Microbiological Evaluation of imported processed cheese sold in Khartoum market

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SUMMARY

This study was carried out to evaluate the microbial quality of imported processed cheese.

The study was based on collecting twenty seven samples of one type of processed cheese, nine from Khartoum, nine from Khartoum North and nine from Omdurman. Samples were collected from groceries of three different areas according to the income level of the majority of residents in the area. The microbial quality (total bacterial count, coliforms, lipolytic bacteria, proteolytic bacteria and yeasts and moulds count of the processed cheese were estimated.

The microbiological results revealed that there was a significant difference ($P<0.01$) between cities in total bacterial count and proteolytic bacteria count ($P<0.05$). They were high in Khartoum North (2.32 ± 0.001 and 1.19 ± 0.013 respectively).

There was no significant difference ($P>0.05$) in coliform and lipolytic bacteria count between the areas, while there was a significant difference ($P<0.001$) in total bacterial count, proteolytic bacteria count ($P<0.01$) and yeasts and moulds count ($P<0.05$). Total bacterial count was high in high income area (2.22 ± 0.007), while proteolytic bacteria count was high in the middle income area (1.18 ± 0.028). Yeasts and moulds count was high in the low income areas (1.33 ± 0.024).

INTRODUCTION

Cheese is a generic name for a group of fermented milk products produced throughout the world in a great diversity of flavours, texture, and forms (Fox *et al.*, 2000). Processed cheese is made by further processing of finished cheese usually a blend of hard rennet varieties with different aromas and degrees of maturity (Bylund, 1995).

There are two main types of cheese in Sudan namely Sudanese white cheese (Gibna bayda) and braided semi hard cheese (Mudaffarra). Other types of cheese provided recently by Sudanese industries, are Mozzarella and Rome. However the processed cheese is not yet produced by the Sudanese industry; as cheese could be stored for longer periods and excess milk could be converted into processed cheese (Nour Eldaeim, 2005).

Pasteurized processed cheese and pasteurized processed cheese spread are made by grinding, mixing, melting and emulsifying with the aid of heat and emulsifying agents one or more varieties of cheese, with or without the addition of foodstuffs such as cream, butteroil, vinegar, salt, spices, meat and vegetables (Alimentarius, 2000).

A comprehensive review of the microbiological safety of cheese considered many pathogens that might be associated with raw milk and cheese and their susceptibility to thermal treatments and activity (Johnson *et al.,* 1990).

MATERIALS AND METHODS

Twenty seven samples of one type of processed cheese were collected from Khartoum State, nine from Khartoum, nine from Khartoum North and nine from Omdurman. From each town the samples were collected from groceries of three different areas according to the income level (high, middle and low income) and hygiene measures. From each area three samples were collected.

The groceries of high and middle income areas had proper cooling system, while groceries of low income areas had no cooling system.

The samples were put in the refrigerator for preservation till analysis.

The samples were analyzed for total bacterial count, coliform count, lipolytic count, yeasts and moulds count and proteolytic bacteria count.

Sterilization of equipments:

Glassware such as Petri-dishes, pipettes and flasks were sterilized in an oven at 250^{o}C for 15 minutes, whereas mixer, distilled water and tubes were sterilized by autoclaving at 121^{o}C for 15 minute.

Preparation of sample dilutions:

Eleven grams of cheese were added to 99 ml of sterile distilled water in a flask and shaken well (making 25 complete up and down or back and forth movements of about 30 cm in 7 seconds) to make 10^{-1} dilution then 1 ml from the abovementioned dilution (10^{-1}) was aseptically transferred to 9 ml sterile distilled water. This procedure was repeated to make serial dilutions of 10^{-1}, 10^{-2} and 10^{-3} from suitable dilutions, 1 ml was transferred to Petri-dishes (duplicate) and the culture medium was poured aseptically into each Petri-dish, mixed gently, left to solidity and incubated (in an inverted position) (Houghtby *et al.,* 1992).

Examination of culture:

Growth on solid media was examined visually with naked eyes for colonies appearance and changes in media .Total bacterial count was determined according to Houghtby *et al.,* (1992) using standard plate count agar. The plates were incubated at 37^{o}C for 24 – 48 hours and colonies were counted. MacConkey agar was used to determine the coliform count according to Christen *et al.,* (1992). The plates were incubated at 37^{o}C for 18 – 24 hours.

The lipolytic count method was done as described by Zaki (1988). Nutrient agar was used to determine this bacterial count. The plates were incubated at 37 ^{o}C for 3 –4 days. The lipolytic colonies were identified by using copper sulphate (20%) flooded after incubation.

Proteolytic bacteria were counted according to Frank *et al.,* (1992) using plate count agar plus 10% sterile skim milk. The plates were incubated at 37^{o}C for 3 – 4 days. The total count of yeasts and moulds were determined according to Frank *et al.,* (1992) using yeast extract agar. The plates were incubated at 25^{o}C for 5 days.

Statistical analysis:

Statistical analysis was performed using the MSTATC (1990). General Linear Models (GLM) were used to determine the quality of cheese.

RESULTS

Microbiological quality of processed cheese as affected by city:-

Table (1) presents the microbiological analysis of processed cheese collected from different cites in Khartoum area. Data showed that there was no significant variation ($P>0.05$) in coliform count and lipolytic bacterial count. However, the highest coliform count was in Omdurman (0.95 ± 0.002) while the lipolytic bacteria count was the same in the three cities (0.99 ± 0.007). Actually no colonies were detected.

Microbiological quality of processed cheese as affected by areas:-

Table (2) presents the microbial examination of processed cheese as affected by area. Data showed that there was no significant difference.
($P>0.05$) between the areas in coliform count. However, a significant difference ($P<0.001$) was observed between the areas in total bacterial count with higher values being in high income area (2.22 ± 0.07).

Microbiological quality of processed cheese as affected by area within each city:-

Table (3) showed that in Khartoum North, the microbiological quality of cheese was not affected ($P>0.05$) by the income level except for total bacterial count which showed a slight increase in middle income areas (2.49 ± 0.013) ($P<0.001$) and proteolytic bacteria count ($P<0.05$) which was high in middle income area (1.38 ± 0.026).

In Omdurman the only effect was in total bacterial count ($P<0.001$) which was higher in high income area (2.30 ± 0.013) and yeasts and moulds count ($P<0.01$) which was highest in low income area (1.56 ± 0.077). In Khartoum the effect of income level tended to be the same as in Omdurman with an effect only in total bacterial count and yeasts and moulds count ($P<0.001$).

DISCUSSION

This study was intended to evaluate the processed cheese in the local market. The philosophy behind this investigation was that the Sudanese market is open to foreign products, beside the fact that there is a trend of producing such products in Sudan. In addition, the imported

products might be subjected to unfavourable environmental conditions such as storage and transportation which render the product unsafe and of low nutritional value, although the product is not yet expired.

Table (1). Microbial count of processed cheese as affected by city.

Microbial count	City			Grand mean	S.L.
	Khartoum North	Omdurman	Khartoum		
Total bacterial count (Log_{10} cfu/gm)	2.32±0.001[a]	1.97±0.001[c]	2.12±0.001[b]	2.14±1.193	***
Coliform bacteria (Log_{10} cfu/gm) *	0.94±0.002	0.95±0.002	0.94±0.002	0.94±0.793	N.S.
Proteoltic bacteria (Log_{10} cfu/gm)	1.19±0.013[a]	0.99±0.013[b]	1.17±0.013[a]	1.12±0.862	*
Lipolytic bacteria (Log_{10} cfu/gm)	0.99±0.007	0.99±0.007	0.99±0.007	0.99±0.802	N.S.
Yeasts and moulds (Log_{10} cfu/gm)	1.35±0.045[a]	1.31±0.045[a]	1.02±0.045[b]	1.23±0.904	*

Means in each row bearing the same superscripts are not significantly different(P>0.05)
*** = (P< 0.001) * = (P<0.05) cfu = Colony forming unit*

- *Coliform count was <the lower dilution level(EST).*

Table (2). Microbial count of processed cheese as affected by areas.

Microbial count	Income area			Grand mean	S.L.
	High	Middle	Low		
Total bacterial count (Log_{10} cfu/gm)	2.22±0.007[a]	2.02±0.007[c]	2.17±0.007[b]	2.14±1.193	***
Coliform bacteria (Log_{10} cfu/gm)	0.95±0.002	0.94±0.002	0.95±0.002	0.95±0.793	N.S.
Proteoltic bacteria (Log_{10} cfu/gm)	1.04±0.028[b]	1.18±0.028[a]	1.14±0.028[a]	1.12±0.864	**
Lipolytic bacteria (Log_{10} cfu/gm)	1.04±0.015	1.05±0.015	1.07±0.015	1.05±0.839	N.S.
Yeasts and moulds (Log_{10} cfu/gm)	1.07±0.024[b]	1.28±0.024[a]	1.33±0.024[a]	1.23±0.904	*

Means in each row bearing the same superscripts.
are not significantly different(P>0.05).
*** = (P< 0.001). ** = (P<0.01). * = (P<0.05).*
S.L.= Significant level.
N.S = Non significant.

The research of this kind might give the authorities a chance to evaluate the unfavourable conditions and make the right decision.

The microbiological examination of processed cheese revealed good hygienic quality of the processed cheese under study that might be due to the heat treatment of cheese. This findings support the objectives of pasteurization stated by International Dairy Federation (1994).

Another reason for good quality of processed cheese under this study is that the processed cheese might be imported shortly before investigations or the storage conditions were good.

The coliform bacteria count was very low (less than ten estimated). This result is in disagreement with the findings of Nour Eldaeim (2005) who reported high colifrm count of processed cheese made from Sudanese white cheese and this might be due to either poor processing condition and / or post poor examined environment.

The microbiological examination of processed cheese revealed low proteolytic, lipolytic bacteria and yeasts and moulds counts which means that cheese is of high quality.

Finally, the microbiological safety of processed cheese has traditionally relied on heat to destroy vegetative pathogens, formulation to prevent growth of surviving heat resistance spore formers and refrigeration to prevent growth of recontamination (Food Research Institute, 2005).

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