

Research Article**Hygiene Behaviour and Food Quality in Lahore, Pakistan****Stephen Mortlock**Global Infectious Diseases and Microbiology Liaison, Laboratory of Environmental Microbiology
Shaukat Khanum Memorial Cancer Hospital and Research Centre, Lahore, Pakistan***Corresponding author**

Stephen Mortlock

Email: stephen.x.mortlock@questdiagnostics.com

Abstract: Food contaminated with pathogenic micro-organisms is a serious threat to human health, particularly in some developing countries. This study was designed to evaluate the quality of food at various outlets around Lahore, Pakistan. Food samples were collected and analysed for total viable count, coliforms, faecal coliforms and *Escherichia coli* using standard methods. Overall, the food from established outlets was of an acceptable quality with an occasional unacceptable result and only one instance of *Salmonella enteritidis* isolated.**Keywords:** Food quality; Microbial contamination; Pakistan.

INTRODUCTION

Food is a basic human need and many developed countries have increased production to meet the growing demand from consumers. With this increase has come controversy about food safety that has occasionally had a huge impact on the food industry. In less developed countries, however a large proportion of the food produced may be spoilt before it can be consumed and the need to simply obtain food often outweighs concern about food safety. Pakistan is becoming an important destination for business travellers and holiday makers alike, there has certainly been an increase in travellers over the last fifteen years: nearly 910,000 international visitors arrived in 2010 (compared to 369,000 tourists for 1996)[1]. Because the standard of hygiene may be below the travellers' ideals, many of them will suffer from one or more episodes of diarrhoea and although unpleasant and debilitating is not generally life-threatening[2,4]. It is easy to forget, however that although nearly three-quarters of the indigenous population has access to safe drinking water, more than half have no proper sanitation and 32% are classified as living below the absolute poverty level (Photograph 1)[5,6].

Lahore is a bustling metropolis located on the banks of the river Ravi, and although smaller in size and population than Karachi is considered to be the cultural, educational and artistic capital of Pakistan. A myriad variety of wheeled vehicles compete for road space with cars, scooters and trucks travelling alongside donkey, ox and horse-carts. The river and canal (which runs through most parts of the city) are both used by humans and animals for swimming, bathing and washing purposes; it is not uncommon to find buffaloes drinking

or bathing while ten yards downstream a mother will be washing clothes, children or cooking utensils. Because of this both the river and canal have been found to contain high levels of *Escherichia coli*, salmonella, campylobacter and shigella[7]. Even the potable drinking water supplies have been found with faecal pathogens and concentrations of lead and chromium well in excess of WHO guidelines[8]. A report in the late 1990's by the Epidemiological Laboratory, Institute of Public Health in Lahore analysed 57 water samples taken from around the city and found 30 contaminated with unacceptable levels of *Escherichia coli* [9]. Unfortunately, there are still many uncovered refuse dumps throughout the city and there is an indiscriminate disposal of human and animal excrement in the streets, the fields and adjacent to the slum areas.

Along many of the streets and roads can be found street vendors (photograph 2) serving a variety of cooked and fresh food, from the 'halva poori' (deep fried bread served with a savoury dish of diced potatoes and chickpeas) to 'katlamas' (fried bread stuffed with mincemeat, or lentil paste). Another favourite is the dish 'chikkar cholay', made from chickpeas cooked in yoghurt and spices eaten with 'naan' bread. Lahore is also renowned for its fresh water fish, which when fried in a chickpea batter tends to disappear remarkably quickly. Although there are new air-conditioned supermarkets being opened, to sell food under more hygienic conditions, with chilled and frozen meat on sale, much of the population still buys food from open-fronted shops or market stalls (Photograph 3). These shops have little protection from the heat or flies and the domestic animals which may be roaming freely around. Most of the meat is classified as 'halal' meat,

where the animal is slaughtered by a transverse cut to the throat. The animal is often slaughtered, butchered, sold and eaten within 24 hours, with no refrigeration.

Because of the increasing tourism a number of the larger hotels and restaurants in Lahore wanted to include food monitoring to ensure that business travellers and holiday-makers were ensured of good quality food from their kitchens. The food monitoring was carried in the Laboratory of Environmental Microbiology at the Shaukat Khanum Memorial Cancer Hospital using guidelines set out in the UK[10-11].

METHODOLOGY

Each month, food samples were collected from the hospital kitchen, some designated restaurants, three international hotels and occasionally a street trader. At each collection, the food was collected into sterile food bags and transported in a cool container (4-10°C) to the laboratory. These samples were then assigned a specific code number for processing. The food was weighed out and a representative sample of about 10grams taken. This was macerated into 100mL of sterile phosphate buffered saline and cultured onto Plate Count Agar (PCA), or Standard Methods Agar (SMA). This is a microbiological growth medium commonly used to assess or to monitor "total" or viable bacterial growth of a sample, it is not a selective medium. The total viable count (TVC) of microorganisms was carried out at both 30°C and 37°C and at two dilutions (the initial 1:10 and 1:100). It was a rare occurrence if the food sample had to be diluted any further to obtain a countable value. The TVC was reported as colony forming units per gram (cfu/g). The test for coliforms was the standard

MPN (most probable number) method where a series of fermentation tubes containing lauryl tryptose broth were inoculated with varying amounts of the prepared food sample and incubated for 24 hours at 35°C. Each fermentation tube contained an inverted tube to trap gases produced by any coliform bacteria present in the sample. After 24 hours, the fermentation tubes were examined for gas production. If there was no gas production, the samples were incubated for another 24 hours and re-examined. Gas production after 48 hours was considered a positive result, indicating the presence of coliform bacteria. A confirmatory test using the API 20E for enterobacteriaceae then performed to identify the bacteria.

RESULTS

Table 1 shows the aerobic plate count results with over 60% obtaining a satisfactory result, even from the street vendor. There were 17 (10%) of samples with unsatisfactory counts which were found to have high levels of coliforms/*E.coli* (Table 2) and were cultured from a range of different foods. Only one sample was found to contain a *Salmonella enteritidis* and this was from an 'egg-burger' bought from a street trader. Although the hospital food had been often been the subject of complaints from both staff and patients it was found to be the best quality (80% satisfactory). A surprising find was high levels of *Staphylococcus simulans* from a *gulab jamun* dish collected from a local restaurant. This organism has been implicated as a potential cause of food poisoning if they produce enterotoxin[12].

Table-1: Aerobic plate counts of prepared foods

	Number of Samples	Microbiological Quality (cfu/g)					
		Satisfactory (<10 ⁴)		Fairly Satisfactory (10 ⁴ - 10 ⁶)		Unsatisfactory (>10 ⁶)	
Hotel A	60	36	60.0%	17	28.4%	7	11.6%
Hotel B	56	41	73.2%	12	21.4%	3	5.4%
Hotel C	13	10	76.9%	2	15.4%	1	7.7%
Local Restaurants	15	7	46.4%	4	26.7%	4 ^a	26.7%
Street Trader	7	4	57.1%	1	14.3%	2	28.6%
Hospital Kitchen	15	12	80.0%	3	20.0%	-	0.0%
Total	166	110	66.3%	39	23.5%	17	10.2%

a: *Staphylococcus simulans* found in one sample

Table 2: Samples containing unsatisfactory or unacceptable levels of coliforms/ *Eschericheria coli*

Food	Number of Samples	Unsatisfactory (10 ² - 10 ⁴ cfu/g)	Unacceptable (>10 ⁴ cfu/g)
Chicken dishes	2	2	-
Chicken with yoghurt	1	1	-
Mutton curry	3	2 ^a	1
Egg-burger	1	-	1 ^c
Beef kofta	1	1	-
Vegetable dhal	1	1 ^b	-
Chocolate mousse	2	2	-
Total	11	9	2

a: *Enterobacteram nigenus* and *E. coli*, b: *Enterobactersa kazaki* and *E. coli*, c: *Salmomella enteritidis*, *Enterobacter sp.*



Fig-1: Women washing in a drainage ditch



Fig-2: Mobile food vendor

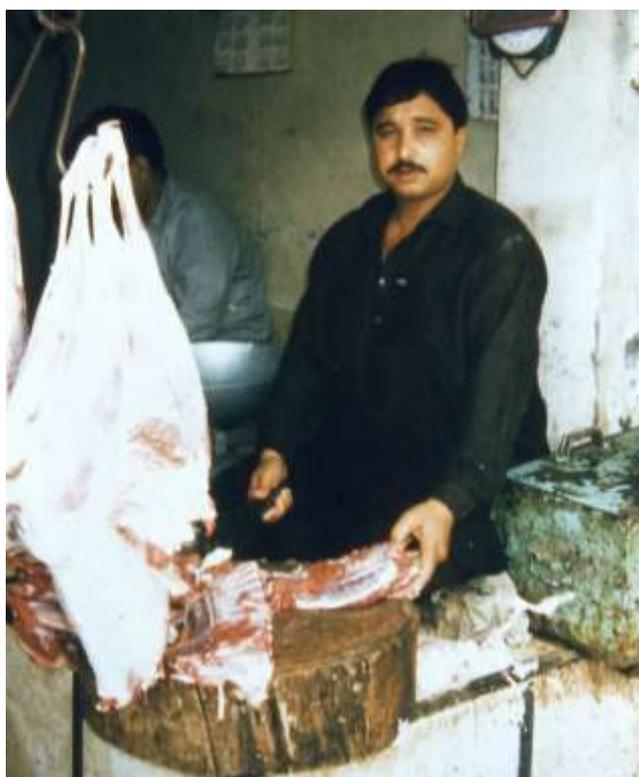


Fig-3: Butcher at work

DISCUSSION

Overall the foods from the hotels gave very good results, while some of the restaurants produced some of the worst aerobic plate counts. And it was from a street trader that the only case of *Salmonella enteritidis* was isolated.

In South Asia, including countries like Pakistan, social and environmental changes are occurring rapidly, with increasing urbanization, changing lifestyles, higher energy density of diets and reduced physical activity. Higher incomes and falling food prices are boosting the consumption of meat, milk and fatty or sugary foods. Recently, however there has also been the introduction of western style fast food outlets, serving pizzas, burgers, fried chicken, French fries and milkshakes. With the exception of a few changes to accommodate local dietary customs, for example the Hawaiian pizza has spicy chicken instead of ham; they bear a remarkable similarity to anything offered in the UK or the USA.

Although the introduction of these food outlets may improve the problem of food supply and hygiene to those who can afford it, if the trend towards 'fast-food' continues this could increase other problems for people who are not used to a deep fried, excessive meat-and-fat highly refined diet. As the number of supermarkets have increased so has come the reliance on packaged foods and the use of salt as a preservative. The need to make retail food cheap has necessitated the use of hydrogenated oil instead of butter and the concept of convenience products in food and saving costs by mass preparation of foods is driving people to buy more fast food. Moreover, larger portion sizes offered in restaurants in an attempt to add value is making people eat more.

Certainly, obesity, diabetes and heart complaints have been shown to be more prevalent in this type of society when western-style foods have begun to replace the traditional fare. Already reports make much of the increase in obesity due to poor diet and lack of exercise[13,14]. This change is certainly more noticeable in the metropolitan areas like Lahore, where there is a gradual shift from joint families to nuclear households. There has also been an increase in the number of working women or with both parents working, so eating out has become a frequent phenomenon with the local fast food outlet often being the first point of call[15].

Although many of the hotels and restaurants still offer traditional fare cooked from fresh produce with generally a high standard of quality, how long can this continue if they are competing against the more westernized fast food outlets. And how long before oven-chips replace rice and naan bread?

REFERENCES

1. data.worldbank.org/indicator/ST.INT.ARVL. [Accessed 26th May, 2015]
2. Mortlock S; Living with the enemy.' MLW, 2001; September: 22-25
3. Mortlock S; Holiday diarrhoea: I blame the food. J Int Food Hygiene, 1999; 10: 27-29
4. Mortlock S; Sun, sea and salmonella: The problems associated with the investigating of an outbreak of gastrointestinal illness at a holiday resort. Medical Laboratory World, 1995; 5-5.
5. http://www.who.int/maternal_child_adolescent/en/, 2015. [Accessed 29th May, 2015]
6. WHO Food Safety Programmes website. [Accessed 26th May, 2015]
7. Khalil K, Lindblom GB, Mazhar K, Kaijser B; Flies and water as reservoirs for bacterial enteropathogens in urban and rural areas in and around Lahore, Pakistan. Epidemiology and infection, 1994; 113(3):435-444.
8. Hussain T ; Study of environmental pollutants in and around the city of Lahore. IV- Chemical analysis of Lahore's Ground water. Proc 2nd All Pak Sci Conf 26-30 December 106-111
9. Epidemiological Laboratory, Institute of Public Health, Lahore, Report on the drinking water supplies in Lahore. 1997.
10. Danish F, Mortlock S; Microbiological Quality of Prepared foods from Selected Kitchen Outlets in Lahore, Pakistan. Br JBS 1999; 56: 177-181
11. PHLS; Microbiological guidelines for some ready-to-eat foods sampled at point of sale. PHLS Microbiology Digest ,1996; 13: 41-43
12. Udo EE, Al-Bustan MA, Jacob LE and Chugh TD; Enterotoxin production by coagulase-negative staphylococci in restaurant workers from Kuwait City may be a potential cause of food poisoning. J Med Microbiol, 1999; 48: 819-823
13. Nanan DJ; The obesity pandemic- implications for Pakistan. J Pak Med Assoc, 2002; 52: 342-346
14. Afridi AA, Khan A; Prevalence and Etiology of Obesity- An Overview. Pak J Nut, 2004; 3: 14-25
15. Hydrie MZI, Basit A, Badruddin N, Ahmedani MY; Diabetes Risk Factors in Middle Income Pakistani School Children. Pak J Nut. 2004; 3: 43-49