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Implementation of Prp and Haccp System for Commercial Cake Filled with Butter Cream Cake Samples in Dakahlia Governorate

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ABSTRACT

HACCP system is an efficient tool for producing safe food in different production lines. In this study sixty cake samples were collected from popular cake industries factories in El-Dakahlia Governorate.Implement of HACCP plan and PRp concepts during preparation of filling cream by showing typical hygiene and how to solve them were observed.A generic plan (HACCP) in accordance to legal requirements was created. Also, a flow chart diagram based on the production of manufacturing cake processing was evaluated.Studying of physicochemical and microbiological analysis for cake samples were examined. Results showed that the filling cream did not match the legal limit. Also, results for total viable count (TVC) were high when compared with legal limits. Pre-requisite programs were designed for pasteurization process at 80°C for 10 min for filling cream in order to be safety and hygienic products. Our results unobserved differences resulting from application of the standard moisture content of the collected filling cake samples, since, the moisture content ranged from 20.88 to 21.97 %. In addition, fat content ranged from 6.30 to 7.30% while protein ranged from 6.03 to 6.95 %, while the pH value ranged from 6.43 to 6.90 and total carbohydrate ranged from 84.54 to 85.73 After Implementation of PRP and HACCP Management System, Total bacterial count ranged from 1.00 to 1.68 log cfu/g and the absence of both *S.aureus*, *Salmonella Typhi*, and *E.coli* from the tested samplesFinally, applying quality systems can potentially avoid hazards and increase consumer safety and acceptability.

Keywords: Cake, Filling cream, HACCP, PRP

INTRODUCTION

Quality management refers to an organization's efforts to improve customer satisfaction and achieve ongoing performance improvement. The five main methods to quality management are as follows: transcendence, product-based, user-based, manufacture-based, and value-based. Another way to describe quality is as "conformance to requirements" and "fitness for use" (WHO, 2002)

To meet and even exceed customer expectations and requirements, total quality management is an integrated effort to first achieve and then sustain a high-quality service provided by an organization and further continuous improvement of process with error prevention at various levels and functions of an industry.(Gimenez-Espin *et al.*, 2013)

Total Quality Management (TQM) is the practice of overseeing the entire business to ensure that it advances in all areas of goods and services that are significant to customers. Its foundation is the conviction that errors can be reduced or avoided, and flaws can be avoided, with the ongoing process of progress serving as the only goal.

Preventive management of risks at all stages of the food supply chain has taken precedence over resource-intensive product inspection and testing, as seen by the introduction of Hazard Analysis Critical Management Points, or HACCP. Additionally, it recognizes and eliminates risks that are essential to food safety. To control the quality and safety of Cake products and protect consumer expectations, it is essential to use ISO standards and the HACCP concept in an integrated manner. This ensures that certified goods meet the minimal criteria established globally. By ensuring and enhancing openness in the process of developing food quality and safety processes, these standards contribute to the modernization and improvement of food safety systems. The ISO established rules, norms, requirements, and specifications to develop a TQM system that works. (Fayaz *et al.*, 2020). In food safety, prerequisites and Hazard Analysis and Critical Control Points (HACCP) are applied to ensure process control, and microbiological standards allow process efficacy to be validated with these goals in mind (Domenech *et al.*, 2013).

Although the variety of bakery items draws in customers, it also complicates the planning, creation, and application of HACCP principles. It is only partially feasible to implement the modern HACCP strategy, which relies on specialists asking a series of probing questions about potential hazards and their control in a systematic and standardized manner to all phases in food operation. Furthermore, not all companies follow the Good Manufacturing Practice (GMP) guidelines, which are necessary for the HACCP concept. In 2020, the largest percentage of food poisoning cases were linked to exquisite bakery items with unbaked filling. (16.5%) (Hunter *et al.*, 2020).

Bakery items such as cakes, biscuits, pies, and pastries are among the most often purchased items in Egyptian marketplaces, particularly those that are filled with cream. Because bakery goods encourage the growth of a variety of bacteria, yeasts, and molds, they are particularly prone to raise issues about food safety when they have a high moisture content (high water activity). There are several intrinsic elements and procedures in bakeries that raise the possibility that these goods might be regarded as possibly

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dangerous. These include handling food often, using perishable products, and using raw foods that may contain germs. Reusing piping bags and other equipment can further increase the risk of cross-contamination (Smith *et al.*, 2004).

Grain used to make baked items is often infected with bacterial spores. Microbiological growth happens when dough is being proved. Baking temperatures destroy microorganisms in their vegetative state and reduce the water activity of baked goods. There are occasions when baked items are stacked, filled, or topped with ingredients for example ; custard , whipped cream , or butter cream that either foster the growth of microorganisms or include diseases such as *Salmonella Typhi*. As a result, a variety of fillers make good medium for microbial development. Some are just moderately acceptable substrates or maybe even inhibitive to microbial development due to one or more limiting properties, such as low water activity, low pH, or inadequate nutrients. Refrigeration, preservatives, or formulation changes are methods used to achieve preservation (Rasmy and Yasin, 2016).

Sîrbu (2023) said that small bakeries find it especially challenging to implement HACCP since there are a lot of items involved and not enough staff members who are familiar with the system. Ensuring Good Manufacturing Practice is necessary to eliminate sanitary weak links before developing a HACCP approach. Unbaked cream filling in baked foods is very delicate. The items' two main areas of hygiene weakness are unclean equipment and uncooked food. Techniques for lowering the microbial counts on equipment are discussed. By reducing pH levels, acetic or citric acid is added to sensitive creams to postpone the growth of harmful bacteria. Summertime is the best time to choose cream goods with fruit as their lower pH levels make them more stable: Cooling remains the most effective way to stop the development of microorganisms. Additionally, consumers must be informed about proper handling and storage of cake until it is time to consume it. Utilizing the HACCP system for cake on a production line was the goal of such study.

MATERIALS AND METHODS

Materials

1-Samples collecting

Sixty cake samples were collected from the local market and cake factories as follows (30 samples with cream cake filling before applying PRp and 30 samples with cream cake filling after applying PRp. All collected samples were prepared for microbial and chemical analysis.

2- Raw Materials

a-Sponge cake ingredients:

Wheat flour (72% extraction), skim milk powder, fresh whole egg, vanilla, salt, sugar, baking powder, butter and preservative as ascorbic acid.

b-Filling cream ingredients:

Natural preservatives; cinnamon and cloves; sucrose Veg. shortening- milk powder and vanilla were obtained from local cake factory. Industrial zone, Gamasa city, El-Mansoura city, El-Dakahlia, Egypt.

Chemicals and microbial media:

All chemicals and all microbial media were acquired from Al-Gamhoria pharmaceutical and chemicals El-Mansoura city, El-Dakahlia, Egypt.

Different Nutrients agar medium (Sutton, 2004) were used for enumeration of total aerobic bacterial count, yeasts, and molds. *Staphylococcus aureus* enumeration of coliforms, to detect *Salmonella Typhi*

Methods

Assessed of risk category

As mentioned in NACMCF (1998) (National Advisory Committee Microbiological on Criteria for Foods), the risk category was determined for different collected cake samples (plain and filling cream).

Processing steps of filling cream

This investigation was carried out on a lab scale to prepare filling cream. The filling cream preparation processes flow chart diagram as follow (Row materials, Whipping, cream performing and final product. Some control methods were used, as shown in Fig. (1), to pasteurize the produced filling cream at 80°C for 10 minutes to ensure of its safety.

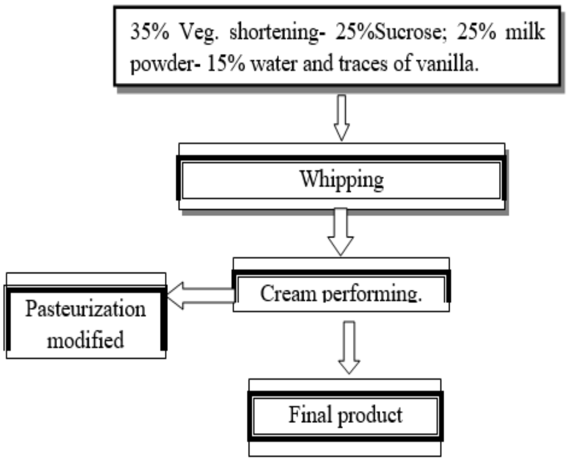

Fig 1. Flow chart diagram of filling manufactured cream

Preparation of sponge cake samples

The ingredients used for sponge cake manufacturing were as follows: -

100gm of wheat flour (72%), 10.5 gm sugar, 15 gm butter, 8 gm skim milk powder, 2 gm sodium chloride, 3.75 gm baking powder, 5 gm vanilla, and 36 gm whole egg.

The liquid ingredients were blended for five minutes on low speed in a Moulinex-France mixer. Next, the dry ingredients (flour and baking powder) and egg were gradually added to the bowl and mixed for one minute on low speed. The sugar was added to the bowl and mixed for an additional nine minutes. Aluminum pans containing batter sponge cake were cooked for 20 minutes at 180 + 5°C in an electric oven as shown in Fig. (2) (Salama *et al.*, 2013).

Hazards Analysis and Critical Control Point from implementation steps

HACCP is a methodical, scientific approach to food safety that pinpoints and eliminates certain food safety risks. Adopting HACCP is a mark of safety and product quality Preprints that guarantees customer pleasure. The HACCP system is founded on seven scientific principles, according to Codex Alimentarius (CAC, 1997). Principle 1: To identify physical, chemical, and biological dangers, do hazard analysis (HA). Principle 2: Using a decision tree to identify critical control points (CCPs). Principle 3: Determining critical limits (CL) to guarantee consistency in the safety evaluations of the relevant processes. Fourth principle: CCP observation. Principle 5: Establish Corrective Actions Corrective actions may range, for example, from "continue cooking until the established temperature is reached" to "throw out the product," depending on the severity of the situation. Principle 6: Putting in place efficient processes for keeping records. Principle 7: Putting processes in place.

Analytical methods:

Physiochemical analysis for different studied cake samples:

pH value was estimated for different cake samples using pH meter (Jen way 3510, England) and. Moisture, protein, fat, carbohydrate, and ash content were determined according to the methods described in AOAC (2005).

Microbiological examination for studied cake samples and filling cream:

Salmonella Typhi., *E. coli*, *Staphylococcus aureus*, yeast, and mold counts, as well as the total aerobic bacterial count were all measured on the various collected and stadied cake samples. To represent the microbiological quality of the examined samples, all prior tests were employed.

Each cake sample weighed ten grams, which were homogenized using a Stomacher (Seward, Model 400, England) for thirty seconds in ninety milliliters of sterile diluent (0.1% peptone water). One milliliter aliquot was plated in each medium and incubated at various temperatures after serial dilutions were made in peptone water, as listed in Table 1.

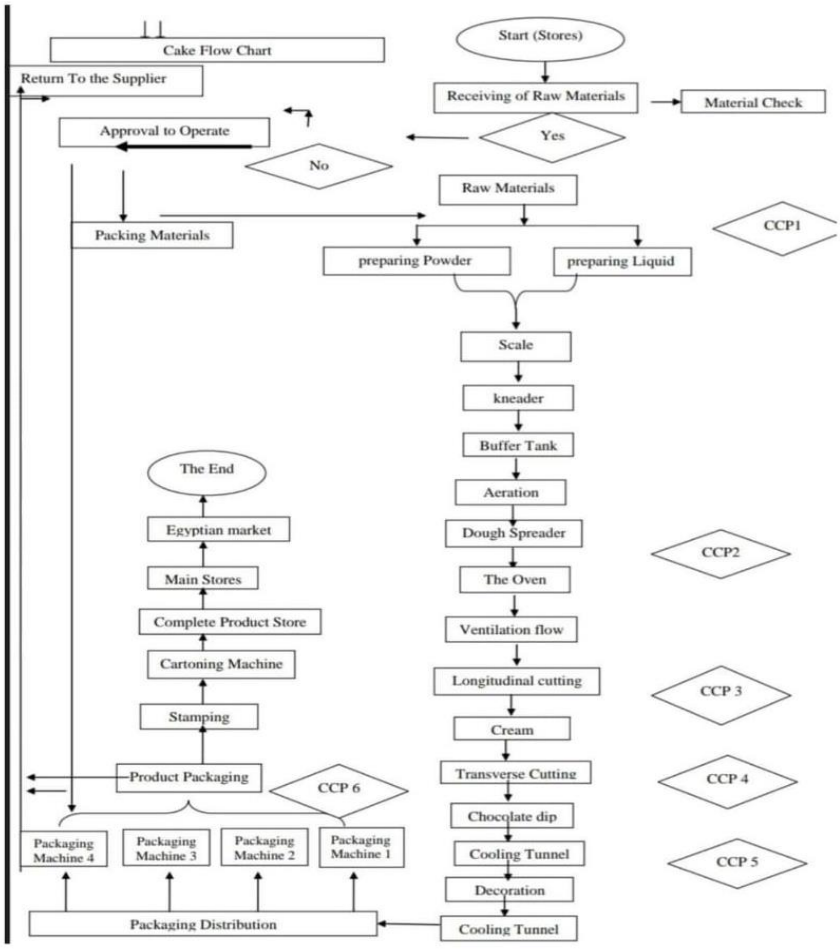

Fig. 2. Cake manufacturing production line

Table 1. Media and incubation conditions used for microbiological analysis.

Microbiological analysis	Incubation Time(h)	Temp(°C)	Growth medium
Total aerobic bacterial count	48	37	Plate count agar
Aerobic spore forming	48	37	Plate count agar
Yeast and mold count	72-120	25	Potato dextrose agar
E. coli	24	44.5	MacConkey agar
Staphylococcus aureus	48	37	Baird parker agar
Salmonella Typhi.	24-48	37	XLD agar

Serial dilutions of various samples were pasteurized in a water bath at 80°C for 20 minutes to count the aerobic spore-forming bacteria. After that, (Sutton, 2004) reported that one milliliter aliquots were plated in the medium (ISO, 1990). Also, the technique employed to isolate *Salmonella Typhi*. followed ISO (2002). Each sample was pre-enriched with 25 g in 225 mL of buffer peptone water, and it was then incubated for 16 to 24 hours at 37°C.

For selective enhancement, 1 mL of buffer peptone broth was transferred to 9 mL each of tetrathionate broth (Sutton, 2004) and was incubated at 41°C for 24h. From each selective enhancement broth, a 5- mm loopful was streaked on selective plates of bismuth sulfite agar and incubated at 37 ˚C for 24h.

Statistical analysis:

The Physiochemical data were subjected to variance analysis. To compare means, Duncan's multiple range tests were employed at the 5% level. The Statistical Analysis System's PROC ANOVA algorithm was used to conduct the analysis (SAS, 2006).

RESULTS AND DISCUSSION

The main object of creating a HACCP plan for cakes is to be one example of an industrial experiment that aims to guarantee product safety and defect-free quality. As a result, eating well-made items can prevent foodborne disease.

Application of HACCP system in production of filling cream:

Implement of HACCP concepts and principles during preparation of filling cream by demonstrating common hygiene flaws and how to fix them. Moreover, for improving the quality and safety of cream products some control measures were applied. As the description product is the only stage in the HACCP plan for a food product, Table (2) lists many attributes of prepared filling cream.

Table 2. Description of prepared filling cream.

Items	Description
Product name	Filling cream
product's raw ingredients	milk powder, Sucrose, vanilla and shorting
Important characteristics of product	pH 4.53- 6.58 Cream TSS 68.71- 68.84%
How the product is to be used	Typically utilized for coating and filling baked goods and candies
Packaging	Sealed polyethylene bags/hermetically sealed metal container
Shelf life	From three to six months at normal retail shelf temperature
Where the product will be sold	Retail, institutions, and food service
Labeling instructions	Required to ensure product safety
Special distribution control	No physical damage, excess humidity or temperature extremes and microbial growth

The identified characteristics especially related to the food safety, (CAC, 2003) were product name, raw materials used in preparing product, important characteristics, intended use and how the product is to be used, packaging, shelf life, where the product will be sold, labeling instructions and special distribution control. The important characteristics related to the safety of product as controlling measures for microbial growth are pH (4.53to 6.58) and total soluble solids, (68.71 to 68.84 %). It could be noticed that pH levels of filling cream are more suitable for microbial growth, especially pathogenic bacteria e. g. *Salmonella Typhi*. These notices were agreement with the observation reported by (Rasmy and Yasin, 2016), controlling of the pH of filling cream, addition natural preservatives and thermal processing and cooling were the most controlling measures which could be used in this study for preventing microbial growth in the final product.

Hazard Analysis and Control measures of raw materials and processing steps of filling cream:

The hazard analysis for a specific food consists of a systematic evaluation of all raw materials and production steps. Identification or hazards assessment (biological, chemical, physical) that are likely to occur and consideration of control for the hazards. To achieve a finished products adequate safety, it is necessary to identify different hazards in the various raw materials and steps of processing which could provide useful baseline data for identifying sources of different hazards and consideration of control measures for the hazards. In addition, from the knowledge of hazard analysis it is possible to establish critical control points in the process. CAC (2003) stated that in order to do a hazard analysis during the preparation of filling cream, a list of the raw ingredients and processing processes of the product under inquiry that have substantial dangers must be prepared. Each raw material used to prepare filling cream, manufacturing step, and set of control measures has been linked to a list of all recognized dangers, as shown in Table (3).

The natural and microbial flora associated with the raw materials might be seen to vary affect their potential dangers (ICMSF, 2005). Based on these findings, it was evident that milk powder, particularly pathogenic bacteria, was the primary potentially hazardous ingredient utilized to make filling cream, as described by Ledenbach and Marshall (2009). Regarding control methods for recognized risks, it is proposed that complaints with raw material requirements and certified suppliers be utilized to prevent various dangers (chemical, biological, or physical), particularly during the raw material receiving stage. Good manufacturing procedures (GMP) are applied during the processing stage, and the processing step is controlled as sifting to reduce physical risks.

Table 3. Hazard Analysis and Control measures of raw materials and processing steps used in preparing filling cream.

Processing steps receiving raw materials	Hazard	Control measures
Sugar	B: yeast and mold. C: Mold toxin and pesticides residues. P: Foreign materials.	Certified suppliers, complains with raw materials specifications and sieving.
Skim Milk powder	B: *Salmonella Typhi* ., Listeria monocytogenes, *E. coli* and *Staph. aureus* C: Pesticides residues, antibiotics, hormones, heavy metals, cleaning chemicals and food additives. P: Foreign materials.	
shortening	C: Substances resulted from rancidity and unlimited antioxidants.	
Vanilla	C: Environmental chemicals and heavy metals. P: Foreign materials.	
Whipping	B: Pathogenic bacteria, spore forming bacteria and yeast & mold.	Pasteurization, addition of natural preservatives and acidification of prepared cream.

B: Biological, C: Chemical and P: Physical hazards.

Biological dangers, particularly pathogenic microorganisms that might infect raw materials, notably milk powder, can be controlled by pasteurization, the inclusion of preservatives, and pH control of produced filling cream. Certain raw materials and processing techniques may pose biological, chemical, and physical risks throughout their creation.

Hazard analysis is the process of collecting and evaluating information on hazards associated with the food under consideration to decide which are significant and must be addressed in the HACCP plan (NACMCF, 1998). More likely different control measures could be used in controlling these hazards. Different manufacturing steps of filling cream include the sites which could be contaminated or affecting the persistence of microbial contamination during processing. The hazard analysis of different processing steps of filling cream production and the control measures could be used as preventive approach as shown in Table (3).

The filling cream used in bakeries cakes is often used without cooling. Different ingredients used for preparing filling cream are whipped and gave cream with pH level 6.6, this level is considered as neutral pH values. Thus, most of microorganisms especially pathogenic bacteria can grow well and make the cream unsafe or could be hazardous (ICMSF, 1980 ;Abdelrasoul *et al.*, 2023)

Also, Sharifzadeh *et al.* (2016) found that in 1993, the highest rate of food poisoning (15.5%) was caused by excellent bakery items with unbaked filling. In addition to the suitable pH level of cream, used milk powder in the recipe of cream, which is sensitive ingredients may be made cream. Resource Extraction Site (RES) unsafe or hazardous, since the milk powder could be a source of *Salmonella Typhi*.

Abdelrasoul *et al.* (2023) and El-Kadi *et al.* (2018) stated that dairy products accounted for 4% of a total of 500 outbreak of human salmonellosis during the 10-year period.

During the established HACCP system in the processing steps of filling cream, microbiological criteria of different raw materials were tested to determine the microbiological profile of those materials.

The findings of the microbiological examination of the raw materials used to make filling cream were displayed in Table (4). The microbiological load of sucrose, Milk, and Shortening was satisfactory, as the total number of bacteria for sucrose, Shortening, and milk was 1.00, 1.78, and 1.00 cfu / g, respectively, while the numbers of yeast and mold were not detected at the detection limit < 10^1cfu / g. Additionally, *E. coli* and *S. aureus* and were not found in any of the sugar, skim milk powder, and shortening samples tested, nor were *Salmonella Typhi.* at the detection limit of less than < 10^1cfu / g. According to Scott *et al.* (2015), it might also be utilized as a criterion for food safety. In addition, *Salmonella Typhi.* were not found in milk powder, per (ICMSF, 2011).

Table 4. Microbiological examinations of raw materials used in preparing filling cream.

Examinations Materials	Total bacterial count	Yeast and mold count	*S. aureus*	*E. coli*	*Salmonella Typhi* .
Sucrose	1.00	<1.0	ND	ND	ND
Milk powder	1.78	<1.0	ND	ND	ND
Shortening	1.00	<1.0	ND	ND	ND

ND: not detected; <1: viable colony was not detected at detection limit < 10^1cfu/g. Our obtained result is agreed with ES (2005)

skim milk powder is an important raw material in the recipe of different biscuit products. Where, it's high nutritional value and functional properties. So that, it could be one of the important sources of hazard microorganisms especially *Salmonell Typhi.* and Enterobacteriaceae (Corlett, 1998)

Risk category of filling cream:

According to NACMCF (1992), the produced filling cream's risk category was assessed. The filling cream's danger features were (+++++). very risky ingredient: sensitive components were present, and no regulating processing step was available to stop the proliferation of microorganisms. Additionally, filling cream was classified as a risk level of five (I) due to its susceptibility to recontamination following preparation, significant possibility of abusive handling following preparation, and lack of a terminal heat procedure following final product packing.

Control measures applied for improving the safety and quality of prepared filling cream.

Certain micro biostatic control techniques, such as pH lowering, cooling, freezing, preservatives, and native antimicrobial systems, also exhibit microbiocidal effects, with the extent of these effects frequently varying according to the application intensity (CAC, 2013). This study examines the use of refrigeration (cooling storage) and heat treatment, namely pasteurization, as control techniques to enhance the safety of the produced filling cream.

Effect of cold storage periods on the microbiological and chemical quality of filling cream

The effect of cold storage at a temperature of 4±1°C for 10 days on the microbiological analysis, pH, and soluble solids ratio of prepared cream filling (Fig. 3). The counts of total aerobic bacteria, yeasts, molds, *S. aureus*, *E coli*, and *Salmonella Typhi* were 2.91, 2.70, 2.00, 2.61, and 2.00 log cfu/g, respectively. A significant increase in different microbial counts was observed during storage at 4±1 °C for 10 days. After 10 days of cold storage filling cream samples had count of 3.51, 2.95, 3.04, 3.00, and 2.08 log cfu/g for total aerobic bacteria (TBC), yeast and molds, *S. aureus* and *E coli*, respectively. *Salmonella Typhi*. was detected in all tested samples.

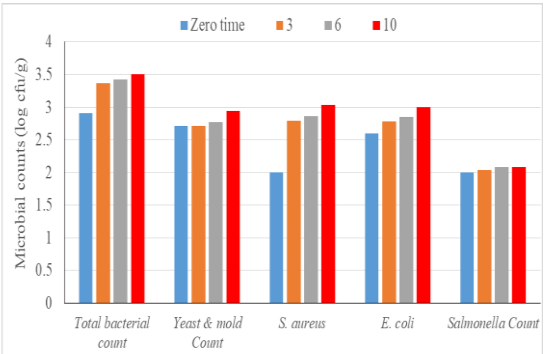

Fig. 3. Changes in microbial counts of filling cream during storage periods at 4±1 °C for 10 days.

The deterioration of cold filling cream is directly related to initial microbial population and bacterial growth during storage Table (5) A slight change was observed in TSS% of filling cream from 68.72 to 68.83 % during cold storage at 4±1 °C. While a significant reduction in pH value was detected in filling cream throughout the storage period (from 6.25 to 5.70). Seema (2015) reported that some bacteria produce acid as they grow and this excreted and lowers the pH of the surrounding environment.

Table 5. Changes in pH and TSS of filling cream during storage periods at 4±1 °C for 10 days

Storage period (days)	pH	TSS (%)
Zero time	6.25^a	68.72^c
3	6.15^b	68.77^b
6	5.72^c	68.78^b
10	5.70^c	68.83^a

Means with the same letters in the same column are not significantly different (P≤0.05).

Effect of pasteurization process on microbiological and chemical quality of filling cream

The effect of pasteurization at 80°C for 10 min. on the microbiological characteristics of filling cream stored at 4°C for 10 days is shown in Table (6). The beneficial impact of heat treatment on the decrease in several microbiological parameters of the treated filling cream was evident. The overall bacterial count, yeasts and molds, *E. coli* and *S. aureus*, and *Salmonella Typhi*. were measured at zero time and were 2.91, 2.70, 2.00, 2.61, and 2.00 log cfu/g of untreated filling cream, respectively. However, *Salmonella Typhi*. was not found in the examined samples, and the microbiological requirements were not found in pasteurized filling cream at detection limits < 10^1cfu/g. The same results were almost observed after 3 and 6 days of storage. While after 10 days of storage a significant increase was detected in total bacterial counts (2.00 log cfu/g), and yeasts and molds were not detected, *S. aureus and E. coli* at the detection limit< 10^1cfu / g. On the other hand, no significant changes were observed in pH and TSS of pasteurized filling cream during 10 days of storage at 4°C.

Table 6. Changes in microbiological and chemical quality counts, pH and TSS of pasteurized filling cream during storage at 4±1 °C for 10 days

Examinations storage period (days)	Total bacterial count	Yeast and mold Count	*S.aureus*	*E. coli*	*Salmonella Typhi.*	pH	TSS (%)
Before pasteurization	2.91	2.70	2.00	2.61	2.00	6.25	68.72
After pasteurization							
Zero time	<1.0	<1.0	<1.0	<1.0	ND	6.48	68.72
3	<1.0	<1.0	<1.0	<1.0	ND	6.45	68.74
6	<1.0	<1.0	<1.0	<1.0	ND	6.45	68.74
10	2.00	<1.0	<1.0	<1.0	ND	6.44	68.74

ND: not detected; <1: viable colony was not detected at detection limit < 10^1cfu / g

Papafotopoulou-Patrinou *et al*. (2016) stated that one of the major concerns in food industry is food preservation and microbial spoilage. Gupta *et al*. (2020) reported that the preservation of foods by heat has probably been practiced by man since the discovery of fire.

The most used technique for this purpose is pasteurization. According to Seema (2015), a great deal of study has been done to understand how pasteurization affects microorganisms. As a result, pasteurization may be utilized as a control method to reduce the number of pathogens in filling cream. Although sterilization is an absolute term which usually means the complete destruction of all forms of life, substantial food preservation can be achieved by less than complete sterilization, pasteurization is such a treatment. This low-temperature heat treatment destroyed spoilage organisms but was low enough so as not to destroy the original characteristics of the liquid being treated. These results were in harmony with Munir and Federighi (2020) who stated that the foodborne salmonellosis problem can be solved by pasteurization through cooking or irradiation. Also, Abd El- Razik (2002), Silva and Gibbs (2012) and Sharifzadeh, *et al.* (2016) found that pasteurization at (80°C /10 min) affects *Salmonella Typhi*. and Enterobacteriaceae growth in cream.

Physiochemical properties of collected filling cake samples.

Physiochemical analysis of the collected filling cake samples is given in Table (7). It could be seen differing moisture content of the collected filling cake samples, since the moisture content ranged from 19.43 to 25.99% At the same time, fat content ranged from 7.10 to 8.59% while protein content ranged from 4.06 to 7.74 % and ash content ranged from 1.45 to 2.21% while pH value ranged from 5.89 to 6.97 and total carbohydrate was ranged from 81.46 to 86.60 These results are disagree with the results obtained by Abdel-Razik (2002), who found that moisture contents of collected filling cake samples from Egyptian market were ranged from 13.83- 15.43%, crude protein 8.84- 9.72%, ash 0.65-0.68%, pH value was ranged from 5.90-7.27.

Table 7. Physicochemical properties of collected filling cake samples before Implementation of PRp and HACCP Management System

Properties samples	Moisture (%)	Fat{B} (%)	Protein{B} (%)	Ash {B} (%)	Total carbohydrate{c} (%)	pH
			Factory samples			
1	19.43±1.47e	8.13±0.99a	4.09±0.38d	1.91±0.24a	85.87±0.60d	6.92±0.69a
2	22.39±0.59d	7.69±0.48c	4.71±0.51a	1.88±0.20b	86.26±1.84c	5.89±0.76d
3	23.05±0.96c	8.04±1.01b	4.06±0.43d	1.45±0.52d	86.45±1.17b	6.82±0.83b
4	24.58±1.00b	7.46±1.09d	4.29±0.35c	1.65±0.37c	86.60±1.88a	6.97±0.49a
5	24.82±1.22a	7.10±0.39e	4.49±0.69b	1.88±0.49b	86.53±1.85ab	6.37±0.64c
			Local market samples			
1	25.75±0.78b	7.57±0.49d	5.38±0.67e	2.09±0.38b	84.96±1.39a	6.18±0.23c
2	25.99±1.00a	7.90±0.53b	6.52±0.51d	1.97±0.49c	83.61±2.55b	5.94±0.55d
3	24.95±2.52e	7.72±0.50c	6.92±0.41b	1.87±0.56d	83.49±2.13b	6.96±0.66a
4	25.27±0.98c	8.59±0.59a	7.74±0.52a	2.21±0.47a	81.46±1.88e	6.40±0.56b
5	25.01±1.35d	8.54±0.70a	6.85±0.68c	1.75±0.55e	82.86±1.65d	6.36±0.56b

{A}: The values shown are mean values of the three different samples.
{B}: Calculated as dry basis.
{c}: Calculated by differences.

Results of physiochemical properties of different filling cake samples of PRP and HACCP Management System are recorded in Table (8). It Unobserved differences resulting from application of the standard moisture content of the collected filling cake samples, since, the moisture content ranged from 20.88 to 21.97 % In the same time either in factory or local market , fat content ranged from 6.30 to 7.30% while protein ranged from 6.03 to 6.95 % and ash was ranged from 1.26 to 1.98 % while the pH value ranged from 6.43 to 6.90 and total carbohydrate ranged from 84.54 to 85.73.Either in fresh or end storage periods in local market. These results are disagree with the result obtained by Abd El-Rady *et al.* (2016), who found that low moisture contents of collected filling cake samples from Egyptian.

Table 8. Physicochemical properties of collected filling cake samples after Implementation of PRp and HACCP Management System

Properties / samples	Moisture (%)	Fat{B} (%)	Protein{B} (%)	Ash{B} (%)	Total carbohydrate{C} (%)	pH
			Factory samples			
1	21.24±0.01d	6.35±0.26c	6.15±0.97d	1.98±0.02a	85.52±0.25b	6.83±0.99b
2	21.20±0.18d	7.30±0.27a	6.07±1.00e	1.82±0.14b	84.81±0.22d	6.70±1.00c
3	21.46±0.01c	6.30±0.10c	6.55±0.98b	1.42±0.12d	85.73±0.06a	6.90±0.56a
4	21.77±0.01b	6.84±0.15b	6.95±1.21a	1.46±0.14d	84.75±0.19d	6.77±1.00c
5	21.97±0.01a	6.86±0.06b	6.26±0.12c	1.67±0.09c	85.21±0.07c	6.89±0.56a
			Local market samples			
1	21.33±0.01c	7.19±0.07a	6.03±0.27c	1.98±0.05a	84.80±0.26c	6.69±0.58b
2	21.68±0.01a	6.93±0.70b	6.63±0.22a	1.26±0.14c	85.16±0.24b	6.53±0.57d
3	21.57±0.01b	6.52±0.49d	6.54±1.11b	1.28±0.13c	85.66±0.31a	6.43±1.00e
4	20.88±0.01d	6.81±0.56c	6.53±1.09b	1.84±0.12b	84.82±0.61c	6.57±0.99c
5	21.30±0.58c	6.92±0.80b	6.62±0.84a	1.92±0.06a	84.54±0.76d	6.89±0.58a

{A}: The values shown are mean values of the three different samples.
{B}: Calculated as dry basis.
{c}: Calculated by differences.

Microbiological analysis:

Microbial analysis of different collected filling cake samples is presented in Table (9). It could be noticed differing microbial load of collected filling cake samples. This difference is due to the differences in the raw materials used in manufacturing cake products, in special the presence of preservatives e.g. sorbic acid and ascorbic. The inclusion of sensitive ingredients in the filling material's components, such as water, starch, milk powder, cocoa, and egg, may be the cause of the filling cake samples' greater microbial load compared to plain cake samples. (Corlett, 1998; Bryan, 1988)

Total bacterial counts ranged from 2.31 to 2.91 log cfu/g. Although, yeast and mold were detected at detection limit <10^1cfu/g of different tested samples, it detected at number of 2.01-2.31 log cfu/g of samples 5 in factory, 2and 4 in local market. Counts of *Staphylococcus aureus* ranged from 2.31 2.61 log cfu/g in. *Salmonella Typhi*. was detected in three samples of tested filling cake products (5 in factory and 2,4 in local market); while other samples were free from *Salmonella Typhi*. For *E. coli*, filling cake sample 4 in factory and 2 in local market had values of 2.01 and 2.31log cfu/g, respectively, while other collected samples had value of <10^1cfu/g. These observations was agreed with DOHSA, (2007), who mentioned that there are several factors that may contribute to the risk of contamination of bakery products as follows: 1) Products contained ingredients that allow growth of bacteria, such as cream and custard; 2) Products are often unrefrigerated for long periods of time; 3) re-use of piping bags, and 4) Use of non-purpose built premises (Olfat, 1988), reported that recontamination of product may be occurring through filling or topping materials which added after baking such as cream or cocoa. Results of microbial analysis in Table (7) and Table (8) showed that, microbial load of filling cake samples were higher than those of the plain cake products. Whereas, total bacterial and spore forming bacterial counts were found to be higher in all samples of filling cake than plain cake. Although *Staphylococcus aureus* was not detected at detection limit < 10^1 cfu/g in different plain cake samples, it was detected in all filling cake samples in counts ranging from 2.31 to 2.61 log cfu/g.

Table 9. Microbiological examinations of different collected filling cake samples before Implementation of PRP and HACCP Management System

Examinations / Samples	Total bacterial count{A}	Yeast & mold count{A}	*S.aureus*{A}	*Salmonella Typhi*{B}	*E. coli*{A}
			Factory samples		
1	2.91a	<1.0	2.48b	ND	<1.0
2	2.61d	<1.0	2.48b	ND	<1.0
3	2.91a	<1.0	2.61a	ND	<1.0
4	2.76c	<1.0	2.31c	ND	2.01
5	2.48e	2.01	2.48b	<1.0	<1.0
			Local market samples		
1	2.61d	<1.0	2.48b	ND	<1.0
2	2.85b	2.31	2.48b	<1.0	2.31
3	2.61d	<1.0	2.31c	ND	<1.0
4	2.68c	2.31	2.48b	<1.0	<1.0
5	2.31f	<1.0	2.31c	ND	<1.0

Means with the same letters in the same column are not significantly different at 5 % level. log cfu/g; No. of positive samples/No. of tested samples; ND: not detected; <1: viable colony was not detected at detection limit < 10^1cfu / g

Filled with vanilla cream.

Microbial analysis of different collected filling cake samples is presented in Table (10). After Implementation of PRP and HACCP Management System, Total bacterial count ranged from 1.00 to 1.68 log cfu/ gm and the absence of both *S.aureus*, *Salmonella Typhi*, and *E.coli* from the tested samples This results agreement with Siddiqui *et al.* (2017). These results were in accordance with the(Egyptian standard 4037/2005) for cake sample.

Table 10. Microbiological examinations of different collected filling cake samples after Implementation of PRP and HACCP Management System

Examinations Samples	Storage periods	Total bacterial count{A}	Yeast and mold count{A}	*S.aureus*{A}	*Salmonella Typhi* {B}	*E.coli*{A}
			Factory samples			
1	Fresh	1.00[e]	ND	ND	ND	ND
2	Fresh	1.46[c]	ND	ND	ND	ND
3	Fresh	1.31[d]	ND	ND	ND	ND
4	Fresh	1.68[a]	ND	ND	ND	ND
5	Fresh	1.61[b]	ND	ND	ND	ND
			Local market samples			
1	Fresh	1.61[b]	ND	ND	ND	ND
2	15 days	1.48[c]	ND	ND	ND	ND
3	30days	1.48[c]	ND	ND	ND	ND
4	45 days	1.01[e]	ND	ND	ND	ND
5	90 days	1.01[e]	ND	ND	ND	ND

Means with the same letters in the same column are not significantly different at 5 % level. {A}log cfu/g; {B}: No. of positive samples/No. of tested samples; ND: not detected

CONCLUSION

GMP is not realized, and the cream filled bakery is weak hygienically in many ways, these factors must be addressed first. If every hygiene risk is to be seen as a CCP, there are endless CCs. Hygiene weak points must first be removed, i.e.: Cleaning plans should be made, which include all rooms, machines and equipment; rules should be made to guarantee that the risk of foreign bodies in the filled-bakery is drastically reduced (no glass and foreign materials and no other small items that could fall in the dough); hygiene training must be conducted regularly to show employs the possible consequences of acting unhygienically; all equipment which come into contact with non-baked fillings (cream mixers, pots, etc.) must be washed hot or disinfected; if these points are observed, there are only a few critical points left. The following points seen as CCs in bakeries when GMP is realized; accepting/preparing raw materials: sensory tests of all raw material (at the latest directly before starting using) to see rottenness, mold, insects and foreign bodies.

PRP (HACCP, GMP and GHP) fine bakery products with sensitive cream fillings, to avoid increase in possibly present pathogenic bacteria; such as cooling and pasteurization must be guaranteed and checked.

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تطبيق نظام البرامج الاشتراطية ونظام تحليل المخاطر علي عينات تجارية من الكيك المحشو بالكريمة بمحافظة الدقهلية

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الملخص

يعد نظام تحليل المخاطر ونقاط التحكم الحرجة (HACCP) أداة فعالة لإنتاج أغذية آمنة في خطوط الإنتاج المختلفة. وفي هذه الدراسة تم جمع عدد ستون عينة من الكيك من مصانع صناعة الكيك المحلية بمحافظة الدقهلية.تمت ملاحظة تنفيذ خطة تحليل المخاطر ونقاط التحكم الحرجة (HACCP) ومفاهيم PRP أثناء تحضير كريمة الحشو من خلال إظهار نظم الجودة النموذجية وكيفية تطبيقها. وقد وضعت هذه الدراسة خطة عامة لتطبيق نظام تحليل المخاطر (HACCP) وفقًا للمتطلبات القانونية ، كما تم تقييم مخطط انسيابي يعتمد على تطبيق نظامHACCP خلال عملية تصنيع وإنتاج الكيك. تم دراسة التحليل الفيزيوكيميائي والميكروبيولوجي لعينات الكيك تحت الدراسة. أظهرت النتائج عدم مطابقة كريمة الحشو قبل تطبيق نظام HACCP للمواصفة القياسية. كما أن نتائج العد البكتيري الكلي (TVC) كانت مرتفعة بالمقارنة مع الحدود المسموح بها قانونا. تم تصميم نظام تحليل المخاطر قبل وأثناء عملية البسترة عند درجة حرارة 80°م لمدة 10 دقائق لكريمة الحشو وقبل تعبئة الكريمة لتكون منتجة بصورة آمنة وصحية. وقد أظهرت نتائج هذه الدراسة انخفاض المحتوى الرطوبي القياسي لعينات الكيكة المحشوة بالكريمة والمستخدمة في هذه الدراسة عند تطبيق نظام HACCPعلي خط الانتاج، إذ تراوح محتوى الرطوبة من 20.88 إلى 21.97%. بالإضافة إلى ذلك، تراوحت نسبة الدهون من 6.30 إلى 7.35%، بينما تراوحت نسبة البروتين من 6.03 إلى 6.92%، كما أدي تطبيق نظام HACCP الى تحسن في قيمة الأس الهيدروجيني لعينات الكيك حيث تراوحت قيمة الرقم الهيدروجيني من 6.43 إلى 6.90 وتراوحت نسبة الكربوهيدرات الكلية من 66.15 إلى 67.45. بعد تطبيق نظام إدارة PRP وHACCP، تراوح إجمالي العد البكتيريا الكلي من 1.00 إلى 1.68 log cfu/gm وغياب كل من *S.aureus* و*Salmonella Typhi* و*E.coli* من العينات التي تم اختبارها. وخلصت هذه الدراسة إلي أنه من الضروري تطبيق نظام تحليل المخاطر ونقاط التحكم الحرجة (HACCP) لتجنب المخاطر وزيادة سلامة المستهلك لهذا المنتج.