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EFFECT OF SKIM BUFFALOES' MILK FORTIFICATION WITH ZINC SALTS ON THE PROPERTIES OF KARIESH CHEESE.

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ABSTRACT: *Skim buffaloes' milk was enriched with two zinc salts being zinc Iodide and zinc sulphate at the rate of : 24 and 36 mg zinc per 100g. skim milk for both salts separately.The kariesh cheese was made from these milks in addition to control. The data showed that the variation in the chemical composition among treatments was slight, but the effect was clearer in its mineral content. The mineral salt contents increased particularly zinc, which increased obviously. Also calcium and potasslum contents increased compared with control except for treatment one which was equal to the control. The total bacterial count, proteolytic bacterial count, lipolytic bacterial count, and mould & yeast increased compared with control.*

Key words: *Kariesh cheese,fortification,zinc salts.*

INTRODUCTION

Zinc is an important element for the health of man. It is essential for growth, development and critical functions in every cell of the body (Weininger and King, 1990). It is well known also that zinc plays a role in thyroid hormone metabolism (Nishiyama *et al.,* 1994), crucial for healing gastric ulcers (Watanabe *et al.*, 1995).

In the late 1960s and early 1970s came the first reports of zinc- response growth failure in the adolescent boys in the Nile Delta of Egypt and rural Iran (Sandstead *et al.,* 1967 and Halstead *et al.,* 1972). As reported by Deal *et al.,* (1993) the fermentation of milk by *Streptococcus salivarius sub-sp thermophillus* or *Lactobacillus delbreuckii sub-sp bulgaricus* increases the zinc availability. Kariesh cheese is Egyptian popular and famous food for healthy and economic purposes besides being processed by fermentation of milk using the previously mentioned bacteria. So it was an ideal food to enrich it with zinc salts.

Therefore this study was carried out to solve the problem of zinc deficiency using a very famous, popular and essential dairy food for Egyptians. It is known that the adult daily requirements of zinc is 15 mg. So the aim was to cover the daily requirements of zinc when 100 g. cheese is consumed.

MATERIALS AND METHODS

1.preparation of kariesh cheese:

The buffaloes' milk was separated. The skim milk was heated to 90 ^{0}c.for a moment and cooled to 40°c. Then divided into 5 equal portions. The first portion was left, as it is, 24mg. and 36mg. Zinc per 100 g. skim milk was added as zinc iodide to second and third portion respectively and 24 and 36mg. Zinc per 100g. skim milk was added as zinc sulphate to the fourth and fifth portion respectively. Then kariesh cheese was manufactured as described by Fahmi (1960), with scattering 3% sodium chloride between layers. The cheeses were rolled in aluminum foil and stored in the fridge.

2.chemical analysis:

Fresh kariesh samples were analysed for pH., moisture,protein, and fat according to Ling (1963). Salt was determined according to AOAC (1990). Soluble tyrosine and tryptophan were estimated according to the method of Vakaleris and Price (1959) which modified by lin *et al* (1982). The minerals were determined according to Hankinson (1975) using atomic absorption spectrophotometer No. 3300

3.microbiological analysis:

Total bacterial, proteolytic, coliforms and mold & yeast counts were determined as described by Marth (1978), Chamber (1962), Sharf (1970), Difco (1966) respectively.

4-Organaleptic properties:

It was evaluated using the scale suggested by Nelson and Trout (1981).

RESULTS AND DISCUSSION

A. Chemical composition.

Data presented in Table (1) illustrate the Chemical composition of Kariesh cheese as affected by the zinc salts enrichment.

1.Moisture:

The moisture content of all cheeses varied slightly except treatment 3 which had the highest moisture content. During storage the moisture decreased gradually in all cheeses. Generally treatments one and four were closely similar to the control. The decrease of moisture content during storage may be due to the acidity developing which helps the curd contraction. Similar results were reported by Wahba and El-Abbassy (1982) who manufactured kariesh cheese and stored it for 3 months and El-Shibiny *et al.*, (1984) who made kariesh cheese from ultrafilterated recombined milk.

Table (1): Effect of skim milk enrichment with zinc salts on the chemical composition of kariesh cheese (per se).

Cheese treatement	Storage period (days)	Determination *						
		Moisture	pH	Protein	Fat	Salt	S.tyrosine (mg)	S.tryptoph a n(mg)
Control	Fresh	79.90	5.01	18.53	0.9	0.93	21.34	13.21
	7	77.63	4.31	19.67	1.0	1.02	25.21	16.11
	14	75.80	4.21	20.32	1.1	1.18	31.21	19.23
	21	75.54	4.11	19.89	1.1	1.20	37.51	21.32
1	Fresh	79.81	4.81	18.94	0.9	1.02	22.25	14.31
	7	76.45	4.3	19.52	1.1	1.16	26.81	17.21
	14	75.01	3.89	19.93	1.1	1.20	30.21	18.31
	21	75.32	3.56	19.76	1.1	1.22	33.43	19.21
2	Fresh	80.25	4.93	17.31	0.9	1.05	20.23	13.24
	7	77.82	4.11	18.54	1.1	1.15	25.12	15.61
	14	76.45	3.79	18.91	1.1	1.22	30.21	17.42
	21	76.14	3.59	19.01	1.1	1.23	35.42	19.82
3	Fresh	81.31	5.03	17.23	0.9	0.95	19.81	13.85
	7	78.39	4.01	18.14	1.0	1.10	26.41	16.21
	14	76.32	3.77	19.45	1.1	1.21	33.23	18.91
	21	77.41	3.51	18.93	0.9	1.27	38.71	22.31
4	Fresh	79.92	4.82	18.91	0.9	1.12	21.23	14.21
	7	76.35	3.92	19.31	1.1	1.20	22.71	15.82
	14	75.25	3.71	20.03	1.1	1.27	28.42	17.99
	21	74.31	3.41	19.71	1.2	1.35	31.16	20.31

* Average of three replicates.

1- kariesh cheese from skim milk enriched with 24 mg zinc per 100 g. skim milk as zinc iodide.

2- kariesh cheese from skim milk enriched with 36 mg zinc per 100 g. skim milk as zinc iodide.

3- kariesh cheese from skim milk enriched with 24 mg zinc per 100 g. skim milk as zinc sulphate.

4- kariesh cheese from skim milk enriched with 36 mg zinc per 100 g. skim milk as zinc sulphate.

2.pH:

The pH of fresh treatments 1, 2, and 4 were lower than control, however treatment 3 was closely similar to the control.During storage the pH of all cheese treatments decreased gradually. The results agree with Wahba and El-Abbassy (1982), El- Shibiny *et al.*, (1984) and Abd El-Salam *et al* (1984).

At the end of storage period the pH values of all treatments were closely similar. However all pH were lower than control. This may be due to the addition of zinc salts which activate intensively the growth of streptococci (kolod-kin *et al.*, 1977)and acid producing bacteria.

3- Protein:

It is obvious from the obtained results that protein of treatments 1 and 4 was similar to control. The protein of treatments 2 and 3 was similar but lower than control. . Protein contents increased gradually during storage and reached its maximum at the end of the fourteenth day of storage. This increase may be due to the decrease of moisture content.. These results agree with those of El-Shibiny *et al.*, (1984) and Abd El- Salam *et al.*, (1984).

4- Soluble Tyrosine and Tryptophan:

Fresh treatment 1 contained the higher soluble tyrosine and tryptophan than fresh control cheese. During storage they increased gradually and reached maximum at the end of storage period. This may be due to the proteolysis occurring during cheese storage. These results agree with those of Wahba and El-Abbassy (1982).

5- Fat:

The fat contents of all fortified cheese treatments increased as storage period proceeded. The increase was in the expense of moisture.The results agreed with El-Shibiny *et al.*, (1984).

6- Salt:

The salt contents of all fortified cheese treatments were slightly higher than that of control cheese. The salt content increased gradually as storage period advanced.

B-Mineral Elements.

Table (2) show the mineral contents of kariesh cheese as affected by zinc salts enrichment. The minerals studied were: Zn, Ca, K, Fe, Mn and Mg. The enrichment with zinc salts caused an increase in the zinc contents of fresh treatments compared with control. The increase was the highest when zinc sulphate was used. The zinc content increased in control treatment, 1 and 4 but decreased in treatments 2 and 3. However the zinc content during storage in all treatments was higher than control. The calcium and potassium contents were higher in all fresh treatments than control. During storage the calcium and potassium increased in control and treatment 1, but decreased in treatments 2,3 and 4. It was obvious that the general trend of the two elements after storage were lower than control. The data presented for manganese and magnesium show that fresh treatments 2 and 3 had higher contents of the both elements than the control cheese. However treatemant1 was slightly higher than control for manganese and lower in magnesium. Treatment 4 was slightly lower in manganese and lower in magnesium than control. The contents of the both elements decreased in all treatments except for magnesium of the treatment1 throughout storage period. In all cases the both elements were lower than control. The iron of fresh cheeses was lower

than that of control. During storage the iron decreased in all treatments except for control. However the iron contents were lower than control Generally the decrease of mineral elements during storage may be due to the synersis of whey during storage. The results were in contrast with Omaima (1999) who collected kariesh cheese samples from Cairo city and found that they contained higher zinc contents than manganese. The results were in agreement with those of Kolod-Kin *et al.*, (1977) who found that Zn levels increased in cheese mass with enriching cheese milk with zinc and Khader (2002) in her studies on both acid and rennet curd before whey synersis.

Table (2): Effect of skim milk enrichment with zinc salts on kariesh cheese mineral contents (mg / 100g. cheese) per se

Storage Peeriod (days)	Minerals*	Treatments				
		Control	1	2	3	4
Fresh	Zinc	1.3	6.32	11.12	11.6	15.06
14		2.7	8.18	7.5	9.12	9.86
Fresh	Calcium	204.54	213.32	243.52	208.22	231.52
14		211.78	242.24	196.38	199.36	215.24
Fresh	Potassium	131.6	128.4	163.4	144	145.4
14		147.2	131.2	134.8	117	107.6
Fresh	Iron	5.2	3.8	3.8	5.2	4.4
14		4.2	3.2	3.2	2.8	3.2
Fresh	Manganese	0.50	0.52	0.56	0.58	0.48
14		0.54	0.46	0.48	0.50	0.4
Fresh	Magnesium	21.86	18.82	21.24	21.82	12.94
14		21.62	20.32	19.54	19.8	19.52

* Average of three replicates.

1- kariesh cheese from skim milk enriched with 24 mg zinc per 100 g. skim milk as zinc iodide.

2- kariesh cheese from skim milk enriched with 36 mg zinc per 100 g. skim milk as zinc iodide.

3- kariesh cheese from skim milk enriched with 24 mg zinc per 100 g. skim milk as zinc sulphate.

4- kariesh cheese from skim milk enriched with 36 mg zinc per 100 g. skim milk as zinc sulphate.

C- Organoleptic properties

It is clear that the enrichment of kariesh cheese milk with zinc salts had great effect on its organoleptic properties. As shown in Table (3) the enrichment with zinc sulphate salts was better than the enrichment with zinc iodide salts, where its fresh samples gained higher scores similar to that of control. Scores of flavour, body & texture acidity, appearance and total scores decreased gradually during storage and reached their minimum at the end of storage period. However treatments enriched with zinc sulphate were better than those enriched with zinc iodide salts. Nevertheless they gained

lower scores than the control. These results could be supported by those reported by Degheidi (1998) who manufactured yoghurt fortified with zinc sulphate at rates 40 and 50 mg zinc sulphate /kg milk and reported that the zinc sulphate gave the best results.

Table (3): Effect of skim milk enrichment with zinc salts on the organoleptic properties of kariesh cheese.

Treatment	Storage period (days)	Organoleptic properties*				
		Flavour (45 point)	Body& Texture (30 point)	A cidity (10 point)	Appearance (15 point	Total (100 point)
Control	Fresh	42	27.5	9.0	15	93.5
	7	43	26	7.7	13.7	90.5
	14	42	27	8.5	13	90.5
	21	42	27.5	8	12.5	90.5
1	Fresh	39	28	7	14	88
	7	38	25	8	14	87
	14	39.5	26.5	7.1	14	87.5
	21	38.5	28	8.5	11.5	86.5
2	Fresh	40	27.5	7.5	14	89
	7	37	25	7.25	14.25	83.5
	14	39	26	7.0	13.5	85.5
	21	39.5	25.8	8.0	10.5	83.8
3	Fresh	39	29	8.0	15	91
	7	39.5	26	8.25	13.75	87.5
	14	42	29	8.0	14.0	93
	21	41.5	28	7.5	11.0	88
4	Fresh	41	28.5	8.5	14	92
	7	37.5	25	7.25	13.5	83.25
	14	41.5	28.5	7.5	14	91.5
	21	40.5	28.5	8.5	12.5	90.0

* Average of three replicates.

1- kariesh cheese from skim milk enriched with 24 mg zinc per 100 g. skim milk as zinc iodide.
2- kariesh cheese from skim milk enriched with 36 mg zinc per 100 g. skim milk as zinc iodide.
3- kariesh cheese from skim milk enriched with 24 mg zinc per 100 g. skim milk as zinc sulphate.
4- kariesh cheese from skim milk enriched with 36 mg zinc per 100 g. skim milk as zinc sulphate.

D- Microbiojlogical properties

The total, proteolytic and lipolytic bacterial counts in fresh cheeses varied among treatments owing to the salts added to cheese milk (Table 4). The increase in counts was highly noticed in the total counts. The increase in total counts is due to intensive growth of lactic acid bacteria (Kolod-Kin *et al.*, 1977). The counts increased during the first 7 days of storage then began

to decrease gradually till the end of storage period. The coliform wasn't detected owing to the intensive hygienic conditions during manufacture. The mould & yeast counts varied among treatments. In fresh cheeses of all treatments they were higher than control. The counts increased gradually in all treatments during storage period. The counts in all treatments were higher than control particularly those enriched with zinc sulphate (Table 4).

Table (4): Effect of skim milk enrichment with zinc salts on the microbiological properties of kariesh cheese.

Microbiological counts *	Storage period (days)	Treatments				
		Control	1	2	3	4
Total x 10^6	Fresh	92	123	141	99	121
	7	112	154	162	121	142
	14	85	116	131	101	96
	21	63	95	85	76	65
Proteolytic x 10^3	Fresh	49	43	52	39	57
	7	53	52	57	50	55
	14	21	19	24	17	22
	21	10	8	13	6	11
Lipolytic x10^3	Fresh	32	30	37	25	40
	7	36	35	42	41	45
	14	21	19	22	9	21
	21	3	7	6	2	8
Coliform	Fresh	ND	ND	ND	ND	ND
	7	ND	ND	ND	ND	ND
	14	ND	ND	ND	ND	ND
	21	ND	ND	ND	ND	ND
Mould&Yeastx10^3	Fresh	19	23	17	28	51
	7	22	18	14	35	60
	14	33	23	52	72	83
	21	45	77	82	121	142

ND: not detected

* Average of three replicates.

1- kariesh cheese from skim milk enriched with 24 mg zinc per 100 g. skim milk as zinc iodide.
2- kariesh cheese from skim milk enriched with 36 mg zinc per 100 g. skim milk as zinc iodide.
3- kariesh cheese from skim milk enriched with 24 mg zinc per 100 g. skim milk as zinc sulphate.
4- kariesh cheese from skim milk enriched with 36 mg zinc per 100 g. skim milk as zinc sulphate.

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تأثير تدعيم اللبن الجاموسى الفرز بأملاح الزنك على خواص الجبن القريش

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الملخص العربي

فى هذه الدراسة تم تدعيم اللبن الجاموس الفرز بملحين من أملاح الزنك هما بود يد وكبريتات الزنك وبمستويين ٢٤ملليجرام، ٣٦ ملليجرام زنك لكل ١٠٠ جرام لبن فرز لكل منهما. وتم صناعة الجبن القريش من هذه الألبان بالإضافة إلى كنترول وقد أوضحت الدراسة أن التفاوت في التركيب الكيماوي نتيجة لهذه المعاملات كان بسيطا ولكن تأثيرها كان اشد وضوحا على محتواها من المعادن حيث زاد محتواها زيادة كبيرة من الزنك وزاد المحتوى أيضا من الكالسيوم والبوتاسيوم مقارنة بالكنترول. كما كانت الخواص الحسية لكل لمعاملات أقل من الكنترول ماعدا المعاملة الرابعة التى تساوت مع الكنترول. أما من حيث الخواص الميكروبيولوجية فقد زاد العدد الكلى والمحللة للبروتين والمحللة للدهن وكذلك الفطر والخميرة مقارنة بالكنترول.