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IMPLEMENTATION OF THE HAZARD ANALYSIS AND CRITICAL CONTROL POINTS (HACCP) SYSTEM FOR SAFETY PRODUCTION OF SOFT CHEESE

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ABSTRACT

The aim of this investigation is to determine the chemical and microbiological hazards and critical control points during the manutactur of soft cheese for developing of HACCP plan for this product. Results indicated that raw milk was the most hazardous. It harbored high bacterial count, with 25% of the tested samples being contaminated with *Brucella* and contained start new sentence 0.15-0.26 mg Cu / Kg but it was free from lead and mercury. Other raw ingredients i.e. dried milk, salt, coconut oil and rennet were also examined for chemical and microbiological hazards. Results also showed that receiving raw milk, pasteurization of pre cheese milk and storage temperature of cheese were found to be the obvious CCPs used to eliminate, prevent or minimize different hazards. Receipt of raw milk must be from certified, hazards-free milk and time / temperature treatment must be not less than 85 °C / 20 sec. as well as storage temperature which must not more than 5° C were the critical limits. Recording time / temperature treatment of milk and the storage temperature can be used as monitoring procedures. All guidelines for the implementation of HACCP system including a flow diagram of processing steps, identifying hazards, controlling at different CCPs through monitoring, corrective active and verifying the HACCP plan as well as record keeping were also established.

INTRODUCTION

Hazard Analysis and Critical Control Points (HACCP) is a system intended to disclose-through examination of raw materials, processes, practices, personnel, products, equipment, and premises rather than reliance on end- product testing and traditional inspection methods (Joint FAO/WHO, 1993). HACCP was suggested to be used in food processing operations (Bryan, 1992) and food service operations (Griffith and Worsfold, 1994). HACCP system has evolved as the system of choice to ensure food safety, because it is logical, practical and preventive in nature As a system, which identifies, evaluates and controls hazards that are significant for food safety, HACCP has the advantage of being able to be implemented at all stages of food chain.

The joint FAO/WHO Food Standard Programme Codex Alimentarius Commission (1997) has been from the first international bodies to adopt HACCP system and promote its application. The guidelines for the appiication of HACCP system as described by Codex Alimentarius Commission are accepted internationally as the reference for HACCP application. Similar guidelines have been developed by the National Advisory Committee on Microbiological Criteria for Foods (NACMCF, 1999).

Food safety is of critical importance for the manufacture of processed food products. No manufacturer wants to make or sell products that may be responsible for injury, illness or death of consumer. In addition unsafe products can result in legal actions and disastrous economic consequences for the food manufacturer.

Soft cheese represent now a big category in consumption of soft cheese in Egypt and most of the Middle East countries. Ultrafiltration (UF) is now the main practice for processing soft cheese.

Some hazardous defects were observed sometimes during marketing and consuming the cheese which consequently increase the returns rejected tetra cheese bricks from retailers and faced with legal considerations for cheese safety. The microbiological and chemical quality of raw materials used in Soft cheese is a very important factor, which contribute to the safety issue of the resultant cheese. Unlimited microbial flora in the raw milk have been recorded by many investigators (EL-Backary, 1990; Kikuch *et al*, 1996). Many investigators have examined the microbial count of other ingredients. Skim milk powder (Abo-El Khier *et al*, 1985; EL-Backary, 1990), sodium chloride, water (Roi *et al*, 1995). Also, many strains of spore forming bacteria (Fayed *et al*, 1989) and yeast (EL-Shibiny *et al*, 1988; Kaminaridies and Laskos, 1992).

Compared with microbiological hazards, relatively little has been reported for control of chemical hazards in dairy products. Ropkins and Beck (2002); Shank and Sundl (1995) examined the heavy metals and pesticides in milk and some dairy products. Carl (1991) pointed out that heavy metals could cause problems in dairy products at certain levels.

Such problems did not take enough consideration to diagnose the problem and found out the scientific approach for practical solutions from the industrial point of view (Sandrou and Arvantitoyannis, 2000). This led to move to the scientific, preventive food safety assurance program, the hazard analysis critical control system (HACCP).

The HACCP system is a systematic approach to the identification, assessment of risk and control of the microbiological, chemical and physical hazards associated with each segment of the food chain from the production to consumption following the seven basic principles (Corlett, 1998).

This study aims to introduce the HACCP system as a food safety tool in the manufacture of Soft cheese by identifying the microbiological and chemical hazards inside the process line of production. The effect of raw materials on these hazards was also observed.

MATERIALS AND METHODS

Raw cows' milk samples were collected from the milk tankers in sterile bottles and taken directly to the laboratory. Skim milk powder was spray dried low heat. Coconut oil was used as additional fat ingredient. Milk coagulation microbial enzyme (Maxiren, 800 granulate IMCU/g) was used as rennet. Water samples were collected in sterile bottles from the main treated water reservoir tanks of the plant. Extra edible grade of sodium chloride unionized, Gluco Delta Lactone (GDL) and calcium chloride 77-80 % flakes, were used.

Manufacturing technique of Soft cheese:

The manufacture of soft cheese is illustrated in the flow diagram (Fig.1) and could be summarized as follows: Raw milk was separated into cream and skim milk. The cream was pasteurized at 115°C for 4 sec. and skim milk was micro-filtered (MF) using Anhydrous A/S membrane filtration. The cream and skim milk were mixed and pasteurized at 74 °C / 2 min before being pumped to the UF modules. The milk solids were concentrated into retentate up to 16 % fat ± 0.2 and 36 %TS ± 0.2 %. The retentate was mixed with skim milk powder + coconut oil (50%). The pre cheese concentrate was homogenized at 50 bar, pasteurized at 85 °C for 20 sec. and cooled to 42 .°C. The pre cheese concentrate was then pumped in closed circulation pipe line to the mixing tank for addition of 4 % salt, 0.015 % $CaCl_2$ and 3 % GDL. The rennet solution (220g / 100liter) was injected automatically in a rate of 4 % for renneting step before pumping to the Tetra Pack Aseptic filling TBA 3 500-cc machine. The cheese tetra bricks were stored at 5 °C tell distribution.

Microbiological analysis:

Samples from each raw material and from all Soft cheese processing steps were examined for enumeration of total aerobic bacterial count (TPC), aerobic spore forming bacteria (*Bacillus spp*), *Coliform* group, *Faecal coliform*, *Molds* and *Yeasts*. Sample were also examined for the presence of *Brucella* , *Staphylococcus aureus and Salmonella* according to ISO Method specify the data and code of this method and the American Public Health Association (1992).

Preparation of tested samples, initial suspension and decimal dilutions were done according to ISO 6887-1(1999)and ISO 6887-3-(2001). Ten grams of sample weighed into a sterile stomacher bag and 90 ml diluents (buffered peptone water) was added and, blended for 1-2 min. Then decimal dilutions to $1.0x10^{-5}$ in buffer peptone water was made to perform enumeration of total plate counts , for *Coliform*, *Faecal coliform*, *Bacillus cereus* and *Staph. aureus*.

The total plate count was done according to the method of ISO 4833-2002 on (TPC) agar and incubated at 30° c for 72 hrs.

The enumeration of *Coliform* group was done by pour plate method according to ISO 4832-2004 on crystal violet neutral red bile lactose (VRBL) and incubated at 37°C for 48 hrs.

Aerobic spore forming bacterial *(Bacillus spp)* count was done using MYP agar (30°C/48 hrs), (ISO 7932,1993).*Staph. aureus* was isolated on Baird Parker agar (37° C /24 hrs) (ISO 6888, 1998).

Presence of *Faecal coliform* (Thermotolerantcoliform) was determined using crystal violet netural red bile lactose (VRBL) (44.5 °C /24 hrs) (NMKL No. 125,1996).

Detection of *Brucella was tested according to* the American Public Health Association (1992).

Salmonella were tested according to ISO 6579,(2001), Pre–enrichment. 25g sample was performed in 225 ml buffer peptone water and incubated at 37°C for 16 – 20 hrs, then 1 ml and 0.1 ml were transferred into

10 ml in two selective enrichment broth Tetrathionate broth (TTB) and Rappart – vassiliadis broth (RV) and incubated at 37°C and 41.5°C for 24 hr, respectively. Loopful from each selective enrichment was streaked on Hektone enteric agar, XLD and phenol red Brilliant green agar at 37°C for 24 hrs. Suspected colonies were subjected to biochemical identification on lysine decarboxylase, triple sugar iron agar and urea agar at 37°C for 24 hrs. replace by "culture giving reactions typical to those of salmonella were serologically conformed and biochemically tested using the Api 20E miniaturized kits.

Quality control :

General guidelines on quality assurance for the preparation of culture media in the laboratory were followed according to ISO 11133-1 (2000) and ISO 11133-2 (2002).

Chemical analysis:

For the determination of heavy metals, samples were digested by wet ashing according to Jackson (1967); Thabet (2001) and A.O.A.C (1985). Extracts were then used for the determination of Lead, Cupper and Mercury using atomic absorption spectrometry method using spectrophotometer (Varian, AA 20).

Developing the HACCP plan:

Hazard Analysis and defining critical control points were carried out according to CAC (1997).

RESULTS AND DISCUSSION

Microbiological Quality of raw materials:

Table (1) shows the counts of total bacteria, aerobic sporeforming bacteria (*Bacillus spp*), *Coliform* group, *Faecal coliform, molds, yeast* count, the presence. of*Salmonella, Staphylococcus aureus and Brucella* in samples of raw milk, skim milk powder, rennet, water and other ingredients used in the preparation of Soft cheese it could be noticed. that raw milk was the very important source of contamination among other different ingredients. The total microbial count of raw milk averaged 6.2×10^6 cfu / ml milk. This high microbial count is due to the poor hygienic practices in the production of the milk, which came from different sources. Abdel Fatah *et al*, (1998) reported similar results for the T.P.C of raw milk. It could be observed also that 25 % of the tested milk samples were contaminated with *Brucella* and 30 % with *Staphylococcus.* Whereas, all other ingredients were free from these hazardous pathogenic bacteria. However, skim milk powder was cfu / ml and the 2nd important source of contamination. It contained averages of 7.6×10^2 T.P.C, 3.2×10^2 aerobic spore form bacteria (*Bacillus cereus*)/ g raw material. Rennet, salt, $CaCl_2$ and water contained lower microbial counts. *Coliform* group bacteria were only present in raw milk. The average count of aerobic sporeforme bacteria, *coliform* , *moulds* & *yeast* in this study was were lower those reported by EL-Backary (1990) and Abo EL-Kheir (1985). The numbers of spore-forming bacteria in raw milk and skim milk powder indicated that they stand as potential sources of microbial contamination. The presence of

some flora (i.e. T.P.C and coliform) in water, $CaCl_2$, NaCl and rennet can be attributed to the post contamination of these ingredients. Coconut oil and GDL were free from microbiological contaminants. Also, most ingredients were free from molds & yeast except skim milk powder, rennet and water, which contained few counts. however Salmonella and F.coliform were not detected in all ingredients. The processing temperature is sufficient to destroy them.

Table 1: Microbiological examination of raw materials used in soft cheese manufacture

Ingredient	Count of microorganisms CFU / g or ml samples					Detection %		
	T.P.C	Aerobic spore forming	*Coliform* group	F. Coliform	Molds & yeast	Brucella	Salmonella	Staph aureus
Raw milk**	6.2×10^5	2.2×10^2	1.4×10^3	<10	25×10^2	25	N.D.	30
Skim milk powder*	7.6×10^2	3.2×10^2	<10	<10	7x 10	N.D.	N.D.	N.D.
Salt (NaCl)*	2×10^2	2 x 10	<10	<10	<10	N.D.	N D.	N D
Rennet*	2 x 10	2 x 10	<10	<10	8x 10	N.D.	N.D.	N D.
Water*	4 x 10	1.4 x 10	<10	<10	2	N D.	N D	N D
Coconut oil*	1 x 10	<10	<10	<10	<10	N D	N.D.	N D
GDL*	<10	<10	<10	<10	<10	N D.	N.D.	N.D
$CaCl_2$*	1.2×10^3	5×10^2	<10	<10	<10	N.D.	N D	N D

* Average of five replicates. ** Average of one hundred sample
N.D. = not detected

Chemical hazards in raw materials of Soft cheese:

Table (2) presents Lead, Cupper and Mercury contents in all ingredients used in Soft cheese manufacture. It could be observed from the results that raw milk samples contained a range of 0.15-0.26 µg Cupper per kg milk whereas it was free from other chemical hazards. Salt (NaCl) contained also Mercury (0.06-0.1 µg) and Lead (< 1.0 µg) / kg, while coconut oil is considered a source of Cupper (0.04-1.7 µg) and Lead (Nil-0.33 µg) / kg of these materials. GDL, water and $CaCl_2$ were found to be free from these heavy metals. Carl (1991) and IDF (1992) reported that cows' milk contained 2-3 µg Lead and <0.07µg Mercury / kg milk. The tolerable weekly intakes for adults established by FAO /WHO were 50 µg for Lead and 3.3 for Mercury (Carl, 1991).

Table 2: chemical hazards of raw materials used in Soft cheese manufacture

Ingredient	Lead µg / kg	Cupper µg / kg	Mercury µg / kg
Raw milk	<10	0.15-0.26	Nil
Skim milk powder	<10	Nil	Nil
Salt (NaCl)	< 1.0	Nil	0.06 – 0.1
Rennet	Nil	Nil	Nil
Water	Nil	Nil	Nil
Coconut oil	Nil – 0.33	0.04 - 1.7	Nil
GDL **	Nil	Nil	Nil
$CaCl_2$ ***	Nil	Nil	Nil

* Average of five replicates. ** Glucono Delta Lactone.
*** Calcium chloride.

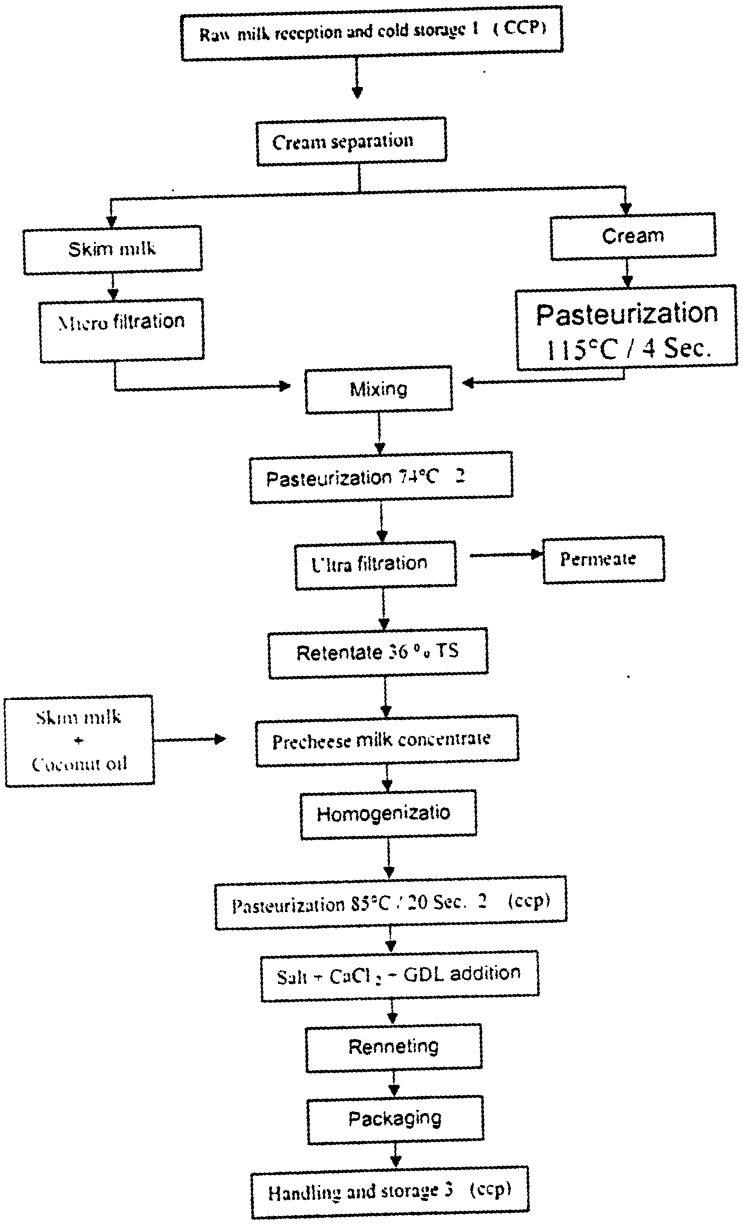

Fig. Flow diagram of Soft cheese manufacture and CCPs for controlling hazards

The much smaller quantities of Pb and Hg found in this study compared to the provisional tolerable limits led us to consider chemical contaminants in raw materials used in Soft cheese is not critical hazards.

Effect of manufacturing steps on microbiological quality of Soft cheese:

Table (3) shows the effect of the main different manufacturing stages on total bacterial count, aerobic spores(*Bacillus spp*), *Coliform* group, *Faecal coliform*,and moulds & yeast count. It can be observed from the Table that T.P.C, Aerobic spore forming (*Bacillus spp*) , coliform bacteria and moulds and yeast increased slightly after cream separation step from 1.2 $x10^5$, $1.2x10^2$, $1.3x10^3$ and 5.3x10 to $1.3x10^6$, $1.5x10^2$, $1.4x10^3$and 7x10 cfu/ml, in the same order. On the other hand these counts decreased after heat treatment and the coliform group were completely destroyed. After the UF concentration the resultant retentate had higher T.P.C 7.3×10^4, 1.8×10^2, <10 and <10, in the same order. The present results are in agreement with those reported by EL-Shibiny *et al* (1994). As a result of heat treatment (85 °C for 20 sec.), the T.P.C and spore forming of preaches milk concentrate were decreased to 5×10^2 and 7x10. The resultant Soft cheese samples after packing stage had lower counts of these microorganisms.

Table 3: Microbiological analysis* during different processing steps of soft cheese

Processing steps	T.P.C	Aerobic spore forming	Coliform	F.coliform	Molds and yeast
Raw milk	1.2×10^5	$1.2x 10^2$	1.3×10^3	<10	5.3 x 10
Milk after separation	1.3×10^6	1.5×10^2	1.4×10^3	<10	7 x 10
After heat treatment	5.6×10^3	9x 10	<10	<10	<10
After UF	7.3×10^4	1.8×10^2	<10	<10	<10
After heat treatment 85 °C	5×10^2	7 x 10	<10	<10	<10
Cheese after packing	3.4×10^2	4.5 x 10	<10	<10	<10

* Average of five replicates.

Application of HACCP system in Soft cheese processing line:

According to Baker (1995) incorporating HACCP system in the initial stages of food product development allows for an assessment of the risk and severity of hazards which may be associated with the raw materials and their processing.

Hazard analysis:

The hazard analysis for Soft cheese manufacture is to identify different hazards in the various raw materials and steps of processing and consideration of control measures for the hazards (Mauropoulbs and Arvantoyannis, 1999).

Table (1) and (2) illustrated the microbiological load and chemical hazards of different raw materials. It is clear from these results that raw milk and skim milk powder harbored the main hazards. *Brucella* and coliform bacteria were the main biological hazards whereas heavy metals were the main chemical hazards.

Table (4) summarizes the HACCP plane at different processing steps. Most hazards were biological (*Brucella, staphylococcus,* coliform) and chemical (heavy metals and cleaning detergent residues).

Table 4 : HACCP plan summary table for Feta cheese Processing steps

Step No.	Process Step	Hazard Description	CCp Determination Q1	Q2	Q3	Q4	CCP	Critical Limits	Monitoring Procedure	Corrective action	Person responsible
1	Receiving and cold storage of raw milk	Biological: Brucella,T.C, coiform	yes	yes	-	-	CCP	- Compliance to raw milk specification (Egyptain standardas 154/91) - Negative for Brucella, coiform - storage temperature below 5°C	- Review and approve receiving report - Review under approved analysis - Reviewing maintenance records	-Reject the lot at receiving -Repeat analysis -Adjust cooling temp. TPC below $3x10^6$	-Receiving Tech Q.C.Tech -Lab Engineer Maintenanc Eng
		Chemical : Preservatives, pesticide resides	yes	yes	-	-	-				
2	Cream separation	Biological: T. C,Coiform	yes	No	No	-	-	- No washing detergent	- Review CIP records	- Review duration temp and Conc Of the subsequent rinses	- Tech. Eng., Q.C Tech., Lab Eng., Line operator
		Chemical: Washing detergent	yes	No	No	-	-				
3	Microfiltration and cream pasteurization	Biological: Coiform,TPC	yes	No	No	-	-	- Flow rate of M.F 7500 – 8500 L/hr	- Review the record of M.F apparatus	Stop M.F unit and pasteunze only	M.F line operator
		Chemical: Washing detergent	yes	No	No	-	-		- Review the record of M.F efficiency		
4	Cream and skim milk pasteurization and mixing	Biological: Coiform,TPC	yes	No	No	-	-	- Creamheat treatment not less than 115 C / 4 Sec - Skim milk heat treatment not less than 72 C / 15 Sec	- Review the pasteurization record - Negative peroxide test	Analyzing the origin of deviaition, calibration	Line operator
		Chemical: Washing detergent	yes	No	No	-	-				
5	Ultrafiltration	Chemical: Cleaning residues	yes	No	No	-	-	-No cleaning residues - TS 35 % -Rate of prod 1500 – 1700 L/hr	- Review CIP records- Review UF records	- Rewash the UF unit with water - Adjust the UF flow rate	-UF operator - Lab Tech - Production supervisor Maintenance Engineer
6	Mixing retentate and skim milk and coconut oil	Chemical: Lead, Cupper - Pesticide	yes	No	yes	yes	-	- Free from heavy metals - Free from pesticides - Compliance to Egyptian standards for coconut oil	- Negative heavy metals - Negative pesticides	- Reject the skim milk powder lot - Reject the coconut lot	- Q C Tech - Lab Tech.
7	Homogenization	Biological: Coiform	yes	No	yes	yes	-	- Free from washing detergents	- Review homogenization records	Rewashing and detection of washing detergent residues	- Q C Tech - Lab Tech
		Chemical: Washing detergent	yes	No	yes	yes	-				
13	Storage	Biological : - TC Moulds & yeest	yes	No	yes	No	CCP	- Storage temperature 25 C	- Review lab records - Review storage records	Hold the batch and destroy if not confirm to specification	- Q C. Tech - Production supervisor
8	Heat treatment 85C/20 Sec	Biological: Coiform	yes	yes	-	-	CCP	- Negative for peroxide test - Heat treatment 85 C / 20 Sec - Free from detergent residues	- Peroxide test - Review pasteurize record - Review analysis record for product	- Readjust pasteurizer temp - Rewashing the apparatus	- Q C Tech - Lab Tech
		Chemical: Washing detergent	yes	yes	-	-					
9	Salting and $CaCl_2$	Biological: Coiform	yes	No	No	-	-	- Negative for coliform, Free from heavy metal, $CaCl_2$ not more than 0.02%	- Review analysis record - Review salt worksheet	Reject salt and $CaCl_2$ lots	Prod. operator
		Chemical: Heavy metal	yes	No	No	-	-				
10	GDL	Chemical: Washing detergent	yes	No	-	-	-	- PH of 4.3 – 4.9 - GDL conc 7 -8 kg / 250 L retentante	- Review record of GDL addition - Review analysis record of cheese	- Hold cheese reinspection and destruction - Rewash GDL tanks	Q C Tech prod Operator
11	Renneting	Biological: Coiform, Staph, molds &yest	yes	No	-	-	-	- Negative for coliform, staph - Molds & yeast not more than 410 cfu/g	- Negative for coliform, staph - Sensory evaluation	Hold the cheese batch and reanalysis	- Q C Tech - Lab Tech - Production operator
		Chemical: Heavy metal	yes	No	-	-	-				
12	Packing	Biological: Coiform, Staph, molds &yest	yes	No	-	-	-	- Negative for staph - coliform less than 10 / g - molds & yeast not more than 400 / g - Free from detergents	- Review records of CIP - Review Sensory evaluation records	- Rewashing Hold the batch and reanalysis	- Q C Tech - Lab Tech - Packing supervisor - Packing Tech
		Chemical: Washing detergent									
13	Storage	Biological : - TC Moulds & yeest	yes	No	yes	No	CCP	- Storege temperature 25 C	- Review lab records - Review storage records	Hold the batch and destroy if not confirm to specification	- Q C Tech - Production supervisor

CCP determination:

Critical control points in the processing line of Soft cheese were determined according to CCP decision tree of CAC (1997). According to the four questions of the decision tree, Table (4) shows that receipt of raw milk, heat treatment of precheese milk (85°C / 20 sec.) and storage of Feta cheese tetra bricks (2-5 °C) were the main three CCPs in the processing line of .Soft cheese.

Critical limits:

Table (4) summarizes the critical limits for each processing step. The critical limit for raw milk reception step was: 1- compliance to Egyptian standard specifications, 2-Negative for pathogenic bacteria and 3-storage temperature not more than 5°C. The critical limit for the second CCP (heat treatment) is that time / temperature treatment must not less than 85°C /20 sec. The critical limit for the 3rd CCP is that storage temperature of cheese must not more than 5 °C.

Monitoring:

Recording the temperature and time at raw milk storage tank and heat treatment of pre cheese concentrate as well as the storage room for the final product were the main motoring procedures in the processing line. A number of non continuous monitoring procedures could be used such as reviewing the records, visual inspection, peroxidase test could be used as monitoring procedures to ensure that a CCP is under control and to monitor its critical limits, as shown in Table (4).

Corrective actions:

According to the obtained data, analysis of raw materials, control of time/ temperature and storage temperature where the three CCPs. When monitoring system indicate that any of the critical limits was out of control, corrective actions should be taken such as, reject of incoming raw materials or stop the line and correct the temperature problem. Table (4) indicates the different corrective actions in each processing step.

Verification:

Microbiological methods may also be considered for verification of HACCP system. Other verification activities may include checks on proper occurrence of CCPs monitoring system (routine calibration), testing of finished product, also random collection of raw materials and end products, then testing them chemically and microbiologically.

Generally, it could be concluded that different principles of HACCP system as followed could be a guideline for application of HACCP system as a food safety tool in the processing line of Soft cheese.

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تنفيذ وتحليل نظام المخاطر ومراقبة الجودة للإنتاج الآمن للجبن الطري

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الهدف من هذا البحث هو التقدير الكمياني والبيولوجي ونقاط التحكم الحرجة داخل خط إنتاج الجبنة الطرية باستخدام نظام تحليل المخاطر ومراقبة الجودة HACCP .

النتائج دلت على أن اللبن الخام قد أهم مصادر الخطر حيث أشتملت عيناته على أعلى عدد بكتيري وأن ٢٥% من العينات الإختبارية كانت ملوثة بالبروسيلا وتحتوي علـى ٠,١٥ – ٠,٢٦ ملجم نحاس / كجم وكانت خالية من الرصاص والزئبق.

أما باقى المواد الخام مثل اللبن الجاف والملح وزيت جوز الهند والمنفحة وقد أختبرها أيضا كميانيا وبيولوجيا وقد أظهرت النتائج أن إستلام اللبن الخام والبسترة قبل تجبن اللبن ودرجة حرارة الجبن قد وجدوا من نقاط المخاطر الظاهرة وقد يستخدموا لإستبعاد أو تجنب أو تقليـل أخـتلاف المخاطر وقد أخذ فى الإعتبار أن اللبن الخام يعامل على درجة حرارة ٨٥ °م لمدة ٢٠ دقيقة لتقليل المخاطر ويجب أن تكون درجة حرارة التخزين لاتزيد عن ٥ °م .

ويتم تسجيل درجة الحرارة والوقت ومعاملة اللبن ودرجة حرارة التخـزين للـتحكم فـى عمليات التصنيع . كل الإرشادات الخاصة بإدخال نظام المخاطر ومراقبة الجـودة شـاملاً علـى مخطط خطوات التصنيع وتعريف المخاطر والتحكم فى جودة المراقبة وتصحيح النشاط وإسـتبيان خطة النظام .