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Effect of Certain Dietary Fibers on Kariesh Cheese Characteristics

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ABSTRACT

Maltodextrin (0.5 , 2.0 %) and Konjac (0.05, 0.1, 0.2 %) as a sources for soluble dietary fiber were used on kariesh cheese making to assess its influence on the viability starter bacteria *(Lb. acidophilus LA-5, B. B-B12 and Str. thermophilus)* used in kariesh cheese making, also to evaluate its effect on the properties of resultant cheese. All treatments were made, preserved at 4°C for 15 days, then chemically, microbiologically sensory evaluated, and compared with control. Results cleared that the dietary fiber addition increased the yield and the moisture of resultant cheese in comparing with the control. Total solids and Protein content have an opposite trend with increasing of dietary fiber addition ratio. Results revealed that all treatments were described with an access in the non protein nitrogen, the soluble nitrogen and TVFA%, in comparison with control. T.A% of cheese samples has a gradual increase throughout kariesh cheese shelf life. In addition, the adding of dietary fiber enhanced the vitality of *bifidobacteria sp*., whereas it numbers were adequately to health census of functional bacteria that were higher than (10^6 cfu/g-1) for their health effects.

Keywords: kariesh cheese, probiotic bacteria, dietary fiber, Maltodextrin, Konjac fiber.

INTRODUCTION

In Egypt, kariesh cheese considered the most popular types of soft cheese consumed by the vast majority of consumers. It characterized by several features such as it made from skim milk either from cow or buffalo's skimmed, which contains 72.50% water, 16.70% protein, 3.98% sugar and 0.1% fat. There was a growing demand at its consumption due to its high protein content and low price Abou-Donia (2008). To improve therapeutic characterizes of kariesh cheese to be one of dairy functional products several approaches have been proposed. Many therapeutic properties must be linked to the functional foods term such as decreasing the riskiness of some diseases (e.g. arteriosclerosis, heart diseases and malnutrition diseases), also, it must be able to curing some other illnesses. Probiotic term is defined as live microorganisms that are also incorporated into functional foods to confer a series of health benefits (FAO, WHO, 2001). Non-digestible ingredients that have beneficial effect on the host by selectively activity of one or limited number of useful bacteria in the colon or stimulating its growth. These ingredients surname in prebiotic. Functional foods which containing combination of probiotics and prebiotics are called synbiotics Salem and El- Shibiny (2003). Great beneficial effects on the human health can be takes place if synbiotic foods were consumed more than the individual consumption of prebiotic or probiotic that was decided by many studies (Gmeiner *et al*., 2000). One of the most fat replacers that have been submitted as food additives in the last 25 years was Maltodextrin. it have that location among the other food additives due to its capacity to reproduce a fat-like mouth feel (Loret and frith 2000). Important properties of maltodextrin such as it is water soluble, non-sweet products that are supplied as spray-dried powders helped in its classification as safe food ingredient by (FDA), in addition the most source of maltodextrin in the fragmentation of starch by enzyme and or acid (Akhilesh *et al.,* 2012). One of the top ten healthiest foods by classified by WHO was Konjac due to its high nutrition characteristics. Also, it has glucose, fructose and sucrose presents in konjac. Moreover, it have over 45% glucomannan, different types of amino acids contain 7 essential amino acids, 9.7% of crud protein, low fat and high in fiber Theivasanthi and Alagar (2012).

Therefore, this work objected to investigate the effect of maltodextrin and Konjac on enhancing kariesh cheese properties, and its effect on the viability of *Bifidobacterium B-B 12*. Strain that used in kariesh cheese making.

MATERIALS AND METHODS

Fresh skim milk obtained from Dairy station, Dairy department, faculty of agriculture, Mansoura university, ABT starter culture used was obtained from Ch. Hansen's Laboratories , Denmark Lypholized .It consists of *lactobacillus acidophilus LA-5, Bifidobacterium B-B12 and Streptococcus thermophilus*, The starter culture was in freeze-dried direct-to-vat set form. After procurement, the starter cultures were stored at –18°C in the absence of atmospheric air. Konjac fiber and Maltodextrin were obtained from Ch. Hansen's Laboratories, Denmark

Kariesh cheese samples was made according to Abou- Donia (2008) from buffalo's skim milk (0.1% fat). Milk was divided into 6 equal portions. The six cheese treatments were made using ABT starter. The first cheese sample was used without any additives and considered as control, whereas the treatments from two to three were fortified with maltodextrin by ratios (0.5 and 2.0%). The treatments from four to six were fortified with konjac fiber by ratios (0.05, 0.1 and 0.2%), respectively. The formed curd was ladled into wooden frames lined with muslin cloth, 2.5% (W/W) salt was dispersed and the curd pressed by suitable weights and left to drain over night at 10°C. Resulting cheese was cut into blocks, packed in polyethylene bags, preserved at refrigerated temperature for 15 days.

Total solids contents of samples was determined according to AOAC, (2005), pH was measured using a pH meter (Corning pH/ion analyzer 350, Corning, NY) after calibration with standard buffers (pH 4.0 and 7.0). Titratable acidity, total nitrogen, soluble nitrogen, non protein nitrogen was estimated according to the methods described by ling (1963). Total volatile fatty acids (TVFA) were determined according to Kosikowiski (1978). Bifidobacteria count was determined according to Dinakar and Mistry (1994). karish cheese samples were sensory evaluated by using score card according to Nelson and Trout (1981).

RESULTS AND DISCUSSION

Changes in T.A%, pH, yield and total solids (TS) during the cold storage of kariesh cheese are illustrated in Table (1). The addition of two types of dietary fiber by its different ratios carried out an access in the yield of resultant cheese compared to control. The obtained results was in agreement with Koca and Metin (2004), who decided that, the moisture content and the yield of soft cheese were increased when fat replacers were added during its making process.

It was noticed that higher yield was found in Konjac treatments compared with control and maltodextrin treatments. Nearly similar results were found by Korish and Abd EL-Hamid (2011), who clear up that, there was an increase in the yield of Egyptian kariesh cheese when hydrocolloids were used.

Data illustrated at the same Table (1) showed that the titratable acidity increased in control and all treatments during storage period, while pH values showed an opposite trend. This may be attributed to lactic acid bacteria growth, which was more active in all treatments due to the presence of some growth factors which increase the production of lactic acid and decrease the pH values. Nearly similar finding were obtained by Ismail *et al.,* (2010). This increase in titratable acidity related with the type of dietary fiber and its ratio. Konjac treatments had higher acidity than control and maltodextrin treatments in the beginning and throughout its shelf life.

Data in the same Table (1) showed that total solid had gradual increase during storage in control and all treatments. In addition all dietary fiber treatments gained a decrease in total solids content when compare with control. Total solids content of fresh cheese sample were 27.19, 25.91, 25.93, 24.82, 23.85% for (M1, M2, K1, K2, K3) respectively and 29.80% for control. Maltodextrin treatments gained an increase in total solids, when compare with Konjac treatments, and that probably due to the access binding capacity of Konjac for the free water, which led to an increased the moisture content in its treatment. There were approximately with these findings by Drake *et al.,* (1996) , Kahyaoglu and Kaya (2003).

Table 1. Changes during storage period on chemical composition and yield of kariesh cheese as affected with dietary fiber using.

Treatment	Storage period (days)	Cheese yield (%)	A%	pH	T.S
	0	18.0	0.70	4.45	29.80
Con.	7	–	0.75	4.43	29.90
	15	–	0.82	4.30	30.22
	0	22.0	0.74	4.40	27.19
M1 (0.5%)	7	–	0.78	4.36	27.34
	15	–	0.80	4.34	27.46
	0	23.1	0.69	4.43	25.91
M2 (2.0%)	7	–	0.74	4.40	26.13
	15	–	0.79	4.38	26.25
	0	23.3	0.72	4.40	25.93
K1 (0.05%)	7	–	0.76	4.35	26.12
	15	–	0.82	4.32	26.20
	0	24.2	0.74	4.43	24.82
K2 (0.1%)	7	–	0.79	4.39	24.95
	15	–	0.83	4.36	25.10
	0	27.5	0.75	4.45	23.85
K3 (0.2%)	7	–	0.78	4.40	24.10
	15	–	0.83	4.37	24.18

Con. : control kariesh cheese with(ABT starter +without dietary fiber)
A%: acidity, M1 : cheese with Maltodextrin (0.5 %) , K1 : konjac treatment (0.05 %), M2 : cheese with Maltodextrin (2.0 %) , K2 : Konjac treatment (0.1 %), K3 : konjac treatment (0.2 %)

Data of protein parameters such as (TP), soluble nitrogen (WSN)/TN, non protein nitrogen (NPN)/TN of kariesh cheese are shown in Table (2). There was a gradual access in the (T.P) content during the progress of storage intervals. This increase might be due to the changes on the total solids content of resultant cheese throughout its shelf life.

The dietary fiber using had a clear effect on the T.P content of all treatment, when compared with the control cheese, where, the T.P content of all treatments was decreased, when attributed to the wet weight. It was

noticeable that the Konjac treatments had the lowest total protein of all treatments. These results are agreed of those reported by El-Shafie (1994).

Data in the same Table showed gradual increase in the soluble nitrogenous compounds and non protein nitrogenous during storage periods. This increase could be due to the protioletic activity of starter bacteria species, which make a partial degradation of the cheese protein content. The sensory characteristics probably improved by the partial degradation of protein fractions during the shelf life of stored kariesh cheese. These results are in agreement with those findings by El-Zeiny and Metwally (2002) and Salama (2004).

Table 2. changes on T.P, W.S.N and N.P.N contents of kariesh cheese as affected with dietary fiber using.

Treatment	Storage Period (days)	Total protein%	Water soluble nitrogen/ TN%	Non protein nitrogen/TN%
Control	0	19.5	25.00	7.210
	7	19.7	25.32	7.621
	15	19.8	25.98	7.982
M1(0.5%)	0	18.5	26.38	8.013
	7	18.6	26.50	8.645
	15	18.8	27.01	9.021
M2(2.0%)	0	16.8	28.21	8.812
	7	16.9	28.30	9.023
	15	17.0	28.93	9.675
K1(0.05%)	0	17.2	27.24	8.510
	7	17.2	27.29	8.674
	15	17.5	27.65	8.921
K2(0.1%)	0	16.7	28.11	8.912
	7	16.8	28.30	9.501
	15	17.0	29.03	9.824
K3(0.2%)	0	16.1	28.31	7.981
	7	16.3	28.42	8.425
	15	16.3	28.98	8.746

Data illustrated in the Table (3) showed that dietary fiber either maltodextrin or Konjac had an enhancing effect on the growth of Bifidobacterium BB-12 on the cheese at zero time or through out storage. Where, the viable counts of Bifidobacteria in dietary fiber treatments were higher than those in control cheese and it was (32-25-23-20-17 $x10^6$) for (K1-K2-M2-K3-M1) respectively, when compare with (11 $x10^6$) for control cheese at the beginning of storage. Results showed that all viable count were decrease during the progress of storage period for all treatments and control.

Moreover the data in the same Table indicates that the presence of dietary fiber encourages the viability of Bifidobacteria and it's ability on survival at environmental factors, which appeared on its viable counts on the end of storage period, where all treatments had higher viable count (10-9-9-6-5 $x10^6$) for (K1- K2-M2 –M1- K3) respectively, when compare with (2 $x10^6$) for control. These results agree with Salem *et al.,* (2007), who reported that, the products supplemented with dietary fiber have better initial counts of probiotic bacteria and their subsequent survival than other products free it.

Table 3. Survival of Bifidobactreium BB-12 in functional kariesh cheese during storage period.

Treatment	Colonies appeared on selective medium ($x10^6$ cfu/ml) Storage period(days)		
	Fresh	7	15
Control	11	4	2
M1 (0.5%)	17	14	6
M2 (2.0%)	23	18	9
K1 (0.05%)	32	20	10
K2 (0.1%)	25	13	9
K3 (0.2%)	20	10	5

The recorded results in table (4) determine the sensory evaluation carried out on kariesh cheese supplemented with dietary fiber.

Regarding to the control group of cheese, the changes of the taste and texture were observed after 7 th days of storage period , while the changes in colour appeared after 15 th days of storage . Slight difference were felt at total score values of sensory attributes between control and all treatments either in all shelf life intervals, where the highest total score was maltodextrin M1 (95%) and the lowest was konjac treatment K3 (92%) at zero time , where the decrease in the total

score of konjac treatments was referred to the decrease in body & texture values, as well as konjac treatments were softer than other treatments and control cheese. The results clearly indicated that supplementation of cheese with dietary fiber gave it more smoothness and softening and enhanced its organoleptic properties of resultant cheese.

Table 4. impact of dietary fibers on sensory attributes of kariesh cheese throughout shelf life intervals.

Treatments	Storage periods (days)	Color & Appearance (15)	Body & Texture (35)	Flavour (50)	Total (100)
	zero	13	32	48	93
Control	7	13	31	45	89
	15	11	29	40	80
	0	14	33	48	95
M1 (0.5%)	7	14	32	45	91
	15	13	31	43	87
	0	14	32	48	94
M2 (2.0%)	7	14	32	44	90
	15	12	31	42	85
	0	14	33	48	95
K1(0.05%)	7	14	32	44	90
	15	13	31	42	86
	0	14	32	48	94
K2 (0.1%)	7	14	32	43	89
	15	13	31	41	85
	0	14	32	46	92
K3(0.2%)	7	13	31	42	86
	15	12	29	39	80

CONCLUSION

The addition of maltodextrin and konjac as a source of dietary fiber had a greet interesting to enhance the characteristics of functional kariesh cheese, which fermented with probiotic bacteria. This functional cheese had a remarkable improvement in its properties such as body and texture, sensory attributes and its chemical composition. Also, the addition of these dietary fibers increases and enhanced the growth and survival of probiotic bacteria used on the fermentation process to achieve its health benefits.

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تأثيراستخدام بعض الالياف الغذائية علي خصائص الجبن القريش

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اًستُخدِمَ المالتودكسترين والكونجاك كمصدر للالياف الغذائية الذائبة في تصنيع الجبن القريش لدراسة تاثيرها علي حيوية سلالات باديء الـ ABT (*lactobacillus acidophilus LA-5, Bifidobacterium B-B12 and Streptococcus thermophilus)* المستخدمة في تصنيعها وكذلك تأثيرها علي جودة الجبن الناتج. تم تقييم جميع المعاملات كيماويا وميكروبيولوجيا وحسيا ومقارنتها بالجبن الكنترول. اضيفت الالياف الغذائية بنسبة (٠,٥ – ٢ %) للمالتودكسترين و(٠,٠٥ – ٠,١ – ٠,٢) للكونجاك حيث تم التصنيع بالطريقة التقليدية وحفظت الجبن الناتجة علي درجة حرارة الثلاجة لمدة ١٥ يوم مع التحليل علي فترات صفر, ٧, ١٥ يوم. اوضحت النتائج ارتفاع المحتوي الرطوبي للجبن المعامل وكذلك زيادة محصول الجبن بزيادة هذه النسب من الاضافة. ازدادت قيم كلا من الحموضة وشقوق البروتين مع زيادة نسبة الالياف المضافة والتقدم في فترات التخزين, كذلك حققت اضافة الالياف الغذائية بالنسب المختلفة زيادة في التعداد الحيوي وحيوية سلالة الـ bifidobacteria الموجودة في البادئ حيث حققت تعدادا اعلي من التعداد الصحي المطلوب(١٠ ٦ خلية حية/جرام) وكذلك تحسنت قدرتها علي المقاومة والمتمثل في انخفاض معدلات التناقص لها مقارنة بالموجودة في جبن الكنترول. اوضحت النائج امكانية استخدام الالياف الغذائية الذائبة بنجاح في تصنيع الجبن القريش مع زيادة محصول الجبن والحصول علي خواص كيميائية وحسية جيدة.