The Nucleus ***55****, No. 4 (2018) 200-218*

www.thenucleuspak.org.pk

The Nucleus
ISSN 0029-5698 (Print)
ISSN 2306-6539 (Online)

Implementation Framework of ISO 22000 Food Safety Management System in Higher Educational Institutes (HEIs) Cafes of Pakistan

S. Shehzadi*, A. Wasim, S. Hussain, M. Shafiq and M. Jahanzaib

Department of Engineering Management, University of Engineering and Technology, Taxila, Pakistan

ARTICLE INFO

Article history:
Received : 06 March, 2018
Accepted : 11 February, 2019
Published : 19 February, 2019

Keywords:
ISO 22000,
Higher Educational Institutes cafes,
Food safety,
HACCP,
PRPs

ABSTRACT

The purpose of this paper is to develop an implementation framework of ISO 22000 FSMS in Higher Educational Institutes (HEIs) cafes of Pakistan under the requirements of ISO standard. The framework has been developed based on the requirements of ISO 22000 food safety management system (FSMS). A total number of 30 HEIs cafes were analyzed through self-observations and face-to-face interviews with the managers of these cafes. The main part of the questionnaire comprises 41 questions about plan, 66 questions about do, 3 questions about check and 6 questions about act section. The findings of this research show that no cafe has been found to follow ISO 22000: 2005 FSMS requirements. Regarding status, 13% (4) of the cafes were found in poor while 86% (26) at moderate level. None of these cafes had Hazard Analysis Critical Control Point (HACCP) system and documentation related to any point. The prerequisite programs (PRPs) were found good in cleaning, sanitation and layout of the premises. However, PRPs were weak in training and documentation. HEIs cafes should be more focused and interested towards the implementation of ISO 22000 standard requirements to provide safe food to students and staff. In conclusion, the proper implementation of prerequisite programs (PRPs) can help organizations to lead implementation of HACCP system. Providing proper training and knowledge related to food safety practices will be helpful for the organizations to provide safe and quality food to customers.

1 Introduction

Safe food is the basic requirement of everyone for having a healthy and balanced life. Our health is directly related with the nutrients we take through our daily diet. Food safety has become a major health concern in today's life. According to the World Health Organization (WHO) report, food borne diseases are a growing issue for all societies leading towards many common challenges regarding food safety and human health [1].

Food borne illnesses are a potential threat and key challenge in developing countries [2]. WHO has reported that more than 200 diseases are caused by unhygienic food [3]. Human health is adversely affected due to biological, chemical and physical hazards [4]. These hazards are mostly caused due to lack of personal hygiene, improper handling and storage of food, improper washing of food processing equipment and poor system of food transportation and distribution facilities [5]. Pakistan is a developing country having 194.9 million populations. According to the National Nutrition Survey (NNS) report, malnutrition is a major health problem in Pakistan. Furthermore, it has been reported that 60% of the food borne diseases are caused due to unhygienic food [6].

Food safety management systems are specifically designed to control the food safety hazards related to food products [7]. Different food safety and quality standards including British Retail Consortium (BRC), Hazard Analysis Critical Control Point (HACCP), ISO 22000, Safety Quality Food (SQF), and International Food Standard (IFS) to name a few, were designed by different organizations. These standards have international acceptance to control procedures, processes, activities and resources consorting to the requirements of these standards. Implementation and maintenance of these systems depend upon four factors: (1) education and training, (2) commitment, (3) external pressure and (4) resources' availability [8].

International Organization for Standardization (ISO) developed the food safety management system standard (ISO 22000) which has been developed for all types of organizations, to help the organizations for identification and prevention of food safety hazards [9]. But the implementation of food safety management systems (FSMS) is impeded by many factors including lack of training, large numbers of products, lack of motivation, size of company and lack of management commitment [10, 11]. This international standard specifies the requirements of interactive communication, system management, prerequisite programs and HACCP principles to ensure food safety [12, 13]. For the application of this standard, it is necessary to have understanding of prerequisite programs (PRPs), HACCP principles and procedures related to its implementation [14]. HACCP principles assessment was found better in certified food businesses; whereas, the assessment of HACCP principles were found weak in non-certified food businesses [15]. Implementation of HACCP improves the microbial quality of food [16]. Prerequisite programs (PRPs) are the programs and practices those are

*Corresponding author: sairashehzadi57@gmail.com

Table 1: Summary and comparison among different food safety management systems.

Features		Food Safety Management System				
		BRC	HACCP	ISO 22000	SQF	IFS
Scope		Processing stages	Whole agriculture food chain	Whole agriculture food chain	Agriculture and processing	Processing stages
Focus		Food safety, food quality and organizational quality	Food safety	Food safety	Food safety, food quality and organizational quality	Food safety, food quality and organizational quality
Codex principles	PRPs	✓	✓	✓	✓	✓
	HACCP	✓	✓	✓	✓	✓
ISO 9001		✓		✓	✓	✓
Legislative status		Voluntary	Compulsory	Voluntary	Voluntary	Voluntary
GFSI status		✓			✓	✓
Acknowledgement		Europe	Worldwide	Worldwide	Australia, Asia-Pacific, North and south America	Europe
Management system		✓	✓	✓	✓	✓
validation and verification		✓	✓	✓	✓	✓
Emergency preparedness/Crisis management		✓		✓		

used to produce safe food products and to reduce or minimize the risks. According to the standard ISO 22000, food industry should establish, implement and maintain the PRPs programs to reduce or prevent the likelihood of food contaminations in working environment. The standard should be appropriate to the organizational needs, size and types of operations and nature of products. Summary and comparison among existing FSMS has been provided in Table 1.

Many researchers around the globe have worked on FSMS in different food sectors. Fig. 1 provides the snapshot of the research conducted in both developing and developed countries. The countries' information has been provided on x-axis whereas different sectors have been listed on y-axis. The sectors focused in the study have been demonstrated through different symbols. For example, Lockis et al. [17] conducted a PRP based study in Brazil.

It can be observed from the Fig. 1 that little or no work has been performed in Pakistan. Several studies have been conducted in educational institutes regarding PRPs and HACCP in different countries. The PRPs were assessed in Brazilian schools and major non-conformities such as inadequate installations, waste management, water supply and sanitation and documentation were found [17]. Similar study was conducted in Portuguese school food services to evaluate the non-conformities in prerequisite programs, major difficulties were found in temperature control, cleaning and sanitizing procedures and waste management for implementation of PRPs in school food services [18]. A survey was conducted for school food service to assess the status of HACCP programs, the results indicated that most of them implemented PRPs completely and major non-conformities were found in food allergy management and food safety training [19].

Youth is the backbone of a country, the future of nations lies in the health of younger generations. Although healthy and safe food is important for everyone, but its importance is enhanced in case of students because they have to perform many cognitive and analytical activities. But unfortunately, students suffer from many diseases such as food poisoning, diarrhea, etc., due to absence of FSMS in higher educational institutions (HEIs) of Pakistan. As a result, they cannot perform well which poses a serious threat to the development of the country. The main objectives of this research are to develop the implementation framework and focus on critical analysis of the food safety system in HEIs of Pakistan as per the requirements of ISO 22000 FSMS to ensure supply of healthy food to the students.

The findings of this research could be helpful for the management of HEIs cafes to capture the requirements of this standard for making their food safety system better.

The remaining paper is structured as follows. Section 2 of the paper consists of research methodology explaining framework development, formation of questionnaire and sample selection. Section 3 discusses implementation of the developed framework. Section 4 of the paper discusses results, while section 5 is about analysis of the results. The conclusions and recommendations for future research are presented in the last section.

2. Research Methodology

2.1 Develop the Implementation Framework of ISO 22000

Research was initiated with the review of research literature in the field of food safety and ISO 22000 food safety management system (FSMS). After identification of principles and objectives of ISO 22000 from literature,

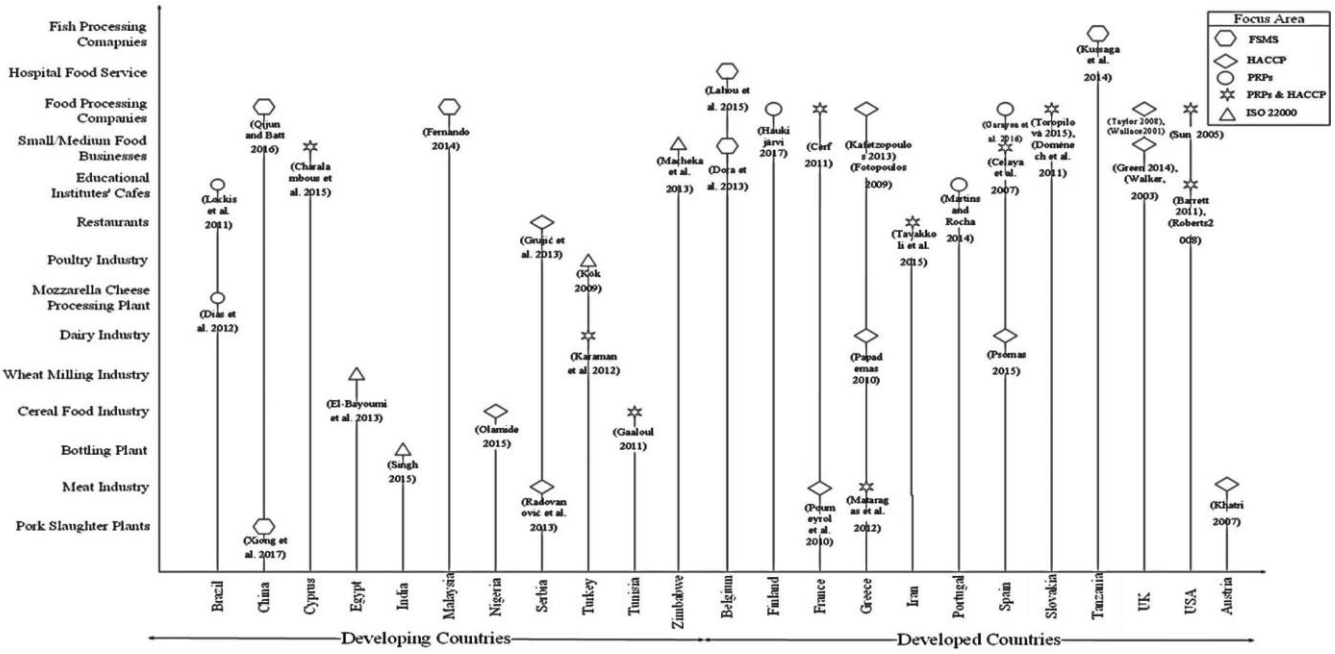


Fig. 1: Summary of literature review.

framework of the ISO 22000 was developed for a small and medium scale organization.

2.2 Sample Selection

The survey was conducted in educational cafeterias located in Wah, Taxila, Rawalpindi and Islamabad (cities of Pakistan). A total number of thirty cafes were selected randomly from the public and private educational institutes for the survey. All of them were assessed for the compliance level of proposed framework based on standard requirements of ISO 22000 FSMS.

2.3 Questionnaire Formation

The questionnaire developed in this research consisted of two sections. First section was related to basic information about the cafes including such as name, number of customers served per day, number of products and years of experience. Second section of questionnaire included four parts namely plan, do, check and act. The 'Plan' part had 41 questions for the company scope, company policy, management commitment, responsibilities and job description, prerequisite programs (PRPs), food safety team leader, HACCP plan, steering team and project time and budget. The 'Do' part contained 66 questions such as resource management, HACCP training, internal communication, PRPs, Hazard analysis operational prerequisite programs (OPRPs) and HACCP plan, SOP and record, internal audit and non-conformities, corrective and preventive actions. The 'Check' part constituted 3 questions such as validation and reevaluation of control measures, verification of FSMS and review of documentation. The 'Act' part consisted of 6 questions related to root cause analysis, corrective and preventive action, improvements of plans, improvements of deficiencies and FSMS improvements. All of the evaluated variables were developed according to the requirements of ISO 22000 FSMS. Five-Point Likert scale (1-5) was employed in this research where 1 represents no compliance whereas 5 show full compliance.

2.4 Data Collection

Survey of cafes was conducted from September 2016 to February 2017 by the trained persons. Data was collected from each cafe through self-observations and the questionnaire was filled by face-to-face interview with the manager of the cafe using Likert scale 1 to 5. The 116 questions (as explained in the previous sub-section) were completed in approximately 4 hours. Furthermore, the data collection was carried out during the peak hours of serving, i.e., 11 am to 3 pm.

2.5. Statistical Analysis

Data was analyzed using the SPSS for Windows (version 20.0). Descriptive statistics is carried out using eq. (1), this equation is used to collect percentage point for each cafe. To calculate percentage point sum of all points from a cafe is divided by total points.

$$Performance\ Point = \frac{Sum\ of\ all\ the\ points\ collected\ from\ one\ cafe}{Total\ number\ of\ points} \times 100 \qquad (1)$$

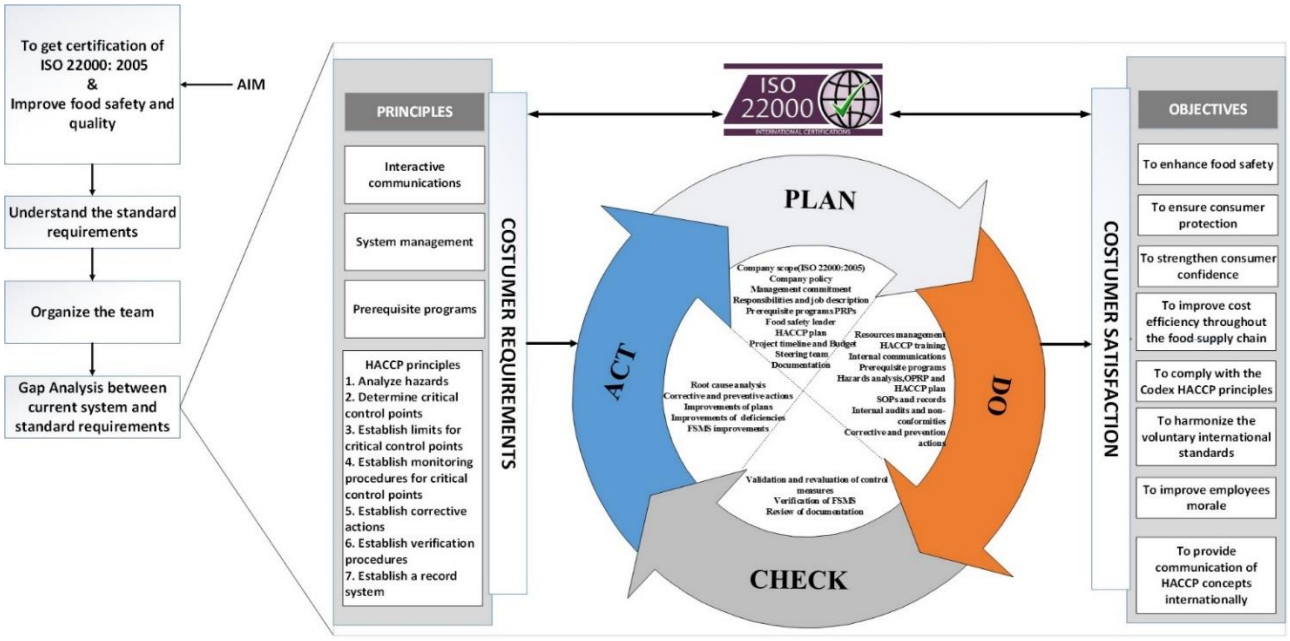


Fig. 2: Implementation framework of ISO 22000 FSMS.

Leader-Laggard Model is analyzed using eq. (2), where sum of all points for a single variable of all cafes is divided by total score. This equation provides us percentage score of a variable.

$$Percentage\ Score = \frac{n_1+n_2+n_3+\cdots+n_n}{N} \times 100 \qquad (2)$$

Where,

n_1= Obtained score by cafe 1

n_2= Obtained score by cafe 2

n_3= Obtained score by cafe 3

n_n= Obtained score by cafe n

N= Total score

Non-parametric Friedman test with $p<0.05$ was used to test the difference between related sample. Tavakkoli et al. [20] also used the Friedman test for data analysis. The reason behind using this test is that it provides better results as compare to other non-parametric test when data set is small [21].

3. Implementation Framework of ISO 22000 Food Safety Management System

Food safety management system ISO 22000 is a tool that provides continuous improvement to ensure food safety. This standard is based on Deming cycle (PDCA) of continuous improvement as shown in Fig. 2 [22]. Implementation of this standard reduces the errors, products rejection and complaints of customers [23].

The proposed implementation framework of ISO 22000 food safety management system is helpful for small organizations to identify the basic requirements. Before the implementation of PDCA, basic general requirements are fulfilled including (i) defining organizational aims, (ii) development of ISO 22000 requirements, (iii) organization of food safety management system team and (iv) identification of gap between current food system and requirements of ISO 22000. Basic principles and objectives should be followed to improve the system and product safety. By employing PDCA for the implementation of food management safety system (Fig. 2) can ensure improvement in customer satisfaction.

3.1 Plan

A project plan is developed for effectively organizing and managing the project. Ten stages are involved at planning phase defining (i) company scope (ii) company policy (iii) management commitment (iv) responsibilities and job description (v) prerequisite programs (PRPs) (vi) food safety team leader (vii) HACCP plan (viii) steering team (ix) project timeline and budget and (x) documentation as shown in Fig. 3.

3.2 Do

In second phase 'Do' of PDCA cycle, execution of food safety plan is conducted. Eight stages are involved at 'do' stage namely (i) resource management (ii) HACCP training (iii) internal communication (iv) prerequisite programs (PRPs) (v) hazard analysis, operational PRPs and HACCP plan (vi) SOPs and records (vii) internal audits and non-conformities and (viii) corrective and preventive actions as shown in Fig. 4.

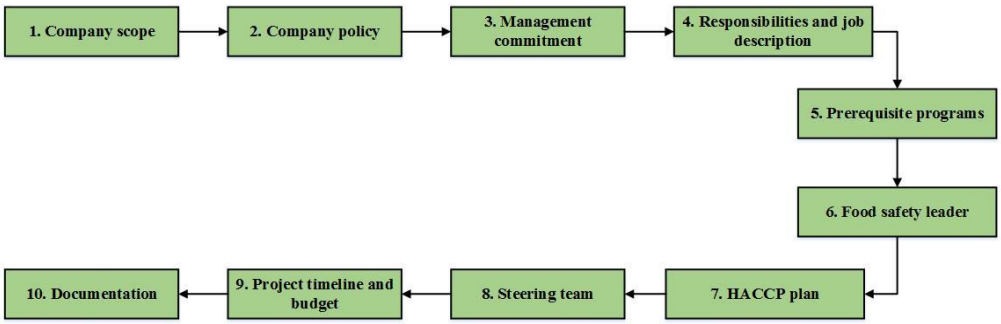


Fig. 3: Stages of 'Plan' (First phase).

Fig. 4: Stages of 'Do' (Second phase).

Fig. 5: Stages of 'Check' (Third phase).

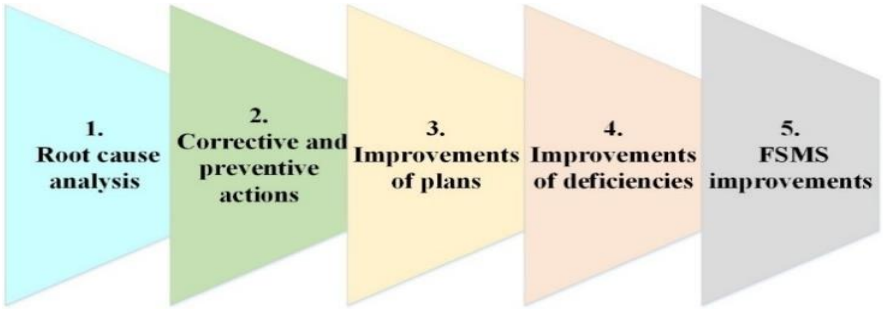


Fig. 6: Stages of 'Act' (Fourth phase).

3.3 Check

Third phase of PDCA cycle is 'check' in which the monitoring is carried out at each point. To check the performance of implementation is very pivotal. Plans and procedures are established to monitor that whole system is working properly or not. Three stages are considered important for this phase including (i) validation and reevaluation of control measures (ii) verification of food safety management system (FSMS) and (iii) review of documentation as shown in Fig. 5.

3.4 Act

Last phase of PDCA cycle is 'act'. In this phase, the organization improves the monitored changes that are essential for the FSMS. (i) Root cause analysis (RCA), (ii) corrective and preventive actions, (iii) improvements of plans, (iv) improvement of deficiencies and (v) FSMS improvements are main stages of 'act' phase as shown Fig. 6.

Table 2: General characteristics of HEIs cafes (n=30).

Characteristics	N	(%)
	Educational level of cafe managers	
Graduate of primary school	3	10
Graduate of secondary school	-	0
Graduate of high school	8	27
Graduate of college	19	63
	Number of customers served	
1999 or less	13	43
2000-4000	7	23
4001 or more	10	33
	Year of experience	
5 or less	12	40
6-10	7	23
11 or more	11	37
	Number of products	
9 or less	10	33.3
9-14	10	33.3
15 or more	10	33.3

4. Results

After receiving the filled questionnaire, the general status of each cafe about FSMS implementation was evaluated individually and comparatively. Most of cafe managers (63%) were graduated from college level and 27% of the cafe managers had high school level education. In addition, 10% of the cafe managers were having only primary level education. Other related characteristics of interviewees are presented in Table 2.

The cafes are classified into three categories depending on the performance score. A cafe with more than 75% performance points is categorized to be at proper level; the cafes with 50-75% of the points are kept in moderate level, while the cafes having less than 50% points are at poor level. Performance points were measured using eq. (1). The results showed that none of the cafes was generally at proper level of implementing the standard requirements. 13% (4) of cafes were assessed in poor level and 86% (26) of them were at moderate level of implementing the standard requirements as shown in Fig. 7.

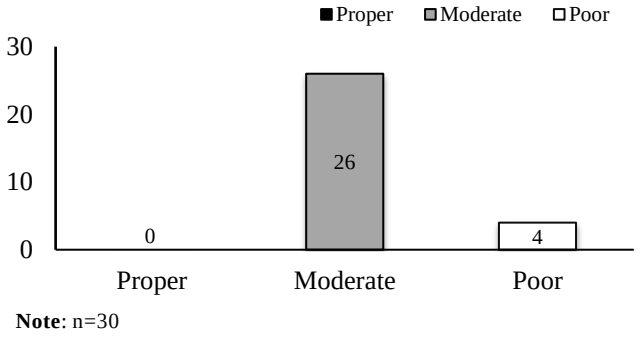


Fig. 7: General comparison of the HEIs Cafes.

All of the HEIs cafes were compared for main variables of plan, do, check and act. At "Plan" stage, it was focused that all cafes (100%) were having proper plan related to responsibilities and job description and prerequisite programs (PRPs). Adversely, 90% (27) of the cafes were lacking in defining company policy; whereas, all of them (100%) were poor in HACCP plan and documentation as shown in Fig. 8. At "Do" stage, none of cafes were implementing ISO 22000 standard requirements. All cafes (100%) were lacking in HACCP training, 100% (30) poor in Hazard analysis, OPRP and HACCP plan at implementation level presented in Fig. 9. At "Check" stage, 66.6% (20) cafes were leading in verification of FSMS. All the cafes (100%) were lacking in review of documentation and 53% (16) of the cafes were lacking in validation and reevaluation of control measures presented in Fig. 10. At "act" stage, 43% (13) of cafes were leading in improvements of deficiencies. Adversely, 93.3% (28) cafes were lacking to FSMS improvement and 60% (18) of the cafes were lacking in corrective and preventive action as shown in Fig. 11.

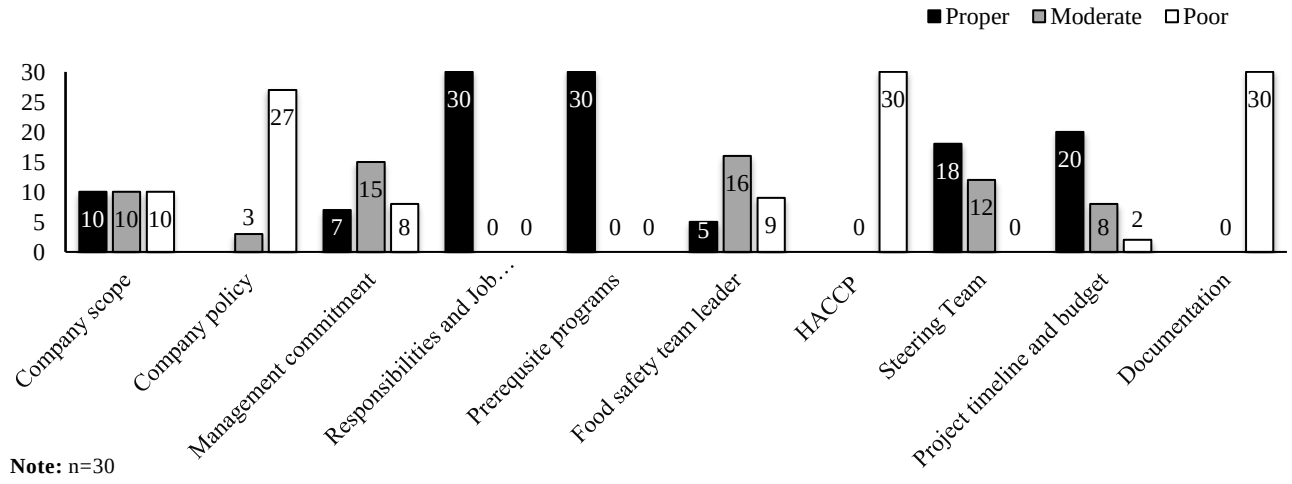
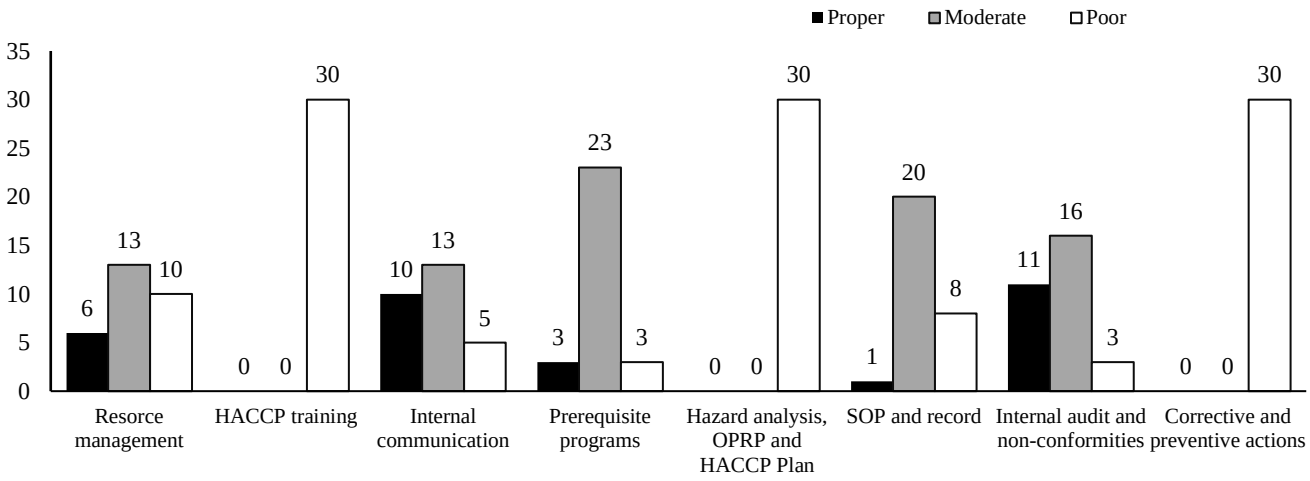
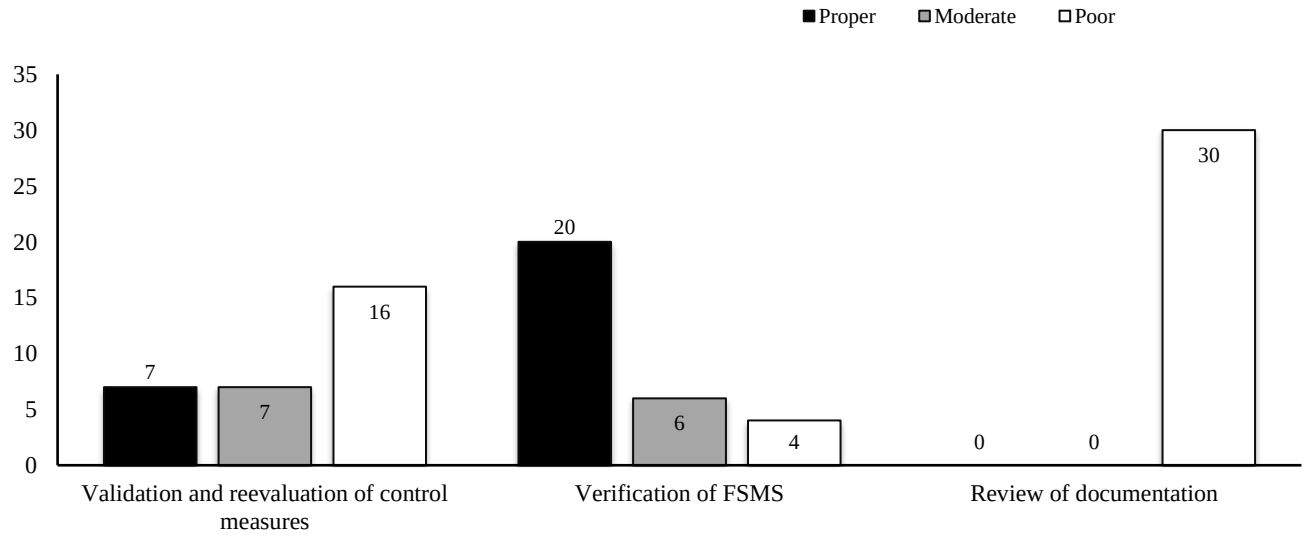


Fig. 8: General comparison of HEIs cafes for "Plan" part of PDCA.



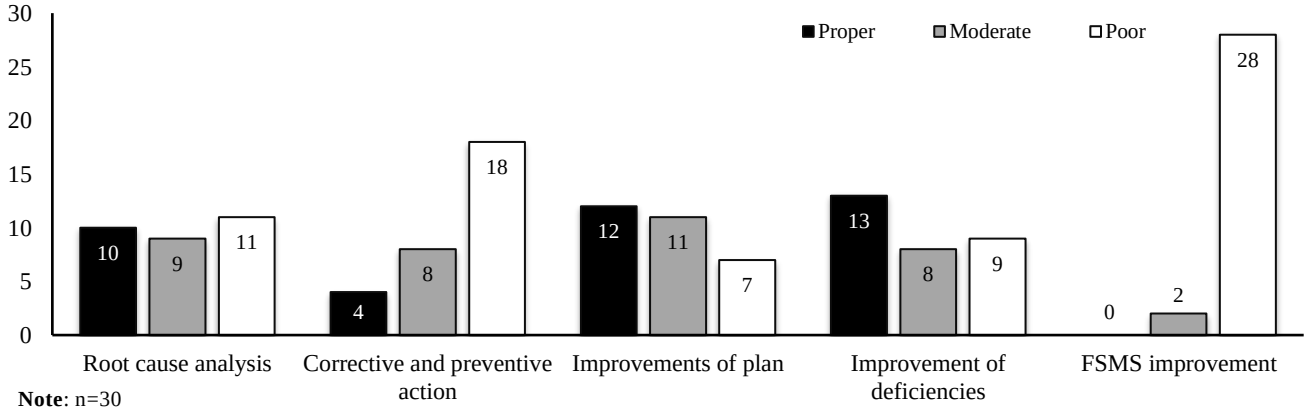
Note: n=30

Fig. 9: General comparison of HEIs cafes for "Do" part of PDCA.



Note: n=30

Fig. 10: General comparison of HEIs cafes for "Check" part of PDCA.



Note: n=30

Fig. 11: General comparison of HEIs cafes for "Act" part of PDCA.

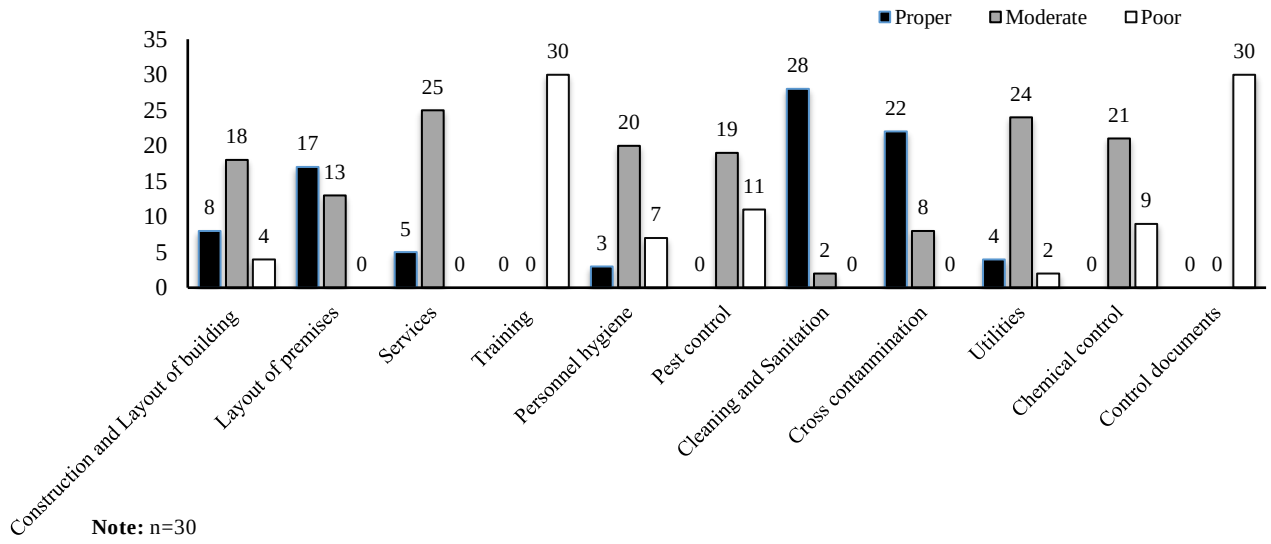


Fig. 12: General comparison of HEIs cafes for Prerequisite programs.

The Friedman test has also been applied to analyze the mean rating of main evaluated variables of plan-do-check-act at $p<0.05$. The score of each evaluated main variable has been provided in Tables 3-6. At 'Plan' stage, responsibilities and job description along with prerequisite programs (PRPs) are the best, whereas company policy, HACCP plan and documentation are the worst features in inspected HEIs cafes features as presented in Table 3. At 'Do' stage, internal audits and non-conformities along with PRPs are the best, whereas corrective and preventive actions and hazard analysis, OPRPs and HACCP plan are worst features in inspected HEIs cafes features as shown in Table 4. At 'Check' stage, verification of FSMS is the best whereas review of documentation is the worst feature in inspected HEIs cafes features as shown in Table 5. At 'Act' stage, improvement of deficiencies is the best whereas FSMS improvement is the worst feature in inspected HEIs cafes features presented in Table 6.

Table 3: Rating of main evaluated variables of plan.

Evaluated variables of "Plan"	Mean rate of compliance	df	Chi-square
Company scope	6.20	9	205.434
Company policy	3.05		
Management commitment	5.93		
Responsibilities and job description	9.52		
Prerequisite programs (PRPs)	8.23		
Food safety team leader	4.88		
HACCP plan	2.58		
Steering team	6.78		
Project timeline and budget	6.77		
Documentation	1.05		

Table 4: Rating of main evaluated variables of Do.

Evaluated Variables of "Do"	Mean rate of compliance	df	Chi square
Resource Management	5.88	7	159.174
HACCP training	2.07		
Internal Communication	6.42		
Prerequisite Programs	5.53		
Hazard analysis, OPRPs and HACCP plan	2.12		
SOP and record	5.15		
Internal audits and non-conformities	6.77		
Corrective and preventive Actions	2.07		

Table 5: Rating of main evaluated variables of Check.

Evaluated Variables of "Check"	Mean rate of compliance	df	Chi-square
Verification of FSMS	2.10	2	46.158
Validation and re-evaluation of control measures	2.75		
Review of documentation	1.15		

Table 6: Rating of main evaluated variables of Act.

Evaluated Variables of "ACT"	Mean rate of compliance	df	Chi-square
Root cause analysis	3.27	4	36.690
Corrective and preventive action	2.60		
Improvements of plan	3.73		
Improvement of deficiencies	3.62		
FSMS improvement	1.78		

After analyzing all the results, it is clear that not even a single cafe is implementing the HACCP system. Before the implementation of HACCP system, it is necessary to implement the basic hygiene environment prerequisite programs (PRPs). Hence, we discussed the PRPs in these cafes in details as shown in Fig. 12.

After collecting all the points from the questionnaire, mean rating of inspected variables about each PRP is analyzed by Friedman test ($p<0.05$). Data showed that there was a significant difference between the evaluated variable for each PRPs as shown in Table 7.

Table 7: Rating of evaluated variables for each prerequisite program.

Prerequisite Programs	Mean rate of Compliance	df	Chi-Square
Construction and Layout of building			
Away from grassy area	6.28	8	94.217
Self-closing door	1.63		
Restricted cooking area	4.35		
Separate rest room, proper storage room and Raw material receiving	4.57		
Condition of doors	4.65		
Condition of walls	4.97		
Condition of windows	6.87		
Condition of floor	6.57		
Condition of ceiling	5.12		
Layout of premises			
Adequate workspace (easy movement)	1.38	1	2.579*
Facilities (soaps and hot water)	1.62		
Services			
Suitable sewage disposal	1.93	1	26.00
Garbage bins with pedals	1.07		
Training			
Personnel hygiene	5.00	4	120.00
Pest control	2.50		
Cleaning and sanitation	2.50		
Cross contamination	2.50		
Chemical control	2.50		
Personnel hygiene			
Checklist for personnel hygiene	2.58	6	60.70
Medical examination and health certificates	6.17		
Correct uniform	3.92		
Hair nets	2.88		
Clean apron	4.50		
Gloves	3.73		
Absence of jewellery	4.22		
Pest control			
Inspection record form	1.02	1	29.00
proper arrangements(Sprays)	1.98		
Cleaning and Sanitation			
Proper schedule follow for cleaning and sanitation	1.57	1	1.33*
Provided with proper facilities	1.43		
Cross contamination			
Follow procedure to avoid cross contamination	1.42	1	1.31*
Non-food surface are cleaned and maintained	1.58		
***Chemical* control**			
Chemical control procedure followed	2.00	1	30.000
Non-food grade chemical(paints, diesel) stored and handled	1.00		
Control documents			
Follow any procedure to manage	1.45	1	1.28*
Record maintained	1.55		
Utilities			
Air	1.90	2	11.830
Water	1.67		
Energy	2.43		

Table 8: Rating of main evaluated variables of PRPs.

Evaluated variables of PRPs	Mean rate of compliance	df	Chi-Square
Construction and Layout of building	6.98	10	240.583
Layout of premises	8.62		
Services	6.37		
Training	2.03		
Personnel hygiene	5.20		
Pest control	4.22		
Cleaning and Sanitation	10.10		
Cross contamination	9.62		
Utilities	7.42		
Chemical control	4.40		
Control documents	1.05		

Table 8 shows the results of Friedman test for main evaluated variables of PRPs at $p<0.05$, significant difference was noticed between the evaluated score of each main evaluated variable of each prerequisite programs (PRPs). Control documents and training are the worst features whereas cleaning and sanitation and layout of premises are the best feature of PRP.

Leader-laggard analysis has also been performed to recognize the effort required by the cafes identified as laggard. This will help cafes to improve their management process. For leader-laggard analysis, all the cafes were divided into three categories on the basis of number of customer served per day. Cafes serving more than 4000 customers were termed as leaders followed by cafes serving between 2000-4000 customers serving per day termed as followers. Finally, the cafes were serving customers less than 2000 customers named as laggard. Each leader, follower and laggard cafe was further differentiated on the basis of percentage score obtained: the percentage score 0-40% represented poor compliance level, percentage score obtained between 41-80% described satisfying compliance level and percentage score obtained between 81-100% showed the good compliance level of ISO standard. The percentage score has been calculated through the equation (Eq. 2). ISO standard compliance level of leader, follower and laggard have been described in Figs. 13, 14 and 15, respectively. The detail of each variable (P1, P2, P3,….., Pn, D1, D2, D3,…, Dn, C1, C2, C3, A1, A2, A3,…., An) has been provided in Annexure A.

Fig. 13 shows FSMS compliance level of the leaders. The categorization is as follows: 0-40% poor, 41-80% satisfactory and 81-100% are having good compliance level in plan-do-check-act.

Fig. 14 depicts FSMS compliance level of the followers. In figure 14, 0-40% represents poor, 41-80% satisfactory, while 81-100% have good compliance level with plan-do-check-act.

Fig. 15 shows FSMS compliance level of the laggards in which 0-40% have poor, 41-80% have satisfactory, while 81-100% have good compliance level with plan-do-check-act.

The comparative analysis has also been performed to identify the similar characteristics among three groups divided on the basis of number of customers served per day as shown in Table 9. This shows the categorization of each variable in either good, satisfying or poor category. It can be seen that the variables having percentage 81-100% are in good category. For example, P11 (categorization of products and production site) and P34 (better team management to identify rule violation status). The satisfying category which from 41-80% need improvements. For example, P12 (information regarding food safety issues related to products throughout the food chain) and P13 (statutory and regulatory requirements). Cafes with the percentage obtained between 0-40% are in weak category. For example, P21 (defined documented and communicated food safety policy) and P22 (ensure the food safety policy). The detailed information of PDCA have been provided in Annexure A.

5. Discussion

Ensuring food safety is a daunting task. Proper implementation is possible only if all sectors including government, producers and consumers put an equal effort [24]. ISO 22000 is an international "Food Safety Management System" standard that finds a way for proper food production or process. There exists limited research to investigate food safety management system for Pakistani food industry.

This research is aimed to develop an implementation framework of ISO 22000 FSMS in HEIs cafes of Pakistan under the requirements of ISO standard. A total number of 30 HEIs cafes were randomly selected to analyze the ISO 22000 requirements in different universities of Pakistan. The findings of this research can be helpful for these cafes to implement the standard and improve the deficiencies of their existing system. After the collection of data about plan-do-check-act and statistical analysis of the results, at each stage of PDCA cycle, major appreciation and lack in the system have been identified. None of the cafes has proper level to implement the requirements of the ISO standard. However, at few aspects cafes have been implementing the requirements of ISO standard. The strong points identified in PDCA include: at plan stage, the cafes were at proper level about the PRPs and responsibilities and job description. At do stage, PRPs were being implemented at moderate level. Only 66.6% (20) cafes were at proper level about the verification of FSMS in check stage. Final at 'act' stage, 43% (13) cafes were at proper level about the improvements of deficiencies of their system.

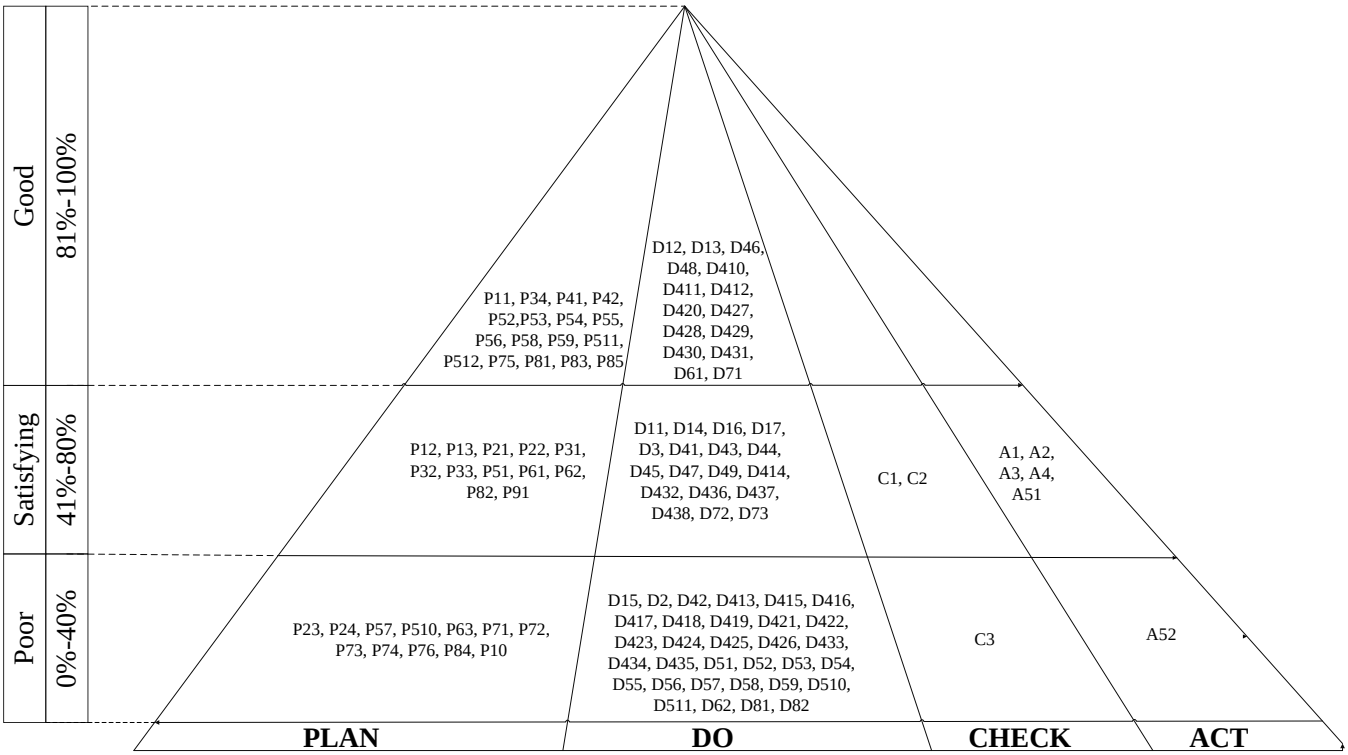


Fig. 13: Compliance Level of FSMS Variables among Leaders.

NOTE: P11, P12, D12, D13…,C1, C2…A1, A2…. Represents the questions.

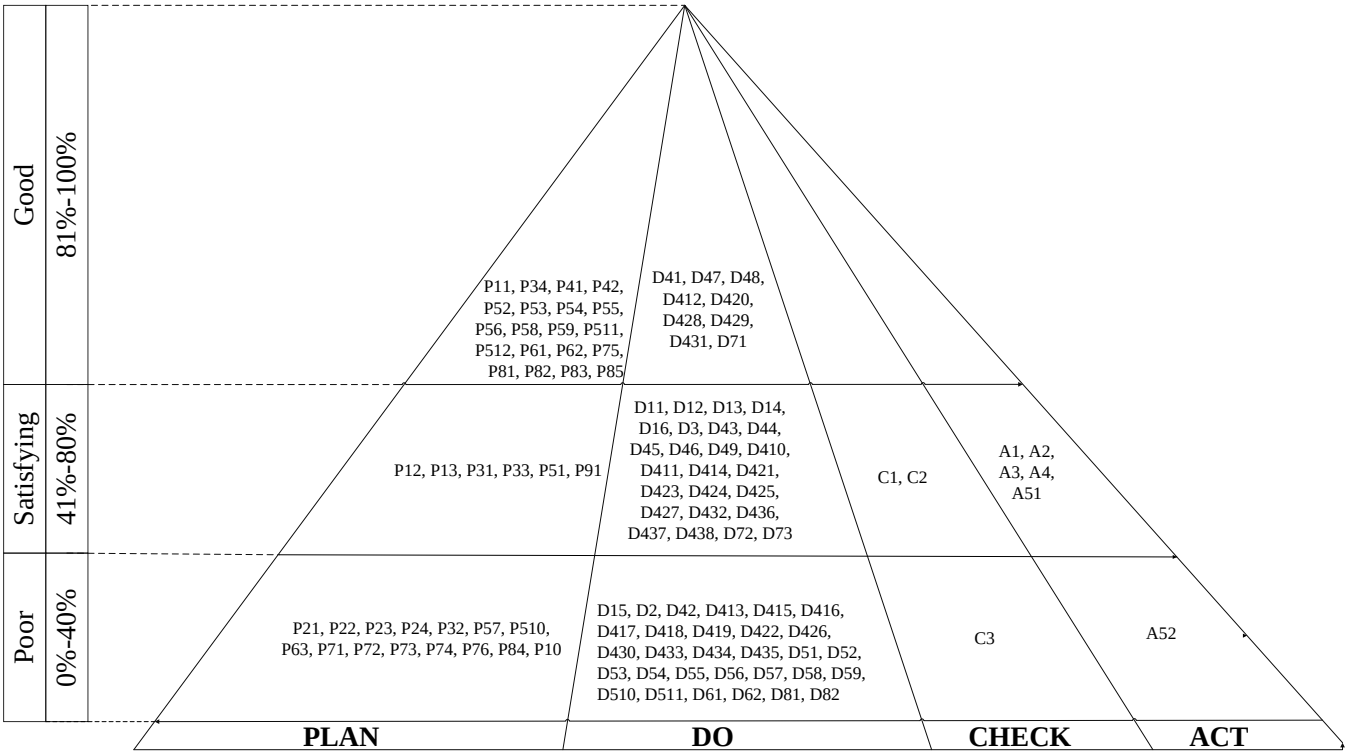


Fig. 14: Compliance level of FSMS variables among followers.

NOTE: P11, P12…D12, D13, C1, C2…A1, A2…. Represents the questions.

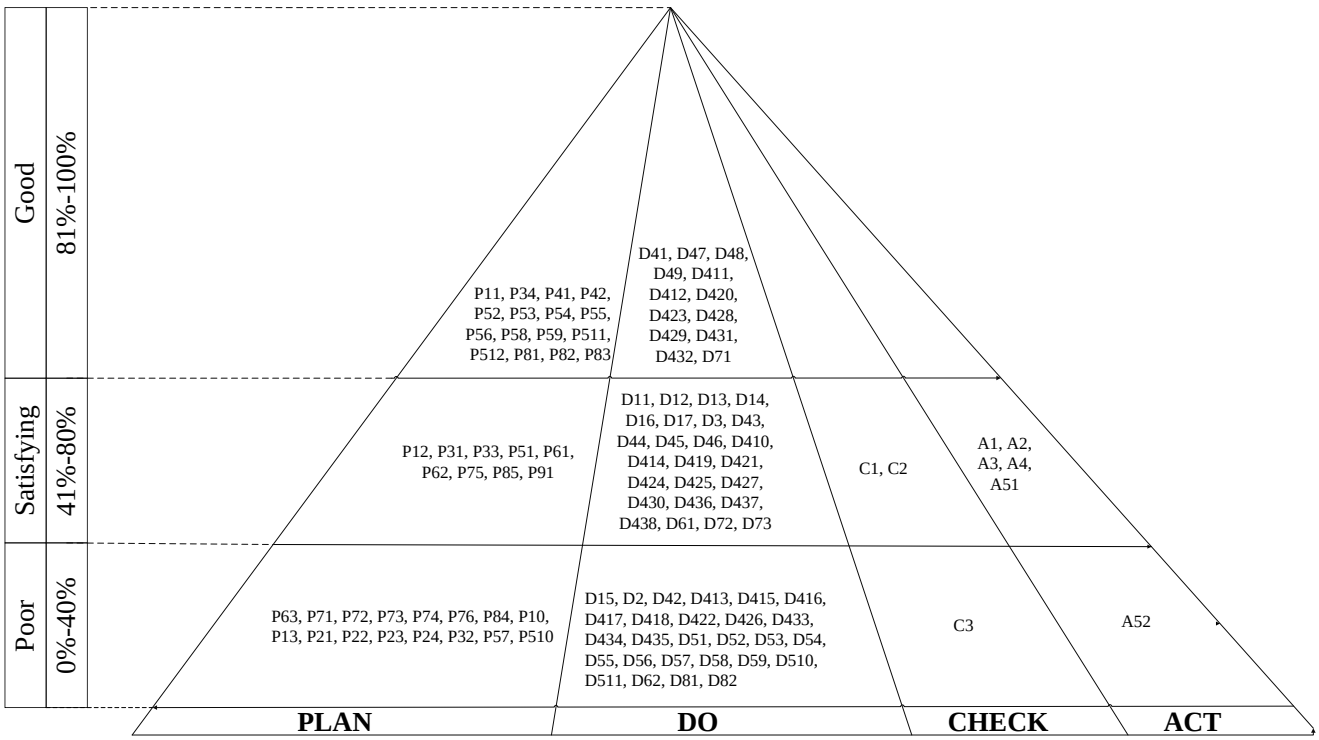


Fig. 15: Compliance level of FSMS variables among laggards.

NOTE: P11, P12…D12, D13, C1, C2…A1, A2…. Represents the questions.

Table 9: Major Similar Lacks in PDCA in different groups based on number of customers served.

Number of Customers	*0-40% (Poor)*	*41-80% (Satisfying)*	*81-100% (Good)*
<2000 2000-4000 >4000	P21, P22, P23, P24, P32, P57, P510, P63, P71, P72, P73, P74, P76, P84, P10, D15, D2, D42, D413, D415, D416, D417, D418, D419, D422, D426, D433, D434, D435, D51, D52,D53, D54, D55, D56, D57, D58, D59, D510, D511, D62, D81, D82, C3, A52	P12, P13, P31, P33, P51, P61, P62, P91, D11, D12, D13, D14, D16, D17, D3, D43, D44, D45, D46, D49, D410, D414, D421, D424, D425, D427, D432, D436, D437, D438, D72, D73, C1, C2, A1, A2, A3, A4, A51,	P11, P34, P41, P42, P52, P53, P54,P55, P56, P58, P59, P511, P512, P75, P81, P82, P83, P85, D41,D47, D48, D411, D412, D420, D428, D429, D431, D71

In additions to strong points the major deficiencies were also identified which require the improvement to ensure the food safety at any level of food processing as provided in Fig. 16. Major deficiency included company policy, HACCP plan and documentation in plan stage; HACCP training and Hazard analysis, OPRP and HACCP plan about do stage; review of documentation during check stage; and FSMS improvements in act stage, were identified.

It must be noted that before the implementation of ISO 22000, the implementation of HACCP and PRPs system is necessary. HACCP is FSMS that is used to identify the food hazards at early stage of food preparation [25]; whereas, PRPs programs are considered as basic pillar for the implementation of HACCP plan [20]. Since all of the cafes were failed to implement the HACCP system; therefore, PRPs have been discussed in detail in this research. The findings show that training and documentation were worst managed by management.

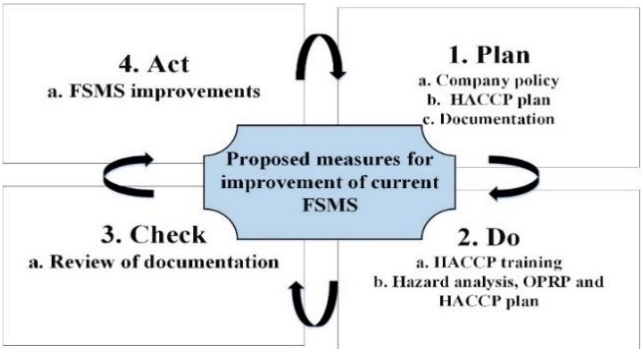


Fig. 16: Proposed measures for improvement of current FSMS.

Documentation is considered as the main barrier for the implementation of HACCP system [26]. The similar studies also reported the documentation as the worst managed policy of the management [20, 27]. Similarly, lack of training also leads to failure of food safety system [28]. Although, the results indicated that employees were being trained for personnel hygiene; however, all the HEIs cafes were failed to provide training related to pest control, cleaning and sanitation, cross contamination and chemical control. A study [29] was conducted about the implementation of HACCP, suggested more trainings to improve the food safety. Many challenges can be overcome by providing awareness and training to employees for implementation of ISO 22000 (FSMS) [30]. All the evaluated HEIs cafes provide food to thousands of students on daily basis. Hence, the implementation of the standards not only provide the safe products but also increase the satisfaction level of the costumers. Poor implementation of the food safety standards lead towards the food borne illness. Similar research was conducted in Spain which concluded that potential benefits of ISO 22000 were not well known which is embedded with high cost to adopt it [31]. Food safety training programs are necessary for successful implementation of HACCP program [19].

3 Conclusions

The findings of this research clearly indicate that managers of cafes were unaware about the standards and their benefits. This research suggests that providing awareness, knowledge and training to employees about the ISO 22000 standard requirements, will help employees to implement the requirements of standards in their food businesses. Managers of the food businesses should focus on the training of employees to create sense of responsibility about the costumers' health. Managers should get certificates about the food safety principles. Prerequisite programs and HACCP system must be focused before the implementation of standards. The conduction of food safety training programs for successful implementation of HACCP programs must be compulsory. Small and medium food serving organizations should follow the developed implementation framework of PDCA of this research to make their food safety system strong and efficient.

Reference

[1] World health organization, "Global burden of foodborne diseases", 2015, Available: http://www.who.int/foodsafety/areas_work/food borne- diseases/ferg/en/, [Accessed 14 May 2017].

[2] S. Akhtar, "Food safety challenges - A Pakistan's perspective", Critical Reviews in Food Science and Nutrition, vol. 55, pp. 219-226, 2015.

[3] World health organization, "Food safety", Available: http://www. who.int/mediacentre/factsheets/fs399/en/, [Accessed 12 April 2016].

[4] Snyder Jr and O. Peter, "Food safety hazards and controls for the home food preparer", Technical Report, Hospitality Institute of Technology and Management, 2006.

[5] Food and Drug Administration, "FDA trend analysis report on the occurrence of foodborne illness risk factors in selected institutional foodservice, restaurant and retail food store facility types (1998-2008)", Washington, DC: FDA National Retail Food Team, 2010.

[6] A. Zulfiqar and B. Sajid, "National nutrition survey Pakistan", Islamabad, PMRC, 2011.

[7] L. Manning, R. Baines and S. Chadd, "Food safety management in broiler meat production", British Food Journal, vol. 108, pp. 605-621, 2006.

[8] M.S. Kök, "Application of food safety management systems (ISO 22000/HACCP) in the Turkish poultry industry: A comparison based on enterprise size", Journal of Food Protection, vol. 72, pp. 2221-2225, 2009.

[9] BsEn ISO 22000, "Food safety management systems requirements for any organisation in the food value chain", 2005.

[10] L. Macheka, F.A. Manditsera, R.T. Ngadze, J. Mubaiwa and L.K. Nyanga, "Barriers, benefits and motivation factors for the implementation of food safety management system in the food sector in Harare Province, Zimbabwe", Food Control, vol. 34, pp. 126-131, 2013.

[11] D. Bánáti and Z. Lakner, "Managerial attitudes, acceptance and efficiency of HACCP systems in Hungarian catering", Food Control, vol. 25, pp. 484-492, 2012.

[12] A. Bilska and R. Kowalski, "Food quality and safety management", LogForum, vol. 10, pp. 2014.

[13] S. Mamalis, D. P. Kafetzopoulos and S. Aggelopoulos, "The new food safety standard ISO 22000. Assessment, comparison and correlation with HACCP and ISO 9000: 2000. The practical implementation in victual business", Presentation at the 113th EAAE Seminar, "A resilient European food industry and food chain in a challenging world", Chania, Crete, Greece, pp. 2012, Retrieved December, 2009.

[14] I. Gaaloul, S. Riabi and R. E. Ghorbel, "Implementation of ISO 22000 in cereal food industry "SMID" in Tunisia". Food Control. vol. 22, pp. 59-66. 2011.

[15] J. Trafialek and W. Kolanowski, "Implementation and functioning of Haccp principles in certified and non-certified food businesses: A preliminary study", British Food Journal, vol. 119, no. 4, pp. 710-28, 2017.

[16] S. Allata, A. Valero and L. Benhadja, "Implementation of traceability and food safety systems (HACCP) under the ISO 22000: 2005 Standard in North Africa: The Case Study of an Ice Cream Company in Algeria", Food Control, vol. 79, pp. 239-53, 2017.

[17] V.R. Lockis, A.G. Cruz, E.H. Walter, J.A. Faria, D. Granato and A.S. Sant'Ana, "Prerequisite programs at schools: diagnosis and economic evaluation", Foodborne Pathogens and Disease, vol. 8, pp. 213-220, 2011.

[18] M.L. Martins and A. Rocha, "Evaluation of prerequisite programs implementation at schools food service", Food Control, vol. 39, pp. 30-33, 2014.

[19] B. Barrett and L. Riggins, "Beliefs and perceptions of school food service personnel about following a HACCP-based Program", Food Protection Trends. vol. 31, pp. 612-619, 2011.

[20] H. Tavakkoli, A. Zabihi, S.A. Khatibi, T. Nasiri, L. Kaviani and N. Dopeykar, "Status of prerequisite programs for the implementation of HACCP system in chain restaurants in Iran", British Food Journal, vol. 117, pp. 1753-1763, 2015.

[21] S. Siegal, "Nonparametric statistics for the behavioral sciences", McGraw-Hill, 1956.

[22] D. Bilalis, I. Stathis, A. Konstantas and S. Patsiali, "Comparison between HACCP and ISO 22000 in Greek organic food sector", Journal of Food, Agriculture and Environment, vol. 7, pp. 237-242, 2009.

[23] A.D. Karaman, F. Cobanoglu, R. Tunalioglu and G. Ova, "Barriers and benefits of the implementation of food safety management systems among the Turkish dairy industry: A case study", Food Control, vol. 25, pp. 732-739, 2012.

[24] Y. Motarjemi and S. Mortimore, "Industry's need and expectations to meet food safety, 5th International Meeting: Noordwijk Food Safety

and HACCP Forum 9-10 December, 2002", Food Control, vol. 16, pp. 523-529, 2005.

[25] M. Baş, A. Ş. Ersun, and G. Kıvanç, "Implementation of HACCP and prerequisite programs in food businesses in Turkey", Food Control, vol. 17, pp. 118-126. 2006.

[26] E. Taylor, "HACCP in small companies: benefit or burden?", Food Control, vol. 12, pp. 217-222, 2001.

[27] S. Grujić, H. Keran, D. Vujadinović and M. Perušić, "Knowledge of employees in restaurants about the means and application of HACCP", Quality of Life, vol. 6, pp. 3-4, 2012.

[28] R. Garayoa, A.I. Vitas, M. Díez-Leturia and I. García-Jalón, "Food safety and the contract catering companies: Food handlers, facilities and HACCP evaluation", Food Control, vol. 22, pp. 2006-2012, 2011.

[29] A. Hatim, S. Suliman and M. Abdalla, "Implementation of HACCP and Food Safety Program in Al-Ain City, Abu Dabi", J. Food Nutr. Disor. 2, vol. 3, pp. 2, 2013.

[30] M.K. Singh, "A study on implementing food safety management system in bottling plant", Procedia-Social and Behavioral Sciences, vol. 189, pp. 433-441, 2015.

[31] C. Escanciano and M.L. Santos-Vijande, "Reasons and constraints to implementing an ISO 22000 food safety management system: Evidence from Spain", Food Control, vol. 40: pp. 50-57. 2014.

ANNEXURE-A

Questionnaire Based on ISO 22000:2005 Food Safety Management System for cafeteria of the Selected University

Section 1: Basic Information about Cafes

Name of University/Cafe: _____

Name of Plant Manager: _____ Education: _____

No of employees: _____ No of Products: _____

Tel. No: _____ Experience: _____ Duration: _____

Please indicate your level of agreement with each of the following statements. 5= Full compliance; 4=Minor deficiency; 3= Implemented small part of requirements ; 2=Major deficiency ; 1=No compliance						
PLAN						
P1: Company Scope						
P11	Does the scope of FSMS address all the products/ products categories and production sites?					
P12	Is there any appropriate information regarding safety issues related to products communicated throughout the food chain?					
P13	Does the company scope conform to both statutory and regulatory requirements?					
P2: Company Policy						
P21	Has the top management defined documented and communicated food safety policy?					
P22	Does the top management ensure the food safety policy?					
P23	Is the company policy communicated, implemented and maintained at all level of organization?					
P24	Does your organization review for continual suitability?					
P3: Management commitment						
P31	Does the management involve to develop, implement and maintain the food safety management system?					
P32	Does your organization conduct Management Review meetings?					
P33	Is food safety reflected in business objectives of the organization?					
P34	Is there any team to check the violations of rules?					
P4: Responsibilities and Job description						
P41	Is each employee clear about their responsibility and job in your organization?					
P42	Are your employees committed to fulfil their responsibilities?					
P5: PRP (prerequisite programs)						
P51	Does your organization plan for prerequisite program implementation?					
	Is there any proper plan for PRPs including?					
P52	Services					
P53	Construction and layout of building					
P54	Layout of premises(work space)					
P55	Personnel hygiene					
P56	Pest Control					
P57	Training					
P58	Cross contamination					
P59	Chemical control					

P510	Control documents					
P511	Utilities					
P512	Cleaning & sanitation					
P6: Food safety team leader						
P61	Have you nominated a food safety team leader in your organization?					
P62	In your organization, food safety leader have an authority to make changes in FSMS?					
P63	Does your food safety team leader have knowledge about HACCP principles?					
P7: HACCP Plan (Hazard analysis and critical control point)						
HACCP Team						
P71	Have you established a food safety team?					
P72	Have the roles and responsibilities been properly delegated to the concern team members?					
P73	Does your organization give trainings about the HACCP principles?					
Describe the product						
P74	Does your organization describe the product details?					
Intended use						
P75	Does your organization describe the end product intended use?					
Flow diagram						
P76	Has the organization create the flow chart diagram of product?					
P8: Steering Team						
	Does your organization have followings:					
P81	A production manager					
P82	A quality assurance manager					
P83	An administrative manager					
P84	ISO coordinator					
P85	Any other person designated for food safety					
Project timeline and budget						
P9	Does your organization defined the timeline and budget for FSMS?					
Documentation						
P10	Does your organization prepare the documents for plan?					
DO						
Resource Management						
D1: Provision of Resources						
D11	Does your organization provide adequate resources to establish and implement the FSMS?					
	Work environment					
D12	Have your organization provided the adequate resources for proper work environment?					
	Infrastructure					
D13	Have your organization provided the adequate resources to establish and maintain infrastructure?					
	Human resources					
D14	Is there any training session conducted on regular basis for the employees' with respect to their duties?					

D15	Are the trainings reviewed and records are maintained properly based on effectiveness?					
	Personnel performing work meet the required standard of:					
D16	Education					
D17	Skill					
HACCP Training						
D2	Does your organization provide HACCP training regularly?					
Internal Communication						
D3	Are the food safety issues handled through internally communication system?					
D4: Prerequisite Program						
	Construction and Lay out of building					
D41	Does your organization situated away from grassy areas?					
D42	Have your organization self-closing doors?					
D43	Have your organization sufficient restricted cooking area?					
D44	Have your organization separate rest rooms, proper storage room, and raw material receiving?					
	Is the building of your organization in good condition including:					
D45	Doors					
D46	Walls					
D47	Windows					
D48	Floor					
D49	Ceiling					
	Layout of premises					
D410	Is there adequate workspace (easy movement) available for employees?					
D411	Are there facilities (soaps and hot water) available for employees?					
	Services					
D412	Is there any suitable process sewage disposal?					
D413	Is there any suitable garbage din with pedal for waste disposal?					
D414	Are the employees trained in followings points? Personnel hygiene					
D415	Pest control					
D416	Cleaning and sanitation					
D417	Cross contamination					
D418	Chemical control					
	Personnel hygiene					
D419	Have you developed any checklist about personnel hygiene?					
	Does your organization take care for employees?					
D420	Medical examination and health certificates					
D421	Correct uniform					
D422	Hair nets					
D423	Clean apron					
D424	Gloves					
D425	Absence of jewelry					
	Pest control					

D426	Does your organization develop the inspection record form for pest control?					
D427	Does your organization proper arrangement (sprays) for pests?					
	Cleaning and sanitation					
D428	Does your organization made proper schedule about cleaning and sanitation procedures?					
D429	Does your organization provide proper facilities for cleaning and sanitation?					
	Cross contamination					
D430	Does your organization follow procedures to avoid cross contamination?					
D431	Non-food contact surfaces are clean and maintain					
	Chemical control					
D432	Are the chemical control procedures followed in your organization?					
D433	Does your organization store and handle non-food grade chemicals (paints, diesel, battery fluids, etc)?					
	Control document					
D434	Does your organization follow any procedure to manage the documentation?					
D435	Is the record maintained in good condition?					
	Utilities					
	Is the supply of following sufficient to maintain food safety:					
D436	Air					
D437	Water					
D438	Energy					
D5: Hazard Analysis, OPRP and HACCP plan						
	Hazard analysis					
D51	Is hazard analysis performed and documented at each stage of flow diagram?					
D52	Is there any procedure for assessment of identified hazards?					
	Operational Prerequisite program					
D53	Is OPRP applied as a control measure?					
	Determine CCP					
D54	Are the critical control points identified based on potential food safety hazards?					
	Critical limit for CCP					
D55	Are the critical limit defined with respect to each CCP?					
	Monitoring procedures					
D56	Is there any monitoring system established for CCP?					
	Corrective action					
D57	Does your organization take corrective actions when critical control limit exceed?					
	Verification procedures					
	Are verification procedures established for HACCP plan at each level including:					
D58	PRP					
D59	OPRP					
D510	Hazard analysis					
	Record system					

D511	Is there any record keeping system established for HACCP plan?					
D6: SOP and records						
D61	Are the SOP developed, followed and maintained in your organization?					
D62	Is there any record established for SOP?					
D7: Internal audits and non-conformities						
D71	Does your organization conduct internal audits at specified intervals to determine the effectiveness of the FSMS?					
D72	Is there any procedure to identify non-conformities?					
D73	Is there any procedure to handle non-conformities?					
D8: Corrective and preventive actions						
	Are the records maintained for:					
D81	Corrective actions					
D82	Preventive actions					
CHECK						
Validation and Revaluation of control measures						
C1	Is validation and revaluation of food safety plan performed before implementation?					
Verification of FSMS						
C2	Does your organization conduct internal audits for verification of FSMS at regular interval?					
Review of documentation						
C3	Is there any proper procedure for review of control documents?					
ACT						
Root Cause Analysis						
A1	Is there any system to identify root cause for any failure occurred, so that its re-occurrence can be prevented?					
Corrective and preventive Actions						
A2	Does your organization take corrective and preventive actions to eliminate the food safety hazards?					
Improvements of Plans						
A3	Does the organization improve the plans to eliminate food safety hazards?					
Improvements of Deficiencies						
A4	Are there proper methods and procedure to improve the FSMS deficiencies?					
A5: FSMS improvements						
A51	Does your organization continuously improve the effectiveness of FSMS?					
A52	Does your organization update their FSMS after internal or external evaluation?					