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# The Adoption and Implementation of the Food Quality System (HACCP) in Mediterranean Region of Turkey

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**Abstract:** Food quality has become a considerable issue in food sector over the past decade. Since the food safety concepts has been paid attention in the developed countries. It is obviously clear that keeping the competition power can be provided by the way of producing quality products. In the developing countries, food quality problems may prevent international trade because of increasing food quality regulations. The aim of this study is to determine the problems which the firms in the Mediterranean region in Turkey faced with as applying HACCP, to examine the expenses of the HACCP implementation in food firms, to determine the economic and social advantage of HACCP and conscious level of the firms about HACCP. The firms applying HACCP tend to export to the EU countries; employ more qualified personnel; and in these firms the managers are not generally the owner of the companies. The most important cost category consists of building, ground and the arrangement of the surroundings. This cost category is occurred because that the HACCP system requiring rearrangement or establishment of this firms. The most important problem as establishing and applying HACCP system is deficiency of training about HACCP.

**Keywords:** HACCP, Food Quality System, Food Safety Control, Survey.

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## 1. Introduction

Hazard Analysis Critical Control Points (HACCP) is a preventive system of food control aimed at food safety assurance [1]. For a HACCP system to function effectively and obtain the support of the organization management, it needs to be designed, operated and maintained within the framework of a structured management system and incorporated into the overall management activities [2].

The development of HACCP policy must involve interaction between government, academia and industry with shared ownership resulting in a safer food supply. HACCP in the global marketplace facilitate trade, world-wide system for ensuring food safety and harmonization of food safety regulations [3].

This system, from the raw material stage, storing products to consumption stage, includes the analysis of the physical, chemical and biological pollution hazards and according to results of the analysis, it also includes to determine and to observe the Critical Control Points (CCP) and to take regulator activities in the condition of being a deviation from the determined critical limits.

In the developing country, food quality problems may prevent international trade because of increasing food quality regulations. According to EU Directive 93/43/EEC on Food Hygiene all food business operators in the European Union, dated 14 June 1993 shall implement HACCP. Also, the joint FAO/WHO Codex Alimentarius Commission describes a series of steps including the 7 HACCP principles giving guidance for the application of the HACCP system [4].

Governments across the world are increasingly mandating the use of Hazard Analysis and Critical Control Points (HACCP) approaches to assuring food safety [5]. But in Turkey, this concept has not become legally compulsory yet.

The Mediterranean region is one of importance in which production, processing and the selling of food is appearing intensively. The number of the firms applying the HACCP system is increasing as a result of both productivity with quality, safety and customer requirements.

This study aims to determine the problems which the firms in the Mediterranean region faced when applying HACCP, estimating the cost of the HACCP implementation in firms, determining the economic advantage of HACCP and the conscious level of the firms about HACCP. Through the literature review, it was observed that the study conducted in order to determine the problems in the food industry, region-wide was too inadequate. This is why this study is a starting point for both the country and region.

## 2. Method

### 2.1. Data collection and characteristics of sample

The main material for this study is formed by the information obtained from the Agro-food manufacture and service firms in the Mediterranean Region. The list of these firms is obtained from the chamber of commerce in the provinces (Adana and Mersin) in which these firms are intensively presented in the Mediterranean coast of Turkey. This list is classified into groups according to the sectors, and from this list, an adequate sample size representing the population is interviewed. As determining the sample size, it is assumed that the person surveyed has knowledge of the HACCP. The firms that know nothing about the HACCP is left out of the survey. In this context, a number of 50 food firms are interviewed, and 10 of them are regarded as not having any information about the HACCP system. Consequently, 40 numbers of the firms are surveyed.

**Table 1.** Distributions of the sample which both apply and don't apply HACCP with regard to sectors

Sectors	Applying HACCP		Not applying HACCP		The whole firms	
	Num.	(%)	Num.	(%)	Num.	(%)
Catering	3	50.0	3	50.0	6	100.0
Fat	2	50.0	2	50.0	4	100.0
Cornstarch	2	66.7	1	33.3	3	100.0
Fruit Juice	5	62.5	3	37.5	8	100.0
Citrus Fruits Packing	2	66.7	1	33.3	3	100.0
Cereals Packing	3	42.9	4	57.1	7	100.0
Milk	1	33.3	2	66.7	3	100.0
Others	1	16.7	5	83.3	6	100.0
Total	19	47.5	21	52.5	40	100.0

In this study, the firms are classified into two groups one of which implements the HACCP system and the other does not. All the firms applying the HACCP system and the equal number of firms not applying HACCP in these provinces, are contacted by phone, and nineteen of the

firms applying the HACCP system and twenty-one of the ones not applying accepted to be interviewed. The information about them is obtained by using the face-to-face interview method. Besides, from the consultant agencies of the HACCP system in the region, general information about certification, training, counseling and the firms' application of the HACCP system is obtained.

Sample size of this study according to sectors is given in Table 1: forty seven point five percent (47.5%) of the firms interviewed apply HACCP, and 52.5% do not. The sample size was chosen with the aim of being equally distributed among sectors. Some of the firms in the sample were unable to respond, so there are some absences in sectors.

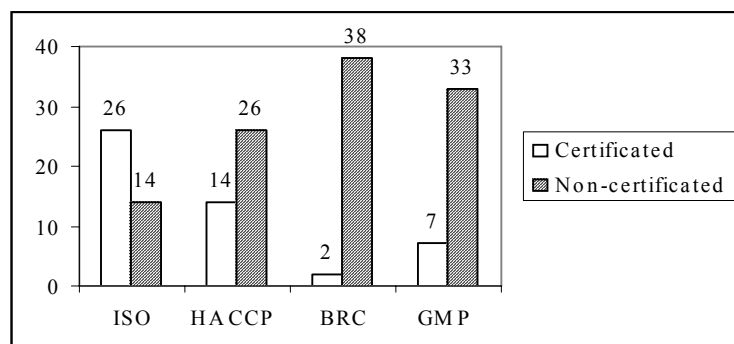
In 35 firms quality control managers were interviewed; in 2 firms, marketing managers and in 3 firms, accountants. In terms of the legal states of these firms, 42% of them are limited, 50 % are anonymous, and the rest consist of various types. The firms interviewed have been working in the food sector for a range from 3 to 57 years.

## 2.2. Survey design and data analysis

The data obtained from the firms by questionnaire is evaluated by calculating means, relative values, and by establishing cross tabulation between the variables. The questionnaire applied to the firms is formed with three sections according to the study's aims. In the first section, there are questions about the general business characteristics (number of employees, capacity usage rate, manager's education and experience etc). In the second section, the questions aimed to determine the conscious level of both the manager and personnel. As for the third section, the questions aimed to determine the firms' expenses which occurred as applying HACCP system. In addition to this, the purpose of the questions was to discover the firms' advantages and disadvantages originating from the application of HACCP.

Descriptive statistics were used to assess a pattern of responses to the interview items, and the chi-square test and variance analysis were used to investigate differences between the firms applying HACCP system and the ones not applying. In addition, the factor analysis is used to determine what the authorized persons perceive from the HACCP. The appropriate factor number is determined by taking the eigenvalue, screen test and the variance into consideration and the Varimax Rotation Technique is used.

## 3. Results



**Figure 1.** Possession of quality certificate of the firms (%)

### 3.1. Characteristics of the firms

Thirty five percent (35%) of the firms included in the survey have HACCP certificate, 65% have ISO (International Organization for Standardization), 5% have BRC (British Retail Consortium), and 17.5% have GMP (Good Manufacturing Practices) (Figure 1). In the fruit juice and cereals packing sectors in the region, approximately 30% of the firms have the ISO document. HACCP certificate is acquiring intensity in catering and fruit juice sectors (Table 2).

**Table 2.** Quality certificate situation of the firms according to their sectors

Sectors	Number	ISO		HACCP		BRC & GMP	
		Num.	%	Num.	%	Num.	%
Catering	6	4	15.4	3	21.4	1	11.11
Fat	4	2	7.7	1	7.1	1	11.11
Cornstarch	3	3	11.5	2	14.3	1	11.11
Fruit Juice	8	6	23.1	4	28.6	3	33.33
Citrus Fruits Packing	3	2	7.7	2	14.3	3	33.33
Cereals Packing	7	7	26.9	1	7.1	-	-
Milk	3	1	3.8	-	-	-	-
Others	6	1	3.8	1	7.1	-	-
Total	40	26	100.0	14	100.0	9	100.00

**Table 3.** Descriptive statistics of the firms applying and not applying HACCP

Variables	Applying HACCP	Not applying HACCP	The whole firms
Number of the firms	19	21	40
Number of the permanent workers (average-person)	101.06 * (105.12) <sup>a</sup>	45.67* (43.78)	71.23* (82.07)
Number of the temporary workers (average-person)	121.20 (147.81)	72.00 (77.91)	104.80 (127.89)
The capacity usage rate (%)	81.31** (65.86)	50.53** (23.45)	64.82** (49.57)
Average age of the managers (year)	41.06 (9.97)	40.80 (8.94)	40.92 (9.31)
Average working time of the manager (year)	9.06 (7.45)	8.95 (8.50)	9.00 (7.91)
Experience of the manager in the sector (average-year)	13.94 (8.49)	15.10 (9.70)	14.55 (9.04)
Number of the engineer related to quality control (average-person)	8.61* (11.15)	2.00* (2.15)	5.13* (8.41)
The activity of the firm in the sector (average-year)	15.05 (13.32)	15.24 (13.92)	15.15 (13.47)
Laboratory possessing (%)	84.2**	57.1**	70.0**

a standard deviations

\* significant at 5% confidence level.

\*\* significant at 10% confidence level.

Some descriptive statistics of the sample are given in Table 3. In the conclusion of the comparison made between the firms applying and not applying HACCP system, significant relationships arise between the number of permanent workers and the firms applying and not applying. The average number of the permanent workers in the firms applying HACCP is 101; this number is nearly half of the ones not applying this system (46%). Similar relation is observed for the number of temporary workers.

Upon comparing the firms, according to their capacity usage rates; it was found that the capacity usage rate was 81.31% in the firms applying HACCP. This rate was 50.53% in the firms not applying HACCP, and this is significant at the 5% confidence level.

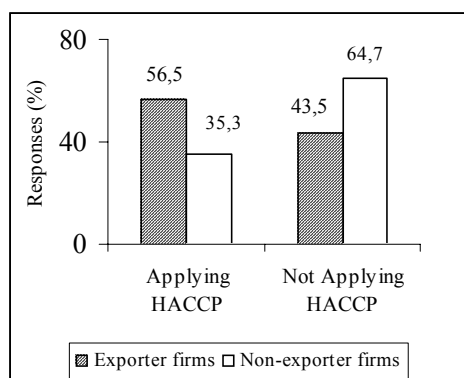
The average number of engineers related to quality control working at the firms applying HACCP is approximately 9, which only 2 engineers are employed in firms not applying HACCP. This relationship is statistically significant.

Average ages of the managers of the firms is 41, and their average working times in the firms is 9 years. Experience in the sector is 14.5 years and activity times of the firms in the sector is approximately 15 years. There is no important relation between the firms applying and not applying HACCP. Fifty seven point five percent (57.5 %) of the firms surveyed export, and 56.5% of them apply HACCP. For the firm which do not export, this rate is less (35.3%).

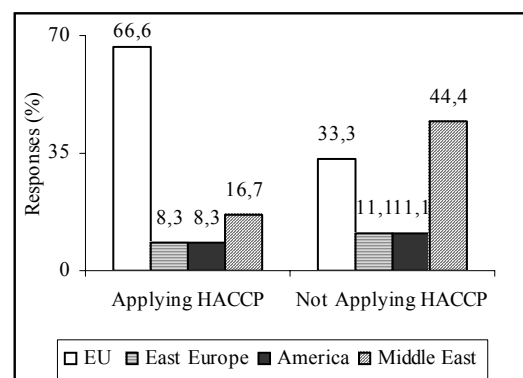
More than half of the firms applying HACCP employ more than 51 permanent workers. Generally medium and large scale firms apply HACCP. Seventy one percent (71%) of the firms applying HACCP employ less than 50 persons. In other words the firms not applying the HACCP system are mostly composed of small scale firms.

Eighty four percent (84 %) of the firms applying HACCP have their own laboratory, as for the firms not applying HACCP, 57 % of them have laboratory. By using cross tabulation, this is found to be significant at the 10 % confidence level. The firms that do not have the laboratory mostly have food products analyzed at the private laboratory.

More than half of the firms surveyed in the region make exportation to the EU countries. 66.6% of the firms applying HACCP prefer EU countries to make exportation, and 44.4% of the firms not applying HACCP prefer Middle East countries (Figure 2 and 3). This situation is caused by the reason that the EU countries pay attention to the quality certificates, importing food products. Middle East countries are not stable markets comparing to EU countries.



**Figure 2.** Exportation situation of the firms applying and not applying HACCP



**Figure 3.** Regions which the firms applying and not applying HACCP make exportation

Training is important in raising industry awareness about HACCP and ensuring that the potential benefits of HACCP to the food industry, regulatory authorities and ultimately the consumers, are realized [6]. There are statistically significant differences between food safety training and implementation of HACCP (Table 4). The average number of the persons trained on HACCP is about 36 per firm applying HACCP, and this number is about 5 in the firms not applying HACCP.

**Table 4.** Training of the personnel about hygiene and food safety (average number of persons).

Training situation	HACCP applying	HACCP not applying	All the firms
On the job training	81.67 (71.72)	49.89 (57.17)	69.75 (67.19)
Food hygiene training	36.25* (47.07)	4.63* (6.95)	23.6* (39.41)
HACCP training	41.25 (54.91)	21.17 (48.42)	35.77 (52.87)
Advanced diploma	3.8 (4.85)	1.46 (1.66)	2.48 (3.54)

\*significant at 10% confidence level.

Managers are responsible for the manufacture and sale of safe food products, as well as the provision of sufficient food handler training to achieve this aim [7]. Fifty-two point six percent (52.6 %) of the managers of the firms applying HACCP are trained on HACCP. For the firms not applying HACCP, most of the managers (38.1 %) find themselves with insufficient knowledge about HACCP but they also state to have no information about this subject. This relation is found statistically significant at 1 % confidence level (Table 5).

**Table 5.** Food hygiene qualification levels of the managers (%)

Qualification levels	HACCP applying	HACCP not applying	All the firms
None qualified	5.3	23.8	15.0
None qualified but informed about subject	5.3	38.1	22.5
On the job training	21.1	4.8	12.5
Food hygiene training	0.0	9.5	5.0
HACCP training	52.6	14.3	32.5
Advanced training	15.8	9.5	12.5
Total	100.0	100.0	100.0

\* significant at 10 % confidence level

**Table 6.** Adequacy of the managers about food safety and hygiene

Adequacy level	HACCP applying	HACCP not applying	The whole firms
Inadequate	22.2	43.8	32.4
Undecided	0.0	12.5	5.9
Adequate	77.8	43.8	61.8
Total	100.0	100.0	100.0

\*significant at 1% confidence level

Table 6 shows that 77.8% of the managers of the firms applying HACCP find themselves sufficiently knowledgeable about the food hygiene and safety. There is no significant difference ob-

served at the firms not applying HACCP. Seventy nine percent (79%) of the managers of the firms applying HACCP possess university, master or doctorate education. At the firms not applying HACCP, this rate was found to be 52.4%. The whole managers of the firms applying HACCP are at least graduated from a high school. The managers of the firms not applying HACCP are determined less educated. At the firms applying HACCP, managers are mostly (76.2%) the owner of the firms, as for firms not applying HACCP, this rate is less.

### 3.2. Consciousness level of respondents

Upon examining the survey, it was determined that 34% of the firms surveyed have the HACCP certificate and approximately 28% do not have the HACCP certificate but they consider applying it in the future, and 20% of the firms surveyed consider gaining the HACCP certificate (Figure 4). More than half of the firms in the region state having heard about HACCP for the first time while they were at the university. This situation occurred because most of the respondents are quality control managers who have education about food hygiene (Figure 5). Ninety five percent (95 %) of the firms interviewed consider that the HACCP system is necessary for the company. Asking the first concepts remembered by the HACCP, 20% of the firms state the hygiene and pureness, 18% state the hazard analysis, and 14% state inspection, control, and enrollment (Figure 6). From these results, it can be said that the firms in the region are aware of the issue.

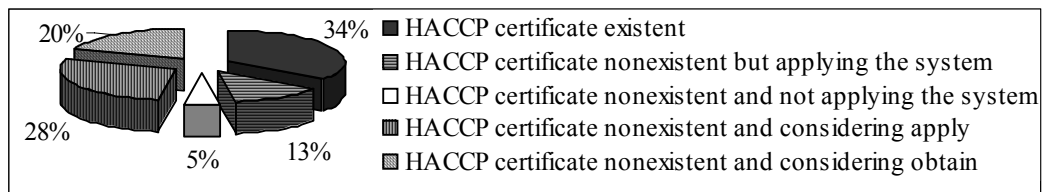


Figure 4. Situation of HACCP certification of firms

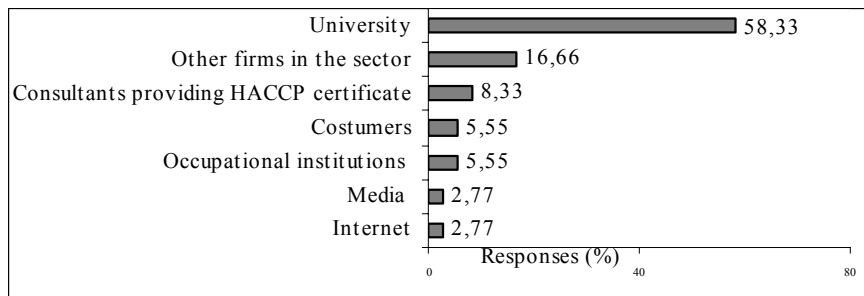


Figure 5. From where the interviewer initially heard about HACCP

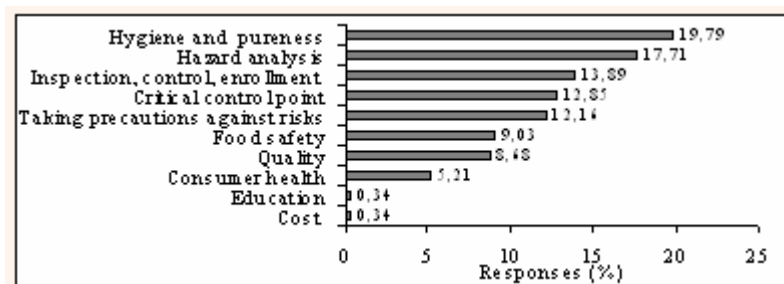


Figure 6. The first concepts about HACCP in the respondents' minds



To determine what the firms perceive from the HACCP system, it was demanded from them to grade the 21 judgment expressions below. Afterwards these variables were evaluated by using factor analysis. According to the result of the Bartlett test statistic, it was found that the factor values are significant at the 5% confidence level. The appropriate factor number was determined to be 7 in the condition that the eigenvalue criterion is more than 1. These 7 factors explain 69.2 % of the variance (Table 7).

**Table 7.** The results of factor analysis

Variables	Factors							h <sup>2</sup>
	1	2	3	4	5	6	7	
The product must be reliable	.840							.781
Food safety is more important than price	.754							.748
The customers' complaint must be regularly enrolled and evaluated	.689							.759
HACCP improves dependence of the customers	.630							.735
HACCP improves the performance of the firm	.611							.739
HACCP improves the confidence between the firm and the customer	.531							.736
HACCP system improves the business satisfaction on the job	.527							.560
HACCP is a means to evaluate the latest market opportunity		.877						.800
HACCP system creates value-added for products		.701						.592
HACCP means reliable food		.605						.638
HACCP is a means to introduce the firm		.599						.669
HACCP creates advantage against rival firms			.769					.773
HACCP provides an international identity to the firm			.668					.677
HACCP system is expensive				-.752				.863
HACCP system is time consuming strategy				-.702				.573
To gain HACCP skills, it is essential to participate actually in the development of the system					.882			.870
High quality food is the first aim					.729			.761
HACCP improves the relations between the upper and the lower managements						.800		.788
HACCP arranges organizations within the firm.						.779		.791
HACCP system should be applied to whole food firms							.846	.848
For HACCP system application, government support is needed.							-.673	.766
<i>Eigenvalue</i>	5.8	3.1	2.6	2.0	1.8	1.5	1.2	
<i>Variance</i>	22.4	11.8	9.8	7.8	7.0	5.8	4.6	
<i>Cumulative variance</i>	22.4	34.2	44.0	51.7	58.7	64.6	69.2	

Consequently, the determined factors are assembled under the titles below. These are:

1. *Food safety and customer's satisfactions*: This factor consists of food safety, reliability, and giving pleasure to the customer and explains 22.4 % of the variance.
2. *Market power*: This factor refers to the opportunity to expand through the new market area, by providing added value to the products, to improve its market power and explains 11.8% of the total variance.
3. *Competition power*: To provide an ability to compete against rival companies, and to create competition by acquiring an international identity. This factor explains 9.8 % of the total variance.
4. *System cost*: This factor, including the fiscal costs brought by the system and the costs caused by the loss in time, explains 7.8% of the variance.

5. *Participation and the quality*: This factor, including participating in the system as learning, and the priority of the firms' quality competence, explains 7% of the total variance.
6. *Organization*: This factor, including providing organizations in the firm and the relation between the upper and the lower management, explains 5.8% of the total variance.
7. *Requirement of the implementation*: This factor, including the necessity to apply the HACCP system and the government support, explains 4.6% of the total variance.

### 3.3. Advantages and disadvantages of the HACCP system

Some advantages carried by the HACCP system to the food firms are depicted in Figure 7 as their priorities. According to this, the advantage stated by the firms is to provide a reliable production process for human health. Ninety two percent (92%) of the firms state that they definitely agree on this opinion. Twenty three percent (23%) of the firms are located at the bottom line, expressing to agree on this opinion that the HACCP system reduces the application costs.

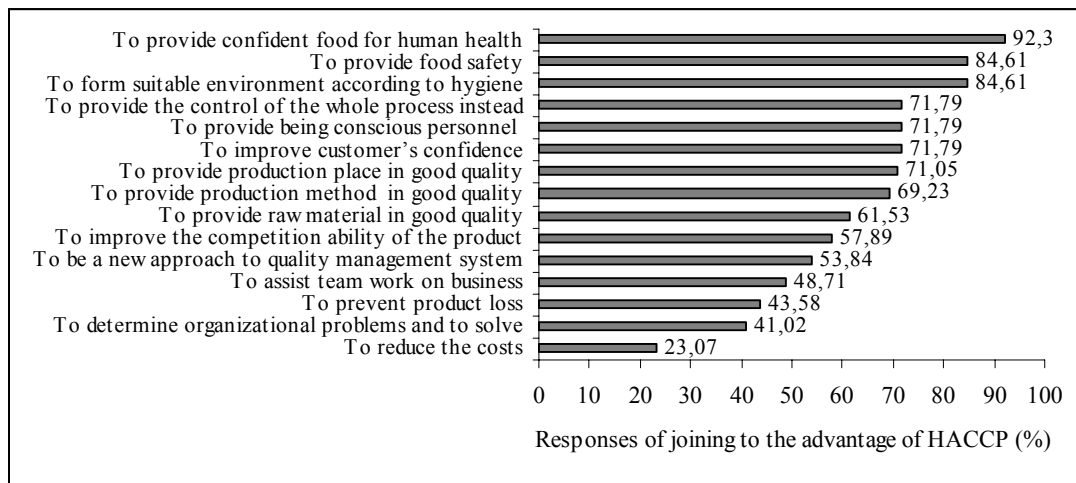


Figure 7. Advantages provided by the HACCP system to the business

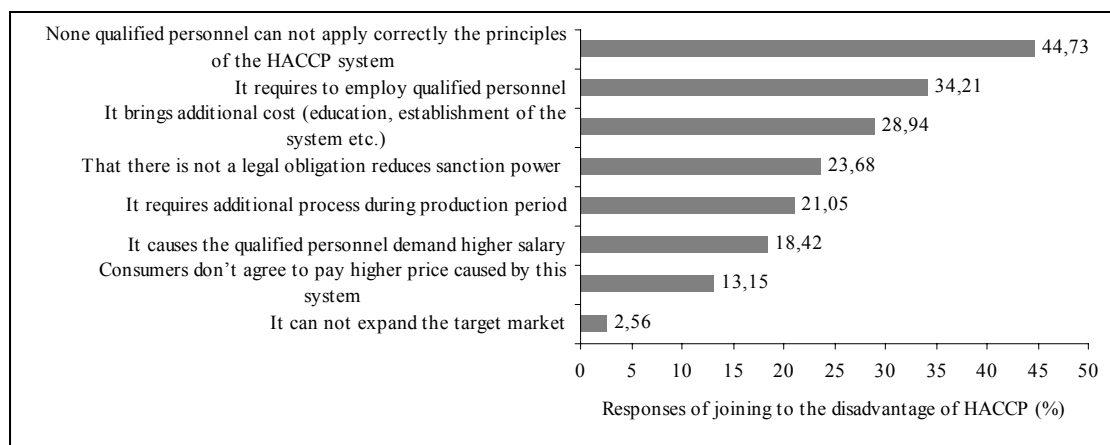


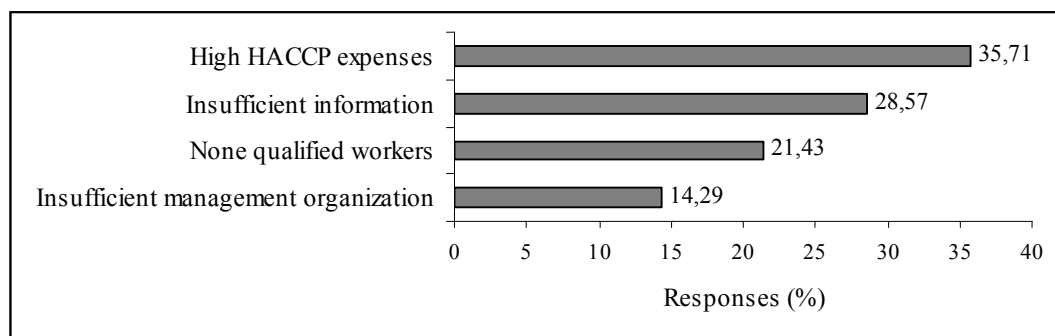
Figure 8. Disadvantages of HACCP system

Some disadvantages caused by the HACCP are given in Figure 8 as their priorities. Approximately 45% of the firms state that the most important disadvantage is that the non-qualified personnel do not apply the HACCP system correctly. This ratio is followed by the opinion with

34 % putting forward that the application of the system produces additional costs. Generally an important majority of the firms consider that there is not any important disadvantage of the HACCP system.

### 3.4. Implementation of the firms not applying HACCP system

It is determined that 53% of the firms interviewed do not apply the HACCP system. Sixty five percent (65%) of the firms not applying HACCP in the region state having attempted to use HACCP, 35% of them state not having attempted to use HACCP system. The important reasons why these firms do not apply HACCP are, due to the lack of customer requirement for this certificate (33%), inadequate food handlers (22.22%), high cost of the system (22.22%), incompetent knowledge about the subject (11.11%) and insufficient facilities and infrastructure (11.11%). Twenty three percent (23%) of the firms having made attempts about the HACCP state to continue their application. Seventy seven percent (77%) of them state to have postponed the activities by planning to continue later. The reasons why the firms had postponed the HACCP system are the high cost of the system (35.71%), inadequate knowledge about the subject (28.57%), inadequate food handlers (21.43%) and the organizational problems in the management of the firm (14.29%). Besides, some of the firms expressed that they have postponed applying the HACCP system because of the fact that they are waiting to establish ISO at their firms. They are only just at the beginning period and there is no legal obligation.



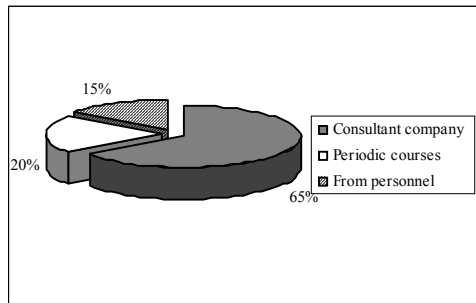
**Figure 9.** The reasons why the firms postpone implementing the HACCP system

### 3.5. Implementation of the firms applying HACCP system

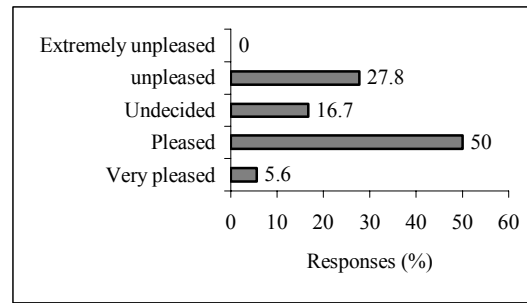
As for the implantation of the firms applying HACCP system, 47% of the firms included into the sample state to apply HACCP at present. Seventy one percent (71%) of the firms applying HACCP check-up on their employees every 6 months. The remaining firms do so every 3 months. Forty-five percent (45 %) of the firms applying the HACCP system assemble a HACCP team to achieve this aim.

An important majority (65 %) of the firms applying HACCP get support from the consultant companies (Figure 10). Half of them prefer domestic companies, and the rest prefer foreign companies. The reasons why the firms prefer foreign companies are; that these companies are more qualified, accredit organizations, and the name of the foreign companies may support the firms to export more easily. The reasons why the firms prefer domestic companies are; that the firms can contact each of them without facing difficulties, and the firms can ensure that the domestic firms are also well qualified. Asking if they are pleased with the companies they are working with, 27.8 % of the firms expressed that they were not pleased, and 50 % of the firms stated that they were.(Figure 11).

There is no Turkish accredited institution to offer HACCP certificate at present. The consultant companies can only offer educational and consultancy service. The firms can only obtain this certificate through the agent of the foreign accredited companies [8].



**Figure 10.** From whom assistance was obtained when applying the HACCP



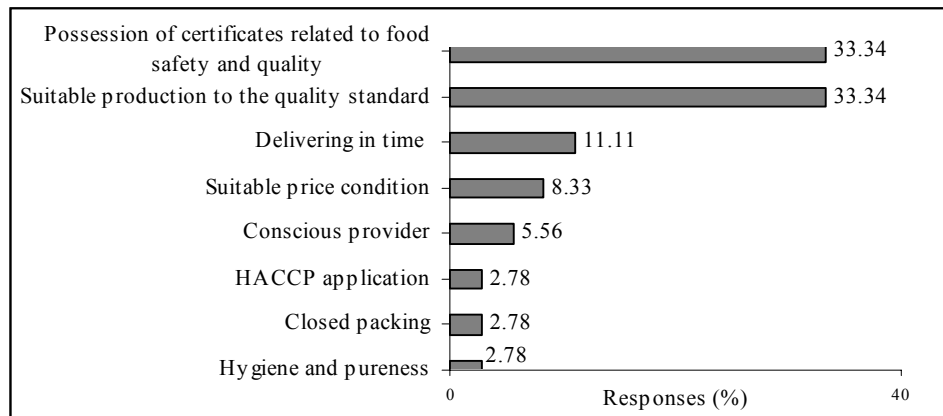
**Figure 11.** Satisfaction from the consultant company in Turkey

The food firms applying HACCP in the region find themselves adequate about the HACCP applications as given Table 8. These ratios only decrease from the view of food products gained from the providers, and of their content's quality and the returning of the package after using.

Asking to the firms applying HACCP in the region what the features they demand from the providers are; the features stated by the firms are shown at the Figure 12 according to that, the document related to food safety and quality (33.34%), production suitable to the quality standard (33.34%), and to deliver the products just in time (11.11%) are the expression stated mostly.

**Table 8.** Adequacy level of the application of HACCP system

HACCP Applications	Very Sufficient	sufficient	Moderate	Insufficient	Extremely insufficient	Total
To inspect the quality and safety of the food products taken by providers	30.0	60.0	10.0	0.0	0.0	100.0
To make periodic medical check-up of the workers	75.0	25.0	0.0	0.0	0.0	100.0
To inspect the critical control points regularly as their potential hazards	50.0	40.0	10.0	0.0	0.0	100.0
To enroll quality control regularly	75.0	20.0	5.0	0.0	0.0	100.0
Storing system	60.0	35.0	5.0	0.0	0.0	100.0
Cleanness of the work place	65.0	30.0	5.0	0.0	0.0	100.0
The enrollment of the customers' complaint	70.0	20.0	10.0	0.0	0.0	100.0
Training of workers	45.0	40.0	15.0	0.0	0.0	100.0
Adequacy of laboratory	55.0	25.0	10.0	5.0	5.0	100.0
Adequacy of the insect control	55.0	40.0	5.0	0.0	0.0	100.0
Maintenance and repairing	50.0	45.0	5.0	0.0	0.0	100.0
Packaging	55.0	35.0	10.0	0.0	0.0	100.0
Recycling of the packing	14.3	42.9	28.6	0.0	14.3	100.0
Filtration	47.1	29.4	5.9	5.9	11.8	100.0



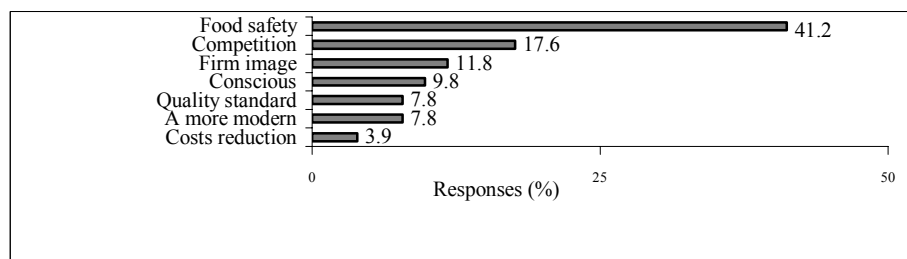
**Figure 12.** Required features of the providers for HACCP

The factors which are important, when deciding whether or not to apply the HACCP system are shown in Figure 13 according to where, health, safety and the quality production (40%), the desire of the management of the firm to achieve aims such as, superiority (22.5%) and customer requirements being met (15%) and legal obligation in EU.



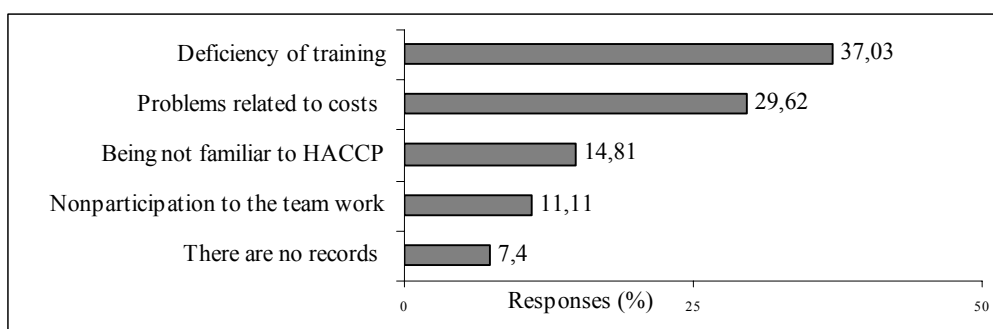
**Figure 13.** Effective factors for deciding whether or not to apply HACCP system

The answer of the open-ended questions asked about the benefits provided by HACCP consists of the first three responses which form more than half of the total responses. These are food safety, competitive advantage and firm image. Afterwards, these three responses are followed by conscious personnel, quality standard, a more modern work place, cost reduction (Figure 14).



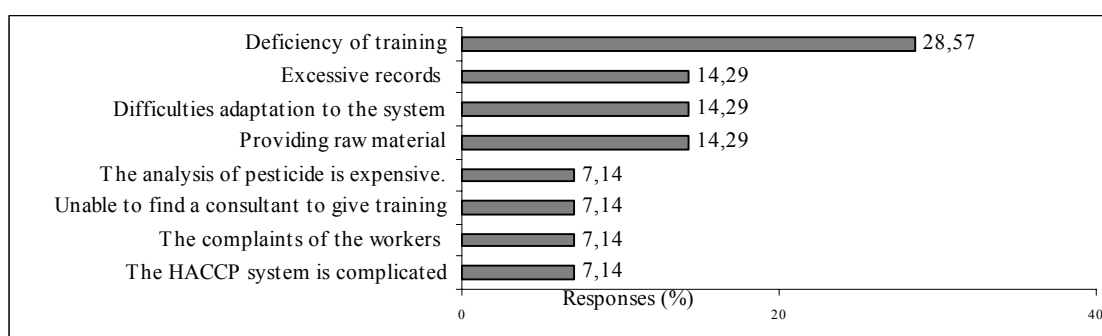
**Figure 14.** Benefits provided by HACCP to the firms

Asking the firms what the difficulties they are confronted with as establishing HACCP system, the deficiency in training was found to be the most important problems (37.63%). Afterwards, the problems related to costs (29.62%), and the problems faced being not familiar to HACCP system can be ranged (Figure 15)



**Figure 15.** The problems faced at the establishment period

The main problem faced when applying the HACCP system is the deficiency of training (28.57%), as the first stated problem faced at the establishment period. This ratio is followed by, the increased numbers of enrollments to be recorded (14.29%), difficulties in the adaptation of the system (14.29%), and provision of raw materials (Figure 16).

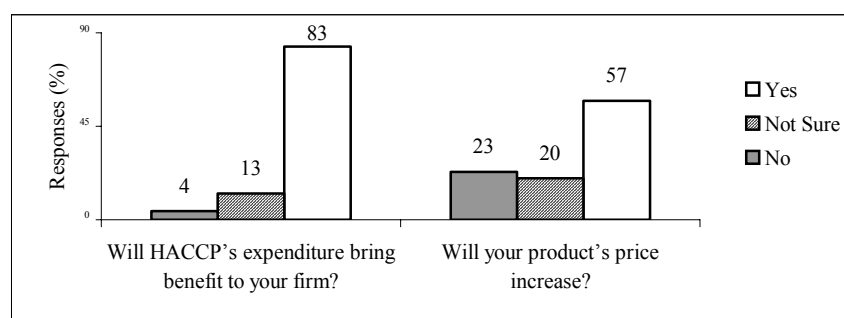


**Figure 16.** The problems faced during application

Lastly, nearly half of these firms state that the HACCP system should be applied in all food companies. It is observed that many certified firms are considered equal to those actually applying the HACCP system. For this reason, inspections should be undertaken more carefully and the certificate should be given to the firms which are truly applying the system. During the process of the establishment of HACCP, the foods should be produced reliably and the possible hazards to the human health should be determined correctly. All risks of the food production process should be filled with awareness, and the continuity of the HACCP applications should be provided. Besides, the firms suggest that the training of the systems like ISO, HACCP is also given by the universities. Besides, consumers should firstly be made conscious about the food hygiene and quality. Selecting the official inspectors, the persons having knowledge and experience about this issue should be especially chosen. Establishing the HACCP system improves the competition power of the firms both in national and international markets.

### 3.5. The costs of HACCP implementation

The expectancies of the firms if there are benefits brought by the HACCP and the price increase of the products are shown at the Figure 17. According to that the firms mostly consider that there are benefits. The firms considering that there are increases caused by the HACCP to the price of the products expect a 20.23% increase rate over the current prices of their products.



**Figure 17.** HACCP's effects on the value of the products and benefits to the firm.

Detailed information about HACCP implementation expenses are obtained from 14 of 19 firms applying HACCP. Table 9, indicates the expenses of the HACCP application according to the cost categories. The expense originated from building, ground and planning of the surroundings is the biggest cost categories with a ratio of 42 %. This is followed by the expense of calibration, repairing-maintenance (21%), hygiene and sanitation, insect control and personnel training.

**Table 9.** The average expenses of the HACCP applications

Cost categories	Average expenditure (€)	%
Building, ground and the planning of the surrounding	12.176	42.17
Hygiene and sanitation	5.162	17.88
Insect control	3.400	11.78
Personnel training	2.057	7.13
Calibration, maintenance and repairing	6.076	21.05
Total	28.871	100.00

Examining the costs of the HACCP application according to the sectors it was observed that building, ground and planning of the surrounding are the biggest expenditures in the corn-starch, cereal packaging, fat, fruit juice, catering and the others sectors (candy, dried nuts, poultry). Calibration, maintenance and repair are the most important expenditures in the citrus packing and fat industry.

**Table 10.** The expenses of the HACCP application according to firm scale (€)

Cost categories	Small size (1-50 persons)	%	Medium size (51-150 persons)	%	Large size (151 persons +)	%
Building, ground and the planning of the surrounding	9.733	53	12.117	49	36.667	40
Hygiene and sanitation	2.056	11	4.987	20	17.500	19
Insect control	3.667	20	2.600	10	5.000	5
Personnel training	1.611	9	2.356	9	2.500	3
Calibration, maintenance and repairing	1.411	8	2.767	11	30.000	33
Total	18.478	100	24.826	100	91.667	100

Analyzing the costs according to the size of the firms, building, ground and planning of the surroundings are found to be the most important expenditures caused by the HACCP applications in the small, medium and large scaled firms. Secondly, important cost categories are the insect control in the small scale firms, hygiene, and sanitation in the medium scaled firms and calibration, maintenance and repair in the large scaled firms. The training expenditures on the personnel to learn the HACCP system has the least important share in the entire (Table 10).

According to the information obtain from the consultancy companies in the region; the price of certification for the HACCP system is approximately 4537.5 € for the small scaled firms, 5100 € for the medium scaled, 6825 € for the large scaled firms. These amounts include the three years' process. The HACCP certificate is renovated one time for every three years. The price demanded by the consultancy companies for two days' training of a group consist of 20 persons is approximately 1300 € and the average price of consultation is 3875 € (Table 11).

**Table 11.** The prices of HACCP certification, HACCP training and consultancy (€)

Firm's size, training, consultancy	Minimum	Maximum	Average price
Small-size (1-50 persons)	4275	4800	4537.5
Average-size (51-150 persons)	4800	5400	5100
Large-size (150 persons +)	5850	7800	6825
HACCP training (2 days)	1000	1600	1300
Consultancy	3500	4250	3875

According to these data, the cost of certification, training and consultancy is a minimum of 9713 € for small scaled firms, 10275 € for medium scaled firms and 12000 € for large scaled firms. Comparing these data with the result of the survey; differences of 8765 € in the small scaled firms were found while these were 14551 € in the medium scaled firms and 79667 € for the large scaled firms. The minimum average expenses of certification, training and consultancy change, but the added cost, establishment and application of HACCP change in a bigger variance according to firm size. Results indicate that the essential HACCP expenses which are certification, training and consultancy are quietly higher for small firms.

On the other hand, the firms not applying HACCP but consider applying in the future, state that they are willing to pay approximately 19139 € from their budget to establish HACCP.

#### 4. Conclusions and Suggestions

Nowadays, traditional quality control methods used in the food industry sector are being replaced with the HACCP food safety systems. HACCP has been tested and endorsed by the national and international regulatory agencies and food industry as an effective means to prevention of food-borne diseases [9]. In the Mediterranean Region, production, processing and selling of the food products are made intensively. The determining of the problems occurring when applying the HACCP system, the examining of the HACCP expenses of the firms, and the determining the conscious level of HACCP system are important from the aspect of the effectiveness of the politics practiced on this issue in this region. Due to the findings of this study, the following procedures are recommended for HACCP application.



The important part of the firms in the region is planning to apply the HACCP system. However, there are many firms not having any knowledge about the topics. For this reason; establishment of this system should be obligatory at once.

In the region, the HACCP system is generally applied in the medium and large scaled firms, especially for the application rate increase in the cornstarch, citrus fruit packing and fruit juice sectors. Capacity usage rate and the number of engineers related to quality control in the firms applying HACCP are higher than the firms not applying. Government should make it obligatory for the firms to employ qualified personnel for food quality and safety.

The firms applying HACCP in general export to the EU countries. As for the firms not applying HACCP, they export to the Middle East. Because EU market is more stable in comparison to the others, the firms applying HACCP have a more guaranteed export.

In the firms applying HACCP, the managers are not generally the owners of the firm. This indicates that these firms have better organizational structure in comparison to others.

The firms perceive the HACCP system firstly as safer food and customer satisfaction, afterwards as a factor providing competing power in the domestic and international markets. From the other aspect, this system is perceived as costly because it takes time and requires additional expenditure. Besides, the system also is perceived as a regulator of the organizations in the firm. First of all, consciousness of food safety should be formed in the consumers' mind. Consumers' demand for quality and safety food may be a reason obliges the firms make investments on this issue.

The qualification level of the personnel about food hygiene and safety is higher in the firms applying HACCP proportionally to the firms not applying. Food safety and hygiene are regarded as the most important advantage. The disadvantage of the firms as applying HACCP system is caused by the unqualified personnel who cannot correctly apply the principles of the HACCP. At the same time, the most important problem for applying the HACCP program is the deficiency of training of personnel. This training should be practical and should facilitate the determining of the CCP hazard. Training should be reinforced with the pictures, figures and other types of visual material.

The other most important reason why firms do not apply HACCP is the cost of the system. The most important cost category is the building, ground and rearrangement of the surroundings. This cost is originated because the HACCP system may require rearrangement. The cost of building, ground, and calibration, repairing and maintenance, hygiene and sanitation may change according to the scale of the firm; the cost of the insect control and training of the personnel do not change, respectively. On the other hand, certification has an important share in the HACCP expenses especially for small firms. Nganje et al. (1999) found that although HACCP expenses are higher for small firms, these firms are more profitable with HACCP systems [10]. Mazocco (1996) proposed that HACCP can serve as an effective quality management tool in providing cost cutting incentives of other inputs [11]. In the region, government should provide a startup support for the small scaled firms to apply HACCP. Otherwise, it does not seem possible for small scaled firms to afford the expense.

Another problem faced as applying HACCP is that the application requires additional times and plenty of procedures. To prevent these, this type of ways which facilitate the process should be used. For example, when buying raw materials the enrollment needed should be written down systematically. At the same time, it is important that the HACCP team members be in contact with each other so as to lessen the loss times.

There is no authorized firm in Turkey to offer HACCP certificate. In order to establish the authorized firms to offer HACCP certificate, the essential legal encouragements should be provided.

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