



Microbial Quality of Food Contact Surfaces in Retail Food Service Establishments

KEYWORDS

food contact surfaces, microbial standards, coliforms, Salmonella, Shigella, Vibrio

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ABSTRACT The present work was undertaken to study the prevalence of pathogenic microorganisms on ready-to-use food contact surfaces. Although many workers have focused on presence of pathogens in street food, little work is reported on their prevalence on surfaces. Swab samples of ready-to-use food contact surfaces were collected over a time period of 6 months from 25 retail food outlets and subjected to microbiological examination to detect the presence of coliforms, Salmonella, Shigella, Vibrio using standard procedures. Total viable count was also analyzed. 64% of samples exhibited the presence of coliforms. 32% of the samples demonstrated the presence of viable Salmonella and Shigella. 28% samples demonstrated the presence of Vibrio. Total viable count ranged between 3.5-9.3 log cfu. No relation between type of surface and nature of microflora could be established. Periodic surface swab microbiological examination is a more reliable method than visual examination of surfaces. Bureau of Indian Standards (BIS) needs to establish microbial specifications concerning food contact surfaces.

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Inadequate hygienic practices within food processing plants may result in the contamination of product with pathogens and be a potential risk to food safety (Metaxopoulos et al., 2003). Absolute elimination of pathogens from raw materials and food processing environment is difficult because many food pathogens are known to attach on food contact surfaces and remain viable even after cleaning (Eisel et al., 1997; Fonnesbech-Vogel et al., 2001; Tompkin, 2002; Jessen and Lammert, 2003; Deza et al., 2005). Food borne pathogens cause economic losses as well as loss of productive man hours. Several food borne disease outbreaks have been reported throughout the world and the most frequently identified factors are cross-contamination, contaminated ingredients/equipments, poor personal hygiene by persons who handle foods, etc (Altekruse et al., 1998; Vought and Tautine, 1998; Shapiro et al., 1999)

Clean food contact surfaces are very important in reducing the likelihood of transmission of food borne diseases (Cunningham et al., 2011). Food contact surfaces is any surface of equipment, utensil, containers and wrappings that come in direct contact with food during preparation, serving, holding and cooking process (Holah and Kearney, 1992). Examples of food contact surface include knives, spoons, grater, scoops, spatulas, pots, mixing bowls, cutting boards, preparation boards, preparation tables, sinks, scales, mixers, kettles, slicer, food processor, etc.

There is little published information on nature of microflora present on ready-to-use food contact surfaces in commercial establishments. The present work was undertaken to document this microflora present on food contact surfaces in Indian retail food outlets.

Samples were collected over a time period of 6 months from 25 eating joints within and around the university campus. A sterile polyester swab (HiMedia, India) held at an angle of 30° was rubbed over a 3 cm X 3 cm area of a food contact surface for about 15 seconds. Various surfaces including serving plates, glasses, spoons, cutting boards, knives were the sources of the samples. Swab samples was brought to the laboratory and analyzed within 4 hours of their collection. They were dipped in peptone water and incubated at 37°C for a few hours. Suitable dilutions of peptone water

were used for detection of coliforms (Meng et al., 2001), Salmonella (Andrews et al., 2001), Shigella (Lampel, 2001), and Vibrio (Kaysner and DePaola, 2001). The poured plates were incubated at 37°C for 24-48 h and observed for microbial growth. All samples were analyzed for total viable count as well.

Total viable count of samples of food contact surfaces ranged between 3.5-9.3 log cfu with a mean of 6.3 cfu. A maximum of 6.4 cfu of coliforms was detected with 64% of the samples testing positive for coliforms, 32% of the samples were positive for the presence of viable Salmonella and also Shigella. 28% of the samples were positive for the presence of viable Vibrio. A maximum of 7.8 cfu of Vibrio was recorded. No relation could be observed between type of food contact surface and nature of microflora detected.

High total viable count obtained in samples collected in this study indicated non compliance with hygienic practices. The retail facilities were contaminated with high population of coliforms which can be attributed to, among other factors, use of non-potable water and possibly reuse of wash water. In outlets which tested negative, hygienic conditions were being maintained and hand-washed serving, etc. was done.

Microorganisms have the ability to attach and grow on food contact surface under favorable conditions. If microorganisms are not completely removed from food contact surface it may lead to biofilm formation and potential pathogenesis. Biofilm consists of microorganisms embedded in the extracellular polymeric substances (EPS) produced by them (Costerton et al., 1987). The attachment of microbes to food contact surfaces is a potential source of food borne pathogenesis and food spoilage (Mattila-Sandholm and Wirtanen, 1992; Carpentier and Cerf, 1993). Many food borne pathogens as E coli, Salmonella, Shigella, Vibrio, Listeria, Pseudomonas, Bacillus, etc have the ability to attach and form biofilms on food contact surfaces (Yang-En-Tan et al., 2014).

Very few countries have issued specifications regarding permissible level of microbes on food contact surfaces. US Public Health Service recommends that clean and disinfected food service equipment should not exceed 10 viable microorganisms per cm². The Public Health Laboratory Service (PHLS) in UK recommends specifications for clean surfaces ready to

use- less than 80 cfu/cm² is satisfactory, 80-1000 cfu/cm² is borderline and above 1000 cfu/cm² is unsatisfactory (Anon, 2006). Bureau of Indian Standards (BIS) country's national standards body has prepared a set of guidelines for maintenance of hygiene standards in food outlets. There are no standards for microbial quality of surfaces used for consumption of food in India (Teja, 2012).

The results of the study highlight the inadequacy of visual examination as a means of assessing the cleanliness of food

contact surface. Periodic swab evaluation is important to check effectiveness of hygienic practices and is a more reliable indicator of sanitary conditions. Presence of *coliforms*, *Salmonella*, *Shigella* and *Vibrio* in randomly collected samples underlines the need to establish and enforce microbial specifications for surfaces.

Acknowledgements-

The facilities provided by the Department of Biotechnology, Punjabi University, Patiala are gratefully acknowledged.

REFERENCE

- 1) Metaxopoulos J, Kritikos D, Drosinos EH (2003). Examination of microbiological parameters relevant to the implementation of GHP and HACCP system in Greek meat industry in the production of cooked sausages and cooked cured meat products. *Food Control*; 14: 323–332.
- 2) Eisel, WG, Linton RH, Muriana PM (1997). A survey of microbial levels for incoming raw beef, environmental sources and ground beef in a red meat processing plant. *Food Microbiol*; 14:273–282.
- 3) Fannesbech-Vogel B, Jorgensen LV, Ojeniyi B, Huss HH, Gram L (2001). Diversity of *Listeria monocytogenes* isolates from cold smoked salmon produced in different smokehouses as assessed by random amplified polymorphic DNA analyses. *Int J Food Microbiol*; 65: 83–92.
- 4) Tompkin, RB (2002). Control of *Listeria monocytogenes* in the food processing environment. *J Food Prot*; 65: 709–725.
- 5) Jessen B, Lammert L (2003). Biofilm and disinfection in meat processing plants. *Int Biodet Biodeg*; 51: 265–269.
- 6) Deza MA, Araujo M, Garrido MJ (2005). Inactivation of *Escherichia coli*, *Listeria monocytogenes*, *Pseudomonas aeruginosa* and *Staphylococcus aureus* on stainless steel and glass surfaces by neutral electrolysed water. *Lett Appl Microbiol*; 40: 341–346.
- 7) Altekruse SF, Timbo BB, Mowbray JC, Bean NH, Potter ME (1998). Cheese associated outbreaks of human illness in the United States, 1973 to 1992: sanitary manufacturing practices protect consumers. *J Food Protect*; 61:1405-1407.
- 8) Vought KJ, Tautine SR (1998). *Salmonella enteritidis* contamination of ice cream associated with a 1994 multistate outbreak. *J Food Protect*; 61:5-10.
- 9) Shapiro R, Ackers M, Lance S, Rabbani M, Schaefer L, Daugherty J, Thelen C, Swerdlow D (1999). *Salmonella thompson* associated with improper handling of roast beef at a restaurant in Sioux Falls, South Dakota. *J Food Protection*; 62:118-122.
- 10) Cunningham AE, Rajagopal R, Lauer J, Allwood P (2011). Assessment of hygienic quality of surfaces in retail food service establishments based on microbial counts and real-time detection of ATP. *J Food Protect*; 74: 686-690.
- 11) Holah JT, Kearney IR (1992). Introduction to biofilms in the food industry. In: Melo LF, Bott TR, Fletcher M, Capdeville B (Eds), *Biofilms- Science and technology*, Kluwer Academic press, Dordrecht, The Netherlands, pp 35-41.
- 12) Meng JH, Feng P, Doyle MP (2001). Pathogenic *E. coli*. In: Downes FP and Ito K (Eds), *Compendium of methods for the microbiological examination of foods*, APHA, Washington DC, USA, pp 331-341.
- 13) Andrews WH, Flowers RS, Silliker J and Bailey JS (2001). *Salmonella*. In: Downes FP and Ito K (Eds), *Compendium of methods for the microbiological examination of foods*, APHA, Washington DC, USA, pp 357-380.
- 14) Lampel KA (2001). *Shigella*. In: Downes FP and Ito K (Eds), *Compendium of methods for the microbiological examination of foods*, APHA, Washington DC, USA, pp 381-385.
- 15) Kaysner CA, DePaola A (2001). *Vibrio*. In: Downes FP and Ito K (Eds), *Compendium of methods for the microbiological examination of foods*, APHA, Washington DC, USA, pp 405-420.
- 16) Costerton JW, Cheng KJ, Gessey GG, Ladd TI, Nickel JC, Dasgupta M, Marrie TJ (1987). Bacterial biofilms in nature and disease. *Ann Rev Microbiol*; 41: 435-464.
- 17) Mattila-Sandholm T, Wirtanen G (1992). Biofilm formation in the food industry: a review. *Food Rev Int*; 8: 573-603.
- 18) Carpentier B, Cerf O (1993). Biofilms and their consequences, with particular reference to hygiene in the food industry. *J Appl Bacteriol*; 75: 499-511.
- 19) Yang-En-Tan S, Chew SC, Yang-Yi Tan S, Givskov M, Yang L (2014). Emerging frontiers in detection and control of bacterial biofilms. *Curr Opin Biotechnol*; 26: 1-6.
- 20) Anon (2006). Examination of the microbiological status of food preparation surfaces. In Anon (Ed) *Food safety authority of Ireland, Dublin*, p. 5.
- 21) Teja GK (2012). Ninety taken ill in Patiala. *The Tribune* dated 13th July, p 8.