**Review article** 



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## Implementation of hazard analysis critical control point in one of the Iranian flight catering establishment: technical barriers and strategies

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#### ABSTRACT

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Keywords: In-flight catering, Hazard analysis critical control point implementation, Technical barriers, Critical control points, Pre-requisite programs Many in-flight caterings have met their passenger's demands which are high quality hygienic food services prosperously by implementation of hazard analysis critical control point (HACCP) system in their establishment. According to this approach, one of the Iranian in-flight catering has implemented HACCP plan as well. But there are latent technical barriers which consist of all those practices, attitudes, and perceptions that can negatively affect understanding of the HACCP concept and therefore resulting improper and inefficient implementation and maintenance of the HACCP principles. They should be recognized and examined as a primary step in the improvement of any HACCP implementation strategy. These barriers are dissimilar from country to country or from production to production. In this study, applied methods for overcoming some kinds of barriers, limitations and best practices in Iranian and other foreign in-flight caterings have been scrutinized and recognized and compared with each other.

#### 1. Intoduction

Nowadays according to technical improvement of manufacturing hi-tech and larger aircraft such as Boeing 747/A and airbus A380 (A3XX) with the potential of carrying 600-800 passengers in a longer distance and emersion of new airlines with a fair price resulting in notable increase of air traveler in a way that number of passengers using airplane raise from 438 million in 1975 to 2.5 billion in 2010 annually and expected to be 16 billion in 2050 (1,2). In actual fact this highly acceptance of using air travel as an appropriate transportation system in worldwide population result in an enormous global market carrying tremendous demands on in-flight food safety (3). Also this growing procedure of air traveling has shown phenomenon of food borne diseases globalization (4). In annual report of European Union representatives of food safety has declared that 63/3% of food borne diseases came to existence were related to food services which were supplied with different kind of mass caterings (5), in otherwise according to the development of tourism industries and pervasive usage of air traveling, nowadays flight catering services has been developed as a highly beneficial industries by billions dollars profits (3), for example, LSG Company (Lufthansa Service Holding AG) by more than 30,000 employees and 52 branches worldwide had 2/3 billion euro income by producing 490 million portions of meals (1). In light of supplying a variety of food services in different parts of the world by this kinds of caterings, priority of implementing a control system which assures the food safety of passengers is obvious (6).

Kitchens which provide required meals services for airline passengers during flight journeys are reprehensive of mass catering but they have their own specifications and complications for preparation of airline passenger services that make different them from mass kitchen of big hotels and restaurants. Time duration between preparations of the meals inflight catering and their consumption in an airplane by according to limited space, cooling and heating equipments of galley has caused it to be a

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food preparation operation with high safety risk. Furthermore, intricacy and multi-stepping of production procedure increases microbiological hazards associated with this kind of food preparation operation.

The fundamental factors effects on production of in-flight meals are consisted of:

- 1. Production volume
- 2. Variety and complexity of in-flight service

3. The number of airlines receiving service as customers

4. The number of flights which each airline need to be serviced by catering

5. Duration of each flight which effects on the volume of on board services.

Due to the fact that each airline own its specific service, the handling of multiple contracts increases the complexity and hardship of planning and control (7). Generic process flow diagram inflight catering is demonstrated in figure 1 (8). Food poisoning which can effects directly on flight safety has been a matter with long historical back ground that sometimes resulted in flight pilot and crew incapacitation (9). Since 1947-2006, 43 outbreaks of food poisoning associated with air traveling were reported. Food poisoning of 9000 passengers and aircrew and death of 11 people were results of these outbreaks (3,7). A number of researchers have found that enough protection of passengers against foodborne diseases cannot be achieved by microbiological quality controls of the end products and controlling should be applied on the whole production process of the catering (10). World Health Organization, Codex International Flight Alimentarius Commission, Services Association and Association of European Airlines emphasize on application of hazard analysis critical control point (HACCP) in airline caterings as a systematic approach to achieve this target (8). Many in-flight caterings have met their passengers' demands which are high quality hygienic food services prosperously by implementation of HACCP system in their establishment (9). Considering these requirements in 2005 two well-known Iranian airlines as members of International Air Transport Association and International Civil Aviation Organization who have obligated to act upon these rules and recommendations constructed a new modern in-flight catering to supply required onboard services of Iranian and foreign airlines by taking to account all HACCP support matrix consist of:

• Pre-requisites programs (PRPs) (good manufacturing practice) be composed of cleaning, operator and environmental hygiene, plant and building design and preventative maintenance.

Calibration

- Good laboratory practice
- Incident management
- Quality management systems
- Personnel and training
- Supplier quality assurance
- Statistical process control (11)

Following these endeavors they have succeeded to achieve HACCP certification in 2007. If a scrutinized cognition of products, raw materials, processes and hazardous agents for consumers' food safety will be applied, implementation of HACCP will not be complicated process and by utilizing simple multi steps as below will be achievable:

1. Review of the production line and all process from the beginning to the end.

2. Determine probable points which risk can be come to existence.

3. Establish a system of control and measurement on these points.

4. Recording and documenting of all related procedures.

5. Assuring that the system is working efficiently (12).

#### 2. Critical Control points (CCPs) in in-flight catering

Codex Alimentarius Commission introduces CCPs as steps which controls should be applied on them to prevent, reduce or eliminate hazards. Indeed the target of HACCP system is concentration on controlling CCPs (13). Applied method for determining CCPs in in-flight catering has been in view of International Flight Catering Association's generic scheme as below (8).

2.1 Control on receiving raw food materials (CCP1)

All receiving raw food materials before entering to catering will be checked by considering hygienic quality (hygienic packaging, not evidences of defrosting signs in freeze products and hygienic conditions of carrier vehicle), temperature of receiving perishable raw materials (refrigerated foods shall be delivered at a maximum of 8 °C and frozen foods –18 °C) and if technical specification, hygienic condition and quality of them will be accordance to defined regulation, receiving will be permitted.

#### 2.2 Control of refrigerators temperature (CCP2)

All of the raw and cooked food materials are kept in appropriate temperature (fresh vegetable 8–10 °C, refrigerated food 4–8 °C, freeze food –18 °C) and specific chilling unit which are built according to food specification. Refrigerator gauges are monitored either by continuous automatic recording or manually at a frequency.



Figure 1. Process flow diagram - potentially hazardous foods

#### 2.3 Control of food cooking

Monitoring is implemented by checking food core temperature upon completion of cooking (by use of laser or probe thermometer or surface color change) where food has been seared according to the minimum required core temperature such as poultry 74 °C, meats 65 °C, comminuted meats 74 °C, fish 65 °C, un-pasteurized eggs 74 °C to ensure destruction or reduction to a safe level of pathogenic bacteria, viruses and parasites.

2.4 Control of post-cook chilling process

To prevent harmful growth of vegetative pathogenic bacteria during post-cook chilling

process, as quick as possible they are placed in shallow trays and inserted in blast chillers racks to achieve food core temperature from 60 °C to 10 °C within 4 h or 60 °C to 5 °C within 6 h. Monitoring is implemented by checking food core temperature at the thickest part of the meal at the start and finish of process following initiation of the chilling process.

2.5 Control of food handling (portioning, decorating, packaging, and tray setting)

To prevent the growth of pathogenic microorganisms to harmful levels during handling, food temperature must not exceed 15 °C and ambient temperature above 15 °C, if not exposure time must not exceed 45 min.

Packed meal are inserted in to trolleys which are open from both side's doors for appropriate cool air circulation up to maximum 20 h at 4 °C, kept in chilling room. To maintain cooling chain before dispatching trolleys to airplane, they should be charged by dry ice to keep the temperature at an appropriate level (must not exceed 10 °C) during transportation and handling process. In a significant number of studies great importance of time and temperature control of meal during handling and transporting from catering to aircraft has been figured (3).

# **3.** Technical barriers to implement and maintain HACCP system in the Iranian flight catering establishment

A number of agents are known as technical barriers, which consist of all those practices, attitudes perceptions that can negatively affect and understanding of the HACCP concept and therefore resulting in proper and efficient implementation and maintenance of the HACCP principals. They can come to the existence in all steps of HACCP programs as before, after and during implementation processes (6). Latent barriers to the implementation of HACCP should be recognized and examined as a primary step in the improvement of any HACCP implementation strategy. The HACCP system is applied by many in-flight catering, but the level of strengthening varies between different countries (6,14). The barriers are dissimilar from country to country or from production to production. Parts of them may be because of inside factors in individual businesses, for instance the level of knowledge or resources and others may be due to outside factors, such as the accessibility to the government or industry support (15). By documentary analytical studies on 50 HACCP implementation projects in different catering industries, their applied methods for overcoming some kinds of barriers, limitations

and best practices have been scrutinized and recognized, which the results of studies are summarized as below (3,6,16-20):

1. Education and training:

1.1. The majority of food business managers are in agreement that employee training is the biggest barrier and most likely the greatest hazard is the lack of food hygiene knowledge between employees accompanied by the force to prepare quite large quantities of food in advance, contribute to the large quantity of food-borne illness outbreaks attributed to catering industries.

1.2. HACCP guidelines were based on regulations rather than safe practical procedures for instance rules such as chill cooked food within 90 min were mostly quoted but without any practical direction on how to accomplish this in an inadequate equipped and massive kitchen's space.

1.3. Application of technical jargon in texts which are inaccessible for catering employees and owners.

1.4. Inadequate attention to deal with many critical practices such as cross contamination in guidelines.

1.5. Paying attention to what was easy to measure rather than on risk for instance regular monitoring focused on fridge temperatures but did not handle adequately other high risk measurements such as cooking time and temperature, chilling time and contact time for detergents and disinfectants.

1.6. Anticipated low technical educated catering's managers and employees to decide about technical affairs and validate them or perform a full hazard analysis.

In case studied in-flight catering, from the first year of establishing, as managing director attitude was that implementation of such a system requires highly educated employee therefore human recourses compartment employed educated young workers without any experience of working in traditional restaurant or catering, afterward training programs has been started by elementary food safety concepts and developed to "Salford model" based on the reliable concept of standard operating procedures, and termed "safe method" which are classified in five parts: cooking, chilling, cleaning, avoiding cross contamination, management control and include the general good hygiene practices (17).

2. Concerned Incomplete control of specific hazards such as important cleaning activities concluding accurate cleaning and disinfecting knives and chopping boards were not attended in the HACCP plans or pre-requisite cleaning schedules.

3. Methods were exclusively on the foundation of food safety but not considering how it could be managed in practical way for instance the function of the manager regarding supervision, responsibility and review were not well thought-out.

4. Some of in-flight catering handlers were not introduced by such a documented recording system previously, to assume that the HACCP plan does not become a paper filling, the employees in charge of measuring and recording the controls must be convinced that the system is designed to identify problems in the process rather than to identify mistakes made by their co-workers hence objective training is required. In this manner problems can be identified and corrective action taken at the opposite point.

5. Some in-flight caterings include ground catering which support required daily meal of catering's or airport's workers or other local customers, since in high season or highly unscheduled demands it will impose extra burden on catering that makes food safety and hygiene control complicated and efforts of the staff frustrated.

Wrong perception of control logic: some 6. managers and caterers lacking appropriate training believe that they can make food completely safe by using particular cleaning and cooking procedure and as long as the meal looks normal and there is no evidence of spoilage, the meal is alright to distribute and consumption. In that case, they will be less driven to adopt risk reduction tools such as HACCP (6). In this case study, applied approach to conquest this matter begins from first steps of establishing such a catering by make use of Iranian and foreign consultants who were cognizant and aware of new approach and international food regulation about food safety and HACCP concept that trace them to managing director and managers of catering in proper way. Furthermore, they delegate head of each compartment to international in-flight catering market leaders to be aware of new hygienic and safe practice procedures.

7. Variation and nature of food produced in catering: hygienic control of some kinds of meal according to their natures and process of preparation is more complicated, for example procedure of preparation of sandwiches by considering row material's variety and nature which are used, constitute more hazards, number of CCPs and need more track (21), definitely cold meals that the largest amount of direct hand-food contact occurs during preparation stages without any cooking process in any of the following steps resulted in most of food poisoning outbreaks in air travel, other important reasons consist of using highly contaminated row materials, cross contamination occurrence during preparation in keeping with or improper temperature (3,7,14). In our subject, in-flight catering to solve these kinds of matter, firstly raw materials

supplier should be certified on food safety management system and approved by catering quality assurance manager auditing, secondly by segmentation of preprocessing area in to different compartments and separating them from cooking area, cross contamination occurring will be prevented. As mentioned in numbers of studies, generally vegetables are entered in caterings are highly microbiological contaminated (3,14,22), in this case study, the receiving area of row vegetables is established out of the in-house catering and first cleaning procedure (removing of original packaging, mud and foreign body) is done there and second steps as washing and disinfecting process will be done automatically appliance preprocessing by in compartment. Fresh eggs were replaced by pasteurized liquid egg and fabric permanent piping bags took place with disposable one in confectionary (9).

Food safety requirements as a customer's 8. demand: in-flight catering customers such as international airlines oblige them to demonstrate documented evidences which approve HACCP and other requirements related to food safety are followed on a regular basis. This task is done by well instructed auditors regularly (23). In this Iranian inflight catering this barrier has been transformed to an opportunity, helps catering to improve its safety management system according to stricture European airlines in-flight catering's regulation and utilize their innovative solutions, for instance one of connoisseur European airlines for the reason that preventing food poisoning between all airplane crew, requested catering to separate the place and chefs, responsible for preparation cabin crew meals and changed the meal's recipes of captain and first officer therefore beside performing this order, catering has been known about new approach. Sometimes their requests are against Iranian health minister regulations, for example, according to regulation catering should sink vegetables in basin containing dish wash liquid detergent to remove probable Echinococcus granulosus eggs attached to leaf but following the Association of European Airlines this practice introduces chemical contamination in vegetables (8).

9. Personnel doggedness on old habits and attitudes: when new HACCP principles or other new food safety systems are established, catering employees consider systems too complicated and beyond their capabilities and persist that existing procedures have worked well during years and enabled them to produce safe food services (6). For example, during first season of training course catering's staffs did not participate at class fervently interested or did not read sanitation manual as claimed that they did not have time, also some confrontations to the recently implemented sanitation programs with employee complaining that they did not get any extra pay to study the manual and complete data collection sheets or control forms as mentioned in Robbins study (24). The policy of the surveying catering is to encourage workers by giving reward to staffs that get the best exam results and participate at each course orderly or participate in documentary procedures, more ever making training attractive, methods more practical and uncomplicated.

10. Worker's time deficiency to accomplish HACCP plan: in a vigorous and crowded establishment such as an in-flight catering, time is always inadequate, therefore it is not unexpected that people always prioritize their habitual tasks according to their own perception (6), nevertheless implementing HACCP plan in all stages requires all personnel participation and they should be trained efficiently to manage their time in such a way that in high season flight be able to handle all tasks and related HACCP system's affairs.

11. Personnel lack enthusiasm of and supervision: workers enthusiasm is an important element to sustain the HACCP system continuing to exist. Supervision is required for all of the catering personnel in order to guarantee that they follow all instructions and the HACCP system is completely operational (6,16). In case studied in-flight catering, for staff motivation, in favor of each job preferment, hygienic function and personnel cooperation in HACCP system maintenance have been scored by supervisors and head of each compartment which can be effective in appraisal and salary.

12. Infrastructure (incorrect plant layout, lack of material and poorly designed equipment): in-flight catering layout must be designed to accomplish unhindered flow of operations keeping the amount of food handling to the minimum occurrences and prevent cross contaminations. Equipments should be designed and constructed in order that cleaning, maintenance, and inspection will be accelerated. They play important roles in eliminating, preventing or controlling hazards and decrease the amount of CCPs. Implementation of HACCP is excessively complicated due to the difficulty of controlling basic sanitary standards in some in-flight caterings which have increased their productivity without the consequent expansion of their facilities and installations or are crowded with staff and machinery to satisfy high season workloads. Also applying technology and modern devices, facilitate verification, documentation steps and keeping CCPs within critical limits (6). For instances, automated computerized monitoring devices that register temperature of refrigerators, cooking process and ambient temperature of critical compartments such as cold kitchen and tray setting. However, in case studied catering all of this factors were not considered and they had to replace some equipments and devices by another ones which were cleanable according to standard procedures and more up to date. Also gradually customers and demand of services have increased, consequently they have changed primary layout and extended in-flight catering in some area as possible.

13. Total costs of HACCP system: in reality, the total cost of the HACCP system is an amount of money related to plan development, installation, application and certification of HACCP system. The largest portion of this cost was the investment in equipment, materials, or services to enable the inflight catering company to improve the PRPs and to satisfy the appropriate HACCP requirements of the system, instead of the cost of the HACCP program itself. The cost of the application of the HACCP system estimated to be rewarded by assuring the safety of the meals, better onboard services, improvement of confidence and lesser airline's passenger complaints (19). Therefore, accessibility of resources to provide the costs of HACCP is fundamental to be successful in implementing and maintaining (6).

#### 4. Conclusions and recommendations

Implementation of HACCP system in in-flight catering requires proper assessment and critical study of other food industries and in-flight catering experiences to be known about probable barriers to achieve an appropriate attitude and prospective of the HACCP plan. Taking into consideration a lot of Iranian and foreign airlines which are operating in Iran commercial air traveling, necessity of supplying a safe food services is highly demanded, as a result all in-flight catering should change traditional preparation of onboard food services and in light of PRPs (which are essential element in task of developing simple, effective HACCP system), implementation of HACCP system can assist them to achieve such a target and improve their services according to international regulations and standards, existing in this industry.

#### **Conflict of Interests**

Authors have no conflict of interest.

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