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The occurrence of indicator bacteria on hands and aprons of food handlers in the delicatessen sections of a retail group

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Abstract

Despite an increase in the number of food handlers receiving food hygiene training, a high number of food poisoning outbreaks still occur as a result of improper food handling practices in the retail industry. In this study, samples were collected from the hands and aprons of food handlers in the delicatessen sections of a prominent South African retail group and analysed for the presence of total viable counts (TVC), total coliforms, *Escherichia coli*, members of the family Enterobacteriaceae and *Staphylococcus aureus* in order to assess the levels of contamination and to establish possible relationships. Noteworthy TVC were present on 98% of hands and 84% of aprons sampled and conformed to the national standard of 1×10^2 cfu cm^{-2} without exception. Coliforms were present on 40% of food handler's hands and on 26% of aprons and when compared to the literature which suggests a target value of <2.5 cfu cm^{-2}, 32% of food handlers exceeded the target with regard to hands and 8% with regard to aprons. *E. coli* was found to only exceed the limit in the case of one food handler. Enterobacteriaceae were present on the hands of food handlers (44%) and on aprons (16%), ranging between 5 and 1.8×10^1 cfu cm^{-2} on hands and between 5 and 2.9×10^1 cfu cm^{-2} on aprons. *S. aureus* counts were present on 88% of hands and 48% of aprons and ranged between negligible and 9.8×10^1 cfu cm^{-2} for hands and up to 6.2×10^1 cfu cm^{-2} for aprons. No significant statistical correlation occurred between the organisms on hands and aprons, indicating that the latter were not likely to be cross-contaminated by hands.

Keywords: Food hygiene; Food handler; Retail industry

1. Introduction

Data on risk factors for food-borne diseases indicate that the majority of outbreaks result from faulty food handling practices (Clayton, Griffith, Price, & Peters, 2002). In an era of frequent travel, safe food handling practices are imperative given the potential for widespread outbreaks of food-borne illness (Lynch, Elledge, Griffith, & Boatright, 2003). Lacking personal hygiene amongst food handlers is one of the most commonly reported practices contributing to food-borne illness and poor hand and surface hygiene is also a significant contributory factor (Cogan, Slader, Bloomfield, & Humphrey, 2002; Collins, 2001). Contamination of surfaces in food premises has been shown to be associated with poor hygiene standards (Powell & Attwell, 1997; Sagoo, Little, Griffith, & Mitchell, 2003). In most countries, food-borne diseases remain a public health predicament in spite of the improvement in hygiene standards, improved food processing practices, education of food handlers and consumer awareness (Domínguez, Gómez, & Zumalacárregui, 2002).

The hands of food handlers can be pivotal as vectors in the spread of food-borne disease due to poor personal hygiene or cross-contamination (Setiabudhi, Theis, & Norback, 1997). According to Taylor, Brown, Toivenen, and Holah (2000) there is evidence from the food industry to

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show that microorganisms are transferred to the hands in the process of handling food and through poor personal hygiene after visiting the lavatory, resulting in the hands being heavily contaminated with enteric pathogens. The transmission of enteric-related pathogenic microorganisms via the hands of food handlers thus continues to be a problem in the food industry (Barza, 2004). Hand-washing, a simple and effective way to cut down on cross-contamination, is all too often forgotten (Rippel, 2002). It was reported that 42% of food-borne outbreaks which took place from 1975–1998 in the United States of America had been caused by the hands of food handlers (Ayçiçek, Aydoğan, Küçükkaraaslan, Baysallar, & Başustaoğlu, 2004).

The risk of food-borne illness due to contact with hands or surfaces depends on both the level of contamination as well as the probability of transfer and the importance of contaminated surfaces in relation to potential transmission of pathogens to food is apparent in food processing (Den Aantrekker, Boom, Zwietering, & Van Schothorst, 2003; Kusumaningrum, Riboldi, Hazeleger, & Beumer, 2003). Several studies have indicated that various bacteria, amongst others *Staphylococcus aureus*, *Escherichia coli* and *Salmonella* sp., survive on hands and surfaces for hours or even days after initial contact with the microorganisms (Jiang & Doyle, 1999; Kusumaningrum, Van Putten, Rombouts, & Beumer, 2002; Scott & Bloomfield, 1990). These microbiota have been associated with food-borne illness for decades and there is no doubt that they, together with members of amongst others the genera *Listeria*, *Campylobacter*, *Bacillus* and *Clostridium* are the cause of illness and even death to many people each year, at immeasurable economic cost and human suffering (Borch & Arinder, 2002).

A microbial indicator is a microorganism or group of microorganisms that is indicative of the possible presence of pathogens and the detection and enumeration of indicator organisms are widely used to assess the efficacy of sanitation programmes (Brown et al., 2000; Ingham, Reyes, Schoeller, & Lang, 2000; Moore & Griffith, 2002). Indicator organisms associated with hygiene practices include, amongst others, total viable counts, total coliforms, *E. coli*, members of the family Enterobacteriaceae and *S. aureus* (Department of Health, 2000). Very little data is available, however, in terms of the limits associated with the occurrence of pathogenic bacteria on hands and aprons, particularly in South Africa currently. The only national standard addresses total viable counts (TVC) on working surfaces as prescribed by the Health Regulations (Republic of South Africa, 1999). This study was therefore aimed at investigating the occurrence of indicator bacteria on hands and aprons of food handlers in a retail group and to determine the relationship between the occurrence of organisms on hands and on aprons. Because the retail group studied have not yet fully implemented a hygiene management system such as HACCP, food handlers have not received adequate training on how hand-hygiene would fit into, for example, a HACCP daily routine. Information obtained in this study was thus used to streamline training modules in terms of transfer of contaminants from hands to aprons and vice versa. The results were furthermore communicated to management in order to indicate the status of food handling practices of food handlers and to highlight the importance of contaminated surfaces in relation to potential transmission of pathogens to food.

2. Materials and methods

2.1. Pilot study

A pilot study was conducted in an outlet which was not included in the actual test sample and involved six food handlers. The purpose of the pilot study was to determine the time requirements and streamline the methodology, as it was important that the time required for collecting the samples was not perceived by the retail outlet managers to be disruptive to the normal work pattern (Walker, Pitchard, & Forsythe, 2003).

2.2. Sampling protocol

Samples from 50 food handlers' hands (indexfingers, thumbs and palms of both the left and the right hands) as well as from their aprons were collected from a random selection in the delicatessen sections of 35 randomly selected outlets of a prominent retail group in the Western Cape Province, South Africa. Samples were collected by the same surveyor on a once-off basis during working hours (week days between 10:00 and 14:00) without previous notification of nor the date or time of the survey. A total of 300 samples were collected from the hands of food handlers during the serving of ready-to-eat food and a further 300 samples were collected from the aprons of food handlers. The collected samples were stored and transported at 0 °C prior to analysis.

2.3. Sampling procedures and enumeration of bacteria

Upon entering each outlet, the manager was informed about the study and the purpose of collecting samples from food handlers' hands and aprons. After random selection of 50% of workers in the delicatessen section, Rodac plates (MERCK) containing selected agar media were used to sample the forefinger (*S. aureus*), thumb (total coliform count, *E. coli* and Enterobacteriaceae) and palm (total viable count) of the left and right hand of each worker selected. Rodac Plates containing the various media were furthermore used to sample the aprons, focussing on these areas that are predominantly exposed (six samples were collected per apron). Colonies were differentiated on appearance and colour. Since no biochemical identification systems were included, results were reported as presumptive only.

Total viable counts: For the enumeration of TVC, Plate Count Agar plates were incubated at 35 °C for 24 h (MERCK, Germiston, SA).