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Chemical Composition of Mish "A Traditional Fermented Dairy Product" from Different Plants During Storage

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Abstract: This study was conducted to evaluate the chemical composition of mish during storage. Ninety samples of mish were collected on the day of manufacture (day one) from three different dairy plants (DP1, DP2, DP3), transported to the laboratory of the Department of Dairy Production, Faculty of Animal Production in ice box and stored at 7°C for 28 days. Samples were analyzed for fat, protein, total solids, ash and titratable acidity at 1, 7, 14, 21 and 28 days. The results showed that fat, protein, total solids, ash and titratable acidity were high in DP1 and low in DP2, except for fat content which was low in DP3. During storage fat, protein, total solids, ash contents and titratable acidity increased to a maximum at day 21 and then decreased thereafter, while titratable acidity steadily increased towards the end. Towards the end of storage, the fat content slightly decreased in DP1 and increased in DP2 and DP3. The protein content slightly decreased towards the end in DP1 and DP2 and increased in DP3. The total solids and ash contents slightly decreased in all three plants at the end of storage, while titratable acidity increased towards the end of storage in all plants.

Key words: Mish, dairy plant, chemical composition, storage period

INTRODUCTION

Fermented products generally have a large shelf life than their original substrate and their ultimate spoilage is different in character. The antimicrobial effects of fermentation are not confined to spoilage organisms alone and can also affect pathogens that might be present. Thus, traditional food fermentation can take potentially hazardous substances as raw materials, such as raw milk and transform them into products with both improved keeping qualities and reduced risk of causing illness (Keller and Jordan, 1990; Mitchell, 2000; Beukes *et al*., 2001).

The fermented dairy products of the Sudan are divided into two major groups; the truly indigenous which include roub, gariss and mish and the quasi-indigenous which include zabadi and jibna beida. Mish is a fermented milk product, which like other dairy products such as cheese, yoghurt, butter and cream, is manufactured in Sudan and in the rural areas where plenty of milk is available during the rainy season. Surplus milk is utilized for the manufacture of fermented dairy products but recently, mish is being produced in the modern dairy plants for consumption in urban areas. The intensity of spicing in mish may differ from region to another and even from family to another within the same district as it depends on spices availability and the taste of the people (El Mardi, 1988; Dirar, 1993). The bulk of milk in the country is produced by nomadic herds of cattle and these produce plenty of milk supply in the rainy season, which is fermented by souring into dairy products some of which are spread in the country whereas others are confined to certain geographic areas (Abdel Gadir *et al*., 1998).

Spontaneous food fermentation has a long history in Africa and relies on indigenous knowledge of the majority of the population, only seldom are fermentation processes fully industrialized and many food production fermentations still occur at the household-scale or at small enterprise scale (Mathara *et al*., 2004). The nature of fermented products is different from one region to another and this depends on the local indigenous microflora, which in turn reflects the climatic conditions of the area (Savadogo *et al*., 2004). Many people throughout Africa enjoy soured milk products, in which the lactic acid bacteria play an essential role in preserving a highly nutritious food product. Fermented milk products are also of great significance for their therapeutic and social values, alleviating lactose intolerance and as a means of generating income (Beukes *et al*., 2001).

This study was carried out to evaluate the fermented dairy product “mish” locally produced by three dairy plants chemically during storage period of 28 days.

MATERIALS AND METHODS

The experiment was carried out in the Department of Dairy production, Faculty of Animal production, University of Khartoum during the period February to June 2009.

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Collection of samples: Ninety samples of mish were collected from DP1, DP2 and DP3 (30 samples from each) in 250 gm size plastic cups, transported to the laboratory in ice box and kept in the refrigerator (7°C) for 28 days. The samples were analyzed for fat, protein, total solids, ash and titratable acidity at 1, 7, 14, 21 and 28 day intervals.

Chemical analysis: Fat content was determined by Gerber method, while protein content was determined by Kjeldahl method (AOAC, 2000).

Total solids content was determined according to the modified method of AOAC (2000) as follows; three grams of mish were placed in a clean dried flat-bottomed aluminum dish and heated on a steam bath for 10 min. The dishes were then dried in an air oven at 100°C for 3 h, after which they were transferred to a desiccator to cool and then weighed. Heating, cooling and weighing were repeated several times until the difference between two successive weighings was less than 0.5 mg. The total solids content was calculated as follows:

$$\text{Total solids (\%)} = \frac{W1}{W2} \times 100$$

Where:

W1 = Weight of sample after drying

W2 = Weight of the original sample

The ash content and titratable acidity were determined according to AOAC (2000).

Statistical analysis: The data were statistically analyzed using Statistical Package for Social Sciences (SPSS, ver. 13). Completely randomized design was used for statistical analysis and means were separated by Duncan Multiple Range Test at $p \leq 0.05$.

RESULTS AND DISCUSSION

Table 1 shows the chemical composition of mish. Fat, protein, total solids, ash and titratable acidity were significantly affected by the dairy plant. The highest fat content was in DP1 (6.82±0.103), while the lowest content was in DP3 (5.27±0.103). The protein content was high in DP1 (8.38±0.169) and low in DP2 (7.44±0.169). The total solids content was high in DP1 (30.93±0.187) and low in DP2 (18.59±0.187). The ash content and acidity were high in DP1 (2.00±0.074 and 3.96±0.035 respectively), while lowest values were obtained from DP2 (1.31±0.074 and 2.48±0.035 respectively).

Table 2 shows the chemical composition of mish during storage period of 28 days. The fat content regularly increased from day one (5.18±0.133) to a maximum at day 21 (6.08±0.133), beyond which the content decreased ($p<0.001$).

The protein content steadily increased to a maximum at day 14 (8.72±0.219) and then decreased towards the end of storage (7.21±0.219) ($p<0.001$). The total solids content followed the same trend as protein content increasing to a maximum at day 14 (23.67±0.242) then decreased to 23.01±0.242 at the end ($p<0.01$). The ash content decreased from 2.03±0.096 at day one to 1.38±0.096 at the end ($p<0.001$). The titratable acidity showed a gradual increase from 2.70±0.046 at day one to 3.84±0.046 at day 28 ($p<0.001$).

The chemical composition of mish from each plant during storage period is presented in Table 3. The results show that fat content showed irregular pattern during storage period slightly decreasing towards the end in DP1, while in DP2 and DP3 the content slightly increased. The protein content slightly decreased towards the end in DP1 and DP2 and increased in DP3. The total solids and ash contents slightly decreased in

Table 1: Chemical composition of mish from different plants at the end of storage period (Mean±SE)

	Manufacturer			
Chemical composition	DP1	DP2	DP3	SL
Fat (%)	6.82^{a}±0.103	5.31^{b}±0.103	5.27^{b}±0.103	***
Protein (%)	8.38^{a}±0.169	7.44^{b}±0.169	7.84^{b}±0.167	**
Total solids (%)	30.93^{a}±0.187	18.59^{c}±0.187	20.75^{b}±0.187	***
Ash (%)	2.00^{a}±0.074	1.31^{b}±0.074	1.48^{b}±0.074	***
Acidity (%)	3.96^{a}±0.035	2.48^{c}±0.035	3.23^{b}±0.035	***

Means in the row bearing the same superscripts are not significantly different ($p>0.05$). *** = $p<0.001$, ** = $p<0.01$.
SL = Significance Level, DP1, DP2, DP3 = Dairy plants 1, 2 and 3 respectively

Table 2: Changes in chemical composition of mish during storage (mean from the three dairy plants) (Mean±SE)

	Storage period (days)					
Parameters	1	7	14	21	28	SL
Fat (%)	5.18^{b}±0.133	6.24^{a}±0.133	5.45^{b}±0.133	6.08^{a}±0.133	6.03^{a}±0.133	***
Protein (%)	7.66b^{c}±.219	8.21^{ab}±0.219	8.72^{a}±0.219	7.64^{bc}±0.219	7.21^{c}±0.219	***
Total solids (%)	23.51^{ab}±0.242	23.91^{a}±0.242	23.67^{ab}±0.242	23.04^{b}±0.242	23.01^{b}±0.242	**
Ash (%)	2.03^{a}±0.096	1.49^{b}±0.096	1.56^{b}±0.096	1.47^{b}±0.096	1.38^{b}±0.096	***
Acidity (%)	2.70^{d}±0.046	3.04^{c}±0.046	3.14^{c}±0.046	3.39^{b}±0.046	3.84^{a}±0.046	***

Means in the row bearing the same superscripts are not significantly different ($p>0.05$). ** = $p<0.01$. *** = $p<0.001$.
SL = Significance Level

Table 3: Chemical composition of mish from each dairy plant during storage (Mean±SE)

	DP1					DP2					DP3				
	Storage period (days)														
Parameters	1	7	14	21	28	1	7	14	21	28	1	7	14	21	28
Fat (%)	6.88±	7.10±	6.45±	7.17±	6.49±	4.78±	5.64±	4.93±	5.51±	5.68±	3.88±	5.99±	4.97±	5.57±	5.93±
	0.230	0.230	0.230	0.230	0.230	0.230	0.230	0.230	0.230	0.230	0.230	0.230	0.230	0.230	0.230
Protein (%)	8.06±	7.74±	10.92±	8.09±	7.11±	6.15±	9.40±	7.13±	7.42±	7.13±	8.76±	7.48±	8.12±	7.42±	7.83±
	0.379	0.379	0.379	0.379	0.379	0.379	0.379	0.379	0.379	0.379	0.379	0.379	0.379	0.379	0.379
Total solids (%)	30.99±	31.78±	30.89±	30.52±	30.49±	19.37±	18.93±	18.49±	18.15±	18.02±	20.16±	21.03±	21.63±	20.44±	20.51±
	0.418	0.418	0.418	0.418	0.148	0.148	0.148	0.148	0.148	0.148	0.148	0.148	0.148	0.148	0.148
Ash (%)	3.30±	1.52±	1.93±	1.65±	1.58±	1.30±	1.32±	1.50±	1.18±	1.18±	1.48±	1.63±	1.26±	1.58±	1.38±
	0.166	0.166	0.166	0.166	0.166	0.166	0.166	0.166	0.166	0.166	0.166	0.166	0.166	0.166	0.166
Acidity (%)	3.63±	3.72±	3.48±	4.20±	4.75±	1.93±	2.26±	2.58±	2.66±	2.97±	2.53±	3.16±	3.38±	3.30±	3.79±
	0.079	0.079	0.079	0.079	0.079	0.079	0.079	0.079	0.079	0.079	0.079	0.079	0.079	0.079	0.079

DP1, DP2, DP3= Dairy plants 1, 2 and 3 respectively

all three plants at the end of storage. The titratable acidity showed an increase towards the end of storage period in all plants.

From the results of chemical composition it was obvious that mish product from DP1 was higher in all chemical components studied, while that of DP2 was of lower composition. This might be attributed to the raw materials used by different plants, since DP1and DP2 use reconstituted whole milk products and DP3 uses fresh cow's milk.

The decrease in protein content during storage might be due to protein degradation leading to formation of soluble compounds (Abdalla *et al*., 1993). Decrease in total solids content was mainly due to degradation of total protein and decrease in fat content during storage period (Hayaloglu *et al*., 2005). Ash in mish was high which might be due to addition of spices (El-Erian *et al*., 1975). Increase in acidity towards the end of storage period was mainly due to increase in the number of lactic acid bacteria which converted lactose into lactic acid (Bozamic and Tratnik, 2001; Hayaloglu *et al*., 2005; Tarakci and Kucukoner, 2006; Cais-Skolinska *et al*., 2008; El Owni and Hamid, 2008).

The findings in this investigation are higher than those reported by El Mardi (1988); Ali *et al*. (2002); Aly *et al*. (2004); El Zubeir *et al*. (2005); Uzeh *et al*. (2006); Adam (2008); Hassan *et al*. (2008). However, the results of ash content in DP2 and DP3 reported in this study are lower than those reported by Ali *et al*. (2002) and Uzeh *et al*. (2006).

From the results it could be observed that from chemical composition point of view, mish deteriorated after the storage period of 21 days, in addition to increase in titratable acidity meaning that the product turned into highly acidic. These results are in accordance with Al-Otaibi and El-Demerdash (2008) who reported maximum fat, total solids and acidity at 21 day of storage of Labneh. However, these results are in disagreement with Haj *et al*. (2007) who reported decreasing chemical composition of stirred yoghurt during storage period of 10 days.

Conclusion: The results of this study concluded that, mish from different dairy plants showed a significant variation in the chemical composition. The product kept good quality chemically up to 21 days.

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