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Determination and Effects of Milk and Dairy Products Consumption Profile in Thrace Region to some Microbiological Parameters

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Abstract- Milk and its products are very important for development and physiology of human organism. In developed countries annual consumption of milk per person is above 100 liters while this rate in our country is about 25 liters. Unfortunately milk is not consumed as needed especially by children. According to the Index of the Global Dairy, economic development, urbanization and increasement of the purchasing power of middle class citizens are the most important factors of the epanding dairy market. Annual consumption milk and its products per person is expected to increase all over the world expect West Europe between the years 2010 - 2020, and this expectation is commented as the increasement of purchasement is being slide from west to east. In spite of milk and its products are important nutrition elements for humans, they can be very serious risk factors for consumer health if they are produced under insufficient hygiene conditions and / or absence of food security systems.

Keywords: milk, dairy products, microbiology, hygiene, correlation.

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DETERMINATIONANDEFFECTSOFMILKANDDAIRYPRODUCTS CONSUMPTIONPROFILE INTHRACEREGIONTOSOME MICROBIOLOGICALPARAMETERS

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Determination and Effects of Milk and Dairy Products Consumption Profile in Thrace Region to some Microbiological Parameters

Emek Dumen ^α, Funda Hatice Sezgin ^ο, Harun Cerit ^ρ & Gülay Merve Bayrakal ^ω

Summary- Milk and its products are very important for development and physiology of human organism. In developed countries annual consumption of milk per person is above 100 liters while this rate in our country is about 25 liters. Unfortunately milk is not consumed as needed especially by children. According to the Index of the Global Diary, economic development, urbanization and increasement of the purchasing power of middle class citizens are the most important factors of the epanding dairy market. Annual consumption milk and its products per person is expected to increase all over the world expect West Europe between the years 2010 -2020, and this expection is commented as the increasement of purchasement is being slide from west to east. In spite of milk and its products are important nutrition elements for humans, they can be very serious risk factors for consumer health if they are produced under unsufficient hygiene conditions and / or absence of food security systems. The aim of this study was to determine the consumption profile of the public who live in Thrace region and how the preferences of the public affect the microbiological quality of the milk and its products consumed by the public. The aim of this study was to determine the consumption profile of the public who live in Thrace region and to expose how the preferences of the public affect the microbiological quality of the milk and dairy products consumed by the public. For this purpose, 450 houses in 3 main cities of Thrace region were visited (Edirne, Kırklareli and Tekirdağ / 150 houses for each city) without prior notice and 9 questions about consuming profiles (which are considered to be effective to the microbiological quality of milk and dairy products that the families consumed) were asked to the household. Besides 1 dairy sample was collected from each house and the samples were analyzed for TAB (total aerobic bacteria), coliforms, *Escherichia coli*, *Listeria monocytogenes*, *Staphylococcus aureus*, *Salmonella* spp. and *Bacillus cereus*. According to the results, it was determined that, consumption profile of the dairy products of the public was directly related with microbiological risk factors.

Keywords: milk, dairy products, microbiology, hygiene, correlation.

Özet- Süt ve ürünleri insan organizmasının gelişimi ve fizyolojisi açısından son derece önemli gıda maddeleridir. Gelişmiş ülkelerde 100 litreye ulaşan ve hatta üzerine çıkan yıllık kişi başı süt tüketimi Türkiye'de 25 litreyi

geçmemektedir. Türkiye'de çocuklar başta olmak üzere süt tüketiminin çok azdır. Küresel Süt Endeksi'ne göre süt ve ürünlerinin tüketimindeki yüksek artışın en önemli itici güçleri arasında; ekonomik büyüme, kentleşme ve orta sınıftan artan satın alma gücü yer almaktadır. 2010-2020 yılları arasında süt ürünlerine olan talebin, kişi başına süt tüketiminde birinci sırada olan Batı Avrupa hariç, dünyanın her yerinde artması beklenmekte, süt ve ürünlerinin tüketimindeki yüksek artış ekonomik gücün Batı'dan Doğu'ya kaydığı bir göstergesi olarak görülmektedir. Ancak süt ve ürünleri, içerdikleri optimuma yakın besin unsurları sayesinde ideal bir besin maddesi olmasının yanısıra, üretimden tüketim sürecine kadar doğru gıda güvenlik sistemlerinin uygulanmaması halinde tüketici sağlığı açısından ciddi bir risk faktörü haline gelebilmektedirler. Bu çalışmada Trakya bölgesindeki 3 ana ilde (Edirne, Tekirdağ ve Kırklareli olmak üzere) yaşayan halkın süt ve ürünlerinin tüketim profillerinin belirlenmesi, tüketim alışkanlıklarının ve tercihlerinin süt ve ürünlerinin mikrobiyolojik kalitesini nasıl etkilediğinin ortaya konulması ve tüketici sağlığı açısından olası risk faktörlerinin araştırılması hedeflenmiştir. Vc- Bu amaçla, her bir ilden 150 hane önceden haber verilmeksizin ziyaret edilmiştir. Hane halkına süt ve ürünlerinin satın alım sürecinden mikrobiyolojik kalitesi üzerine etkili olduğu düşünülen ve tüketicilerin tercih profillerini de kapsayan 9 adet soru sorulmuştur. Yanısıra, her bir evden 1 adet süt / süt ürünü örneği alınarak her bir örnek *Escherichia coli*, *Listeria monocytogenes*, *Staphylococcus aureus*, *Salmonella* spp. ve *Bacillus cereus*. Açısından analiz edilmiştir. Elde sonuçlar, süt ve ürünlerinin satın alımdan tüketime kadar geçen süreçte tüketiciye bağlı değişkenlerin süt ve ürünlerinin mikrobiyolojik kalitesi üzerine birinci derecen etkili olduğunu göstermiştir.

Anahtar sözcükler: süt, süt ürünleri, mikrobiyoloji, hijyen, korelasyon.

I. INTRODUCTION

Milk is a very important human nutrient because of its optimal components. However, milk and its products are very appropriate media for both saphrophytes and pathogens due to same reason. Milk and dairy products may have serious microbiological risk factors for consumers unless they are produced, stored, transported and sold under inadequate hygienic conditions. According to the laws related to the new hygiene regulations of European Union (EU), it is a compulsory process for all kinds of food plants to apply food security systems at the all steps of the production and selling practices since 2005 (5). Foodborne pathogens are important risk factors for public health all

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over the world because of their widespread existence features (9), and even milk and milk products are produced under best hygienic applications, they may risk public health because of secondary contamination sources as consumers' hands, house storing conditions, false usages and the equipments used in houses.

In developed countries, one of the most important preventive factors for the public health is to provide healthy and qualified foods for balanced diets to the consumers while eliminating the possible pathogens and producing all kinds of foods under sufficient hygienic conditions. Continuously increasing population of the world, pollution of the natural sources, industry, lack of education due to economic reasons complicates to provide hygienic and safe food products and enlarges nutrition problems and cause to increase the cases suffering from food-borne illnesses and toxications all over the world. Based on these reasons, it is very important to determine the contamination ways of the foodborne pathogens, and the risk factors.

In this study, it was aimed to determine the effects of milk and dairy products consuming profiles (brand choice, obtaining the milk and milk products packaged / open, house storing conditions after purchasing, dairy products choice etc.) to the microbiological quality of dairy products in 3 main cities of Thrace region (Edirne, Tekirdağ and Kırklareli) by using statistical methods. It was also aimed to expose the correlations and effective factors that influence public health due to consuming habits.

II. MATERIAL AND METHODS

a) House Visits and Questionnaire Program

Total 450 houses in three main cities of Thrace region were visited (150 houses for each city) without

prior notice and 9 questions about consuming profiles (which are considered to be effective to the microbiological quality of milk and dairy products that the families consumed) were asked to the household. The questions that are asked are indicated below:

- Which dairy products do you consume generally?
- How many times do you food shopping in a week, what is your dairy products purchasing frequency?
- What kind of sales point (supermarket, grocery, local markets, etc.) do you prefer for milk and dairy products?
- Do you purchase milk and dairy products packaged and / or unpackaged – open? Which one / ones are packaged / unpackaged – open?
- What is average consuming period of milk and dairy products after purchasing?
- How do you store the milk and dairy products that you have purchased?
- Do you prefer a sales point specially for purchasing milk and dairy products ? If the answer is yes, why?
- Do you observe that the dairy products that you purchased spoiled and / or spoiling up to consuming period?
- Do you consider the expiry date of the milk and dairy products that you have purchased?

b) Sampling Program

During the study, 450 samples were collected. The collected samples were analyzed for TAB, coliforms, *E. coli*, *S. aureus*, *Salmonella* spp., *L. monocytogenes* and *B. cereus*. Table 1 shows the details of the collected samples. Table 1

Table 1: Details of the collected samples

City	Type of dairy product	Number of collected samples
Tekirdağ	Cheese	40
	Yogurt	30
	Milk	30
	Butter	20
	Ice cream	20
	Cream	10
	Cheese	40
Edirne	Yogurt	30
	Milk	30
	Butter	20
	Ice cream	20
	Cream	10
Kırklareli	Cheese	40
	Yogurt	30

Milk	30
Butter	20
Ice cream	20
Cream	10
TOTAL	450

c) *Microbiological Analyses*

TAB (total aerobic bacteria), coliforms, *E. coli* (*Escherichia coli*), *S. aureus* (*Staphylococcus aureus*), *L. monocytogenes* (*Listeria monocytogenes*), *Salmonella* spp. and *B. cereus* (*Bacillus cereus*) and were determined for each milk sample. Microbiological analyses were performed according to FDA / BAM (2005).

TAB: TAB was enumerated in PCA (Plate Count Agar) after incubation at 30 °C for 48 h.

Coliforms: Coliforms were isolated by surface plating on VRBA (violet red bile agar). Plates were incubated at 37 °C for 24 h.

E. coli: *E. coli* were examined by surface plating on TBX (Tryptone Bile X – glucuronide) Agar. Plates were incubated at 44 °C for 24 h for enumerating.

S. aureus: *S. aureus* was determined by surface plating on BPA (Baird Parker Agar) supplemented with egg yolk-tellurite emulsion. Spread plates were incubated at 35 °C for 46-48 h. Colonies with typical *S. aureus* morphology were examined microscopically following Gram staining and tested for catalase and coagulase activity.

L. monocytogenes: 25 gr sample has been put in 225 ml BLEB (Buffered Listeria Enrichment Broth Base), incubated for 4 hours in 30°C and after that selective agents and 25 mg/L natamisin has been added in the mediums and incubated for 48 hours in 30°C. At the 24th hour of the incubation period, samples were surface plated on Oxford and Palcam agars. Spread plates were incubated for 48 hours in 35°C. By the end of the 48th hour of the incubation, *Listeria monocytogenes / ivanovii* has been passaged to Chromogenic Listeria Agar Base. Yeast Extract added TSA (trypticase soy agar) passages have been made from the colonies with the *Listeria* spp. suspicion and cultures have been purified. The suspicious isolates have been identified according to gram staining, catalase, motion, dextroglucose, malt sugar, rhamnose, mannitol, xylose fermentation and esculin hydrolization tests for verification.

Salmonella spp.: Samples were pre - enriched in BPW (Buffered Peptone Water). After an incubation period at 37°C for 24 hours, isolates then selectively enriched in RVSB (Rappaport Vassiliadis Soy Broth). Selectively enriched isolates were incubated at 37°C for 24 hours, then enriched cultures were spread plated on Brilliant Green Phenol Red Lactose Sucrose Agar. Besides, XLD (Xylose Lysine Deoxycholate Agar) was also used for verification. Spread plates were inoculated for 24 hours at 37°C and chemical tests were used to identify the suspected colonies. At this stage TSA (Triple Sugar Iron Agar), urea broth and SIM (Semi Indol Motility) agar were used and identification procedure was completed.

Bacillus cereus: *B. cereus* were examined by surface plating on BCA (Bacillus Cereus Agar). Plates were incubated at 37°C for 24 hour for enumerating.

d) *Statistical Analysis*

Mann Whitney U method was used for determining binary relationship correlations and group differences (3).

III. RESULTS

In this study, total 450 houses that were located in three main cities of Thrace region (Edirne, Tekirdağ and Kırklareli / 150 houses for each city) were visited without prior notice and the relations among consuming profile of the public and microbiological quality of the milk products after purchasing period was explored. According to the results we got, cheese was the most preferred dairy product and yoghurt, milk, butter, ice cream and milk cream followed cheese respectively.

It was determined that 16.2% of total samples were contaminated coliforms, while 4.3% of the samples were contaminated with *E. coli*, 10.2% of the samples were contaminated with *S. aureus*, 5.4% of the samples were contaminated with *Salmonella* spp. and 0.8% of the samples were contaminated with *L. monocytogenes* and *B. cereus* in general (detailed data not shown). Table 2

Table 2 : Binary correlations of the microbiological parameters according to Kendall's tau-b correlation analysis method. Bold written characters have positive significant correlations at p<0.005 level

	TAB	Coliforms	<i>E.coli</i>	<i>S. aureus</i>	<i>Salmonella</i> spp.	<i>L. monocytogenes</i>	<i>B. cereus</i>
TAB	Correlation Coefficient	1.000	.880	.425	.677	.478	.181
	Sig.	-----	.000	.000	.000	.001	.001
	N	371	371	371	371	371	371

Coliforms	Correlation Coefficient	.880	1.000	.483	.504	.381	.206	.206
	Sig.	.000	-----	.000	.000	.000	.000	.000
	N	371	371	371	371	371	371	371
<i>E. coli</i>	Correlation Coefficient	.425	.483	1.000	.147	.478	.277	.277
	Sig.	.000	.000	-----	.005	.000	.000	.000
	N	371	371	371	371	371	371	371
<i>S. aureus</i>	Correlation Coefficient	.677	.504	.147	1.000	.431	.168	.168
	Sig.	.000	.000	.005	-----	.000	.001	.001
	N	371	371	371	371	371	371	371
<i>Salmonella spp.</i>	Correlation Coefficient	.478	.381	.478	.431	1.000	.245	.245
	Sig.	.000	.000	.000	.000	-----	.000	.000
	N	371	371	371	371	371	371	371
<i>L. monocytogenes</i>	Correlation Coefficient	.181	.206	.277	.168	.245	1.000	.664
	Sig.	.001	.000	.000	.001	.000	-----	.000
	N	371	371	371	371	371	371	371
<i>B. cereus</i>	Correlation Coefficient	.181	.206	.277	.168	.245	.664	1.000
	Sig.	.001	.000	.000	.001	.000	.000	-----
	N	371	371	371	371	371	371	371

Kendall's Tau – b correlation analysis method was used for determining the relationships among the microbiological parameters (Table 2). Due to the results there were positive binary correlations among all the analyzed microbiological parameters and all the parameters were influenced each other to reproduce.

In our study, also, binary relations for all microbiological parameters were determined separately.

Thus, group differences among the microbiological parameters were exposed and microbiological "dirtiness" of the cities was determined (Table 3 - 5). According to the results, Kırklareli was the "cleanest" city which was followed by Edirne and Tekirdağ.

Table 3 : In terms of microbiological parameters analysed between Edirne and Kırklareli to compare testing the group differences and microbiologic spread

	TAB	Coliforms	<i>E. coli</i>	<i>S. aureus</i>	<i>Salmonella spp.</i>	<i>L. monocytogenes</i>	<i>B. cereus</i>
Mann-Whitney U	9548.000	8988.000	9390.000	9603.000	9599.000	9522.000	9522.000
Wilcoxon W	19139.000	18579.000	18981.000	19194.000	19190.000	19113.000	19113.000
Z	-.244	-1.558	-.999	-.172	-.219	-1.407	-1.407
Sig. (2-tailed)	.807	.119	.318	.864	.826	.160	.160

- There is not significant differences between Edirne and Kırklareli cities in terms of microbiological pollution profile of the houses and spreading of the microbiological parameters ($p > 0.005$)

Table 4 : In terms of microbiological parameters analysed between Edirne and Tekirdağ to compare testing the group differences and microbiologic spread

	TAB	Coliforms	<i>E. coli</i>	<i>S. aureus</i>	<i>Salmonella spp.</i>	<i>L. monocytogenes</i>	<i>B. cereus</i>
Mann-Whitney U	6412.000	6188.000	6045.000	6204.500	6301.500	6487.000	6487.000
Wilcoxon W	16282.000	10559.000	10416.000	16074.500	10672.500	10858.000	10858.000
Z	-.278	-.960	-2.629	-1.112	-1.081	-.234	-.234
Sig. (2-tailed)	.781	.337	.009	.266	.280	.815	.815

There was significant sifference for *E. coli* parameter between Edirne and Tekirdağ cities ($p < 0.005$). Edirne was significantly "cleaner" than Tekirdağ for *E. coli* parameter.

Table 5 : In terms of microbiological parameters analysed between Kırklareli and Tekirdağ to compare testing the group differences and microbiologic spread

	TAB	Coliforms	<i>E. coli</i>	<i>S. aureus</i>	<i>Salmonella</i> spp.	<i>L. monocytogenes</i>	<i>B. cereus</i>
Mann-Whitney U	6246.000	6288.000	6138.000	6078.000	6252.000	6348.000	6348.000
Wilcoxon W	15837.000	15879.000	10509.000	15669.000	10623.000	15939.000	15939.000
Z	-.496	-.433	-2.033	-1.265	-.898	-1.218	-1.218
Sig. (2-tailed)	.620	.665	.042	.206	.369	.223	.223

There was significant difference for *E. coli* parameter between Edirne and Kırklareli ities ($p < 0.005$). Kırklareli was significantly "cleaner" than Tekirdağ for *E. coli* parameter

IV. DISCUSSION

Like all foods, dairy products must be purchased carefully and stored correctly up to consuming period, even they are produced, packaged, transported and sold under ideal hygienic conditions. According to the results we got, due to uncorrect consuming habits may cause to increase the initial load of microbiological flora dairy products and / or the dairy products may be contaminated with pathogens rapidly. Thus, dairy products may contaminate each other and / or other kind of foods that are stored in refrigerator and increase the total microbiological load of the refrigerator. This situation is evaluated as an important risk factor for consumers' health.

Cheese was the most preferred dairy product and yoghurt, milk, butter, ice cream and milk cream followed cheese respectively. Dairy products include nearly optimal nutrient elements and because of this reason they can easily contaminate with pathogens under inadequate hygienic conditions from producing to consuming and cheese may serve as an ideal medium for bacterial proliferation because of the absence of competing starter culture, high water activity, protein and fat content. In our study, statistical correlations were exposed among all the analyzed microbiological parameters and it was concluded that explored microbiological parameters induced each other to produce. The reason for this situation may be including of high virulence polymorphic genes and / or transferring the mentioned genes to each other of the pathogens that we explored and forming of more resistant species. Medical literature indicates that some species as *S. aureus* have weak competitive feature and they are generally suppressed in mixed cultures. Additionally, it is also said that lactic acid bacteria in foods prevent growing of pathogens as *E. coli*, *S. aureus*, *L. monocytogenes* and *B. cereus*. However, presence of differential proteins said to be relate / interact with other proteins of other pathogens (as *L. monocytogenes*) are being explored by means of developing comparative subproteomic analysis techniques. Before development of subproteomic techniques, it has been considered that asymptomatic

pathogen serovars originated from clinical and environmental sources, however now it is being evaluated that pathogen serovars are probably integrated from different serovars by gaining various differential proteins (11). This situation may cause pathogens to develop resistance to antibiotics and / or antimicrobial agents by help of the mobile genetic structures as plasmids and transposons, thus even "safe considered" foods may become a serious risk factor for consumers' health.

Another point that must not be forgotten is; all foods, but especially dairy products may become a serious threat for consumers' health for microbiological aspects if they are not stored and consumed correctly even if they are produced under very best hygienic conditions. According to the results, different microorganisms can easily contaminate the milk and dairy products each other which are stored in the refrigerator of houses to be consumed. Thus, total microbiological load of the refrigerator increase and contaminated dairy products risk each other and other foods which are stored in refrigerator.

Cheese was the most preferred dairy product. Microbiological examination of cheese is important for protecting public health, preventing adulteration and developing both internal market and exportation. Various microorganisms exist in the normal flora of cheese. Most of the microorganisms that form microflora of cheese help to develop texture, taste and aroma of the cheese and the aforementioned microorganisms can not survive in gastrointestinal system of human because of its pH values (16). Plate count and lactic acid bacteria values of the cheese are not very important because under normal conditions cheese must have a microbiological flora to be formed. This microflora may vary according to pH value, aging period, humidity level of the cheese (19). Microbiological examination of cheese is important for the foodborne pathogens that threat public health as *S. aureus*, *E. coli*, *L. Monocytogenes* and *Salmonella* spp. (18, 7). Also *S. enteritidis* is one of the most important foodborne pathogens that risk especially short aged and fresh milk based cheese. Aforementioned pathogens can contaminate to cheese via human, different equipments used in producing stages in

houses and cause serious toxication / infection cases (6). In this study, it was determined *S. aureus* in 8 cheese samples (1.7%), *E. coli* in 4 cheese samples (0.9%), *Salmonella* spp. in 3 cheese samples (0.7%) and *B. cereus* and *L. monocytogenes* in 1 cheese sample (0.2%) respectively. All the positive samples explained above were obtained as open (non – packaged) from the local food bazaars. It is thought that routine controls that would be performed by governments' related authorized offices and applying effective food security systems at every step of cheese producing process would be very important for public health. Another conclusion that was determined was the importance of packaging. The cheese samples which were positive for mentioned foodborne pathogens above, might be produced under hygienic condition and the contamination might be formed because of secondary contamination sources as food contact surfaces, sales staff, equipment and even consumers. Therefore, controlling of foods in place by the specified official staff and applying continuous education programs that would be organized by government especially with the help of visual media and press would be very useful to decrease the incidence of foodborne infections / toxications.

Yoghurt was the “second preferred” dairy product according to the results in our study. Because of its high acidity, it is said to almost any pathogens can grow in yoghurt (13). In this regard, microbiological examinations generally done for existence of antibiotics and to determine morphologically differences of the cultures for yoghurt (20). There are numerous lactic acid bacteria and a little amount of non – pathogen saprophytes in normal microflora of yoghurt (15). Yoghurt was evaluated as the dairy product with minimum risk and all the yoghurt samples were negative for the analyzed microbiological parameters in this study. It is thought that, preferring yoghurt among the dairy products from the sales points whose hygienic status is unclear / unpredictable / suspicious, like restaurants, bazaars and markets would be very effective for decreasing foodborne risk factors for the consumers.

Milk was the “third preferred” dairy product. Raw milk is generally contaminated with various saprophytes and pathogens from primary and secondary contamination sources as animal itself, mammary, staff, equipments used in milking and feces (8). Saprophytes cause to spoil milk and dairy products, while pathogens cause to increase microbiological risk factors for consumers. Because of the reasons mentioned above, it is very important to use high quality raw milk at production process of the dairy products (16). Microbiological quality of raw milk is also very important for consumers' health, too. Probably, raw milk is not convenient for people to consume because of its high rate of pathogens content and various dangerous

pathogens as *Brucella* spp., *Salmonella* spp., *E. coli*, *S. aureus*, *Streptococcus* spp. and *Campylobacter* spp. may be existed in raw milk (8). However, 41.4% of the houses that are visited indicated that they were providing the milk as open (unpackaged) raw milk from the sales points as open bazaars and directly from the farmers. According to the microbiological analysis of milk samples collected, any microbiological risk factor was detected in the pasteurized milk samples, however, 65% of raw milk samples were evaluated as unsuitable for human consuming from microbiological aspect. The users declared that they heated raw milk until boiling for eliminating the possible pathogens, however heat treatments that are applied in house conditions would not be effective to eliminate all the pathogens in raw milk that threat consumers' health. The pathogens as *E. coli* and *S. aureus*, are toxigenic microorganisms and they may produce high amount of enterotoxins when they reach optimal virulence and the mentioned enterotoxins can not be denaturated by heat treatments. When the percentage of raw milk usage is considered, it can be said that, “milk choice” of the families may cause serious foodborne infections and / or toxications. In this respect, it is thought that formal / governmental studies about integrating food safety education programs to primary, secondary and high schools, determining pilot districts and educating the housewives about food hygiene practices and using educative public spots about food safety in visual media would be very effective to prevent possible foodborne infections and toxications and protecting public health.

Butter was the “fourth preferred” dairy product according to the results. In butter, only certain microorganisms can survive because of its solid structure and salt rate, so butter is quite resistant to microbiological spoilage. Butter contains microscopic water droplets in its fat phase (<10 μm diameter and approximately 5×10^{-10} ml. volume) and each droplets contain nitrogen to survive maximum 10 microorganisms (12). This situation cause butter to have a high resistance. However the mentioned situation also cause butter to be a more risky dairy product for the psychotropic pathogens as *L. monocytogenes* and *B. cereus*. In our study too, it was detected *L. monocytogenes* and *B. cereus* in 1 butter sample (0.2%). It is thought that mentioned pathogens not only risk the butter itself, but they may risk all the refrigerator because of their the psychotropic feature.

Ice cream was the “fifth preferred” dairy product. Experimental part of the study were performed in December – January and probably from this reason ice cream was the one of the “least preferred” dairy product. However it is guessed that consumption of ice cream would increase in summer season. For the microbiological examination of ice cream, plate count and coliforms are considered in many countries. In some developed countries besides the explained

pathogens parameters above, it is obligatory for ice cream to be free also for *L. monocytogenes* ve Salmonella spp. According to Turkish Food Codex, too, at least 25 grams of ice cream must be free from both *L. monocytogenes* and Salmonella spp., and plate count, total coliform group bacteria count, *E. coli*, *S. aureus* and *B. cereus* must not be more than 2 cfu / ml. (4). Ice cream is generally contaminated by pathogens in the production process via staff, equipments and contact surfaces, but the pathogens hardly grow / survive at the ice cream storage temperatures (14, 16). In our study, 19 ice cream samples (31.7%) were positive for coliforms, 1 sample was positive for *B. cereus* in (0.2%) and 3 samples were positive for *S. aureus* in (5%) respectively. All samples which were positive for the explained parameters above, were isolated from open (unpacked) purchased ice cream samples. Like all foods, at ice cream processes, it is very important to apply food security systems at every stage to provide the consumers' safe products.

Cream was the "sixth and least preferred" dairy product. The microbiological flora is the most important factor that affect the quality and storage period of cream (1). In this regard, heating and cooling processes must arrange optimally to minimize pathogen growth, because rapid cooling operations cause cream to have physical defects. The microbiological examinations of the raw and cooled milk are the foremost processes to protect public health (10). Coliforms, *S. aureus* and TAB must not be more than 10 cfu / gr, 2 cfu / gr and 10⁴ cfu / gr respectively in high quality cream products (4). According to the results we got, 36.6% (11 samples of 30) of the analyzed cream samples were not appropriate for human consuming microbiologically. In our country, cream is generally supplied unpackaged. Cream which is not sold / consumed daily in sales points / houses may be a serious risk factor for human health. Besides, because of its optimal nutrient ingredients, cream can be easily contaminated with various pathogens if it is produced under insufficient hygienic conditions. Due to the results, 35% of the families (157 houses) indicated that they were supplying the cream open, while 58% of the families were purchasing packaged cream. Packaging of foods with appropriate materials (which do not constitute chemical and microbiological risks for consumers' health) by using correct procedures (vacuum, heat treatment, etc.) prevent to grow pathogens significantly (5). Besides, supplying cold chain while transportation, storage and selling, is an another important factor to prevent microorganism growth. In our study, 70% of the unpackaged and 18% of packaged cream samples were evaluated risky for human consuming (data not shown). The reason of pathogen growth in packaged cream may originated from package and / or production processes. Any microbiological risk factors were determined in the

cream products which are purchased from the malls and supermarkets.

According to the results, for the analyzed microbiological parameters there were not statistically significant differences between Edirne and Kırklareli, while significant differences were exposed for *E. coli* between Edirne – Tekirdağ and Kırklareli – Tekirdağ cities. Kırklareli was the "cleanest" city and it was followed by Edirne and Tekirdağ. The habits that might be effective on the microbiological quality of dairy products (open purchasing, not considering expiry date of the product, storing the product at the balcony instead of refrigerator, high product stocking and consuming dairy products in long terms, not considering spoilage signs of the products, etc.) were mostly observed in Tekirdağ. And was leastly observed in Kırklareli. Open dairy product purchasing habit was also mostly observed in Tekirdağ when compared with two other cities and according to the results we got Tekirdağ was the first risky city for *E. coli* parameter.

V. CONCLUSION

Foodborne infections and toxications are widespread all over the world and threat consumers' health seriously. In our study, it was detected that there were correlations between consuming habits and microbiological quality of the dairy product after purchasing period. It is thought that the consciousness – raising programs that would be prepared for public by the related official government institutions and to convey to the public these programs via visual and pressed media, integration of hygiene and food safety programs to especially primary and secondary schools would be very important to decrease the incidence of the pathogens after purchasing period in the houses and to prevent possible outbreaks.

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