Incorporation of Plant Seeds Solids (Sweet Lupine and Chickpea) Into Karish Cheese Analogs

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ABSTRACT

Two different trails of Karish cheese analogs prepared by replacing 3% of skimmed milk solids with sweet lupine and chickpea seeds solids. Results of technological and microbiological properties during storage period (5 – 10°C) showed that the yield(regarding to T.S with the same level of moisture) of resultant cheese increased in a range of 8.22 – 9.3% for the sweet lupine and chickpea based Karish cheese. On the other hand, Fat/Dry matter (%), total nitrogen (%) and acetaldehyde content (ppm) increased during storage period comparing with control trail. Furthermore, plant seeds solids based Karish cheese trails were acceptable toward organoleptic properties.

Keywords: Karish cheese analogs, sweet lupine and chickpea seeds solids, solids substitution, cheese yield.

INTRODUCTION

Karish cheese is one of the most popular and oldest varieties consumed in Egypt (Abou Donia, 1991), owing to its high protein, low fat contents and reasonable price (Fahmi, 1960 and Abou Dawood, 2002).

The rapid increase in prices of dairy products as a result of shortage in milk supply in developing countries have led to a greater demand for partial replacement of milk protein with lower priced plant protein (Friedman, 1996). Development processes by plant proteins can be economically and nutritionally incorporated into human diet either as an extension or replacement of animal proteins and fat.

Legumes such as common beans, lupines or chickpeas have considered as a valuable protein sources (Bhardwaj, 2002 and Ulloa *et al.*, 1988). The use of legume proteins finds an increasing application in the manufacturing of dairy products. This may be due to their lower cost, functional advantages and medical effects (Metry *et al.*, 2003). Plant proteins are usually accompanied by various fibers, chronic insoluble fiber could enhance glucose tolerance and consequently modify blood insulin,

glucagon and insulin/ glucagon ratio (Al-Zaid *et al.*, 1991). On the other hand, lupine seed proteins decrease plasma cholesterol and have an important therapeutic effect (Chango *et al.*, 1998).

The seeds of sweet lupine (*Lupinus mutabilis*) do not contain alkaloids or trypsin inhibitors which are safe for human feeding. On the other hand, chickpea (*Cicer arietinum*) seeds protein is important for human nutrition as a major source of one of the main macronutrient of modified infant formula (Ulloa *et al.*, 1988). Chickpea protein was introduced for the preparation of cheese bakery and meat products (chick-foods) because of its high nutritional and functional properties (Sanchez-Viogue *et al.*, 1998). Newman *et al* (1987) and Paredes-Lopez *et al* (1991) reported the nutritional advantages of chickpea protein including good balance of essential amino acids, high protein digestibility and low level of antinutritional factors. Lupine and Chickpea contain 35 – 52% protein, 5 – 20% oil and 25 – 40% fibers (Petterson and Mackintosh 1999 and Bhardwaj 2002).

All the previous nutritional and technical advantages of legumes proteins led us to introduce and incorporate lupine and chickpea seeds protein into Karish cheese (Karish cheese analog) as a source of plant solids, then study their effects on the chemical, physical, microbiological and organoleptic properties of the resultant cheese.

MATERIALS AND METHODS

Starter:

Active mesophilic acidifying and aroma cultures (M. M. Series) which contain *Lactococcus lactis* subsp. *lactis*, *Lactococcus lactis* subsp. *cremoris* and *Lactococcus lactis* subsp. *lactis* var. *diacetylactis* obtained from Rhonue. Poulenc., France.

Culturing milk:

Mesophilic acidifying and aroma cultures were used directly with an average inoculation level of 2 – 5 u /100l milk at 32°C until curding.

Preparation of sweet lupine and chickpea:

Sweet lupine and chickpea (local variety) cleaned from sediments, washed with water, soaked 5h/5°C, blanched 1h/90°C in boiling tap water, cooled by tap water ,grinded using blender 3 min. and then dried at

45°C/30h. The prepared seeds were grinded by blender to obtain fine particles and stored until used.

Cheese making:

Karish cheese was made conventionally (Fahmi, 1960) from cow's skimmed milk (0.05% fat and 8.5% SNF) faculty herd supplemented with 3% skimmed milk powder for control trail and 3% plant seeds for cheese analog (substitution in a range of 3% according to Metry *et al*, 2003). Anato was added with level (5ml/50kg milk) before curding. Milk was acted on by mesophilic lactic acid starter at 32°C until curding. The formed curd was ladled into wooden frames lined with muslin cloth, 2% salt was dispersed and the curd pressed by suitable weights. Resultant cheese was stored at refrigerated temperature 8 – 10°for 15 days.

Methods of analysis:

The pH, titratable acidity, total solids were determined according to official methods of analysis (AOAC, 1975.). Total nitrogen determined as described by Rowland (1938). Total viable, total coliform, mould and yeast counts were determined using tryptose glucose extract agar, violet red bile agar and potato dextrose agar, respectively as described by APHA (1985). Acetaldehyde content as ppm was determined using the basis fuchsin reagent according to the method of Robinson *et al* (1977). While formol and shilovich numbers were measured by the method described by Tawab and Hofi (1966).

Sensory evaluation:

Among the storage period 15 days/8-10°C, the acceptability of cheese samples were evaluated by 20 specialized trained panelists. The scoring included flavor, (10 points), texture (10 points), color and appearance (10 points) and overall acceptability (10 points).

RESULTS AND DISCUSSION

Three different Karish cheese analog trails were prepared by replacement (3%) skimmed milk powder (T.S 95.5%,Protein 34.4% and Fat 0.07%) in the formula of Karish cheese control by (3%) sweet lupine(T.S 93.12%,Protein 38.9% and Fat 11.8%) and chickpea solid material(T.S 93%,Protein 24% and Fat 5.2%). The resultant cheese trails were examined toward physico-chemical and microbiological properties during storage period.

Physico-chemical properties of Karish cheese analog based plant solids of sweet lupine and chickpea:-

Data in Table 1 show changes in pH, acidity and acetaldehyde contents during storage of Karish cheese analog based 3% plant solid of sweet lupine and chickpea comparing with the control trial of Karish cheese supplemented with 3% skimmed milk powder. The pH of all treatments, including the control, decreased slightly during storage. On the other hand, all treatments showed increasing acidity during storage, the rang being 1.56:1.87, 1.23:1.42 and 1.27: 1.39 for treatments control, Karish cheese analog based sweet lupine and chickpea, respectively. After five days of storage, optimum increases of acetaldehyde content were noticed in all trials. The control trail had the largest acetaldehyde content as compared with the Karish cheese analog based plant seed solids. Decreases may be due to the inability of aroma cultures action with plant solids. It seems that the existence of plant solids restrict the action of aroma cultures which have been opposite tendency with the observed in previous research that used aroma cultures in fermented milk products (Akaline, 1996; Helmy *et al.*, 2000 and El-Nemr, 2006). Acetaldehyde content was found in Karish cheese analog based lupine 14% and chickpea 6% lower than control Karish cheese after 5 days of storage. The decreasing of acetaldehyde content during storage is in agreement with the results of Khattab (1986); El-Samragy; (1988) and El-Nemr *et al* (2003).

The total solids of Karish cheese analog based plant seeds solids (sweet lupine and chickpea) during storage period is presented in Table 1. Data indicate that cheese was generally characterized by high moisture content. However, Karish cheese analog based plant seeds solids lupine and chickpea were lower than control trail in moisture, and ranged between 65.44 – 64.63% for control trail, 57.22 – 55.11% for lupine based cheese and 56.99 – 55.33% for chickpea based cheese. The Karish cheese analog based plant seeds solids held higher yield than control cheese ranged between 8.22 – 10%. That trend agreed with results of Abdel Tawab *et al* (1998), Murad *et al* (1998) and El-Nemr *et al* (2003).

Table 2 demonstrates Fat/ Dry matter (%),total nitrogen,formol number and shilovich number during storage period. The results in Table 2 indicated that the addition of 3% of plant seeds solids increased and enhanced of the previous parameters in Karish cheese analog. Fat content in sweet lupine and chickpea increased fat/dry matter ratio in Karish cheese analog based plant seeds solids in range 10.67% and 13.47% for chickpea

and lupine based cheese comparing with 2.91% for control trail at the end of storage period. Also, total nitrogen (%) and soluble nitrogen expressed as formol number and shilovich number generally increased during storage due to protein breakdown (Abdou & Dawood 1977). This may be the result of increasing proteolytic activity in Karish cheese analog.

Microbiological properties of Karish cheese analog based plant solids of sweet lupine and chickpea:-

Table 3 indicated that the numbers of cells of the different microbial groups (total counts, coliform and mold – yeast) in Karish cheese analog based plant seeds solids compared with control trail of Karish cheese were within the numbers reported by other researches (Abou-Dawood 1996 and 2002).

Sensory evaluation:-

Up to the end of storage period, all Karish cheese analog samples were accepted. The recorded scores in Table 3 indicated that the chickpea based cheese slightly increased in acceptability comparing with lupine based cheese. Generally, the treatments of Karish cheese analog based plant seeds solids gave a satisfied result compared with control.

CONCLUSION

From the forgave results, it can be concluded that the incorporation of lupine and chickpea seeds solid into Karish cheese analog seems to serve dual purposes, first as a yield enhancer and increasing nutritional advantages of products.

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Table 1: Chemical properties of Karish cheese analog (incorporated with 3% lupine or chickpeas seeds solids) during storage period at 8-10°C (Average of 3 replicates)

	Storage period (days)	Control supplemented with 3%skim milk powder	Karish cheese with 3%lupine solids (Based lupine)	Karish cheese with 3% chickpea solids (Based chickpea)
Total Solids%	Fresh	34.56	42.78	43.01
	5	34.82	43.01	43.29
	10	34.99	44.27	44.97
	15	35.37	44.89	44.67
pH	Fresh	4.41	5.49	5.37
	5	4.37	5.32	5.26
	10	4.01	4.73	5.01
	15	3.97	4.66	4.97
Acidity %	Fresh	1.56	1.23	1.27
	5	1.63	1.29	1.32
	10	1.81	1.34	1.37
	15	1.87	1.42	1.39
Acetaldehyde ppm	Fresh	39.71	38.79	37.91
	5	49.11	42.11	46.31
	10	47.81	39.71	40.01
	15	41.11	38.91	46.31

Table 2: Chemical properties of Karish cheese analog (incorporated with 3% lupine or chickpeas seeds solids) during storage period at 8-10°C (Average of 3 replicates)

	Storage period (days)	Control supplemented with 3%skim milk powder	Karish cheese with 3%lupine solids (Based lupine)	Karish cheese with 3% chickpea solids (Based chickpea)
Fat/ DM%	Fresh	2.56	11.97	9.91
	5	2.59	12.28	9.99
	10	2.63	12.91	10.31
	15	2.91	13.47	10.67
Total nitrogen %	Fresh	3.71	4.83	5.22
	5	3.74	4.97	5.37
	10	3.78	5.11	5.81
	15	3.87	5.33	5.97
Formol No.	Fresh	10	12	11
	5	11	14	15
	10	12	16	17
	15	14	19	19
Shilovich No.	Fresh	30	31	30
	5	31	33	32
	10	33	35	33
	15	34	36	35

Table 3: Microbiological properties of Karish cheese analog (incorporated with 3% lupine or chickpea seeds solids) during storage period at 8-10°C (Average of 3 replicates)

	Storage period (days)	Control supplemented with 3%skim milk powder	Karish cheese with 3%lupine solids (Based lupine)	Karish cheese with 3% chickpea solids (Based chickpea)
Total count log cfu/g (10^6)	Fresh	6.91	7.06	7.11
	5	7.32	7.23	7.63
	10	7.63	7.91	8.01
	15	8.61	8.65	9.07
Coliform log cfu/g (10^6)	Fresh	Nil	Nil	Nil
	5	Nil	Nil	Nil
	10	Nil	Nil	0.36
	15	0.23	Nil	0.21
Mold &Yeast log cfu/g (10^6)	Fresh	0.91	0.87	1.09
	5	0.97	1.21	1.36
	10	0.99	2.41	2.09
	15	1.21	2.61	3.41

Table 4: Sensory properties of Karish cheese analog (incorporated with 3% lupine or chickpea seeds solids) during storage period at 8-10°C (Average of judgers)

	Storage period (days)			
	0	5	10	15
Control				
Flavor 10	8.5	9	9	8.5
Texture 10	9.5	9	8.5	8
Overall 10	8.5	8.5	8	8
Lupine based cheese				
Flavor 10	8	8.5	8	8
Texture 10	9	9	9	8.5
Overall 10	8	8	8	7.5
Chickpea based cheese				
Flavor 10	9	9	9	8
Texture 10	9	9	8.5	8.5
Overall 10	9	9	9	8.5

الملخص العربى

إدماج جوامد الحبوب النباتية للترمس الحلو و الحمص البلدي في مشابه الجبن القريش

طارق مراد النمر

قسم علوم و تكنولوجيا الألبان – كلية الزراعة (الشاطبي)

جامعة الاسكندرية – الاسكندرية – مصر

تم تصنيع مشابه الجبن القريش باستبدال ٣% من الجوامد اللبنية بجوامد حبوب الترمس الحلو و الحمص البلدي. و لقد أوضحت النتائج المتحصل عليها زيادة الريع للجبن الناتج بقيم تراوحت ما بين ٨,٢٢ – ٩,٣%(نسبة للجوامد الصلبة) لكلا المحاولتين. علاوة على الزيادات المحسوسة في محتويات الدهن/المادة الجافة و النيتروجين و الأسيتالدهيد خلال التخزين لمدة ١٥ يوم في حرارة 8 – ١٠°م. و على نحو آخر فلقد أوضحت النتائج أن إستبدال الجوامد النباتية للترمس الحلو و الحمص البلدي في مشابه الجبن القريش كان مقبلا تجاه الخواص الحسية.