

Chemical Composition of Rural Dairy By- Products

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Abstract:

About 100 samples of rural house made dairy by- product namely; Whey, Buttermilk (churned milk, laban khad) and Rayeb milk were investigated for their chemical composition. It was found that the mean values (\pm standard deviation (SD)) for chemical composition of Whey were 0.133 \pm 0.046%, 0.849 \pm 0.299%, 9.46 \pm 3.75%, 0.385 \pm 0.23%, 4.33 \pm 2.73%, 9.28 \pm 3.28%, 9.67 \pm 3.25%, 3.33 \pm 2.71%, 3.77 \pm 3.17%, 90.32 \pm 3.25% and 0.76 \pm 0.22%, for total nitrogen (T.N), total protein (T.P), protein / D.M, fat, fat /dry matter (D.M), solids not fat (S.N.F), total solids (T.S), salt, salt in serum, moisture and acidity, respectively. The mean values (\pm SD) for the chemical composition of Rayeb milk were 0.70 \pm 0.04%, 4.49 \pm 0.27%, 42.05 \pm 5.39%, 1.20 \pm 0.64%, 11.01 \pm 5.43%, 9.60 \pm 1.06%, 10.80 \pm 1.08%, 89.19 \pm 1.08% and 0.88 \pm 0.30%, for T.N, T.P, protein in D.M, fat, fat in D.M, S.N.F, T.S, moisture and acidity, respectively. And, the mean values (\pm SD) for the chemical composition of Buttermilk were 0.47 \pm 0.04%, 3.04 \pm 0.30%, 42.85 \pm 11.57%, 1.6 \pm 0.52%, 14.86 \pm 7.66%, 6.47 \pm 1.88%, 7.54 \pm 1.80%, 0.31 \pm 0.23%, 0.34 \pm 0.26%, 92.45 \pm 1.80% and 0.38 \pm 0.17% for acidity, for T.N, T.P, protein in D.M, fat, fat in D.M, S.N.F, T.S, salt, salt in serum, moisture and acidity, respectively.

Keywords: cheese whey; Rayeb milk; Buttermilk; Dairy by-products; Rural by-products.

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Introduction:

Whey, Rayeb milk and Butter-milk are considered some of the most important types of dairy by – products commonly produced in Egyptian villages. They also play a vital role in the health and economic life of the Egyptian farmers. These products contain most of the milk constituents including protein, lactose, vitamins, minerals and low fat content (*Abd-alla, 2004*).

Whey is a watery thin liquid which is normally produced during cheese making by the coagulation and separation of casein missiles from milk (*Tsakali, et al. 2010*). It is a high nutritious by- product contains valuable nutrients like proteins, minerals, lactose and vitamins (*Ismail, et. al. 2014*).

The chemical composition of liquid sweet and acid Whey had been reported by (*Shay and Wegner, 1986*). The obtained results for sweet and acid Whey were: water 93.2-93.6 and 93.2%, fat < 0.05 and < 0.05, lactic acid 0.2 and 0.5- 0.6% respectively.

Buttermilk is the term used to refer to the liquid phase released during churning (destabilization) of cream in the butter making process (*Morin et.al., 2007*).

It is also known as natural sour Butter milk. In Upper Egypt, milk is poured into skin bags (Kerba) and left to sour for periods determined by experience. Air is blown into the kerba before closing it tightly and shaking until the fat globules coalesce. After the removal of Butter, the remainder is called laban khad or sour Butter milk (*Abd El- Malek., Demerdash*

1970., El-Gendy 1983.,Abou-Donia1984., 1992.,1999a, b).

The commercial Buttermilk is sweet Buttermilk (a by- product from churning sweet cream into butter) (*Sodini et.al., 2006*).

The chemical composition of sweet cream Buttermilk are 9.9%, 0.6 % and 3.7% for T.S, fat, total proteins, respectively, which is characterized with titratable acidity of 1.2% (*Singh et.al., 2006*).

Sour Buttermilk differs from sweet one in respect to titratable acidity which is even as high as 1.0%. However, there is no much difference in the chemical composition of the two types of Buttermilk (*Singh et.al., 2006*).

Rayeb milk is also known as laban Matared, natural sour milk and gravity sour skimmed milk. In Lower Egypt, farmers fresh milk is poured in shallow or deep earthenware or clay pots (Matared or shalia), and leaved without disturbed in awarm, non sunny place for few days so that fat globules rises and the milk coagulates. This partially skimmed milk called laban Rayeb or laban matared or gravity skimmed fermented milk (*Abd- el Malek and Demerdash, 1970*); (*EL- Gendy; 1983*); (*Abou-Donia 1984; 1991; 1992; 1999*); (*Abdalla, 2004*).

Abd-El-hamid et.al.,(2008) reported that the average value of the chemical composition of Rayeb milk were 1.08%, 1.68%, 0.503%, 10.51% for acidity, fat, total nitrogen and total solids respectively, during the summer.

The aim of the present study was to through light on the chemical composition of different types of

dairy by – products obtained from farmer's house.

Materials and Methods:

100 sample of rural dairy by – products (including Whey, Rayeb milk and Butter milk) were collected randomly from villages in some centers of Assiut Governorate. They include 46 sample of Whey (from Dairout, Elwan and Benizeid), 26 sample of Buttermilk (from Dairout and Benizeid), and 28 sample of Rayeb milk (from Dairout, Benizeid and El-Badary). The collected samples were kept under cooling till analysis.

Methods of analysis:

- Moisture, total solids content and titratable acidity of all investigated samples were estimated according to A.O.A.C., (2000).
- T.N content of all investigated samples was measured using microkjeldahl method according to A.O.A.C.,(2000).
- The curd protein content was calculated as $T.N.\% \times 6.38$ (Plummer, 1988). While protein in dry matter was obtained as follow: $\text{protein in dry matter} = (\text{Curd protein} / \text{total solids}) \times 100$.

- Fat content in all investigated samples was estimated using Gerber method (Ling, 1963); while fat in dry matter was calculated as follow: $\% \text{ fat in dry matter} = (\% \text{ Fat} / \% \text{ total solids}) \times 100$.
- S.N.F was calculated as: $\% \text{ T.S} - \% \text{ fat}$.
- Sodium chloride levels of Whey and Buttermilk were measured using Mohr method of A.P.H.A., (2004).
- Salt in serum content was calculated as: $(\text{salt}\% / \text{moisture}) \times 100$.
- All statistical analyses were performed with SPSS 20.0 (SPSS, Inc., Chicago, IL, USA).

Results and Discussion:

In the present study the chemical composition of 46 sample of Whey, 28 sample of Rayeb and 26 sample of Buttermilk were examined. The following results were obtained:-

• **The Chemical Composition of Whey samples.**

The average chemical composition of Whey samples are represented in Table (1).

Table (1): Shows the Chemical Composition of Whey samples

	Minimum	Maximum	Mean	Std. Deviation
% Moisture	78.23	94.08	90.3291	3.25598
% T.P	0.35	1.87	0.8498	0.29966
% Protein in dry matter	3.62	19.13	9.4670	3.75736
% Fat	0.1	1.0	0.385	0.2357
% Salt	0.36	9.06	3.3398	2.71734
% Acidity	0.25	1.09	0.7633	0.22125
% Total solids	5.92	21.77	9.6709	3.25598
% Solids not fat	5.72	21.67	9.2861	3.28508
% Total nitrogen	0.05	0.29	0.1332	0.04697
% Fat in Dry matter	0.46	10.93	4.3366	2.73399
% Salt in serum	0.39	10.77	3.7756	3.17171

* N of samples 46.

It was found that the mean value of moisture content was 90.32%,

which ranged from 78.23% to 94.08%. These results are in good

agreement with those obtained by *Abd alla (2004)*, who reported that the mean value of Whey moisture content was 89.10% and ranged between 78.26% and 92.81%. While, *Caric,(1990)* found that the mean value was 93.7% in sweet Whey and 93.5% in acid Whey. Similar results were reported by *Shay and Wegner (1986)* and *Kosikowski (1979)*.

The T.S content in the examined samples ranged from 5.92 to 21.77% with an average of $9.67\pm 3.25\%$. Similar results were obtained by *Abdalla (2004,)* who reported that the mean value was $10.57\pm 2.84\%$. While, *Caric(1990)*, found that the mean value was 6.4% for sweet Whey and 6.5% for acid Whey.

The percentage of acidity in investigated samples ranged from 0.25 to 1.09% with an average of $0.76\pm 0.22\%$. While, *Abd alla., (2004)*, found that this value ranged from 0.46 to 1.23% with an average of $0.85\pm 0.17\%$. On the other hand, *Caric.,(1990)*, found that the mean values were 0.1% for sweet Whey and 0.4% for acid Whey.

The fat content in investigated samples ranged from 0.1 to 1.0% with an average of $0.38\pm 0.235\%$. While, *Abd alla., (2004)*, found that

the value ranged from 0.1 to 1.2% with an average of $0.42\pm 0.31\%$. *Sodini et.al.,(2006)*, reported that the mean value was 0.4%. On the other hand, *Caric.,(1990)*, found that the mean value of fat content was 0.5% for sweet Whey and 0.1% for acid Whey.

The percentage of sodium chloride levels in investigated Whey samples ranged from 0.36 to 9.06% with an average of $3.31\pm 2.71\%$. While, *Abdalla (2004)*, found that these values ranged from 0.35 to 12.46% with an average of $3.76\pm 3.19\%$.

The percentage of T.P in collected Whey samples ranged from 0.35 to 1.87% with an average of $0.84\pm 0.296\%$. While, *Abdalla (2004)*, reported that the values ranged from 0.35 to 1.96% with an average of $0.91\pm 0.44\%$. *Caric(1990)*, found that the mean value was 0.8% for acid and sweet Whey. *Kosikowski (1979)*, reported that the average value of total protein content of Whey was 0.80% for sweet Whey and 0.75 for acid Whey.

• **The Chemical Composition of Rayeb Milk Samples.**

The average chemical composition of Rayebmilk samples are represented in Table (2).

Table (2): Shows the chemical composition of Rayeb milk samples.

	Minimum	Maximum	Mean	Std. Deviation
% Moisture	86.27	91.11	89.1954	1.08950
% T.P	3.97	4.98	4.4946	.27477
% Fat	0.4	2.8	1.201	0.6417
% Acidity	0.45	1.93	0.8886	0.30520
% Total nitrogen	0.62	0.78	0.7045	0.04307
% Total solids	8.89	13.73	10.8046	1.08950
% Solids not fat	8.45	12.13	9.6039	1.06308
% protein in dry matter	29.06	55.79	42.0567	5.39334
% fat in dry matter	3.36	23.65	11.0139	5.43511

* N of samples 28.

It was found that the maximum value of moisture content was

91.11%, while the minimum value was 86.27% with a mean value of

89.19%. Present data is in agreement with those found by *Abdalla, (2004)* who reported that, the maximum value for moisture was 91.00 %, the minimum was 88.16% and the mean was 89.49%. The same results were found by *Mohran and Said, (1988)* who found that the mean value for the moisture content of Algerian fluid fermented milk was 88.66%.

On the other hand, the T.S content of investigated Rayeb milk samples ranged from 8.98 to 13.73% with an average of $10.80 \pm 1.08\%$. That is in agreement with *Abdalla (2004)*, who found that, this average value was $10.49 \pm 0.68\%$, and with *Abd-El-hamid et.al., (2008)* who found that this average was 10.51%. A higher value was reported by *Mohran and Said, (1988)* (mean value 13.25%) for the T.S of Algerian Rayeb milk and that found by *Zedan et. al., (2003)*, who detected a mean value of 11.68% for Rayeb milk manufactured by combined culture of *Lactobacillus helveticus mesophilic* freeze shocked.

The percentage of acidity content in present Rayeb milk samples ranged from 0.45 to 1.93 % with an average of $0.88 \pm 0.30\%$. The same finding reported by *Khalafalla et. al., (1988)*, that the mean value of total solids was 0.87% for Rayeb milk produced in lower Egypt. A lower value was reported by *Abdalla (2004)*, for the average total acidity content of Rayeb milk from upper Egypt ($0.69 \pm 0.15\%$). On the other hand, a higher mean value of total acidity content of Rayeb milk reported by *Dawood (1975)*, of 1.43 %.

And *Abd-El-hamid et.al., (2008)*, of 1.08%.

The determination of fat content in Rayeb milk samples revealed that the mean value was $1.20 \pm 0.64\%$ and it was ranged from 0.40 to 2.80 %. These values are approximately in agreement with those found by *Abdalla (2004)*, who reported that the mean value of fat content was $1.60 \pm 0.72\%$, and ranged between 0.50 and 3.00%. Similar results reported by *Abd-Elhamid (2008)*, who found that this average was 1.68 % and by *Zedan (2003)*, who reported that the mean value of fat content of Rayeb milk was 1.95 %.

The average of calculated fat in D.M of Rayeb milk was found to be $11.014 \pm 5.435\%$ that ranged from 3.36 to 23.56%.

The average value of T.P of Rayeb milk samples in the present work was 4.49 ± 0.27 which was ranged from 3.97 to 4.98. This value was found by *Abdalla (2004)*, ranged from 4.10 to 4.98 % with an average of $4.57 \pm 0.24\%$, these results are in good agreement with the obtained data. Same findings were reported by *Olasupo and Azeez (1992)*, who found that the mean value in Nigerian cultured milk (Nono) was 4.7% T.P. And by *Mohran and Said (1988)*, who found that the average values were 3.29 and 3.32 % for commercial and household Algerian fermented milk, respectively.

• The Chemical Composition of Buttermilk Samples.

The average chemical composition of Buttermilk samples are represented in Table (3).

Table (3): Shows the Chemical Composition of Buttermilk samples.

	Minimum	Maximum	Mean	Std. Deviation
% Moisture	89.22	95.00	92.4585	1.80781
% T.P	2.55	3.57	3.0473	0.30748
% Fat	0.50	2.19	1.0681	0.52607
% Salt	0.13	1.09	0.3162	0.23683
% Acidity	0.16	0.85	0.3838	0.17298
% Total solids	5.00	10.78	7.5415	1.80781
% Solids not fat	3.69	10.08	6.4735	1.88159
% Fat in dry matter	5.39	32.16	14.8648	7.66008
% Total nitrogen	0.40	0.56	0.4776	0.04819
% Protein in dry matter	26.25	65.80	42.8546	11.57517
% Salt in serum	0.14	1.22	0.3447	0.26661

* N of samples 26.

It was found that the maximum value of moisture content for investigated Buttermilk samples was 95.00 %, and the minimum value was 89.22% with a mean of 92.45%. The present data are in agreement with these of *Lonkar et.al., (2011)*, who found that the average value was $92.44 \pm 1.06\%$. These results are differ from that of *Britten et. al., (2008)*, who found that, the maximum value for moisture content was 92.00% and the minimum was 88.00% for sweet Buttermilk and with that of *Bakry et.al., (2011)*, who found that the average values were 93.71 ± 1.52 and 94.68 ± 0.54 for buffalo and cow Buttermilk respectively.

Data in Table (3) revealed that the T.S content of Buttermilk samples ranged from 5.00 to 10.78% with an average of $7.54 \pm 1.80\%$. Higher values were found by *Britten et.al., (2008)*, who reported that, the maximum value of T.S was 12.00% and the minimum was 8.00% for sweet Buttermilk and by *Morin et.al., (2007)*, who reported that, the mean value of Buttermilk was $9.12 \pm 0.17\%$.

The percentage of acidity in investigated Buttermilk samples ranged from 0.16 to 0.85% with an average of $0.38 \pm 0.17\%$. These results are in agreement with these obtained by *Lonkar et.al., (2011)*, who found that the average value was $0.3 \pm 0.035\%$. Lower values were reported by *Bakry et. al., (2011)*, who found that the average values of acidity were 0.28 ± 0.06 and 0.24 ± 0.03 % for buffalo and cow Buttermilk respectively and *Ibrahim et.al., (1990)*, who found that the mean value was 0.18%.

The fat content in investigated Buttermilk samples ranged from 0.50 to 2.19% with an average value of $1.06 \pm 0.52\%$, while *Bakry et. al., (2011)*, found that the average values were 1.34 ± 0.7 and $0.8 \pm 0.3\%$ for buffalo and cow Buttermilk respectively. A Lower result was reported by *Morin et.al., (2007)*, (the mean was $0.51 \pm 0.02\%$).

The T.P. content in present Buttermilk samples ranged from 2.55 to 3.57% with an average of $3.04 \pm 0.30\%$. These results are in good agreement with *Singh et. al., (2006)*, who found that the mean value was 3.7 % for sweet Buttermilk

and added there is no big difference in the chemical composition of the two types of Butter milk. While, lower results were reported by Bakry *et.al.*, (2011), who found that the average values were 2.98 ± 0.45 and 2.75 ± 0.25 for buffalo and cow Buttermilk respectively.

The salt levels in present Buttermilk samples ranged from 0.13 to 1.09% with an average of $0.31 \pm 0.23\%$. Bakry *et.al.*, (2011), found that the average values were 0.26 ± 0.13 and $0.28 \pm 0.03\%$ for buffalo and cow Buttermilk respectively.

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الخصائص الكيميائية للمنتجات اللبنية الثانوية الريفية

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الهدف من البحث:

دراسة التركيب الكيميائي لبعض اهم المنتجات اللبنية الثانوية الريفية و تقدير المكونات الرئيسية لهذه المنتجات.

تتلخص نتائج الدراسة فيما يلي :

تم تجميع ١٠٠ عينة من المنتجات اللبنية الثانوية المحلية الريفية والتي اشتملت علي ٤٦ عينة من الشرش ، ٢٨ عينة من اللبن الرايب ، و ٢٦ عينة من اللبن الخض ودراسة التركيب الكيميائي لهذه المنتجات.

اظهرت النتائج ما يلي:

١. متوسط التركيب الكيميائي للشرش ٠.١٣% ، ٠.٨٤% ، ٩.٤٦% ، ٠.٣٨% ، ٤.٣٣% ، ٩.٢٨% ، ٩.٦٧% ، ٣.٣٣% ، ٣.٧٧% ، ٩.٣٢% و ٠.٧٦% ، لكل من النتروجين الكلي، البروتين، البروتين في الجوامد الصلبة، الدهن، الدهن في الجوامد الصلبة، الجوامد الصلبة اللادهنية ، الجوامد الصلبة الكلية، الملح ، الملح في السيرم ، الرطوبة والحموضة علي التوالي.
٢. متوسط التركيب الكيميائي للبن الرايب ٠.٧٠% ، ٤.٤٩% ، ٤٢.٠٥% ، ١.٢٠% ، ١١.٠١% ، ٩.٦٠% ، ١٠.٨٠% ، ٨٩.١٩% و ٠.٨٨% ، لكل من النتروجين الكلي، البروتين، البروتين في الجوامد الصلبة، الدهن، الدهن في الجوامد الصلبة، الجوامد الصلبة اللادهنية، الجوامد الصلبة الكلية، الرطوبة والحموضة علي التوالي.
٣. متوسط التركيب الكيميائي للبن الخض ٠.٤٧% ، ٣.٠٤% ، ٤٢.٨٥% ، ١.٦% ، ١٤.٨٦% ، ٦.٤٧% ، ٧.٥٤% ، ٠.٣١% ، ٠.٣٤% ، ٩٢.٤٥% و ٠.٣٨% ، لكل من النتروجين الكلي، البروتين، البروتين في الجوامد الصلبة، الدهن، الدهن في الجوامد الصلبة، الجوامد الصلبة اللادهنية، الجوامد الصلبة الكلية، الملح ، الملح في السيرم ، الرطوبة والحموضة علي التوالي.