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COMPARISON OF CHEESE CHEMICAL ANALYSIS BY USING DIFFERENT TYPES OF COAGULATION

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ABSTRACT

For whole lactation period and all treatments, the average protein % was found as 14.42± 0.44, 11.96± 0.46 and 13.44± 0.74 when using renin, Osher (50%) and Jibeen (50%) enzymes respectively, 14.26± 0.36, 12.14± 0.35 and 13.61± 0,60 for renin, Osher (75%) and Jibeen (75%) enzymes respectively and 14.36± 0.39, 12.02± 0.26 and 13.55±± 0.42 for renin, Osher (100%) and Jibeen (100%) enzymes respectively. The average fat % obtained was 20.06± 0.84, 15.99± 0.75, and 16.95± 0.80, for renin, Osher (50%) and Jibeen (50%) enzymes respectively/. An average fat % of 19.97± 0.80, 16.00± 0.59 and 18.35± 0.44 obtained for renin, Osher (75%) and Jibeen (75%) enzymes respectively. Also a content of 20.39±0.57, 15.91± 0.40 and 18.54± 0.31% for renin, Osher (100%) and Jibeen (100%) enzymes respectively. The ash % when using renin, Osher (50%) and Jibeen (50%) enzymes obtained, was 4.27± 0.37, 3.27± 0.31, and 3.47± 0.26 respectively. Using renin, Osher (75%) and Jibeen (75%) enzymes, the ash % 4.07± 0.28, 3.04± 0.21, and 3.47± 0.26 respectively, and 4.12± 0.24, 3.04± 0.52 and 3.25± 0.16 for renin, Osher (100%) and Jibeen (100%) enzyme respectively. Also a significant variation ($p<0.05$) was detected betweenthe means of the milk components (protein, fat, ash %) for the different stages, whole lactation period and all treatments. The milk components showed low percentages, when plant enzymes were used compared to renin enzyme, Jibeen enzymes gave higher average % rather than Osher enzyme. In general, coagulating the milk with plant enzymes resulted in a decrease in the total solids % of the soft cheese in association with the type of coagulant used, variations in the contents of the milk components in addition to the method of coagulation used.

INTRODUCTION

The chemical composition of cheese was greatly affected by the type of coagulation.

Renin is the most popular enzyme for cheese making, it gives good results since the main cheese components (protein, fat and ash) were higher than the other plant coagulants, (Green, et. al. 1987).

Also Rollema et. al. (1988) reported that the levels of protein and total solids of white cheese tend to increase when milk coagulated by renin enzyme compared to different plant enzymes. Dalgleish et. al. (1989) gave that the ash content of cheese was created by using renin enzyme when the fat content of milk prepared for cheese making was increased. The fat % (4.4) of milk relatively increased, also the ash % (4.8) for white cheese compared to 2.2% of fat of milk where the ash % of cheese was 3.6%. In addition, the protein % followed the same trend since it was increased due to increase of fat % and renin coagulation rather than acid coagulation and plant enzyme coagulation.

Pszezola (1989) reported, the type of enzyme used for coagulation and the levels of total solids in milk used for cheese processing affect most of the cheese components and the cheese yield since the levels of protein, fat and ash % tend to increase, when the total solids of milk used for cheese making were high. The variation was clear and was significantly affected according to the type enzyme used for coagulation and it was found to be higher (protein, fat and ash percentage) when milk was coagulated by renin enzyme, compared to plant and microbial enzymes.

Reddly et. al. (1990) reported that the chemical composition of hard cheese differs greatly due to type of enzyme used for milk coagulation. The protein, fat, ash and total solids percentage of cow milk from the same stage of lactation (after two months up to four months after calving) showed a significant difference ($p<0.05$) for protein and fat percentages and the ash percentage was higher but no significant difference ($p>0.05$) for ash percentages was found when milk was coagulated by renin enzyme compared to plant enzymes and microbial enzyme. Furthermore, some plant enzymes, e.g. (Terrestiris enzymes) tend to give results near to the renin enzyme and also no significant difference between these enzymes and renin enzyme was detected. The results obtained by Kumosinski, et. al. (1991) showed that most of cheese components and its total solids differ according to the type of enzyme used for coagulation. The percentages of protein and fat showed a significant difference between renin

enzyme and two types of plant enzymes (two different concentrations of solanum and terristris enzymes). Terristris enzyme gave results near to that of the control enzyme, which was renin enzyme. Horme, (1990) compared three methods of coagulation enzymes (renin, fermentation produced chymosin (FPC) and plant enzyme), and found that the percentages of protein, fat and ash showed a significant difference ($p<0.05$) and they were highest for renin coagulation and lower when milk was coagulated by plant enzymes specially the enzyme extracted from (Calotropisprocera plant) due to the losses of most milk components with the drained whey according to weak curd formed when milk was coagulated by these enzymes.

Procedures of Manufacturing

Renin Cheese

1. 5kg of milk were taken from the milk of the dairy herd of Kenana farm.
2. Milk was heated to 72^{o}C, then cooled to 42^{o}C.
3. Starterculture was added (1%) and then temperature was adjusted to 42^{o}C for 45 minutes.
4. Renin enzyme was added, then coagulation of milk was observed.
5. Time of coagulation was recorded from the addition of the renin enzyme till the complete coagulation of milk occurred.
6. When coagulation occurred, the curd was put on wooden trail, surrounded by clothes with harrow orifices to ensure good draining of whey.
7. Cheese was salted by socking it into salty solution, where the concentration of Nacl was 10% for 24 hours.
8. The weight of cheese was determined after the salting was completely done after 24 hours from the beginning of cheese salting.

Osher Enzyme (Calotripisprocera) Cheese

1. 5 kg of cow milk were obtained from the milk of Kenana farm dairy herd.
2. Milk was heated to 72^{o}C and then cooled to 42^{o}C.
3. 1% of starterculture was added and temperature was adjusted to 42^{o}C for 45 minutes.
4. The extracted Osher enzyme was added at three different concentration (50%, 75%, and 100%) respectively during the first, second and third two months after calving respectively.
5. Time of coagulation was recorded from the addition of the enzyme till the complete coagulation of milk.
6. Cheese was salted by socking it into 10% solution of Nacl for 24 hours.

7. Cheese was weighted and its final weight was determined.

Jibeen Cheese (Solanumdubium)

1. 5kg of cow milk from Kenana dairy herd were used for cheese.
2. Milk was heated to 72^{o}C then cooled to 42^{o}C.
3. 1% of the starterculture was added and temperature was adjusted to 42^{o}C for 45 minutes.
4. Jibeen enzyme was added with three different concentrations (50%, 75% and 100%).
5. Time of coagulation was recorded from the addition of the enzyme till the complete coagulation occurred.
6. When coagulation occurred, the cheese was surrounded with clothes with narrow orifices and then put on wooden trails for complete draining whey.
7. Cheese was salted by Nacl by socking it into 10% Nacl solution for 24 hours.
8. Cheese weight was then determined.

RESULTS

Table (1): Average protein % obtained by using renin, Osher (50%) and Jibeen (50%) enzymes for lactation stages and whole lactation period for all treatments.

Treatment		Renin Control		Osher (50%)		Jibeen (50%)		Significance
Lactation Stage		Mean	SD	Mean	SD	Mean	SD	
(1)	1st stage	14.46	0.45	11.80	0.45	13.55	0.73	*
(2)	2nd stage	14.30	0.55	11.82	0.51	13.38	1.04	*
(3)	3rd stage	14.50	0.33	12.26	0.26	13.40	0.41	*
Total	Whole period	14.42	0.44	11.96	0.46	13.44	0.74	*

NS ≡ not significant

* ≡significant ($p < 0.05$)

Table (2): Average protein % obtained by using renin, Osher (75%) and Jibeen (75%) enzymes for lactation stages and whole lactation period for all treatments.

Treatment		Renin Control		Osher (75%)		Jibeen (75%)		Significance
Lactation Stage		Mean	SD	Mean	SD	Mean	SD	
(1)	1st stage	14.31	0.39	12.25	0.50	13.45	0.50	*
(2)	2nd stage	14.22	0.33	12.17	0.27	13.16	0.62	*
(3)	3rd stage	14.28	0.41	12.00	0.22	13.87	0.45	*
Total	Whole period	14.26	0.36	12.14	0.35	13.61	0.60	*

NS ≡ not significant

* ≡significant ($p < 0.05$)

Table (3): Average protein % obtained by using renin, Osher (100%) and Jibeen (100%) enzymes for lactation stages and whole lactation period for all treatments.

Treatment		Renin Control		Osher (100%)		Jibeen (100%)		Significance
Lactation Stage		Mean	SD	Mean	SD	Mean	SD	
(1)	1st stage	14.51	0.37	12.02	0.31	13.35	0.38	*
(2)	2nd stage	14.49	0.39	11.97	0.31	13.96	0.19	*
(3)	3rd stage	14.11	0.33	12.06	0.17	11.68	0.45	*
Total	Whole period	14.36	0.39	12.02	0.26	13.55	0.42	*

NS ≡ not significant

* ≡significant ($p < 0.05$)

Table (4): Average Fat % obtained by using renin, Osher (50%) and Jibeen (50%) enzymes for lactation stages and whole lactation period for all treatments.

Treatment		Renin Control		Osher (50%)		Jibeen (50%)		Significance
Lactation Stage		Mean	SD	Mean	SD	Mean	SD	
(1)	1st stage	20.30	0.78	15.66	0.67	19.58	0.94	*
(2)	2nd stage	19.57	0.77	15.76	0.65	17.97	0.52	*
(3)	3rd stage	20.32	0.85	16.55	0.65	18.72	0.54	*
Total	Whole period	20.06	0.84	15.99	0.75	16.95	0.80	*

NS ≡ not significant

* ≡significant ($p < 0.05$)

Table (5): Average Fat % obtained by using renin, Osher (75%) and Jibeen (75%) enzymes for lactation stages and whole lactation period for all treatments.

Treatment		Renin Control		Osher (75%)		Jibeen (75%)		Significance
Lactation Stage		Mean	SD	Mean	SD	Mean	SD	
(1)	1st stage	20.12	0.75	16.15	0.75	18.50	0.37	*
(2)	2nd stage	19.40	0.52	16.00	0.46	17.81	0.45	*
(3)	3rd stage	20.38	0.83	15.85	0.57	18.51	0.38	*
Total	Whole period	19.97	0.80	16.00	0.59	18.35	0.44	*

NS ≡ not significant

* ≡significant ($p < 0.05$)

Table (6): Average Fat % obtained by using renin, Osher (100%) and Jibeen (100%) enzymes for lactation stages and whole lactation period for all treatments.

Treatment		Renin Control		Osher (100%)		Jibeen (100%)		Significance
Lactation Stage		Mean	SD	Mean	SD	Mean	SD	
(1)	1st stage	20.31	0.66	15.73	0.51	18.13	0.36	*
(2)	2nd stage	20.31	0.57	15.76	0.24	18.71	0.20	*
(3)	3rd stage	20.55	0.52	16.05	0.38	18.56	0.26	*
Total	Whole period	20.39	0.57	15.91	0.40	18.54	0.31	*

NS ≡ not significant

* ≡significant ($p < 0.05$)

Table (7): Average ash % obtained by using renin, Osher (50%) and Jibeen (50%) enzymes for lactation stages and whole lactation period for all treatments.

Treatment		Renin Control		Osher (50%)		Jibeen (50%)		Significance
Lactation Stage		Mean	SD	Mean	SD	Mean	SD	
(1)	1st stage	4.23	0.31	3.53	0.26	3.52	0.29	*
(2)	2nd stage	4.25	0.43	3.11	0.26	3.55	0.27	*
(3)	3rd stage	4.35	0.40	3.16	0.23	3.36	0.22	*
Total	Whole period	4.27	0.37	3.27	0.31	3.47	0.26	*

NS ≡ not significant

* ≡significant ($p < 0.05$)

Table (8): Average ash % obtained by using renin, Osher (75%) and Jibeen (75%) enzymes for lactation stages and whole lactation period for all treatments.

Treatment		Renin Control		Osher (75%)		Jibeen (75%)		Significance
Lactation Stage		Mean	SD	Mean	SD	Mean	SD	
(1)	1st stage	4.20	0.29	3.10	0.20	3.60	0.20	*
(2)	2nd stage	4.02	0.25	3.10	0.22	3.25	0.22	*
(3)	3rd stage	4.00	0.30	2.92	0.21	3.57	0.22	*
Total	Whole period	4.07	0.28	3.04	0.21	3.47	0.26	*

NS ≡ not significant

* ≡significant ($p < 0.05$

Table (9): Average ash % obtained by using renin, Osher (100%) and Jibeen (100%) enzymes for lactation stages and whole lactation period for all treatments.

Treatment		Renin Control		Osher (100%)		Jibeen (100%)		Significance
Lactation Stage		Mean	SD	Mean	SD	Mean	SD	
(1)	1st stage	4.05	0.28	4.03	0.21	3.21	0.26	*
(2)	2nd stage	4.11	0.25	2.092	0.19	3.21	0.14	*
(3)	3rd stage	4.21	0.25	3.10	0.16	3.35	0.16	*
Total	Whole period	4.12	0.24	3.04	0.52	3.25	0.16	*

NS ≡ not significant

* ≡significant ($p < 0.05$)

DISCUSSION

Table (1) shows the average protein % obtained by using renin, Osher (50%) and Jibeen (50%) for lactation stages and whole lactation period. The average protein % for the whole lactation period was 14.42 ± 0.44, 11.96 ± 0.46 and 13.44±0.74 for renin, Osher (50%) and Jibeen (50%) enzymes for all treatments.

Table (2) shows average protein % obtained using renin, Osher (75%) and Jibeen (75%) enzymes for lactation stages and whole lactation period. The average protein % for the whole lactation period was 14.26 ± 0.36, 12.14 ± 0.35 and 13.61 ± 0.60 for renin, Osher (75%), and Jibeen (75%) respectively and for all treatments.

Table (3) shows the average protein % obtained using renin, Osher (100%) and Jibeen (100%) for different lactation stages and whole lactation period and all treatments was 14.36 ± 0.39, 12.02 ± 0.26 and 13.55 ± 0.42 for renin, Osher (100%) and Jibeen (100%) respectively. The results obtained showed a significant difference ($p<0.05$) between the average of protein % when using renin and different concentrations of Osher and Jibeen coagulants for all lactation stages, whole lactation period and all treatments. Similar results were also given by Caricet. al. (1995), Green et. al. (1987) and Bradly et. al. (1990). The differences in the protein content of the white soft cheese were associated with type of coagulant used for processing. Coagulating the milk with renin enzyme, the levels of protein tend to increase compared to plant enzymes (Rollman et. al. 1988), Dimitreli et. al. (2004) and (Kumosinski et. al. 1991).

Table (4) shows the average fat % obtained by using renin Osher (50%) and Jibeen (50%) enzymes for the stages of lactation and whole lactation period. The average fat % for whole lactation period for all treatments was 20.06±0.84, 15.99±0.75 and 16.95±0.80 for renin, Osher (50%) and Jibeen (50%) respectively.

Table (5) shows average fat % using renin, Osher (75%) and Jibeen (75%) enzymes for the 3 stages and whole lactation period. The average fat % for whole lactation period for all treatments obtained was 19.97±0.80, 16.00±0.59 and 18.35±0.44 for renin, Osher (75) and Jibeen (75%) respectively.

Table (6) shows average fat % using renin, Osher (100%) and Jibeen (100%) enzymes for lactation stages and whole lactation period.

The average fat % obtained for the whole lactation period and all treatments was 20.39±0.57, 15.91±0.40 and 18.54±0.31 for renin, Osher (100%) and Jibeen (100%) enzymes respectively. Also, results showed a significant difference ($p<0.05$) between the average fat % for all stages, whole lactation period and all treatments. The average fat % obtained when using renin enzyme was higher compared to that of the plant enzymes. This indicated, the type of coagulant used affected the fat component of the milk used. Also differences in the fat content of the raw milk prepared for white cheese processing and method of coagulation used cause variation in the final fat content of the finished cheese. This comes in agreement with that explained by Abdalla (1993) (Home 1990) and (Cari et. al. 1993).

Table (7) shows average ash % obtained using renin, Osher (50%) and Jibeen (50%) enzymes for the 1st. 2nd. and 3rd. stage of lactation and whole lactation period. The average ash % for the whole lactation period for all treatments obtained was 4.27±0.37, 3.27±0.31, and 3.47±0.26 for renin, Osher (50%) and Jibeen (50%) enzymes respectively.

Table (8) shows average ash % obtained using renin, Osher (75%) and Jibeen (75%) enzymes for different lactation stages and whole lactation period. The average ash % for the whole lactation period obtained was 4.07±0.28, 3.04±0.21 and 3.47±0.26 for renin, Osher (75%) and Jibeen (75%) enzymes respectively.

Table (9) shows the average ash % obtained using renin, Osher (100%) and Jibeen (100%) enzymes for lactation stages and whole lactation period. The average ash % for the whole lactation period and all 0treatments obtained was 4.12±0.24, 3.04±0.52 and 3.25±0.16 for renin, Osher (100%) and Jibeen (100%) enzymes respectively. A significant difference ($p<0.05$) was detected between the average of the ash % for the different stages, lactation period, renin enzyme and plant enzyme with different concentrations for all treatments. Ash content showed low percentages, when plants coagulants were used compared to renin enzyme. The chemical composition of cheese showed low cheese components, when the cheese milk was coagulated by plant enzymes (Bebe, 1980). In general, coagulating the milk with plant enzymes resulted in a decrease in the percentages of the total solids of white soft cheese. This agreed with that reported by Andren et. al. (1982), Dalglish (1985), Bines (1989) and Psozola (1989).

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