



RESEARCH ARTICLE

Microbiological and chemical qualities of cream-filled pastries sold in Kerman city confectioneries, southeast of Iran

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Özet

Sami M, Nasri A, Bagheri M, Sharifi H. Güneydoğu İran'ın Kerman şehri pastanelerinde satışa sunulan kremalı ürünlerin mikrobiyolojik ve kimyasal kaliteleri. **Eurasian J Vet Sci, 2013, 29, 3, 138-142**

Amaç: Mevcut amacı Kerman şehrinde bulunan pastacılar da satışa sunulan kremalı ürünlerin kimyasal ve mikrobiyolojik durumlarını incelemektir.

Gereç ve Yöntem: Toplam 50 adet pastaneciden elde edilen 250 adet örnek toplandı ve kimyasal (yağ içeriği ve asidite) ve mikrobiyolojik (total bakteri ve koliform sayısı, koagülaz pozitif *Staphylococcus aureus*) durumu belirlendi.

Bulgular: Şehrin farklı bölgelerindeki pastanecilerden elde edilen örneklerde total bakteri sayısı dışında ($P<0.05$) diğer parametreler arasında istatistiksel fark alınmadı. İncelenen örnekler total bakteri sayısı (n:38, %76), koliform sayısı (n:30, %60), *E. coli* sayısı (n:7, %14), *S. aureus* sayısı (n:10, %20), yağ (n:38, %76) ve asidite (n:24, %48) açısından incelendiğinde İran Ulusal Standart merkezince belirlenen değerlere uymadığı belirlendi.

Öneriler: Pastaneler halk sağlığı açısından sağlık problemleri oluşturabilir.

Anahtar kelimeler: Kremalı ürünler, bakterial ve kimyasal muayene, pastane, İran

Abstract

Sami M, Nasri A, Bagheri M, Sharifi H. Microbiological and chemical qualities of cream-filled pastries sold in Kerman city confectioneries, southeast of Iran. **Eurasian J Vet Sci, 2013, 29, 3, 138-142**

Aim: This study was conducted to analyze the microbial and chemical properties of cream-filled pastries marketed in Kerman confectioneries.

Materials and Methods: Totally 250 samples were collected from 50 confectioneries located in Kerman and tested to determine chemical (fat content and acidity) and microbial (total bacterial and coliform counts, coagulase positive *Staphylococcus aureus*) qualities.

Results: There were no significant differences among the samples taken from different confectioneries in different parts of the city, except for total count ($P<0.05$). This investigation demonstrated that the number of samples were not in the standard ranges defined by the Iranian National Standard including total counts (n: 38, 76%), coliform (n: 30, 60%), *E. coli* (n: 7, 14%), *S. aureus* (n: 10, 20%), fat (n: 38, 76%) and titratable acidity (n: 24, 48%).

Conclusions: Cream-filled pastries may cause healthy problem in public health.

Keywords: Cream-filled pastries, bacterial and chemical quality, confectioneries, Iran





Introduction

Bakery products such as cream-filled pastries are an important part of human balanced diet. Cream-filled pastries are popular and widely consumed in many countries and continue to dominate the interest of large segments of the population. Since most consumers of these products are vulnerable age groups like children and youth, the products are especially required to be microbiologically and chemically safe (Smith et al 2004).

According to the definition of the United States Department of Agriculture, ready-to-eat (RTE) foods refers to "food which is in a form that is edible without washing, cooking or heating by the consumer and that is reasonably expected to be consumed in that form" (DBPR 2002). This category can be considered as high risk foods because they do not require any heating or processing before consumption. In addition, pathogens may be transmitted to food by food handlers from a contaminated surface, another food, or hands contaminated by organisms of their gastrointestinal tract origin (Cruickshank 1990). Milk based products, such as cream in cakes are good media for microbial growth due to high nutrient value. However, not applying standards of hygiene by food handlers can cause contamination with pathogenic microorganisms such as *Staphylococcus aureus* and *Escherichia coli* (Caglayanlar 2009, Jacob 2010).

Based on findings about chemical properties, high acidity rate indicates that cream-filled pastries have been stored under unsuitable condition and potentially putrefied (Smith et al 2004). On the other hand, high fat content of these highly consumed products may be a serious human health hazard and can lead to obesity and heart diseases (Lichtenstein 2006, Mosca et al 2011).

In most previous studies in Iran, microbial loads of cream-filled pastries have been reported (Soltan Dallal et al 2010, Nikniaz et al 2011), however, to the best of our knowledge, this is the first survey of chemical quality of these products in Iran. It is argued that, compared with the scale of the problem in developing countries, there has been relatively little study on microbial and chemical quality of these products and their consequences. In this research, we tried to evaluate microbiological quality (total bacterial count, *Coliforms*, *E. coli* and coagulase positive *Staphylococcus aureus*) and chemical properties of cream-filled pastries (fat content and titratable acidity) in Kerman city.

Materials and Methods

Sampling

Kerman city, with a population of more than 700,000, is located in southeast of Iran. There are about 150 confectioneries in this city. We divided the city into four areas (northeast,

northwest, southeast and southwest) and 50 confectioneries were selected randomly from the list of Kerman confectioneries. From June to July 2011, 250 cream-filled pastries samples were randomly collected. Samples were transferred to the lab in coolers filled with ice. The food samples were kept at 4°C and analyzed within 2 hours of collection. The cream of five samples from each confectionery was pooled in a sterile polyethylene bag and labeled.

Microbiological analysis

Pooled samples were tested for total bacterial count, total *Coliforms*, *E. coli* and *Staphylococcus aureus* by the methods as described in compendium of methods for the microbiological examination of foods (Kornacki and Johnson 2001, Lancette and Bennett 2001). For serial dilution preparation, 10 g of sample was aseptically transferred into 90 mL of buffered peptone water in a sterile stomacher polyethylene bag and homogenized for 2 minutes at 260 rotations per minute (RPM) in a Stomacher® 400 (Interscience-Bag Mixer 400). Three serial dilutions were plated in duplicates onto plate count agar (PCA), violet red bile agar (VRBA) and Baird-Parker agar base with egg-yolk tellurite emulsion for the enumeration of total aerobic bacteria, *Coliforms* and *Staphylococci*, respectively. PCA plates were incubated at 30°C for 2 days; VRBA and Baird-Parker plates were incubated at 37°C for 1 day. Red colonies which were 0.5 mm in diameter or larger were counted as *coliforms*. For the isolation of *E. coli*, suggestive of *E. coli* colonies on VRBA were selected and directly streaked onto EMB agar and incubated for up to 24 hours at 37°C. Suspected *E. coli* colonies, Green metallic sheen colonies, were subjected to biochemical tests to confirm *E. coli* strains. Typical black colonies with pale zone on Baird-parker were counted as suggestive of *Staphylococcus aureus* colonies. Isolates were confirmed by gram staining and standard biochemical tests such as the oxidative/fermentative (O/F) utilization of sugars and catalase test. The coagulase test was used to differentiate *S. aureus* from coagulase negative staphylococci.

Chemical analysis

The fat content and titratable acidity were determined according to the methods of Association of Official Analytical Chemists (AOAC 1996). Cream fat was measured by Gerber Method via a special calibrated butyrometer. Titratable acidity was measured by titration of 10 mL melted cream containing 0.5 mL phenolphthalein by 0.1 N NaOH.

Statistical analysis

The microbial count data were converted to base 10 logarithms before statistical treatment. Data are presented as Mean \pm SE or percentages and corresponding 95% confidence intervals (CIs). We used descriptive statistics and 95% confidence intervals (95% CI) to show confectioneries with



Table 1. Microbial counts of cream-filled pastries samples.

	N*	Total (log ₁₀)			Coliform (log ₁₀)			Staphylococci (log ₁₀)		
		Mean±SE	Max	Min	Mean±SE	Max	Min	Mean±SE	Max	Min
Region1	9	5.35±0.34 ^a	6.82	3.85	2.60±0.69 ^a	5.23	<1	0.80±0.56 ^a	4.63	<1
Region2	14	5.05±0.31 ^a	6.81	3.48	2.11±0.54 ^a	5.00	<1	0.91±0.41 ^a	3.89	<1
Region3	12	5.26±0.22 ^a	6.30	3.93	1.91±0.45 ^a	4.30	<1	0.90±0.48 ^a	4.00	<1
Region4	15	4.73±0.19 ^b	6.45	3.48	1.92±0.50 ^a	4.83	<1	0.29±0.29 ^a	4.48	<1
Total	50	5.06±0.13	6.82	3.48	2.09±0.26	5.23	<1	0.70±0.21	4.63	<1

*Number of Confectioneries. Data are expressed as mean log colony-forming units per gram± standard error in duplicate count. Region 1 = Northeast, Region 2 = Northwest, Region 3 = Southeast, Region 4= Southwest.

^{a,b};Means in each column with different superscript letters are significantly different (P<0.05).

Table 2. Chemical quality of cream-filled pastries samples.

	N*	Fat (%)			Titratable acidity (Lactic acid %)		
		Mean±SE	Max	Min	Mean±SE	Max	Min
Region1	9	27.00±3.16	40	12	1.39±0.11	1.89	0.99
Region2	14	28.43±2.24	42	16	1.49±0.12	2.34	0.99
Region3	12	30.83±2.13	44	22	1.40±0.10	2.07	0.72
Region4	15	25.67±2.96	55	15	1.12±0.12	1.80	0.36
Total	50	27.92±1.32	55	12	1.34±0.06	2.34	0.36

*Number of Confectioneries, Region 1 = Northeast, Region 2 = Northwest, Region 3 = Southeast, Region 4= Southwest, Data are expressed as mean ± standard error in triplicate measurements.

Table 3. Number of unacceptable sample according to Iranian National Standards.

Factor	Acceptable range*	Unacceptable samples	Percentage	95% CI
Total count (cfu/g)	>20000	38	76	64.1 - 87.8
Coliform (cfu/g)	10	30	60	64.4 - 73.6
<i>E. coli</i> (cfu/g)	0	7	14	5.8 - 26.7
Staphylococci (cfu/g)	0	10	20	8.9 - 31.1
Fat (%)	35<x<48	38	76	64.1 - 87.8
Titratable acidity (Lactic acid %)	0.9-1.5	24	48	34.2 - 61.8

* Iranian National Standards

non-acceptable range of microbial and chemical amount. A One-way analysis of variance (ANOVA), followed by pairwise comparison using the Duncan test, explore the impact of different areas on chemical and microbial amount. We assumed P-value less than 0.05 as a significant level. The data were analyzed using Stata 10 software.

Results

Results of microbial counts of cream-filled pastries which were collected from four areas of Kerman city are shown in Table 1. The findings show that Southwest confectioneries (region 4) had low level of contamination. The means of total count, coliform count and Staphylococci in region 4 was lower than three other areas. A statistically significant difference was detected in total count among four areas and we had a lower total count in southwest by comparison with other regions (P<0.05), but there was not a statistical significant in

Staphylococci and coliform counts between different regions (P>0.05). In our study, the average numbers of bacterial load (total, coliform and Staphylococci) were higher compared to the Iranian National Standards (ISIRI 1993). Chemical tests results are shown in Table 2 (titratable acidity and fat content). According to the results, the maximum and minimum amounts of fat content belong to the areas number 4 and 1, respectively. There was not a statistical significant in titratable acidity and fat content between four regions (P>0.05). National standards for fat content and titratable acidity are 35-48% and 0.09-0.15%, respectively. The means of fat content in four areas did not fit standards of Iran National defined range. In contrast, the means of titratable acidity of four areas were in agreement with the Iranian National Standards. According to the Iranian standard defined range, 6 samples out of 50 (12%; 95% CI: 4.5-24.3) were acceptable microbiologically, and 5 samples (10%; 95% CI: 3.3-21.8) were in normal range due to chemical properties; however, none of





the confectioneries were acceptable due to chemical and microbial properties, either. Table 3 shows the number of unacceptable samples based on Iranian microbial and chemical standards.

Discussion

In this study, we found out cream-filled pastries in this area did not have an acceptable microbial and chemical quality and none of them were acceptable, either (Table 3). Some confectioneries were categorized into high social class and were located in plutocratic areas. It was so interesting that there were not any significant difference between these confectioneries and other confectioneries in the lower class areas, except for total count. Surprisingly, confectioneries in southwest area had a lower amount of total count (Table 1).

According to the microbial analysis, it was demonstrated that the products were contaminated with microorganisms of public health concern (Table 3). The high total bacterial, coliform and Staphylococci count and existence of *E. coli* may be a consequence of not applying standards of hygiene during the processing and sale of the products which includes the handlers, quality of cream and added materials to cream. Nikniaz et al (2011) evaluated microbial contamination in cream-filled pastries in Tabriz and the result indicated that the contamination rate for *coliforms* (38.8%), *E. coli* (48.8%), *S. aureus* (31.2%), moulds (27.5%) and yeasts (70%) were higher than the standard defined by the Iranian National Standard.

The detection of *coliforms* suggests possible fecal contamination. Enteric bacteria presence indicates impoverished hygienic practices among handlers of cream-filled pastries. Due to the significance of the fecal-oral route transmission for many bacterial food-borne diseases, basic hygiene measures assume a decisive importance in food safety management (Utermann 1998). Coliform presence is such an important hygiene indicator for cream-filled pastries that many investigations have been conducted on the subject to date, for instance in Khezri et al (2007) study in Mashhad, the load of *coliforms* and *E. coli* had been recorded 69% and 26%, respectively. In Ahvaz, Fazlara et al (2005) reported that 95% of samples were contaminated to *coliforms* and from these positive samples, approximately 88.75% were positive for *E. coli*. Shadan et al (2004) showed that 53.83% of cream-filled pastries were contaminated by *coliforms* and *E. coli*. In our study, 60% of samples in Kerman city were contaminated with *coliforms* and *E. coli* was found in 14% of samples (Table 3).

Staphylococcus aureus causes the spoilage of milk and its products such as cream at even refrigerator temperatures. Detection of *Staphylococcus aureus* is also important cause for public health concern, because it can lead to an exten-

sive range of infections especially food-borne intoxication (Uzeh et al 2006). In our study 20 % of samples were positive for coagulase test of *staphylococcus aureus* (Table 3). In other studies it has been demonstrated that 10.5%, 10% and 60.5% of cream-filled pastries in Mashhad (Khezri et al 2007), Shahrkord (Pishgar et al 2007), and Zahedan (Shadan et al 2004) were contaminated respectively. Besides, there are many reports about confectionery products contamination by *staphylococcus aureus* in other countries. During 1969-1972, more than 30% of food-borne diseases were related to confectionery products and *Staphylococcus aureus* was the most common cause of contamination (Smith et al 2004). In Brazil many food poisonings have been recorded due to consumption of *Staphylococcus aureus* contaminated cream-filled pastries which were stored in room temperature (Costanzo Anunciação et al 1995). In India 87% cream-filled pastries were positive for *Staphylococcus aureus* (Desai and Kamat 1998).

The chemical test results of cream-filled pastries were not in agreement with Iran standard and none of the confectioneries were acceptable according to their chemical properties (Table 3). Consuming High fat content meals can be harmful for human health, for instance in a study it was shown that 3 to 5 hours after a very high-fat meal, the blood vessel's function became abnormal. During this period, people especially those who already had coronary diseases, could be at high risk of having a cardiac event (Plotnick et al 2003). Eating too much saturated fat is one of the major risk factors for heart disease. A diet which is high in saturated fat causes a soft, waxy substance called cholesterol to build up in the arteries. Too much fat also increases the risk of heart disease because of its high calorie content, which increases the chance of becoming obese (another risk factor for heart disease and some types of cancer). Consumption of polyunsaturated fat may increase the risk for some types of cancer. Reducing daily fat intake is not a guarantee against developing cancer or heart disease, but it does help to reduce the risk factors. This information show the importance of public concern about side effects of fat especially dairy products which are consumed daily by people, therefore enough attention should be concentrated on this part (Lichtenstein 2006, Mosca et al 2011).

About half of our samples had unacceptable acidity according to Iranian standards (Table 3). Titratable acidity expressed as lactic acid percent. As bacterial numbers increase, the quality of milk product decreases and the titratable acidity value increases. Therefore, when the cream-filled pastries stored under unsuitable condition, titratable acidity is increased.

Conclusions

According to the findings mentioned above, cream-filled pastries did not have acceptable microbial and chemical qualities in this area and this is an important cause of concern for



public health. Therefore, monitoring of these food providers, the manufacturing processes and providing standard raw materials is necessary.

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