



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

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# RATIONALE OF THE STUDY I

**Canteens provide a major proportion of a student's meal during lunchtime**

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

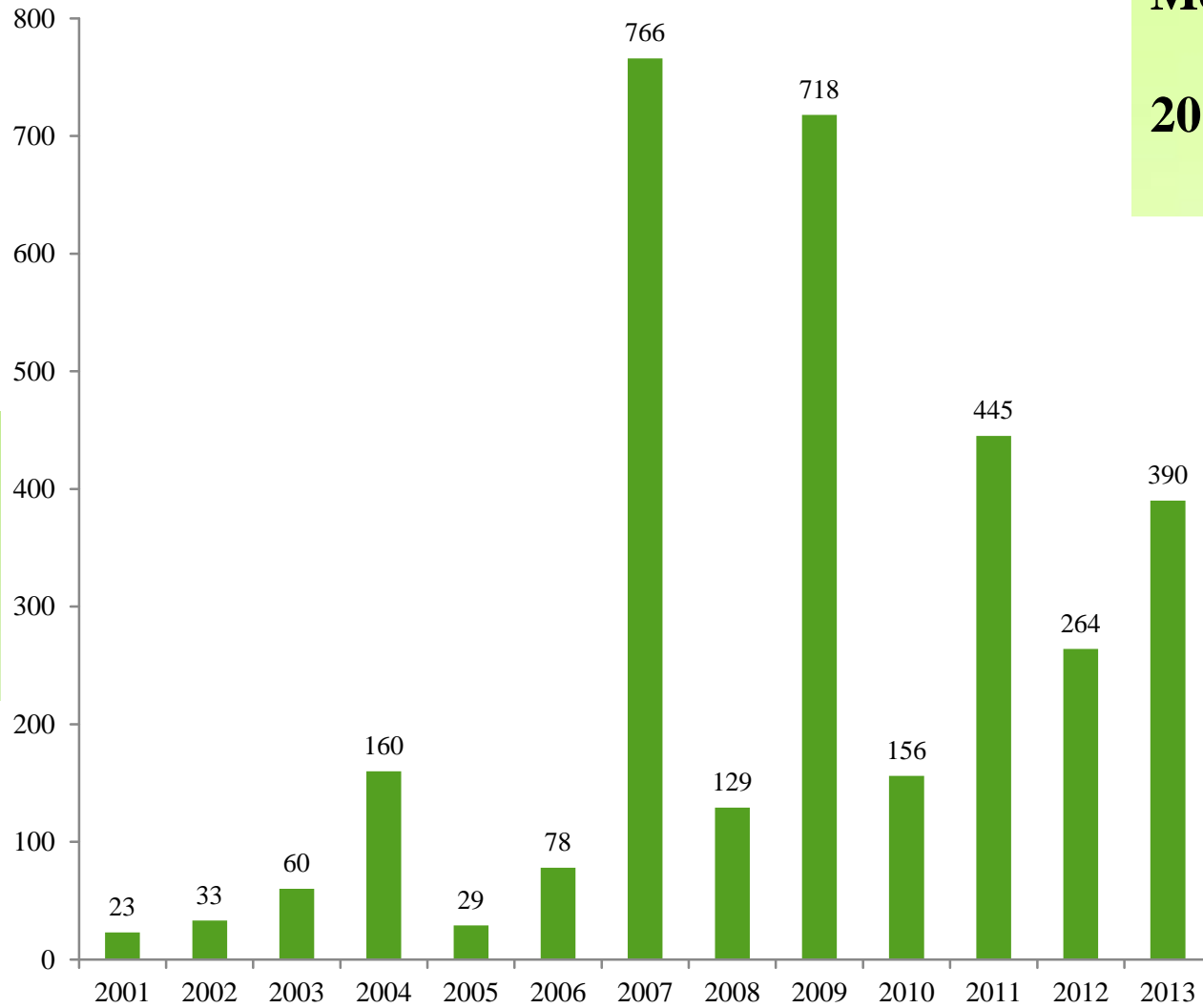


**School children : one of the most susceptible population group**

**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

Year

# **SOME GLIMPSES OF MAURITIUS**

**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 Ad 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

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

Should abide by the list of products allowed for sale (Government Gazette of Mauritius No. 74, 2009)

- Customers(700-1000)
- Mainly for students
- Staff

- Limited/no seating facility
- Size of canteen may vary

Canteen owners are not allowed to prepare foods on site



**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

# SAMPLING

176 SECONDARY SCHOOLS

68 state owned/managed

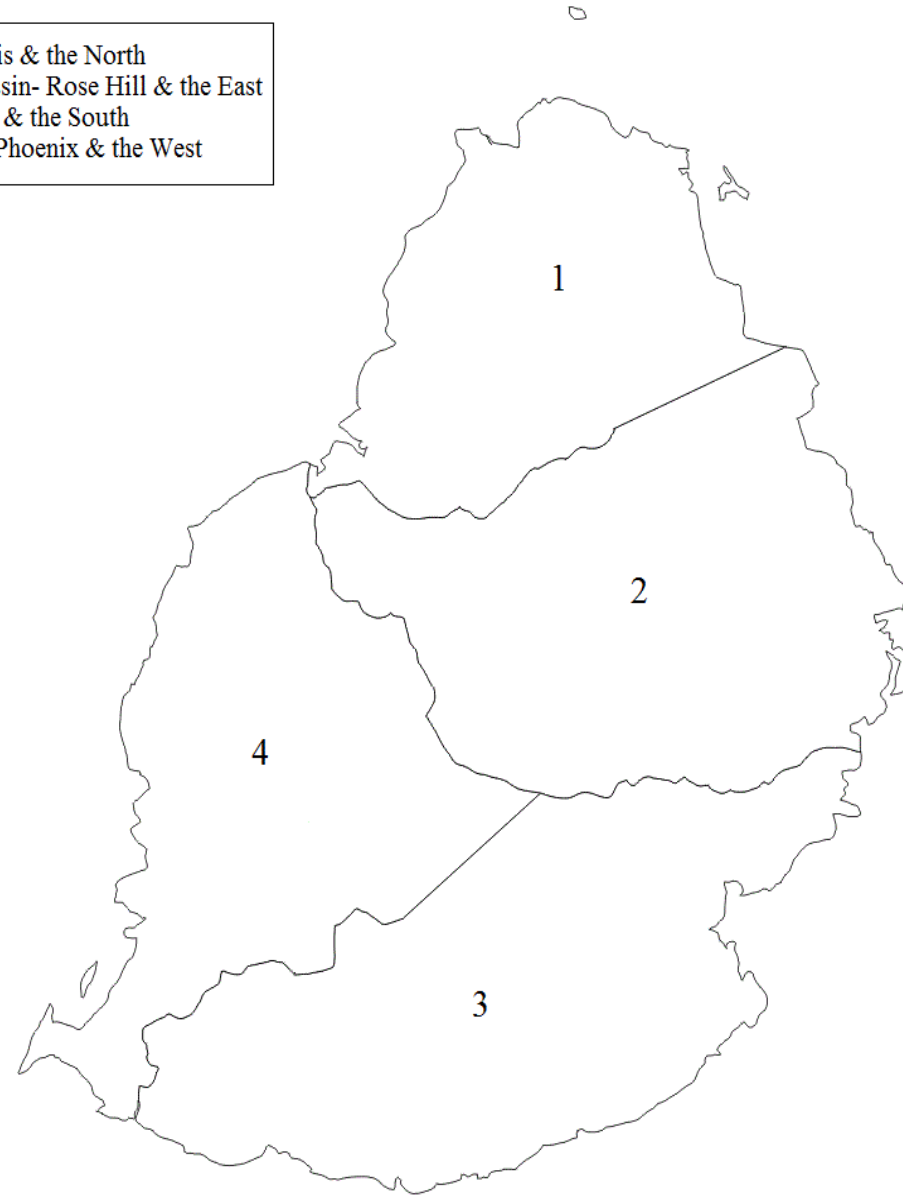
98 state funded but privately managed

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



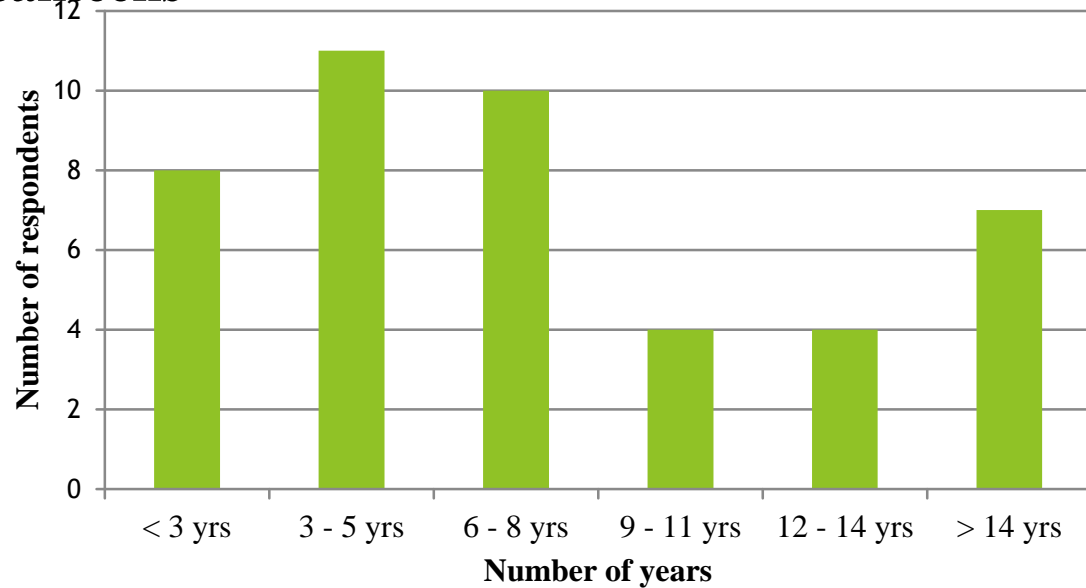
24 %



76 %

30-60 yrs-89 %

**More than 6 years of experience in school canteens**



Number of employees	
1-2	31 %
3-5	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, dhol puri

Fillings were prepared in caterers' domestic kitchens







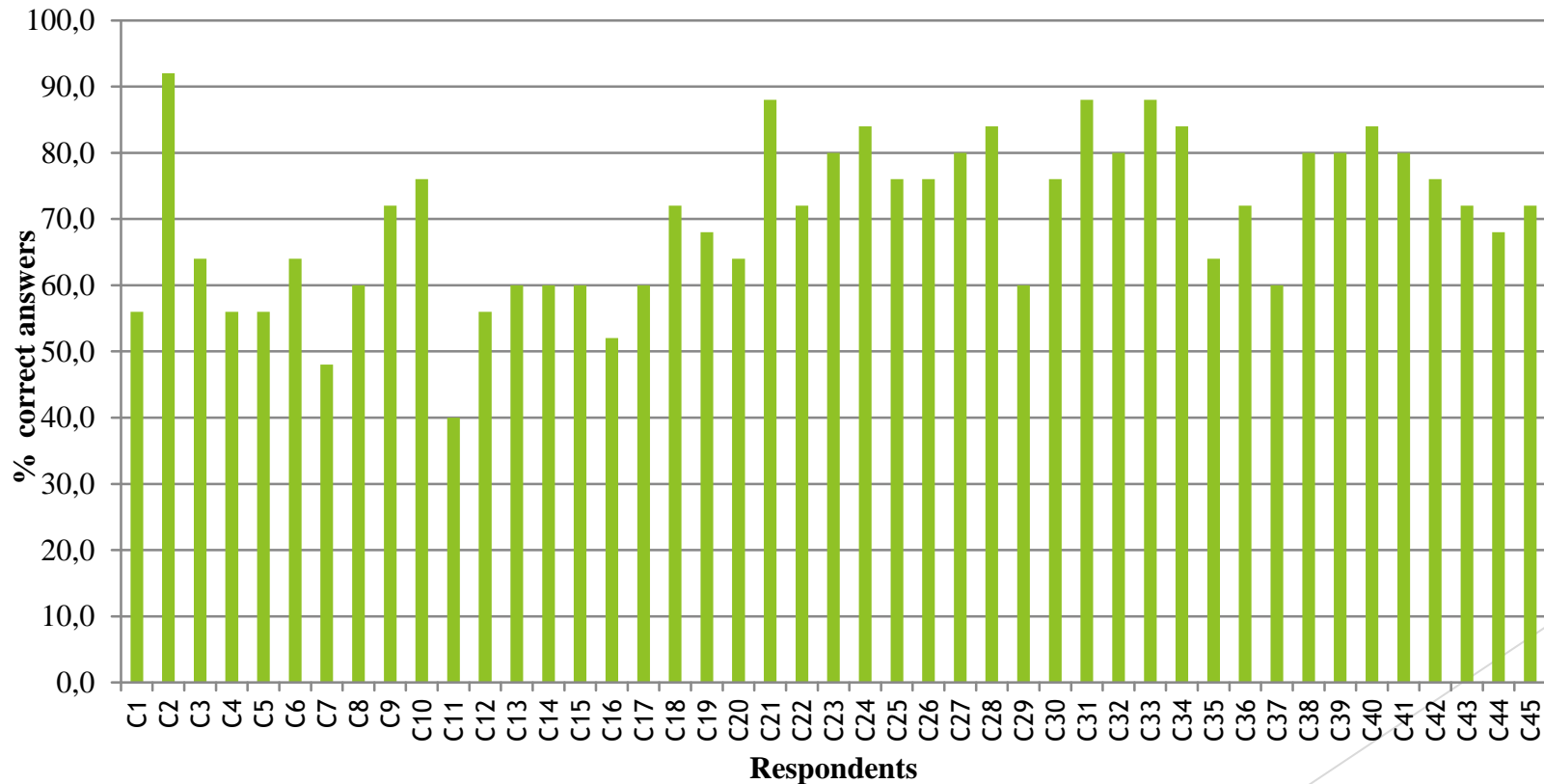




LOW FAT/LOW SUGAR SNACKS

# FOOD SAFETY KNOWLEDGE I

**Mean Overall food safety score: 70 % ; (40-92%)**



# FOOD SAFETY KNOWLEDGE II

	Knowledge Statements	% of respondents (n= 45)		
		Correct answer	Incorrect answer	Don't know
	<b>General food safety</b>	98.5	0	1.5
	<b>Sources of Contamination</b>	84.0	15.1	0.9
Aprons are compulsory but hairnets are optional to wear	<b>Personal hygiene</b>	77.0	20.7	2.2
An unsafe food will always smell/taste/look bad	<b>Safe and unsafe food</b>	56.3	42.6	1.1
A spoilt food will always cause food poisoning				
Harmful bacteria are killed during refrigeration	<b>Storage of food</b>	55.5	32.6	11.9
Poor knowledge on holding of hot food; core temp of cooked chicken; correct method of thawing frozen foods	<b>Food handling practices</b>	55.1	20.0	24.9



# COMPLIANCE OF CANTEENS WITH THE MFR 1999 I

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

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

Criteria	% compliance
<b>Door, Floors, Waste management, Crockery and utensil; Use of drinking straws, Personal hygiene</b>	<b>73-76</b>
<b>Personal hygiene</b>	<b>73</b>
<b>Pest control</b>	<b>67</b>
<b>Cleaning and disinfection</b>	<b>65</b>
<b>Storage of food</b>	<b>63</b>
<b>Ceilings; Cleaning agents and disinfectant</b>	<b>61</b>

# COMPLIANCE OF CANTEENS WITH THE MFR 1999 II

Criteria	% compliance	
Temperature control	57	<ul style="list-style-type: none"><li>➤ Inaccurate knowledge on storage T, cooking T, reheating of foods</li><li>➤ Inadequate facilities for T control in the school canteen premises</li></ul>
Scullery	49	Scullery not separated and food preparation area
Preparation tables	47	<ul style="list-style-type: none"><li>➤ Many canteens did not have dedicated working surfaces for raw &amp; ready-to-eat foods</li><li>➤ Some tables had in built cupboards underneath-limited access to cleaning &amp; potential site for harbourage of pests</li></ul>
Adequate hand-washing facilities	46	Manual tap; no nail brush;no proper hand drying facilities, soap dispenser and paper towel dispenser
Windows	42	No fly screen; no proper window opening to allow for proper ventilation and lighting

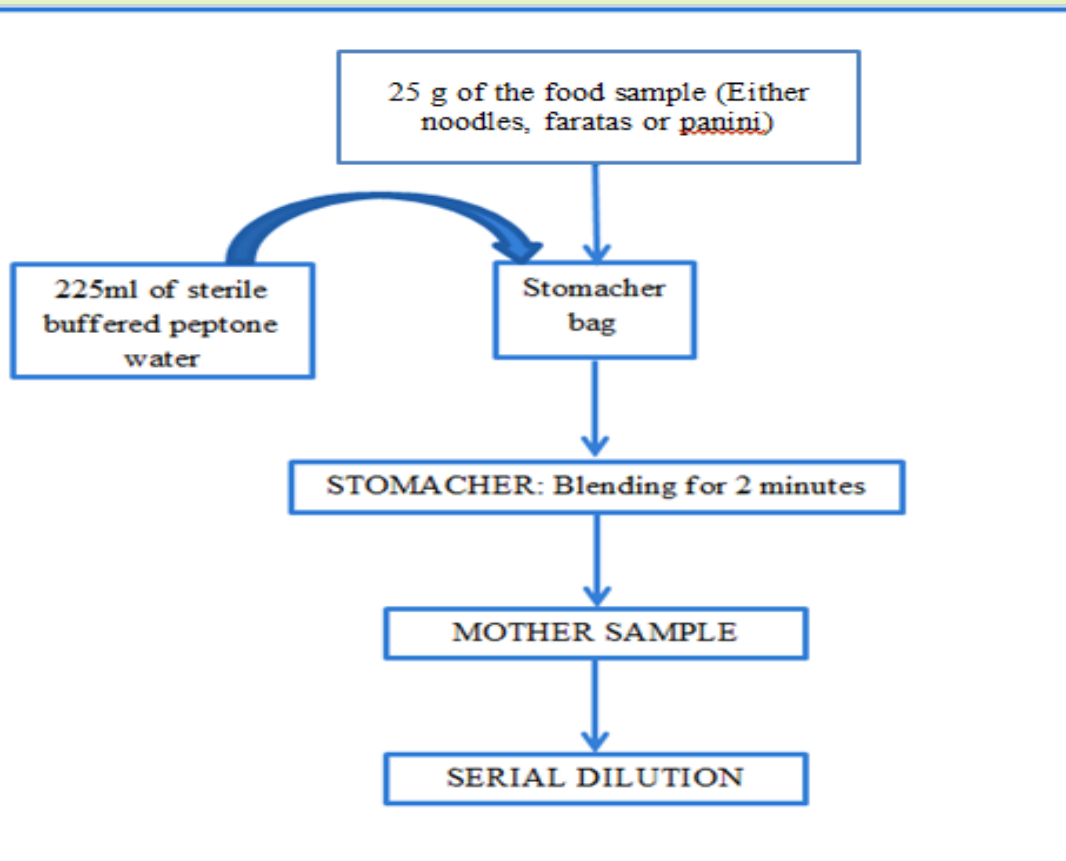


# EVALUATION OF THE MICROBIOLOGICAL QUALITY OF MOST POPULAR PRODUCTS



# MICROBIOLOGICAL STATUS-METHODOLOGY

- ▶ 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*

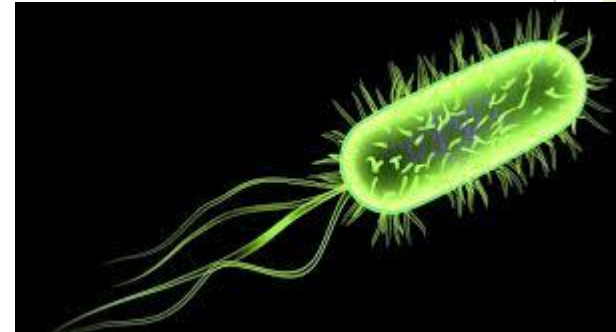
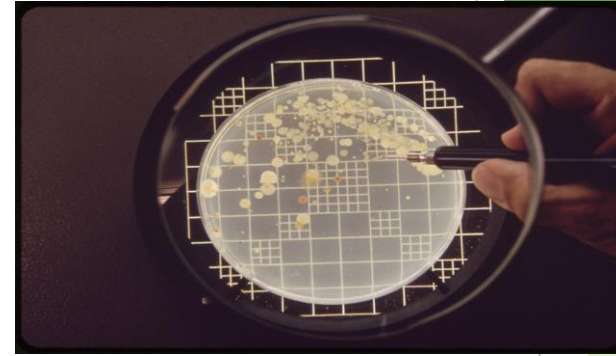
- ▶ General microbial quality
- ▶ Has to be  $< 5 \log \text{ cfu/g}$

## ▶ *Escherichia coli*

- ▶ Sanitary quality
- ▶ Has to be  $< 2 \log \text{ cfu/g}$

## ▶ *Staphylococcus aureus*

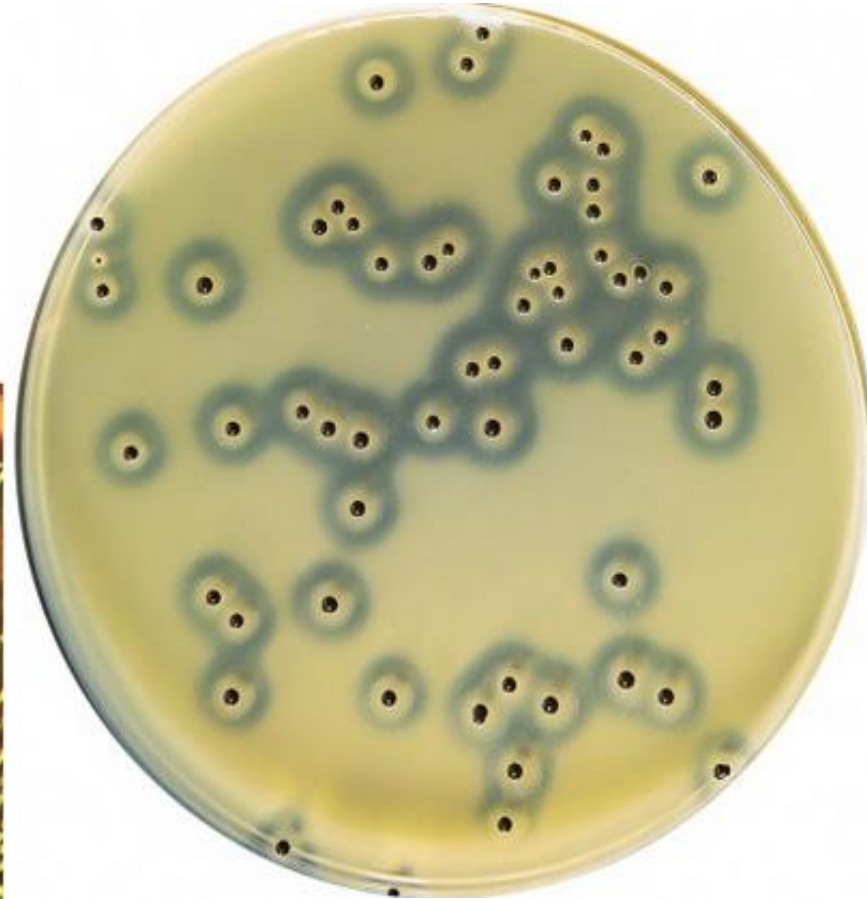
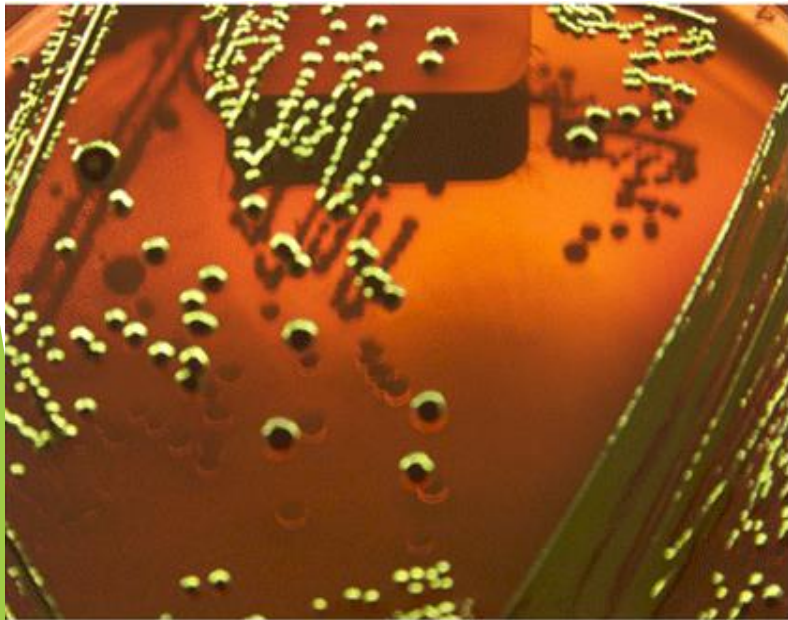
- ▶ Hygienic quality and food safety
- ▶ Has to be  $< 2 \log \text{ cfu/g}$





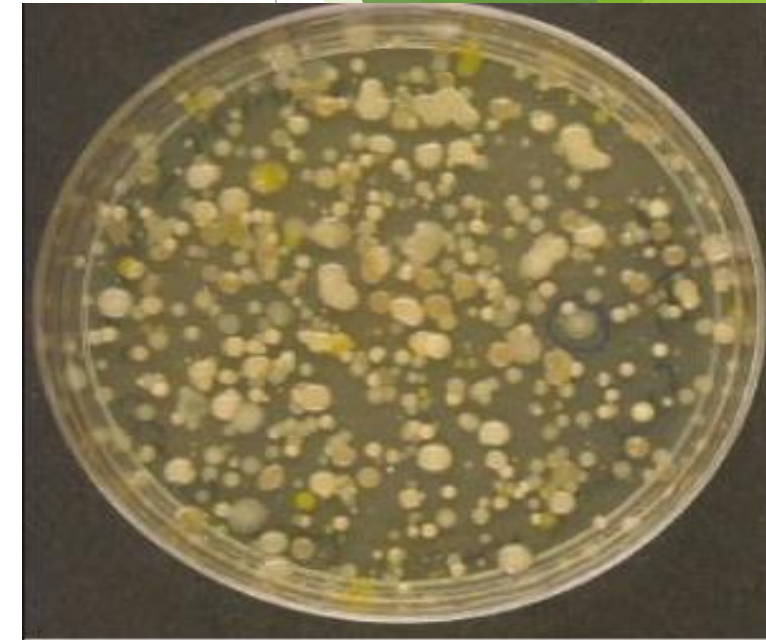
# END RESULTS

Presumptive *E. coli*



Presumptive *S. aureus*

Mesophilic aerobic bacteria



*Salmonella* spp., *L. monocytogenes*, *Clostridium*: not detected in any of the food samples

	FARATA			PANINI			FRIED NOODLES		
	NORMAL FLORA	FECAL FLORA	HUMAN FLORA	NORMAL FLORA	FECAL FLORA	HUMAN FLORA	NORMAL FLORA	FECAL FLORA	HUMAN FLORA
A									
B									
C									
D									
E									
F									
G									
H									



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



**Bacteria from environment, food preparation surface, tables, utensils**

**Poorly cleaned hands after using the toilets**

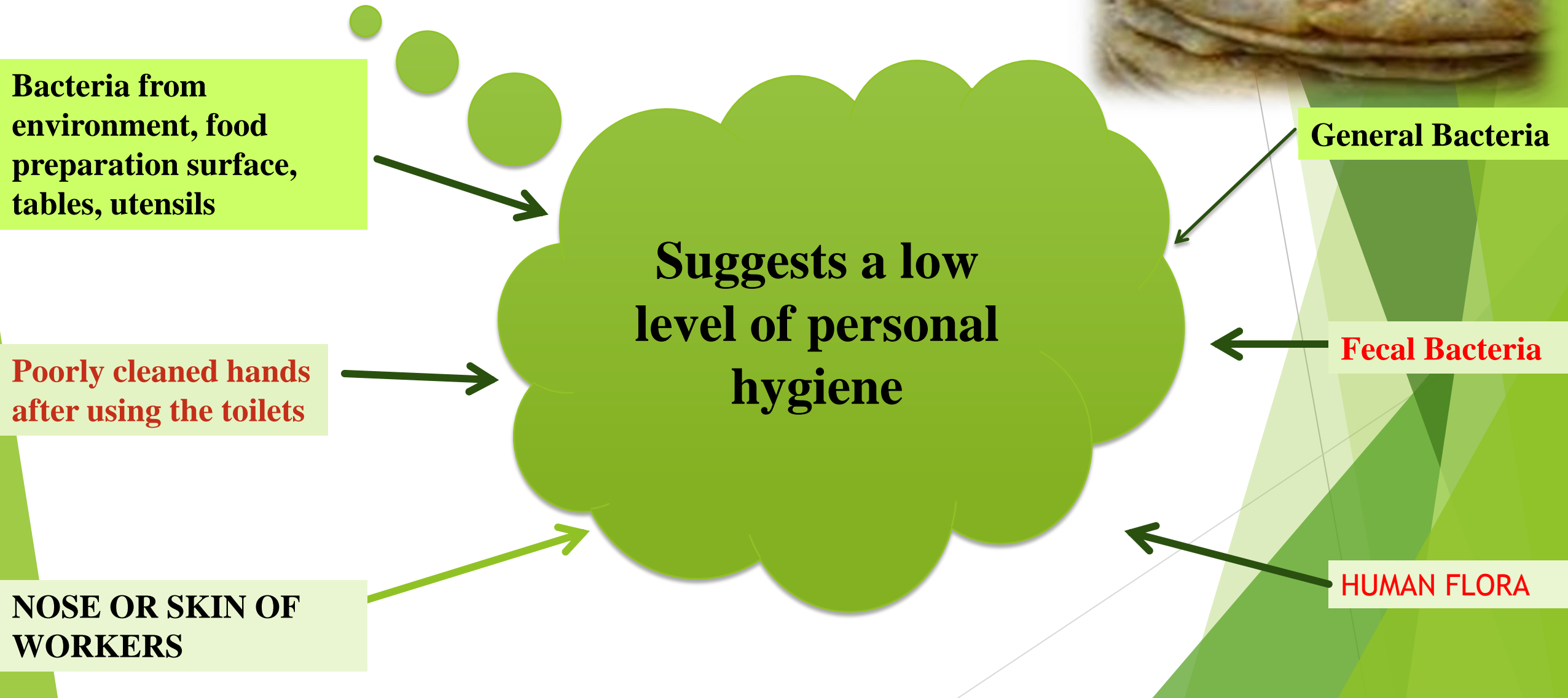
**NOSE OR SKIN OF WORKERS**

**Suggests a low level of personal hygiene**

**General Bacteria**

**Fecal Bacteria**

**HUMAN FLORA**



# MICROBIOLOGICAL FINDINGS: FRIED NOODLES



**Bacteria from environment, food preparation surface, tables, utensils**

**Poorly cleaned hands after using the toilets**

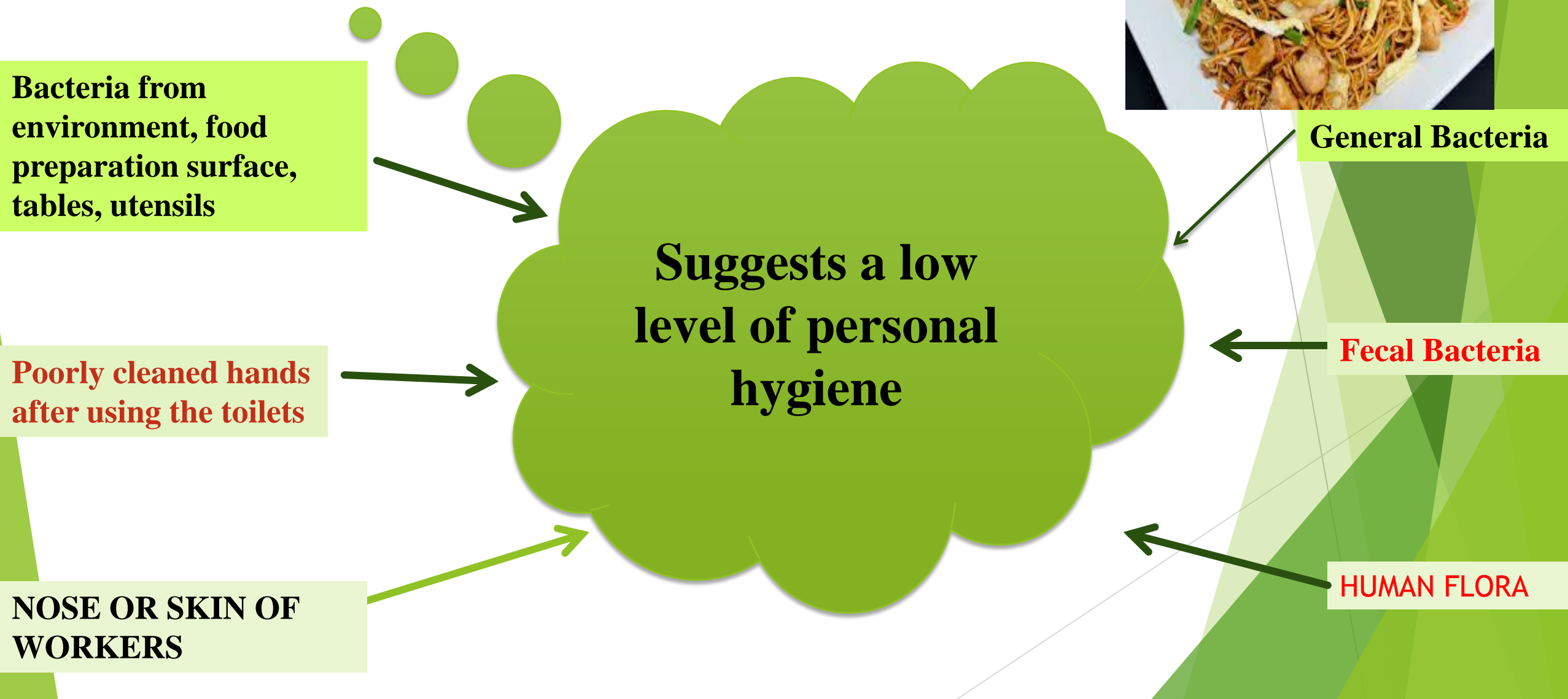
**NOSE OR SKIN OF WORKERS**

**Suggests a low level of personal hygiene**

**General Bacteria**

**Fecal Bacteria**

**HUMAN FLORA**



# MICROBIOLOGICAL FINDINGS: PANINI



**General  
Bacteria**

**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

*'Préparation 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

- ▶ Hotee, M. F (2011) *A critical analysis of food poisoning in Mauritius*. MSc Degree in Food Technology. Faculty of Agriculture, University Of Mauritius. Unpublished.
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- ▶ Soon, J. M., Singh, H. and Baines, R., 2011. Foodborne diseases in Malaysia: A review. *Food Control* 22, pp. 823- 830
- ▶ MICROBIOLOGICAL REFERENCE CRITERIA FOR FOOD  
: [http://www.foodsafety.govt.nz/elibrary/industry/Microbiological\\_Reference-Guide\\_Assess.pdf](http://www.foodsafety.govt.nz/elibrary/industry/Microbiological_Reference-Guide_Assess.pdf)

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New Zealand Food Regulations (1984) and the International Commission for Microbiological Specification for Foods (ICMSF) (1996)

ICMSF (1996): ready-to-eat foods with total viable counts between  $0-10^3$  cfu/g (or 0-3 log cfu/g ) is acceptable, between  $10^4-10^5$  cfu/g (or between 4-5 log cfu/g) is tolerable or marginally acceptable and  $10^6$  cfu/g and above (or  $\geq 6$  log 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 cfu/g for faratas, 3.0-5.7, < 2, < 2 log cfu/g for paninis and 4.4-6.7, < 2 - 4.1, < 2 - 4.2 log cfu/g for noodles respectively. Based on the microbiological standards used, faratas and fried noodles sold at several canteens would be deemed unacceptable.



