

Food Safety Practices on Dairy Farms in Turkey: A Case Study of Izmir Province

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Abstract: The aim of this study was to determine the food safety and quality practices on dairy farms that are located in Izmir province. By means of a survey in which dairy farmers responded to a special questionnaire, data were collected from 103 dairy farmers. Chi-square (Test of Independence), Variance (one-way ANOVA) and Kruskal Wallis Test were used to analyze the data. The 5-point Likert scale was used in measuring problems raised in dairy farming about food safety and quality practices and proposed solutions for problems from farmers.

Key words: Dairy farms, food safety, milk, food quality, farmers, Turkey

INTRODUCTION

Today besides meeting the need in the quantity of food requirement, food safety and production according to quality criteria are the main problems of food procurement (Ilbery and Kneafsey, 2000). Milk is a nutritive medium for pathogens so that milk is listed among high risk carrying food products. It is estimated that 1.5% of foodborne illnesses are caused by milk (Bean *et al.*, 1996). So, as in the other food products, food safety in milk and dairy products appears to be the most important quality criteria.

In Turkey, problems related with the structure of the dairy sector restrict the applying of food safety rules in the dairy firms. The basic problem which does not change according to the size of the firm is the restrictions depend on dairy farms which are the 1st step in supply chain. To provide quality and safety production, HACCP, GMP and GHP principles or the application of ISO quality assurance systems is not enough in the industry unless appropriate and sufficient amount of milk supply to the firms.

In this study, food safety and quality criteria of dairy farms were determined in Izmir province where it is one of the most important production places in Turkey according to the number of dairy farms and milk production (Demirbas *et al.*, 2007; Demirbas and Karagozlu, 2007, 2008). The current practices and the knowledge level of dairy farmers on quality of milk, food safety and quality system practices were evaluated. In addition, related problems and solutions were examined.

MATERIALS AND METHODS

Farm selection: The Ege Agricultural Region and Izmir are important milk-processing centres due to the presence of modern dairy farms and dairy processing industries compared to other agricultural regions of Turkey. According to the average 2007/2009 years, 15.68 % of the milking cow population (two ages and over cow numbers) is located in Ege region. The concern of Izmir in this statistic is quite impressing (24.48% of the population). The survey was carried out in 5 counties and 20 villages. The proportional contribution of counties to the milking cow population in the province was taken into account in the selection of these counties. Likewise, for the determination of the villages where the survey was carried out, the proportional contribution of the villages to milking cow population in counties was considered. Commercial dairy farms that supply milk to the market (local dairies, cooperatives, dairy factories) represent the scope of the study. These farms were chosen on the basis of their suitability to the purpose of the study. The very small family-run farms were set apart and farmers having at least three milking cows were surveyed.

Data analyses: The study involved an interview with the 103 dairy farmers using a pre-tested structured questionnaire in Izmir. The dairy farms were divided into homogeneous groups by the number of their milking cows (Table 1). The difference between the groups of the dairy farmers' age, education level and their experiences in dairy farming was determined by one-way ANOVA for continuous variables (Newbold, 1995). For the continuous

Table 1: The variables tested by Chi-square analysis and the groups of the variables

Name of the variables	Groups belonging to the variables
Age of farmers (years)	
≤34	1st group
35-44	2nd group
45-54	3rd group
≥55	4th group
Education level of farmers (years)	
Primary school	1st group
Middle and high school	2nd group
University (2 and 4 years of education)	3rd group
Size of the farms (The number of milking cows) (Head)	
3-7	1st group
8-12	2nd group
13-17	3rd group
17+	4th group

variables, a Normal Distribution Test was applied by Jarque-Bera Test (Gujarati, 2005). For variables displaying normal distribution, analysis of variance was performed. For the variables not displaying normal distribution, Kruskal-Wallis Test which is a non-parametric one-way variance analysis was applied (Field, 2009).

Whether there were differences between groups in terms of the characteristics of the farm and the farmers and their practices was determined by using Chi-square analysis (Test of Independence) (Malhotra, 1996; Gujarati, 2005) for intermittent variables. In these analyses, the principle that the expected count of the cells should not be <1 and that cell numbers which have an expected count <5 should not be >20.0% of total cells was taken into consideration. When the principle has been missed, the designated groups were combined. If the minimum expected value was (<5), the Fisher Exact Test if it was (5<) the Yates Chi-square Test was used in the evaluation. The variables showing significant differences were shown in Table 1.

In measuring the problems encountered in dairy farming and the current food safety and quality practices and proposed solutions from farmers, the 5-point Likert scale was applied by setting one as very low and five as very high.

RESULTS AND DISCUSSION

General specifications of the dairy farms and farmers: In the studied farms, the average number of the milking cow per farm was 14.6 head indicating a significant figure with respect to whole Turkey average of 2.34 milking cows per farm. The average size of the dairy farms was about 5 ha and daily milk production was 215 L. The average amount of the marketed milk was 86.8% of milk produced.

Table 2: The general specifications of the farmers

Groups	Age	Education	Experience in the dairy farming
1st group (n = 46)	43.800	6.000	15.24
2nd group (n = 26)	49.230	5.960	17.92
3rd group (n = 14)	45.000	5.790	20.21
4th group (n = 17)	46.000	6.470	19.82
Total (n = 103)	45.690	6.040	17.35
p-value*	-	0.728	0.17
Chi-square value	-	1.303	5.03
p-value **	0.146	-	-
F-value	1.834	-	-

Significant for $p < 0.05$; *Kruskal Wallis Test; **One-way ANOVA Test

In the studied dairy farms, the farmers were questioned about their age, total years of education and experience in the dairy farming as general specifications. These variables can affect the farmers practices, their approach and preferences with respect to food safety and quality. For variables displaying normal distribution, Analysis of Variance (one-way ANOVA) was performed. For the variables not displaying normal distribution, Kruskal-Wallis Test which is a non-parametric one-way variance analysis was applied (Table 2).

The farmers were on average 45.69 years old and they had 6.04 years of education. The average experience in the dairy farming was determined as 17.35 years. No significant statistical difference was found between the group averages ($p < 0.05$).

The knowledge level of the dairy farmers related to food safety and quality standards

Quality criteria of milk: The major quality criterion for milk is dry matter content, fat content, total viable cell count and somatic cell count in milk. In the Turkish Food Codex, communicate on raw milk and heat treated drinking milk; the milk quality standards that have to be required in farming facilities are stated (Official Journal, 2000).

On the studied dairy farms, farmers appear to have the best awareness on fat content (19.42%) among milk quality criteria. This is followed by dry matter content (7.77%), total viable cell count (5.83%) and somatic cell count (2.91%), respectively.

The variables that are thought to influence the farmers' milk safety and quality practices and differences between the groups for these variables were analyzed with Chi-square analysis. As a result of the analysis, differences were found between the groups in terms of the knowledge level on dry matter content and total viable cell count in the milk produced of farmers and the size of the farms (Table 3). As the farms size increase, the tendency to know of the farmers' dry matter content and total viable cell count in the milk produced rises.

Table 3: The knowledge level on total viable cell count and dry matter content of the milk produced of farmers

Size of the farms (Head)	Total viable cell count in the milk produced		Chi-square (p*)
	Know	Do not know	
3-12	1	71	0.009
13+	5	26	-
Dry matter content of the milk produced			
Size of the farms (Head)	Know	Do not know	Chi-square (p*)
3-12	1	71	-
13+	7	24	-

Table 4: The knowledge level on fat content and total viable cell count of milk produced of farmers

Education level of farmers	Fat content of milk produced		Chi-square (p*)
	Know	Do not know	
Primary school	11	62	0.016
Middle school and over	7	9	-
Total viable cell count of milk produced			
Primary school	6	69	0.017
Middle school and over	5	10	-

*p<0.05 (significant); **Fisher Exact Test was used in the evaluation

There were differences between the groups in terms of the knowledge level on fat content and total viable cell count of milk produced of farmers and the education level of farmers (Table 4). When the education level of farmers increased the situation to know of the farmers fat content and total viable cell count in the milk produced rises.

Equipments and machinery asset that utilized to measure milk quality: As to the data, equipments were inadequate to determine the quality of milk in addition considerable lack of equipment is very important in terms of food safety and milk quality. Only two of the farms were found to have acidometer and refractometer, only one farm had thermometer. None of the facilities had lactodensimeter which was used to measure the density of milk.

Records and record systems on dairy farms: On 64.08% of the dairy farms milk yield record, on 72.82%, record of pedigree and on 33.01% health record was kept. Record keeping rate was generally high on the dairy farms according to the average of Turkey.

As a result of the Chi-square analysis, differences were found between the groups in terms of the keeping records and the age and education level of farmers (Table 5-7). As the age and education level of farmers increase, the tendency to keep record of the farmers rises.

The specifications related to animal health and hygiene: On the dairy farms, the performance of the controls and tests related to animals were prior among animal health

Table 5: Record keeping situation on milk yield of farmers

Education level of farmers	Record of milk yield		Chi-square (p*)
	Keeping	Not keeping	
Primary school	48	33	0.045
Middle school and over	18	3	-

*p<0.05 (significant); **Fisher Exact Test was used in the evaluation

Table 6: Record keeping situation on pedigree of cows of farmers

Age of farmers	Record of pedigree		Chi-square (p*)
	Keeping	Not keeping	
34-44	30	18	0.048
≥45	45	10	-

*p<0.05 (significant) **Yates Chi-square Test was used in the evaluation

Table 7: Record keeping situation on health of cows of farmers

Age of farmers	Health record of cows		Chi-square		
	Keeping	Not keeping	Value	Degree of freedom	p*
≤34	3	10	9.123	3	0.028
35-44	13	22	-	-	-
45-54	16	18	-	-	-
≥55	2	19	-	-	-

*p<0.05 (significant)

and hygiene criteria. Predominantly mastitis, alum, plague and black disease vaccinations were performed on the studied farms. The application rates of the other important vaccines are significantly lower.

Using bedding materials in the barns: Using bedding materials in barns is very important for cattle health. Bedding and bedding management contribute to cow comfort, udder health and milk quality. In general, cattle bedding materials should be comfortable to lay on, non-abrasive, non-slippery, highly absorbent of water and urine and display low levels of environmental bacterial (Zehner *et al.*, 1986; Barberg *et al.*, 2007).

On the studied farms, usage of the bedding materials was only 11.65%. On the dairy farms that are using bedding materials, usage of straw was 25% this was followed by sawdust and straw (16.67%), finally sand (16.67%). Also, the frequency of changing bedding materials was 50% on half a year.

Cooling condition: In animal husbandry, climate and nature conditions are included to stress factors and these situations have also negative effects on yield per animal. For a variety of reasons, the incidence of health problems in livestock including dairy cows increases during warm Summer months (Montoya *et al.*, 1995; Kadzere *et al.*, 2002). On 14.56% of the studied farms cooling was applied and in 85.44% of farms there was no means of cooling.

Storage conditions of manure: The other important issue related with barn and about food safety is the storage and waiting period of the manure. There must be a manure pit

which can be used for the accumulation and storage of the manure in daily stable cleaning and this pit must be cleaned out in every 3 or 6 month (Yuksel *et al.*, 2004). The manure must be kept in suitable storages to provide food safety and by this way environmental pollution could be prevented. Also, storing manure piles in the open air effects the health and hygiene conditions on farms negatively (Atilgan *et al.*, 2006). However 93.20% of the studied farms, manure that is originated from the animals were placed nearby the farms, 3.88% of dairy farms used manure for crop production and 2.91% kept them in the storages.

Milk storage conditions: According to the collected data, on 39.60% of the dairy farms, milk was kept in aluminum cans, on 25.74% plastic cans and on 15.84% steel cans were used after milking. It took about 1 h to collect milk which was milked in the morning and about 45 min in the evening.

Problems encountered in dairy farming on food safety issue and proposed solutions: According to the 5-point Likert scale, on the studied dairy farms, most important food safety problem confronted by the farmers is the negative effect of high feed prices to production (4.88). This is followed by negative effect of low milk prices (4.80) and reproductive problems (4.15).

The solution proposals from farmers were listed as follows the dairy farming should be supported by the government and there should be an efficient control mechanism from farmers to consumers, production should be done in hygienic conditions and farmers should be educated about dairy farming and food safety.

The study was intended to provide a comprehensive picture of food safety practices on dairy farms in Izmir. In animal production, food safety practices regarding to farm to fork approach is getting increase in the world and in Turkey. Also increasing in the knowledge of consumers and farmers on healthy and quality production plays an important role in this improvement. Milk which has a high importance in human health and nutrition supplies from dairy farms. So, to ensure and generalize food safety applications to provide safety and quality milk and milk products on dairy farms which are the 1st steps of production is getting important.

When the results were generally evaluated, the knowledge level of farmers on food safety of milk was determined to be inadequate. Also equipment necessary to measure quality of milk were inadequate. The studied farms are faced with various technical and economical problems which make it difficult for farms to adapt to food

safety practices. As it is mentioned in literature, only taking care of the health of farming animals is not sufficient to ensure the food safety. The whole production process should be considered on the dairy farms (IDF, 2007; Noordhuizen and Metz, 2005).

In terms of public health, besides the technical inadequacy, the level of knowledge of the farmers on food safety practices should be increased. Standard practices for food safety should be improved. Although, results indicate a rather good level of farmers' knowledge of most important action points, the findings can be used to modify current education programs aimed at improving farm-level food safety. The close relationship between cattle management and milking practices on the one hand and milk quality components on the other suggest a need to develop payment methodologies based on a list of production specifications (Srairi *et al.*, 2009). It is a crucial fact that almost half of the marketed milk is sold to big milk factories and cooperatives is significant to improve the farmers' knowledge levels on food safety. Along with that fact, the improvement of the technical abilities and the knowledge level of the personnel of the cooperatives might develop the benefit expected from the cooperatives.

CONCLUSION

In this study, the knowledge level of farmers on food safety and quality of milk is determined to be inadequate. Studied farms are faced with various technical and economical problems which make it difficult for farmers to adapt to food safety practices.

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