

## Research Article

### Application of Hazard Analysis and Critical Control Point in Sports Meeting Food

Mei Zhou

Shanghai Jianfeng Vocational College, 201999, China

**Abstract:** This study discusses Hazard Analysis and Critical Control Point (HACCP) theory and its effect on sports meeting food security management to provide a new way for solving sports meeting food security problems. Hazard factors in sports meeting security management are detected by identifying and analyzing potential hazard links and control strategies are put forward through combining characteristics of sports meeting food security process and analyzing critical control points. According to the good results from various management methods of one sports meeting in this city, we found that after using the HACCP management mode, the health knowledge awareness rate of workers increased to 91%, health certificate holding rate increased from 74 to 100% and dismissal rate of staffs dismissed due to “five diseases” increased from 88 to 100%, which not only saves material and financial resources, but also had better effect than traditional mode. Therefore, the control strategy of sports meeting food security should be based on food security management process and five aspects, which are food practitioner and sports meeting participants, raw materials of food, tableware, environment and methods, should be controlled. HACCP management system is an effective way for ensuring food safety and it is a reliable way to carry out a quality management system that centers on HACCP in food safety management.

**Keywords:** Critical control points, food security, HACCP system, hazard analysis, sports meeting food

## INTRODUCTION

With the development of China's economy and society, sports cause is also thriving with various scales of sports meetings and has become an important competition index of comprehensive national power. In the meantime, food security draws international attentions because of continuous food safety accidents. As an event that clustered with a lot of people, sports meeting's food security is concerned with athletes' health, competitive condition and the process of match. Therefore it is getting more and more attention. Sports meeting has characteristics like high-clustered people, big mobility of people, complicated composition of people, etc. Therefore, food security management of sports meeting must be combined with these characteristics instead of stiffly using other food management modes. HACCP is a step or process that when measures are taken in this step, hazard of food can be prevented, eliminated or reduced to an acceptable level (Xinjian, 2012). At present, foreign countries are trying to widely apply HACCP theory in the process of food production and also trying to strengthen food security management of sports meeting. The study of HACCP application in food security management of sports meeting is good for improving food quality, reducing food security risk and thus can save management cost, provide management methods for sports meeting food security management

department and also has reference significance for its application in other fields.

Nowadays, scales of sports meetings are expanding and participants are increasing by years. Facilities of gymnasiums are improving and more and more people are having meals in the canteen of gymnasium in concentrated times, which means food security issue is more and more severe that one problem in food will influence a large number of people and is directly related to eaters' health and the process of sports meeting. Many hidden dangers that will cause food security accidents have been found during daily supervision such as incomplete examination of canteen's sanitation and unreasonable function layout, operational process and health facilities of canteen. HACCP system was established by American food producer and American spaceflight planning department in the early 1970's (Jun, 2013). With its continuous application in catering industry after the establishment, it becomes an important research field in China and abroad. Liu Chunju *et al.* (2013) and Yan (2014) applied HACCP theory to instant food soybean production. Based on the comprehensive analysis of Chinese and foreign HACCP software, Kaiyi (2010) and Chunju *et al.* (2013) systematically integrated HACCP planning management of key points and control points comparison and applied it to a hotel's food security control. Food security problems severely influence customers' life safety and cause wild public attention. Food safety is a system engineering which

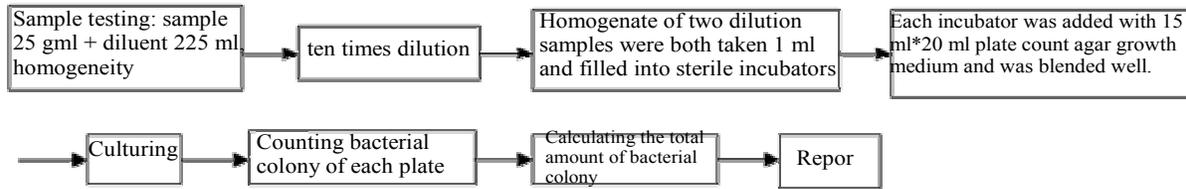


Fig. 1: Measuring process of the total amount of bacterial colony

starts from farmlands and ends on tables which means customers should develop safe food consumption habits (Kaiyi, 2010) and HACCP system should be applied to sports meeting food safety to make sure what people eat are healthy and keep them away from diseases.

## MATERIALS AND METHODS

**Research objects:** One sports meeting of this city was taken as the research object and it had about three thousand participants including athletes, workers and spectators. All people dined in canteen and were mainly served with Chinese meals. The area of the canteen was about 400 m<sup>2</sup> and the total numbers of seats were 380.

**Research contents:** First, the relevant information of the gymnasium canteen should be known. Questionnaires and HACCP system were used to investigate workers' hygienic knowledge level before and after management to observe their sanitary habits (Hua and Gang, 2009). Health certificate of workers in canteen and demission of staff with "five diseases", i.e., dysentery, typhoid, phthisis, infectious hepatitis and infectious skin disease were also inspected and it mainly included numbers of people that had physical examination, numbers of qualified people and numbers of demission (Qiongbo and Yongyi, 2010). Another inspected thing was procurement and certificate demanding of raw materials which includes inspections of production or business certificate and operating license of manufacturing enterprise and operating agency, examining report or laboratory sheet of products in same bath, inspection and quarantine report of meat products, etc., (Shihong *et al.*, 2009).

The second step was to investigate people's satisfaction in sports meeting. Complaints from workers, athletes and spectators to canteen were inspected mainly to see the change of content.

The third step was to supervise and inspect various aspects and the inspecting steps were tableware disinfection examination, investigation of qualified rate of microorganism on workers' hands and inspection of sanitary quality of cooked food.

**Research methods:** According to theories and procedures of international food law, a HACCP schedule that was appropriate to the canteen's characteristics was made and was contrast analyzed before and after implementation. The food processing flow chart was made first and then critical points of HACCP schedule were ensured.

**Sampling examination and test methods:** Coliforms of tableware should be measured first. According to GB14934-1994 standards, disinfected tableware were picked 5 to 10 pieces randomly each time and every piece of tableware was stuck with two testing papers. Coliforms testing papers were moistened with stroke-physiological saline solution and were stuck to inner side of tableware immediately. After 30 min, they were taken down and put into sterile plastic bags. Sampling papers stayed in normal temperature for about 17 h. If the testing papers stayed in blue, then it was coliforms negative and if they turned into yellow and had red spots or flush, then it was coliforms positive.

The second step was the measurement of microorganism on workers' hands. According to GB15982-1995 standards and measurement of microorganism on medical workers' hands, people that being inspected should close five fingers together and their fingers were wiped with stroke-physiological saline solution soaked cotton swab from finger roots to finger tips twice. After that, the part of cotton swab that had been held was cut off and the rest of cotton swab was put into a test tube filled with 10 mL sampling solution

The third step was the measurement of bacterial colony in cooked food. According to GB4789.2-2010 standards, the measuring process of the total amount of bacterial colony has been shown in Fig. 1.

The fourth step was the count and inspection of coliforms in cooked food. According to GB4789.3-2010 standards, coliforms in cooked food were counted and measured by using MPN counting method.

**Statistical method:** All data were statistically analyzed by SPSS 18.0 and hygienic knowledge awareness rate of workers, change rate of behavior, qualified rate of sampling tests before and after HACCP were compared by chi-square test.

## RESULTS

**The flow chart of processing technique:** After on-site inspection and analysis of gymnasium canteen, the production and processing flow was made according to different processing methods and it was verified on site later to ensure its accordance with actual production (Xiuhua, 2011). Following is the flow chart of production and processing (Fig. 2).

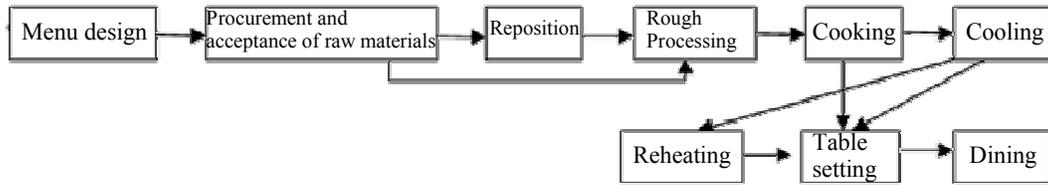


Fig. 2: Flow chart of processing technique

Table 1: Comparison of workers' awareness rate of hygiene laws before and after HACCP system

	Sample number	Qualified number	Qualified rate (%)	$\chi^2$	p
Before implementation	40	20	50	21	<0.01
After implementation	45	41	91		

Table 2: Health certificate transaction and dimission of workers before and after the application of HACCP

	Number of workers	Number of staffs undergoing physical examination	Patients with "five diseases"	Number of staff dismissed due to "five diseases"	Number of staffs with health certificate
Before implementation	142	122	17	15	90
After implementation	140	140	15	15	125

Table 3: Micro-bioassay testing results of workers' hands before and after the application of HACCP

	Sample number	Qualified number	Qualified rate (%)	$\chi^2$	p
Before implementation	42	22	52	3.9	<0.05
After implementation	50	40	80		

**HACCP schedule table:** Critical Control Points (CCP) were ensured according to The Guide to Hazard Analysis and Critical Control Point System and its Application and critical limit and CCP monitoring system were established to make sure the effectiveness of the HACCP system.

**Contrast analysis before and after HACCP system:**

Questionnaires were designed to check workers' hygienic knowledge and full mark was 100 and pass mark was 80. After the application of HACCP system, the awareness rate of hygiene laws was more than twice than before and the difference was statistically significant (Table 1).

The application of HACCP system increased awareness of managers and enabled them to be sensitive to problems, which improved food issues and raised health certificate holding rate from 74 to 100% as well as dimission rate of staffs dismissed due to "five diseases" from 88 to 100% (Table 2).

On the basis of workers' current health and sanitary condition, their hands were tested by using micro-bioassay. Hands of workers in canteen were sample inspected and details are listed in Table 3. Here  $\leq 10$  cfu/cm<sup>2</sup> means qualified.

After the application of HACCP, the requirement for food was higher which increased the qualification rate of food procurement and acceptance. Therefore, the control of CCPs and the application of HACCP both significantly improved food quality. The overall trend of complaint was declining after implementing HACCP system and 50% of respondents were satisfied about canteen and the rest of them were approximately satisfied. The analysis result of canteen tableware showed that after the application of HACCP, the

qualification rate was increasing and statistical tests indicated that the qualification rate of coliforms increased, which had significance. Cooked food that was kept in servery less than 2 h was tested. Besides, after testing, aerobic bacterial count and coliforms were qualified according to national testing standards and pathogenic bacterium were not found, which means cooked food was safe to eat within 2 h.

**DISCUSSION**

HACCP, also known as hazard analysis critical points, is a logical and systematic system which confirms, analyzes, evaluates and controls the possible biological, chemical and physical harms in the process of food production (Zhujun, 2011). In the meantime, as a scientific and systematic method, it is wildly applied in real life and gradually evolves from a kind of management method into a management system along with the continuously widening application fields. HACCP is a food safety guarantee system that can increase efficiency and save manpower and material resources. Taking food safety risk management as the idea, based on HACCP food safety system, this study discerns and accesses food safety risk and uses effective management to control food risk within an acceptable range to ensure sports meeting food security. Based on HACCP theories, the sports meeting used the HACCP system that was appropriate to catering industry and perfectly guaranteed food security, which proved the effectiveness of HACCP system in food security of big events. HACCP is gradually becoming an international food sanitary safety management system (Sharma *et al.*, 2011; Kafetzopoulos *et al.*, 2013; Wallace *et al.*, 2014) and provides manufacturing enterprises and regulatory

authorities with the most ideal safety monitoring and control method. It is very necessary to widely apply HACCP management system in catering industries. However, there are certain difficulties. Gymnasium canteen has better health facilities and higher management level that they can execute intervening measures pretty well. However, it is difficult for most of the middle and small-sized restaurants to carry out HACCP management system because most of them take profits as their biggest goal and are lack of correct business conception. Most of them have large staff mobility and the workers are usually less educated which means intervening measures cannot be well executed. Risk management technology is becoming one of the important research objects in the field of food regulation (Xiongzhou *et al.*, 2011) and the introduction of it to food safety supervision is good for food regulation decision. Also, it can reasonably arrange limited supervision power and increase the efficiency and level of regulation. Food risk index is based on the category of catering industry, business scope and other food safety related factors and by the means of effective management and can control the food risk within an acceptable range.

In HACCP system, products, technologies and process links have specificity that different products have different hazards, same product using different technologies will have different hazards and same product with same technology will have different hazards in different process places. The diversity of gymnasium canteen products, complexity of technologies and lack of relevant standards and norms will cause difficulties in wide application of HACCP system in catering enterprises, school canteen, etc. The outdated food security management philosophy of managers, big investment to HACCP system, staff training and update of facilities will all cause increasing in cost, which will result in poor subjective initiative of HACCP system implement. Besides, there are no relevant laws and regulations in China to support the application and popularization of HACCP system. The implement of HACCP system in canteen needs large amount of money as well as the development of relevant facilities and later maintenance that too much cost makes popularization of HACCP system become difficult. The application of HACCP system can effectively control various contaminations and hazards in food process and processing environment. It can control most of the food security issues, make the canteen management more scientific and standard as well as raise the supervision level of hygiene administrative department.

### CONCLUSION

After including canteen in the research, the sanitary control level of the canteen increases significantly and

hygiene habits and health awareness of workers improve a lot. Health certificate transaction and workers dismissed due to “five diseases” increase as well. After sampling tests, qualified rate of certificates in procurement and acceptance of canteen raw materials increase and the difference has statistical significance. Complaints about food and satisfaction from people all improve. Aerobic bacterial count and coliforms in cooked food are effectively controlled.

### REFERENCES

- Chunju, L., L. Dajing, W. Haihong *et al.*, 2013. Application of hazard analysis and critical control point in instant food soybean production. *Jiangsu Agric. Sci.*, 41(5): 237-239.
- Hua, W. and D. Gang, 2009. Establishment and application of HACCP in the university refectory. *Mod. Prev. Med.*, 36(12): 2291-2292.
- Jun, L., 2013. Application of HACCP System and Remote Monitoring System in School Canteen. Soochow University, Soochow.
- Kafetzopoulos, D.P., E.L. Psomas and P.D. Kafetzopoulos, 2013. Measuring the effectiveness of the HACCP food safety management system. *Food Control*, 33: 505-513.
- Kaiyi, W., 2010. Development status and analysis of HACCP information. *Chinese Agr. Sci. Bull.*, 26(5): 309-313.
- Qiongbo, W. and W. Yongyi, 2010. Application of HACCP theory in school canteen food security. *China Med. Herald*, 7(26): 127-128.
- Sharma, A., K.R. Roberts and K. Seo, 2011. HACCP Cost Analysis in Retail Food Establishments. *Food Protect. Trends*, 31(12): 834-844.
- Shihong, H., L. Yun and T. Guoping, 2009. Application of HACCP in food security management in school. *Mod. Prev. Med.*, 36(5): 966-967.
- Wallace, C.A., L. Holyoak, S.C. Powell *et al.*, 2014. HACCP: The difficult with hazard analysis. *Food Control*, 35: 233-240.
- Xinjian, Z., 2012. Application of HACCP system in food safety of university catering service. 6(4): 24-27.
- Xiongzhou, H., Y. Guidong and W. Suwen, 2011. Application of food risk index in expo food security. *Shanghai J. Prev. Med.*, 23(6): 292-294.
- Xiuhua, X., 2011. HACCP establishment and implementation of catering enterprises. *J. Vocat. Inst. Comm. Technol.*, 2: 38-41.
- Yan, L., 2014. Application of HACCP system in hotel enterprises. *Market Mod.*, 9: 97.
- Zhujun, D., 2011. Social management of food safety. *J. Shijiazhuang Tiedao Univ. Soc. Sci. Edn.*, 5(3): 45-47.