ASSESSMENT OF HYGIENE LEVEL IN SECONDARY SCHOOL CANTEENS IN MAURITIUS AND THE MICROBIOLOGICAL QUALITY OF POPULAR FOOD ITEMS ON SALE

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Canteens provide a major proportion of a student’s meal during lunchtime.

Moral & legal responsibility to provide students with safe foods & beverages.

School children: one of the most susceptible population group.

FBD outbreaks have occurred in schools (62%) and academic institutions (17%) (Soon, Singh, & Baines, 2011).
FOOD POISONING INCIDENTS IN MAURITIUS MOHQL

Most individuals between 10-19 yrs (28%), 20-29 yrs (22%) & 30-39 (16%) yrs (Hotee, 2011)

No. Of Food poisoning incidents
104 school children of a government school were found victims of food poisoning cases after consuming hot meals provided by caterers hired by the government to provide food to the school (L’ Express, 2013)

Seven students from the LTK Secondary School had a malaise after having ‘Des boissons au lait aromatisées’ (L’ Express, 2013)

12 students of Form I from A d college, Phoenix were victims of food poisoning after consuming Potato and egg salad, fried noodles and fried rice (L’ Express, 2013)

20 students from a primary school in Congomah, had abdominal and stomach pain after consuming ‘sirop de canne à sucre.’ (L’ Express, 2014)
1 canteen/school

- Limited/no seating facility
- Size of canteen may vary
- Customers (700-1000)
- Mainly for students
- Staff

The variety & quality of products sold may vary widely among the schools.

Canteen owners are not allowed to prepare foods on site.

Should abide by the list of products allowed for sale (Government Gazette of Mauritius No. 74, 2009).
WHAT IS THE LEVEL OF FOOD SAFETY AND HYGIENE IN OUR SECONDARY SCHOOLS?
OBJECTIVES OF THE STUDY

- To evaluate the food safety knowledge and practices of canteen workers in secondary schools

- To assess the level of food hygiene/safety prevailing in canteens of secondary schools

- To determine the microbial status (pathogenic and hygienic indicators) of the most popular hot meals served at lunch time
176 SECONDARY SCHOOLS

- 68 state owned/managed
- 98 state funded but privately managed
- 20 fee paying

113,872 students

45 canteens from 41 public and private secondary schools from all 4 educational zones

1- Port Louis & the North
2- Beau Bassin- Rose Hill & the East
3- Curepipe & the South
4- Vacoas-Phoenix & the West
DATA COLLECTION

OBJ 1: FACE TO FACE INTERVIEW WITH CANTEEN WORKERS

Structured questionnaire

Profile & characteristics of business
Types of foods on sale
Storage practices

Section to assess food safety & hygiene knowledge

Scoring system
1- each correct answer
0- wrong answers & ‘don’t know
Total scores were calculated, & converted into %

SPSS Ver 16.0
MS EXCEL 2007

OBJ 2: ON-SITE OBSERVATION OF CANTEENS

Checklist based on Part V of the Mauritian Food Regulations 1999

✓ Building, design and facilities
✓ Waste management
✓ Equipment & utensils
✓ Cleaning & disinfection
✓ Pest control
✓ Control of operations
✓ Personnel

Scoring system
1- each compliant criterion
0- for non-compliant criterion
Sum of scores of individual criterion of each category and the total percentage compliance
MAIN FINDINGS
More than 6 years of experience in school canteens

Number of respondents

<table>
<thead>
<tr>
<th>Number of years</th>
<th>Number of respondents</th>
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<tbody>
<tr>
<td>&lt; 3 yrs</td>
<td>24%</td>
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<tr>
<td>3 - 5 yrs</td>
<td>76%</td>
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<tr>
<td>6 - 8 yrs</td>
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<td>9 - 11 yrs</td>
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<td>12 - 14 yrs</td>
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<td>&gt; 14 yrs</td>
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</table>

Number of employees

- 1-2 employees: 31%
- 3-5 employees: 69%
FOODS SOLD IN SCHOOL CANTEEN

Total No. of different food items: 70

Main beverages
- Water
- Fruit juice, tea/coffee

Prepared on-site

Few were outsourced – pizza, dholl puri

Fillings were prepared in caterers’ domestic kitchens
LOW FAT/LOW SUGAR SNACKS
Mean Overall food safety score: 70 %; (40-92%)
## FOOD SAFETY KNOWLEDGE II

<table>
<thead>
<tr>
<th>Knowledge Statements</th>
<th>% of respondents (n= 45)</th>
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<tbody>
<tr>
<td></td>
<td>Correct answer</td>
</tr>
<tr>
<td>General food safety</td>
<td>98.5</td>
</tr>
<tr>
<td>Sources of Contamination</td>
<td>84.0</td>
</tr>
<tr>
<td>Personal hygiene</td>
<td>77.0</td>
</tr>
<tr>
<td>Safe and unsafe food</td>
<td>56.3</td>
</tr>
<tr>
<td>Storage of food</td>
<td>55.5</td>
</tr>
<tr>
<td>Food handling practices</td>
<td>55.1</td>
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</tbody>
</table>

- Aprons are compulsory but hairnets are optional to wear
- An unsafe food will always smell/taste/look bad
- A spoilt food will always cause food poisoning
- Harmful bacteria are killed during refrigeration
- Poor knowledge on holding of hot food; core temp of cooked chicken; correct method of thawing frozen foods
## COMPLIANCE OF CANTEENS WITH THE MFR 1999 I

Mean overall compliance score: 69.7% (SD=13.9) (32 - 94 %)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>% compliance</th>
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<tbody>
<tr>
<td>Control of operations ; Food handler certificate</td>
<td>100</td>
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<tr>
<td>Walls; Re-usable containers for inedible materials and waste</td>
<td>91</td>
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<tr>
<td>Fridge/ refrigerator/ chilled rooms; Equipment and utensils</td>
<td>90</td>
</tr>
<tr>
<td>Wrapping of food</td>
<td>83</td>
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<tr>
<td>Building, design and facilities</td>
<td>79</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Criteria</th>
<th>% compliance</th>
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</thead>
<tbody>
<tr>
<td>Door, Floors, Waste management, Crockery and utensil; Use of drinking straws, Personal hygiene</td>
<td>73-76</td>
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<tr>
<td>Personal hygiene</td>
<td>73</td>
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<tr>
<td>Pest control</td>
<td>67</td>
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<tr>
<td>Cleaning and disinfection</td>
<td>65</td>
</tr>
<tr>
<td>Storage of food</td>
<td>63</td>
</tr>
<tr>
<td>Ceilings; Cleaning agents and disinfectant</td>
<td>61</td>
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</table>
## COMPLIANCE OF CANTEENS WITH THE MFR 1999 II

<table>
<thead>
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<th>Criteria</th>
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<tr>
<td>Temperature control</td>
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<tr>
<td>Scullery</td>
<td>49</td>
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<tr>
<td>Preparation tables</td>
<td>47</td>
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<tr>
<td>Adequate hand-washing facilities</td>
<td>46</td>
</tr>
<tr>
<td>Windows</td>
<td>42</td>
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- Inaccurate knowledge on storage $T$, cooking $T$, reheating of foods
- Inadequate facilities for $T$ control in the school canteen premises
- Scullery not separated and food preparation area
  - Many canteens did not have dedicated working surfaces for raw & ready-to-eat foods
  - Some tables had in built cupboards underneath-limited access to cleaning & potential site for harbourage of pests
- Manual tap; no nail brush; no proper hand drying facilities, soap dispenser and paper towel dispenser
- No fly screen; no proper window opening to allow for proper ventilation and lighting
EVALUATION OF THE MICROBIOLOGICAL QUALITY OF MOST POPULAR PRODUCTS
8 schools: 2 from each school zone
3 samples of each food type (panini, fried noodle and farata) were pooled to form one composite, analytical sample
2 independent trials

- Total Viable Counts (ISO 4833:2003)
- E. coli (Eosin Methylene Blue agar (Bello et al., 2011)
- Staphylococcus aureus (ISO 6888-1)
- Clostridium perfringens (ISO 15213:2003)
- Salmonella spp. (ISO 6579:2002)
- Listeria monocytogenes on PALCAM agar
INTERPRETATION OF RESULTS

- **Total Viable Counts**
  - General microbial quality
  - Has to be < 5 log cfu/g

- **Escherichia coli**
  - Sanitary quality
  - Has to be < 2 log cfu/g

- **Staphylococcus aureus**
  - Hygienic quality and food safety
  - Has to be < 2 log cfu/g

Presumptive *E. coli*

Presumptive *S. aureus*

Mesophilic aerobic bacteria

*Salmonella* spp., *L. monocytogenes, Clostridium*: not detected in any of the food samples
<table>
<thead>
<tr>
<th></th>
<th>FARATA</th>
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<th>PANINI</th>
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<th>FRIED NOODLES</th>
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<tr>
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<td>NORMAL FLORA</td>
<td>FECAL FLORA</td>
<td>HUMAN FLORA</td>
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Paninis sold at the eight schools were deemed generally acceptable with
-TVC in the range of 3.0-5.7 log cfu/g and
-undetectable levels of foodborne pathogen *S. aureus* and fecal contaminant *E. coli*

**FRIED NOODLES** and **FARATAS** canteens harboured a

moderately high level of mesophilic aerobic bacteria (TVC) (4.4-6.7 log cfu/g),

objectionably high level of foodborne pathogen *S. aureus* (3.1 to 5.0 log cfu/g) and

high level of fecal indicator bacteria *E. coli* (3.1 – 5.1 log cfu/g) for 7 out of 8 schools

This probably reflects inadequate personal hygiene of canteen workers since the preparation of fried noodles and cooking of faratas involves extensive manual handling of the products

Advanced preparation
MICROBIOLOGICAL FINDINGS: FARATA

Suggests a low level of personal hygiene

- General Bacteria
- Fecal Bacteria
- HUMAN FLORA
- Bacteria from environment, food preparation surface, tables, utensils
- Poorly cleaned hands after using the toilets
- NOSE OR SKIN OF WORKERS
MICROBIOLOGICAL FINDINGS: FRIED NOODLES

Bacteria from environment, food preparation surface, tables, utensils

Poorly cleaned hands after using the toilets

NOSE OR SKIN OF WORKERS

Suggests a low level of personal hygiene

General Bacteria

Fecal Bacteria

HUMAN FLORA
Bacteria from environment, food preparation surface, tables, utensils

Suggests a satisfactory level of personal hygiene except in one school
HALF-DAY WORKSHOP FOR CANTEEN OWNERS

SAFE FOOD HANDLING PRACTICES

- L'hygiène alimentaire – l’importance

- Risques alimentaires – microbes, produits chimiques, risques physiques et les précautions à prendre

- La chaîne alimentaire

- Précautions pour garantir la sécurité alimentaire dans la chaîne alimentaire

Poster

‘Preparation des aliments sains’
IMPROVING FOOD SAFETY AND HYGIENE IN CANTEENS

- **Training**
  
  *Education of food handlers*
  
  *Training of health inspectors*
  
  *Education of students*

More systematic, regular and proactive official control

- **Provision of an enabling environment for workers in school canteens**
  (an appropriate location, a proper design and layout of school canteen, basic equipment, hand washing facilities among others)

- **Posters and visual aids on different aspects of food safety in the school premises**
REFERENCES


Acknowledgements
The organising committee of Qualireg
The University of Mauritius

ICMSF (1996): ready-to-eat foods with total viable counts between $0-10^3$ cfu/g (or $0-3 \log \text{cfu/g}$) is acceptable, between $10^4-10^5$ cfu/g (or between $4-5 \log \text{cfu/g}$) is tolerable or marginally acceptable and $10^6$ cfu/g and above (or $\geq 6 \log \text{cfu/g}$) is unacceptable

Mauritian and New Zealand Regulations are more stringent stating that RTE foods with TVC exceeding $10^5$ cfu/g are unfit for consumption and therefore are of objectionable quality.

TVC, *E. coli* and *S. aureus* counts ranged from $4.7-6.7$, $3.4-5.1$, $< 2-5.0 \log \text{cfu/g}$ for faratas, $3.0-5.7$, $< 2$, $< 2 \log \text{cfu/g}$ for paninis and $4.4-6.7$, $< 2 - 4.1$, $< 2 - 4.2 \log \text{cfu/g}$ for noodles respectively. Based on the microbiological standards used, faratas and fried noodles sold at several canteens would be deemed unacceptable.