

SUMMARY

Two hundred random samples of milk and cheese were collected from different supermarkets at Alex. Province for spectrophotometric determination of the levels of nitrates and nitrites. The data indicated that the mean values of nitrates in raw and pasteurized milk samples were found to be 3.9 ± 1.3 and 4.8 ± 2.7 mg/kg, respectively while the average values in milk powder and condensed milk samples were 87.3 ± 7.3 & 94.6 ± 6.4 mg/kg respectively. Meanwhile the nitrates concentrations in soft cheese, full cream, processed and hard cheese were 62.5 ± 4.8 , 71.20 ± 9.6 , 29.20 ± 9.6 , 29.20 ± 5.9 & 17.81 ± 3.8 mg/kg respectively. The mean values of nitrites in milk powder and condensed milk samples were found to be 1.30 ± 0.2 & 1.02 ± 0.1 mg/kg respectively. While they were not detected in raw and pasteurized milk samples. However the nitrites concentrations in soft cheese, full cream, processed and hard cheese samples were 0.90 ± 0.4 , 1.1 ± 0.6 , 0.51 ± 0.3 & 2.92 ± 0.7 mg/kg respectively. The results were evaluated according to STEPHNY *et al.* (1978) and BERTELSEN (1979). The obtained data indicated that high concentration of nitrates and nitrites in some types of milk and cheese samples may favour nitrosamines formation which constitutes a hazard for human health. Thus the use of such preservative in milk and cheese must be strictly controlled to prevent the possible formation of the carcinogenic nitrosamines.

Keywords: Chemical, pollution, milk, cheese, nitrates, nitrites
hygienic significance

INTRODUCTION

Nitrates and nitrites are enormously added under prescribed limitation to processed foods as preservatives and colour stabilizers (ANONYMOUS, 1968 and DUNCAN and FOSTER, 1968).

The contents of nitrates and nitrites in milk and cheese have been studied by many investigators (STEPHNY *et al.* 1978; BERTELSEN, 1979; PAPAJOVA and HERMANOVA 1986; SHIDLOVSKAYA 1986; and TRIF *et al.* 1992).

Nitrites in milk and milk products have affinity to interact with secondary amines in food stuffs to form N-nitroso-compounds. The possibility that reaction could take place in mammalian stomach after ingestion of foods containing nitrites and secondary amines has received much attention (SANDER, 1968, SEN *et al.* 1970 and PENSABENE and FIDDLER, 1988). Most of the nitrosamines compounds are carcinogenic and in addition some exhibit mutagen C-embryopathic and tetragenic effects (DRUCKREY *et al.* 1967 and MAGEE and BARNES 1967). Therefore, it is very important from the public health point of view to determine the levels of nitrates and nitrites in various types of milk and cheese marketed at Alexandria city.

MATERIALS AND METHODS

Sampling:

Two hundred samples of milk and some milk products (25 of each), including raw milk, pasteurized milk, powdered milk, condensed milk, soft cheese, full cream cheese, processed cheese were purchased from different supermarkets at Alexandria city. The samples were transferred to the laboratory with a minimum of delay.

I- Preparation of samples for analysis. were carried out according to the method described in A.O.A.C. (1980).

A- Reconstitution of samples :-

Samples were reconstituted as follows :-

- Condensed milk :- One part of condensed milk sample was thoroughly mixed with two and half parts of distilled water.
- Milk powder :- 130 grams of milk powder were added to 900 ml distilled water.
- Cheese :- 20 grams of each cheese sample were thoroughly mixed in a blender with 200 ml distilled water.

B- Extraction of fat from the samples :-

Extraction of fat from each sample were carried out by heating the liquid mixture in a water bath at 60 °C then filtered.

II- Determination of nitrates and nitrites in the samples.

Nitrates and nitrites levels in prepared milk and cheese samples were determined according to APHA (1960) and (1971), RESPECTIVELY.

RESULTS

The results are recorded in Tables (1) and (2).

DISCUSSION

Nitrates have relatively low toxicity to man and animals, but it may be converted to more toxic nitrites during storage and technological processes (W.H.O. 1977).

The recorded data in table (1) indicated that the mean concentration of nitrates in raw milk was 3.9 ± 1.3 mg/kg and in pasteurized milk was 4.8 ± 2.7 mg/kg these results lie within the permissible limits of STEPHNY *et al.* (1978) (50 mg/g). Although it reflect clearly that water and foods of dairy animals are subjected to nitrates pollution due to these compounds reach the milk produced by dairy animals via drinking water & foods (W.H.O, 1977). However higher values were stated by TRIF *et al.* (1992), they found that raw & pasteurized milk samples exhibited an avrage concentration of 102.57 & 127.07 mg/kg nitrates respectively. On the other hand the mean values of nitrates in milk powder (87.3 ± 7.3) and condensed milk (94.6 ± 6.4) samples exceeded the permissible limit of STEPHNY *et al.* (1978) 50 mg/kg. Our findings are higher than those obtained by SHIDLOVSKAYA (1986) & CVAK, *et al.* (1986) they mentioned that the mean values of nitrates was 1.78 mg/kg in examined milk.

The mean values of nitrates in soft cheese and full cream soft cheese were 62.5 ± 4.8 & 71.20 ± 9.6 mg/kg, respectively. On the other hand the lowest values of nitrates were detected in processed and hard cheese as 29.20 ± 5.9 & 17.81 ± 3.8 mg/kg respectively (table 1). Nearly similar concentrations were obtained by PAPAJOVA & HERMANOVA (1986) and TRIF *et al.* (1992). However higher values of nitrates in cheese samples have been reported by HEESCHEN & NIJHUIS (1985).

Nitrites are more toxic than nitrates to man and animals Bertelsen (1979) set a guide line value for nitrites in milk & milk products to be 2 mg/kg. Accordingly nitrites levels in the examined milk samples were under this limit where these concentrations were found to be 1.3 ± 0.2 & 1.02 ± 0.1 mg/kg in milk powder & condensed milk, respectively; while it was not detected in raw & pasteurized milk (table 2). Our results are nearly similar to those concluded by TRIF *et al.* (1992). On the other hand a higher nitrites values were recorded by CVAK *et al.* (1986).

The mean values of nitrites levels found in soft cheese, full cream, processed and hard cheese samples were found to be 0.90 ± 0.4 , $.10 \pm 0.6$, 0.51 ± 0.3 and 2.92 ± 0.7 mg/kg, respectively (table 2). It is obvious from the above mentioned data that the concentrations of nitrites in various types of cheese lie within the permissible limit (2mg/kg) except that of

hard cheese. Our results are nearly similar to the results reported by GOODHEAD *et al.* (1976); SEN & DONALDSON (1978); STEPHNY *et al.* (1978), and BIRKJAER & THOMSEN (1979), However higher concentration were determined by PAPAJOVA & HERMANOVA (1986). The high level of nitrites in hard cheese may be probably a sequence of similar microbial activity or may be due to extraddition of nitrites as preservative. This holds the view reported by PHILLIPS (1968), KEYBETS *et al.* 1970 and WOLFF & WASSERMAN (1972). They found that nitrite reducing bacteria produced nitrite level in some food products by reduction of nitrate.

This work clarifies some types of milk & cheese containing nitrates & nitrites above the permissible limits which constitute a major risk for human health. The exceeding doses of these chemicals may increase the possibility of nitrosamines formation by reaction with secondary amines (HAWKSWORTH & HILL 1971 and GRAY *et al.* 1979). Nitrosamines were overall the most toxic and carcinogenic compound (MAGEE & BARNES, 1962). In this respect WHITE (1975) recommended that the acceptable daily dietary intake of nitrates & nitrites were 99.8 mg and 11.22 mg/person respectively. For this strict control measures on using these chemicals should be adapted in order to minimize the hazard for human health.

REFERENCES

- Anonymous, (1968): Nitrites, nitrosamines and cancer, *Lancet*. 2; 1071-1072.
- A.P.H.A. (1960): Standard methods for examination of water and waste waters 11th Ed. New York.
- A.P.H.A.; (1971): Standard methods for the examination of water and waste water 13th Ed. Washington D.C.
- Association of Official Analytical Chemistry Official Methods of Analysis (1980): 13th Ed. Association of Official Analytical Chemists., Arlington, V.A.
- Bertelsen E. (1979): Nitrates and nitrites in milk and dairy producta. *Dairy Sci. Abst.* 5056.
- Birkkjaer H.E. and Thomsen D. (1979): Varying the addition of saltpetre in manufacture of different types of Danish cheese. *Dairy Sci. Abst.* 3392.
- Cvak Z., Cerny L. and Bartulikova (1986): Levels of nitrites in samples of infants and baby food of foreign and Czechoslovak origin. *Ceskaslovensk Hygiena* 31 (2) 70-76.
- Druckrey H.; Preussmann, R.; Ivankovic, S. and Schmahl., D. (1967): Organotrope carcinogene wirkung bei 65 Verschiedenen N-Nitroso verbindungen and BD Ratten 2-Krebsforsch. 69: 103.

- Duncan, C.L. and Foster, E.M. (1968): Effect of sodium nitrites, sodium outgrowth of an aerobic spores. Appl. Microbiology 16 : 406-411.
- Goodhead K., Gough T.A., Webb K.S., Stadhouders J. and Elgersma. H.C. (1976): The use of nitrites in manufacture of Gouda cheese. Lack of evidence of nitrosamine formation. Neth milk Dairy Journal. 30: 207 - 221.
- Gray J. I., Irvin D.M. and Kaduda Y. (1979): Nitrites and N. nitrosamines in cheese. J. food prot., 42 263-272.
- Hawksworth, G. and Hill, M.J. (1971): The formation of nitrosamines by human intestinal bacteria. Biochem. J. 122: 28-29.
- Heeschen W. and Nijhuis H. (1985): Nitrates and nitrites in milk and milk products. Malkeveizeitung welt der mich 39 (24) 961-963.
- Keyblets, M.J., Broot E.H. and Keller G.H. (1970): An investigation into the possible presence of nitrosamine in nitritesbearing spinach. Food Cosm, Toxicol. 8: 167 - 171.
- Magee, P.N. and Barnes, J.M. (1967): Carcinogenic nitros compounds. Advan. Cacer. Res. 10: 163.
- Papajova H. and Hermanova V. (1986): Nitrites and nitrates in cheese made in Slovakia - Zbornik Prac Vyskumneho Ustavo Mliekarskehov. Zilina 9 187 - 194.
- Pensabene, J.W. and Fiddler (1988): Food additives. Determination of volatile N-nitrosamines in frankfutures containing minced fish and surimi. J. Assoc. Off. Anal. Chem. Vol. 71 No. 4, 834 - 983.
- Phillips, W.E. (1968): Changes in nitrate and nitrite contents of fresh and processed spinach during storage. J. Agr. Food Chem. 16: 88 - 91.
- Sander, J. (1968): Nitrosamine synthesis by bacteria. Hopp-Seyler's 2. Physiol. Chem. 349 - 432.
- Sen, N.P.; Smith, D.C. and Schwingamer, L. (1970): Formation of nitrosamines in nitrate treated fish. Can. Inst. Food Technol. 3: 66 - 69.
- Sen N.P. and Donaldson B. (1978): Improved colormetric method for determing nitrates and nitrites in foods. J. Assoc. Off. Anal. Chem> 61: 1755 - 1760.
- Shidlovskaya V.P. (1986): Nitrates and nitrites contents of milk and dried milk products Molochnaya Promyshlennost 1: 29 - 31.
- Stephny R.W., Elgersma R.H. and Schuller P.L. (1978): Nitrates, nitrites and N-nitrosamine contents of various types of Dutch cheese. Neth. Milk Daity J., 32: 143 - 148.

- Trif A., Parvu D., Ciulan V and Vrejoiu G. (1992): The presence of nitrates in milk and the protection of the consumer. Facultatea de Medicina Veterinara Timisoara - Romania.
- White. J.W. (1975): Relative significance of dietary sources of nitrate and nitrites. *J. Agr. Food. Chem.* 24; 202.
- Wolff, I.A. and Wasserman A.E. (1972): Nitrates, nitrites and nitrosamines, *science* 177: 15-19.
- W.H.O. (1977): Nitrates, nitrites and N-nitrosamines compounds, *Environmental Health, Criteria*, 5 W.H.O. Geneva.

Table (1): Mean values (mg/kg) of nitrates in various types of milk & cheese samples .

Type of samples	Nitrates (mg/kg)		
	Minimum	Maximum	Mean
1- Raw milk	0	5.8	3.9 ± 1.30
2- Pasteurized milk	0	8.3	4.8 ± 2.7
3- milk powder	73.6	99.8	87.3 ± 7.3
4- Condensed milk	87.2	100.1	94.6 ± 6.4
5- Soft cheese	33.93	78.35	62.5 ± 4.8
6- Full cream soft cheese	47.46	97.8	71.20± 9.6
7- Processed cheese	21.20	38.30	29.20± 5.9
8- Hard cheese	11.23	29.11	17.81± 3.8

Table (2) : Average values (mg/kg) of nitrites in different types of milk & cheese samples .

Type of samples	Nitrites (mg/kg)		
	Minimum	Maximum	Mean
1- Raw milk	0	0	0
2- Pasteurized milk	0	0	0
3- Milk powder	0.11	1.46	1.30±0.2
4- condensed milk	0.13	1.30	1.02±0.1
5- soft cheese	0.41	1.25	0.90±0.4
6- Full cream soft cheese	0.33	1.88	1.10±0.6
7- Processed cheese	0.24	1.01	0.51±0.3
8- Hard cheese	0.63	4.11	2.92±0.7