



## Barriers and benefits of the implementation of food safety management systems among the Turkish dairy industry: A case study

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### ABSTRACT

The aim of this research was to determine the barriers and advantages of the Hazards Analysis and Critical Control Points (HACCP) and food safety programs (FSPS) employed by the dairy industry in Aydin, Turkey. By conducting face-to-face interviews and using questionnaires, the structure of Aydin dairy plants' food safety management systems was characterized. The questionnaires elicited information about the applications of food safety systems, dairy plant managers' opinions about any inspection systems, and their expectations for government and local legal authorities in food safety systems. Twenty-eight operating dairy plants in Aydin with a production licence from the Ministry of Food, Agriculture and Livestock show activity in the sector for more than 10 years (53.5%) with joint-stock or limited company status (60.7%). These plants produce white cheese, fermented milk products and butter. Implementing a clear and efficient food safety management system can improve legal issues (85.7%) and increase client trust (64.3%). This is positively correlated with the ages of dairy plant managers in the dairy industry in Aydin ( $p < 0.05$  and  $p < 0.01$ ). All the same, not understanding the HACCP was specified as one of the main barriers to its utilization. Almost half of managers (46.5%) reported not really knowing what HACCP was, while 35.8% reported that it was too expensive to employ. On the other hand, the main difficulties with prerequisite program (PRP) applications in Aydin dairy plants was determined to be a result of insufficient physical conditions (35.7%) and cost (46.4%).

A lack of knowledge relating to and the cost of HACCP and other food safety programs were the main barriers to implementation in the Aydin dairy industry. Providing periodical training and consultation services for FSMS applications in the dairy industry by the government and also providing financial support must be provided.

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### 1. Introduction

Dairy products are an essential component to the Turkish diet but they are also a potentially hazardous product if they are processed in non-conforming conditions. Therefore they are identified as a high-risk food product. During dairy processing, microorganisms from several sources e.g. personnel, water, equipment, additives and packaging materials (Demirbas, Karahan, Kenanoglu, & Karagozlu, 2006; Papademas & Bintsis, 2010) can contaminate the product. In addition, dairy products are also potential carriers of veterinary drugs, chemical pollutants and microbial toxins. Because of these concerns, countries have established procedures and

systems to minimize these risks. National and international institutions have been created to focus on minimizing economic losses and infection risks from all steps in the dairy production process (Scott, 1989; Topal, 2001). Concordantly, the Hazard Analysis and Critical Control Point (HACCP) system identifies, maintain, evaluates, controls and monitors each production point that is significant for food safety. HACCP was developed by the Codex Alimentarius Commission (CAC, 1996; ISO, 2007). However, HACCP is most effective when used with other quality management systems and standard operating procedures, such as Good Manufacturing Practices (GMP) or Good Hygiene Practices (GHP) (Kok, 2009). The Food Safety Management System (FSMS) was introduced by the International Organization for Standardization (ISO). The FSMS set interrelated or interacting elements to establish policy and objectives and to achieve those objectives. The FSMS is used to direct and control an organization with regard to food safety (ISO, 2007).

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HACCP-based programmes, like ISO 22000 and BS PAS 220:2008, and other auditable commercial standards system, that include food safety elements like BRC and IFS, have been widely implemented in the dairy industry (Papademas & Bintsis, 2010).

Private food quality and safety commercial standards enable businesses to improve and control quality of their product. It also improves supplier and retailer trust while supporting consumer objectives. These systems are the most effective and economic way of ensuring a safe food supply especially in light of the worldwide food safety problems that many countries have been enduring (Trienekens & Zuurbier, 2008). Therefore, several studies have been published concerning the implementation of HACCP and commercial standards for milk and milk products, such as pasteurized, ultra high temperature (UHT) and condensed milk (Dijkers, Huurnink, Pennings, & van den Berg, 1995; Sandrou & Arvanitoyannis, 2000a; Ali & Fischer, 2002), yoghurt (Sandrou & Arvanitoyannis, 2000a), a variety of cheeses (Arvanitoyannis & Mavropoulos, 2000; Arvanitoyannis, Varzakas, & Koukaliaroglou-van Houwelingen, 2009; Evrensel, Temelli, & Anar, 2003; Mavropoulos & Arvanitoyannis, 1999; Sandrou & Arvanitoyannis, 2000b), ice cream (Arvanitoyannis et al., 2009; Mortimore & Wallace, 1998; Papademas & Bintsis, 2002), as well as, cream and butter (Ali & Fischer, 2005; Sandrou & Arvanitoyannis, 2000a). The private sector in the global dairy industry utilizes developed hazard management and control processes systems both in response to market demands and legal regulations (Demirbas & Karagozlu, 2007).

The food safety literature demonstrates that success in developing, installing, monitoring and verifying a successful HACCP system involves a complex mix of managerial, organizational and technical hurdles. Even the largest food companies, equipped with important resources, technical specialists and management skills, may face difficult challenges implementing an HACCP system. Therefore a small or medium-sized enterprise (SMEs) may feel that the difficulties of HACCP are insurmountable (Taylor, 2001a). Potential problems in the execution of HACCP need to be identified

and examined as an initial step in the actual development of any HACCP execution strategy. These problems or barriers vary from country to country or from business sector to business sector. Some may be due to internal factors in a business' operations, like the knowledge level or available resources for the business. Others may be related to external factors, such as the accessibility of government or industry support (WHO, 1999).

The difficulties applying HACCP in food businesses, especially among smaller food manufacturers, have been widely studied. Lack of economical resources, purchasing power, more complex food-handling practices, lack of technical expertise and limited personnel have all been cited as possible barriers to HACCP implementation in retail and catering sectors (Jouve, 1994; Mortlock, Peters, & GriYth, 1999; Stevenson, 1990). In the catering industry the most paramount problems have been identified as lack of knowledge, training, high staff turnover, the large variety of products, change in potential demand, variability in workloads, and the large numbers of part-time workers (Adams, 2000; Panisello & Quantick, 2001; Ward, 2001). Several researchers have identified similar results in the foodservice and retail industries (Jevšnik, Bauer, Zore, & Raspor, 2007; Jevšnik, Hlebec, & Raspor, 2008; Strohbehn, Gilmore, & Sneed, 2004). In addition to this, studies in hospital food services, catering establishments, hotels, kebab houses, takeaways and restaurants, have determined that the basic reason of not developing food safety applications result from the lack of knowledge about these systems (Bas, Yuksel, & Cavusoglu, 2007). In some milk plants in Izmir city, Turkey, it was documented that the critical factor cited by plant managers for not implementing a HACCP system was the high cost of implementation (Demirbas & Karagozlu, 2007).

The outflow of high quality and safe dairy foods from Turkey is an important consideration given relations with the European Union (EU). Because of this, forming, maintaining and controlling food safety, in all food-related business sectors is within the frame of the Turkish Food Codex Regulation and the regarding regulations since 1997. The sanctions covering this subject have been recently fortified with the Veterinary Services, Plant Health, and Food and

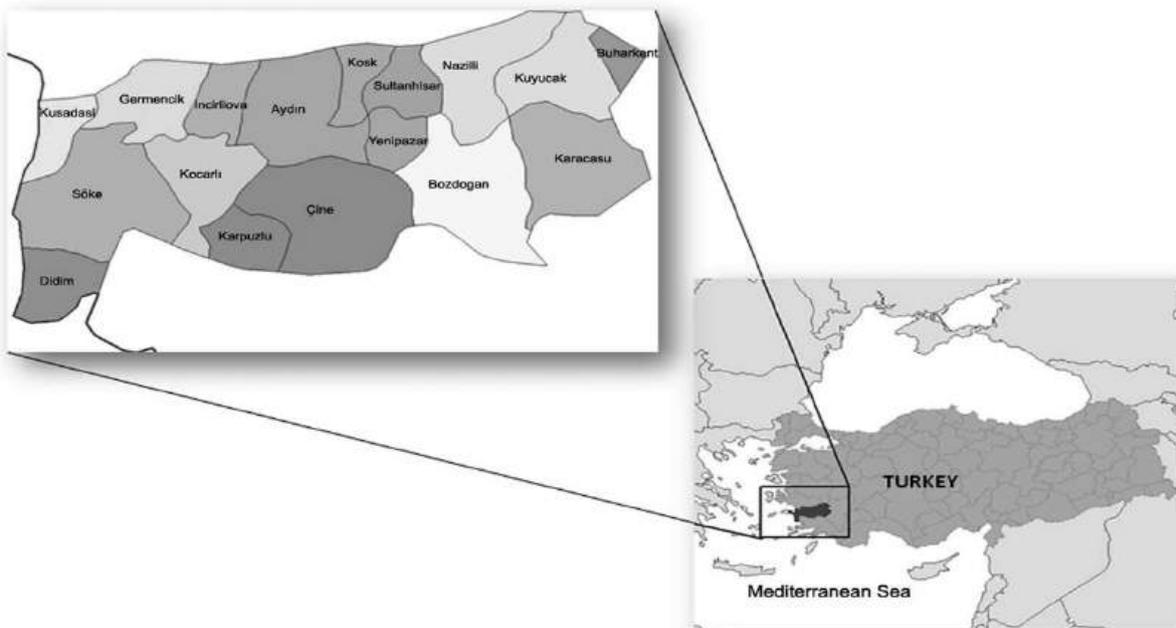


Fig. 1. Aydın and its counties.

**Table 1**  
Characteristics of dairy industry and managers ( $n = 28$ ).

Characteristics	n (%)	
	n	(%)
<i>Dairy business</i>		
Year of establish		
1–5 Years	8	(28.6)
6–10 Years	5	(17.9)
11–20 Years	13	(46.4)
21 Years or more	12	(42.8)
Legal structure		
Joint-stock company	4	(14.3)
Limited	13	(46.4)
Collective	1	(3.6)
Individual	6	(21.4)
Public	2	(7.2)
Cooperative	2	(7.2)
Milk processing type		
Milk storage	4	(14.3)
Fermented milk products	22	(78.6)
UHT or pasteurized milk	3	(10.7)
Cheeses	27	(96.4)
Butter	6	(21.4)
Ice cream	2	(7.1)
<i>Manager of dairy business owner</i>		
Age		
30 Years and younger	2	(7.1)
31–50 Years	17	(60.7)
Older than 50 years	9	(41.8)
Educational level		
Graduate of primary school	10	(35.7)
Graduate of high school	7	(25.0)
Graduate of collage or bachelor degree	9	(32.1)
PhD degree	2	(7.2)
Years experience in dairy sector		
5 Years or fewer	1	(3.6)
6–20 Years	9	(32.1)
21–30 Years	10	(35.7)
More than 31 years	8	(28.6)

Feed Law (No: 5996) (Anonymous, 2010). Although the HACCP system is obligatory in Turkey, there are still numerous barriers to implementation these systems.

There is no research, to date, identifying the main barriers to developing and implementing HACCP or other food safety management systems among the majority of dairy plants in Turkey. The aim of this study was to determine the benefits and barriers in the application of HACCP and FSMS in Turkish dairy processing plants. For this reason, Aydın city, Turkey was chosen as the research pilot cite because of the high density of dairy units. This research examines the structure of dairy enterprises, the legal framework relating to food safety systems; and the applications and barriers to food safety systems used in the Aydın dairy industry. The study then applies are larger perspective by discussing the legal framework and applications of food safety systems in all of the Turkish dairy industry. Finally, we suggest modifications in current

food safety systems and their applications, based on the study's findings.

## 2. Material and methods

### 2.1. Business

This research was performed from March to July 2010 and involved 28 dairy plants in Aydın province. The Aydın province is situated in the west of Turkey, as seen Fig. 1. Only active dairy plants with production licences from the Turkish Ministry of Food, Agriculture and Livestock have been taken into consideration. The number of the dairy business based on districts of Aydın is as follows; Centrum (5), Cine (5), Soke (4), Nazilli (3), Umurlu (3), Kocarlı (2), Yenipazar (1), Kuyucak (1), Karpuzlu (1), Germencik (1), Bozdoğan (1), Kusadasi (1).

Researchers prepared a written questionnaire in cooperation with the Aydın Food, Agriculture and Livestock City Directorate for this study. Researchers trained in HACCP visited each dairy plant and prerequisite programs. Researchers had an educational background in food safety in accordance with ISO/TS 22003 (ISO, 2007). During the plant visits, the researchers employed the questionnaire, which was followed by face-to-face and narrative interviews regarding the questions and responses, to ensure the accuracy of the responses. The narrative interview technique allowed the interviewees to talk freely about their experiences with HACCP and FSMSs. Interview questions were used as a guide to elicit the interviewees' stories. The narrative interviews were analyzed using researchers' notes. To insure uniformity the same interviewer and note taker was utilized for every interview. The research team members read each of the questions aloud during the interview also and then asked the questions to insure clarity. The interviews enabled us to identify and characterize the main barriers involved. However, face-to-face and narrative interviews required a lot of time, which is a drawback to this method.

### 2.2. Questionnaire design

A written questionnaire in 4 parts was developed specifically for this study. Part 1 included six questions related to food business (legal status of the plant, product diversity, educational level of managers, etc), Part 2 included fifteen questions regarding improvements in the food safety management systems, and Part 3 included twenty-three questions barriers and difficulties encountered in implementing food safety systems. Part 4 included nine questions related to government and legal authority expectations of dairy plants. The scores were converted to a 100-point scale.

### 2.3. Pilot study

The questionnaires were piloted on three dairy plant administrators and other equally responsible technical managers at

**Table 2**  
Managers' opinions of benefits of implementing a food safety management system ( $n = 28$ ).

Responses	n (%)				
	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
Increased product quality	3 (10.7)	0 (0)	2 (7.2)	3 (10.7)	20 (71.4)
Reduction in complaints	3 (10.7)	1 (3.6)	5 (17.9)	6 (21.4)	13 (46.4)
Increased customer confidence	7 (25.0)	0 (0)	3 (10.7)	4 (14.3)	14 (50.0)
Compliance with legislation	3 (10.7)	1 (3.6)	0 (0)	5 (17.9)	19 (67.8)
Increased market share of the products	15 (53.5)	0 (0)	1 (3.6)	5 (17.9)	7 (25.0)
Prevent food poisoning	8 (28.6)	2 (7.1)	4 (14.3)	5 (17.9)	9 (32.1)
Useful business management discipline	5 (17.9)	2 (7.1)	2 (7.1)	9 (32.1)	10 (35.8)

**Table 3**Managers' opinions of how they could help themselves to improve food safety in their businesses ( $n = 28$ ).

Responses	n (%)				
	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
To follow new developments and technology	0 (0)	0 (0)	4 (14.3)	4 (14.3)	20 (71.4)
Implementing basic hygiene procedures	1 (3.6)	0 (0)	1 (3.6)	5 (17.9)	21 (75.0)
Using control lists routinely	1 (3.6)	0 (0)	0 (0)	7 (25.0)	20 (71.4)
Insuring only good product buy	1 (3.6)	0 (0)	2 (7.1)	4 (14.3)	21 (75.0)
Give more training to keep everyone aware	3 (10.7)	1 (3.6)	4 (14.3)	5 (17.9)	15 (53.5)
Less staff turnover	6 (21.4)	0 (0)	3 (10.7)	1 (3.6)	18 (64.3)
Avoid cross contamination	7 (25.0)	0 (0)	2 (7.1)	5 (17.9)	14 (50.0)
To apply food safety system based on HACCP system	11 (39.3)	4 (14.3)	1 (3.6)	3 (10.7)	9 (32.1)

individual sites, not group managers. Based on the pilot test groups, the questionnaires were modified. Additional questions were added to ensure sufficient coverage of certain areas and questions were rewritten to increase clarity based on these areas.

#### 2.4. Statistical analysis

All statistical analyses were conducted using SPSS for Windows (Version 16.0, 2007, Chicago, IL). Statistical significance was set at  $p < 0.05$  and  $p < 0.01$ . The differences between educational levels of managers, age values, barriers and benefits of FSMSs, expectations of dairy plants from the legal authorities' values were determined by a correlation analysis test.

### 3. Results

#### 3.1. Characteristics of the dairy industry in Aydn

Demographic information related to characteristics of the dairy industry and the managers in Aydn, Turkey is presented in Table 1.

More than half (53.5%) of the dairy plants in Aydn have been active for more than 10 years and are legal structured as joint-stock and limited companies (60.7%). The dairy plants produced mostly cheeses (96.4%), fermented milk products (78.6%), butter (21.4%), UHT and pasteurized milk (10.7%) and ice cream (7.1%). Greater than fourteen percent (14.3%) of the plants operate as milk storage units.

More than half of the (60.7%) dairy sector managers were between 31 and 50 years of age. Many of the managers (60.7%) had primary and high school education degrees and 96.4% had greater than five years experience in the sector (Table 1).

#### 3.2. Improving food safety in dairy plants

As shown in Table 2, the majority of dairy plant managers discussed two primary benefits of implementing of a food safety

management system. The main benefits were aiding compliance with food-related legislation (85.7%) and increasing product quality (82.1%). The rest of the benefits were as follows: useful business management discipline (67.9%), reduction in complaints (67.8%) and increased customer confidence (64.3%).

When asked what top management needs to do to improve food safety practices in their plants, a large percentage disagreed that a HACCP-based food safety management system was necessary (53.6%). However, dairy industry representatives believed that using control lists routinely (96.4%) would improve safety as would implementing basic hygiene procedures (92.9%), insuring only good products were bought (89.3%) and to follow new developments and technology (85.7%) (Table 3).

#### 3.3. Barriers and difficulties encountered in implementing food safety systems

As shown in Table 4, cost was the primary (46.4%) barrier to adopting prerequisite programmes (PRPs) in Aydn dairy plants, then insufficiency in the plants' physical conditions (35.7%), insufficiency in HACCP knowledge (28.6%) and lack of personnel training (17.9%).

Dairy plant administrators were asked to agree or disagree with different statements related to the difficulties of implementing HACCP and food safety management system (FSMS). A high percentage of the managers (46.5%) relayed that lack of knowledge about HACCP/FSMS was the main barrier to their implementation. In addition, food safety not being a business priority was listed as an important barrier (39.3%) as was the perceived cost (35.8%) (Table 5).

Amongst the difficulties that food safety officers perceived he or she will experience, during the application of food safety management systems, the extra workload of such systems was not a concern (75%) nor was the burden of responsibility being on one person (75%). Also a concern about time lost due to the food safety system was not a major concern.

**Table 4**Barriers identified by managers to implementing PRPs in dairy industries ( $n = 28$ ).

Responses	n (%)				
	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
Insufficiency in HACCP knowledge	13 (46.4)	5 (17.9)	2 (7.1)	4 (14.3)	4 (14.3)
Cost	11 (39.3)	1 (3.6)	3 (10.7)	4 (14.3)	9 (32.1)
Time	21 (75.1)	2 (7.1)	1 (3.6)	2 (7.1)	2 (7.1)
Staff turn-over	25 (89.3)	1 (3.6)	0 (0)	2 (7.1)	0 (0)
Lack of management support	22 (78.6)	1 (3.6)	0 (0)	2 (7.1)	3 (10.7)
Insufficiency in physical conditions	13 (46.4)	1 (3.6)	4 (14.3)	4 (14.3)	6 (21.4)
Lack of staff motivation	27 (96.4)	1 (3.6)	0 (0)	0 (0)	0 (0)
Confusion in terminology	24 (85.7)	0 (0)	3 (10.7)	0 (0)	1 (3.6)
Insufficiency of simple guidelines	17 (60.8)	4 (14.3)	2 (7.1)	2 (7.1)	3 (10.7)
Intensity of paperwork	24 (85.7)	3 (10.7)	0 (0)	0 (0)	1 (3.6)
Lack of personnel training	18 (64.3)	2 (7.1)	3 (10.7)	3 (10.7)	2 (7.2)
Not enough support from the legal authorities	24 (85.7)	2 (7.1)	1 (3.6)	0 (0)	1 (3.6)

**Table 5**  
Statements relating to barriers to food safety management systems ( $n = 28$ ).

Statements	n (%)				
	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I cannot see the benefits of HACCP/FSMS	17 (60.7)	0 (0)	3 (10.7)	3 (10.7)	5 (17.9)
I do not have the time for food safety issues	20 (71.4)	2 (7.1)	4 (14.3)	1 (3.6)	1 (3.6)
Inadequate Turkish sources about HACCP/FSMS	18 (64.3)	0 (0)	3 (10.7)	2 (7.1)	5 (17.9)
Increase of workload	20 (71.5)	0 (0)	3 (10.7)	3 (10.7)	2 (7.1)
HACCP/FSMS is too complicated	21 (75.0)	2 (7.1)	3 (10.7)	1 (3.6)	1 (3.6)
Perceived cost	14 (50.0)	2 (7.1)	2 (7.1)	2 (7.1)	8 (28.7)
Food safety is not really a business priority	14 (50.0)	1 (3.6)	2 (7.1)	3 (10.7)	8 (28.6)
Lack of knowledge about HACCP/FSMS	10 (35.7)	3 (10.7)	2 (7.1)	2 (7.1)	11 (39.4)

#### 3.4. Managerial expectations for government support in food safety systems

The Ministry of Food, Agriculture and Livestock City Directorate serves as the legal authority for the dairy plants in Aydın. When asked how the ministry could help dairy plants implement and sustain food safety programs, managers uniformly agreed that consultation services provided by the authorities would be the most valuable support in the application of FSMSs (60.7%). Manager, secondly, responded that free training (57.1%) provided by the government would be helpful, and thirdly they wanted a reward system employed in the sector (50.0%) (Table 7). Additionally, other expectations declared by managers are described in Fig. 2. Managers also wanted governing bodies to provide financial support (credit, encouragement or fund) for FSMS application, decrease the Value Added Tax (VAT) on dairy products, and protect Turkish dairy plants from unfair competition practices.

The dairy plant managers thought that controls performed by the Aydın Food, Agriculture and Livestock City Directorate were useful in FSMS applications (96.4%), but the frequency of the controls were not sufficient (67.8%) (Table 8). Generally, managers at the plants wanted the authorities to not only be a controller but also to orient them any program applications. Fewer dairy plant managers wanted to be the only controller rather than the authorities (10.7%).

Table 9 describes a positive correlation between level of age of dairy plant managers and increased customer confidence in the product; as well as a positive correlation with the age of plant managers and lack of problems with the plant's legal conditions. Also, time insufficiency and the education level of dairy plant managers were positively correlated with plant managers age ( $p < 0.01$ ,  $p < 0.05$ ). However, there is a negative correlation between consultancy requests for FSMS and food safety issues and the education level of managers ( $p < 0.01$ ). This means that when the age of the dairy plant manager increases, he believes his role is to provide utility of FSMS applications to gain customer trust and harmony in the legal conditions. Besides this, when the education level of the manager increases, he will not find the time separated for FSMS requisites sufficient ( $p < 0.05$ ).

**Table 6**  
The difficulties which food safety responsible experienced at the FSMS applications ( $n = 28$ ).

Responses	n (%)				
	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
Responsibility being on one person	21 (75.0)	2 (7.1)	1 (3.6)	0 (0)	4 (14.3)
Extra workload	21 (75.0)	2 (7.1)	3 (10.8)	0 (0)	2 (7.1)
Time lost	20 (71.4)	1 (3.6)	2 (7.1)	1 (3.6)	4 (14.3)

#### 4. Discussion

During the last three decades, HACCP protocols have been increasingly implemented for the benefit of the food industry (Panisello & Quantick, 2001) and consumers. HACCP enables an industry to identify potential hazard points and faulty practices in the beginning stages of food production, processing, or preparation (Bas, Ersun, & Kivanc, 2006). In developing countries, the execution and consequence of HACCP in many dairy industries is complicated, mainly due to the lack of technology available in food plants. Instead expensive, complicated and extensive HACCP plans have been developed without prerequisite programs being considered (Roberto, Brandao, & Barbosa da Silva, 2006). In our research, cost, insufficiency in the current plant's physical conditions, and knowledge insufficiency about HACCP practices were the most important barriers to using PRP applications in Aydın, Turkey's dairy plants (Table 4). In other research, time and money were determined to be the major barriers to improving food safety. Similar problems have been determined by other authors (Bas et al., 2007; Gilling, Taylor, Kane, & Taylor, 2001; Panisello & Quantick, 2001; Ward, 2001). On the other hand, the difficulties of executing HACCP in Turkish food businesses have been named as insufficient equipment and physical conditions of the facility (Bas et al., 2006). Ours is the first study that documents these as the issues interfering with food safety in the Turkish dairy industry, which is a large contributor to the food supply.

The Turkish Ministry of Agriculture has not provided any technical support or educational training to plants processing milk and dairy products (Demirbas & Karagozlu, 2008). This was apparent in a recent questionnaire study of 115 food plants in Ankara, Turkey. Eight-seven percent of managers in that study agreed that among the difficulties experienced during the application of food safety systems, 'not enough support from the authorities' was provided (Bas et al., 2007). Although 92.8% of the dairy plant managers in our study declared they had support from the Ministry (Table 4) 67% felt that government regulation was insufficient (Table 8). In our study, managers declared that the controls performed by the Food, Agriculture and Livestock City Directorate were useful for FSMS practices (Table 8). One of the differences between our findings and previous studies was the managers' belief in the effectiveness of the Food, Agriculture and

**Table 7**  
Expectations of dairy plants from the legal authorities ( $n = 28$ ).

Responses	n (%)				
	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
Free training	7 (25.0)	0 (0)	5 (17.9)	5 (17.9)	11 (39.3)
Reward system	7 (25.0)	3 (10.7)	4 (14.3)	10 (35.7)	4 (14.3)
Consultation service	8 (28.6)	0 (0)	3 (10.7)	5 (17.9)	12 (42.9)

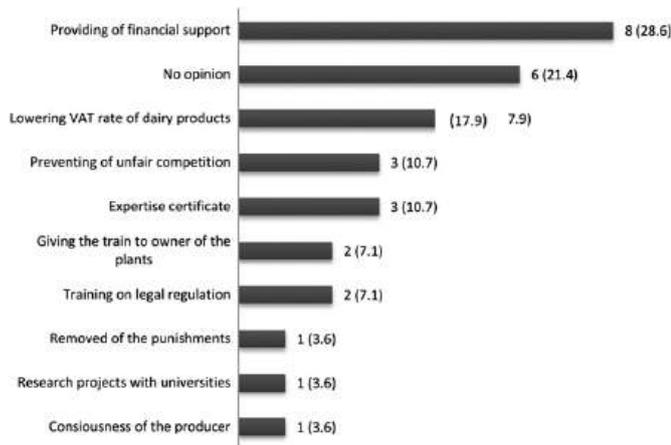


Fig. 2. Expectations of the managers from the legal authorities ( $n = 28$ ) (A respondent may have given more than one benefits).

Livestock City Directorate controls performed at dairy plants. So, the enforcement authority has a vital role in insuring food safety in dairy processing (de Sitter & van de Haar, 1998).

There are numerous forms, procedures, instructions and plans that have been required during the application of food safety management systems and PRPs. Other studies have found that the extensive documentation requests were time consuming and complex (Taylor & Forte, 2008). According to our research, the intensity of documentation during the institution of PRPs and periodical controls were not important (96.4%) impediment to applying food safety systems at the dairy plants in Aydın (Table 4.) However, developing and implementing strong written standard operating procedures in the food industry are one of the difficult stages required in building an effective HACCP and other food safety systems in Turkey (Demirbas & Karagozlu, 2007). According to Gilling et al. (2001) in their study in Northwest England, it was determined that one of the main barriers to successful guideline adherence to HACCP was interviewees frustration with 'excessive paperwork'. The difference between our findings could stem from the use of software programmes that decrease document volume, thus making documentation easier in the applications of these systems. It has been also suggested that food safety documentation and record keeping does not have to be burden, and can have many benefits other than complying with HACCP principles (Taylor & Taylor, 2008).

There is a major disagreement between prerequisite programs and HACCP plans and how they should be executed. The reasons for this misunderstanding are the negative guideline factors such as to establish a correct relation between prerequisite programs and HACCP plans in the programs and a lack of understanding about the programs. But it is hard to say which barrier takes place first (Vela & Fernandez, 2003). Our study demonstrates that the main barrier to executing a HACCP-based food safety management system in dairy product producers are cost of application and a lack of knowledge about HACCP/FSMS. Food safety is not really a business priority in

Table 9

Correlation between educational level and age of managers and barriers-benefits of FSMS and expectations of dairy plant managers from the legal authorities.

Responses	Age	Education level
Customer confidence	0.51 <sup>b</sup>	
Lack of problems with the legal conditions	0.48 <sup>a</sup>	
Time insufficiency		0.41 <sup>a</sup>
Consultancy request		-0.49 <sup>b</sup>

<sup>a</sup> Correlation is significant at the 0.05 level (2-tailed).

<sup>b</sup> Correlation is significant at the 0.01 level (2-tailed).

part because our finding shows that it is perceived to cost too much to implement (Table 5). The main difficulties of executing HACCP in Turkey food businesses have been named as lack of prerequisite programs, lack of knowledge and inadequate Turkish information sources related to HACCP (Bas et al., 2007). Similar to our findings, Youn and Sneed (2002) identified employee and resource barriers in a national study of school foodservice directors. They documented that the primary barriers were lack of employee training and financial resources.

Dairy plant owners in Aydın have a low education level of 60.7% (primary and high school) and are typically between 31 and 50 years old (60.7%). Inheriting their jobs from their family (they do this work from childhood) has been observed in this business sector. Owners often have little or no previous food safety knowledge or hygiene training. Only 21.4% of dairy plant managers had HACCP or FSMS training (all data not shown, in Karaman et al., 2011). The lack of managerial training results in a lack of knowledge about HACCP (46.5%), an unwillingness to use HACCP/FSMS (39.3%) and an inability to see the benefits to HACCP or FSMSs (60.7%) (Table 5). It has been previously observed that micro-to small-scale food industries are generally not in the position to implement the HACCP guidelines due to their small size, lack of technical expertise and training, rapid personnel turnover, and limited resources (Azanza & Zamora-Luna, 2005; Panisello & Quantick, 2001; Taylor, 2001b; Torres, 2000).

According to a questionnaire study performed in 86 dairy plants in Izmir, the biggest impediment to implementing HACCP was the inadequacy of the work force and their lack of knowledge concerning food safety (Demirbas & Karagozlu, 2007). However, there is a popular perception that implementing HACCP in dairy plants is excessively difficult (Gilling et al., 2001). Similarly, psychological barriers such as lack of risk awareness and staff motivation need to be addressed for effective HACCP implementation (Taylor, 2008).

In general, effective HACCP plan execution requires a team effort rather than the commitment of a single individual (Azanza & Zamora-Luna, 2005). Our study documents that this is also true in the Aydın dairy industry. The responsibility of food safety practices does not belong to one person but is shared between the staff of the plant (Table 6). In this sense, teamwork and staff involvement in the development of a HACCP system could be an important aspect in personnel motivation (Gilling et al., 2001).

Our results indicate when the education level of dairy plant owner increases, their desire for governmental consultation

Table 8

Opinions of the dairy plant managers about the controls made by the legal authorities ( $n = 28$ ).

Responses	n (%)				
	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
The controls are useful	0 (0)	0 (0)	1 (3.6)	9 (32.1)	18 (64.3)
The controls are not affected by our clean unit and food production with quality	5 (17.9)	4 (14.3)	4 (14.3)	10 (35.6)	5 (17.9)
Provisions whose application are difficult are requested at the controls	15 (53.6)	7 (25.0)	2 (7.1)	3 (10.7)	1 (3.6)
The frequency of the controls are not sufficient	2 (7.1)	2 (7.2)	5 (17.9)	9 (32.1)	10 (35.7)
The legal authorities must be the only controller	8 (28.6)	3 (10.7)	10 (35.7)	4 (14.3)	3 (10.7)

support in FSMS practices decreases. This negative correlation suggests that FSMS application in dairy plants might increase by employing plant managers from the operators with high education levels (Table 9). In another study conducted in 86 dairy plants that were selected with proportional sampling, it was determined that when the education level of the dairy plant owners increased so did the rate of periodical food safety checks on the raw milk and products (Demirbas & Karagozlu, 2008). The increased checks then reflect positively on food safety and quality outcomes (Demirbas & Karagozlu, 2008). Similar results have been reported by Tokuc, Ekuklu, Berberoglu, Bilge, and Dedeler (2009), Buccheri et al. (2007), and Shiferaw et al. (2000).

HACCP is used for the identification, analysis, and control of hazards in food products before they are submitted to the customer for purchase or consumption. HACCP is mandatory in Turkey. Motivating elements beyond this for executing HACCP programs have been reported as satisfying regulatory requirements and improving product quality and safety (Herath & Henson, 2010). Also appealing were the ability to sell products for higher prices, reduction in product wastage and reducing cost of goods produced because of reduced the amount of product recalls (Scott, 2005). In our study we found dairy plant managers think FSMS applications have some benefits, such as increased product quality, satisfying legal requirements and increased customer confidence in the product (Table 2). Similar results were provided by Bas et al. (2007). We also found that managers believed FSMS systems increased customer trust but that does not cause an increase on market share (25%). This result suggests that food safety systems are not used for increasing product market share.

According to Table 3, our plant managers believed that basic hygiene procedures, quality controls on input materials, providing lists of routine control checks, and adherence to those controls was more important than the application of a FSMS based on HACCP. In other research in Turkey, contrary to our findings, only a small percentage (26.1%) of food-sector managers followed the HACCP system to improve food safety in their businesses (Bas et al., 2007). Other studies have documented that only when HACCP plans are understood and applied correctly are they effective for preventing industry-based food-borne illnesses (Demirbas & Karagozlu, 2008). Every business needs its own food safety system with practical and simple checklists on-site (de Sitter & van de Haar, 1998).

The new European Union (EU) hygiene regulations will apply to member states from 2005/2006 and will impact all sectors of the food chain. The regulations in short will expect primary producers to adopt full a HACCP system (Bas et al., 2007). Turkey has been a member of the Food and Agriculture Organization (FAO) and Codex Alimentarius Commission since 1948. Despite not being an EU member, the Turkish government has adopted new regulations for the Turkish Food Code that are in line with the upcoming regulations being implemented in the European Union. Our findings indicate that most of the dairy plants will welcome the new regulations since managers in our studied desired that the authorities implement sufficient controls (67.8%). However, we also found that old and new regulations need to have more frequent adherence checks conducted by the Turkish food safety authorities (Table 8). de Sitter and van de Haar (1998) observe that any official inspection is limited with regards to time and inspectors' observations only relate to a portion of a particular process at a given point in time. Therefore an increase in audit frequency may be welcome, as our finding suggest, and could be more effective than an increase in audit duration.

Aydın's smaller dairy plants suffer from insufficient technical experience that impedes FSMS in small establishments. In the US, technical support programs are available for very small plants, as is a free phone service that addresses any questions. The network

responsible for giving information and making technical guidelines for these small establishments was set up by the US Department of Agriculture. As shown in Table 7, our findings indicate that Turkish dairy plant manager's desire similar programming from the local agricultural organizations. Many studies have indicated that FSMS-related consultation services and training is a desired commodity in the Turkish food industry (Bas et al., 2007; Demirbas & Karagozlu, 2008; Demirbas et al., 2006).

## 5. Conclusions

Our study indicates that the most important barriers for FSMS implementation in the Turkish dairy industry are due to insufficient funds, plant conditions, and knowledge about HACCP practices. Managers do not perceive food safety as a business priority because of the cost outweighs the benefits, currently in Turkey. Results indicate that owners of the dairy plants have little or no previous food safety knowledge or hygiene training. Because of their insufficient knowledge, plant managers believed that basic hygiene procedures, quality controls on input materials, lists of routine control checks, and adherence to those controls were more important than the application of a FSMS based on HACCP. Inheriting their jobs from their family could compound these misconceptions. Unlike previously suggested, the data showed that the intensity of documentation required during the institution of PRPs and periodical controls involved were not important impediment to applying food safety systems. Although, the controls performed by the Food, Agriculture and Livestock City Directorate were useful for FSMS practices in Aydın, it was commonly felt that the frequency of adherence checks conducted by the Turkish food safety authorities need to increase. FSMS application may be further enhanced in dairy plants that employ plant managers with high education levels.

Our study was based on questionnaires and interviews. These techniques have clear drawbacks. The most important drawback is the extensive time required by the face-to-face and a narrative interview process. Reading each of the questions aloud during the interview followed by a reiteration when asking the questions, to insure clarity to the owner of the businesses, requires a lot of time. This method could be improved with other approaches such as 'left the adherence problem solved' (McGannon & Mauws, 2000) or using multiple researchers to conduct interviews.

Despite the limitations of the qualitative methodology used in this research, our findings were able to elucidate clear barriers and benefits to food safety programs in the dairy industry in Turkey. Our findings also suggest that we need program clarifications to help managers understand the goals of food safety regulations and the strategies behind controls and inspections. The data also indicate that in additional training or information be provided to increase managers' and staffs' understanding of basic food safety principles. The government must provide financial support to establish FSMS in these plants and to support long-term maintenance of FSMS in the industry. Furthermore, the Turkish Ministry of Food, Agriculture and Livestock needs to provide an FSMS-related consulting service and 'hotline' to improve FSMS application, especially for smaller plants. Finally, local universities could help by supporting FSMS-related training activities or programs and making them available to dairy plant employees. Our study documents all that is working well in food safety in the dairy industry and all that can be built upon to improve food safety in that industry.

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