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ORIGINAL ARTICLE

Evaluation of Microbial Contamination and Chemical Qualities of Cream-filled Pastries in Confectioneries of Chaharmahal Va Bakhtiari Province (Southwestern Iran)

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Abstract
Objectives: High consumption of bakery products such as cream-filled pastries may cause serious health risks and food poisoning to humans. Therefore, investigation of the microbial and chemical qualities of bakery products containing cream is necessary. The purpose of the present study was to investigate the chemical qualities and microbial contaminations of cream-filled pastries collected from confectioneries located in six cities in Chaharmahal Va Bakhtiari province (Southwestern Iran).
Methods: Microbial tests and chemical characteristics (fat and acidity level) were done on 228 cream-filled pastries samples that were collected randomly from various confectioneries.
Results: After microbial tests, it was found that 33.33% of all samples were contaminated by microbial agents. The microbial tests showed that Shahrekord (10.09%) and Broujen (9.21%) cities had high levels of contamination and in Koohrang (1.31%) it was low compared with the other four cities. High contamination of coliforms (61.84%), staphylococci (48.68%), and yeast (27.63%) were observed in almost all samples. The chemical analysis showed maximum amounts of fat content and titratable acidity in cream-filled pastry samples obtained from Lordegan and Shahrekord cities, respectively.
Conclusion: The findings of the present work demonstrated that the microbial contamination and chemical quality of cream-filled pastries produced in confectionaries of Chaharmahal Va Bakhtiari province were not in acceptable ranges. These problems may be related to fecal contamination of cream samples

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or lack of hygiene by handlers and it is necessary to observe the standards of hygiene and to develop safe food handling techniques and aseptic pastry manufacturing systems in some confectioneries of Chaharmahal Va Bakhtiari province.

1. Introduction

Cream-filled pastries are bakery products that are consumed a lot in the food and confectionary industries; however, they are a common cause of food poisoning in humans [1,2]. Food poisoning affects healthy people around the world and the most common symptoms include nausea, vomiting, abdominal pain, cramps, and diarrhea [3].

Milk and milk-based products like desserts and cakes containing milk or cream are rich nutrient media for microbial growth. Nonconformity of standards of food hygiene by food staff may lead to food contamination [2,4]. *Staphylococcus aureus*, *Salmonella*, *Campylobacter*, *Escherichia coli*, molds, and yeasts can contaminate bakery products, in particular cream-filled pastry, and they are the major micro-organisms causing food-borne diseases in humans [5,6]. In addition, it is clear that the increase of fat content and acidity levels of bakery products like cream-filled pastries, cream pies, and cream puffs may be related to the risk of obesity and heart disease [2,7].

E. coli is a gram-negative, facultative anaerobic bacterium that belongs to the *Enterobacteriaceae* family and is one of the important causes of food poisoning [8,9]. *S. aureus* is a gram-positive, nonmotile, non-sporeforming facultative anaerobe which is significant in food industries and causes a range of illnesses, especially foodborne diseases, via enterotoxins [10,11].

Microbial and chemical characteristics of cream-filled pastries in food and confectionary industries must be evaluated. In the present study, the chemical qualities and microbial contamination of cream-filled pastries (*S. aureus*, *E. coli*, and yeast) collected from confectionaries in Chaharmahal Va Bakhtiari province (Southwest of Iran) were examined.

2. Materials and methods

2.1. Study area and sampling

In the present study, six cities (Shahrekord, Ardal, Farsan, Lordegan, Koohrang, and Brougen) of Chaharmahal Va Bakhtiari province (Southwestern Iran) with a population of $>$ 1,000,000, were subjected to sample collection. A number of 228 cream-filled pastries samples were collected randomly from 34 different confectioneries from July 2013 to September 2013. All samples were transported to the laboratory immediately in cool conditions and stored at 4°C and were analyzed within 2 hours of collection. In addition, the cream of three samples from each confectionery were suspended in sterile polyethylene bags and labeled for further tests.

2.2. Microbiological analysis

The microbiological tests and bacterial counts were done on suspended samples according to specific standard instructions for coliforms, *E. coli*, *Staphylococcus aureus*, and yeast [12,13]. Each cream sample (10 g) was separately added into sterile 0.1% buffered peptone water (90 mL) and homogenized in a sterile stomacher polyethylene bag for 2 minutes at 220 *g* in a Stomacher (Interscience-Bag Mixer 400, St., Nom., France) and then was serially diluted in 0.1% peptone solution (Sigma−Aldrich, Pool, UK). One hundred-microliter aliquots of three serial dilutions were spread-plated in triplicate on the surface of plate count agar (Merck, Darmstadt, Germany), violet red bile agar (Merck), Baird−Parker agar base with egg-yolk tellurite emulsion, Saboroud dextrose agar (Merck), and Yeast Extract Glucose Chloramphenicol agar (Merck), for the enumeration of total aerobic bacteria, coliforms, *Staphylococci*, and yeast, respectively. For bacterial growth turn over the plates and plate count agar, violet red bile agar, and Baird−Parker plates were incubated at 30°C for 1−2 days and Yeast Extract Glucose Chloramphenicol agar plates were incubated for 48 hours for 5 days at 20−25°C for yeast total count. Confirmatory cultures and tests including culturing of isolated bacteria on eosin methylene blue agar, gram staining, and standard biochemical tests such as the oxidative/fermentative utilization of sugars, catalase, and coagulase tests were performed for isolation and differentiation of *E. coli* from *Salmonella* and other coliforms, as well as *S. aureus* from coagulase negative staphylococci. The average number of visible colonies obtained from plate counts and the number of colony forming units (CFU/g) were evaluated.

2.3. Biochemical examination

The titratable acidity (lactic acid%) and fat content of cream-filled pastries collected from confectionaries in Chaharmahal Va Bakhtiari province were examined. The fat content and titrable acidity were determined according to the methods of the Association of Official Analytical Chemists [14]. The fat content of cream samples was measured using the Gerber method (primary and historic chemical test to determine the fat content) via a special calibrated butyrometer. The titrated acidity of cream specimens was measured by a titration of 10 mL melted cream containing 0.5 mL