

Small and micro enterprises – aspects of knowledge, attitudes and practices of managers' and food handlers' knowledge of food safety in the proximity of Tygerberg Academic Hospital, Western Cape



Division of Human Nutrition, Stellenbosch University, Tygerberg, W Cape

Maritha Marais, BScDiet, DipHospDietet

Nelene Conradie, BScDiet

Demetre Labadarios, MB ChB, PhD, FACN

Objective. This study determined hazard analysis and critical control point (HACCP) awareness among managers of food-producing small and micro enterprises (SMEs) as well as selected aspects of the knowledge, attitude and practices of respective food handlers regarding food safety.

Setting. SMEs within a 30 km range of Tygerberg Academic Hospital.

Methods. SMEs were divided into two categories: those providing food to clients at risk of illness ($N = 64$) and to clients free of illness ($N = 81$). SMEs were randomly selected and managers/employees completed validated questionnaires regarding HACCP (145 managers) and food safety (159 food handlers).

Results. Only 6% of managers reported awareness of HACCP being mandatory in South Africa. More than 70% of managers and food handlers had received no formal training regarding food safety. The perception that food safety control should focus on general cleanliness still prevailed among 57.2% of managers. Food handlers achieved an unsatisfactory score (46.0%) on the basic principles of food safety. Ignorance among food handlers regarding important risk factors was as follows: ways of identifying contaminated food likely to cause food poisoning (77.5%), period of keeping prepared food safe (50.9%), correct way of cooling food (63.1%) or reheating food (84.9%), reason for checking date codes (68.1%) and use of a thermometer (90.6%). There was no significant difference in the results obtained between food handlers in SMEs providing food to healthy clients or clients at risk of illness.

Conclusion. Creating awareness and understanding of HACCP among managers of SMEs and education regarding the control of risk factors remain crucial.

The increasing number of restaurants is an indication of a growing tendency to eat in places other than at home. In some cases, meals served at these establishments are implicated in foodborne disease outbreaks.^{1,2} Adequate protection of the consumer from foodborne illness can be achieved by inspection and personnel training based on good manufacturing practices and hygienic food preparation. Moreover, the application of a systematic approach, such as the hazard analysis critical control point (HACCP) system, to the identification, evaluation and control of food safety hazards must be carried out to achieve food safety.³⁻¹⁰ In this regard, HACCP principles and associated legislation are currently being incorporated within all commercial sectors of the food supply chain, as appropriate.¹⁰ In South Africa, HACCP is in the

process of becoming mandatory, and a regulation concerning the use of HACCP has been published.¹¹

HACCP is an important tool in combating the worldwide escalation of foodborne disease. Yet, despite wide dissemination and support of these principles, successful HACCP implementation has been limited. Scientific evidence of unacceptable public health risks is the accepted criterion in determining HACCP applications.¹² However, when implementing HACCP, it is difficult to distinguish between realistic and unrealistic hazards.⁹ Theoretically at least, HACCP can be applied in all sectors and segments of the food chain, but, for certain segments of the food chain, the utilisation of standard sanitary operating procedures (SSOPs) may be more appropriate,^{8,13} which must be developed by a food company in order to provide

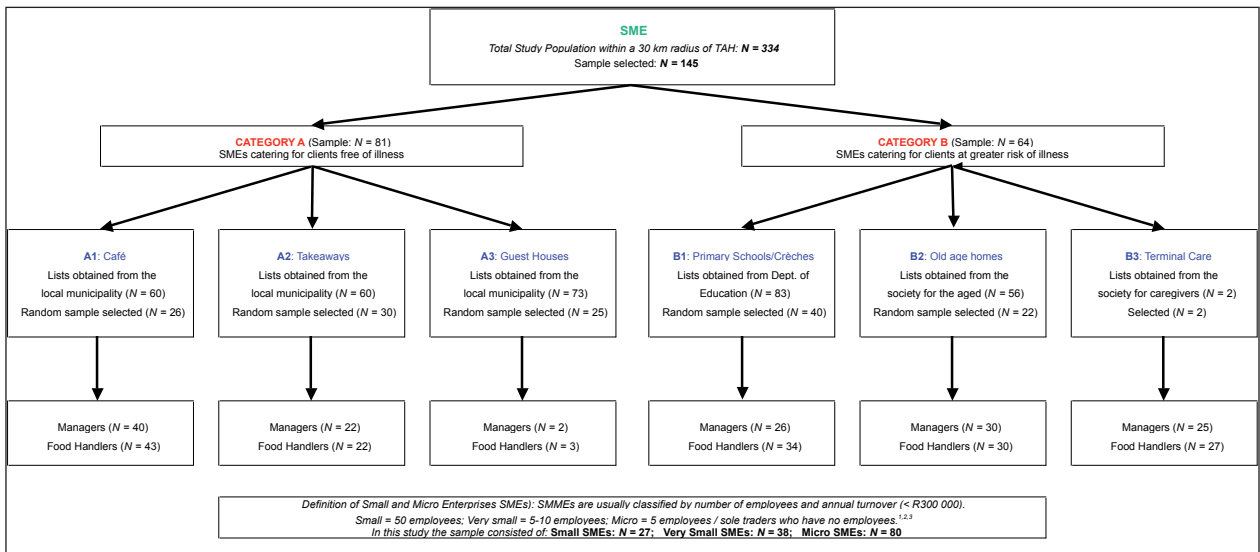


Fig. 1. Diagrammatic representation of sample population (N = 145).

a solid foundation for HACCP implementation.^{8,13} Good manufacturing practices (GMPs) include such aspects of food production as employee and facility hygiene practices, food handling practices, facility and equipment design, processing, control measures, storage and distribution.^{8,13-15}

It is in the interest of all food producers, manufacturers, distributors, retailers and regulators to formally manage good hygiene practices. In practice, however, the adoption of adequate hygiene standards by small businesses has been slow. In this regard, the provision of adequate guidance to small and micro enterprises* (SMEs)^{5,6,14,19} to ensure microbiologically safe products at the point of consumption is a difficult endeavour. Additionally, the natural occurrence of pathogens on raw materials of animal and vegetable origin is often compounded by unreliable water supply, poor temperature control and lack of even rudimentary knowledge of applied food microbiology.^{14,20,21} In this regard, the mission statement of the Codex Alimentarius Commission includes the provision of guidelines for the entire sector of food and catering enterprises worldwide with Codes to enable the supply of unconditionally safe food. The microbiological safety of products offered by SMEs can gradually be enhanced by introducing these guidelines in the form of the 'attention points' concept. In this way, the mental preparedness to pursue further improvements can be stimulated.¹⁴

Against this background, the aim of this study was to investigate selected aspects of the knowledge, attitudes and practices of managers and food handlers with regard to HACCP and food safety in the SMEs food service units in close proximity to the Faculty of Health Sciences, Stellenbosch University, situated next

to Tygerberg Academic Hospital (TAH) in Bellville, W Cape.

Methodology

The study was of a descriptive, analytical design employing convenience sampling of SMEs within 30 km proximity from TAH, representing two categories of facilities and six sub-groups (Fig. 1). Category A (three sub-groups: cafés, take-aways, guest houses) consisted of SMEs catering for clients free of illness, whereas category B (three sub-groups: primary schools/ crèches, old-age homes, terminal care units) catered for clients at greater risk of illness, so that very strict implementation of food safety practices is needed. SMEs managed by catering companies or state-owned facilities as well as franchises, factory outlets, butcheries, bakeries, dairies, delis and street vendors were excluded from the study.

Lists of SMEs, old-age homes, crèches and primary schools were obtained from the local municipality, society for the aged, society for care givers and the department of education, respectively. Facilities that complied with the inclusion criteria were identified and divided into the sub-groups (Fig. 1). A random sample was drawn from each sub-group of the two SME categories to ensure even distribution of all sub-groups throughout the selected area.

Four groups (N = 6 per group) of 4th-year dietetics students from Stellenbosch University were appointed as fieldworkers and collected the data over a period of 2 weeks. The fieldworkers were informed of the aim of the study, trained in the sampling design of the study, the completion of the study questionnaires and standardised in terms of interviewing techniques.

Students visited randomly selected SMEs according to a predetermined schedule. They determined whether

* Definition of SMMEs (small, medium and micro enterprises): SMMEs are usually classified by number of employees and annual turnover (< R300 000). Medium = 100 employees; small = 50 employees; very small = 5 - 10 employees; micro = 5 employees/sole traders who have no employees.¹⁶⁻¹⁸

a facility was an SME (according to the definition) and whether the manager was willing to participate and allow the SME to be included in the study. If the manager did not wish to participate or allow the SME to be included in the study, the fieldworkers selected the next SME on the list. After obtaining written informed consent for participation in the study, questionnaires were completed as appropriate.

Two pre-tested, self-administered, multiple-choice questionnaires (managers' and food handlers' questionnaires), were designed from the available literature.^{7,14,15,19-33} These were used to firstly determine selected aspects of knowledge, attitudes and practices of SME managers regarding HACCP and food safety including enforcement of legislation, training in food safety and hygiene, HACCP awareness, knowledge and perceptions of food safety, hygiene and food quality as well as constraints managers experienced in the implementation of hygiene principles. Measuring instruments consisted of closed-ended questions, four-point Likert scale and five statements to investigate perceptions regarding food safety, hygiene and food quality. The statements were:

- Continuous training and reinforcement of hygiene principles is cumbersome.
- Food safety control should focus on the general appearance, structure and cleanliness of food outlets and this will successfully deal with the problem of foodborne illness.
- There is no money to be made out of food safety, it only incurs expenses.
- It is necessary to do microbiological tests to determine the level of hygiene in my facility.
- Food quality is only important when something goes wrong.

Secondly, the food handlers' questionnaire investigated knowledge regarding ways of identifying contaminated food likely to cause food poisoning, personal hygiene, high-risk food groups, temperature control, cross-contamination and cleaning/sanitation procedures (using closed-ended questions with one mark allocated to every correct answer).

A pilot study was performed to test the face validity of the questionnaires and to assess clarity of questions, candidate instructions, layout and time requirements. SMEs used in the pilot study were excluded from the main study. Each manager of an SME and 10% of the food handlers (usually 1 or 2 from each SME) completed self-administered questionnaires *in situ* under the supervision of the fieldworkers.

The study was approved by the Committee for Human Research of the Faculty of Health Sciences, Stellenbosch University. Respondents were assured of

confidentiality in their participation and the responses were kept anonymous. Participation was voluntary.

Statistical analysis

Excel (Microsoft Office 2003) and Statistica 7 (StatSoft. Inc (2004) (data analysis software system), version 7, www.statsoft.com) was used to analyse data. One of the researchers entered the data, which were checked by another researcher and cleaned by the statistician. Descriptive statistics as well as the Pearson chi-square test ($p < 0.05$) was used, as appropriate, to analyse the results and compare the difference in knowledge, attitudes and practices of managers as well as food handlers' knowledge of food safety between respondents in SMEs categories A and B. Only differences that were statistically significant ($p < 0.05$) are reported in the results.

Results

In total, 145 SMEs participated in the study (Fig. 1). According to the SME definition, the majority of SMEs were micro-enterprises (category A: 48.4% and category B: 61.0%), while only 17.7% in category A and 19.5% in category B were small enterprises. The remaining SMEs were very small enterprises (see footnote, p. 52).

Managers' questionnaire

A total number of 145 questionnaires were completed by the managers from SMEs (category A: 64 and category B: 81 (Fig. 1). Thirty-two per cent of participants in category A indicated that they were the owner of the SME, the majority were female and 65.6% were ≥ 40 years of age (Fig. 2a). By contrast, 63.8% of participants in category B were the owner of the SME, the majority were male and 41.3% were in the age group ≥ 40 years (Fig. 2a). Both categories of SMEs were mostly managed by participants with > 5 years experience in the food service industry (category A: 66.7% and category B: 61.3%). A large percentage of the managers reported that they did not have any formal food safety training (category A: 68.8% and category B: 75.5%)

Enforcement of legislation

The majority of managers in both categories (category A: 68.8%, category B: 67.9%) indicated infrequent or seldom visitation from an environmental health officer (EHO). Of those SMEs which had been visited ($N = 110$), only 45.1% had received a written report on the aspects that were assessed, namely hygiene practices of workers and hygiene conditions of the facility (74.0% and 94.4% respectively). Also, 98.1% of the SMEs that received a report indicated that the report was favourable and 83.3% indicated that the recommendations in the hygiene report were helpful.

Training in food safety and hygiene

The majority of SMEs provided in-house training to their employees in hygiene (65.9%). Nevertheless, 31.2% of the SMEs in category A and 16.3% in category B did not provide any training at all with no significant difference between the two categories. In both categories A and B the reasons for not providing any training included: 'staff were fully trained' (6.2%, $N = 9$); 'there was no time to do so' (2.7%, $N = 4$) or 'hygiene was not something that needed to be taught' (4.8%, $N = 7$). Importantly, 43.2% of the SMEs at schools and crèches (group A1: $N = 16$) did not provide any training when compared with 13.6% in the case of old-age homes (group A2: $N = 3$).

HACCP awareness

The majority of managers had never heard of HACCP before (category A: 68.7%, $N = 44$ and category B: 71.6%, $N = 58$), with only 6.2% ($N = 4$) in category A and 3.7% ($N = 3$) in category B reporting that they thought they had sufficient knowledge of HACCP. Very few managers, only 7.8% ($N = 5$) in category A and 7.4% ($N = 6$) in category B, said they understood and/or used the CCP decision tree¹¹ to determine whether a food risk should be controlled. It is also important to note

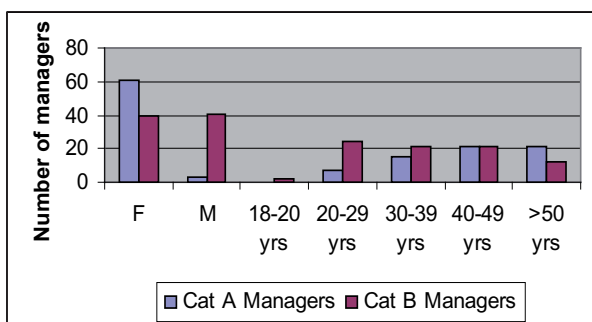


Fig. 2a. Gender and age distribution of managers of SMEs ($N = 145$) included in the study. NB: There was no significant statistical difference between male and female managers for all variables.

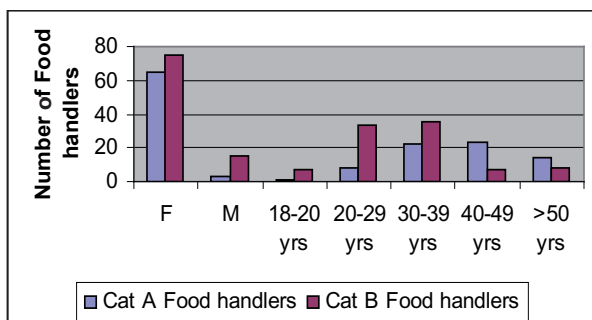


Fig. 2b. Gender and age distribution of food handlers ($N = 159$) included in the study. NB: There was no significant statistical difference between male and female food handlers for all variables.

that only a minority of managers (category A: 10.1%, $N = 7$; and category B: 2.5%, $N = 2$) were aware of the fact that HACCP is in the process of becoming mandatory in South Africa, and that regulation concerning the use of HACCP had been published. Owing to the small number of respondents statistical analysis in this case would not have been meaningful.

Knowledge and perceptions of food safety, hygiene and food quality

Managers ($N = 145$) were asked whether they agreed or not with five statements regarding food safety, hygiene and food quality (Fig. 3). Forty-four per cent strongly disagreed with the statement 'continuous training and reinforcement of hygiene principles is cumbersome' while 57.2% fully agreed with the statement 'food safety control should focus on the general appearance, structure and cleanliness of food outlets and this will successfully deal with the problem of foodborne illness'. Furthermore, 47.6% of managers disagreed with/had doubts about the statement 'there is no money to be made out of food safety, it only incurs expenses'. Importantly, 19.6% of managers fully agreed with the statement 'it is necessary to do microbiological tests to determine the level of hygiene in my facility' and 46.9% strongly disagreed with the statement 'food quality is only important when something goes wrong' (Fig. 3). No significant difference in opinion was found between the two categories. In general, managers in

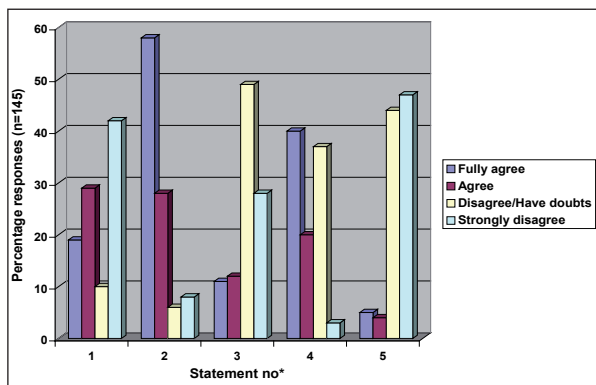


Fig. 3. Managers' attitude towards food safety, hygiene and food quality ($N = 145$).

*Statements:

1. Continuous training and reinforcement of hygiene principles is cumbersome.
2. Food safety control should focus on the general appearance, structure and cleanliness of food outlets and this will successfully deal with the problem of foodborne illness.
3. There is no money to be made out of food safety, it only incurs expenses.
4. It is necessary to do microbiological tests to determine the level of hygiene in my facility.
5. Food quality is only important when something goes wrong.

this study exhibited a positive attitude towards food safety, hygiene and food quality. In view of the fact that category A represented the vulnerable study population, it was noteworthy that 81.3% of those managers reported that their staff were motivated and committed to a hygienic working environment, which was significantly different ($p = 0.034$) from category B (65.4%).

Constraints managers experienced in the implementation of hygiene principles

More than half of the managers did not experience any of the constraints in the implementation of hygiene principles referred to in the questionnaire (Table I). In

category B, however, 50.5% ($N = 41$) did experience difficulties with access to information regarding hygiene as a constraint ($p = 0.018$). Managers believed they did not need to change their practices because they produced safe food 'at the moment' (category A: 59.4%, $N = 38$; and category B: 59.2% $N = 48$). Ninety-six per cent of all managers believed that it is important to determine the factors that actually cause foodborne illness, and half of all participants (50.7%) confirmed that a re-arrangement of infrastructure could improve the food safety of meals served in their SME. With regard to the latter, 85.9% and 93.8% of managers in category A and category B respectively were convinced that they implemented and maintained good to very good hygiene practices in their facilities

Table I. Constraints experienced by managers to the implementation of hygiene programmes (N = 145)

Constraint	Category A	Category B	p-value
	(N = 64) Yes	(N = 81) Yes	
Rapid staff turnover or high levels of seasonal staff	9 (14%)	23 (28%)	0.038
The practice of rotating employees between tasks	13 (20%)	29 (36%)	0.041
Lack of expertise regarding the systematic approach to the identification and evaluation of food safety hazards	22 (34%)	31 (38%)	0.628
Limited access to information regarding hygiene	20 (31%)	41 (50.5%)	0.018
Lack of motivation and commitment by employees	12 (19%)	28 (35%)	0.034
Lack of funding for technical expertise, validation and verification, etc.	30 (47%)	31 (38%)	0.297
Reduced workspace leading to cross-contamination between raw and cooked food	14 (22%)	33 (41%)	0.015
Reduced number of employees to cope simultaneously with continuous monitoring of food safety as well as the food service operations	14 (22%)	31 (38%)	0.034
Basic lack of hygiene knowledge and understanding	15 (23%)	35 (43%)	0.012
Recruitment from lower socio-economic classes with low educational levels	22 (34%)	38 (47%)	0.127
There is no need to change because we produce safe food already	38 (59%)	48 (59%)	0.988
I have a busy day-to-day existence and long-term planning is a non-essential activity	15 (23%)	19 (23%)	0.997
Suppliers do not comply with specification	9 (14%)	26 (32%)	0.011
It is important to determine factors that actually cause foodborne illness	63 (98%)	76 (94%)	0.195
A re-arrangement in infrastructure could improve safety of meals served	28 (44%)	44 (55%)	0.182

* $p < 0.05$ = significant difference between category A and category B.

(Fig. 4). According to the results (Table I), the following constraints posed significantly less problems for managers in category A than category B:

- Rapid staff turnover or high levels of seasonal staff ($p = 0.038$)
- The practice of rotating employees between tasks ($p = 0.041$)
- Lack of motivation and commitment by employees with respect to food safety ($p = 0.034$)
- Reduced workspace leading to cross-contamination between raw and cooked food ($p = 0.015$)
- Reduced number of employees to cope simultaneously with continuous monitoring of food safety as well as the foodservice operations ($p = 0.034$)
- Basic lack of hygiene knowledge and understanding ($p = 0.012$)
- Suppliers do not comply with specification ($p = 0.011$).

Food handlers' questionnaire

A total of 159 questionnaires were completed by food handlers (category A: $N = 68$ and category B: $N = 91$) (Fig. 1). The majority of food handlers in both categories was either a cook or performed a combination of tasks in the SMEs (Fig. 5). Food handlers were mostly female (category A: 95.5% and category B: 82.4%). In category A the majority (86.7%) of food handlers were ≥ 30 years of age, while in category B 75.5% were 20 - 39 years of age (Fig. 2b). The majority (37.5%) of food handlers in category B had between 1 and 5 years' experience in the food industry but in category A such experience was distributed evenly (29.8%, 32.8% and 29.8%) between the categories of 1 - 5 years, respectively 5 - 10 years and ≥ 10 years. Only 27.8% of all food handlers reported that they had received formal hygiene training and of those more than half said that it was longer than 2 years preceding the date of this study (category A: 52.6% and category B: 56.0%).

The mean number of questions on basic aspects of hygiene answered correctly by food handlers was below 50% (category A: 45.5% and category B: 46.5%) (Fig. 6). For both SME categories, the most poorly answered question (percentage of correct reply given by $\leq 25\%$ of the food handlers) related to temperature control (Q19, 20, 21), knowledge regarding micro-organisms (Q2, 4) and the wearing of gloves (Q9). The most satisfactorily answered question (percentage of correct reply given by $\geq 75\%$ of food handlers) addressed general cleaning procedures (Q7, 10, 11, 12). Nearly all food handlers knew that they should not be allowed to handle food when they had any symptoms associated with foodborne disease, and 94% knew that

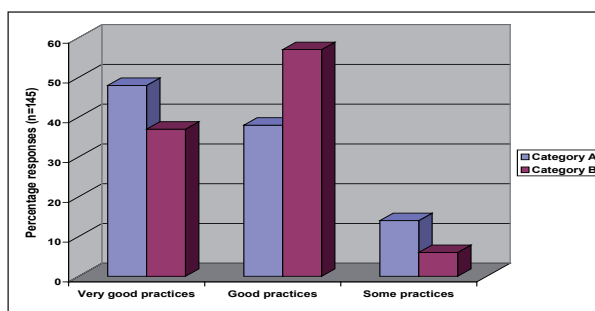


Fig. 4. Managers' perception that their SME implemented good hygiene practices ($N = 145$).

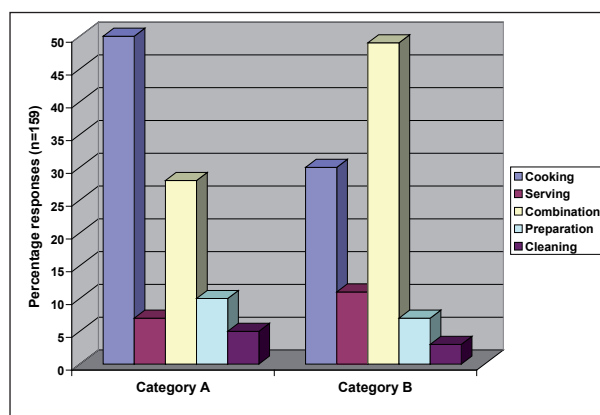


Fig. 5. The tasks/activities included in the job description of food handlers ($N = 159$).

diarrhoea was a common symptom of food poisoning. There was no significant difference in the results obtained between food handlers in SMEs providing food to healthy clients or to clients at risk of illness.

Discussion

Implementation of HACCP in SMEs at times poses serious practical problems and the challenge to provide suitable information remains a reality. Lack of evidence regarding the situation in South Africa, led to this investigation of selected aspects of the knowledge, attitudes and practices among managers and food handlers at SMEs regarding food safety and HACCP.

In this study only 6.2% of all managers were aware of the fact that HACCP is in the process of becoming mandatory in South Africa and that regulations concerning the use of HACCP had been published. This apparent lack of awareness and enforcement may be a contributory factor to SMEs being deprived of a valuable source of information and guidance from environmental health officers.^{22,23,24} The findings in this study correspond with the reported increasing evidence that the use of HACCP is limited within small companies, which are less likely to invest in hygiene and food safety than larger companies and are less likely to have HACCP plans in place.^{8,10,25,34}

Small businesses may lack in-house knowledge and resources to identify foodborne microbial hazards

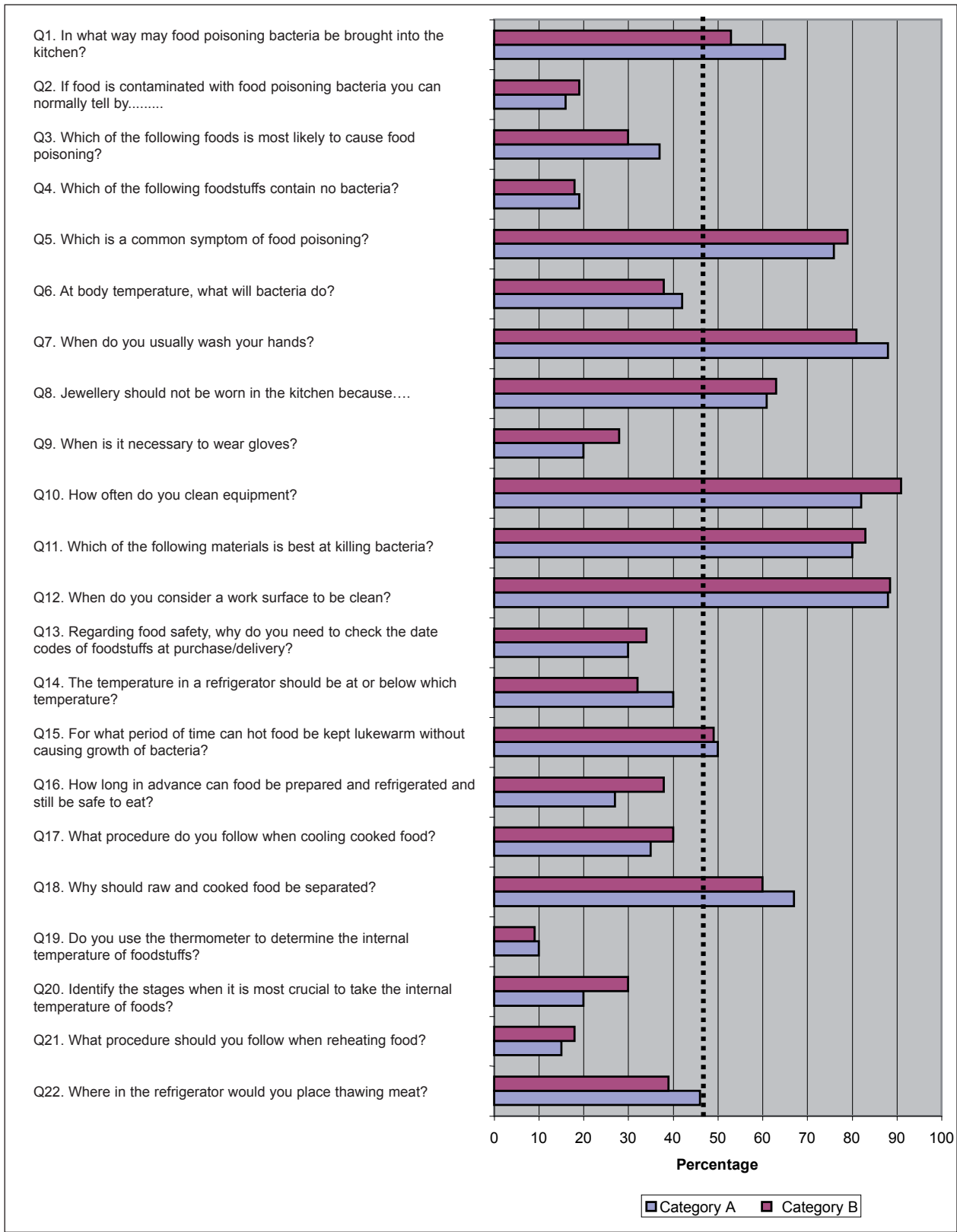


Fig. 6. Food handlers' knowledge regarding food safety, food quality and hygiene (N = 159). (Mean score attained = 46%; dotted line.)

and therefore correctly implement HACCP.^{6,20,24,25} However, the successful use of GMPs would appear to result in safe and wholesome food products.^{8,19,22} Generally, managers believed that food hygiene was significant only when something went wrong as they perceived their business to be at low risk

of foodborne disease. This may be due to lack of knowledge and understanding, creating a barrier to accurately assessing the risk posed by their business and providing appropriate hygiene training for their staff.^{20,24,26} It is important to convince SMEs that the traditional era of 'safety by inspection' has now been

replaced by an integrated HACCP system.^{14,20} It is of concern that 57.2% of managers still carried the traditional perception of food safety, namely that food safety control should focus on the general appearance, structure and cleanliness of food outlets and this will successfully deal with the problem of foodborne illness. Barriers to practising food safety should be removed by creating an understanding of the perception of microbiological risks and persuasion to control these.^{14,20,23,26,27} This paradigm shift can only be achieved through appropriate education and guidance,^{21,26,28,29} and by creating commitment and willingness to modify existing practices.^{14,20} Contrary to other studies,^{8,10,24,25} this study confirms that lack of commitment may stem from the fact that managers have limited access to information regarding hygiene and there is a sense of false security, as reflected by the perceptions that their staff were fully trained, they did not have time, or hygiene was not something that needed to be taught (Table I).

The findings of the present study also indicate that less than one-third of all facilities (31.2% in category A and 16.3% in category B) provided training in food safety and hygiene. Although the lack of training at primary schools and crèches is disconcerting, it is however encouraging to observe that 86.4% of the old-age homes reported that they provided training. Similar to findings in other studies, 72.2% of all managers participating in this study had not received any formal hygiene training. Furthermore, such training was not done on an annual basis.^{25,26,29,30} Since training was seen as a once-off activity, refresher training was neither planned nor implemented.²⁶ More than 60% of the managers had > 5 years experience in the food service industry and Yapp *et al.* also found that experienced managers were less likely to attend food hygiene courses and they were more reluctant to use standard equipment to monitor temperatures.²⁴

Food handlers employed at SMEs have to cope simultaneously with continuous monitoring of food safety systems as well as the food service operations,⁴ but unfortunately they did not recognise that reduced workspace may lead to cross-contamination between raw and cooked food. Taylor *et al.* found standards of hygiene were better during preparation and cooking in those premises with documented hazard analysis systems.²⁸

Food handlers in both categories achieved an unsatisfactory score (46.0%) on the basic principles of food safety and although this was disappointing, it was in line with findings in other studies.^{28,29,31,35} Questions in which food handlers in this study achieved a score > 75% for both categories addressed general cleaning procedures. Ignorance among food handlers regarding important risk factors related to the identification of contaminated food (77.5%), period of keeping prepared food safe (50.9%), correct way

of cooling food (63.1%) or reheating food (84.9%), reason for checking date codes (68.1%) and use of a thermometer (90.6%). Questions in which food handlers achieved a score of < 25% for both categories were mainly related to critical control points. In line with the findings of Walker *et al.*, this study demonstrated that food handlers may be aware of the need for hygiene, such as cleaning of work-surfaces, but they did not appear to appreciate the importance of temperature control and the role of cooking and low temperature storage on the control of microbiological hazards.²⁹ Since temperature treatment is frequently the CCP in a production process, the inadequate appreciation of temperature control could be a major hindrance to effective HACCP implementation.²⁹

A major challenge in the industry is to motivate food handlers to apply what they have learnt regarding food hygiene.^{14,24,31,32,33,35} Walker *et al.* found little correlation between food hygiene training and premises food hygiene standards.²⁹ However, food bacterial loads isolated from inexperienced food handlers were found to be higher than those from experienced ones, a finding that supports the principle that inexperienced personnel should not be employed in FSUs without being well trained.^{4,31,32,33} In this regard, poor hand hygiene and improper glove use by food handlers need to be emphasised. In this study, food handlers had limited knowledge of when it was necessary to wear gloves (category A: 13.2% and category B: 5.4%). Although food handlers knew when hands needed to be washed (> 80% in both categories), in practice this remains a problem, as verified by another study which concluded that only 14% of caterers performed adequate hand hygiene practices at all times.³⁵ Furthermore, available evidence²⁸ indicates that many food handlers (80%) still mistakenly think detergents are capable of reducing bacteria to a safe level.

Practical ways of enabling SMEs to produce safer food should receive attention urgently. Simplified HACCP toolkits are being developed to encourage own auditing by SMEs.^{3,14,28,36,37} Other groups of researchers suggest the use of simplified four-step HACCP plans³⁴ or to concentrate on attention points, using 'Ten commandments of Food Safety'.¹⁴ Based on the findings, there is a need for the compulsory training of managers and food handlers in basic food hygiene and HACCP in these institutions. These must include training in the prerequisite programmes (PRPs) and GMPs prior to teaching HACCP.

Conclusion

The SMEs' apparent lack of understanding of the HACCP approach is of concern. Litigation and enforcement efforts by regulators can contribute to motivating food handlers and managers to improve current food safety practices. Courses for managers

and food handlers must create an understanding of the nature and action of micro-organisms regarding food safety. Periodic microbiological evaluation of high-risk food service operations is recommended, in addition to the current visual inspection practices in order to minimise the risk of foodborne disease outbreaks. Professionals can take the lead in the introduction of appropriate food safety training and assist in the design and implementation of HACCP plans. In this way management is encouraged to take ownership of HACCP plans and food handlers are made aware of PRPs and relevant HACCP principles.

New ways of imparting knowledge on safe food handling practices can include the development of HACCP Resource Centres, improving access to information at libraries or through electronic-based sources.

The authors would like to acknowledge the assistance of the final-year BSc Dietetics students (2004), Stellenbosch University and the help of the statistician, Professor D Nel. Without the participation of the SMEs, the study would not have been possible.

1. Bean NH, Griffin PM, Goulding JS, Ivey CB. Foodborne Disease Outbreaks, 5-Year Summary, 1983-1987. *Enteric Diseases Branch Division of Bacterial Diseases Center for Infectious Diseases Summary* 1990; 39(SS01): 15-23.
2. Bean NH, Goulding JS, Lao C, Angulo FJ. Surveillance for Foodborne-Disease Outbreaks – United States, 1988-1992. Division of Bacterial and Mycotic Diseases National Center for Infectious Diseases 1996;45(SS-5):1-55.
3. Tuominen P, Hielm S, Aarnisalo K, et al. Trapping the food safety performance of a small or medium sized food company using a risk-based model. *The HYGRAM® system*. *Food Control* 2003 (in press).
4. Soriano J, Rico H, Moltó J, Manes J. Effect of introduction of HACCP on the microbiological quality of some restaurant meals. *Food Control* 2002;(13): 253-261.
5. Worsfold D. Training caterers for the new hygiene regulations. *British Food Journal* 1996; 98(6): 27-32.
6. Bryan FL. Hazard analysis critical control point (HACCP) systems for retail food and restaurant operations. *J Food Protection* 1990;(53): 978-983.
7. Lambiri M, Mavridou A, Papadakis JA. The application of HACCP in a flight catering establishment improved the bacteriological quality of meals. *Journal of the Royal Society of Health* 1995; 115(1): 26-30.
8. Report of FAO Expert Technical meeting Vancouver, Canada, Dec 1994. The use of hazard analysis critical control point (HACCP) principles in food control. *FAO Food and Nutrition*, 1995 Paper 58 (Rome).
9. Raschke A. Hazard Analysis and CCP identification. Will the real CCP please stand up! *Institute for International Research. Food & Beverage Quality Control. Hygiene & safety Compliance* (Workshop). 1997 Oct (unpublished).
10. Ropkins K, Beck AJ. HACCP in the home: a framework for improving awareness of hygiene and safe food handling with respect to chemical risk. *Trends in Food Science & Technology* 2000; 11(3): 105-114.
11. Regulations relating to the application of the hazard analysis and critical control point system (HACCP System). Regulation Gazette No. 7696 Vol. 456 Pretoria 27 June 2003 No. 25123 (No. R. 908) Foodstuffs, Cosmetics and Disinfectants Act, 1972 (Act No. 54 of 1972).
12. Gilling SJ, Taylor EA, Kane K, Taylor JZ. Successful hazard analysis critical control point implementation in the United Kingdom: Understanding the barriers through the use of a behavioural adherence model. *Journal of Food Protection* 2001; 64(5): 710-715.
13. Corlett DA. *HACCP User's Manual*. Aspen Publishers Inc, Gaithersburg, Maryland, 1998.
14. Mossel DAA, Jansen JT, Struijk. Microbiological safety assurance applied to smaller catering operations world wide. From angst through ardour to assistance and achievement - the facts. *Food Control* 1999; 10(3): 195-211.
15. Mortimore S. How to make HACCP really work in practise. *Food Control* 2001; 2(4): 209-215.
16. Act No. 102 of 1996: National Small Businesses Act, 1996. No. 1901. 27 Nov 1996 <http://www.gov.za/gazette/acts/1996/a102-96.htm> (last accessed 16 September 2003).
17. Karungu P, Marabwa E, Stettler M. Development Co-operation Report: Evaluation of ODA to the SME sector. *Department of Finance and International Development Co-operation*. June 2000. p iii, 7,14. <http://www.finance.gov.za/documents/dct/SME.pdf> (last accessed 16 September 2003).
18. Keene WE. Lessons from investigations of foodborne disease outbreaks. *JAMA* 1999; 281: 1845-1847.
19. Holt G, Henson SJ. Information for good food hygiene practise in small businesses. *British Food Journal* 2000; 102(4).
20. Panisello PJ, Quantick PC. Technical barriers to HACCP. *Food Control* 2001; 12(3): 165-173.
21. Kassa H, Harrington B, Bisese M, Khuder S. Comparison of Microbiological Evaluations of Selected Kitchen Areas with Visual Inspections for Preventing Potential Risk of Foodborne Outbreaks in Food Service Operations. *J Food Prot* 2001; 64(4): 509-513.

22. Kivela K, Lam M-L, Inbakaran R. Food safety in school catering in the People's Republic of China. *Int J Contemporary Hospitality Management* 2002; (14)6: 301-312.
23. Taylor E. HACCP in small companies: benefit or burden? *Food Control* 2001; (12)4: 217-222.
24. Yapp C, Fairman R. Factors affecting food safety compliance within small and medium-sized enterprises: Implications for regulatory and enforcement strategies. *Food Control* 2006; 17: 42-51.
25. Walker E, Jones N. An assessment of the value of documenting food safety in small and less developed catering businesses. *Food Control* 2002; 13: 307-314.
26. Worsfold D, Griffith CJ. A Survey of Food Hygiene and Safety Training in the Retail and Catering Industry. *Nutrition & Food Science* 2003; 33(2): 68-79.
27. Ehiri J, Morris G. Hygiene training and education of food handlers: does it work? *Ecology of Food & Nutrition* 1994; 6: 341-345.
28. Taylor E, Kane R. Reducing the Burden of HACCP on SMEs. *Food Control* 2005; 16: 833-839.
29. Walker E, Pritchard C, Forsythe S. Food handlers' hygiene knowledge in small food business. *Food Control* 2003; 14: 339-343.
30. Mortlock MP, Peters AC, Griffith CJ. A National Survey of Food Hygiene Training and Qualification Levels in the UK Food Industry. *Int J Env Health Res* 2000; 10(2): 111-123.
31. Ayçiçek H, Aydoğan H, Kuçukkaraslan A, et al. Assessment of the bacterial contamination on hands of hospital food workers. *Food Control* 2004; 15: 253-259.
32. Martinez-Tomé M, Vera AM, Murcia MA. Improving the control of food production in catering establishments with particular reference to the safety of salads. *Food Control* 2000; 11(6): 437-445.
33. Legnani P, Leoni M, Mirolo G, Alvaro N. Hygienic control of mass catering establishments, microbiological monitoring of food and equipment. *Food Control* 2003 (in press).
34. Snyder OP (jnr). Application of HACCP in Retail Food Production Operations. *Food Protection Trends* 2005; 25(3): 182-188.
35. Clayton DA, Griffith CJ. Observation of Food Safety Practices in Catering Using Notational Analysis. *British Food Journal* 2004; 106(3): 211-227.
36. DeMirijjan G. HACCP: Retail style. *Food Safety Professional* 2003; Fall.
37. Campioli J, Cluskey M, Sneed J. Developing a Practical Audit Tool for Assessing Employee Food-Handling Practices. *J Child Nutr & Management* 2002; 1 (Spring).

COMPETITION CLICK AND WIN R500

R500 will soon be on its way to Tamaryn Reid, who took the cover photo. Why not get clicking – you may be the winner next time!

The digital photographs should be related to food and nutrition issues/activities, especially ones illustrating important topics in the southern African setting. They must be submitted electronically (**NB: minimum 300 dpi resolution**) to Emma Buchanan at emmab@hmpg.co.za with a copyright declaration that the photograph can be published in the SAJCN, and that permission has been obtained from any identifiable person or people featured. If there is any story or background that adds to your picture's interest, please send it too and if we use the photo we will find space for it!

The photographs will be evaluated by a panel of artists, whose decision will be final.