui prolifèrent, mais la température atteinte ne permet pas de détruire les entérotoxines thermorésistantes. Les aliments ne sont pas toujours réchauffés et ceux qui sont vendus dans la rue sont souvent conservés de nouveau à température ambiante après réchauffage avant d'être consommés.

Le contrôle de la température et de la durée de la cuisson et de la conservation des aliments est un point de contrôle essentiel identifié dans les analyses de risque réalisées dans les deux communautés; c'est sur ce point que les programmes d'éducation pour la santé et pour la salubrité des aliments destinés à lutter contre les toxi-infections alimentaires bactériennes aiguës devront faire porter leurs efforts.

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