

**PREPARATION OF WHEY PROTEIN FRACTIONS
 α -LACTALBUMIN, β -LACTOGLOBULIN AND
GLOBULIN FROM SALTED RENNET WHEY**

M. A. KHORSHID*, I. D. RIFAAT, A. A. HOFI,
AND M. A. ABD EL-SALAM

Buffalo and cow rennet salted whey were fractionated for globulins at pH 6.8, α -lactalbumin, at pH 4.0 and β -lactoglobulin at pH 5.2. All the fractions were analysed for N and P content. The N contents of the three fractions in both kinds of whey are almost the same. Furthermore, the P contents of β -lactoglobulin globulins in buffalo and cow almost the same, being 0.1%, while the P content of α -lactalbumin in cow, being 0.04% is lower. The percentage of whey protein fractions were determined in buffalo salted whey. The amount of β -lactoglobulin in salted buffalo rennet whey being 0.43% was higher than the globulins, being 0.2%, while the α -lactalbumine is inbetween, being 0.32%.

Whey proteins are rich source of the essential amino acids and contribute to such diverse properties as flavor, color, body, and keeping quality of milk and product. In this connection trials were made to prepare the whey protein fractions from salted rennet whey. The quantitative determination and analysis of the whey protein fractions for P and N contents were carried out in this paper.

Materials and Methods

Preparation of Globulins, α -Lactalbumin, and β -Lactoglobulin

The whey protein fractions were prepared according to the method of Aschaffenburg and Drewry (1957).

Electrophoretic separation of whey protein fractions

The whey proteins were separated by paper electrophoresis using the electrophoretic cell of the hanging type as describe by Durrum (1950). The electrophoretic separation of each of the fractions was carried out on filter strips using 0.1 ml of 2% solutions of the proteins. The separation took place under refrigeration for 12 h. using veronal buffer pH, 8.6, ionic strength of 0.05 and electric current of 0.5/1 cm mA at 300 V as described by Block et al. (1955). At the end of the run, the strips were dried, then stained by bromophenol blue as described by Durrum (1950), washed with tap water and then dried at room temperature.

* Dairy and Food Tech. Lab. N.R.C., Dokki, Cairo, U.A.R.

Chemical analysis

Phosphorus was estimated spectrophotometrically as described by Snell and Snell (1949), nitrogen was determined by the micro-Kjeldahl method as described by Ling (1956), and dry weight and ash contents were determined according to the method of Chibnall et al (1943). The determination of albumin nitrogen plus NPN and β -lactoglobulin nitrogen plus NPN, was carried out according to Aschaffenburg and Drawry (1959). The determination of NPN total whey protein nitrogen were carried out according to Ling (1956). β -lactoglobulin nitrogen was calculated by the difference between the β -lactoglobulin N plus NPN and NPN. α -lactalbumin N was calculated by the difference between the total albumin N plus NPN and β -lactoglobulin N plus NPN. Globulin N was calculated by the difference between the total whey protein nitrogen and albumin nitrogen plus NPN.

Results and Discussion*1.—Identification of whey protein fractions by paper electrophoresis*

As shown in Fig 1, 3 separate zone were presented on the electropherogram of the whey proteins according to their relative movements. The β -lactoglobulin fraction was the fastest component, while the globulins fraction was the lowest, and α -lactalbumin was intermediate.

2.—The Nitrogen distribution in buffalo salted whey

The β -lactoglobulin nitrogen ranged from 23.66 to 96.39 mg N/100 ml with a mean value of 67.15 mg N/100 ml table 1. These values would indicate that β -lactoglobulin per cents in the salted rennet whey were 0.14, 0.61, and 0.43% respectively.

TABLE 1.—NITROGEN DISTRIBUTION IN BUFFALO RENNET SALTED WHEY:

	Min.	Max.	Mean.
β -lactoglobulin nitrogen mg N/100 ml	23.66	96.39	67.15
β -lactoglobulin per cent	0.14	0.61	0.43
α -lactalbumin nitrogen mg N/100 ml	29.42	100.80	50.37
α -lactalbumin per cent	0.19	0.64	0.32
Globulin nitrogen mg N/100 ml	6.16	62.44	31.91
Globulin per cent	0.02	0.40	0.20

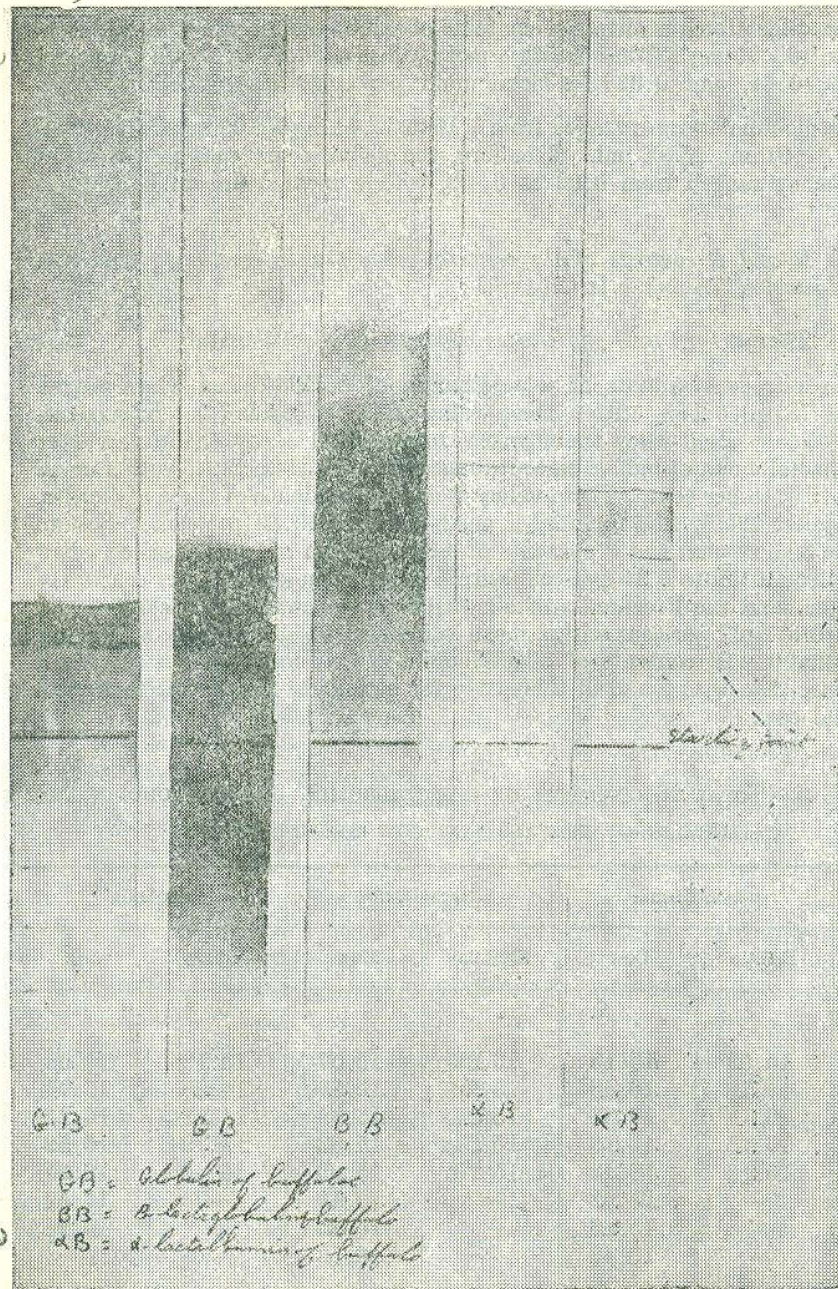


FIG. 1.—The electrophoretic separation of globulins, α-Lactalbumin and β-Lactoglobulin in buffalo whey

The α -lactalbumin nitrogen contents of salted rennet whey ranged from 29.42 to 100.80 mg N/100 ml with a mean value of 50.37%, which amounted to 0.19, 0.64, and 0.32% α -lactalbumin per cents respectively.

The globulin nitrogen ranged from 6.16 to 62.44 mg N/100 ml with an average of 31.91 mg N/100 ml. Therefore, the globulin per cent in the salted rennet whey ranged from 0.02 to 0.4% with a mean value of 0.20%.

3.—*The N and P contents of the prepared whey protein fractions; globulins, β -lactoglobulin and α -lactalbumin:*

a) *The nitrogen and phosphorus contents of α -lactalbumin*

The nitrogen contents of α -lactalbumin of buffalo salted whey ranged from 14.78 to 16.18% with a mean value of 15.37% table (2). In α -lactalbumin of cow salted whey the nitrogen contents had nearly the same values as in α -lactalbumin of buffalo since it ranged from 15.18 to 16.46 with a mean value of 15.48 per cent. These values were in accordance of these of Gordon and Ziegler (1955), who reported a mean value of 15.86 per cent. Results in table 3 show that the P contents of α -lactalbumin of buffalo salted whey ranged from 0.09 to 0.16 per cent with a mean value of 0.11 per cent. On the other hand the P contents of α -lactalbumin of cow salted whey ranged from 0.0 to 0.07 per cent with a mean value of 0.04% Brand *et al* (1945), found that the P contents of α -lactalbumin of cow milk was 0.02% which was lower than that found in this study for buffalo's, but similar to that of the local cow.

TABLE 2.—TOTAL N, CONTENTS OF α -LACTALBUMIN, β -LACTOGLOBULIN AND GLOBULIN OF BUFFALO AND COW RENNET WHEY.

No.	α -lactalbumin		β -lactoglobulin		Globulin	
	Buffalo	Cow	Buffalo	Cow	Buffalo	Cow
1.	15.52	15.18	16.02	15.57	15.12	16.66
2.	14.78	16.46	15.90	15.33	14.95	16.74
3.	16.18	15.33	15.57	16.34	14.17	16.24
4.	16.18	15.19	15.74	15.62	15.79	16.52
5.	16.18	15.23	15.79	15.29	15.46	16.35
6.	—	15.62	—	15.40	—	16.52
7.	—	15.38	—	15.23	—	16.24
8.	—	15.46	—	16.52	—	—
Mean	15.37	15.48	15.80	15.54	15.10	16.47

All values correct for moisture and ash Content.

TABLE 3.—TOTAL PHOSPHORUS CONTENTS OF α -LACTALBUMIN, β -LACTOGLOBULIN AND GLOBULIN OF BUFFALO AND COW RENNET WHEY.

No.	α -lactalbumin		β -lactoglobulin		Globulin	
	Buffalo	Cow	Buffalo	Cow	Buffalo	Cow
1.	0.09	0.07	0.09	0.12	0.14	0.09
2.	0.09	0.04	0.07	0.10	0.10	0.13
3.	0.09	0.06	0.11	0.09	0.08	0.07
4.	0.11	0.00	0.08	0.16	0.08	0.08
5.	0.16	0.00	0.08	0.13	0.07	0.16
6.	—	0.06	—	0.09	—	0.10
7.	—	0.04	—	0.07	—	0.08
8.	—	0.05	—	0.07	—	—
Mean	0.11	0.04	0.09	0.10	0.10	0.10

All values correct for moisture and ash content.

b) *The N and P contents of β -lactoglobulin*

The β -lactoglobulin of buffalo salted rennet whey contained nitrogen ranged from 15.57 to 16.02% with a mean value of 15.80%, table (2). The nitrogen contents of the same protein fraction of cow salted rennet whey were in the same range as buffalo's, being 15.29 to 15.62% with a mean value of 15.54%. These values were accordance of these of Chibnall (1958), Polia *et al* (1950), and Halwer (1950), who reported a mean values of 15.58, 15.46 and 15.60% respectively.

The P contents of β -lactoglobulin of buffalo salted rennet whey ranged from 0.07 to 0.11% with a mean value of 0.09%, table (3). In β -lactoglobulin of cow salted rennet whey the P contents had nearly the same values in β -lactoglobulin of buffalo since it ranged from 0.07 to 0.16% with a mean value of 0.10%.

c) *The N and P contents of globulins*

The nitrogen contents of globulins of buffalo salted rennet whey ranged from 14.17 to 15.79% with a mean value of 15.10%, table (2). In globulin of cow salted whey, the nitrogen contents was slightly higher than in globulin of buffalo since it ranged from 16.24 to 16.74% with a mean value of 16.47%. Smith *et al.* (1946) found that the nitrogen contents of globulin of cow milk, being 16.05 was higher than that of globulin of buffalo salted rennet whey of this text, but lower than that of globulin of local cow.

The P contents of globulin of buffalo salted whey ranged from 0.07 to 0.14% with a mean value of 0.10%, table (3). In globulin of cow salted rennet whey the P contents was nearly the same as in globulin of buffalo since it ranged from 0.07 to 0.13% with a mean value of 0.10%.

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تحضير مشتقات بروتين الشرش وهي الفالكتا البيومين وبيتا لاكتوجلوبولين وجلوبيولين من الشرش الملح

الدكتور محمد عبد الجليل - الدكتور ابراهيم الدسوقي رفعت
الدكتور عبد الحميد العوفى - الدكتور محمد الحسينى عبد السلام

الملخص

أجرى فصل الجلوبيولين من الشرش الملح المحضر بواسطة المنفحة من لبن جاموسى وبقرى على pH ٦.٨ أما الفالكتا البيومين فصل على pH ٤، وبيتا لاكتوجلوبولين فصل على pH ٢.٥

هذا وقد أجرى تحليل هذه البروتينات لمعرفة محتواها من النتروجين والفوسفور وقد وجد أن البروتينات الثلاثة المفصولة من النوعين من الشرش تحتوى على نسبة واحدة من النتروجين .

هذا وقد وجد أن البتالاكتوجلوبولين والجلوبيولين المحضرين من شرش اللببىن الجاموسى والبقرى يحتوى على نسبة واحدة من الفوسفور وهى ١.٥٪ أما الفالكتا البيومين المحضر من شرش لبن بقرى يحتوى على ٤.٥ ٪ فوسفور .

هذا وقد وجد أن نسبة بيتا لاكتوجلوبولين فى الشرش الملح المحضر من لبن جاموسى هى ٤٣٪ والجلوبيولين ٢٪ والفالكتا البيومين ٣٢٪ .

* معمل الصناعات الغذائية والالبان - المركز القومى للبحوث - الدقى .