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Composition and Quality of Kareish Cheese Supplemented with Probiotic Bacteria and Dietary Fibers

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ABSTRACT

The composition and quality of kareish cheeses made by adding 0.5 and 1% date seed powder (DSP) or 0.5 and 1% oat powder (OP) or their were evaluated at 0. 7, 14, 21 and 28 days of cold storage. The obtained results showed that the addition of DSP and OP was of no inhibitory effect on the starter activity. As the level of the different additives was increased, the coagulation time and curd tension decreased, while syneresis increased. All treated cheeses were of higher yield and total solids, compared with the control. It was also clear that most of samples characterized with higher decrease in acidity ,fat, salt ,salt in moisture ,total nitrogen (TN),TN/DM ,water soluble nitrogen (WSN), while WSN/TN was of higher increase of DSP and OP. Total bacterial count, lactic acid bacteria and bifidobacteria were higher in fiber supplemented fresh Kariesh cheese, while lower counts were recorded in all stored Kariesh cheese samples including control .All Kariesh cheese samples were free of coliform bacteria, either when fresh or during storage up to 4 weeks. Kariesh cheese containing DSP and OP was acceptable and of good flavour, body and texture, appearance .Generally, it could be recommended that the addition of date seed powder and oat powder and ABT starter could be applied in making good quality probiotic kareish cheese.

Keywords: Kareish cheese, ABT, Dietary fiber.

INTRODUCTION

Kariesh cheese is the most popular acid-coagulated soft cheese in Egypt. Recently, this cheese is conventionally produced by acid coagulation of mechanically skimmed cow's and buffalo's milk or buttermilk by culturing with lactic acid bacteria. (Awad *et al*.2015). Cheese has become more common because it is source for calcium and phosphorus. These elements are essential for bones and teeth formation. While its sodium and potassium play an important role in the formation of body liquids and muscles. Plus it is a relatively fat free cheese, so it is often recommended for persons suffering from obesity, cholesterol and heart diseases.

Date seeds (DS) are produced in huge amounts in the Middle East and represent approximately 10–15% of the total date fruit weight. That means the annual production weight of DS waste exceeds 1 million ton. Needless to say that the extraction of the DS is, by far, the single, largest, easily available, low cost, non-toxic, biodegradable family (El-Naggar *et al*. 2018).It has recently shown that DS possess excellent nutritional qualities and represent a good source of bioactive components. Date seeds are also ground and added to the feed of some animals. In addition, date pits are used in making a caffeine-free drink that can substitute for non-caffeinated coffee when coffee-related flavour is desired. Such a drink has been used in the Arab world for centuries (Rahman *et al*., 2007; Habib and Ibrahim 2009).

Additionally DS are rich in some antioxidants. The determination of their polyphenolic profile (Habib *et al*., 2014) revealed a total amount of polyphenols of 50.2 mg/g, with the primary compounds being epicatechin and catechin, whose antioxidant properties are well established (Fraga and Oteiza 2011). Date seeds have also been shown to exert in vitro and in vivo antioxidant effects (Habib and Ibrahim 2011).

Concerning oats, it is well-known that one quality source of functional fiber is whole oats, being high in soluble dietary fibers (SDF), particularly β-glucan (Johansson *et al*., 2004). The common Oat (Avena sativa) is a species of cereal grain grown for its seed, which is known by the same name (usually in the plural, unlike other grains). While oats are suitable for human consumption as oatmeal and rolled oats. Oats have numerous uses in food; most commonly, they are rolled or crushed into oatmeal or ground into fine oat flour (O powder). Oatmeal is chiefly eaten as porridge. But may also be used in a variety of baked goods, such as oatcake ,oatmeal cookies, and oat bread. Oats may also be consumed raw, cookies and in several different drinks.

The objective of the present work was to study impact of supplementation of kariesh cheese with DS powder or O powder on composition and quality of the resultant bio-kariesh cheese

MATERIALS AND METHODS

Fresh skim milk was prepared from cow's milk obtained from El-Serw Animal Prod. Res. Station, Animal Prod. Res. Institute, Agric. Res. Center, Egypt. (DS) powder and (O) powder were obtained from the local market. . ABT-5 culture which consists of *S. thermophiles*, *Lactobacillus acidophilus* + *Bifidobacterium* was obtained from Chr. Hansen's Lab A/S Copenhagen, Denmark Dry coarse commercial food grad salt was obtained from El-Nasr Salines Company, Egypt.

Skim milk was pasteurized at 75±2°C for 30 min and divided into seven portions. The first portion was served as a control. Each of the other portions was mixed with DS powder in ratios of 0.5% and 1% ,O powder in ratios of 0.5% and 1%, DS powder 0.5%: O powder 0.5% and DS powder 1%: O powder 1%, then cooled to 45°C. All treatments were inoculated with 2% of activated probiotic bacteria (ABT5) ,and incubated at 42°C. After complete coagulation, the curd was treated and salted as previously described by Ezz El-Din (1978).

The coagulation time was detected during cheese making in the inoculated with starter and incubated at 42°C milk, followed by coagulation at 30 min intervals and at the end of coagulation. The curd tension was determined using the method of Chandrasekhara *et al*., (1957) whereas the curd syneresis was measured as given by Mehanna and Mehanna (1989).

Treatable acidity in terms of % lactic acid was determined according to Ling (1963). pH was measured using a pH meter (Corning pH/ion analyzer 350, Corning, NY).Total solids (TS), fat and total nitrogen (TN) contents of samples were determined according to AOAC (2000). Salt contents were estimated using Volhard method according to Richardson (1985). Salt-in-moisture content was calculated. Water soluble nitrogen (WSN) was estimated by the Kjeldahl method according to the AOAC (2000). Total volatile fatty acids (TVFA) were determined as described by Kosikowski (1978) and expressed as ml of 0.1 N NaOH / 100 g cheese.

For examining the cheese microbiologically, samples were analyzed for total viable bacterial count (TVBC), lactic acid bacteria (LAB) and coliform bacteria according to the methods described by the American Public Health Association (1992). The count of bifidobacteria was determined according to Dinakar and Mistry (1994).

A panel of 10 trained panelists judged the sensory character of the cheeses. The score points were15 for colour and appearance, 35 for body and texture and 50 for flavour outlined by Nelson and Trout (1964).

Data were subjected to statistical analysis using general liner model procedure adapted by SPSS 10 for windows (SPSS, 1999) with one way ANOVA and Duncan test was done.

RESULTS AND DISCUSSION

Effect of adding of date seed powder or oats powder to skim cow's milk on starter activity:

Data in Table (1) deal with the development of acidity of skim milk inoculated with ABT-5 cultures as affected by DSP and OP during 210 min. An increase of titratable acidity in control and all samples were detected during incubation period. It could also be noticed that no pronounced differences in acidity between treatments during the first 60 min. However, by progressing incubation time, noticeable differences in acidity of all treatments were detected. It could also be obvious that the used powders were of no inhibitory effect on the starter activity. Similar results were reported by Sharma, (2011), who found that the addition of fiber to milk did not affect the fermentation time to reach pH 4.6.

Table 1. Effect of adding date seeds powder (DSP) and oats powder (OP) to skim cow's milk on starter activity (expressed as acidity percentage) during 210 min of incubation at 42°C

Treatments	Incubation time (min)							
	0	30	60	90	120	150	180	210
Control	0.18	0.21	0.22	0.23	0.26	0.32	0.40	0.52
0.5 %DSP	0.19	0.21	0.23	0.27	0.33	0.40	0.55	-
1.0 % DSP	0.19	0.21	0.23	0.28	0.33	0.45	0.57	-
0.5% OP	0.18	0.20	0.22	0.25	0.30	0.43	0.62	-
1.0 % OP	0.19	0.20	0.24	0.28	0.36	0.51	0.60	-
0.5% DSP+0.5 % OP	0.18	0.22	0.23	0.27	0.38	0.46	0.52	-
1 % DSP+1 % OP	0.19	0.22	0.24	0.31	0.47	0.54	0.65	-

The effect of adding DSP and OP on coagulation time, curd tension and curd syneresis was shown in Table (2). Coagulation time of control cheese milk was of higher significant in the same cases than that of treated cheese milk. This might be attributed to the differences in the growth of the starter bacteria. Similar results were obtained by Abd El-Hamid (2016) for wheat –bran supplemented kariesh cheese. Also, Vasiljevic *et al*, (2007) reported that Oat β-glucan addition to yoghurt enhanced lactic and propionic acid production. The decrease of acid coagulation time may be due to the gelation effect of DSP and OP.

Curd tension is an indirect measure for the firmness and gel structure of the resultant cheese. Kariesh cheese with 0.5% DSP was of the highest curd tension (21.72 gm.), followed by cheese with 0.5% OP (21.69 gm.). The differences were almost insignificant.

Syneresis as shown in the same Table reveals that DSP or OP had pronounced effect on the syneresis conversely curd tension. Syneresis of 1.0% DSP and OP characterized with the highest significant value (8.6 ml) after 120 min , while in the presence of 0.5% OP, the lowest value (7.83 ml) was recorded.The extent of syneresis depends on some factors like the composition of milk, temperature, the fermentation rate ,calcium equilibria ,the casein concentration ,the gel firmness at cutting time and the surface area of the curd Piyasena and Chambers, (2003).

Table 2. Effect of date seed powder (DSP) or oats powder (OP) on coagulation time, curd tension and curd syneresis of the prepared curd.

Treatments	Coagulation time (hrs)	Curd tension (g)	Curd syneresis (gm/15 gm of curd)* Time (min)			
			10	30	60	120
Control	3.45^{A}	21.60^{A}	4.20^{B}	6.24^{BC}	7.21^{B}	7.87^{B}
0.5 %DSP	3.25^{AB}	21.72^{A}	4.08^{BC}	6.15^{C}	7.17^{B}	7.79^{C}
1.0 %DSP	3.25^{AB}	21.46^{AB}	4.35^{AB}	6.50^{AB}	7.35^{AB}	8.06^{AB}
0.5% OP	3.15^{B}	21.69^{A}	4.16^{B}	6.19^{C}	7.18	7.83^{BC}
1.0 % OP	3.20^{B}	21.44^{AB}	4.38^{AB}	6.54^{AB}	7.41^{AB}	8.11^{AB}
0.5%DSP+0.5 % OP	3.30^{AB}	21.48^{AB}	4.31^{AB}	6.44^{B}	7.29^{B}	7.99^{B}
1 % DSP+1 % OP	3.15^{B}	21.28^{B}	4.77^{A}	6.85^{A}	7.72^{A}	8.42^{A}

***ABC Letters indicate significant differences between kareish treatments**

***Whey excluded (grams) from 15 gm of curd kept at room temperature for 10, 30, 60 and 120min.**

Results in Table (3) indicated that cheese from all treatments were of higher yield compared with the control. The values were 18.91,19.18,19.24,19.16,19.37,19.74 and 20.17% respectively for C,T1,T2,T3,T4,T5 and T6.These results differed significantly, and came in agreement with Abd El-Hamid *et al.* (2016), while. Onwulats (2008) found that dietary fiber absorbed water from the environment.

It is clear from Table (3) that the acidity of all samples increased with advancing storage period .This could be attributed to the fermentation of residual lactose in cheese. Results also indicated that most of samples except T3 and T6 were of less acidity, compared to the control. On the contrary pH values of fresh and stored cheese took an opposite trend of acidity, which is in accordance with the findings of Tseng and Zhao (2013). The 1% DSP + 1% OP fresh Kariesh cheese had the lowest pH of 5.72 while the fresh control had a pH of 5.75. There were almost significant ($p<0.05$) differences in acidity and pH between the experimental Kareish cheese and the control at all ages.

Results in Table (3) also show that total solids contents increased gradually during storage, reaching the maximum at the end of storage period .This increase might be due to losses of moisture during cold storage, and to the increase of acidity which accelerates whey syneresis.

On the other hand, the addition of different additives resulted in remarkable increase (mostly significant) in TS of the resultant cheese that was associated with the level of addition. These results agree with Fernandez-Garcia, (1998), who reported that the addition of oat fiber in the manufacture of plain yogurt increased total solids. Results illustrated that fat contents of all cheeses steadily increased towards the end of storage period. While fat/TS ratio was of the same trend. Incorporation of DSP and OP decreased insignificantly fat and fat on dry matter. These results are in agreement with El-Sayed *et al.* (2016), who showed that increasing the amount of sesame hulls in Kareish cheese made from skimmed buffalo's milk fortified with 1%, 2%, 3%, 4% and 5% sesame hulls decreased fat. From the same Table it could be also noticed that salt and salt in moisture contents in all cheese treatments gradually increased during storage period with no pronounced differences due to the applied treatments.

Table 3. Effect of date seed powder (DSP) or oats powder (OP) on yield (%), acidity (%), pH and gross chemical composition (%) of Kareish cheese.

Treatments	Storage period (days)	Yield	Acidity	pH values	TS	Fat	Fat/ DM%	Salt	Salt in moisture
C	0	18.91^{D}	1.24±0.02^{ABc}	5.75±0.03^{Ca}	25.43±0.09^{Bcd}	2.54±0.01^{Ab}	9.99±0.15^{Ab}	1.43±0.01^{Abc}	1.88±0.03A^{b}
	7		1.40±0.01^{ABc}	5.06±0.06^{BCa}	26.36±1.10^{Bc}	2.66±0.03^{Aab}	10.09±0.12^{Bab}	1.69±0.02A^{b}	2.24±0.02A^{ab}
	14		1.69±0.02^{Ab}	4.88±0.04^{Ab}	27.11±1.43^{Bb}	2.75±0.01^{Aab}	10.14±0.30^{Bab}	1.87±0.05^{Aab}	2.46±0.05^{Aab}
	21		2.01±0.03^{Aab}	4.45±0.02^{Cbc}	27.91±0.07^{Aab}	2.98±0.02^{ABa}	10.67±0.11^{BCab}	1.99±0.05^{Aa}	2.68±0.06^{ABa}
	28		2.22±0.05^{Aa}	4.37±0.01^{Cbc}	28.11±1.12^{ABa}	3.12±0.05^{Aa}	11.10±0.21^{Aa}	2.16±0.03^{Aa}	2.91±0.03^{Aa}
T1	0	19.18^{C}	1.21±0.01^{Bbc}	5.81±0.02^{Aa}	25.50±1.32^{ABbc}	2.52±0.02^{Ab}	9.88±0.19^{ABbc}	1.40±0.04A^{b}	1.84±0.02^{Ab}
	7		1.39±0.04^{Bb}	5.59±0.03^{Aab}	26.39±1.^{07ABb}	2.62±0.06^{ABab}	9.92±0.12^{Bb}	1.66±0.06^{ABb}	2.20±0.02^{Aab}
	14		1.62±0.03^{ABab}	4.77±0.01^{ABb}	27.18±1.1^{Bab}	2.74±0.08^{ABab}	10.08±0.26^{ABb}	1.86a±0.06^{Ab}	2.49±0.06^{Aab}
	21		1.91±0.05^{ABa}	4.56±0.05^{Bb}	27.78±0.07^{ABa}	3.00±0.07^{Aa}	10.79±0.30^{ABab}	2.01±0.03^{Aa}	2.71±0.05^{Aa}
	28		2.11±0.01^{ABa}	4.42±0.06^{Bbc}	28.04±0.09^{Ba}	3.11±0.03^{Aa}	11.09±0.18^{Aa}	2.12±0.04^{Aa}	2.86±0.04^{Aa}
T2	0	19.24^{BC}	1.22±0.05^{Bbc}	5.77±0.03^{ABa}	25.54±1.12^{Abc}	2.50±0.04^{Ab}	9.78±0.11^{ABbc}	1.38±0.01^{Bb}	1.81±0.04^{ABb}
	7		1.41±0.02^{ABb}	5.06±0.01^{BCab}	26.48±1.18^{Ab}	2.64±0.05^{Aab}	9.96±0.14^{ABb}	1.65±0.03^{Bab}	2.19±0.05^{ABab}
	14		1.59±0.03^{Cb}	4.73± 0.02^{Bb}	27.22±1.49^{Aab}	2.75±0.03^{Aab}	10.10±0.09^{ABb}	1.83±0.04^{Bab}	2.45±0.07^{Aab}
	21		1.89±0.01^{Bab}	4.62±0.04^{ABb}	27.96±1.55^{Aa}	3.02±0.04^{Aa}	10.80±0.05^{Aab}	2.00±0.05^{Aa}	2.70±0.09^{Aa}
	28		2.08±0.00^{ABa}	4.57± 0.05^{Ab}	28.16±1.31^{Aa}	3.11±0.05^{Aa}	11.05±0.03^{Aa}	2.11±0.03^{Aa}	2.85±0.06^{Aa}
T3	0	19.16^{C}	1.25±0.02^{Abc}	5.74±0.05^{ABa}	25.51±0.08^{Bbc}	2.51±0.04^{Ab}	9.83±0.05^{ABc}	1.41±0.06A^{b}	1.85±0.04^{Ab}
	7		1.44±0.03^{Ab}	5.19±0.04^{Bab}	26.38±1.15^{ABb}	2.68±0.03^{Aab}	10.15±0.09^{Ab}	1.69±0.03^{Aab}	2.24±0.03^{Aab}
	14		1.60±0.02^{Cb}	4.71±0.05^{Bb}	27.19±1.60^{Bab}	2.78±0.06^{Aab}	10.22±0.15^{Aab}	1.85±0.02^{Aab}	2.47±0.05^{Aab}
	21		1.88±0.01^{Bab}	4.64± 0.05^{ABb}	27.95±1.07^{Aa}	3.04±0.05^{Aa}	10.87±0.07^{Aab}	2.02±0.06^{Aa}	2.72±0.04^{Aa}
	28		2.05±0.02^{ABa}	4.61±0.06^{Ab}	28.13±1.55^{Aa}	3.13±0.04^{Aa}	11.12±0.05^{Aa}	2.13±0.05^{Aa}	2.87±0.02^{Aa}
T4	0	19.37^{B}	1.19±0.03^{Dbc}	5.83±0.3^{Aa}	25.54±0.09^{Ab}	2.48±0.03^{ABb}	9.71±0.06^{Bc}	1.39±0.03^{ABb}	1.83±0.01^{Ac}
	7		1.36±0.02^{Cb}	5.64±0.05^{Aab}	26.41±0.08^{ABab}	2.66±0.05^{Aab}	10.07±0.09^{Ab}	1.66±0.05^{ABab}	2.21±0.03^{Ab}
	14		1.62±0.00^{ABab}	4.90±0.04^{Ab}	27.21±1.10^{Aab}	2.78±0.06^{Aab}	10.21±0.05^{Aab}	1.80±0.06^{Bab}	2.41±0.02^{Bab}
	21		1.84±0.06^{BCa}	4.68±0.06^{Ab}	27.94±1.44^{Aa}	2.99±0.07^{ABa}	10.70±0.04^{Ba}	1.98±0.05^{Aa}	2.67±0.05^{ABa}
	28		1.99±0.05^{Ba}	4.48±0.04^{Bbc}	28.11±1.15^{ABa}	3.10±0.08^{Aa}	11.02±0.16^{ABa}	2.10±0.04^{Aa}	2.83±0.04^{ABa}
T5	0	19.74^{AB}	1.21±0.01^{Cbc}	5.78±0.02^{ABa}	25.57±1.33^{Ac}	2.43±0.09^{Bb}	9.51±0.17^{Cbc}	1.37±0.05^{Bb}	1.81±0.04^{ABbc}
	7		1.41±0.02^{ABb}	5.05±0.04^{Ca}	26.44±1.12^{Ab}	2.62±0.04^{ABab}	9.91±0.2^{Bb}	1.67±0.03^{Aab}	2.22±0.05^{Ab}
	14		1.61±0.05^{Bab}	4.72±0.05^{Bab}	27.24±1.50^{Aab}	2.75±0.01^{ABa}	10.09±0.19^{ABb}	1.81±0.03^{ABab}	2.42±0.05^{Bb}
	21		1.79±0.07^{CDab}	4.61±0.04^{ABb}	27.97±0.09^{Aab}	2.94±0.03^{Ba}	10.51±0.17^{Cab}	2.00±0.02^{Aa}	2.70±0.01^{Aa}
	28		1.97±0.02^{Ba}	4.52±0.03^{ABb}	28.20±1.16^{Aa}	3.08±0.02^{ABa}	10.92±0.21^{Ba}	2.12±0.01^{Aa}	2.86±0.07^{Aa}
T6	0	20.17^{A}	1.26±0.06^{Ab}	5.72±0.03^{Ba}	25.60±0.08^{Ac}	2.41±0.06^{Bbc}	9.42±0.12^{Dc}	1.35±0.04^{Bc}	1.78±0.03^{Bc}
	7		1.44±0.03^{Aab}	5.19±0.02 ^{Ba}	26.51±0.09^{Ab}	2.61±0.05^{ABb}	9.84±0.24^{BCb}	1.67±0.07^{Abc}	2.22±0.03^{Ab}
	14		1.65±0.01^{Aab}	4.88±0.01^{Aab}	27.32±1.11^{Aab}	2.74±0.04^{ABb}	10.02±0.13B^{ab}	1.82±0.05^{ABb}	2.44±0.05^{Bab}
	21		1.83±0.04^{Ca}	4.70±0.03^{Ab}	27.99±1.60^{Aa}	2.95±0.06^{Ba}	10.53±0.22^{Ca}	2.02±0.03^{Aab}	2.73±0.04^{Aa}
	28		2.01±0.023^{ABa}	4.45±0.01^{BCb}	28.24±1.44^{Aa}	3.07±0.04^{ABa}	10.80±0.05^{BCa}	2.11±0.02^{Aa}	2.87±0.01^{Aa}

ABCD Letters indicate significant differences between kareish treatments
abcd Letters indicate significant differences between storage times
C: Kareish cheese (control)
T1: Kareish cheese with 0.5 % date seed powder
T2: Kareish cheese with 1.0 % date seed powder
T3: Kareish cheese with 0.5 % oats powder
T4: Kareish cheese with 1.0 % oats powder
T5: Kareish cheese with 0.5 % date seed powder + 0.5 % oats powder
T6: Kareish cheese with 1.0 % date seed powder + 1.0 % % oats powder

Table (4) deals with total nitrogen (TN) of different cheeses throughout 28 days of storage. As the storage period progressed, the TN parallely increased but the differences were almost insignificant. The apparent increase is due to the loss of water and the increase in total solids. Similar observations were noticed by McMahon *et al.,* (1996). Total nitrogen content at zero time in the control cheese was 2.37%, and it decreased to 2.35, 2.32, 2.36, 2.33, 2.27 and 2.24% for T1, T2, T3, T4, T5 and T6 respectively. This means that adding DSP and OP decreased TN of the resultant cheese. This observation might be attributed to the high water-holding capacity of the additives.TN/DM ratio had the same trend of TN.

The values of WSN and WSN/TN of all cheese treatments gradually increased during storage period. This was attributed to continuous degradation of cheese protein. These results are in agreement with those reported by Omar *et al.,* (1999). Addition of DSP and OP slightly decreased WSN and WSN/TN .These results disagree with Foda *et al.,* (2007), who showed that increasing turmeric concentrations increased the WSN/TN, compared with control. Table (4) also shows the values of TVFA of different cheese treatments during 28 days expressed as ml 0.1 NaOH 100 g-1 cheese. The values of TVFA contents significantly increased during storage. Control cheese had the highest significant values at zero time (2.72 ml 0.1 NaOH 100 g-1 cheese) while T6 had the lowest one at zero time (2.48 ml 0.1 NaOH 100 g-1 cheese) .Statistical analysis presented in Table (4) showed almost significant differences between treatments and during storage.

Table 4. Effect of date seed powder (DSP) or oats powder (OP) on TN, TN/ fractions and TVFA contents of Kareish cheese

Storage period (days)	C	T1	T2	T3	T4	T5	T6
	TN (%)						
0	2.37±0.03^{Abc}	2.35±0.07^{Ac}	2.32±0.03^{ABc}	2.36±0.07^{Ab}	2.33±0.05^{ABc}	2.27±0.08^{Bc}	2.24±0.06^{BCc}
7	2.49±0.02^{Ab}	2.45±0.05^{ABbc}	2.42±0.05^{Bbc}	2.47±0.08^{Ab}	2.45±0.04^{ABbc}	2.40±0.05^{BCbc}	2.35±0.07^{Cbc}
14	2.58±0.05^{Aab}	2.57±0.08^{Ab}	2.52±0.05^{ABb}	2.58±0.08^{Aab}	2.57±0.08^{Ab}	2.49±0.07^{Bb}	2.43±0.09^{BCb}
21	2.69±0.04^{Aa}	2.67±0.07^{Aab}	2.63±0.08^{ABa}	2.66±0.09^{ABa}	2.66±0.06^{ABa}	2.57±0.06^{Bab}	2.55±0.05^{Bab}
28	2.76±0.02^{Aa}	2.77±0.05^{Aa}	2.71±0.06^{Ba}	2.74±0.05^{ABa}	2.72±0.07^{ABa}	2.68±0.09^{Ba}	2.67±0.06^{BCa}
	TN/DM %						
0	9.32±0.22^{Abc}	9.21±0.27^{Abc}	9.08±0.17^{ABbc}	9.25±0.27^{ABbc}	9.12±0.21^{Bbc}	8.87±0.21^{Bbc}	8.75±0.20^{Bbc}
7	9.44±0.25^{Ab}	9.28±0.21^{Ab}	9.13±0.25^{ABbc}	9.36±0.35^{Ab}	9.27±0.19^{Bb}	9.07±0.19^{Bb}	8.86±0.15^{BCb}
14	9.51±0.32^{Ab}	9.45±0.19^{Aab}	9.25±0.30^{ABb}	9.48±0.17^{Ab}	9.48±0.25^{Ab}	9.14±0.25^{Bb}	8.89±0.20^{BCb}
21	9.63±0.27^{Aab}	9.61±0.25^{Aa}	9.41±0.29^{Ba}	9.52±0.20^{Aab}	9.52±0.20^{Aab}	9.19±0.29^{BCab}	9.11±0.30^{Cab}
28	9.81±0.18^{Aa}	9.87±0.31^{Aa}	9.62±0.25^{ABa}	9.74±0.26^{Aa}	9.67±0.26^{Aa}	9.50±0.19^{Ba}	9.45±0.22^{BCa}
	WSN %						
0	0.562±0.04^{Ac}	0.558±0.03^{Ac}	0.552±0.02^{Ac}	0.560±0.05^{Ac}	0.554±0.05^{Ac}	0.546±0.04^{Ac}	0.540±0.01^{Acd}
7	0.614±0.02^{Abc}	0.611±0.02^{Abc}	0.608±0.03^{Abc}	0.612±0.03^{Abc}	0.611±0.03^{Ab}	0.601±0.02^{ABbc}	0.597±0.05^{Bc}
14	0.684±0.01^{Ab}	0.679±0.04^{Ab}	0.675±0.05^{Aab}	0.682±0.02^{Ab}	0.677±0.03^{Aab}	0.668±0.03^{ABb}	0.663±0.03^{ABbc}
21	0.756±0.02^{Aab}	0.752±0.05^{Aab}	0.750±0.01^{Aa}	0.755±0.04^{Ab}	0.754±0.04^{Aab}	0.742±0.05^{Bab}	0.738±0.02^{BCb}
28	0.814±0.05^{Aa}	0.811±0.03^{Aa}	0.807±0.03^{ABa}	0.811±0.02^{Aa}	0.809±0.02^{Aa}	0.794±0.02^{Ba}	0.790±0.05^{BCa}
	WSN/TN %						
0	23.71±3.25^{Bc}	23.74±2.98^{ABc}	23.79±3.56^{ABcd}	23.72±2.53^{ABc}	23.77±3.20^{ABc}	24.05±3.11^{Ac}	24.10±3.17^{Acd}
7	24.65±2.76^{ABbc}	24.93±3.59^{Abc}	25.12±4.10^{Ac}	24.77±1.93^{ABb}	24.93±2.56^{Ac}	25.04±2.53^{Abc}	24.36±2.53^{ABc}
14	26.43±3.55^{Ab}	26.42±4.22^{Ab}	26.28±3.22^{ABb}	26.43±2.57^{ABb}	26.34±3.72^{ABab}	26.82±2.79^{Ab}	26.04±3.37^{Bb}
21	28.10±4.03^{Bab}	28.16±3.51^{ABa}	28.51±5.27^{Aab}	28.38±3.20^{ABa}	28.34±4.11^{ABa}	28.87±2.50^{Aab}	28.94±3.18^{Aab}
28	29.49±3.95^{ABa}	29.27±4.36^{Ba}	±3.20^{Aa}29.7	±2.86^{ABa}29.59	±3.25^{Aa}29.74	±3.32^{Aa}29.62	±2.63^{Aa}29.58
	TVFA*						
0	2.72±0.05^{Ad}	2.69±0.06^{ABd}	2.63±0.11^{ABd}	2.65±0.08^{ABc}	2.67±0.15^{ABe}	2.53±0.07^{Bd}	2.48±0.08^{Be}
7	3.61±0.04^{Ac}	3.55±0.05^{Ac}	3.50±0.05^{ABc}	2.53±0.07^{ABc}	3.51±0.11^{ABd}	3.44±0.13^{Bc}	3.33±0.07^{BCd}
14	4.45±0.07^{Ab}	4.44±0.07^{Ab}	4.42±0.09^{Abc}	4.45±0.09^{Ab}	4.48±0.02^{Ac}	4.35±0.11^{Bbc}	3.21±0.12^{BCc}
21	5.36±0.06^{Aab}	5.33±0.03^{Aab}	5.30±0.10^{Ab}	5.31±0.15^{Aab}	5.33±0.09^{Ab}	5.22±0.07^{Bb}	5.15±0.06^{Bb}
28	6.88±0.08^{Aa}	6.83±0.05^{Aa}	6.80±0.21^{Aa}	6.82±0.08^{Aa}	6.88±0.08^{Aa}	6.71±0.09^{Ba}	6.66±0.09^{BCa}

***expressed as ml 0.1 NaOH 100 g^{-1} cheese**

****See legend to Table (3) for details.**

Table (5) shows the changes in total bacteria count (TBC), lactic acid bacteria and bividobacteria of different kareish cheese samples during cold storage. From these results it could be seen that the minimum of these numbers were reached the after 28 days of storage. It could also be observed also that the TBC of T6 was the highest (8.44 log cfu/g), and significantly higher than the control, while they significantly decreased at the end of storage period to reach 1.37 log cfu/g. The activity of lactic acid bacteria in kareish cheese samples increased the acidity and consequently decreased the TBC (Mehanna *et al.*, 2002). Bifidobacteria counts of samples containing DSP and OP were significantly higher than those of control. The highest numbers of Bifidobacteria were observed at fresh cheese in C,T1,T2,T3,T4,T5 and T6 .They were 6.39, 6.42, 6.45 ,6.46,6.50,6.54 and 6.59 log cfu/g respectively.

Moreover the control or the treated cheese samples were completely free from coliforms, while in the fresh samples, or in the samples tested during the storage.

Survivability of the used probiotic bacteria in fresh and the early stages of kareish cheese storage and in the presence of DSP and OP is quite important for making probiotic product. This was achieved since the counts of the probiotic bacteria were more than the recommended minimum counts (one million viable cells/ml) given in the literature (Rybka and Kailasapathy, 1995; Tamime *et al.*1995) to achieve the desired probiotic effect.

Table 5. Effect of date seed powder (DSP) or oats powder (OP) on some microbial groups (log cfu/ml) of Kareish cheese

Storage period (days)	Total Bacterial Count						
	C	T1	T2	T3	T4	T5	T6
0	7.80±1.16^{BCa}	7.89±1.25^{BCa}	7.96±1.93^{Ba}	8.01±2.05^{ABa}	8.11±0.87^{Aa}	8.23±0.75^{Aa}	8.44±1.99^{Aa}
7	5.33±1.72^{BCb}	5.39±1.73^{BCb}	5.41±1.57^{Bb}	5.46±1.98^{Bb}	5.56±0.95^{ABb}	5.64±2.02^{Ab}	5.71±1.27^{Ab}
14	4.40±1.53^{BCc}	4.41±1.50^{Bc}	4.45±0.93^{Bc}	4.50±1.42^{ABc}	4.58±1.27^{ABc}	4.68±1.66^{Ac}	4.73±2.18^{Ac}
21	2.29±0.87^{CDd}	2.33±1.12^{Cd}	2.38±1.22^{BCd}	2.45±1.50^{Bd}	2.52±1.55^{ABd}	2.56±2.10^{Ad}	2.63±1.92^{Ad}
28	1.12±0.95^{Ce}	1.17±1.79^{Be}	1.20±1.85^{Be}	1.25±1.89^{Abe}	1.28±0.99^{Ae}	1.33±1.93^{Ae}	1.37±1.95^{Ae}
	Lactic acid bacteria						
0	7.41±1.22^{Ba}	7.44±0.93^{Ba}	7.46±1.22^{Ba}	7.50±1.52^{ABa}	7.54±0.87^{Aa}	7.59±1.22^{Aa}	7.63±0.87^{Aa}
7	5.04±1.55^{BCb}	5.06±0.87^{BCb}	5.11±1.57^{Bb}	5.13±1.34^{Bb}	5.17±1.15^{ABb}	5.22±1.51^{Ab}	5.29±0.95^{Ab}
14	4.13±0.39^{BCc}	4.16±1.52^{BCc}	4.20±0.92^{Bc}	4.24±1.51^{ABc}	4.31±1.32^{ABc}	4.39±0.72^{Ac}	4.47±0.99^{Ac}
21	1.82±0.95^{CDd}	1.86±1.34^{Cd}	1.90±1.22^{BCd}	1.95±0.88^{Bd}	2.03±1.82^{ABd}	2.14±0.83^{Ad}	2.21±1.12^{Ad}
28	1.36±0.82^{De}	1.40±0.95^{CDe}	1.43±0.95^{BCe}	1.47±0.96^{Be}	1.53±0.95^{ABe}	1.60±0.95^{ABe}	1.67±0.70^{Ae}
	Bifidobacteria						
0	6.39±1.35^{BCa}	6.42±1.12^{Ba}	6.45±1.25^{ABa}	6.46±1.20^{ABa}	6.50±0.87^{Aa}	6.54±1.12^{Aa}	6.59±1.07^{Aa}
7	6.02±1.39^{BCab}	6.05±1.37^{Bb}	6.10±0.83^{Bab}	6.12±1.36^{ABb}	6.15±0.95^{ABab}	6.17±0.85^{Ab}	6.21±0.86^{Aab}
14	5.79±1.07^{Cb}	5.81±1.29^{BCbc}	5.84±0.97^{Bb}	5.86±1.39^{ABbc}	5.88±0.73^{Ab}	5.89±1.25^{Abc}	5.92±0.75^{Abc}
21	5.41±0.82^{Cc}	5.44±0.88^{BCc}	5.47±0.82^{BCc}	5.48±1.79^{Bcd}	5.50±0.80^{ABbc}	5.53±1.73^{Ac}	5.55±0.67^{Acd}
28	5.15±0.95^{Ccd}	5.18±1.35^{BCd}	5.20±1.03^{Bcd}	5.22±1.37^{ABe}	5.25±1.03^{ABcd}	5.28±0.82^{Acd}	5.30±0.92^{Ad}

***See legend to Table (3) for details.**

****Coliform bacteria were not detected in all samples.**

Sensory evaluation of food products is an important indicator of potential consumer preference. Data given in Table (6) represent the average scores for sensory properties of fresh and stored Kareish cheese as affected by using date seed powder and oat powder. This was noticed among fresh or stored samples. Storage of kareish up to 28 days decreased the quality of all treatments including the control. Colour scores decreased as the level of date seed powder or oat power increased since this is led to the colour became darker. Similar behavior may have occurred in yoghurt fortified with commercial fibers from apple and inulin (Güler 2013). Generally, the appearance of final product was affected by the ingredients used in manufacture of cheese. The control and T1Kariesh cheeses received higher scores for texture than the other treatment. All treated cheeses were accepted by panelists even at the end of storage period.

Table 6. Effect of adding date seed powder or oats powder to skim cow's milk on organoleptic properties of Kareish cheese

Treatments	Storage period (days)	Color & Appearance (15)	Body & Texture (35)	Flavour (50)	Total (100)
C	0	14	33	45	92
	7	13	32	46	91
	14	13	32	44	89
	21	12	31	42	85
	28	12	30	39	81
T1	0	13	33	46	92
	7	13	32	47	92
	14	12	31	45	88
	21	12	31	45	88
	28	11	30	43	84
T2	0	10	30	41	81
	7	10	30	41	81
	14	10	30	38	78
	21	9	29	38	76
	28	9	28	37	74
T3	0	13	33	46	92
	7	13	32	46	91
	14	12	32	45	89
	21	12	31	43	86
	28	11	30	40	81
T4	0	13	31	45	89
	7	12	31	45	88
	14	12	30	44	86
	21	12	30	43	85
	28	11	29	40	80
T5	0	13	32	44	89
	7	13	32	44	89
	14	12	31	44	87
	21	12	30	43	85
	28	11	29	42	82
T6	0	10	29	40	79
	7	10	29	40	79
	14	9	28	39	76
	21	9	27	39	75
	28	9	26	38	73

***See legend to Table (3) for details.**

In general, the addition of date seed powder and oat powder had a pronounced effect on the colour, appearance, texture and flavour of the Kariesh cheeses, but it was possible to produce accepted healthy Kariesh cheese with satisfactory sensory attributes.

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تركيب وجودة الجبن القريش المدعم ببكتريا البروبيوتيك والالياف الغذائية

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أُجري هذا البحث بغرض الاستفادة من المحتوى العالى من الالياف المتواجد فى نوى البلح والشوفان فى تدعيم الجبن القريش مع استخدام البادىء الحيوى ABT-5 مما يحسن من الخواص الصحية و الغذائية للجبن الناتج.حيث تم تصنيع 6 معاملات باضافة نوى البلح او الشوفان او خليط منهما بنسبة 0.5 أو 1.0% بالاضافة لمعاملة المقارنة واخذ العينات اللازمة للتحليل طازجة وبعد مرور 7و14و21و28 يوم واجراء الاختبارات الكيماوية والميكروبيولوجية والحسية لجميع المعاملات .واشارت النتائج ان اضافة مسحوق نوى البلح والشوفان بنسب مختلفة ادى الى انخفاض وقت التجبن وقوة الخثرة مع زيادة نسبة التشريش . كذلك كانت نسبة التصافى والمادة الصلبة مرتفعة فى كل المعاملات مقارنة بالكنترول. كما لوحظ انه كلما زادت نسبة الاضافة من كلا من نوى البلح والشوفان ادى ذلك لانخفاض فى قيم الحموضة والدهن والملح والملح فى الرطوبة والنتيروجين الكلى والنيتروجين الكلى/المادة الجافة والنيتروجين الذائب فى حين ارتفعت قيم النيتروجين الذائب /المادة الجافة.كما ادى التدعيم بالالياف الى زيادة العد الكلى للبكتيريا وبكتيريا حامض اللاكتيك والبيفيدوبكتريا بينما مع التخزين انخفضت الاعداد البكتيرية.وكان لتدعيم الجبن بالالياف تاثير جيد على الخواص الحسية.وفى كل الاحوال كانت اعداد البكتيريا البروبيوتيك مناسبة مع الاضافات المذكورة لانتاج جبن قريش حيوى وصحى.