

# **Chemical evaluation of imported processed cheese sold in Khartoum market**

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## **SUMMARY**

This study was carried out to evaluate the chemical 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 chemical composition (fat, protein, total solids, titratable acidity and ash) of the processed cheese were estimated.

The results indicated that there was a significant difference ( $P < 0.01$ ) in total solids and a significant difference ( $P < 0.05$ ) in titratable acidity, while there was no significant difference ( $P > 0.05$ ) in fat, protein and ash contents of cheese samples obtained from the three cities.

Protein and fat were high in Omdurman ( $8.87 \pm 0.093$  and  $29.50 \pm 0.148$  respectively), while the titratable acidity and ash were high in Khartoum ( $0.669 \pm 0.002$  and  $2.67 \pm 0.056$  respectively).

Total solids content was high in Khartoum North ( $50.22 \pm 0.116$  respectively). Fat and protein contents were high in high income area ( $29.61 \pm 0.203$  and  $8.95 \pm 0.007$  respectively), while total solids and ash content were high in low income area ( $47.87 \pm 0.264$  and  $2.72 \pm 0.091$  respectively).

## **INTRODUCTION**

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). Processed cheese performance shines brightly in the food industry. This product combine flavour and function with long shelf life to help the food processing industry to find the unique combination of melt, flow, shred and flavour to serve their needs (Turner, 2003).

However, while processed cheese popularity is growing, it will likely grow even faster if dairy processors can more easily customize and control it's characteristics (Haines, 2004). Traditionally, processed cheese was made by heating and stirring mixture of natural cheese, chelating salts, fat and water at temperature between 70 and 95°C for short time about 5 to 10 minutes (Siew, 2004). The modern manufacture of natural cheese consist of four basic steps: coagulating, draining, salting and ripening. Processed cheese manufacture

incorporates extra steps, including cleaning, blending and melting. Dairy products such as milk or butter may also be added to the processed cheese especially if it is intended for spreading (Dallas, 1997).

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 food must contain at least 51% cheese, no more than 44% moisture and less or equal to 23% fat. Pasteurized processed cheese spread may have moisture content between 44 and 60% but must include at least 51% cheese and at least 20% milk fat. Processed cheese products do not comply with the previous standards such as product with more than 50% moisture, or substantial levels of non dairy products (Glass and Doyle, 2005).

Recently, processed cheese is imported from neighboring countries according to standards set by the government. This study attempted to highlight on the ability of cheese to retain its quality during storage.

## **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 protein, fat, total solids, ash, titratable acidity according to AOAC,(2003).

### **Protein content:-**

The protein content was determined by Kjeldahl method.

### **Fat content:-**

The fat content was determined by Gerber method.

### **Total solids content:-**

Total solids content was determined according to the modified method of AOAC (2003).

Two grams of cheese samples were weighed and placed in a clean dry porcelain dish and heated on a steam bath for 10 – 15 minutes. The dishes were then placed in an oven at 100°C for three hours, then cooled and weighed quickly. Heating, cooling and weighing were repeated until the difference between two successive readings was less than 0.1 mg.

The total solids content was calculated from the following equation:

$$\text{T.S. (\%)} = \frac{W_1}{W_2} \times 100$$

Where:

$W_1$  = Weight of sample after drying

$W_2$  = Weight of sample before drying

**Ash content:-**

The ash content was determined according to the method described in AOAC (2003).

**Titrateable acidity:**

Titrateable acidity was determined according to AOAC (2003).

**Statistical analysis:**

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

## RESULTS

**Chemical composition of processed cheese as affected by city:-**

**Table (1)** presents the chemical composition as affected by city from which the samples were collected. Data showed that there was no significant difference ( $P > 0.05$ ) between the three cities in fat content, protein content and ash content. However, fat content was high in Khartoum ( $29.50 \pm 0.148$ ) and low in Khartoum North ( $29.22 \pm 0.148$ ). The protein content was high in Khartoum ( $8.87 \pm 0.093$ ) and low in Omdurman and Khartoum North with value ( $8.75 \pm 0.093$ ). The ash content was high in Omdurman and low in Khartoum North. Total solids contents was high in Khartoum North ( $50.22 \pm 0.116$ ) and low in Khartoum ( $46.28 \pm 0.116$ ).

Titrateable acidity showed a significant difference ( $P < 0.05$ ) between the three cities with higher values in Omdurman ( $0.698 \pm 0.002$ ) and lower values in Khartoum ( $0.619 \pm 0.002$ ).

**Table (1).** The chemical composition of processed cheese as affected by city.

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Chemical	City	Grand mean	S.L.
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Composition (%)	Khartoum North	Omdurman	Khartoum		
Fat content	29.22±0.148	29.33±0.148	29.50±0.148	29.35±4.423	N.S.
Protein content	8.75±0.093	8.75±0.093	8.87±0.093	8.79±2.420	N.S.
Total solids content	50.22±0.116 <sup>a</sup>	48.78±0.116 <sup>b</sup>	46.28±0.116 <sup>c</sup>	48.43±5.681	**
Titratable acidity	0.659±0.007 <sup>b</sup>	0.698±0.002 <sup>a</sup>	0.619±0.002 <sup>c</sup>	0.659±0.662	*
Ash content	2.63±0.056	2.67±0.056	2.64±0.056	2.65±1.328	N.S

Means in each row bearing the same superscripts are not significantly different ( $P>0.05$ ).

\*\* = ( $P<0.01$ ).

\* = ( $P<0.05$ ).

S.L. = Significant level.

N.S = Non significant ( $P>0.05$ ).

### **Chemical composition of processed cheese as affected by income level**

#### **areas:-**

**Table (2)** presents the chemical composition of processed cheese as affected by area from which the samples were collected. No significant difference was observed between the three areas ( $P>0.05$ ) in fat, protein, total solids and ash contents. However, the fat content ( $29.61 \pm 0.203$ ), protein content ( $8.95 \pm 0.077$ ) and total solids content ( $48.72 \pm 0.265$ ) were high in high income area compared to other areas. The ash content was high in low income area ( $2.72 \pm 0.091$ ).

The titratable acidity was significantly high ( $P<0.001$ ) in high income area ( $0.692 \pm 0.007$ ) and low in low income areas ( $0.632 \pm 0.007$ ).

**Table (2).** The chemical composition of processed cheese as affected by income level areas.

Chemical Composition (%)	Income area			Grand mean	S.L.
	High	Middle	Low		
Fat	29.61±0.203	29.33±0.204	29.11±0.203	29.35±4.423	N.S.
Protein	8.95±0.077	8.79 ±0.077	8.73±0.077	8.82±2.426	N.S.
Total solids	48.72±0.264	48.67±0.264	47.89±0.264	48.43±5.681	N.S.
Titrateable acidity	0.692±0.007 <sup>a</sup>	0.653±0.007 <sup>b</sup>	0.632±0.007 <sup>b</sup>	0.659±0.662	***
Ash	2.62±0.091	2.60±0.091	2.72±0.091	2.65±1.328	N.S

Means in each row bearing the same superscripts are not significantly different(  $P>0.05$ ).

\*\*\* = ( $P<0.001$ ).

S.L.= Significant level.

N.S = Non significant.

**Chemical composition of processed cheese as affected by income level area within each city:-**

**Table (3)** presents the chemical composition of processed cheese as affected by area within each city. In Khartoum North the income level did not significantly affect ( $P>0.05$ ) the chemical composition of processed cheese in terms of fat, protein, total solids and ash contents. However, cheese collected from low income area tended to be slightly acidic ( $0.590 \pm 0.013$ ) compared to cheese collected from other areas.

In Omdurman no changes was observed ( $P>0.05$ ) in fat, total solids and ash contents with regard to income level. The protein content was slightly higher in cheese collected from high income area ( $8.90 \pm 0.134$ ). Cheese collected from middle income area tended to be slightly acidic ( $0.688 \pm 0.013$ ).

In Khartoum the income level did not significantly ( $P>0.05$ ) affect the fat, protein, total solids, ash contents and titratable acidity.

## DISCUSSION

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

Processed cheese is a product of other types of cheese which might be of low quality from the start, and if the manufacturing conditions are not ideal the contamination might happen to the processed cheese.

The present study found that the fat content was high in process cheese under study and the percentage of fat in all samples fulfills with the standards of Alimentarius (2000).

The protein content of processed cheese was lower than the other varieties of cheese and this is due to the added water that reduced the total solids content. This result is in agreement with Nour Eldaeim (2005).

Hamed *et al.*, (1997) mentioned that the protein content of the process cheese decreased by storage time a result that might be due to limited degradation or assimilation of protein in cheese.

The variation of total solids content between examined samples might be due to the variation of different percentages of moisture contents in the examined process cheese. However, the total solids content of processed cheese under study was agreement with the standards of Alimentarius (2000).

The samples collected from some low income areas are slightly acidic, that might be due to the storage conditions, meaning that high temperature conditions were favourable to lactic acid bacteria that produced lactic acid from the remaining lactose in the cheese curd.

This result is in disagreement with the findings of Nour Eldaeim (2005) who reported a decrease in the acidity of processed cheese during processing. However, although the result does not agree with Nour Eldaeim (2005), but there might be some thermophilic lactic acid bacteria survived processing heat treatment.

Nour Eldaeim (2005) mentioned that the ash content increased in processed cheese due to the addition of emulsifiers.

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Table (3): Chemical composition of processed cheese as affected by income level area within each city.

City		Fat (%)	Protein (%)	Total solids (%)	Titratable Acidity (%)	Ash (%)
Khartoum North	High income area	29.83±0.352	9.07±0.134	51.17±0.458	0.737±0.013 <sup>a</sup>	2.75±0.158
	Middle income	28.83±0.352	8.82±0.134	49.33±0.458	0.652±0.013 <sup>b</sup>	2.60±0.158
	Low income area	29.00±0.352	8.83±1.34	50.17±0.458	0.590±0.013 <sup>c</sup>	2.53±0.158
	Grand mean	29.22±4.414	8.91±2.437	50.22±5.786	0.668±0.661	2.63±1.323
	S.L.	N.S.	N.S.	N.S.	*	N.S.
Omdurman	High income area	29.17.0.352	8.90±0.134	48.0±0.458	0.713±0.013	2.58±0.158
	Middle income	29.67±0.352	8.62±0.134	49.83±0.458	0.688±0.013	2.52±0.158
	Low income area	29.17±0.352	8.73±0.134	48.00±0.458	0.693±0.013	2.92±0.158
	Grand mean	29.34±4.422	8.75±2.415	48.61±5.693	0.698±0.682	2.67±1.335
	S.L.	N.S.	***	*	N.S.	N.S.
Khartoum	High income area	29.83±0.352	9.05±0.134	46.50±0.458	0.677±0.013	2.53±0.158
	Middle income	29.50±0.352	8.95±0.134	46.83±0.013	0.620±0.013	2.68±0.158
	Low income area	29.17±0.352	8.62±0.134	45.50±0.458	0.612±0.013	2.70±0.158
	Grand mean	29.50±4.435	8.87±2.432	46.28±2.432	0.636±0.651	2.64±1.325
	S.L.	N.S.	N.S.	N.S.	N.S.	N.S.