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A review of the needs and current applications of hazard analysis and critical control point (HACCP) system in foodservice areas

Yi-Mei Sun [a,*], H.W. Ockerman [b]

[a] Department of Food and Beverage Management, Leader University, Tainan 709, Taiwan
[b] Department of Animal Sciences, The Ohio State University, OH 43210, USA

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Abstract

The reported food related illness per year was 76 millions cases in the US [Food Control 13(6–7) (2002) 363] and 9.4 millions in the UK [Food Control 14 (2003) 169], and this data indicated that there are still needs for improvement in the food production chain. The food service area is one of the last hurdles for food items in the food chain and, millions of people eat out or utilize catering services each year which stresses the need for an improved system of food safety in food service. Also, in the food service area, especially in small or medium size food business there visually appears to be a tremendous need for a better system than is currently in place.

Research [Food Control 14 (2003) 169; Food Control 11 (2000) 447] showed that education with knowledge of food safety and proper food handling are needed and will help the food service personnel (workers and managers) with a better understanding in food service and better hygiene practices which resulted in safer foods. Besides, risk assessment, HACCP has been applied in most of the food production areas. For most of the food chain, HACCP is mandatory by law and government's regulations. There appears to be needs for applying Pre-requisite Programs (PRP) [Food Control 14 (2003) 169; Irish J. Agric. Food Res. 39 (2000) 221] and later HACCP in food service areas to ensure the safety of food consumption in the total food chain [Food Control 12(3) (2001) 165] since a chain is no stronger than its weakest link. This paper will discuss the needs, current applications and the prospects of HACCP in food service areas.

Keywords: HACCP; Foodservice; Food safety

1. Introduction

The most common bacteria that cause foodborne diseases in US are *Salmonella* (378 cases in 2003), pathogenic *Escherichia coli* (272 cases of *E. coli* O157:H7 in 2002 and 74 cases in 2003), *Campylobacter* (126 cases in 1997 and 268 cases in 2002), etc. Over 325,000 people are hospitalized each year and there are up to 5000 deaths in the US—mostly children and the elderly (http://www.outbreakinc.com/Resources/). The onset times of most sickness and their syndromes are different due to the species involved, the health conditions of hosts, and the amounts of bacteria (can sometimes be less than 100 cfu/g) or toxins consumed. However, sickness can usually be observed from a few hours to 2 days, or more after consumption. Thus, it is difficult to trace the causes and the sources of many gastrointestinal illnesses. Gastrointestinal infections, a growing problem worldwide, can be a major concern if customers or consumers became ill as a result of foods from catering or foodservice. These types of cases usually involve large numbers of consumers instead of several isolated individuals. The reported foodborne illness cases per year were 76 millions in the US (Tauxe, 2002) and 9.4 millions in the UK (Walker, Pritchard, & Forsythe, 2003). It was also reported in a combined statistics results from USA, UK and The Netherlands which indicated that up to 70% of food illness were associated with catering or foodservice functions (Griffith, 2000) which indicated the importance of food safety in the foodservice areas.

Food safety is one of the most important aspects in foodservice operations but usually receives the smallest

* Corresponding author. Tel.: +1-614-688-5696; fax: +1-614-292-2929.
E-mail addresses: ysun30@mail.leader.edu.tw (Y.-M. Sun), ockerman.2@osu.edu (H.W. Ockerman).

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amount of visibility and attention (Manask, 2002). However, the needs to ensure food safety have caused a lot of public concerns. It has been suggested that the food should be safe from harmful substances from farm to fork and since foodservice is the last or almost the last steps of food preparation, it guards the final linkage of food safety for the public in the operational food chain. Thus, it is very important to maintain safety of the food that is served by the foodservice areas.

HACCP was established 30 years ago, and has become the universally accepted method for increasing food safety and have been adopted for food assurance in many food areas (Griffith, 2000). However, due to the complexity of foods, and the preparations involved in foodservice, it is harder to monitor and control the food safety in this segment of the industry. The structures and the varieties (the locations, on the street or stores; the various sizes; the type of foods that they serve) in several foodservice areas, are the factors that make foodservice unique and different from food manufacturing. Also, it is different to apply HACCP from big businesses to small businesses and try to control the safety of food that they provide because the variations in size of the operations can be tremendous. Several researches had concluded that improper food handling and/or storage techniques need to be improved and changed, in order to decrease foods that caused illnesses (Manask, 2002). This can be accomplished by education and applications of HACCP which has proved to be the best methods to achieve this goal.

2. Hazard analysis and critical control point (HACCP) system

End point testing is not a good way to ensure food safety (Walker et al., 2003), because by the times the results are obtained, the food has been served and consumed and hard to trace or recall. Therefore, more procedures must be taken during the processing and by monitoring the processing procedures with a HACCP system that has been proven to be a more acceptable procedure. Food safety programs of the past tend to correct the hazard conditions after they have happened. The HACCP approach is to control problems before they happen (McSwane, Rue, & Linton, 2003) during processing and/or serving. By following the procedures of safe food production with the HACCP system, foodborne illnesses will be reduced and safer foods will be served.

Hazard analysis critical control point (HACCP) was introduced to foodservice by Minnesota Foodservice Quality Assurance program in 1974 (Rivituso & Snyder, 1981). This technique is a hazard preventive concept and method that has been used to control food processing procedures by identifying the hazards of food production and their critical control points, etc.; and furthermore, to ensure food safety by controlling the hazards and reducing the risks. Walker and Jones (2002) stated that the use of HACCP is an approach for the prevention and control of foodborne diseases by identifying hazards and risks at every stage of the food production and determine where controls are needed.

Hazards can be things that cause harm (Griffith, 2000), and they can be biological, chemical, or physical in nature (McSwane et al., 2003). During the hazard analysis step, risk should be estimated. Hazards that have little or no risk, or unlikely to occur, can often be monitored and controlled by standard operation procedures (SOPs; routine employee hygiene practices, cleaning procedures, etc.) and good manufacture practices (GMP) and need not necessary be critical control points addressed by the HACCP system (McSwane et al., 2003). But significant hazards that might occur during processing will need to be monitored and addressed as CCPs. There are seven standard principles of the HACCP system recommended by the FDA Food Code (McSwane et al., 2003). They are (1) hazard analysis, (2) identify the critical control points (CCPs) in food preparation, (3) establish critical control limits (thresholds) which must be met at each identified critical control point, (4) establish procedures to monitor CCPs, (5) establish the corrective action to be taken when monitoring indicates that a critical limit has been exceeded, (6) establish procedures to verify that the HACCP system is working, and (7) establish effective record keeping that will document the HACCP system.

HACCP has been applied in meat processing areas and packing plants for the purposes of food safety. The elements of HACCP application were listed in the papers by Mortimore (2001). The HACCP program can monitor food production from raw materials and follow the food through processing to end products and even as far as serving based on controlling time, temperature, and specific factors that are known to contribute to foodborne disease outbreaks (McSwane et al., 2003). In foodservice, the application of HACCP is similar to that in food manufacturing, more types of food items are used and often mixed in the process at the same time. With the smaller operating spaces and the possible tight operating time during rush hours, it is harder to control the operating procedures and more chances for possible cross-contaminations.

3. Applications of HACCP in foodservice

HACCP has been introduced to foodservice by Bill Vomvoris, a foodservice director, in 1987 (King, 1992). FDA had also acknowledged that a HACCP system in manufacturing plants differs from the HACCP system in the foodservice areas due to the fact that foodservice

contains more hazards mainly due to the time and procedures involved from the preparation of foods to serving. The handling and assembling, holding time and temperature, reheating procedure, and serving hygiene of personnel are all factors that make foodservice operations unique and different from food manufacturing. Seward (2000) suggested the need to have a more flexible HACCP for foodservice because the sizes of foodservice (including small and large businesses) operations vary tremendously.

A flexible HACCP system is more suitable for foodservice operations which due to the complexity of their recipes, menus, food varieties, and amounts involved in the operation varies tremendously for different types of foodservice operations. Large foodservice units can be big restaurants, hotels, nursing homes, schools and hospital cafeterias, health-care centers, etc. that serve more variety of food to hundreds of people at meal times; and smaller units such as cafés, snack or sandwich bars, coffee bars, kiosks, carts and etc. (Manask, 2002) which serve limited variety of food to less people.

Proper kitchen layout and flow charts of food productions are the first two things that need to be considered before implementation of HACCP in foodservice. Kitchen design and operation according to HACCP concepts (Hopkins, 1991) will help in HACCP implementation and applications. Kitchen layout must support physical segregation during storage and preparation with one-way flow of the food processing after hygienically facilities are established (Kang, 2000). Examples of kitchen layout and processing flow charts can be obtained from the report by Snyder (1986).

A general and simplified example of food preparation and production flow chart (generic flow diagram for catering operations) was illustrated by Griffith (2000) in Fig. 1 along with possible CCPs in the process. The most commonly used CCPs in kitchen operations are cooking, cooling, reheating, and hot/cold holding (McSwane et al., 2003). The processing flow chart (Fig. 1) can only be applied for certain foods, since not all foods used and prepared in restaurants are alike. Therefore, for HACCP application in foodservice, the first task is to list the food served in the menu and find the hazard locations and list them on the flow chart for the food preparation and then determine CCPs for the types of foods that pose hazards (McSwane et al., 2003) as is illustrated in Fig. 1. By listing the foods served, and finding the possible CCPs and the control limits, monitoring the CCPs and taking corrective actions if problems occur (in case of deviations from CCPs), and then validating the HACCP plan and keeping records to document on HACCP worksheets will help to establish a HACCP program that will assist in producing safer product.

HACCP program need to be established for each food product preparation and this should contain the flow chart as well as standard operation procedures that need to be accomplished (ex. receiving, storage, cooking, serving etc.), type of hazards (physical, chemical or biological), control methods, control limits, monitoring frequency and documentation, corrective actions when limits are exceeded, and the personnel who is responsible (Seward, 2000; Soriano, Rico, Molto, & Manes, 2002). Soriano et al. (2002) also provided detailed examples of processing flow charts and HACCP worksheets for two cooked food items, and one worksheet example is illustrated in Table 1. According to the menu served, what types of food are prepared in the kitchen; is the food ready-to-eat (RTE), ready-to-use (RTU) or need to be cooked; what is the storage condition; after cooking, chilling or hot-holding before serving; all of these needed to be considered and recorded on worksheets which is the basic procedures that need to be considered before implementation of HACCP in foodservice (Bryan, 1981).

FDA emphasized the role of Pre-Requisite Program (PRP) for the implementation of HACCP (Griffith, 2000). The concepts of Pre-Requisite Program (PRP)

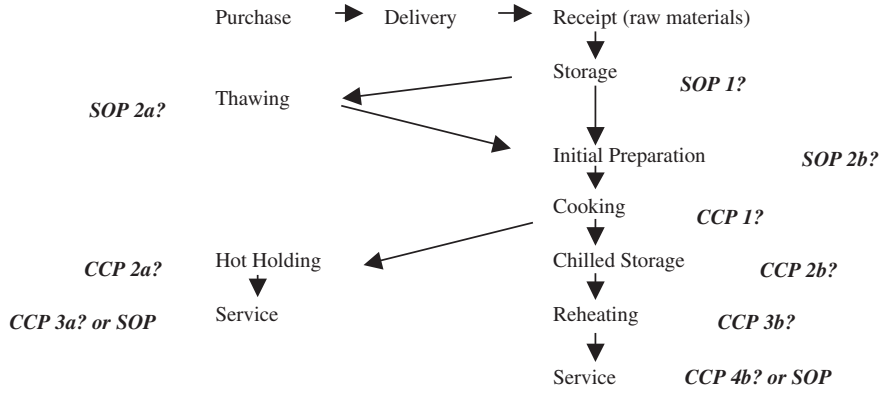

Fig. 1. Generic flow diagram for catering operations (Griffith, 2000) with possible (?) SOPs (standard operating procedures) and CCPs (critical control point) listed.

Table 1
HACCP worksheet for critical control points in university restaurants: Spanish potato omelet (Soriano et al., 2002)

Item	Hazard	Control	Limit	Monitoring frequency/ documentation	Action (for exceeding limits)	Personnel responsible
1. Receiving	Chemical	Certified supplier with HACCP program	Specified tolerance for each item	Certificates of conformance for each lot	Reject as supplier	Receiving or designated operator
2. Storage at room temp	Physical	Compliance with raw material specifications	Free of foreign materials	Operator check	Eliminate product	Storaging or designated operator
3. Refrigerated storage	Biological	Temperature records Produce disposition records	Product temperature of $\leqslant 3$ °C	Record product temperature each shift Continuous monitoring of storage temp	Place product on hold (i.e. retain, release or destroy) Adjust temp according to specification and evaluate risk	Storaging or designated operator
4. Frying	Chemical	Temperature	$\leqslant 180$ °C	Check temp	Investigate temp/ time abuse and evaluate risk	Cooking operator
		Heating time	Avoid intermittent heating	Check heating time		
5. Cooking	Biological	Temp/time control specifications	$T^a > 80$ °C during a $t > 10$ min	Check temp Check time	Adjust T^a/t of cooking	Cooking operator
6. Slicing	Biological	Good handling practice	Using clean utensils Good hygiene Use gloves	Observe procedures	Modify procedures	Cooking operator
7. Hot-holding display	Biological	Temperature and time control specifications	Internal $T^a > 70$ °C Time of display <4 h	Measure T^a of holding display	Increase T^a	Serving or designated operator

T^a: specific temperature (minimum) for cooking; t: specific time (minimum) for cooking.

and how it will benefit HACCP had been reported by Wallace and Williams (2001). It has been recommended that before HACCP is utilized, a Pre-Requisite Program is needed (Seward, 2000). If the PRP are not used, there probably will be a waste of resources and money and might cause more resistance for future utilization and HACCP system implementation. PRP, which support HACCP plan, also called standard operating procedures (SOP), includes good personal hygiene (employee hygiene practice), cleaning and sanitation programs (environmental hygiene practice), proper facility-design practices, equipment-maintenance, and supplier selection and specification programs (cross-contamination control) (National Restaurant Association Educational Foundation, 2002, Chap. 9, p. 3). The study done by Walker and Jones (2002) claimed that poor implementation of pre-requisites for food safety caused sicknesses in this food business and they suggested that the establishment of PRP could provide a solid foundation to develop HACCP. PRP includes various practices in kitchen, such as ingredient and product specifications, staff training, cleaning and sanitation procedures, hygienically designed facilities, etc. (Walker et al., 2003). Specific food handling and sanitation practices, prevention of cross-contamination, even employee and environmental hygiene can be recognized as future CCPs. However, many of these are difficult to measure and monitor, and document. Therefore, many food establishment operators currently see them as standard operating procedures (SOPs) or ''house policies'' rather than CCPs (McSwane et al., 2003). Thus, PRP is important and should be in place before HACCP is established. The relationships of PRP and HACCP combined together for a total food safety and quality management system were listed by Mortimore (2001) and are illustrated in Fig. 2.

There are some useful examples of worksheets in helping food safety and to assist HACCP establishment. Seward (2000) suggested the methods that the McDonald's Corporation used can be a good example to increase food safety. First, make a food safety daily checklist based on HACCP; second, establish monthly food safety checklist; third, manager training on food safety; fourth, crew training on food safety; and last, use

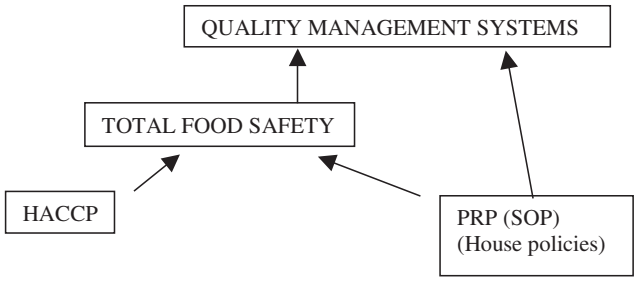

Fig. 2. Food safety within a quality management program (Mortimore, 2001).

a 0.5 micro water filter to ensure the water source is potable. Norton (1992) also suggested a qualified first-aid and medical service (e.g. handy phone numbers) should be on site and local health inspectors can be of assistance with a HACCP program.

4. Present studies of HACCP in foodservice areas

The reasons for using a HACCP system can be due to customer demands, self improvement, and legal compliance (Mortimore, 2001). Bryan (1990) reported in his investigation about the lack of usage of HACCP systems in the retail food and restaurant operations and suggested this was the most important factor and was responsible for many foodborne illnesses between 1973 and 1982 in the USA.

Hazard analysis was conducted for the street venders in a resort town of Pakistan (Bryan et al., 1992), and *Salmonella* was found in many samples. They concluded that the problems were caused by the re-contamination from either cutting boards, knives and/or hands of the vendor, as well as improper holding and inadequate cooking. It was suggested that health agency personnel, vendors and consumers need to be informed and take proper preventive actions. The microbiological quality of ready-to-use (RTU) vegetables was investigated in health-care food service (Odumeru et al., 1997). Samples were taken after 24 h of processing for various vegetables and salads being stored at 4 and 10 °C. It was recommended that strict control of storage temperature at 4–5 °C was a very important factor in maintaining the quality of vegetables.

Four school food delivery systems were evaluated by Avens, Poduska, Schmidt, Jansen, and Harper (1978) and their results suggested that educational programs were needed for workers in foodservice sanitation and food safety. Another case of food for 16 school canteens or cafeterias prepared by six food contractors in Bahrain, UK was investigated (Ali & Spencer, 1996) in the areas of preparations, cooking, delivering, and sales. No cooling systems were used in delivery trucks. It was suggested that the safety of food sold in school should focus on contamination by workers who handled food in addition to proper cooking and holding temperatures.

A successful input indicated that the applications of HACCP also helped to improve a Greek catering service in reducing the aerobic colony counts and *E. coli*, *Staphylococcus aureus* and *Salmonella* in the foods (Hatakka, 1998). Martinez-Tome, Vera, and Murcia (2000) checked the safety of salads in four school kitchens by sampling and collecting their salads, then presenting the results to the employees, and then educating and training the kitchen workers. After that, a decrease of microbial population was observed. This also indicated that the knowledge of hygiene practice of food handlers can be a CCP. The foods safety and knowledge and attitudes and the culture and environment impact on hawkers in Malaysia were also studied (Toh & Birchenough, 2000). They found the education levels as well as their culture and environment reflected hawkers' knowledge and attitudes towards food safety. Also, it was reported that trained personnel had significantly higher visual scores in their investigation of 70 out of 350 food service operations in Toledo, Ohio (Kassa, Harrington, Bisesi, & Khuder, 2001).

The microbiological quality of 1012 hot meals prepared by 33 countries that were served on aircraft from 1991 to 1994 was monitored by Hatakka (1998) from Finland. He found that the microbial conditions of many samples exceeded the acceptable standards recommended by the Association of European Airlines (AEA) and the numbers were considerably varied due to countries where the foods were prepared. Because of the extensive handling and extend hours from production to service for foods of airline catering, they are very susceptible to foodborne outbreaks. The implementation of HACCP have helped to improve the safety of in-flight foods greatly was also reported by Kang (2000). For the cases reported in the foodservice areas from school to flight catering to street venders, shows the need of HACCP and improvements in food safety.

Improper food handling is responsible for 97% of foodborne illness associated with catering (Griffith, 2000). The main ineffectiveness of utilizing hazards and problems of monitoring temperatures (especially at cooking) and cross-contamination resulted from poor cleaning practices were reported by Walker and Jones (2002). The survey conducted by Walker et al. (2003) indicated that poor results (60%) for the implementation of HACCP in small and medium size food businesses in UK centered around their temperature control and record keepings.

Griffith (2000) reported that there are food safety problems which involved working personnel in food safety implementation within the catering industry. The problems identified were: (1) high turnover of staff; (2) low staff pay; (3) low statue of staff; (4) large number of part-time workers; (5) staff language problems and/or

low educational levels; (6) often little attention to quality assurance; (7) large number of complex meals; (8) majority of food often served/prepared to meet short periods of high demand at mealtimes; (9) current fashion for visually "artistic" dishes requiring increased handling; (10) provision of food to large numbers of vulnerable consumers; (11) poor access to food safety information; and (12) facilities and equipment often cramped and inadequate. Above all, high job turnover and large numbers of part-time workers were the major problems with the training of those food handlers.

Lack of time and expertise were also claimed by some catering managers (Walker et al., 2003) that indicates the urgent need for education of managers and personnel in the foodservice areas. All of these problems lead to difficulties in providing accurate and appropriate hygiene information. One of the major problems is that the food workers often lack interest and they often have a negative attitude toward safety programs (Griffith, 2000).

The major risk factors associated with general outbreaks of foodborne illness (Bryan, 1990; Griffith, 2000) are summarized in Table 2. The data from Table 2 showed that incorrect storage had been improved through the past 10 years (from 103% to 28%). The types of catering locations and the food illness outbreaks were also shown in Table 3 (Griffith, 2000) which indicated the significance of food safety in the foodservice areas.

In the study by Soriano et al. (2002) in a university restaurant, they found that the HACCP system did improve the microbiological quality and they claimed that the implementation of HACCP improved food safety of some university restaurants when their microbiological quality was compared before and after introduction of HACCP (Soriano et al., 2002). But they also found that the HACCP system was often not implemented correctly due to small working space and low numbers of employees. Solutions were also recommended by Soriano et al. (2002) which suggested that restaurants need to offer a documented training for personnel in hygiene, GMP, cleaning and sanitation procedures, and personal safety to avoid the problems of cross-contamination and to have an amplification of the space allocated for the kitchens and this would make it possible to increase the numbers of employees, and then accomplish the HACCP system. Ali and Spencer (1996) suggested that HACCP programs can improve the safety of food and the HACCP system must be introduced to food workers (with educational program and training) so they can understand it and use it routinely.

Table 3
Types of catering locations implicated (as %) in outbreaks of foodborne illness

Locations	Percentages (%)
Institutional catering	36
Restaurants	25
Hotels	14
Private residence	8
Others/unknown	17

5. The needs for full implement of HACCP in foodservice areas

The ultimate goal for foodservice operations is to produce and serve safe and wholesome food. The increases of food illness shows the needs of improving food safety in this food service areas, and the applications of HACCP in the foodservice area, which is the last part of the food production system before consumption (Morrison, Caffin, & Wallace, 1998). For catching up in the modern world, the HACCP system is needed for all food businesses. It was reported that HACCP systems have not yet been homogeneously implemented across all of the food industry (Panisello & Quantick, 2001). The implementation of HACCP system will help food managers to identify and control potential problems in their operation (food preparation and cleaning, etc.) and reduce the incidence of foodborne illness (McSwane et al., 2003). Norton (1992) reported that most foodservice operations have components for HACCP already in place. However, difficulties in attitudes of foodservice about food safety are mainly due to the lack of education and proper training about HACCP (Toh & Birchenough, 2000; Walker et al., 2003). In order to serve a safer food, it is necessary to make HACCP practices a daily kitchen routine (Baker, 2002) and integrate them into daily operations (Seward, 2000), as well as educating food-

Table 2
Major risk factors associated with general outbreaks of foodborne illness (Bryan, 1990; Griffith, 2000)

Risk factor	Outbreak[a] (2000)	Outbreaks in US[a] (1990)
Inadequate cooking or re-heating	33%	24%
Incorrect storage (improper cooling or hot-holding)	28%	103%[b]
Cross-contamination from unclean materials and surfaces	15%	20%
Infected food handler	12%	24%

[a] Data does not add up to 100% due to more than one factor may be implicated in any one outbreak.
[b] Over 100% due to the combined data from improper cooling and hot-holding.

service workers about HACCP and how to apply HACCP in foodservice.

HACCP is also a preferred approach to retail food safety because it provides the most effective and efficient way to ensure that food products are safe (McSwane et al., 2003). Walker and Jones (2002) stated that the UK Government is committed to require 30% of UK food businesses to implement full HACCP by April 2004. The public health objectives for the United States in the year of 2010, indicates that more preventing effects need to be done (Tauxe, 2002). In large foodservices operations it is easier to implement HACCP (Morrison et al., 1998) and it is more difficulties in small food businesses. However, there are larger numbers of small businesses foodservice operations (Morrison et al., 1998; Walker et al., 2003). For example, in UK, small food businesses are about 99% of all food operations (Walker et al., 2003) and typically 75–85% of catering businesses are likely to be owner-managed (Griffith, 2000). However, Walker et al. (2003) reported that the proposed European Union legal requirement of full seven-stage HACCP in all business probably will cause problems for small and medium sized multi-product businesses which are lacking in-house knowledge and access to experts.

Implementing HACCP in small catering operations is different. Basic principles of HACCP will need to be applied and assured safe catering (ASC) and systematic assessment of food environment (SAFE) approaches need to be established, these will allow HACCP principles to be applied in even small-scale catering operations (Griffith, 2000) in the future. Griffith (2000) reported that smaller operations are likely to find beneficial use of a generic HACCP approaches, development of one generic HACCP plan with variations. HACCP records can be used by food managers to check their flow charts and production logs to improve product safety, to assist health departments in inspection and would be very useful to the investigators if a foodborne disease outbreak occurs (McSwane et al., 2003). HACCP is a long-term project (Griffith, 2000). If foodborne illness occurred, the ability of providing food safety records (King, 1992) with a continuous process monitoring of operation can help to understand what caused the illness.

It was recommended that similar foods can have similar operating procedures which can share the same HACCP plans. A generic model of HACCP (HACCP-based model) for in-flight catering had been adapted and a customized HACCP had been developed to suit the needs of those catering meals for aircraft (Kang, 2000). However, the annually numbers of people with foodborne illness lead the UK government to support the acts of legally requiring all types and sizes of food business, excluding primary producers, to document and verify their food production processes. That suggests a five-stage HACCP needs to change to full seven-stage HACCP.

Since 1995, all proprietors of food businesses in the UK have been required to carry out hazard analysis, that included and covered five of the seven HACCP principles in the foodservice areas (Walker & Jones, 2002). Thus, most applications of HACCP in foodservice areas are currently using only five criteria (Bryan, 1990) instead of seven criteria which are using in food manufacturing plants. It has been suggested that HACCP in the foodservice needs to be flexible (McSwane et al., 2003) and the use of generic approaches of HACCP in foodservice is better for the future full HACCP implementation (Walker et al., 2003).

Even a perfectly sound HACCP system is not a guarantee of perfect food safety since some portentous hazards, critical points (personal hygiene, handwashing, etc.) cannot always be accurately monitored and corrected (Kang, 2000). For personal hygiene, there are some procedures that can be taken, (1) pre-employment health screening, (2) in-service health monitoring, (3) staff hygiene rules, and (4) hand hygiene (Kang, 2000). For cleaning and disinfections of food contact surfaces, proper wash (manual wash or machine wash) and disinfecting followed by regular microbiological testing to monitor and confirm the safety of foods is necessary.

Usually, there is no microbiological testing in food service areas and only visual methods were used to evaluate the cleanliness of the food service operation. This study emphasized that besides visual evaluations, periodic microbiological testing is needed to ensure the safety of food (Kassa et al., 2001). Supporting programs for HACCP by staff training and microbiological analysis (Kang, 2000) were suggested as well as the use of independent inspection services which is recommended to supply an operation with their own internal inspection efforts. Significant concerns of food safety in foodservice areas have increased since people eat out more and cook less at home. The studies about HACCP in foodservice areas are important because it can support the future development of hygiene legislation (Soriano et al., 2002; Walker & Jones, 2002) to provide safe foods from farm to fork (Odumeru et al., 1997).

Thus, HACCP is needed in foodservice and no doubt that the development of a HACCP in all food businesses is essential (Walker & Jones, 2002) to ensure the whole production line of the food chain is acceptable and which is necessary to improve public health. For HACCP to be effective when targeting the specific needs of the retail food establishment, it must be compatible with the products sold, the clients served, and the facilities and equipment used during food production. HACCP will contribute to overall quality assurance system (ISO 9000) in international food trade (Mortimore, 2001; Orriss & Whitehead, 2000; Wallace & Williams, 2001;

Williams et al., 2003). However, the application of HACCP in foodservice areas still poses needs for people with HACCP knowledge and management skill to really set up the HACCP system and put it to work.

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