J. Agric. Sci. Mansoura Univ., 30 (10): 6085 - 6093, 2005

STUDY ON SPREADABLE PROCESSED CHEESE

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ABSTRACT

A process for the preparation of directly acidified co-precipitate curd (CB) with lactic acid and the replacement of unripened cheese (Passkey) was done to formulate processed cheese preparation. The blends containing 25, 50, and 75 % of CB. Vegetable fat was used, while commercial emulsifying salts adjusted the pH values in the manufacture of spreadable processed cheese. The chemical analysis of fresh spreadable processed cheese showed an increase in total solids (TS) and total protein (TP), but during storage period (3 months) a slight effect was observed on their chemical composition such as the moisture, fat and pH, this was related to proportional of the rate replacement. The replacement with the additive CB caused increase oiling off, meltability and penetration but during storage period, the meltability and firmness of the spreadable processed cheese were decreased. It was observed that replacement of passkey as cheese with CB improved the organoleptic properties of the resultant cheese. The optimum ratio of 50 : 50 % of passkey cheese to CB has been recommend for production of spreadable processed cheese. On the other hand, the total bacterial count was decreased while coliform bacteria, yeast and mould were disappeared.

Keyword : Co-precipitate, CB = cheese base, passkey cheese, low fat cheese, rheological properties, meltability, penetration, Firmness, Oiling - off .

INTRODUCTION

Spreadable processed cheese is a dairy product resulting from the mixing and heating of the blend. The quality of processed cheese is governed by multitude of factors: (a) The age and type of the cheese which used in the blend as well as block slices or spread multitude of factors. (b) Processing conditions. (c) Direct or indirect heating of the cheese blend. (d) Level of moisture content in the end product. (e) Amount and type of emulsifying salts used. (f)The added flavoring ingredients. (g) The consumer perceives the consistency. Rennet casein is generally regarded as the best ingredient among all types of casein in preparing processed analogues with good melting properties. In addition, rennet is relatively inexpensive and can be stored for long time without spoilage. Tamime *et al.*(1990) described as a diary product which is produced from standardized milk and chemical composition is similar cheese. Such a product may be achieved by the application of ultrafiltration (UF). Egyptian scientists have been experimenting with the use of local varieties of cheese and other dairy ingredient to manufacture processed cheese (Tamime and Younis, 1991). UF retentate has been used by Gouda and El - Shibiny (1987) to concentrate reconstituted skim milk powder and to use the UF retentate to replace 40% of base during the manufacture of processed cheese spread. More recently, Abo El - Nor *et al.* (1996 and 1998) demonstrated the suitability of a mixture of rennet casein (60-70%) and milk protein concentrate powder (30-40%) in

the manufacture of block and spread block and spread processed cheese analog. Abo EL - Nor *et al* (2001) used the native phosphocaseinate in the manufacture of block and spread processed cheese and whole milk protein concentrate in the manufacture of block and spreadable processed cheese analogs.

The aim of thy study is to develop the introduce CB in the manufacture of processed cheese by different ratios to give product similar quality of spre adable processed cheese .

MATERIALS AND METHODS

1.Materials :

Raw buffaloes milk was obtained from the Faculty of Agric. Al - Azhar Univ., Cairo, Egypt.Co-precipitate was prepared as cheese base.

Emulsifying salts: (JOHA) emulsifying salt was used commercial codes "S 9 s".

Skim milk powder : Natural non Fat dry milk powder low heat Extra Grade made from pasteurized milk origin India, was used

Vegetable oils : Hydrogenated palm kornel oil Laurie coca Butter substitute "Witco a 340 " origin Indonesia, was used. Lactic acid: Laboratory RE – AGENTS lactic acid was used.

2. Methods of analysis :

Chemical Composition :

Moisture, Fat content, protein and pH were determined according to the British standard Institution (1976).

Microbiological analysis :

Total bacterial count of milk and cheese were determined according to American Public Health Association (1987). Aerobic spore forming, Coliform, Yeast and Moulds count were determined as described by American Public Health Association (1987).

Experimental :

Passkey cheese manufacture :

It was carried out according to the method of Hofi *et al.*(1970).

Processed cheese making process :

Processed cheese was manufactured as described by Meyer (1973). Control was made without any additives. Milk co-precipitate was used as cheese base by ratios of 25, 50 and 75 %. Emulsified salts of (JOHA) was added.

Co - precipitate analysis :

Co-precipitate was prepared in the laboratory, curd of buffaloes milk was prepared as in Fig.(1).

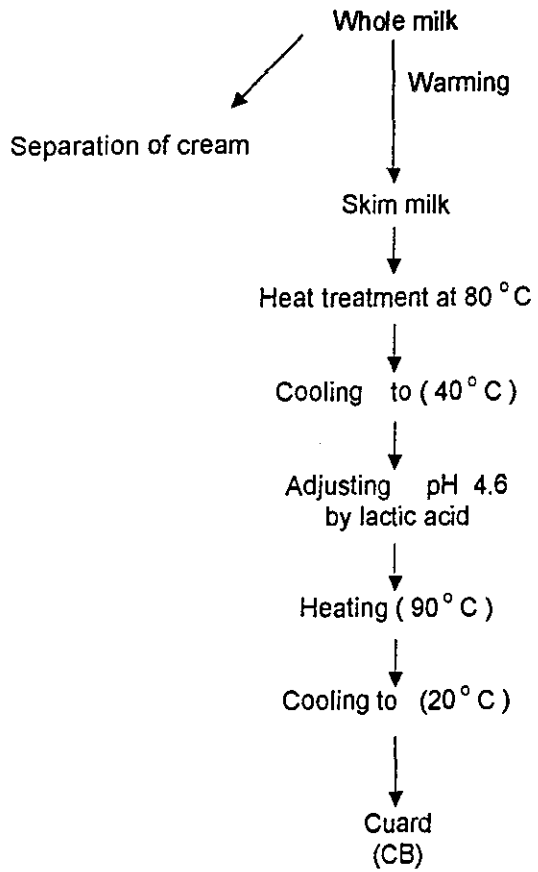

Fig. (1) : Preparation of co-precipitate as cheese base (CB).

Rheological properties :

Oiling - off (%) of cheese samples was determined as suggested by Nilson and Laclair (1976).

Melting of cheese samples were suggested, as well as by Olson and Price (1958), with slightly modified by Sallvello *et al.* (1989).

Curd Firmness of cheese samples were measured at 15^{0}C using a penetrometer cone of 30 angle and the speed of the cone was adjusted at 3 mm/see to a depth of 20 mm penetration was recorded in triplicate at 3 different spots in each sample .The firmness were recorded in Newton (N).

Sensory evaluation :

A score panel of some members of the staff of the Dairy Department, Al-Azhar University was carried out; body & texture, appearance, flavor and color according to the scale suggested by Meyer (1973).

RESULTS AND DISCUSSION

Chemical determination :

Four different batches (O, 25, 50 and 75 % CB) for passkey cheese (nature unripened without fat cheese), which made spreadabal processed cheese were analyzed. Table (1) showed that the chemical determination were affected by the rate of CB curd substitution. As shown from the data , the fat / dry mater (F/DM) ranged from 45.8 - 46.6 % , hence the change was independently of CB substituting ratio. The same trend was also appeared for the total solids content. Also the different amounts of added water resulted in a corresponding variation in pH values of cheese, while the pH value increased by increasing amount added water.

Microbiological Examination:

Heating of cheese blend is one of the most important step in making spreadable processed cheese, it is considered the main factor responsible for good keeping quality of cheese during the following period: fresh, 1, 2 and 3 months. Untabulated data showed that heating cheese blend caused in sharp reduction in total bacterial count, as well as the count of aerobic spore forming bacteria.

Table (1): Chemical and Microbiological composition of fresh spreadable processed cheese with different percentage co-precipitate curd (average of 3 replicates).

Cheese analysis	Percentage of CB substitution			
	Control	25 %	50 %	75 %
Chemical: Moisture	58.6	58.8	58.4	58.2
Fat	19	19.2	19.3	19.5
TS	41.4	41.2	41.6	41.8
F/ DM	45.8	46.6	46.3	46.6
pH	5.7	5.7	5.7	5.7
TP / DM	5.65	5.54	5.52	5.51
Microbiological: TC	22×10^2	21×10^2	17×10^2	15×10^2
Aerobic forms	15×10^2	19×10^2	14×10^2	15×10^2
Coliform	ND	ND	ND	ND
Yeast & Mould	ND	ND	ND	ND

ND= Not detected.

However, the aerobic spore forming bacteria comprised mostly the whole sum of total bacterial count such finding might be attributed to the heat resistance ability of aerobic spore formers bacteria. The obtained results were in agreement with those stated by Abdel - Baky *et al.* (1987). They gave a close count for each total and aerobic spore former bacterial count in processed cheese made from co-precipitate curd prepared by direct acidification. On the other hand, the results of coliform bacteria, yeast and mould determination indicated that the heating treatment of cheese blend at 90^0C /10 min. caused in complete ubsent of all coliform bacteria, yeast and mould being existed in either cheese cured or CB , which had been introduced in preparing cheese blend.

Rheological properties:

Addition of CB to processed cheese gave Rheological properties better than the control. Table (2) showed the Rheological properties of processed cheese samples either of control or the made by using Co-precipitate (CB).

Table (2): Rheological properties of spreadable processed cheese.

Treatments	Consistency (PE)	Oiling-off (%)	Meltability (mm)
CB: Passkey Control	144	55	23
25 : 75	147	54	26
50 : 50	150	54	29
75 : 25	155	52	32

The Results of (CB) were slightly more than of control for consistency and meltability and slightly less for oiling - off. So, when increase (CB) substitution of passkey cheese gave best results of rheological properties such as; meltability range (23 , 26 , 29 , 32 mm), oiling of range (55 , 54, 54, 52 %), consistency rang (144,147, 150, 155 mm), the best ratio of (CB) was 50 % substitution of passkey cheese and melted very well and very open structure.

Organoleptic properties:

The consumption of processed cheese is mainly determined by its organoleptic properties such as; flavor, appearance and structure. Indeed the involving of any new ingredient into cheese blend should be evaluated throw its affect on organoleptic properties of produced cheese. Table (3) showed the organoleptic properties assessment of processed cheese samples, either of control or this made by using co-precipitate (CB). The tabulated results revealed that the mean organoleptic score of control samples (92 points), while that of processed cheese of 50 % replaced CB curd being (91 points) for spreadable processed cheese .

The evaluation of the other CB replacement ratios (25 and 75 %) showed that the lowest score. Also, it could be observed that values of variation in organoleptic properties between cheese samples were mostly due to flavor followed by appearance properties, however the structure properties did not exert such different. These results could supported the flavor of produced spreadable processed cheese were the best flavor provide 50% replaced ratio. These results disagreement with Olson and Jounson (1990) ; Mistry *et al.*, (1996) and Mistry (2001). However, an optimum ratio (50:50) of matured cheese CB has been recommend for the production of spreadable processed cheese, and if the proportion of CB in the blend was increased more than 50% the taste of the products becomes flat and lacking the typical taste of natural cheese.

Mean values of the organoleptic scores within each processed cheese, were examined after manufacture by panel test and score were awarded for appearance (20 points) structure (20 points) , Flavor and aroma (40 points), according to Meyer, (1973).

Table (3): Organoleptic scores of spreadable processed cheese.

Properties	Control	Percentage of (C .B)		
		25 %	50 %	75 %
Appearance (20)	18	17	18	18
Structure (40)	35	33	35	33
Flavor (40)	39	37	38	38
Total (100)	92	87	91	89

Effect of storage on properties of spreadable processed cheese :

Table (4) showed that results of the chemical composition of spreadable processed cheese as revealed by the moisture and pH, values were stable.

Table(4): Chemical, Microbiological composition and Rheological properties of spreadable processed cheese during storage period (3 months).

Treatment	Storage Period (3 months)	Storage temperature	
		4 - 8 °C	20 - 25 °C
Chemical analysis			
Moisture %	Fresh	58.8	58.8
	1	58.8	58.7
	2	58.75	58.65
	3	58.7	58.6
Fat / DM	Fresh	46.6	46.6
	1	46.6	46.9
	2	47.2	47.9
	3	47.8	48.3
PH	Fresh	5.7	5.7
	1	5.7	5.7
	2	5.7	5.7
	3	5.7	5.65
T.P/DM	Fresh	5.54	5.54
	1	5.54	5.6
	2	5.6	5.62
	3	5.56	5.66
Microbiological Analysis			
Total count	Fresh	25×10^2	25×10^2
	1	25×10^2	26×10^2
	2	27×10^2	27×10^2
	3	28×10^2	28×10^2
Acrobic Spore form bacteria	Fresh	14×10^2	14×10^2
	1	14×10^2	15×10^2
	2	16×10^2	17×10^2
	3	17×10^2	18×10^2
Rheological properties			
Consistency (PE)	Fresh	150	150
	1	150	148
	2	149	146
	3	148	145
Oiling -off %	Fresh	55.4	55.4
	1	55.5	55.2
	2	55.9	56.3
	3	56.1	57.5
Meltability (mm)	Fresh	29	29
	1	28.7	28.2
	2	27	26.1
	3	26.5	25.3

It could be concluded that content did not show in remarkable change during storage period (3 months) at refrigerator, while there was slight decrease in the moisture content during storage period (3 months) at room temperature (20 - 25 ^{0}C). The increase of Oiling -off during storage period (3 months) at room temperature 20 - 25 ^{0}C was higher than that storage at refrigerate.

The addition of (CB) in processed cheese spread improved its meltability as judged from comparing substation ratio. Generally, the meltability of the processed cheese spread tended to decrease with storage period (3 months) .

Results observed a slightly decrease in consistency of spreadable processed cheese during storage period (3 months). In general, trend of total bacterial count of spreadable processed cheese was relatively low after manufacture. At the end of storage period , total bacterial count was higher than fresh processed cheese . Similar results were previously reported for processed cheese by Shendy & Shukry (1993) and Emara (1984).

Organoleptic Evaluation :

The organoleptic evaluation of spreadabale processed cheese stored at different temperatures shown in Table (5). From these data, it could be seen that processed sample stored at refrigerator (5 - 8 $^{\circ}$C) maintained their satisfactory flavor, appearance and texture during storage period for one month. While, the appearance, flavor and texture of spreadable processed cheese samples stored at room temperature (20 - 25 $^{\circ}$C) were accepted . Similar results were previously by Emara (1984).

Table (5): Organoleptic scores of spreadable processed cheese during storage period (3 months).

Properties		Storage Period (3 months)	Storage temperature	
			4 - 8 $^{\circ}$C	Room tem 20 - 25° C
Appearance	(20)	0	18	18
Structure	(40)		35	35
Flavor	(40)		38	35
Total	(100)		91	91
Appearance	(20)	1	18	18
Structure	(40)		35	35
Flavor	(40)		37	37
Total	(100)		90	90
Appearance	(20)	2	17	17
Structure	(40)		35	34
Flavor	(40)		36	35
Total	(100)		88	86
Appearance	(20)	3	17	16
Structure	(40)		35	33
Flavor	(40)		36	34
Total	(100)		88	83

REFERENCES

Abdel - Baky, A.A. ; El Nashawy, A.A. ; Farahat, S.M. amd El - Desoki, M.E. (1987). The use of Ras cheese made by direct acidification in the manufacture of processed cheese spread. Egpt. J. of Dairy Sci., 15: 273.

Abo El - Nour A. ; Scheurer Gomar M. and Buchheim, W. (1996). Physicochemical and rheological properties of block-type processed cheese analogue manufacture from rennet casein and total milk protein, Milchwissenscaft 51: 684.

Abo El - Nour A. Scheurer Gomar M. and Buchheim, W. (1998). Use of rennet casein and milk protein concentrate in the production of spread – type processed cheese analogues , Milchwissenscaft 53 :686.

Abo El - Nour A. ; Buchheim, W. and M.H. Abdel - Salam (2001). The use Novel milk protein preparation in the manufacture of processed cheese analogue. Egyptian J. Dairy Sci. 29: 313.

American Public Health Association , Inc. (1967) . Standard Methods for the Examination of Dairy Products , 1790 Broadway , New York , 19 . U.S.A .

British Standard Institution (1976). Gerber Method for the determination of fat in milk products, British Standard Institution England Bs: 696 part 2.

Emara , H. M. (1984). Effect of storage period on properties of processed cheese MSc .Thesis, Zagazig University.

Gouda, A. and El - Shibiny, S. (1987). The use of Ultrafiltersed skim milk in the manufacture of processed cheese spread. Egyptian J. Dairy Sci. 15: 255.

Hofi, A. A. ; Youssef, E. H. ; Ghoneim, M.A. and Tawab G. A. (1970). Ripening changes in cephalotyre "Ras cheese manufacture from raw and pasteurized milk with special referenced to flavor". Dairy Sci. 53:1207.

Meyer, A . (1973). Processed cheese manufacture , Food trade press Ltd, London .

Mistry, V. V. ; Metzger, L. E. and Maubis, J. L. (1996). Use of ultrafiltrated sweet butter milk in the manufacture of reduced fat chedder cheese. J. Dairy Sci. 79:137.

Mistry, V. V. (2001). Low fat cheese technology. Int. Dairy J. 1:43.

Nilson K. M. and Laclair F. A. (1976).A national survey of quality of Mozzarella cheese from ultrafiltered whole milk retentates. Amercan Dairy Review (10), 18 Indian Dairy Sci.,54 :10.

Olson, N. F. and Jounson, M. E. (1990). Light cheese products factories and economics. Food Tech. 44:93.

Olson, N. and Price, W. (1958). A milking test for pasteurized processed cheese spread. J. dairy Sci. 4: 999.

Sallvello, p. ; Ernstrom, C. and kalab, M. (1989). Microstructure and meltability of model processes cheese made with rennet casein and acid casein. J. Dairy sci. 72 :1.

Shendy, A. E. M. and Shukry, A. H. H. (1993). Acceleration ripening of unprocessed Ras cheese curd by using mixed lactic , and proteolytic stsrter . Al-Azhar J. of Agric. Res. Vol. (18) :165.

Tamime, A. Y. ; Youns, M. F. and Davies, G. (1990). Quality of processed cheese mad from reconstitute skim milk powder cheese base. J. Dairy Sci. 18:15.

Tamime, A. Y. and Youns, M. F. (1991). Production of processed cheese using chedder cheese and cheese base. 1. Aspects of processing. Milchwissenschaft, 46 (7) : 423.

دراسة على مفرود الجبن المطبوخ

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تم ترسيب الخثرة الحامضية (CB) بالتحميض المباشر بواسطة حمض اللاكتيك بغرض استبدالها محل الجبن الباسكى الطازج كدعامة أساسية فى صناعة الجبن المطبوخ .

وتم إضافة (CB) الخثرة الحامضية بنسب استبدال ٢٥ % ، ٥٠ % ، ٧٥ % مع استخدام دهن نباتى للمخلوط . وتم ضبط pH ثابت للجبن المطبوخ بواسطة استخدام ملاح استحلاب .

وكان التحليل الكيماوى للجبن المطبوخ الطازج زيادة المواد الصلبة والنيتروجين الكلى وكان التأثير طفيفاً للتركيب الكيميائى للجبن المطبوخ أثناء فترة التخزين (٣ شهور) على درجة حرارة (٤ - ٦° م) مثل الرطوبة والدهن ، pH ، وذلك بتغير نسب الاستبدال . أما التحليل البكتريولوجى فقد أوضحت النتائج تناقص كلا من العدد الكلى للبكتريا للبكتريا والجراثيم نتيجة للمعاملة الحرارية المستخدمة فى التصنيع ، كما لوحظ زيادة فى أعدادها بزيادة مدة التخزين سواء فى الجو العادى أو فى الثلاجة أما الخمائر والفطريات فقد اختفت تماماً.

إضافة (CB) الخثرة الحامضية بنسبة استبدال مختلفة أدت إلى زيادة زادت كلا من خاصية Oiling-off والانصهار وأيضا حسنت من القوام وذلك للجبن المطبوخ الطازج . بينما قلت هذه النسب أثناء فترة التخزين (٣ شهور) .

نسبة الاستبدال الخثرة الحامضية CB بدلا من الجبن الباسكى أدت الى تحسين الخواص الحسية مثل القوام والتركيب واللون والمظهر للجبن المطبوخ الناتج . وكانت أفضل نتائج نسب الاستبدال ٥٠ : ٥٠ للخثرة الحامضية و الجبن الباسكى على التوالى فى صناعة الجبن المطبوخ .