

## **Assessment of Sodium, Calcium and Potassium in Buffalo's Raw Milk and its Rural Products in Some Centers of Sohag Governorates, Egypt.**

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### **ABSTRACT**

Concentrations of sodium (Na), potassium (K) and calcium (Ca) were assessed in samples of raw Buffalo's Milk, Laban rayeb, Cream, Kareish cheese and Mish cheese. The following mean concentrations (and ranges) were recorded in raw Buffalo's Milk: Na (ppm), 282 (241-633); K (ppm), 537 (243-774) and Ca (ppm), 418.2 (214- 493). The Laban rayeb showed mean concentrations of Na (ppm), 299 (210-354); K (ppm), 412 (157-615) and Ca (ppm), 364 (129- 486). However, the mean concentrations of Na (ppm), 242 (82-302); K (ppm), 165 (53-286) and Ca (ppm), 176 (61- 300) in Cream were lower than the concentrations observed in raw Buffalo's Milk. The Kareish cheese showed mean concentrations of Na (ppm), 5558 (3550-7240); K (ppm), 1410 (960-2660) and Ca (ppm), 1765 (1030- 2370). The Mish cheese showed mean concentrations of Na (ppm), 29489 (19100-28000); K (ppm), 2121 (1300-2330) and Ca (ppm), 3323 (2570- 4070). The mean concentrations in Kareish cheese and Mish cheese were significantly higher than in raw Buffalo's Milk, Laban rayeb and Cream.

### **INTRODUCTION**

Milk and dairy products are good source of essential nutrients (Serra Majen *et al.*, 1998). The contribution of milk and dairy products to the recommended dietary intakes for some minerals can be important in relation to other foods. Thus, the knowledge of the minerals concentrations in milk samples and dairy products is of particular interest (Rodriguez *et al.*, 2001). Minerals which are quantitatively minor compounds, are not sources of energy but are essential for the life because they contribute to multiple and different vital functions in the organism, like bone structure, homeostasis, muscular, contraction and metabolism via the enzymatic system (Snezana *et al.*, 2012). Also, the mineral content may vary because of its handling by humans (Zurera-Cosano *et al.*, 1994).

The mineral fraction of milk (approximately 8–9 g/l) (Gaucheron, 2005; Gaucheron, 2011). Na and K, are present mainly in the free form and only to a limited extent in the form of ion pairs. Calcium plays the role in the physicochemical properties of casein micelles, such as gelation induced by acid and rennet, heat stability, ethanol stability and sediment formation (Gao, *et al.*, 2009).

Calcium is an essential macronutrient for humans, which represents approximately 2% of body weight in an adult person (Petrovich, *et al.*, 2007). This element has mainly a structural function in bones and teeth, regulation of many vital biological functions. More recently, the interest in calcium has centered on its role in preventing osteoporosis. The bioavailability of calcium in milk is considered to be excellent (Renner, 1989).

Sodium and potassium concentrations in the body are 1.4 g/kg and 2 g/kg, respectively (Belitz, *et al.* 2009). Sodium is present mostly as an extracellular constituent and maintains the osmotic pressure of the extracellular fluid. In addition, it activates some enzymes, such as amylase. The excessive intake of sodium is of importance because it can lead to hypertension. Milk is not a rich source of sodium.

Potassium is most common cation in the intracellular fluid. It regulates the osmotic pressure within the cell and also in the activation of a number of glycolytic and respiratory enzymes (Belitz, *et al.* 2009). Milk and yogurt, as well as nuts, are also excellent sources of potassium.

The aim of this work was the determination of Na, K and Ca concentrations in raw buffalo's milk and its products. Also, the contribution of the daily consumption of milk and its products to the mineral intake of the Upper Egypt population was established.

### **MATERIALS AND METHODS**

150 samples of fresh raw buffalo's milk and house-made rural milk products including, Laban Rayeb, Cream, Kareish cheese and Mish cheese were collected from 5 centers of Sohag Governorate. These are: Akhmim, Dar-el-Islam, Guhayna, El-mruga and Girga.

All investigated raw milk samples as well as the rural milk products were kept under cooling until the application for analysis to determine the elements (Na, K and Ca).

Mineral content was determined according to the method described by James (1995). The obtained ash was dissolved in 5 ml HCl (36.6%) and the volume was completed to 50 ml by distilled water. The dilutions applied to (flame photometer) laboratory of chemical analysis, faculty of agriculture, Sohag university.

Statistical analyses: Data were programmed in a computer for statistical analysis using SAS, 1998 program

### **RESULTS AND DISCUSSION**

Results presented in Table 1 revealed that the sodium concentrations of raw milk samples and some traditional milk products obtained from various villages related to Sohag Governorates, the highest concentration of sodium in the raw buffalo's milk was in Akhmim while lower concentration was in El-mruga and the average sodium concentration in the raw milk were  $282 \pm 28.5$  ppm with a range of (241- 633) ppm, Reference

values for Na are between 480 ppm (Commission of the European Communities, 1991) and 508-556 ppm (Pennington *et al.*, 1989; Holland *et al.*, 1991). The Na concentration found in present work was within this interval, being similar to other data observed in Spanish regions (Lo pezMahia *et al.*, 1991), and lower than those detected in Italian regions (Mazzota *et al.*, 1993). The highest concentration of Na in the Laban Rayeb in Akhmim also, while it was less concentration in the Girga and the average concentration in Laban Rayeb

299 ± 46.1 ppm with range (210- 354) For the cream was higher concentration in El-mraga and less concentration in Girga while the highest concentration in kariesh cheese in Guhayna and less concentration in Akhmim for Mish cheese concentration was higher in Akhmim and less concentration Girga. The Mish cheese contains higher concentrations of Na than other products with average concentration 29489±172 ppm owing to the high quantity of salt added as preservative.

**Table 1. sodium concentrations of different products collected from some centers of Sohag Governorates.\***

	Na(ppm)				
	Raw milk	Laban Rayeb	Cream	kariesh cheese	Mish cheese
Akmim	313±14.14	349.3±7.23	161.5±0.71	4440±70	31900±100
Dar-elislam	264±12.28	328.5±6.36	190.5±6.364	4613.33±28.87	29466.7±152.75
Guhayna	311.67±11.5	298.3±14.57	171.33±101.5	7100±87.18	30083.3±202.07
El-mraga	252±15.56	292.5±50.2	194.67±39.17	4616.67±241.79	29016.7±104.08
Girga	268.33±17.59	228±25.98	104.67±35.79	7020±262.3	26976.7±107.86
Average	282±28.5 (241- 633)	299±46.1 (210- 354)	165±36.1 (82-302)	5558±133.3 (3550-7240)	29489±172 (19100- 32800)

\* Values are average of three samples.

Results presented in Table 2 revealed that the potassium concentrations of raw milk samples and some traditional milk products obtained from various villages related to Sohag Governorates, the highest concentration of potassium in the raw buffaloes milk was found in samples of Dar-elislam while lower concentration was in El-mraga and the average K concentration in the raw milk were 537±141 ppm. The highest concentration of K in the Laban Rayeb in Akhmim also while it was less concentration in

Guhayna and the average concentration in Laban Rayeb was 412±112 ppm. For the cream was higher concentration in Akhmim and less concentration in Girga while the highest concentration in kariesh cheese in Dar-elislam and less concentration in Guhayna for Mish cheese concentration was higher in Guhayna and less concentration Akhmim. The Mish cheese contains higher concentrations of K than other products with average concentration 2121±273.8 ppm may be due to the additive substances during making of this product.

**Table 2. potassium concentrations of different products collected from some centers of Sohag Governorates.\***

	K (ppm)				
	Raw milk	Laban Rayeb	Cream	kariesh cheese	Mish cheese
Akmim	528±12.73	606.5±12.02	288±7.07	1720±226.27	1775±134.35
Dar-elislam	701.5±120.9	354±29.7	226±7.07	1850±190	2206.7±115.9
Guhayna	485.3±25.01	323.7±11.5	231.67±2.51	1103.3±200.33	2465±190.92
El-mraga	335.7±151.1	381.3±47.09	274±48.5	1206.7±207.44	1920±186.82
Girga	632±127.1	395.3±157.8	192±66	1170±183.85	2240±56.57
Average	537±141 243-787	412±112 157-615	242±38.7 61-268	1410±347.4 1020-2010	2121±273.8 1100-2600

\* Values are average of three samples.

Results presented in Table 3 revealed that the Calcium concentrations of raw milk samples and some traditional milk products obtained from various villages related to Sohag Governorates, the highest concentration of Calcium in the raw buffaloes milk was in Dar-elislam while lower concentration was in Akhmim. The highest concentration of Ca in the Laban Rayeb in Akhmim also while it was less concentration in Girga. For the cream was higher concentration in Guhayna and less concentration in Akhmim while the highest concentration in kariesh cheese in Dar-elislam and less concentration in El-mraga for Mish cheese concentration was higher in Guhayna and less concentration Akhmim. The Mish cheese contains higher concentrations of Ca than other products with average concentration 3323±371.8 ppm.

The contribution of milk and dairy products to the recommended dietary intakes for some minerals can be important in relation to other foods. The approximate

contributions of each element from the consumption of Serving of buffalo's milk, Laban Rayeb, Cream, Kariesh cheese and Mish cheese were calculated in Table 4. These mineral intakes were compared with the Recommended Dietary Allowances (RDA) for adults established by the U.S. National Research Council (National Research Council, 1989). Milk and milk products are an excellent source for Ca and for K. So, the mean consumption of Serving of buffalo's milk supplies 11.28%, 5.37% and 10.45% of the RDA requirements for Na, K and Ca respectively. Also, Laban Rayeb supplies moderate amounts of Na, K and Ca while Cream supplies smaller amounts of minerals. However, the contribution of Mish to the RDA values was very high source of Na 235.9% (Table 4). The results are in good agreement with results obtained by Pennington *et al.* (1987, 1995a,b) of the contribution to the mineral recommended intakes for fluid whole milk

sample from U.S.A. The mineral content of milk varies widely due to numerous factors, such as lactation period, the breed of animal, climate, season, dietary composition of animal feed and soil contamination

(Ford *et al.*, 1986; Moreno-Rojas *et al.*, 1993; Tiscornia, 1977). Also, the mineral content may vary because of its handling by humans (Zurera-Cosano *et al.*, 1994).

**Table 3. Calcium concentrations of different products collected from some centers of Sohag Governorates. \***

	Ca (ppm)				
	Raw milk	Laban Rayeb	Cream	kariesh cheese	Mish cheese
Akmim	272.5±9.19	473.33±20.23	117.5±50.2	1373.33±194.25	2710±121.24
Dar-elslam	604.5±14.8	323.5±30.4	179.5±12.02	2225±275.77	3450±296.99
Guhayna	417.5±9.19	396.5±99.70	283±24.04	1935±205.06	3706.67±335.01
El-mraga	335±137.2	343.67±42.09	163.3±51.6	1365.33±202	3306.67±183.39
Girga	461.33±11	282.67±31.75	136.5±43.13	1925±35.36	3440±141.07
Average	418.2±127	364±73.6	176±64.4	1765±380.5	3323±371.8
	266-615	246-486	105-300	1140-2420	2570-3910

\* Values are average of three samples.

**Table 4. Contribution to daily dietary intake of Na, K and Ca for the consumption of buffalo's milk, Laban Rayeb, Cream, Kariesh cheese and Mish in adult population from Sohag Governorate.**

Element	RDA values	Contribution of Serving									
		Raw milk		Laban Rayeb		Cream		kariesh cheese		Mish cheese	
		Amount	%RDA	Amount	%RDA	Amount	%RDA	Amount	%RDA	Amount	%RDA
Na(ml)	500	56.4	11.28	59.8	11.96	2.475	0.726	222.3	44.46	1179.56	235.9
K(ml)	2000	107.4	5.37	82.4	4.12	3.63	0.124	56.4	2.82	84.84	4.24
Ca(ml)	800	83.6	10.45	72.8	9.1	2.64	0.33	70.6	8.83	128.92	16.12

Serving of milk = 200 ml    Serving of Laban Rayeb = 200 ml    Serving of Cream = (15g)    Serving of Kariesh cheese=(40g)

Serving of Mish=(40g)

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تقييم الصوديوم والبوتاسيوم والكالسيوم في اللبن الجاموسي الخام ومنتجات اللبن الريفية لبعض مراكز محافظة سوهاج ، مصر.

عطيت الله حسن عطيت الله و محمد فرغلي يونس  
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تم تقدير تركيزات الصوديوم والبوتاسيوم والكالسيوم في اللبن الجاموسي الخام واللبن الرايب والقشدة والجبن القريش وجبن المش وقد كانت التركيزات في اللبن الخام ٥٣٧, ٢٨٢, ٤١٨.٢ جزء في المليون لكل من الصوديوم والبوتاسيوم والكالسيوم علي التوالي. كما اوضح متوسط التركيزات في اللبن الرايب ٢٩٩, ٤١٢, ٣٦٤ جزء في المليون لكل من الصوديوم والبوتاسيوم والكالسيوم علي التوالي. وقد وجد ان متوسط تركيزات القشدة ٢٤٢, ١٦٥, ١٧٦ جزء في المليون لكل من الصوديوم والبوتاسيوم والكالسيوم علي التوالي والتي كانت اقل من التركيزات المتحصل عليها في اللبن الخام. وكان متوسط التركيزات في الجبن القريش ٥٥٥٨, ١٤١٠, ٢٦٦٠ جزء في المليون لكل من الصوديوم والبوتاسيوم والكالسيوم علي التوالي ومتوسط التركيزات في الجبن المش ٢٩٤٨٩, ٢١٢١, ٣٣٣٢٣ جزء في المليون لكل من الصوديوم والبوتاسيوم والكالسيوم علي التوالي , وقد اوضحت النتائج ان متوسط التركيزات في الجبن القريش وجبن المش مرتفع بصورة كبيرة مقارنة باللبن الخام واللبن الرايب والقشدة.