IMPROVEMENT OF WHITE CHEESE SPREAD PROPERTIES 1. COPARATIVE STUDYSITION

Ismail, M.M[1]. and M.N. Hamad[2]

[1]Dairy Technology Department, Animal Production Research Institute, Agricultural Research Centre, Dokki, Giza and [2]Dairy Science Department, Faculty of Agriculture, Damietta University.

ABSTRACT

The aim of this study was to develop properties of white cheese spread by using various ingredients. Seven treatments of cheese were manufactured from different ratios of quark, Ras, Cheddar, precooked cheeses, skim milk powder, whey powder, palm and butter oils and emulsifiers. Resultant cheese was stored for 8 weeks at 5 or for 4 weeks at 25°C. Increasing amount of Ras and Cheddar cheese added to the blend of processed cheese spread decreased the pH values while increased water soluble nitrogen of the resultant cheese. Total solids, fat, total nitrogen and total volatile fatty acids values of cheese raised by increasing proteins and oils in the blends. Heating of cheese blends at 85°C for 15 min. decreased total viable bacterial count and mould and yeast numbers. From the sensory evaluation, the treatment which gained the highest scores contained quark 30%, Ras cheese 5%, precooked cheese 5%, Cheddar cheese 4%, palm oil 15%, butter oil 3%, skim milk powder 2%, whey powder 3%, emulsifying salts 3% and water 30%.

Key words: *White cheese spread- ingredients- Ras cheese*

INTRODUCTION

Cheese spread is a soft, spreadable, cheese or product containing cheese. The process cheese spread is produced by blending natural cheese in the presence of emulsifying salts and other dairy and nondairy ingredients followed by heating and continuous mixing to form a homogeneous product with an extended shelf life. Various chemical and compositional properties of process cheese affect the final functional properties of process cheese. Therefore, while formulating a process cheese, manufacturers often try to control the final chemical properties of process cheese through appropriate selection of ingredients in order to achieve a process cheese formula that will have a specific functional property after it is manufactured. However, the availability of natural cheese (type and age), cost, availability of other ingredients, and presence or absence of rework varies from day to day. These are some of the constraints that manufacturers have to deal with while formulating their process cheeses in order to achieve a final product with consistent functional properties on a daily basis (Kapoor and Metzger 2008).

Tamime (2011) showed that there are many types of processed cheese made worldwide. They are grouped into two different categories based on the physical characteristics of the product: processed cheese and spreadable processed cheese. Smith (1990) proposed that the main difference between processed cheese and processed cheese spread products is the level of moisture content in the product, which affects its rheological properties, the spreadable type being softer. However, the commercial manufacture of processed cheese may also include the ‘block’ and ‘slices’ types.

In Egypt, white soft cheese spread is a new dairy product which made in many areas. It is a favorable cheese for large numbers of consumers because of its delicious taste, white color and easily spreadable. Unfortunately, some defects appear in this cheese like crystals formation and sweet taste.

The present study aimed to use different ingredients to manufacture of soft cheese spread with good quality and shelf life.

MATERIALS AND METHODS

Materials:

Quark cheese used in the ingredient blends was prepared from skim milk concentrates by reconstituting, then added 10% palm oil and homogenized at 50 bars, then added citric acid and rennet at pH 5.2. Ras cheese (2-3 months) was obtained from private Ras cheese production laboratory in Domiatta Governorate. Precooked cheese was the residual of previous processed cheese blend. Three months old Cheddar cheese was imported from Newzeland by El_Amreity Company, Alobour city, Egypt. The chemical composition of quark, Ras cheese, Cheddar cheese and precooked cheese was indicated in Table (1).

The emulsifying salts used were Egy Phos S20, Egy Phos SCC and Egy Phos B3 emulsifier (consists of sodium monophosphate, sodium diphosphate, sodium polyphosphate and sodium orthophosphate) which obtained from The Egyptian Company for Dairy Products and Food Additives, 10th of Ramadan city, Egypt and CR 15 emulsifier (consists of sodium polyphosphate and sodium triphosphate) which obtained from Magic Line Company, Mansoura City, Dakahlia Governorate, Egypt.

Other ingredients were whey powder (imported from USA and packaged by Misr Food Additives Company, Badr City, Egypt), butter oil (imported from France by Flecgard, S.A., Importer, Arab Trading Company), Cocoa butter substitute (imported from Premium Vegetable Oils Company, Kuala Lumpur, Malaysia), skim milk powder (low heat – spry dried – ADPI Extra Grade, imported from Germany by El_Amreity Company, Alobour city, Egypt) and potassium sorbate (Pharmacentical Company, Pfizer).

Table 1. Chemical composition of ingredients

Ingredients	pH	TS %	Fat %	Protein %	Salt %
Quark	5.18	32.54	13.4	12.27	0.24
Ras cheese	4.94	68.24	36.2	29.67	3.1
Precooked cheese	5.56	55.51	28.7	8.5	1.9
Cheddar cheese	4.73	63.48	34.5	26.7	1.4
Whey powder	--	95.11	2.0	10.0	-
Skim milk powder	--	96.53	3.0	37.4	-

Manufacture of white cheese spread:

The manufacture of cheese spread was carried out as described by Meyer (1973). The detailed ingredients blends and formulations for seven cheese

treatments are indicated in Table (2). Processed cheese spread was made as follows:

Ras cheese was cut into small-pieces with a sharp knife. The pieces were fed into electric mincer to convert them into finally minced cheese. Each formulation of blends was placed in a 15 kg processing tanks (double jackets tank), closed and heated by undirected fire under atmospheric pressure and continuous stirring “100 RPM”, at a temperature of 80-85°C for 15 minutes. The resultant processed cheese spread of all treatments were filled in 120 g plastics and stored for 8 weeks at 5±1°C (refrigerator) or for 4 weeks at 25±3°C (room temperature). The processed cheese spread were chemically, microbiologically and organoleptically analyzed while fresh and then each week during the storage period.

Table 2. White cheese spread formulation

Ingredients %	Treatments						
	A	B	C	D	E	F	G
Quark	30	30	30	30	30	30	30
Ras cheese	4	5	3	5	8	4	5
Precooked cheese	6	2	5	7	4	5	5
Cheddar cheese	0	3	2	0	1	1	4
Skim milk powder	5	6	4	2	6	5	2
Whey powder	0	1	3	4	0	2	3
Palm oil	21	12	19	17	18	17	15
Butter oil	0	8	1	5	0	3	3
Emulsifying salts	3	3	2.5	3	3	2.5	3
Water	31	30	30.5	27	30	30.5	30
Total	100	100	100	100	100	100	100
Preservatives	**0.2% potassium sorbate with cheese ingredients and surface spray before closing**						

Methods:

The chemical composition of various ingredients and cheese spread samples were determined in triplicate (AOAC, 1990). The fat content of samples was determined by the Babcock-fat test described by Bartels et al., (1987). Cheese pH was measured using a Spear Tip combination electrode (VWR Scientific, Montreal, QC, Canada). Salt contents of ingredients were estimated using Volhard method according to Richardson (1985). Total volatile fatty acids (TVFA) was determined as described by Kosikowski (1978), and expressed as ml of 0.1N NaOH, 100 g-1 cheese. Cheese samples were analyzed for total viable bacterial count (TVBC); colifom bacteria; staphylococci; moulds and yeast counts according to the methods described by the American Public Health Association (1992). The cheese samples were scored for flavor (50 points), body and texture (35 points) and appearance and color (15 points) by twenty panelists in Dairy Department, Faculty of Agriculture, Damiatta University.

RESULTS AND DISCUSSION

Chemical composition of white cheese spread:

The average chemical composition of seven treatments of processed cheese spread stored at 5 and 25°C was reported in Table 3. As it is expected, preservation of cheese by refrigeration at 5°C increased its shelf life to eight weeks while it just was four weeks for treatments stored at 25°C.

There was clear variation in the gross composition of the processed cheese spread. This was attributed to the use of different raw ingredients in cheese manufacturing. Treatments A, C, D and F had the highest pH values whereas samples B, E and G possessed the lowest one. This may be due to the high content of treatments B, E and G from Ras and Cheddar cheeses which had low pH values (4.94 and 4.73 respectively). The total contents of Ras and Cheddar cheeses in A, B, C, D, E, F and G samples were 4, 8, 5, 5, 9, 5 and 9% respectively.

Gradual decrease in pH values was noticed in both cheese stored at 5 and 25°C. However, the great decrease occurred in cheese stored at 25°C. The observed differences in cheese pH between treatments stored at refrigerator and others stored at room temperature may be related to a difference in bacterial growth and enzymatic activation rates in both cheese treatments which happened slowly in cold storage cheese. Similar results were reported by Hamad and Ismail (2009).

Shirashoji *et al.,* (2006) showed that the type and level of emulsifying salts and the type and age of natural cheese used during process cheese manufacture have a marked influence on the final pH of the resulting process cheese.

There were no pronounced differences in TS contents of different treatments at zero time or during storage period except D treatment which had high TS values as compared with other treatments. TS contents of A, B, C and D samples kept at 5°C after eight weeks were 44.23, 44.76, 43.78 and 47.02% respectively. This was associated with the high TS content of formulation ingredients of treatment D (Table 2).

High palm and butter oils percentages in formulation ingredients of A and D samples resulted high fat contents in the produced cheese. At the end of storage period, fat ratios of treatments A, B, C, D, E, F and G stored at 5°C were 28.30, 27.40, 27.22, 29.58, 26.40 and 27.77% respectively.

The salt contents were approximately similar for different cheese spread treatments at zero time or within storage period. The salt percentages of A, B, D and F samples preserved by cooling were 1.36, 1.26, 1.26 and 1.29% respectively after eight weeks of storage.

Prolongation of the storage period had no clear effects on contents of TS, fat and salt in all cheese variants stored at cooling or room temperatures.

The differences in TN content (1.20 to 1.31%) between samples reflected differences between formulations (Table 4). As a result of high protein contents of formulations ingredients, cheese treatments B and E had the greatest protein contents while treatment D had the lowest one. The total protein contents calculated from quark, Ras cheese, precooked cheese, Cheddar cheese, skim milk powder and whey powder for every formulations

Table 3. Effect of using various ingredients and storage temperature on the chemical composition of white cheese spread

Treatments	Storage time (weeks)	pH values		TS (%)		Fat (%)		Salt (%)	
		Storage temperature °C							
		5	25	5	25	5	25	5	25
A	0	5.91	5.91	44.15	44.15	28.05	28.15	1.35	1.35
	1	5.88	5.84	44.00	44.25	27.90	28.25	1.35	1.34
	2	5.82	5.75	43.98	44.23	27.85	28.27	1.34	1.33
	3	5.79	5.65	43.99	44.32	28.00	28.27	1.36	1.35
	4	5.76	5.54	44.10	44.41	28.10	28.25	1.35	1.36
	5	5.71	-	44.15	-	28.10	-	1.33	-
	6	5.65	-	44.18	-	28.15	-	1.34	-
	7	5.57	-	44.16	-	28.15	-	1.35	-
	8	5.48	-	44.23	-	28.20	-	1.36	-
B	0	5.80	5.80	44.71	44.71	27.35	27.35	1.25	1.25
	1	5.78	5.71	44.68	44.74	27.25	27.30	1.25	1.24
	2	5.72	5.65	44.70	44.75	27.32	27.40	1.24	1.23
	3	5.70	5.55	44.72	44.64	27.35	27.37	1.26	1.25
	4	5.56	5.50	44.75	44.75	27.35	27.40	1.25	1.26
	5	5.51	-	44.75	-	27.35	-	1.23	-
	6	5.35	-	44.80	-	27.40	-	1.24	-
	7	5.30	-	44.82	-	27.40	-	1.25	-
	8	5.28	-	44.76	-	27.45	-	1.26	-
C	0	5.87	5.87	43.69	43.69	27.05	27.05	1.15	1.15
	1	5.84	5.80	43.53	43.71	27.1	27.15	1.15	1.14
	2	5.80	5.71	43.75	43.67	27.2	27.20	1.14	1.13
	3	5.77	5.56	43.66	43.55	27.15	27.15	1.16	1.15
	4	5.66	5.44	43.90	43.73	27.3	27.22	1.15	1.16
	5	5.61	-	43.81	-	27.25	-	1.13	-
	6	5.55	-	43.74	-	27.20	-	1.14	-
	7	5.47	-	43.69	-	27.20	-	1.15	-
	8	5.45	-	43.76	-	27.25	-	1.16	-
D	0	5.85	5.85	46.97	46.97	29.50	29.50	1.24	1.24
	1	5.83	5.80	46.90	47.01	29.40	29.55	1.25	1.26
	2	5.82	5.71	46.91	47.13	29.40	29.57	1.23	1.33
	3	5.79	5.56	46.88	47.10	29.40	29.55	1.26	1.35
	4	5.78	5.41	46.95	47.07	29.45	29.58	1.25	1.36
	5	5.71	-	47.00	-	29.45	-	1.23	-
	6	5.56	-	47.05	-	29.50	-	1.24	-
	7	5.49	-	47.10	-	29.55	-	1.25	-
	8	5.41	-	47.02	-	29.55	-	1.26	-
E	0	5.79	5.79	44.49	44.49	26.25	26.25	1.40	1.40
	1	5.74	5.74	44.51	44.52	26.20	26.35	1.41	1.45
	2	5.68	5.70	44.52	44.55	26.25	26.40	1.42	1.48
	3	5.62	5.65	44.50	44.58	26.25	26.35	1.42	1.52
	4	5.61	5.44	44.52	44.61	26.30	26.40	1.41	1.56
	5	5.55	-	44.52	-	26.30	-	1.43	-
	6	5.46	-	44.60	-	26.25	-	1.44	-
	7	5.41	-	44.61	-	26.30	-	1.45	-
	8	5.36	-	44.60	-	26.35	-	1.46	-
F	0	5.90	5.90	44.09	44.09	27.75	27.75	1.22	1.22
	1	5.88	5.80	44.08	44.12	27.75	27.70	1.23	1.23
	2	5.81	5.71	44.10	44.15	27.70	27.75	1.24	1.23
	3	5.77	5.61	44.12	44.18	27.75	27.80	1.24	1.24
	4	5.73	5.50	44.12	44.22	27.75	27.77	1.25	1.23
	5	5.71	-	44.15	-	27.75	-	1.25	-
	6	5.62	-	44.16	-	27.80	-	1.26	-
	7	5.56	-	44.18	-	27.80	-	1.27	-
	8	5.49	-	44.16	-	27.85	-	1.29	-

Table 3 continued

G	0	5.81	5.81	43.77	43.77	26.75	26.75	1.35	1.35
	1	5.76	5.70	43.78	43.81	26.70	26.75	1.34	1.34
	2	5.73	5.68	43.79	43.82	26.70	26.75	1.34	1.33
	3	5.68	5.56	43.79	43.84	26.75	26.85	1.35	1.34
	4	5.63	5.41	43.81	43.88	26.75	26.80	1.36	1.35
	5	5.60	-	43.80	-	26.75	-	1.34	-
	6	5.58	-	43.81	-	26.80	-	1.34	-
	7	5.54	-	43.82	-	26.85	-	1.35	-
	8	5.44	-	43.82	-	26.80	-	1.36	-

ingredients were 7.27, 8.49, 7.34, 6.92, 8.93, 7.65 and 7.72% for A, B, C, D, E, F and G treatments respectively. On the other hand, storage of white cheese spread for four or eight weeks at 25 and 5°C had no pronounced effects on protein percentages of various samples.

Water soluble nitrogen (WSN) contents were higher in B, E and G treatments than those of A, C, D and F samples (Table 4). This may be attributed to the high contents of ripened Ras and Cheddar cheeses in cheese blends of samples B, E and G. On the other side, gradual increase in WSN contents of the variants of processed cheese spread was observed during storage period either in refrigerator or at room temperature. The higher values of WSN/TN obtained in cheese stored at room temperature might be explained by the retarding effect of refrigerator on the activity of proteolytic organisms or enzymes during storage time (Hamad 1997).

The characteristics of natural cheese(such as Cheddar, Swiss or Ras) utilized to manufacture process cheese have a major influence on process cheese characteristics and appropriate selection of natural cheese is critical in order to achieve a process cheese with the desired chemical and functional characteristics (Zehren and Nusbaum 2000).

Because of high contents of palm and butter oils of A, D and F blends, the total volatile fatty acids (TVFA) values in these treatments were higher than those of other samples at zero time and during storage period (Table 4). TVFA contents of all samples stored at 5 and 25°C gradually increased within storage period and the rates of increasing were higher for samples kept at 25°C than that stored at 5°C. This may be due to fat breakdown by lipases enzymes to volatile fatty acids.

All processed cheese spread met the Egyptian legal standard (Egyptian Standard Organization, 2002).

Kapoor and Metzger (2008) stated that the differences in the source and age of natural cheese on a daily basis lead to variations in the total calcium content, pH, and intact casein content of the process cheese and hence the functional properties of the process cheese. Also, the type and amount of emulsifying salts that are added to process cheese influence the state of calcium in process cheese and the process cheese pH.

Because the emulsifying salts are a major ingredient in process cheese manufacture, in our study sodium phosphate salts were used as appropriate emulsifiers for processed cheese spread. Mizuno and Lucey (2005) stated that trisodium citrate is the preferred emulsifying salt for slice-on-slice

Table 4. Effect of using various ingredients and storage temperature on TN, SN and TVFA of white cheese spread

Treatments	Storage time (weeks)	TN (%)		WSN (%)		WSN/TN (%)		TVFA*	
		Storage temperature °C							
		5	25	5	25	5	25	5	25
A	0	1.20	1.20	0.818	0.818	68.17	68.17	16	16
	1	1.20	1.21	0.845	0.905	70.42	74.79	21	21
	2	1.20	1.21	0.854	0.961	71.17	79.42	24	27
	3	1.21	1.22	0.881	1.001	72.81	82.05	28	31
	4	1.21	1.22	0.901	1.020	74.46	83.61	31	37
	5	1.22	-	0.925	-	75.82	-	34	-
	6	1.23	-	0.946	-	76.91	-	37	-
	7	1.22	-	0.972	-	79.67	-	39	-
	8	1.23	-	0.991	-	80.57	-	42	-
B	0	1.29	1.29	0.861	0.861	66.74	66.74	15	15
	1	1.29	1.30	0.899	0.926	69.69	71.23	19	20
	2	1.30	1.31	0.925	1.001	71.15	76.41	21	27
	3	1.31	1.30	0.958	1.025	73.13	78.85	23	32
	4	1.30	1.30	0.973	1.047	74.85	80.54	28	36
	5	1.30	-	1.001	-	77.00	-	30	-
	6	1.29	-	1.015	-	78.68	-	33	-
	7	1.31	-	1.037	-	79.16	-	35	-
	8	1.30	-	1.051	-	80.85	-	38	-
C	0	1.21	1.21	0.820	0.820	67.77	67.77	14	14
	1	1.21	1.20	0.852	0.908	70.41	75.67	17	19
	2	1.20	1.22	0.875	0.970	72.92	79.51	20	25
	3	1.22	1.21	0.911	1.008	74.67	83.31	22	30
	4	1.21	1.20	0.945	1.031	78.10	85.92	24	35
	5	1.21	-	0.960	-	79.34	-	26	-
	6	1.20	-	0.971	-	80.92	-	30	-
	7	1.20	-	0.985	-	82.08	-	34	-
	8	1.20	-	0.997	-	83.08	-	37	-
D	0	1.18	1.18	0.815	0.815	69.07	69.07	17	17
	1	1.18	1.17	0.840	0.901	71.19	77.01	19	23
	2	1.17	1.18	0.861	0.965	73.59	81.78	22	27
	3	1.18	1.17	0.911	0.998	77.20	85.30	24	32
	4	1.18	1.19	0.940	1.015	79.66	85.29	27	39
	5	1.19	-	0.956	-	80.34	-	30	-
	6	1.19	-	0.972	-	81.68	-	34	-
	7	1.19	-	0.986	-	82.86	-	39	-
	8	1.20	-	0.994	-	82.83	-	44	-
E	0	1.31	1.31	0.872	0.872	66.56	66.56	12	12
	1	1.32	1.31	0.902	0.938	68.33	71.60	15	18
	2	1.31	1.32	0.935	1.015	71.37	76.89	17	22
	3	1.30	1.30	0.952	1.039	73.23	79.92	20	27
	4	1.32	1.31	0.975	1.067	73.86	81.45	22	32
	5	1.31	-	0.990	-	75.57	-	26	-
	6	1.31	-	1.002	-	76.49	-	29	-
	7	1.30	-	1.024	-	78.77	-	31	-
	8	1.30	-	1.060	-	81.54	-	33	-
F	0	1.23	1.23	0.832	0.832	67.64	67.64	17	17
	1	1.23	1.24	0.852	0.910	69.27	73.39	19	21
	2	1.24	1.23	0.875	0.975	70.56	79.27	22	26
	3	1.25	1.25	0.910	1.014	72.80	81.12	24	32
	4	1.23	1.24	0.936	1.038	76.10	83.71	27	39
	5	1.24	-	0.975	-	78.63	-	30	-
	6	1.23	-	0.999	-	81.22	-	34	-
	7	1.25	-	1.022	-	81.76	-	39	-
	8	1.25	-	1.029	-	82.32	-	44	-

Table 4 continued

G	0	1.24	1.24	0.864	0.864	69.68	69.68	15	15
	1	1.24	1.26	0.892	0.919	71.94	72.94	18	20
	2	1.25	1.26	0.919	1.008	73.52	80.00	20	25
	3	1.26	1.25	0.945	1.030	75.00	82.40	23	31
	4	1.25	1.26	0.965	1.054	77.20	83.65	26	37
	5	1.26	-	0.985	-	78.17	-	29	-
	6	1.24	-	1.001	-	80.73	-	32	-
	7	1.25	-	1.019	-	81.52	-	36	-
	8	1.25	-	1.035	-	82.80	-	39	-

process cheese varieties, whereas disodium phosphate (or appropriate combinations of di- and trisodium phosphates) is used in loaf-type process cheese and process cheese spreads. Therefore, all emulsifying salts used in this study were sodium phosphate.

Ingredients such as nonfat dried milk (NDM) and whey-based dairy ingredients such as liquid whey, whey powder, and whey protein concentrate (WPC) can be used in processed cheese spread (FDA 2006). Since the addition of these ingredients to process cheese formulation helps to reduce the cost of the product, manufacturers often try to maximize the addition of NDM and whey based dairy ingredients in their products. The amounts of these ingredients typically added to process cheese are not known to cause pronounced changes in processed cheese properties.

Microbiological quality of white cheese spread:

Before cooking of the blend of ingredients, total viable bacterial count (TVBC) and mould and yeast numbers of all samples were very high (Tables 5). The numbers of total viable bacteria were higher in treatments A, B and F than those of samples C, D, E and G. Few numbers of coliform, sporeforms bacteria and *Staphylococcus aureus* were detected in cheese blends of different treatments before cooking. Heating of ingredients at 80-85°C for 15 minutes during cooking greatly decreased TVBC and mould and yeast numbers of various cheese spread treatments whereas coliform, sporeforms bacteria and *Staphylococcus aureus* disappeared from fresh cheese and during storage period. As it was before cooking, TVBC and mould and yeast numbers of cheese treatments A, B and F were higher than those other samples. It could also be appeared that TVBC and mould and yeast numbers were lower in cheese treatments stored at 5°C than that of stored at 25°C, which is mainly due to the retarding effect of low temperature upon the growth and activity of these bacteria. During storage period there was clear increase in the TVBC and mould and yeast numbers in all processed cheese spread samples.

Processed cheese shows very low susceptibility to microbial spoilage (Glass *et al.,* 1998). In spite of this, processed cheese varieties have been associated with certain microbiological safety concerns. Improper packaging and storage of processed cheese can lead to mold growth.

Sensory characters of white cheese spread:

The results given in Table 6 described the influence of using different ingredients and storage at various temperatures on the organoleptic properties of white cheese spread of all samples. No pronounced differences were observed in color and appearance scores of different cheese

Table 5. Effect of using various ingredients and storage temperature on some microbial groups of white cheese spread

Treatments	Storage time (weeks)	TVBC ($x10^3$)		Coliform ($x10^3$)		Spore-forms ($x10^3$)		Moulds & Yeast ($x10^3$)		*Staph. aureus* ($x10^3$)	
		Storage temperature °C									
		5	25	5	25	5	25	5	25	5	25
A	before cooked	5000	5000	7	7	8	8	220	220	1.5	1.5
	0	3.50	3.50	-	-	-	-	1.56	1.56	-	-
	1	3.75	4.20	-	-	-	-	1.59	1.72	-	-
	2	3.90	6.40	-	-	-	-	1.76	1.99	-	-
	3	4.10	11.95	-	-	-	-	1.87	4.65	-	-
	4	4.13	21.30	-	-	-	-	1.91	8.99	-	-
	5	4.50	-	-	-	-	-	2.20	-	-	-
	6	9.85	-	-	-	-	-	4.65	-	-	-
	7	14.40	-	-	-	-	-	6.25	-	-	-
	8	19.30	-	-	-	-	-	8.80	-	-	-
B	before cooked	4500	4500	11	11	14	14	230	230	1.2	1.2
	0	3.20	3.20	-	-	-	-	1.49	1.44	-	-
	1	3.42	4.18	-	-	-	-	1.52	1.86	-	-
	2	3.65	5.50	-	-	-	-	1.68	2.00	-	-
	3	3.81	10.86	-	-	-	-	1.78	5.05	-	-
	4	3.90	19.20	-	-	-	-	1.81	9.56	-	-
	5	4.65	-	-	-	-	-	2.26	-	-	-
	6	9.15	-	-	-	-	-	4.65	-	-	-
	7	13.87	-	-	-	-	-	6.98	-	-	-
	8	18.40	-	-	-	-	-	8.96	-	-	-
C	before cooked	4000	4000	15	15	18	18	200	200	1.1	1.1
	0	3.15	3.15	-	-	-	-	1.51	1.51	-	-
	1	3.33	4.65	-	-	-	-	1.66	1.88	-	-
	2	3.52	5.61	-	-	-	-	1.89	2.63	-	-
	3	3.81	8.24	-	-	-	-	1.91	4.98	-	-
	4	4.11	17.10	-	-	-	-	1.99	9.25	-	-
	5	5.12	-	-	-	-	-	2.19	-	-	-
	6	9.69	-	-	-	-	-	4.53	-	-	-
	7	12.86	-	-	-	-	-	6.00	-	-	-
	8	16.20	-	-	-	-	-	8.32	-	-	-
D	before cooked	3800	3800	8	8	11	11	185	185	8.6	8.6
	0	2.95	2.95	-	-	-	-	1.50	1.60	-	-
	1	3.02	4.01	-	-	-	-	1.68	1.97	-	-
	2	3.59	5.92	-	-	-	-	1.85	2.30	-	-
	3	3.61	10.12	-	-	-	-	1.99	6.18	-	-
	4	3.75	18.50	-	-	-	-	2.18	9.54	-	-
	5	4.01	-	-	-	-	-	2.30	-	-	-
	6	9.05	-	-	-	-	-	4.18	-	-	-
	7	12.11	-	-	-	-	-	5.95	-	-	-
	8	14.80	-	-	-	-	-	7.52	-	-	-
E	before cooked	3700	3700	2	2	7	7	190	190	5.5	5.5
	0	2.85	2.85	-	-	-	-	1.44	1.44	-	-
	1	3.09	4.16	-	-	-	-	1.58	1.71	-	-
	2	3.44	5.99	-	-	-	-	1.74	1.95	-	-
	3	3.52	11.00	-	-	-	-	1.85	6.02	-	-
	4	3.70	20.25	-	-	-	-	1.99	9.89	-	-
	5	4.30	-	-	-	-	-	2.21	-	-	-
	6	8.97	-	-	-	-	-	4.52	-	-	-
	7	10.64	-	-	-	-	-	5.86	-	-	-
	8	13.65	-	-	-	-	-	6.95	-	-	-

Table 5 continued

F	before cooked	4900	4900	2	2	8	8	250	250	2.4	2.4
	0	3.52	3.52	-	-	-	-	1.83	1.83	-	-
	1	3.87	4.15	-	-	-	-	1.95	2.02	-	-
	2	4.11	5.16	-	-	-	-	2.21	2.41	-	-
	3	4.31	10.14	-	-	-	-	2.48	4.13	-	-
	4	4.62	19.90	-	-	-	-	2.65	8.85	-	-
	5	5.17	-	-	-	-	-	2.86	-	-	-
	6	9.15	-	-	-	-	-	4.05	-	-	-
	7	13.85	-	-	-	-	-	6.30	-	-	-
	8	18.40	-	-	-	-	-	8.21	-	-	-
G	before cooked	3850	3850	9	9	13	13	205	205	1.8	1.8
	0	3.00	3.18	-	-	-	-	1.43	1.43	-	-
	1	3.29	4.15	-	-	-	-	1.52	1.64	-	-
	2	3.54	5.86	-	-	-	-	1.63	1.89	-	-
	3	4.01	10.12	-	-	-	-	1.98	4.16	-	-
	4	4.35	17.20	-	-	-	-	2.30	8.49	-	-
	5	4.75	-	-	-	-	-	2.76	-	-	-
	6	8.24	-	-	-	-	-	3.98	-	-	-
	7	11.54	-	-	-	-	-	5.12	-	-	-
	8	15.20	-	-	-	-	-	7.98	-	-	-

treatments. The main differences samples were found in sensory evaluated body and texture and flavour. Formulation ingredients of treatments C, F and G granted the resultant cheese the highest scores of body and texture at zero time and during storage period. With respect to flavour, cheese treatments E and G gained higher scores than that of other treatments. This may be due to the high content of ripened Ras and Cheddar cheese in their blend ingredients. Finally, treatment G had the greatest total scores of organoleptic properties for white cheese spread.

Garimella Purna *et al.,* (2006) found that as the age of natural cheese used in process cheese manufacture increased, the unmelted firmness of the resulting process cheese decreased and the meltability of the resulting process cheese increased.

It is obvious that the total score gained by the examined cheese, generally, decreased by advancing the storage period. Such decrease, however, was more noticeable when storage was carried out at higher than at lower temperature.

CONCULASION

Processed white cheese spread were successfully produced from the formulation contained quark 30%, Ras cheese 5%, precooked cheese 5%, Cheddar cheese 4%, palm oil 15%, butter oil 3%, skim milk powder 2%, whey powder 3%, emulsifying salts 3%, water 30% and potassium sorbate (0.2%) as preservatives.

Table (6): Sensory evaluation of processed cheese spread

Treatments	Storage time (weeks)	Color& Appearance (15)		Body & Texture(35)		Flavour (50)		Total (100)	
		Storage temperature °C							
		5	25	5	25	5	25	5	25
A	0	14	14	27	27	46	46	88	88
	1	13	12	27	26	46	46	88	85
	2	12	11	27	24	46	42	86	77
	3	12	10	27	23	45	40	85	74
	4	12	8	26	19	44	36	83	65
	5	12	-	26	-	44	-	83	-
	6	11	-	26	-	43	-	81	-
	7	11	-	26	-	43	-	80	-
	8	10	-	23	-	38	-	72	-
B	0	14	14	29	29	46	46	90	90
	1	13	12	29	28	46	46	89	87
	2	12	11	29	25	45	43	87	79
	3	12	11	29	23	45	40	86	74
	4	12	9	28	19	44	36	86	65
	5	12	-	28	-	44	-	84	-
	6	11	-	27	-	43	-	82	-
	7	11	-	27	-	43	-	81	-
	8	10	-	25	-	39	-	75	-
C	0	14	14	30	30	47	47	93	93
	1	13	13	30	29	47	46	92	89
	2	13	11	30	29	47	45	91	86
	3	13	11	30	26	47	41	91	78
	4	13	10	29	20	47	37	90	68
	5	12	-	29	-	47	-	88	-
	6	12	-	29	-	45	-	86	-
	7	11	-	28	-	43	-	83	-
	8	11	-	27	-	42	-	80	-
D	0	14	14	27	27	46	46	88	88
	1	13	12	27	27	46	46	87	85
	2	12	11	27	24	46	42	85	78
	3	12	11	27	23	45	40	84	75
	4	12	9	27	19	44	36	83	65
	5	12	-	26	-	44	-	83	-
	6	11	-	26	-	43	-	81	-
	7	11	-	26	-	43	-	80	-
	8	10	-	24	-	39	-	74	-
E	0	14	14	26	26	44	44	85	85
	1	13	12	26	25	44	43	84	81
	2	12	11	26	23	44	42	83	77
	3	12	10	26	22	43	39	82	71
	4	12	8.	26	19	43	35	81	63
	5	12	-	25	-	43	-	80	-
	6	11	-	25	-	42	-	79	-
	7	11	-	25	-	42	-	78	-
	8	10	-	22	-	37	-	69	-
F	0	14	14	30	30	47	47	92	92
	1	13	13	30	30	47	45	91	89
	2	13	11	30	29	47	43	91	84
	3	13	11	30	26	46	43	90	80
	4	13	9	30	21	46	36	89	67
	5	13	-	30	-	45	-	89	-
	6	12	-	29	-	44	-	86	-
	7	12	-	29	-	43	-	85	-
	8	12	-	28	-	43	-	83	-

G	0	14	14	30	30	49	49	95	95
	1	14	13	30	30	49	48	94	92
	2	14	12	30	29	49	47	94	88
	3	14	12	30	28	49	46	93	86
	4	14	10	30	23	48	40	92	74
	5	14	-	30	-	47	-	91	-
	6	13	-	30	-	46	-	90	-
	7	13	-	29	-	45	-	88	-
	8	13	-	29	-	42	-	84	-

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تحسين خواص الجبن الأبيض القابل للفرد ١- دراسة مقارنة

مجدي محمد إسماعيل[١] ، محمد نور الدين فريد حماد[٢]
[١]قسم بحوث تكنولوجيا الألبان – معهد بحوث الإنتاج الحيواني – مركز البحوث الزراعية – مصر.
[٢]قسم الألبان – كلية الزراعة – جامعة دمياط.

استهدفت هذه الدراسة تحسين خواص الجبن الأبيض القابل للفرد باستخدام انواع مختلفة من المكونات. حيث تم تصنيع سبع معاملات من الجبن الأبيض القابل للفرد باستخدام نسب مختلفة من الكوارك و الجبن الراس و الشيدر و الجبن السابق اعداده و اللبن الفرز المجفف و الشرش المجفف و زيت النخيل و السمن و املاح الأستحلاب. و تم تخزين الجبن الناتج لمدة اربعة اسابيع على درجة حرارة ٢٥°م و لمدة ثمانية اسابيع على درجة حرارة ٥°م. و تشير النتائج إلى أن زيادة كميات جبن الراس و الشيدر المضافة لخلطة الجبن الأبيض القابل للفرد ادت إلي انخفاض قيم الرقم الهيدروجيني و زيادة قيم النتروجين الذائب في الماء. و قد ارتفعت قيم المواد الصلبة و الدهن و البروتين و الأحماض الدهنية الكلية الطيارة بالجبن بزيادة نسب البروتينات و الزيوت في مكونات الخلطة. كذلك تشير النتائج إلي أن تسخين مكونات الخلطة على درجة حرارة ٨٥°م ادى إلي خفض العد الكلي للبكتريا و اعداد الفطريات و الخمائر. و تشير نتائج التحكيم الحسي أن معاملة الجبن المحتوية على ٣٠% كوارك و ٥% جبن الراس و ٤% جبن شيدر و ٥% جبن سابق اعداده و ٢% لبن الفرز مجفف و ٣% شرش مجفف و ١٥% زيت نخيل و ٣% سمن و ٣% املاح الأستحلاب و ٣٠% ماء كانت أفضل المعاملات.