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### An Integrated Approach for Enhancing Food Safety in Qatar

Ipek Goktepe\*, Hammad Asim, Israa ElNemr, Patrick Irungu, Hao Feng, Hee Kyung Park, Mosbah Kushad, Sheikha AlZeyara, Mohammed AlHajri

Qatar University  
\* i.goktepe@qu.edu.qa


This study was carried out to assess hygiene conditions, food handling practices, food safety knowledge of food service providers (FSPs), and the microbial quality of food served in different food service establishments in Doha. Fifty-three FSPs were randomly selected among 200 FSPs. Face-to-face interviews with the food safety managers at each participating FSP were conducted using a survey consisting of 40-questions (demographic data on workers, HACCP training, knowledge on personal hygiene, and safe-food handling practices) in October-December 2015. In addition to survey questionnaire, a checklist was used to determine the implementation of international food safety standards by observing actual practices applied at each FSP. All FSPs who took part in the initial survey were also invited to participate in one of three one-day educational workshops focused mainly on important components of food safety management system and held in 2016. At the time of workshops, each participant was also encouraged to take part in the microbial quality assessment study. Out of 53 establishments, only 10 FSPs (2 fine-dine-in, 2 casual sit-in, 2 catering, 2 fast-food, and 2 takeaway) accepted to provide food and swab samples from their entities. At the time of each visit to select FSPs, various menu items (food cooked in a short time, ready-to-eat foods, vegetables, dairy-based deserts, sandwiches, and raw seafood, e.g. oysters) were sampled in duplicate (based on the daily menu prepared at the time of sampling) at different food preparation stages (receiving, food storage, food preparation, holding/cooking, and serving). The microbial quality of food samples (n=105) served and swabs collected from food preparation surfaces (n=58) were also assessed using select media (APC, MCA, XLT4, and LSA). The identification of positive samples was carried out using VITEK-2 system. After the microbial assessment, a follow-up survey

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consisting of 24 questions was developed to determine the impact of the educational trainings on food service providers' daily operational practices. The FSP managers who participated in the initial survey were invited by phone or email or in person to take part in the follow-up survey. Out of 53 FSPs, only 16 were available to answer the questions due to reasons beyond the control of the research team. The major reasons for a low participation were 1) several managers moved back to their country without any contact information, 2) many of them changed their jobs and there was a no way of communicating with them since they did not provide an alternative email or a phone number. The survey results indicated that average service years of FSPs was 11, the average age of food safety managers interviewed was 33, most managers (66%) had college degree, and 68% of them were trained on HACCP. It was demonstrated that casual-sit-in and fine-dine-in restaurants are the only FSP types which consistently kept records (100%), followed by fast-food (36%), and catering (14%) FSPs. The microbial analysis indicated that the average APC in food samples collected from all FSPs met the international standards, while the APC counts of swab samples were considered unsatisfactory since the levels were above  $10^6$  Log<sub>10</sub> CFU/cm<sup>2</sup>. The highest bacterial count was reported in swab samples (7.26 Log<sub>10</sub> CFU/cm<sup>2</sup>) collected from preparation area in takeaway restaurants. Concerning the target organisms (*Escherichia coli*, *Salmonella* spp., and *Listeria monocytogenes*), among 105 food samples and 58 swab samples collected, 13 samples (8%) exhibited positive results for possible target pathogens. Positive samples were identified as *Klebsiella pneumoniae*, *Klebsiella oxytoca*, *Pseudomonas aeruginosa*, and *Pantoea* spp. Overall, the participants were highly satisfied (average score:  $4.39/5 \pm 0.20$ ) with the information presented in the training workshops held in 2016, indicating that the workshops helped improve their knowledge on food safety; change their attitudes towards safe handling foods, and inform them about the changes on food safety laws and regulations in Qatar. These results provided insight information on the aspects of behavioural changes that confirm the value of intervention studies. One important note which is important to mention that the participating managers indicated that they need open communication between the policymakers and the FSPs to be able to make sure that they will not be left behind if there is any changes/updates on food safety rules and regulations applied in the country. This issue is going to be addressed by posting constant updates on GSO (food safety standards applied in Qatar) on the website recently developed and hosted under the Ministry of Public Health website. Results obtained in this study might help food safety managers in these select FSPs to better understand the need for implementing effective control measures in order to prevent contamination and eventually protect the public health.