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Gross Composition of milk and dairy products produced in Assiut villages

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Abstract:

About 100 samples, of whole raw buffaloes, cows, goats and ewes milk as well as some raw milk house made dairy products namely, Kareish cheese, buttermilk (laban khad) and butter were investigated for their gross composition. It was found that about 75 % of produced milk in this area is buffalo's milk. The average composition of buffalo's ' milk was 3.75 % , 5.95 % , 5.54 % and 0.68 % for total proteins , fat , lactose and ash respectively , which has Sp Gr. 1.032 and 15.95 % T.S. Investigated cow's milk showed less T. S. (12.89 %) and Sp .Gr. (1.029) than buffalo's milk , and it contains 3.66 % proteins , 3.86 % fat, 4.62 % lactose and 0.73 % ash. Ewe's milk has the highest values of all milk constituents; 4.70 %, 6.3 % , 5.61 % and 0.77 % for proteins, fat , lactose and ash respectively with 17.39 % total solids and 1.033 Sp. Gr. Goat's milk was the lowest one in its composition which contains 3.18 % proteins, 3.82 % fat , 4.78 % lactose and 0.65% ash with 12.43% T.S and 1.027 Sp .Gr.. All milk samples were fresh with titratable acidity of 0.15 – 0.16 % and pH value of 6.57 – 6.63.

It was found that the moisture content of Kareish cheese from cow's milk was lower than that of buffalo's milk (68.14 % and 71.95 % respectively). The corresponding values of protein, fat, salt and ash contents of cheese were 15.90 % and 15.64 % , 7.9 % and 4.67 % , 4.84 % and 3.79 % and 4.97 % and 5.14 % for cow's and buffalo's milk cheeses respectively. The acidity and pH values in cheese were 1.21 % & 4.17 and 1.42 % & 4.00 in the same order. Investigated butter samples revealed that fat content were 81.9% and 85.77% for cow's and buffalo's milk respectively. Salt content of cow's one was higher (1.13 %) as compared with 0.23 % for buffalo's one. The fat and protein contents of investigated buttermilk were 1.34 % and 2.98 % for buffalo' product while cow's one showed values of 0.8 % and 2.75 % respectively.

Key words: Gross composition, Milk, Dairy products, Ewe's milk, Goat's milk, Assiut villages.

Introduction:

Milk is nutritionally balanced food, as it contains vitamins, proteins, carbohydrates, lipids and minerals in colloidal form

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and there is no adequate substitute of this food. Cows, buffalo, ewes and goats were domesticated centuries ago and their milk is used as diet by the people of all ages throughout the world (Macrae et al., 1994). According to Byron *et al.* (1974), the average of cows milk constituents are (87.20%), (3.50%), (3.70%), (4.90%) and (0.70%) for moisture, proteins, fat, lactose and ash respectively. The mean value of buffalo's milk composition produced in Egypt is about 6.0 % Fat, 3.7 % total protein (T.P) , 4.8% lactose and 0.9 %ash with a total solids(T.S) content of 15.4 % which higher than those detected in cow's milk by Mohran and Fahmy (1994). Acidity and pH values were approximately equals in both species (0.16 and 6.70) as reported by Enb et al. (2009).

The native cattle, i.e. Baladi cows are the main cows in Upper Egypt which cow's milk forms an important part while buffalo's milk represents the majority of the bulk milk produced in this area. (Abo-Elnaga et al., 1993). Ewe's and goat's milk are rarely produced and consumed in Assiut villages.

The physico-chemical characteristics of cow's milk produced in Upper Egypt had been reported (Abdel-Mottaleb and Abo-Elnaga, 1967 and Mohran and Fahmy, 1994). El- Gazzar et al., (1981) studied the quality of Friesian cow's milk at Sakha. The physical and physico-chemical properties of Egyptian buffalo's milk had been investigated by Abdel- Salam and El- Shibiny (1966) and Hofi et al., (1966). The quality of Chinese buffalo's milk had investigated by Han et al, (2007). The composition of Murrah river buffaloes milk (Bulgaria) was reported by Fundora et al, (2001) & Najenova and Dimitrov (2003) while the Italian one was examined by Supino et al, 2004). All of these buffaloes milk had higher protein, fat, total solids and lower lactose contents than those reported for Egyptian cow's and buffaloes milk.

There are variations between reports that concerning the composition of goat's and ewe's milk (El-Shibiny, 1978, Anifantakis, 1986 and Park, 2006a). Ewe's milk has higher Sp.Gr., viscosity, refractive index, titratable acidity and lower freezing point than cow's milk (Haenlein & Wendorff, 2006). The average protein content in ewe's milk (5.8 % w/w) is higher than in goat's (4.6 %) or cow's milk (3.3 % w/w) (Park et al., 2007).

Butterfat can be recovered from milk and converted to a number of products, the most common of which is butter. Butter is an emulsion of water in oil and has the following approximate composition: Fat more than 80 %, moisture less than 16 %, salt about 2% and SNF about 2% also. It is made by the churning of milk, cream or both (Meshref, 2010). The obtained butter is manually worked and stored in refrigerator till consumed or sold.

Most butter products in Assiut villages transformed into Ghee (Samna) by boiling process (Abo-Elnaga et al., 1993). It was found that, the chemical composition of butter produced from cow's milk was 0.50 – 0.70, 80.0 – 82.0 and 82.0 – 85.0 for protein, fat and dry matter (%) respectively (Ayar et al., 2009).

The characteristics and the manufacture process of house-made fermented milk products had been reported by El-Gendy (1983) and Mohran (2004). Kareish cheese is one of the ancient Egyptian's white, soft cheeses processed from skimmed milk consumed fresh or after pickling. Today, it becomes very popular because of its remarkable health quality as the only known low fat cheese consumed by the Egyptians. It is often recommended for persons suffering from obesity or heart disease. (Hofi et al., 2004).

In Upper Egypt the milk is collected in water-skin (Kerba), churned when the acidity is suitable, butter granules are strained and the reminder is called butter milk (labnn khad or laban Kerba) which is usually used for making Kareish cheese. (El-Gendy, 1983). Several trials were carried out to use butter milk in making some dairy products such as cheese (Antila and Witting, 1978 and Abdel-Salam et al., 1981); yoghurt like fermented milk (El-Batawy et al., 1987) beverage (Farah and Bechman, 1981) and chocolate milk (Jeevan and Ganesh 1979).

Little information about chemical characteristics of milk and rural dairy products consumed in Assiut villages. Thus, the aim of this work was to throw light on the gross compositions of milk and house-made dairy products produced and consumed in Assiut villages.

Materials and methods

1- Materials:-

100 samples of milk and house-made rural dairy products including Kareish cheese, butter and butter milk (Laban Khad) were collected in winter season from some villages belonging to some centers of Assiut Governorate (Abnoub, El-Fath, Abo-Teeg, Manfalout and Assiut). The collected samples were kept under cooling till analyses.

2- Methods of analysis:-

Moisture, total nitrogen (TN) and ash contents as well as titratable acidity of milk and all investigated products samples were estimated according to **A.O.A.C (2000)**. The pH measurement was made using a digital pH – meter calibrated with pH 4 and 7 buffers. Total crud protein content was calculated as N×6.38. (Plummer, 1988). The percentage of fat content had been estimated by using Gerber method (B.S.I. 1958). Specific gravity (Sp. Gr.) of milk samples was determined according to Ling (1963) while milk lactose content was measured by the method of I.D.F. (1974). Salt levels of butter, butter milk and Kareish cheese were determined by using the "Mohr methods" of A.P.H.A. (2004).

All analyses were performed in duplicate.

Obtained data were programmed in a computer for statistical analysis using SAS 1998 program.

Results and discussion

The average chemical composition of milk of some lactating animals produced and consumed in Assiut villages are represented in Table (1). The Sp. Gr. Of examined milk samples were 1.032, 1.029, 1.033 and 1,028 for buffalo, cows, ewes and goats milk respectively. The moisture contents of respective milks were 84.05%, 87.11%, 82.60 % and 87.60%, the total solids (T.S %) contents were vice versa. The total protein content of ewe's milk was the higher one (4.70%) followed by buffalo's milk (3.75%), cow's milk (3.66%) and the lowest one was goats milk (3.18%). These values when calculated on DM basis, cow's milk showed the higher value (30.57%) followed by ewe's milk (26.97%), while buffalo's and goat's milk had 24.62% and 24.53% respectively.

Regarding fat content, ewe's milk showed the higher value (6.30%) than 5.95% of buffalo milk, while cow's and goat's milk had the lowest fat values (3.86% and 3.82% respectively). The fat content as calculated in DM were 40.05%, 36.22%, 29.89% and 28.78% for buffalo's, ewe's, cow's and goat's milk respectively. Lactose content was high in both of ewe's and buffalo's milk with value of 5.61 and 5.54 % respectively as compared with goat's and cow's milk that had values of 4.78% and 4.52% respectively.

Acidity and pH values were approximately equals in all types of milk. pH values ranged from 6.57 in (ewe's milk) to 6.63 in goat's milk, while total acidity ranged from 0.15% in both of cow's and goat's milk to 0.16% in buffalo and ewe's milk.

The ash content varied from 0.68% in buffalo's milk to 0.87% in goat's milk, while ash content of ewe's milk was 0.77% which higher than cow's milk (0.73%). The ash content of buffalo's milk found in present work was lower than that revealed by literature; this may be due to the feeding systems of lactating animals.

Such results are in an agreement with these reported by Byron et al (1974) for cow's milk, on the other hand these results are higher than that reported by Mohran and Fahmy (1994) for imported Friesian and its crossbred (Friesian × Baladi) cow's which characterized with low S.N.F (8.144 and 8.422 %) respectively, which are lower than the legal minimum for Egyptian cow's milk (8.5%).

Results in Table (1), show that variations of chemicals characteristics of the investigated milk samples as related to the lactating animals were significant.

The fat content in buffalo's milk was found in present work lower than that found in Murrah river buffalo's milk by Fundora et

al (2001) and Lindmark-Monsson et al (2003) of 7.59% and 8.27% respectively.

The average protein content in sheep milk was in agreement with that of Anifantakis (1986) and Park (2006).

It could be concluded from the foregoing results that the physico-chemimcal characteristics and constituents of milk produced and consumed in Assiut villages were highly affected by the types of lactating animals.

Table (2) represents the chemical analysis and physical characteristics of house made Kareish cheese produced in Assiut villages. The fat content was differed according to the type of used milk and a wide range in the fat content of cheese samples as showed by the high values of SD

Cheese produced from cow's milk found to have higher fat content (7.9%) than that of buffalo's milk (4.67%). This may be due to that the fat globules of cow's milk are smaller than that of buffalo's milk which lost in butter milk during churning process and appeared in respective cheese.

Vice versa the moisture content was higher in buffalo's cheese than that of cow's one (71.95±9.6% and 68.14±9.96% respectively). The average content of total proteins, salt, ash, pH value and acidity not have marked differences between the two groups of cheese.

The moisture content of investigated cheese samples was higher than that reported by Mohran et al (1984) for Kareish chesses made from Laban Rayeb while it in agreement with those reported by Abou-Donia et al (1975) and Moussa et al (1984) for cheese of Alexandria and Monoufia regions respectively.

The fat and protein contents as calculated in DM were (16.70±15.00 and 28.4±12.4%) and (55.3±17 and 49.7±10.4%) for buffalo's and cow's cheese respectively, revealing the nutrient value of this cheese as compared with its cost.

Abo-Elnaga et al., (1993) concluded that more than 60% of milk produced in country side are used for making butter which transformed into Ghee (Samna).

Table (3), gives the averages of chemical composition of butter produced from either buffalo's or cow's milk in Assiut villages. Results indicated that the composition of both two types of butter was different. The buffalo's butter contains less moisture, salt, ash and titratable acidity than that of cow's one, but has a higher value of fat content. The recorded values are 13.36± 4.4 and 15.83±3.5% for moisture, 85.77±4.7 and 81.90±2.5% for fat of buffalo's and cow's butter respectively. A wide range was found in the case of salt and ash contents of cow's butter as indicated by the SD values. The fat content found in present result was higher than that reported by Enb et al., (2009) who reported that the fat contents of buffalo's and cow's butter were 79.40 % and 78.90 % respectively. The

titrtable acidity and salt content in buffalo's butter were less as compared with cow's butter. This may be due to the low moisture content of buffalo's butter which contains both of acid and salt. Meshref (2010) found that the total acidity and salt levels in butter samples collected from farmer's houses in Beni- Suef villages were 0.20 % and 0.57 % respectively. According to the Egyptian Standards the analyzed butter samples were in comply with the limits.

Table (1) averages of chemical analysis of buffalo, cow, ewes and goat milk samples

Milk type	Number ofsamples	Density	Moisture %	Protein%		Fat %		Lactose %	Ash %	pH	Acidity %
				Milk	D.M	Milk	D.M				
Buffalo	17	1.032± 0.0022	84.05± 1.625	3.75± 0.8	24.62± 12.24	5.95± 1.00	40.05± 9.175	5.54± 1.29	0.68± 0.366	6.61± 0.215	0.16± 0.022
Cow	15	1.029± 0.0025	87.11± 1.525	3.66± 1.00	28.39± 5.88	3.86± 0.9	29.89± 4.66	4.62± 0.865	0.73± 0.53	6.62± 0.215	0.15± 0.031
Ewes	5	1.033± 0.0012	82.60± 0.625	4.70± 0.75	26.96± 3.82	6.30± 0.25	36.22± 2.09	5.61± 0.21	0.77± 0.087	6.57± 0.2	0.16± 0.0125
Goat	5	1.027± 0.0017	87.57± 0.615	3.18± 0.215	24.53± 2.36	3.82± 0.75	28.78± 1.77	4.78± 0.425	0.65± 0.075	6.63± 0.12	0.15± 0.027

Table (2) averages of chemical analysis of buffalo and cow Kareish cheese samples

Type of cheese	Number of samples	Moisture %	Protein %		Fat %		Salt %		Ash %	pH	Acidity %
			Cheese	D.M	Cheese	D.M	Cheese	Serum			
Buffalo Kareish cheese	22	71.950± 9.625	15.639± 8.98	55.311± 17.18	4.67± 4.3	16.70± 14.8	3.79± 4.35	5.26± 5.675	5.138± 4.185	4.00± 0.965	1.42± 0.655
Cow Kareish cheese	8	68.143± 9.96	15.90± 5.99	49.70± 10.435	7.9± 2.5	25.41± 12.385	4.84± 3.14	7.30± 5.595	4.97± 3.3	4.17± 0.41	1.21± 0.52

Table (3) averages of chemical analysis of buffalo and cow butter samples

Type of cheese	Number of samples	Acidity %	Moisture%	Fat %	Salt %	Ash %
Buffalo butter	15	0.151 ± 0.045	13.365 ± 4.425	85.77 ± 4.75	0.230 ± 0.425	0.3199 ± 0.475
Cow butter	5	0.177 ± 0.035	15.832 ± 3.52	81.9 ± 2.5	1.128 ± 1.98	1.334 ± 2.1455

Table (4) averages of chemical analysis of buffalo and cow butter milk samples

Milk type	Number of samples	Moisture%	Protein%		Fat%		Salt%	Ash%	pH	Acidity%
			milk	D.M	milk	D.M				
Buffalo butter milk	9	93.717 ± 1.52	2.984 ± 0.45	48.671± 12.815	1.344± 0.7	21.391± 9.065	0.261± 0.135	0.628± 0.37	5.845± 0.425	0.28± 0.06
Cow butter milk	2	94.685 ± 0.54	2.75 ± 0.25	51.835± 0.575	0.8± 0.3	15.78± 7.28	0.28± 0.03	0.67± 0.01	5.97± 0.04	0.24± 0.03

Data in Table (4), represent the chemical analysis of buffalo's and cow's butter milk. This table showed the high nutritive values of the product. It contains a high value of proteins D. M. (48.67 % and 51.83 % for buffalo's and cow's products respectively). The fat contents in D.M. were 21.39 % and 15.78 % in the same respect. Titratable acidity was less than 0.3 % for the two types of investigated butter milk. These characteristics are in agreement with those reported by Abdel-Malek and El-Demrdash (1970), El-Gendy (1983) and Mohran (2004). Ibrahim et al (1990) reported a composition of butter milk which was contained less fat (0.2 %) and total nitrogen (0.56 %). The high fat content of examined butter milk indicated the fat levels of resultant Kareish cheese (Table, 2).

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التركيب الأجمالى للبن والمنتجات اللبنية المنتجة في قرى أسيوط

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[2] قسم علوم و تكنولوجيا الألبان، كلية الزراعة، جامعة أسيوط.

تم تجميع حوالي 100 عينة من اللبن الخام (جاموسي، بقري، ماعز و نعاج) والمنتجات اللبنية الريفية منزلية الإنتاج (جبن قريش ، زبد ، لبن خض)حيث تم دراسة تركيبها الكيميائي.

وجد ان اللبن الجاموسى يمثل 75% من اللبن المنتج في هذه المنطقة (قرى بعض مراكز أسيوط) وأظهرت النتائج ان متوسط التركيب الكيميائي للبن الجاموسى هى:- 3.75%، 5.95 %، 5.54% و0.68% للبروتين والدهن و اللاكتوز و الرماد على التوالي. وكثافتة النوعية 1.032 و نسبة الجوامد الصلبة الكلية به 15.95%. اعطى اللبن البقري نسبة اقل من الجوامد الصلبة الكلية (12.89 %) و الكثافة النوعية 1.029 عن اللبن الجاموسي ويحتوي على 3.66% بروتين و 3.86% دهن و 4.62% لاكتوز و 0.73% رماد. أظهر لبن النعاج اعلى قيم لمكونات اللبن مقارنة بباقي الأنواع ونسبة مكوناته 4.70% ، 6.3% ، 5.61% ، 0.77% للبروتين و الدهن و اللاكتوز و الرماد على التوالي و\الجوامد الصلبة الكلية وجدت بنسبة 17.39% و الكثافة النوعية 1.033. و على العكس أظهر لبن الماعز اقل قيم لمكونات اللبن مقارنة بأنواع اللبن الاخرى (3.18% بروتين ، 3.82% دهن ، 4.76% لاكتوز ، 0.65% رماد و 12.43% جوامد صلبة كلية و 1.027 كثافة نوعية) وتوضح النتائج ان اللبن كان طازجا حيث أن نسبة الحموضة بين 0.15-0.16% وال pH 6.57-6.63 .

وجد ان محتوى الرطوبة في الجبن القريش البقري اقل من الجبن الجاموسي (68.4% - 71.95% على التوالي) و ومحتوى الجبن من البروتين و الدهن و الملح و الرماد على النحو التالى:- 15.90% و 7.9 % و 4.84% و 4.97% للجبن البقري على التوالى بينما تلك المكونات فى الجبن الجاموسي كانت 15,64 % و 4,67 % و 3,79 % و 5,14 % بنفس الترتيب . الحموضة الكلية 1.21% و ، 1.42% للجبن البقرى والجاموسى على التوالى وقيمة ال pH تساوى 4,17 و 4.00 . عينات الزبد المختبرة تحتوى على دهن بنسبة 81.9% و 85.77% للبقري و الجاموسي على التوالي محتواها من الملح كان اعلى فى البقرى (1.13%) من الجاموسي (0.23%) . قيم الدهن والبروتين في اللبن الخض كانت 1.34% و 2,98% للجاموسي و 0.8 و 2.75% للبقري على الترتيب.