Results and Discussion

Chemical composition of the cheese milk and concentrates

Data in Table (30) represent the chemical composition of the UF buffaloes milk retentate at two concentrations used in preparing white soft cheese and the control.

Total solids in the cheese milk were 14.8, 23.20 and 14.52% in the control , 80% UF retentate and 50% UF-retentate. The differences are in fat , lactose, total protein and ash due to the concentration and dilution that occurs in milk.

Also, fat content was much higher in the 80% retentate (9.30%) when compared with either of the control or 50% retentate as both have a fat content of 5.80%.

Regarding lactose content , it was much higher in the control (4.80%) followed by the 80% retentate (2.76%) then the 50% retentate (1.74%). This is due to the ultrafiltration and dilution effect. However, the total protein content was the lowest in the control (3.47%). This concentration was increased up to (6.20%) in the 50% retentate with an extra increase (9.90) in the 80% retentate. Such result confirming the effect of ultrafiltration and dilution on the content of the treated milk.

Results showed that the pH value of 50% retentate was almost similar to the control (6.63 versus 6.65), while they were lower than the 80% retentate (6.83). Acidity % was relatively higher in 80% retentate than in buffaloes' milk (control) which in turn higher than the 50% retentate. This may be explained on

Table (30): Chemical composition of UF-retentate used in manufacturing white soft cheese.

Parameters	Buffaloes' milk (control)	* Concentration of UF-Buffaloes' milk retentate	
		80% (1:4 w/w)	50% (1:1 w/w)
Total solids %	14.80	23.20	14.52
Fat %	5.80	9.30	5.80
Lactose %	4.80	2.76	1.74
Total protein %	3.47	9.90	6.20
pH	6.65	6.83	6.63
Acidity %	0.19	0.20	0.15

* Water : retentate.

the dilution of some buffer salts present in milk on dilution with water. Also, it is obviouly noticed that the obtained total solids matches reall well with the behaviour of the recorded acidity parameter.

In conclusion the 80% retentate was of the highest total solids% , fat % , total protein, pH and acidity% as compared with control and 50% retentate. The 50% retentate was almost similar to the control in total solids% , fat%, pH and a cidity %. However , it was the least of all in lactose content

Curd tension :

Table (31)shows the curd tension of white soft cheese made from buffaloes' milk and UF-retentate of 80 and 50% concent-rations.

Table (31): Curd tension of white soft cheese made from buffaloes' milk and UF-retentate of 80 and 50% concentration. (per gm).

Buffaloes' milk (control)	Concentration of UF-Buffaloes' milk retentate	
	80% (1:4 w/w)	50% (1:1 w/w)
70.52	60.07	45.0

It is clear that the curd tension widely varied among the three manufactured white soft cheeses. The highest curd tension was for the control cheese, followed by the 80% retentate cheese then the 50% retentate cheese. This result matches real well with the behaviour of acidity content as it is clear from Table

(37) which may be the reason for such obtained curd tension. The reduction in curd tension was 14.8 and 36.2% when comparing the 80% and 50% retentate cheese with the control cheese. Whereas, the reduction in curd tension was 25.1% when comparing 80% to 50% retentate cheese. This result could be due to the reduction in the acidity content. Also, it may be attributed to that , during the ultrafiltration process, the milk constituents is subjected to high pressure , continuous mixing and partioning that may enhance the swelling of milk proteins and affect the firmness of the curd.

Bacteriological quality of cheese

Lactic acid bacterial count of cheese :

Data in Table (32 and Fig. 29) show the lactic acid bacterial count of white soft cheese prepared from buffaloes' milk and UF-retentate of 80 and 50% concentration during storage for 4 weeks.

Results clarified that at zero time, the fresh cheese of control had the highest lactic acid bacterial count, followed by 80% retentate cheese , then 50% retentate.

The respective reduction of cfu/g was 8.5% and 32% for 50 and 50% retentate as compared with the control cheese. This may be attributed to the high lactose content as apparent from the rapid acid development. This confirms the findings of El-Abd et al (1975).

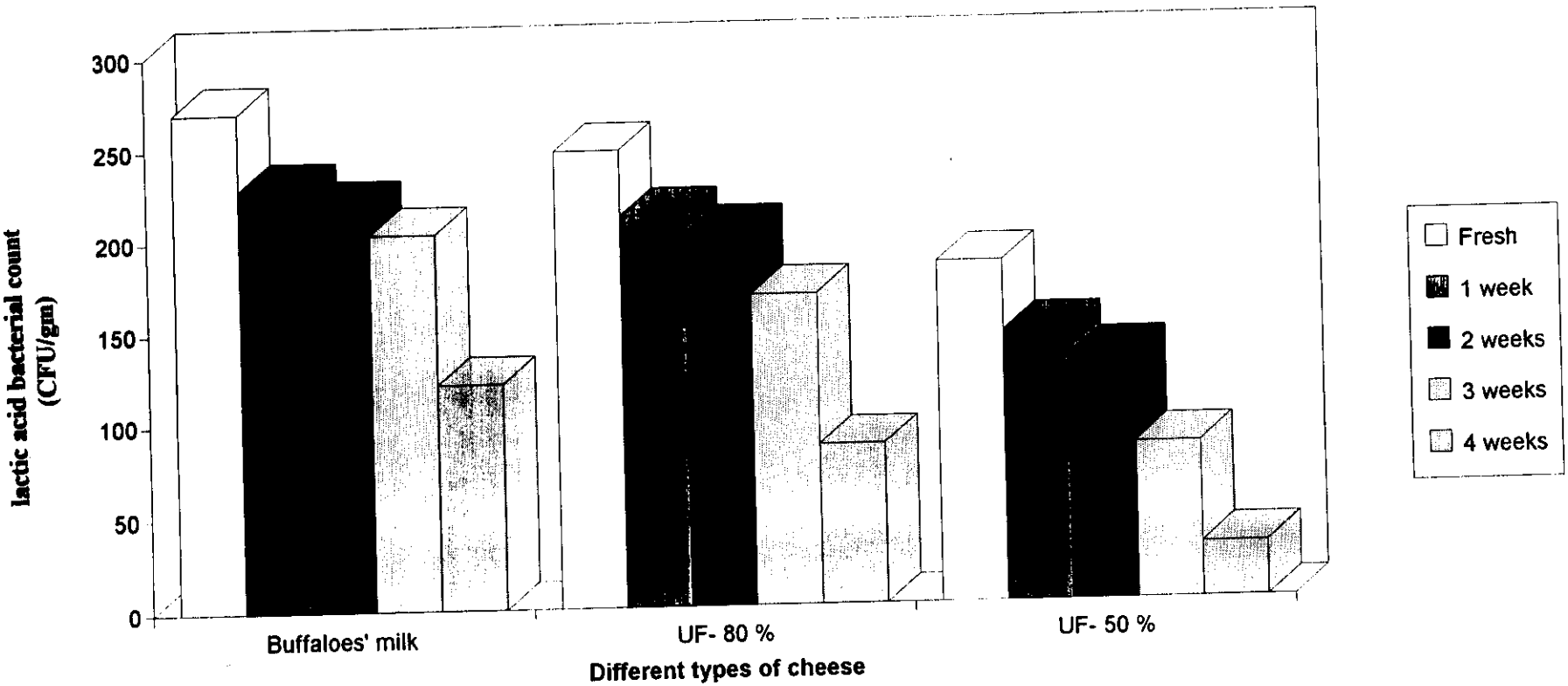
The reduction in lactic acid bacterial count between the three compared white soft cheese was increased as storage time progressed. At the fourth week of storage, the reduction in

Table (32): Lactic acid bacterial count (cfu/gm) and total bacterial count of white soft cheese manufactured from buffaloes' milk and UF-retentate of 80 and 50% c oncentrations during storage.

Storge period (weeks)	Buffaloes' milk (control)	* Concentration of UF-Buffaloes' milk retentate	
		80% (1:4 w/w)	50% (1:1 w/w)
	(counts x 10^6/gm)		
Lactic acid bacterial count			
0 (fresth)	270	247	183
1	228	211	145
2	218	201	131
3	203	167	83
4	121	85	29
Total bacterial count:			
0 (Fresh)	287	255	193
1	231	221	158
2	222	209	142
3	212	175	091
4	140	061	033

* Water : Retentate w/w.

Fig. (29): Lactic acid bacterial count (CFU/ gm) of white soft cheese manufactured from buffaloes' milk and UF- retentate of 80 % and 50 % concentraions during storage.



CFU/g was 29 and 76% for 80 and 50% retentate cheese as compared with the control.

It is also clear that lactic acid bacterial count of the manufactured three treatments decreased by extended storage time with quite differences. In comparing lactic acid bacterial count of freshly made cheese and after 4 weeks storage, the reduction in count was 55% for the control cheese, 65% for the 80% retentate cheese and 84% for the 50% retentate cheese.

These results agree with the findings of Eastern and Mason (1951) as they reported that *S. lactis* organisms would reach their maximum number about the third day after manufacture and the maximum loss in bacteria occurred during the first two weeks after manufacture, being about 54% in raw milk cheese and 40% in heated milk cheese.

This result matches real well with those of Hickey *et al.*, (1983) , Hoier (1984) and Abd-El Salam *et al.*, (1992).

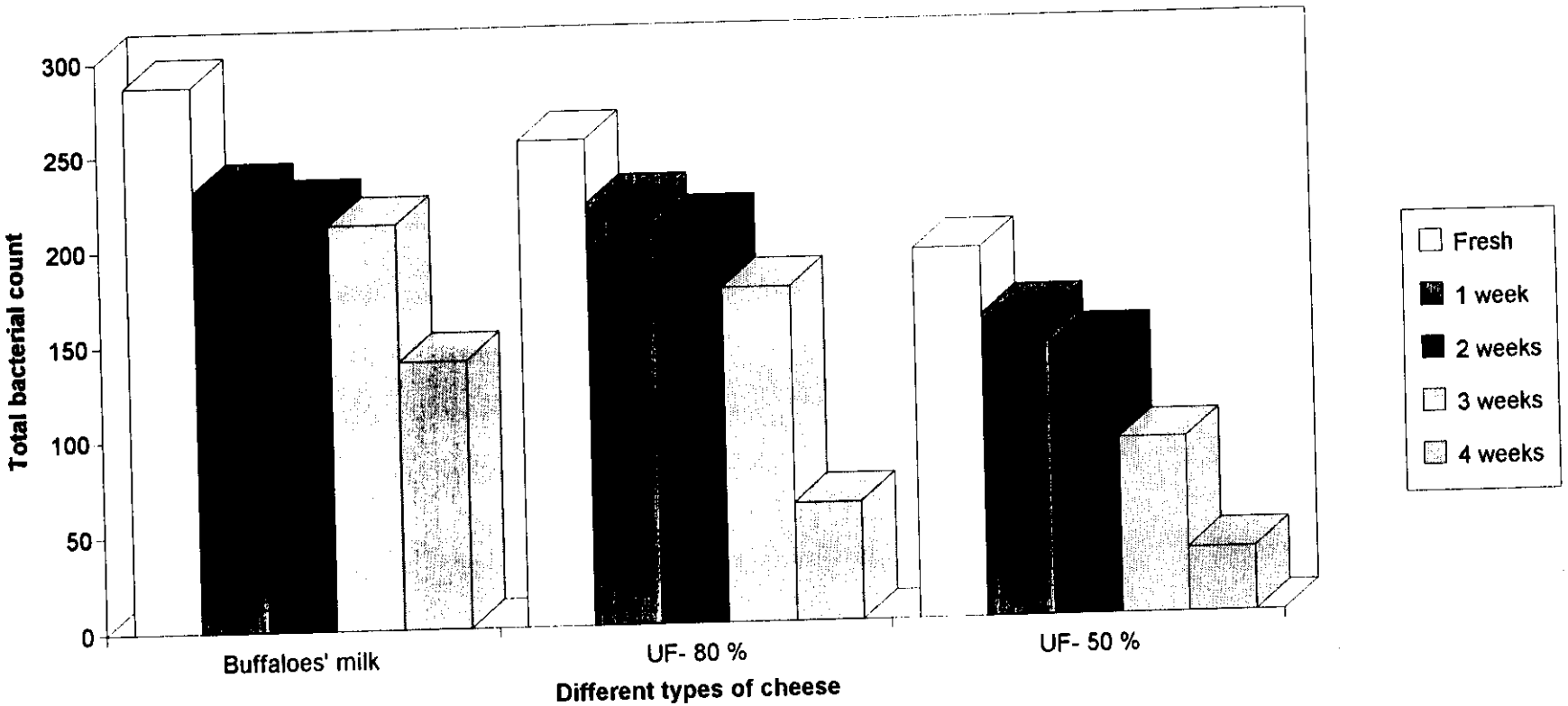
Also, it was noticed that the more dilution of retentate (from 80 to 50%) reduced the lactic acid bacterial count of the manufactured white cheese.

Total bacterial count :

Results in (Table 32 and Fig. 30) clarified the effect of storage time on the total bacterial count of white soft cheese made from buffaloes'milk (control) and the retentate of 80% and 50% concentration .

It was clear that total bacterial count behaved in a similar manner as for lactic acid bacterial count previously discussed with different magnitudes. This could be due to the responsibility of

Fig. (30): Total bacterial count (CFU/ gm) of white soft cheese manufactured from buffaloes' milk and UF- retentate of 80 % and 50 % concentraions during storage.



lactose for the carbon source of bacteria in dairy products. It is generally noticed that the highest total bacterial count was for the control fresh cheese. It decreased by 11% than the 80% retentate cheese and by 33% than the 50% retentate cheese. This trend was noticed during the whole storage period.

Results also showed a continuous decrease in the total bacterial count in the three treatments as the storage time proceeded. The respective reduction in total bacterial count was 51% , 76%, and 83% for the control cheese, 80% retentate cheese and 50% retentate cheese , respectively.

Chemical composition of cheese :

Total solids :

changes in total solids content of white soft cheese made from buffaloes'milk and UF-retentate of 80 and 50% concentration during storage period of 4 weeks are recorded in Table (33).

It is generally noticed that the freshly made white soft cheese had the higher total solids content. This percentage decreased slightly as the storage period proceedes. The reduction in total solids content when comparing freshly made cheese with stored cheese was 8.6, 13.6, and 21.5% for the control , 80% retentate and 50% retentate cheese consequently. These results agree with Ismail *et al.*, (1982) and Hassan *et al.*, (1983) who attributed this to the low salt content of the pickling solution. The same observation was found by Salama *et al.*, (1982) who reported that storage at low temperature probably increased the

Table (33): Changes in total solids % of white soft cheese manufactured from buffaloes' milk and UF-retentate of 80 and 50% concentration during storage.

Storage time (weeks)	Buffaloes' milk (control)	Concentration of UF-Buffaloes' milk retentate	
		80% (1:4 w/w)	50% (1:1 w/w)
	%		
0 (fresh)	40.5	43.6	48.5
1	39.0	42.2	37.4
2	38.3	41.1	35.9
3	37.5	39.3	33.8
4	37.0	37.0	30.2

swelling of cheese protein and increased the moisture content of cheese.

In conclusion, freshly made white soft cheese manufactured from 80% retentate had the highest total solids% (43.6) which decreased to 37.0% at the 4th week at storage. The respective percentage of total solids was 38.5 and 30.2% for the 50% retentate cheese, while control cheese attained 40.5% total solids which decreased to 37% after 4 weeks in the refrigerator.

Fat content (%)

Results in Table (34) represent changes in fat content of white soft cheese made from buffaloes'milk and UF-retentate of 80 and 50% concentration during storage. There is a quite variation in fat content of the three treatments. It is obviously clear that the 80% retentate cheese contained the highest fat content as compared with the control cheese and the 50% retentate cheese. This result was true for the fresh and the stored cheese for the whole storage periods. Also, the 50% retentate cheese was much lower in fat content as compared with the control cheese for the fresh and stored cheese. The differences in fat content between treatments are due to the great differences in the fat content of the cheese milk (table 30). Results showed that there was a slight continuous reduction in fat content of the three treatments of the manufactured cheese as the storage period increased up to the fourth week. The reduction in fat content may be due to the increase in moisture content during the cold storage. The fat content was reduced by 4.2, 14.2 and 19.4% in the control, 80% retentate and 50% retentate cheese respectively.

Table (34): Changes in fat content of white soft cheese manufactured from buffaloes' milk and its UF-retentate of 80 and 50% concentration during storage.

Storage time (weeks)	Buffaloes' milk (control)		Concentration of UF-Buffaloes' milk retentate			
			80% (1:4 w/w)		50% (1:1 w/w)	
	Fat %	Fat/ DM	Fat %	Fat/ DM	Fat %	Fat/ DM
0 (fresh)	19	46.9	21	38.2	18	46.8
1	19	48.7	20.2	47.9	17.6	47.1
2	18.8	49.1	20.0	48.7	17.0	47.4
3	18.5	49.3	19.0	48.3	16.0	47.3
4	18.2	49.2	18.0	48.6	14.5	48.0

Regarding the fat per dry matter, the results indicated an increase in the 80% retentate cheese than other cheeses which is due to the high fat content in its cheese milk. Fat / dry matter of all treatments behaved similarly, increased gradully during storage. After 4 weeks the differences between treatments was undetectable.

Lactose content :

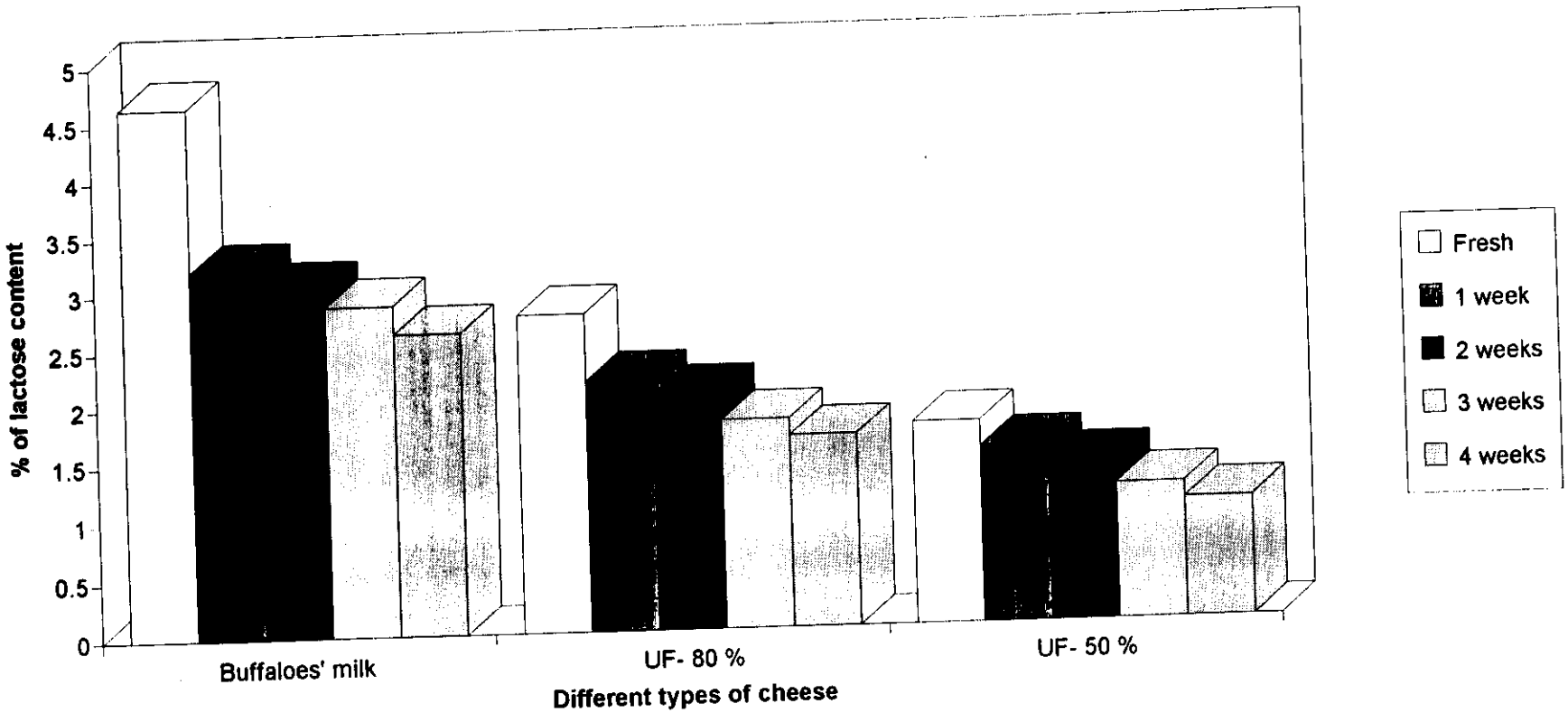
Changes in lactose content of white soft cheese manufactured from buffaloes' milk and UF-retentate of 80% and 50% concentration during storage are presented in (Table 35 and Fig. 31).

Results show that buffaloes'milk cheese (control) had the highest lactose content as compared with the 80 and 50% retentate cheese. This is true for the freshly made cheese and during storage period. Also, the 80% retentate cheese was much higher in lactose content as compared with the 50% retentate cheese for freshly made cheese and during the whole storage period. This is expected as the lactose content in milk used in cheese making was significantly differed between the treatments.

During storage the lactose content from all treatments gradually decreased all through the storage period. The reduction in lactose content was 44.0% for the control cheese, being 40.2% for 80% retentate cheese and 41.4% for the 50% retentate cheese.

For freshly made cheese, the control cheese contained 4.64% lactose, whereas the 80 and 50% retentate cheese contained 2.76 and 1.74% lactose, respectively. This result represent a respective 40.5% and 62.5% reduction in lactose

Fig. (31): Changes in lactose content (%) of white soft cheese manufactured from buffaloes' milk and UF- retentate of 80 % and 50 % concentrations during storage.



Table(35):Changes in lactose content (%) of white soft cheese manufactured from buffaloes' milk and UF-retentate of 80 and 50% concentrations during storage.

Storage time (weeks)	Buffaloes' milk (control)		Concentration of UF-Buffaloes' milk retentate			
			80% (1:4 w/w)		50% (1:1 w/w)	
	Lactose %	Lactose/ DM	Lactose %	Lactose/ DM	Lactose %	Lactose/ DM
0 (fresh)	4.64	11.5	2.76	6.3	1.74	4.5
1	3.20	8.2	2.17	5.1	1.51	4.0
2	3.03	7.9	2.04	5.0	1.36	3.8
3	2.87	7.7	1.80	4.6	1.16	3.4
4	2.62	7.1	1.65	4.5	1.02	3.4

content as compared with the control cheese. Almost simlar trend of lactose content was noticed for the stored cheese during the 4 weeks of storage. Concerning lactose per dry matter, a great differences were observed between the treatments either in fresh or after 4 weeks. Also, a graduall decrease was noticed during storage.

Total nitrogen content :

The behaviour of total nitrogen content of white soft cheese manufactured from buffaloes'milk and UF-retentate of 80% and 50% concentration is presented in Table (36).

Results showed that the highest total nitrogen content of freshly made cheese was for the 80% retentate cheese (2.67), followed by the 50% retentate cheese (2.26%) , then the control cheese (1.90%) which had the lowest content. This may be due to the differences in the composition of the cheese milk (Table 30) , and to the differences in moisture content. This trend was noticed up to the third week of storage. Whereas, at the 4th week of storage, total nitrogen content of the 50% retentate cheese was almost similar to that of the control. The high nitrogen content of ultrafiltered milk cheese are attributed to its higher retention and, no curd particles are lost in this method (Maubois and Mocquot, 1975).

It is also noticed that the reduction in total nitrogen content by the end of storage period as compared with the freshly made cheese varied among the three treatments. Such reduction was 6.0%, 15.7% and 22.5% for the control 80% retentate and the 50% retentate cheese, respectively.

Table (36): Changes in total nitrogen content of white soft cheese manufactured from buffalo milk and UF-retentate of 80 and 50% concentration during storage.

Storage time (weeks)	Buffaloes' milk (control)		Concentration of UF-Buffaloes' milk retentate			
			80% (1:4 w/w)		50% (1:1 w/w)	
	T.N. %	T.N./ DM	T.N. %	T.N./ DM	T.N. %	T.N./ DM
0 (fresh)	1.90	4.7	2.67	6.1	2.26	5.9
1	1.87	4.8	2.60	6.2	2.17	5.8
2	1.84	4.8	2.50	6.1	2.05	5.7
3	1.79	4.8	2.39	6.1	1.91	5.7
4	1.78	4.8	2.25	6.1	1.75	5.8

It is also clear that total nitrogen per dry matter for each of the three cheese types was not much changed when comparing between freshly made cheese and the 4th week stored cheese where differences were almost ignorable.

pH and acidity % :

Data in Table (37) clarified the behaviour of pH and acidity during the storage of white soft cheese made from buffaloes' milk and UF retentate of 80 and 50% concentration.

It is generally noticed that the 80% retentate cheese was of the highest pH value. This was followed by the 50% retentate cheese, then the control cheese which had the lowest pH value. This result was true for all of the studied storage periods. It is also clear that pH value for the 3 treatments decreased slightly and gradually as the storage period increased.

Regarding acidity percent it was obviously clear that the control cheese was of the highest value. This was followed by the 80% retentate cheese, then the 50% retentate cheese which had the lowest acidity. This result was for the freshly made cheese and during the whole storage periods. Also, the acidity was increased for the three treatments with the storage development. These results showed that the presence of high lactose in cheese encouraged the development of slightly high acidity all through the storage period. This is in accordance with those reported by El Abd *et al.*, (1975) who found that acidity of Domiati cheese stored in whey (high lactose) to be higher than that stored in brine or mixed brine and whey. It seems that the high salt content of this type of cheese limit the bacterial activity.

Table (37): Changes in pH and acidity of white soft cheese manufactured from buffaloes' milk and UF-retentate of 80 and 50% concentration during storage.

Storage time (weeks)	Parameter	Buffaloes' milk (control)	Concentration of UF-buffaloes milk retentate	
			80%(1:4 w/w)	50% (1:1 w/w)
0 Fresh	pH	6.2	6.57	6.37
	Acidity %	0.22	0.19	0.15
1 week	pH	6.16	6.49	6.27
	Acidity %	0.45	0.29	0.21
2 weeks	pH	5.85	6.37	6.15
	Acidity %	0.65	0.44	0.35
3 weeks	pH	5.82	6.33	6.11
	Acidity %	0.76	0.51	0.43
4 weeks	pH	5.50	5.97	5.81
	Acidity %	0.85	0.62	0.53

However , the presence of high lactose would be essential to encourage the growth and activity of lactic acid bacteria under the adverse conditions of the high salt content. Abd El-Salam et al (1992) obtained the same results and they suggested that the presence of lactose in Domiati cheese may serve two objectives, a substrate for lactic acid fermentation and as a protective agent for the growth and activity of bacteria towards the adverse conditions for the high salt content.

Soluble nitrogen content :

Changes in soluble nitrogen content of white soft cheese made from buffaloes'milk and UF-retentate of 80% and 50% concentration under different storage periods are recorded in Table (38).

Results show that the 80% retentate cheese had the higest soluble nitrogen content than the 50% retentate cheese and the control cheese. This was for the freshly made cheese and during storage. Also, the 50% retentate cheese was higher in soluble nitrogen content than the control cheese.

The high soluble nitrogen of the UF-cheese was mainly due to the retention of whey proteins in the curd during the ultrafiltration process. (Abd El-Salam *et al.*, 1981).

It is obviously clear that soluble nitrogen content of the three treatments was markedly increased as the storage time progressed. Freshly made cheese contained 0.22, 0.31 and 0.27% soluble nitrogen for the control, 80% retentate and 50% retentate cheese respectively, being 0.47, 0.60, and 0.54% after 4 weeks of

Table (38): Changes in soluble nitrogen content of white soft cheese manufactured from buffaloes' milk and UF-retentate of 80 and 50% concentrations during storage.

Storage time (week)	Buffaloes' milk (control)		Concentration of UF-Buffaloes' milk retentate			
			80% (1:4 w/w)		50% (1:1 w/w)	
	S.N.%	S.N./T.N	S.N.%	S.N/T.N	S.N.%	S.N/T.N
0 fresh	0.22	11.58	0.31	11.61	0.27	11.95
1	0.30	16.04	0.37	14.23	0.35	16.13
2	0.37	20.11	0.46	18.40	0.43	20.98
3	0.43	24.02	0.52	21.76	0.49	25.65
4	0.47	26.4	0.60	26.67	0.54	30.86

storage in the refrigerator which is due to the breakdown of protein.

Regarding the SN/TN ratio, it was found that its behaviour followed the previous results (Omar, 1987). The initial SN/TN ratio was slightly hgiher in fresh cheese made from ultrafiltrated milk and during storage. Thus, suggests that the ultrafiltration enhanced the protein degradation of cheese. The SN/TN ratio increased during the storage in UF-cheese more than the control. The increase was 127.98, 129.72 and 158.24% in control, 80 and 50% UF retentate respec. The increase in 50% retentate was more than 80% retentate cheese. This may be due to the high moisture content which enhance protein breakdown.

Tryptophan content:

Data in Table (39) clarified the changes in tryptophan content of white soft cheese made from buffaloes' milk and UF-retentate of 80 and 50% concentration during storage. Similar trend was observed for tryptophan content as of the soluble nitrogen content previously discussed with considerable differences.

Tryptophan content was relatively higher in 80% retentate cheese compared to the 50% retentate cheese. While either of the two retentate cheese contained almost higher amount than control cheese. The control fresh cheese had the least amount of tryptophan (25 mg/100 g) which increased rapidly up to the 4th week of storage (66 mg/100g). Whereas 80% and 50% retentate cheese contained higher amounts of tryptophan (48 and 40

Table (39): Changes in tryptophan content of white soft cheese manufactured from buffaloes' milk and its UF - retentate of 80 and 50% concentration during storage.

Storage time (weeks)	Buffaloes' milk (control	Concentration of UF-Buffaloes' milk retentate	
		80%(1:4 w/w)	50% (1:1 w/w)
0 Fresh	25	48	40
1	43	67	61
2	52.5	77	68
3	62	83	75
4	66	87	80

mg/100g respectively), which increased up to 80 and 87 mg/100g, respectively at the end of the 4th week storage.

It is clear that tryptophan content increased dramatically during the first week by 72, 40 and 52% for control, 80% retentate and 50% retentate cheese, respectively. Whereas, the respective increase after 4 weeks was 164, 81 and 100% when compared with freshly made cheese in the same order.

Tyrosine content :

As it is clear from Table (40) the tyrosine content behaived the same trend as tryptophan. The minimal tyrosine content was in the freshly made cheese. It was 17, 40 and 33 mg/100g in the control, 80% retentate and 50% retentate cheese, respectively. During the first week of storage, the respective tyrosine content increased to 47, 98 and 86 mg/100g. This result indicates that the high rise in tyrosine content was in the first week of storage for the three treatments of soft white cheese. During the whole storage period, the control cheese contained the lowest tyrosine content compared to the other two treatments. After 4 weeks the increase in tyrosine content was 335% , 275% and 294% for the respective control cheese, 80% retentate, and 50% retentate cheese with sequence.

Organoleptic scoring :

Data in Table (41) illustrate the organoleptic scoring for the properties of white soft cheese made from buffaloes'milk and UF retentate of 80 and 50% concentration during storage period.

Table (49): Changes in tyrosine content of white soft cheese manufactured from buffaloes' milk and its UF-retentate of 80 and 50% concentration during storage.

Storage time (weeks)	Buffaloes' milk (control	Concentration of UF-Buffaloes' milk retentate	
		80%(1:4 w/w)	50% (1:1 w/w)
	(mg/100 gm)		
0 Fresh	17	40	33
1	47	98	86
2	59	120	108
3	65	130	119
4	74	150	130

Organoleptic scoring of freshly made cheese was 77, 75, and 74 for the control cheese, 80% retentate and 50% retentate cheese, respectively. All of the three treatments were slightly acid taste and good in flavour as clear in Table (41), the flavour scoring was 45, 46, and 45 for control cheese, 80% retentate and 50% retentate cheese in sequence. However, the scoring for the last 3 weeks of storage was 82, 83, 83 for the control cheese with acceptable sligt salt tast, good flavour and mild texture at the end of storage period. The respective scoring points for 80% retentate cheese was 82, 80 and 80 with an excellent flavour, favourable slight salt taste and mild texture. Also, the respective scoring for the last 3 weeks of storage was 73, 66 and 62 for the 50% retentate cheese with good flavour, slight salty and very soft texture.

It could be noticed that, control, 80% and 50% retentate cheese stored at refrigerator for 4 weeks had relatively loss in body and texture. However, UF-retentate cheese was more soft in texture, this might be attributed to the higher moisture content for cheese stored at low temperature as previously mensioned in Table (33). These results indicated that the 80% retentate cheese was similar to the control cheese at the second week of storage with extra 2 more points in scoring for flavour and taste , and close to the control cheese scoring preferable in its flavour. So, it could be noticed that the 80% retentate cheese was the closest organoleptic properties to the control cheese with a slightly better flavour during the last 3 weeks of storage.

Table (41): Changes in the organoleptic properties of white soft cheese manufactured from buffaloes' milk and UF-retentate of 80 and 50% concentrations during storage.

Storage time (Weeks)	Organoleptic score			Total
	Flavour	Body & texture	Apperance	
Control cheese (Buffaloes' milk)				
0 (Fresh)	45	23	9	77
1	48	24	9	81
2	48	25	9	82
3	49	25	9	83
4	50	24	9	83
80% retentate cheese				
0 (Fresh)	46	21	8	75
1	48	22	8	78
2	50	24	8	82
3	51	22	7	80
4	52	21	7	80
50% retentate cheese				
0 (Fresh)	45	21	8	74
1	44	22	7	73
2	43	23	7	73
3	40	20	6	66
4	38	18	6	62

Results also clarified that the 50% retentate cheese was of the lowest organoleptic quality as compared with either the control and/or the 80% retentate cheese during the whole storage periods especially during the last 3 weeks.

These results are matched with those obtained by Abd-El-Salam *et al.*, (1992) who reported that cheese with high lactose content was ranked of the highest score in organoleptic properties all through the storage period.