

Assessment of microbial contamination of chicken products sold in Parbhani city

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Abstract

Three restaurants were randomly selected in Parbhani city for the purchase of chicken products which were then screened for microbial contamination. For the chicken curry samples the total aerobic counts ranged from $2.06-2.80 \times 10^6$ cfu/g; *Staphylococcus aureus* count : $1.1- 1.47 \times 10^6$ cfu/g ; Enterobacteriaceae count: $1.57- 2.17 \times 10^6$ cfu/g ; lactic acid bacteria count(LAB) count : $1.70 - 2.33 \times 10^6$ cfu/g. With respect to the sample of Tandoori chicken, the total aerobic count ranged from 3.54×10^6 cfu/g; *S. aureus* count: $1.8 \times 10^5- 2 \times 10^7$; Enterobacteriaceae count: 5.09×10^8 cfu/g; LAB count : $1.3 -4.6 \times 10^8$ cfu/g. Probable organisms isolated from chicken curry were *E. coli*, *Streptococcus* sp., *Clostridium* sp., *Klebsiella* sp., *Shigella* sp., *Pseudomonas* sp., *Lactobacillus* sp., and *S. aureus* while those organisms isolated from Tandoori chicken include *Salmonella*, *Proteus*, *Shigella*, *S. aureus*, *Klebsiella* and *Lactobacillus* sp. Most of the chicken products sampled were therefore considered to pose health risk to consumers, making it imperative to institute not only sanitary measures during processing, storage and marketing but also to ensure steady source of power supply.

Keywords: Microbial contamination, Chicken curry, Tandoori chicken.

Introduction

Food-borne illnesses in human beings due to bacterial pathogens and their toxins are well documented worldwide (Hazariwala *et al*, 2002); Lin *et al*, 2002). Food-borne illness imposes a substantial economic and quality of life burden on society by way of acute morbidity and chronic sequelae (Duff *et al*, 2003). Staphylococcal intoxication is a leading cause of food-borne intoxication and enterotoxigenic *Staphylococcus* strains have been isolated from foods implicated in illnesses (Adesiyun, 1995; Cencil *et al*, 2003). *Salmonella* spp has been reported by the United States Department of Agriculture Food Safety and Inspection Service (FSIS) as one of the most common causes of food-borne illness associated with meat and poultry products. *Yersinia enterocolitica* is a salt-tolerant, psychrotrophic rod that is widely distributed in nature, in aquatic and animal reservoir for human pathogenic strains (Hillers *et al*, 2003). In 1998, there were an increased number of reported cases of illness due to *Listeria monocytogenes* which the Centers for Disease Control and Prevention as well as state and local health departments in the U.S. attributed to the consumption of cooked hot dogs

and deli meats (FSIS, 1999). Shehu and Adesiyun (1990) reported 39.5% of milk to be positive for *E. coli*. Enterotoxigenic *Escherichia coli* has been involved in food-borne illness and recovered from various food types, processed or raw (Firstenberg and Sullivan, 1997). *Campylobacter jejuni* and *C. coli*, often responsible for causing *Campylobacter enteritis* (campylobacteriosis) in humans. A number of foods in India have been reported to have high incidence of bacteria, however, there is little /scanty information about the extent of microbial contamination of chicken products sold in Indian supermarkets. The fact cannot be overemphasized that raw or pre-processed foods sold in supermarkets pose a direct health hazard to consumers if they contain an infective dose of pathogens or toxic levels of their toxins. The purpose of this study was to evaluate the microbial contamination occurring in Chicken products at retail outlets in order to facilitate the assessment of microbiological risks associated with them. The microbial estimates determined were total viable counts, *Staphylococcus aureus* counts, Enterobacteriaceae, psychrophiles and lactic acid bacteria in respect to microbiological quality of the chicken products.

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Material and Methods

Source and collection of samples: Three samples of chicken curry were collected from the restaurants in Supermarket area, Kachhi bazaar area and Vasmat road area. Tandoori chicken samples were collected from Railway station area, Shivaji complex area and Jintur road area. The samples were put in sterile plastic containers and transferred to the laboratory ice-cooled within 2 hrs of collection. The samples were collected from these sites randomly at the beginning, middle and at the end of city.

Bacteriology: Total and Differential Counts: One gram of each sample was weighed into a mortar (that had been previously sterilized) and ground with a sterile pestle until it became smooth and 9 ml of sterile distilled water was poured into the mortar. This was transferred to a test-tube followed by serial dilution up to 10⁻⁷ dilution. To determine total viable counts, 1 ml of each of 10⁻⁵ and 10⁻⁷ dilutions were plated on nutrient agar plates in triplicates. The plates were incubated at 37°C for 24 hours. The same procedure was repeated for *Staphylococcus aureus* count, enterobacteriaceae count, lactic acid bacterial count on mannitol salt agar, MacConkey agar and De Man Rogosa Sharpe (MRS) agar respectively. Psychrophillic count done for all samples in Parbhani City. They were incubated on nutrient agar plates at 40 °C for 48 hours. For MRS agar, the plates were incubated at 37°C for 48-72 hours. Anaerobic count was done by incubating plates in an anaerobic jar for 24 hours.

Identification of Isolates: The isolates obtained on plate counts were identified based on established conventional cultural, morphological and biochemical characterizations. (Encinas *et al.*, 1996)

Statistical Analysis: All data were analyzed using the general linear model procedures of SAS and Analysis of Variance (ANOVA).

Results

Mean total viable count, *Staphylococcus aureus* counts, enterobacteriaceae count, psychrophillic count and LAB counts are shown in Table 1 for microbial counts of Chicken curry and Table 2 for microbial counts of Tandoori chicken from

Parbhani city. The three sampled of chicken curry had total viable counts that were between 2.06-2.87 x 10⁶ cfu/g (Table 1). This is an acceptable range for total viable count of organisms by the Public Health Laboratory Service (PHLS, 1996). The sample from Railway station area had total viable count of 4.0 x 10⁸ cfu/g (Table 2) which was above the PHLS approved (10⁶-10⁷cfu/g).

The enterobacteriaceae counts for all samples obtained were above the limit specified by the British Standard Institute (BSI, 1991, 1993) except samples collected from Shivaji complex and it was observed also that this was the sample with the highest LAB count. Coliform counts for Chicken curry were in the range of 1.57x10⁶-2.17x10⁶ while those for Tandoori chicken were between 5.0x10⁴-9.6x10⁸. The *S. aureus* count in all samples were within 10⁵-10⁶ cfu/g (Tables 1 and 2) except samples from one location (Jintur road area) that had 2.2x10⁷ cfu/g which was significantly different from all samples and above the approved value by PHLS and BSI. Lactic acid bacteria (LAB) counts were highest in two samples- one of Tandoori chicken and the other of Chicken curry (Tables 1 &2). These values were significantly (P< 0.005) higher than all other samples. Organisms isolated also indicated the presence of *Lactobacillus* species. Probable isolates of microorganisms from Chicken curry were *E. coli*, *Staphylococcus aureus*, *Streptococcus sp.*, *Clostridium sp.*, *Klebsiella sp.*, *Shigella sp.*, *Pseudomonas sp.*, *Lactobacillus sp.* In Tandoori chicken, *Salmonella sp.*, *Proteus sp.*, *Shigella sp.*, *Staphylococcus aureus*, *Klebsiella sp.*, *Lactobacillus sp.* were isolated. All these microorganisms have been implicated in food-borne illnesses (Firstenberg and Sullivan, 1997; Hazariwala, 2002).

Discussion

The mortality associated with these pathogens is not well documented in India however, the economic impact of these illnesses is important (absenteeism, medical care, investigations, withdrawal of the contaminated products, loss of confidence in products). The high total viable counts from area such as the Railway station could be

Table1. Microbial counts of Chicken curry samples (cfu/g) from three locations in Parbhani city.

Sr.No.	Microbial Counts	Supermarket area	Kachhi bazaar area	Vasmat road area
1.	Aerobic count	2.5 x 10 ⁶	2.06 x 10 ⁶	2.87 x 10 ⁶
2.	<i>S.aureus</i> count	1.3 x 10 ⁶	1.1 x 10 ⁶	1.47 x 10 ⁶
3.	LAB count	2.13 x 10 ⁶	1.7 x 10 ⁶	2.33 x 10 ⁶
4.	Coliform count	1.7 x 10 ⁶	1.57 x 10 ⁶	2.17 x 10 ⁶

Table 2. Microbial counts of Tandoori chicken samples (cfu/g) from three locations in Parbhani city.

Sr.No.	Microbial Counts	Railway station area	Shivaji complex area	Jintur road area
1.	Aerobic count	4.0x10 ⁸	3.5 x 10 ⁶	3.72 x 10 ⁷
2.	<i>S.aureus</i> count	1.8x10 ⁵	3.3 x 10 ⁵	2.2 x 10 ⁷
3.	LAB count	1.3x10 ⁴	3.7 x 10 ⁵	4.6 x 10 ⁴
4.	Coliform count	9.6x10 ⁸	5.0 x 10 ⁴	5.2 x 10 ⁷
5.	<i>Psychrophillic</i> count	3.0x10 ⁵	5.6 x 10 ⁶	4.1 x 10 ⁶

attributed to improper cleaning and sanitizing of equipment and poor employee hygiene within the store and more importantly due to erratic power supply in this area. The enterobacteriaceae counts for all samples obtained from Chicken curry and Tandoori chicken were above the limit specified by the British Standard Institute (BSI, 1993) except samples collected from Shivaji complex area of Parbhani city and it was observed also that this was the sample with the highest LAB count. The BSI specified that enterobacteriaceae count greater than 104cfu/g is considered unsatisfactory. Adesiyun (1994) demonstrated gross contamination with *S. aureus* and *E. coli* of preprocessed bovine milk in Trinidad. Food-borne salmonellosis has been associated with consumption of various foods especially meat and poultry products (Adesiyun, 1993). The high enterobacteriaceae counts are an indication of potential microbial contamination during processing, distribution and storage. Their presence in large numbers in food indicates inadequate processing/or recontamination due to cross contamination by raw materials, dirty equipment or poor hygienic handling (Ikeme, 1990). Enterobacteriaceae occur as normal flora of the intestinal tract. They are widely distributed in nature and this account for their presence in chicken products. However, *E. coli* and *Enterobacter* spp. have the potential to cause diarrhea (Volk, 1982). According to Zhao *et al.*, (2003). The process of freezing reduces the numbers of some coliforms such as *Campylobacter jejuni*. According to Kuku (1985), the presence of *S. aureus* could be as a result of it being a common organism on the skin and hands hence their presence in Chicken products may be as a result of contamination due to handling, processing, transportation and storage. Its presence in high numbers is a good indication of poor hygiene and temperature control. The presence of Staphylococci in high numbers in cured meat may

indicate the presence of enterotoxin -producing strains of *S. aureus* (AS/NZS, 1999), thus the data generated are of great importance to inform public health authorities, to detect food-borne diseases outbreaks early and to implement and evaluate food safety programmes.

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