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A STUDY ON HYGIENIC STANDARD OF FOOD PREMISES AND MICROBIOLOGICAL QUALITY OF FOOD IN KOTA BHARU

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ABSTRACT

Introduction - The hygienic aspects of food premises are a major concern for public health officers and inspectors in preventing foodborne illness. A study of the status of hygiene standard of food premises and microbiological quality of food provided findings on hygienic standard of food premises in relation to microbiological quality of food for further analysis of sources of food contamination.

Methods - A cross sectional study of 362 food premises in the area under the Municipal Jurisdiction of Kota Bharu were randomised and evaluated for hygienic aspects based on standardized form used by the District Health Office. Staple and snack / kuih groups of food were selected at the time of premises evaluation which then analysed for total plate count (CFU/gm), coliform count (MPN/ml) and *E. coli* (MPN/ml).

Results - Out of the 362 premises, 78.2 % had satisfactory score with a mean ± SD of 62.43 ± 9.0 and 21.8 % had unsatisfactory score with a mean ± SD of 44.40 ± 4.0. Microbiological analysis of food samples showed that 34.08% of sample had unsatisfactory in total plate count, 47.8% in coliform count and 24.7% in *E. coli* count. *E. coli* count was detected more in staple foods as compared to snacks/ kuih. There was a significant association between the premise hygiene score in all three variables of microbiological analysis ($P<0.001$).

Conclusion-This study was found to have overall relationship between microbiological findings of selected food examination and the hygiene score of food premises. Appropriate measures, such as education of food handlers in improving the hygienic practice, particularly by environmental health officers, public health inspectors and local authorities are needed in order to reduce the prevalence of foodborne diseases. Training in food handling and practices on the parameters identified should be focused more on the premises with low hygiene score.

Keywords: Food , Food premises, microbiological quality

INTRODUCTION

In Malaysia from 1990 to 1997, a total of 24,056 persons were reported to suffer from food poisoning (Ministry of Health Malaysia, 1999). Food poisoning cases increased from 3,078 in 1995 to 8000 in 1998 while, inspection failure increased from 3607 in 1995 to 7,000 in 1998. Available information based on activities of Food quality Control Division does not allow correlation analysis between premises rating score and status of food microbiology because the score and food samplings were done at different time. This is because inspection and food sampling may have been carried out independently of each other. Although a premise with low score would often have food samples collected, they were not normally done at the same time of premise rating. This study was intended to look at the actual association between the hygiene of premises and microbiological quality of food. The basis is that, the hygiene score would affect microbiological quality of food.

A study done in Jakarta by Kampen (1998) compared the quality of streets food with similar home-prepared food, and food from tourist hotels. They found that even food from five star hotels were not always safe. A study done in United Kingdom by Powell and Attwell (1995) showed that there was no correlation between inspections rating and bacteriological counts of foods. However, there were no such data for Malaysia. In Bangkok, Thailand, coliform bacteria were found in more than 50 percent of the food samples (Dawson, 1996)

METHODOLOGY

The food premises selling meals and snacks in main area under the Municipal Council jurisdiction of Kota Bharu were selected by randomization of the mapping numbers according to the proportion of total premises in eight divided zones (Appendix 1). Selected premises were scored using standard evaluation checklists. A score of 50% or more were categorized as acceptable. Food were collected at the time of premises evaluation and analyzed for total plate, coliform and *Escherichia coli* count in the Food Quality Control Laboratory, Kota Bharu.

RESULTS

Out of the 362 premises, 78.2 % had satisfactory score with a mean ± SD of 62.43 ± 9.0 and 21.8 % had unsatisfactory score with a mean ± SD of 44.40 ± 4.0 (Table 1). Almost half (47.2%) of the food premises sampled had unsatisfactory cleanliness in the area of food preparation. About one third of food handlers were not wearing a proper shoes or used sandals, improper used of kitchen waste bag, inadequate and improper used of garbage bin and did not labelled the source and food ingredients properly (Table 2). There were a total of 713 (362 staples and 351 snacks) food sampled. The majority of foods selected were ready to eat foods. Almost one third (34.08%) of the food sampled had unsatisfactory total plate count (Table 3). *E.coli*

count was detected in about a quarter of food sampled which more in staple food. There was a significant association (P<0.001) between the satisfactory levels of microbiological analysis among different groups of food. There was also significant association between the premise hygiene score in all three variables of microbiological analysis (P <0.001), whereby premises with the score less than 50 had more unsatisfactory results (Table 3). In multiple logistic regression analysis (Table 4), it was found that the premises with improper use of food container, unclean area of food preparation, improper use of shoes and inadequacy and improper garbage bin were more likely to have unsatisfactory total plate count. The evaluation parameters of improper use of food container, unclean area of food preparation, improper uses of shoes and inadequacy or improper garbage bin were significantly associated with unsatisfactory coliform count. For unsatisfactory *E.coli* count the only significant association was found in the parameters of improper use of food container and unclean area of food preparation.

DISCUSSION

In this study, the unsatisfactory hygiene score (21.8%) of premises was lower as compared to the data reported by the Kelantan State Health Office (2000) whereby, out of 113 premises that were studied from January to June 1998 and 1999, 34% were found to have hygiene score of less than 50. The study was conducted in districts of Kota Bharu (57 premises), Pasir Mas (21 premises) and Tanah Merah (35 premises) among the street food premises (road side stall or canteen and static hawker). The percentage of unsatisfactory of hygiene score in Kota Bharu was not specifically mentioned. The difference could be because of the type of the premises studied. The Health Department's data only included "stalls / hawkers " type of premises which were sold different types of foods, whereas our study included all types of premises which sold staple and snack food.

In Bangkok, Thailand, it was also found that, contamination of food handlers' hands and utensils ranged from 18 to 69 percent depending on the availability of adequate and safe water supply (Dawson, 1999) In our study most of the food stalls / canteens had water supplied by the state water agency. However, the quality of water supplied could not be ascertained, as it was not tested. The evaluation of the premises in this study using the evaluation form was quite comprehensive. Among the parameters assessed, more than 30% of the premises had unsatisfactory score in labelling and quality aspects of ingredients, area of food preparations, used of proper food container, immunization of Thyphoid vaccine (TY2) among food handlers, wearing a proper shoes, overcrowding of kitchen environment and usage of proper kitchen waste bag and garbage bin. Improper handling of garbage bin will provide the attraction and food for insects and rodents. Such conditions and practices are likely lead to cross contamination of cooked foods. The high percentage of unsatisfactory evaluation parameters and the premises with low hygiene score needed further attention.

Foodborne illnesses can be prevented by good hygiene practices during the preparation of food (Scott, 2000). To prevent the occurrence of foodborne illnesses, it is therefore important to ensure that foods sold are safe and hygienic. Total plate count was used to measure the general bacteria load of the food sampled and is useful tool in monitoring food process and the results may reflect the hygienic level of food handling and retail storage (Collins *et al,* 1989). Thirty four percent of total foods sampled, and almost half (40.3%) of the staple food had unsatisfactory total plate count. This result was almost equal to the Kelantan State Health Office study whereby it was found that 41.7% of staple foods sampled were unsatisfactory. The total food sampled by the Kelantan Health Office during their study, only 15% out of 386 samples had unsatisfactory total plate count. This lower percentage could be because of a lower proportion of staple foods in their study compared to the current study (50.7%). Almost one third of their food samples were "raw water" (29.7%). Unsatisfactory coliform count was found in 47.8% of total food sampled, affecting almost 50% of both staple and snack food. The report by Kelantan Health Office (2000) showed that, the percentage of food with unsatisfactory coliform count was almost equal to this study for the total food sampled, but lower in staple food (26%). Instead, the majority of unsatisfactory coliform count in their study was found in raw water (38.2%). According to Eley (1992), the presence of total coliforms and *E. coli* in foods may indicate faecal contamination which could be due to insufficient cooking, use of raw vegetables, cross contaminations because of not separating raw and cooked food, and contaminated ingredients.

In this study, *E. coli* count was found in a quarter of the total food sampled, which was noted to be more in the staple foods (33.2%). The presence of *E.coli* was found to be higher than reported by the Kelantan State Health Office for the total food sampled (7.7%). However, they found 50% of their raw water had significant *E.coli* count. This indicates high proportion of water used by the premises were contaminated but comparison could not be done because the current study did not collect water sample. Since water is used in all stages of food preparation including serving and washing utensils, and if the results produced by Kelantan Health Office was true, it could explained that the high incidence rate of food and waterborne diseases that frequently occurr in Kelantan (Ministry of Health Malaysia, 1999b).

A study conducted in one nonindustrialized country by Monge and Chinchilia (1996) also demonstrated a significantly high prevalence of *E.coli* in raw vegetables sampled from open markets. The result of their study showed a serious contamination of vegetables with faeces. Some of the staple food sampled in the current study used raw vegetables as part of the food served. The result of the study mentioned above could be significant as contamination could come from either water or vegetables or materials used. However our scope is grossly limited, as we did not study specify raw water or vegetables, specifically.

Analysis of the data showed that there was a significant association between the hygiene scores and microbiological results. Even though there was a significant association, the poor microbiological quality of food could not be directly due to

condition of the premises. In this study only the end-stage handling could be observed, which may be irrelevant to the actual initial handling and subsequent storage of the cooked food. Some of the food was prepared elsewhere and the inability to fully assess all the activities in the kitchen, assessment of the kitchen's environment and other facilities prevented a possibility of direct association to be made.

The total plate count, coliform count and *E.coli* count results were found significantly associated with some parameters of premises evaluation. However, poor hygiene practices of food handlers during food preparation might not have resulted in food contamination if the food is adequately cooked (Longree, 1980). This occurs provided that the contamination does not occur during serving. The organisms that may have been transmitted by dirty hands or dirty work surfaces were killed during cooking. There could only two possible sources of infection that could be think of. It could be contaminated water or raw materials used in the preparations. Mosupye (1999) suggested that the presence of contamination of indicator organisms in food may be attributed to poor personal hygiene, poor practices among food handlers and cross contamination from the environment.

CONCLUSION

Overall, the relationship between microbiological quality of food and the hygiene evaluation score of food premises were significant. Even though it is not possible to assume direct relationship between the hygiene condition of the premises and the quality of foods, effort should be made to achieve 100 percents satisfaction of hygiene status of premises. The relationship could be studied again once this has been achieved to look again at the association between hygiene score of premises and quality of food.

The presence of indicator organism in foods beyond acceptable limit, especially *E.coli* contamination that showed significant association between hygienic status of premises, therefore the sources need to be verified.

The complexity of determining the status of hygiene of food lies not in the testing or analysis of food, but rather in determining the source of contamination. A detailed assessment is definitely going to be expensive, time consuming and labour intensive, not to mention the expertise needed. However, if the issue of food safety is going to be addressed comprehensively, this issue must be tackled.

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Table 2: Frequency distribution of parameters used in evaluation of hygiene score group of 362 selected premises in Kota Bharu

Parameters of evaluation	Satisfactory No (%)	Unsatisfactory No (%)
Area of food preparation	191 (52.8)	171 (47.2)
Wearing proper shoes / no sandals	222 (61.3)	140 (38.7)
Proper used of kitchen waste bag	232 (64.1)	130 (35.9)
Adequacy/use of garbage bin	233 (64.4)	129 (35.6)
Labelling / source of ingredients	236 (65.2)	126 (34.8)
Overcrowding of kitchen environment	239 (66.0)	123 (34.0)
Used of proper food container	246 (68.0)	116 (32.0)
Immunization of TY2	249 (68.8)	113 (31.2)
Wearing proper costume / apron	257 (71.0)	105 (29.0)
Cleanliness of the premise & environment	293 (80.9)	69 (19.1)
Separation of raw and cooked food	306 (84.5)	56 (15.5)
Cleanliness food utensils	310 (85.6)	52 (14.4)
Personal hygiene	328 (96.6)	34 (9.4)
Dish washing places	356 (98.3)	6 (1.7)

Table 3: Microbiological results of food according to parameter of analysis

Parameter of analysis	Staple foods		Snacks / kuih		Total	p value *
	No	(%)	No	(%)	No (%)	
1. Total Plate count						
Satisfactory	216	(59.7)	254	(72.4)	470 (66.0)	
Unsatisfactory	146	(40.3)	97	(27.6)	243 (34.0)	<0.001
2. Coliform count						
Satisfactory	164	(45.3)	208	(59.3)	372 (52.2)	
Unsatisfactory	198	(54.7)	143	(40.7)	341 (47.8)	<0.001
3. *Escherichia coli* count						
Satisfactory	242	(66.8)	295	(84.0)	537 (75.3)	
Unsatisfactory	120	(33.2)	56	(16.0)	176 (24.7)	<0.001

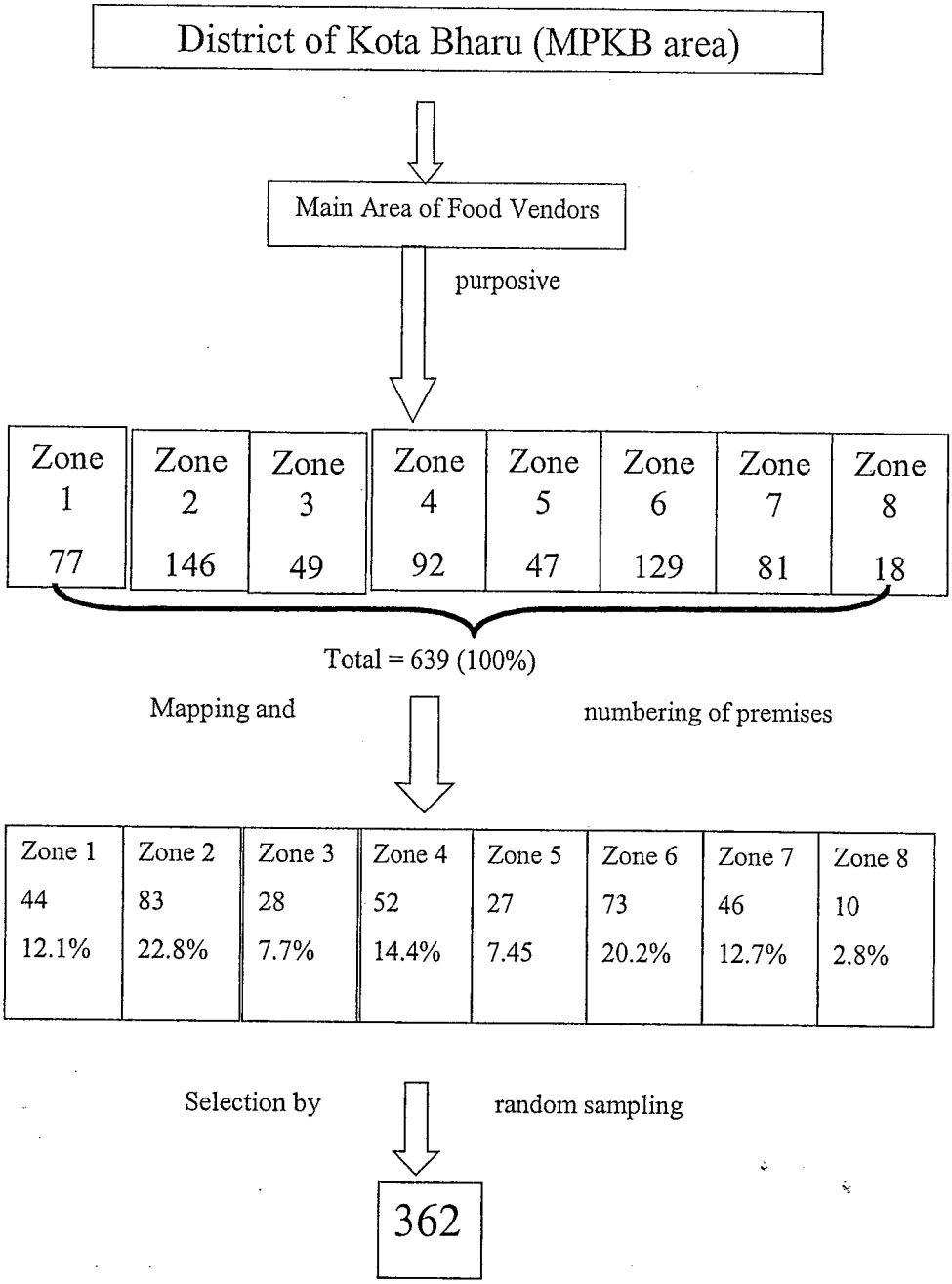
** Chi Square test*

Table 5: Food microbiology and parameters of premise hygiene evaluation

Factors	Crude Odds ratio *	Adjusted Odds ratio	95% CI Of Adjusted Odds ratio	*P* #
Total plate count				
Improper use of food container	1.90	1.81	1.30 , 2.50	<0.001
Unclean area of food preparation	2.03	1.95	1.41 , 2.70	<0.001
Improper use of shoes	1.50	1.40	1.01 ,1.95	0.038
Inadequacy and improper garbage bin	1.46	1.43	1.03 , 1.99	0.032
Coliform count				
Improper use of food container	1.87	1.80	1.31, 2.49	<0.001
Unclean area of food preparation	1.51	1.43	1.06, 1.94	0.021
Improper use of shoes	1.61	1.53	1.12, 2.08	0.007
Inadequacy and improper garbage bin	1.79	1.78	1.31, 2.45	<0.001
E.coli count				
Improper use of food container	2.08	2.03	1.43, 2.88	<0.001
Unclean area of food preparation	1.69	1.63	1.14, 2.31	0.007

* Simple logistic regression #Multiple logistic regression

Appendix 1


District of Kota Bharu (MPKB area)
Main Area of Food Vendors
purposive
Zone 1 77
Zone 2 146
Zone 3 49
Zone 4 92
Zone 5 47
Zone 6 129
Zone 7 81
Zone 8 18
Total = 639 (100%)
Mapping and
numbering of premises
Zone 1 44 12.1%
Zone 2 83 22.8%
Zone 3 28 7.7%
Zone 4 52 14.4%
Zone 5 27 7.45
Zone 6 73 20.2%
Zone 7 46 12.7%
Zone 8 10 2.8%
Selection by
random sampling
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