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EXTRACTION OF CASEIN FROM OUT DATED YOGHURT AND LONG LIFE MILK

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An attempt has been made to prepare caseins from fresh whole milk, expired ultra high temperature (UHT) milk and expired yoghurt by lactic acid precipitation. It was found that fresh whole milk casein was well comparable with standard casein in respect of lactose, protein and fat. Whereas caseins obtained from expired UHT milk and yoghurt had comparatively low lactose and protein but abnormally high fat content. Bulk density, porosity and water sorption power of these caseins were poor as compared to standard casein. Organoleptically the whole casein ranked good, whereas UHT milk and yoghurt caseins were fair. Removal of fat with hexane helped to improve the quality and storage stability of caseins obtained from out dated UHT milk and yoghurt.

Key words: Casein, Porosity, Water sorption.

Introduction

Casein is a complete protein which can be used as a supplement in wheat flour and in animal feeds [1,2]. Furthermore, compounds of casein with arsenic, iron, mercury, iodine and silver have been used in medicine. Although casein in the form of cheese has played an important part in the human race since immemorial time, yet it has several non-food uses [2,3].

In Pakistan a substantial quantity of milk and yoghurt become out dated in the market every year and are virtually being wasted [4]. These wastes can be utilized for the manufacture of some products of industrial importance such as casein and lactose.

The main purpose of this research project was, therefore, to utilize the dairy industry's reject material (i.e., expired UHT milk and expired yoghurt) for the preparation of casein and to evaluate its quality by comparing with standard casein.

Materials and Methods

The raw materials consisting of fresh whole milk, expired UHT milk and expired yoghurt were obtained from the Milkways plant situated at Tandlianwala.

Method of preparation of casein. Fat was removed from fresh milk, expired UHT milk and expired yoghurt by Alfa-Laval cream separator. Before separating cream from yoghurt, it was blended with water in the ratio of 1:1. The skimmed samples were warmed to 38° using water bath, lactic acid was added gradually with gentle agitation until mixture reached an isoelectric point of protein (pH 4.65). The curd so formed was drained to remove whey and washed 3-4 times with cold water to remove residual lactose and lactic acid, pressed to remove excess water and dried in hot air oven at 60° till the product attained 6.5±1.5% moisture. Finally the caseins were ground to pass 50 mesh screen and packed in plastic jars.

Evaluation of caseins. The caseins were evaluated for physico-chemical characteristics by comparing with standard casein. Fat, moisture protein, ash, acidity, solubility in water and lactose were determined according to standard methods [5]. Porosity, bulk density and water sorption power were measured [6]. The sensory evaluation of caseins was also carried out [7]. The skimmed samples of milk and yoghurt were also analysed for composition [5]. The data obtained on organoleptic quality were analysed statistically [8].

Results and Discussion

Recovery data. Recovery of cream from fresh whole milk, expired UHT milk and expired yoghurt was 9.80, 3.33 and 1.48% whereas the percentage of fat recovered from cream was 5.08, 1.59 and 0.73. The difference in recovery of fat from samples was due to the fact that milk was homogenised before manufacturing of UHT milk and yoghurt whereas fresh whole milk was not homogenised.

The caseins recovered were 3.4, 3.2 and 3.2% from fresh whole milk, UHT milk and yoghurt respectively.

The solids as sludge separated from UHT milk and yoghurt during skimming were 0.94 and 1.33% repsectively but fresh milk did not contain these solids. These solids might be additives used as stabilizer in processed milk and yoghurt.

Chemical composition: Raw materials. The skimmed samples of whole milk, UHT milk and yoghurt contained moisture 91.1, 91.2 and 90.5%; acidity 0.09, 0.10 and 0.56%; ash 0.8, 0.5 and 0.5%; protein 3.61, 3.40 and 3.44%; fat 0.24, 2.00 and 2.74%; whereas lactose 4.15, 2.60 and 2.45% respectively (Table 1). All the above values in this research study are in line with those of earlier [3].

Finished products. Table 1 shows that the caseins of standard, whole milk, UHT milk and yoghurt respectively had moisture 6.6, 6.6, 7.8 and 6.0%; acidity 0.08, 0.02, 0.02 and 0.1%; ash 5.0, 5.0, 4.0 and 4.2%; protein 85.74, 83.74, 73.90 and 69.66%; fat 1.0, 2.1, 16.3 and 20.12%; whereas the lactose percentage was 0.4, 0.15, 0.17 and 0.22%. All these values of caseins were comparable with the findings of earlier workers [1,2].

TABLE 1. CHEMICAL COMPOSITION OF RAW AND FINISHED PRODUCTS.

Components %	Fresh whole milk		Expired UHT milk		Expired yoghurt		Standard casein
	After skimming	Casein	After skimming	Casein	After skimming	Casein	
Moisture	91.10 ± 0.10	6.60 ± 0.10	91.20 ± 0.10	7.8 ± 0.20	90.50 ± 0.10	6.00 ± 0.00	6.00 ± 0.00
Acidity	0.09 ± 0.01	0.02 ± 0.00	0.10 ± 0.00	0.02 ± 0.00	0.56 ± 0.01	0.10 ± 0.10	0.08 ± 0.00
Ash	0.80 ± 0.10	5.00 ± 0.25	0.50 ± 0.00	4.00 ± 0.10	0.50 ± 0.01	4.20 ± 0.20	5.00 ± 0.00
Protein	3.61 ± 0.01	83.30 ± 1.11	3.40 ± 0.10	73.90 ± 1.50	3.44 ± 0.02	69.66 ± 0.02	85.74 ± 1.00
Fat	0.24 ± 0.02	2.10 ± 0.10	2.00 ± 0.06	16.30 ± 0.20	2.74 ± 0.10	20.12 ± 0.04	1.00 ± 0.00
Lactose	4.15 ± 0.02	0.15 ± 0.01	4.10 ± 0.10	0.17 ± 0.01	2.45 ± 0.01	0.22 ± 0.02	0.40 ± 0.01

Results are expressed as mean ± SD for three observations.

Physical quality of caseins. The bulk density of standard, whole milk, UHT milk and yoghurt caseins were 0.48, 0.68, 0.67 and 0.61 respectively. Porosity of standard casein was the lowest (0.19) and that of yoghurt was the highest (0.41). Both whole milk and UHT milk caseins had porosity value of 0.27 each. These differences in values between standard and other caseins were due to smaller size of particles and low level of fat in standard casein.

All the caseins were found to be insoluble in water. The water sorption power was 5.0, 4.9, 4.2 and 2.8% for standard, whole milk, UHT milk and yoghurt caseins respectively. The standard casein had less fat and hence absorbed more water, whereas the water sorption decreased with an increase in fat contents.

Sensory evaluation of caseins. All the caseins were subjected to sensory analysis for colour, flavour, taste and odour by a panel of seven judges using hedonic ratings for each ranging 0–10 (Table).

The standard, whole milk, UHT milk and yoghurt caseins respectively scored 40.0, 34.5, 25.1 and 20.4 out of total of 40 for standard of excellence. However, on the overall rating all the caseins were found acceptable.

Defattening of caseins. The skimming method seems ineffective for removal of fat from homogenised milk products. As caseins of UHT milk and yoghurt had abnormally high fat contents, which could deteriorate their keeping quality, so it was considered necessary to defat. On the basis of the initial trials it was found that the hexane was found to be the best solvent for defattening. The original fat in standard, whole milk, UHT milk and yoghurt caseins were 1.0, 2.1, 16.3 and 20.12% respectively but after defattening process it was 0.12, 0.66, 1.28 and 1.63% in these four samples.

TABLE 2. SENSORY EVALUATION OF DIFFERENT CASEINS.

Casein source	Out of 10 scores for standard of excelence				Overall rating (40)
	Colour	Taste	Flavour	Odour	
Standard	10.0±0.0	10.0±0.0	10.0±0.0	10.0±0.0	40.0 a
Whole milk	8.7±1.1	9.0±0.8	8.5±0.3	8.4±0.9	34.6 b
Expire UHT milk	7.1±1.0	6.0±1.2	6.0±0.8	6.0±0.8	25.1 c
Expired yoghurt	5.5±1.1	5.1±0.9	4.8±0.6	5.0±0.8	20.4 d

Results are expressed as means ±SD for seven judges. Mean values sharing same letter are non-significant.

It is concluded that casein prepared in laboratory was of good quality obtained from whole milk whereas those of expired UHT milk and expired yoghurt were fair in quality.

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