PRODUCTION OF PROBIOTIC YOGHURT FORTIFIED WITH DATE SEEDS (*phoenix dactylifera* L.) POWDER AS PREBIOTIC AND NATURAL STABILIZER

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Abstract

The present study aimed to evaluate the use of date seeds powder (DSP) as a natural prebiotic stabilizer in the manufacture of set yoghurt and their effect on some physicochemical, microbiological, rheological and sensory properties of this yoghurt during storage period at 4±1°C. Probiotic set yoghurt was produced using common yoghurt starter culture and probiotic starter culture ABT-2. Titratable acidity showed a slight decrease as a result of increasing the percentage of DSP level. It was found that the water holding capacity of yoghurt samples ranged from 62.17% to 79.43% during storage period. The addition of DSP to probiotic set yoghurt stimulated the growth of probiotic bacteria. The total viable counts of (*S. thermophilus* ST-20Y, *L. acidophilus* LA-5 and *B. bifidum* BB-12) decreased slightly during the refrigerated storage, but remained at sufficient levels (>6 log cfu/g) for up to 14 days. The coliform and mould & yeast counts were not detected in all samples. The use of DSP as a prebiotic and natural stabilizer at concentration of 0.5% in probiotic set yoghurt manufacture improved their sensory and rheological properties.

Key words: Date seeds powder (DSP), prebiotic stabilizer, probiotic set yoghurt.

INTRODUCTION

Yoghurt is a fermented milk product, which is produced by fermenting milk with bacterial cultures consisting of a mixture of *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus thermophiles* (Tamime & Robinson, 1999) which are responsible for development of typical yoghurt flavour. Yoghurt may have two primary defects: variation in viscosity and/or syneresis. Processing, incubation and storage conditions have an effect on these changes. Dairy ingredients and stabilizers have sometimes been added to overcome such defects. Stabilizers are often added to the milk base to enhance or maintain the appropriate yoghurt properties including texture, mouth feel and appearance, viscosity /consistency and to prevent whey separation (Tamime & Robinson, 1999).

The date palm (*Phoenix dactylifera* L.) is one of the major fruit trees in Egypt and many regions of the world. The fruit is composed of a fleshy pericarp and seed (pits) which constitute approximately 10-15% of the total fruit weight (Almana & Mahmoud, 1994). Date pits could be used as an excellent source of functional food component because they contain a balance of fats, proteins, minerals and carbohydrates. Chemical composition of date pits showed high amount of fibre (75 to 80%), fat (10 to 13%), proteins (5 to 6%) and ash (Al-Farsi et al. 2007). Other studies have also revealed much higher amounts of phenolic content and antioxidant in date pits as compared to the corresponding flesh (Al-Farsi *et al*. 2007). Date pits are a major waste product of the date industry that could offer potentially valuable material for the production of useful food ingredients. This waste product of date processing industries could be regarded as an excellent source of food ingredients with interesting technological functionality that could also be used in food as an important source of dietary fiber without any negative impact on sensory quality of end-products if the pits are properly milled (Almana & Mahmoud, 1994). The polysaccharide content is often expressed in terms of the fiber content, and is divided into crude fiber, neutral detergent fiber (NDF) and acid detergent fiber (ADF). Hamada *et al*. (2002) indicated the presence of high content of lignin and resistant starch in date pits.

Resistant starch is a type of starch that is resistant to digestion. Resistant starches are considered polysaccharides in which several monosaccharides, in this case is glucose. Resistant starch is used in food products due to its physicochemical properties including swelling, increased viscosity, gel formation, and water-binding capacity. Due to the resistance to digestive enzymes, resistant starch can be used as a dietary fiber. There is also an evidence that resistant starch may have prebiotic activity due to the resistance to digestion and subsequent fermentation, resulting in an increase in bowel health. It stimulates the growth of probiotic bacteria and improves culture viability (Ha & Zemel, 2003).

The present study aimed to evaluate the use of date seeds powder (DSP) at different ratio as a prebiotics and natural stabilizer in set yoghurt manufacture and its effect on some physicochemical, microbiological, rheological and sensory properties of probiotic set yoghurt during storage period at 4±1°C.

MATERIALS AND METHODS

Materials:

Fresh liquid skimmed cow milk (0.16% titratable acidity as lactic acid, pH 6.52, o.44% fat, protein 2.65 % and 9% SNF) was used in the manufacture of probiotic set yoghurt and was obtained from dairy farm of Agriculture College, Alexandria University, Egypt. Skimmed milk powder "Miro" (95% T.S., 1.2% fat and 32% protein) was obtained from Alexandria local market. Dried date fruits (*Phoenix dactylifera* L.) of Bent-Aisha dates were purchased from the Pomology Department

Faculty of Agriculture, Alexandria University, Egypt. 2, 2-diphenyl-1-picrylhydrazyl (DPPH) and Butylated Hydroxy Toluene (BHT) were purchased from Sigma-Aldrich, Germany. Other chemicals and reagents used in the present study were of analytical grade and purchased from El-Gomhouria Co. for trading chemical and medical Appliances, Alexandria, Egypt. A commercial classic yoghurt starter containing *S. thermophilus* and *L. bulgaricus* strains (1:1) and probiotic starter culture ABT-2 which consists of *S. thermophilus* ST-20Y, *L. acidophilus* LA-5 and *B. bifidum* BB-12 were obtained from Chr. Hansens laboratories, Denmark) were used. Starter cultures were freeze-dried direct-to-vat set (DVS) form and stored at –18°C until used. ABT-2 were added to the milk after the preliminary incubation at 37 ± 1°C for 18 h.

Methods

Preparation of defatted date seeds powder (DSP):

About 100 g of seeds were separated from the date fruits soaked in water, washed several times to remove any adhering date flesh and then air dried for 24 h at room temperature. Dried seeds were milled in a heavy-duty grinder, and then sieved using 1 to 2 mm mesh sieve to obtain a homogeneous fraction and the obtained powder was preserved at -20°C until analysis. Oil was extracted from the obtained powder by a Soxhlet extraction apparatus using n-hexane as a solvent for 16 h. The DSP was kept in plastic container at –20˚C until further use.

Manufacture of probiotic set yoghurt

The total solid content of milk was standardized to 12% by adding 30 g skimmed milk powder and divided into four equal batches. One batch was kept without stabilizer as a control (C). To the other three batch (0.1%, 0.3% and 0.5%) of DSP were added (T_1, T_2 and T_3), respectively. The mixtures were homogenized with Ultra Turrax blender (IKA, Merck, Germany) at 14000 rpm, to dissolve added ingredients. All batches were heated to 80°C for 15 min and cooled to 42±1°C. Then, all batches were inoculated with (0.02% w/w) yoghurt starter culture and (0.05% w/w) probiotic culture of ABT-2 starter culture, disposed into plastic cups (200 ml) and incubated at 42±1°C until complete coagulation. Yoghurt treatments were transferred to cool storage at 4±1°C, and kept for 14 days and analysed for their physicochemical, microbiological, rheological and sensory properties when fresh and after 7 and 14 days of storage, respectively. Three replicates of probiotic set yoghurt were made.

Physicochemical properties

Moisture, crude protein, crude fat, crude fiber, titratable acidity as lactic acid and ash contents were determined according to AOAC (2007), and nitrogen free extract (NFE) content was determined by differences (crude protein, crude fat, crude fiber and ash) from 100. The dietary fiber was determined according to the method described by Asp *et al*. (1983). The minerals (K, Ca, Mg, Na, Fe and Zn) were determined according to the AOAC (2007). Ca, Mg, Fe and Mn procedures using a Perkin Elmer Atomic Absorption spectrophotometer (Model 2380, Japan), while K and Na were determined by coring flame photometer (Model 410, Japan), and the water holding capacity (WHC) as described by Arslan & Ozel (2012). The pH was determined using glass electrode pH meter (Persica model pH 900, Switzerland). Triplicate measures were taken for each sample.

Determination of total phenolic content and antioxidant activity

One gram sample of defatted DSP was mixed with 10 ml of 80% methanol and stirred at room temperature for 24 h and filtered. The total phenolic content (as % gallic acid) was determined in the filtered by Folin-Ciocalteu reagent according to the method of Lim *et al*. (2006), while the antioxidant activity was determined by DPPH as described by Brand-Williams *et al*. (1995) and expressed as percentage inhibition of the DPPH radical.

Rheological properties

The texture properties of yoghurt were measured at 20°C using a texture analyzer (TA1000, Lab Pro (FTC TMS-Pro, USA). A two-bite penetration test was performed and operated at a crosshead speed 1 mm/sec and penetration distance of 10 mm/sec. Hardness, adhesiveness, springiness, cohesiveness, gumminess and chewiness were evaluated by the method described by Bourne (1978).

Microbiological properties

The total bacterial count was determined according to Marshal (1992). For enumeration of *S. thermophilus*, diluted samples were plated on M17 agar (Oxoid Ltd) and incubated at 37˚C for 48-72 h under aerobic conditions (Rybka & Kailasaphaty1996). *L. bulgaricus* was determined using MRS–agar (Rybka and Kailasaphaty 1996). *L. acidophilus* counts were determined using MRS-sorbitol agar while *B. bifidum* was performed on MRS-NNLP medium according to (Dave & Shah 1998). The plates of *L. acidophilus* cultures and *B. bifidum*, were anaerobically (Anerocult A system; Merck, Darmstadt, Germany) incubated at 37°C for 72 ± 1 h.

The coliform bacteria, mould & yeast counts were enumerated according to standard methods for examination of dairy products (Marth, 1998) using the violet red bile agar (VRBA) and acidified potato dextrose agar (PDA), respectively. The results were expressed as log number of colony forming units per g (cfu/g).

Sensory evaluation

Sensory evaluation of yoghurt samples was carried out by 10 panelists including staff members Faculty of Agriculture El-Shatby, Alexandria University. The sensory attributes tested were taste (45 points), body & texture (35 points) appearance & colour (10 points), odour (10 points) and the overall acceptability as described by Ranadheera *et al*. (2012).

Statistical analysis

All data were expressed as mean values ± SD. Statistical analysis was performed using one way analysis of variance (ANOVA) followed by Duncan's Multiple Range Test with $P \geq 0.05$ being considered statistically significant using SAS software program (SAS, 2004).

RESULTS AND DISCUSSION

Physicochemical and microbiological properties of defatted DSP

Table (1) presents the proximate composition of DSP. DSP contained 6.80% moisture, 6.20% protein, 0.07% crude fat and 1.14% ash. The data showed that DSP had high percentages of crude fiber (15.12%). The results obtained in the present study for DSP are in a general agreement with those of Hamada *et al*. (2002).

The results also showed that, the DSP composed of 75% neutral detergent fiber (NDF); 57.5% acid detergent fiber (ADF) and 10.5% hemicellulose. The ADF is very high, which may indicate the presence of substantial amounts of lignin and perhaps resistant starch in DSP. Almana & Mahmaud, (1994) evaluated date pits as an alternative source of dietary fiber in comparison with wheat bran, and suggested that they may provide a valuable contribution to dietary fiber intakes. Therefore, DSP were examined because they may have an extractable high value-added components in functional foods.

The data given in Table (1) indicated that DSP had higher total phenolic content (70.72 mg/100g) and antioxidant activity (45.44%). The results obtained in the present study are agreement with those reported by Al-Farsi *et al*. (2007).

The DSP contained several important minerals. The results indicated that the DSP contented the high level of potassium (605 mg/100g) then followed by Ca, Mg, Na and Fe (289, 67, 34.8 and 7.7 mg/100g), respectively. The level of Zn was considerably low (1.2 mg/100g). Generally, DSP may be considered as a good source of K, Ca, Mg and Fe. The results obtained in the present study are in a good agreement with those reported by Abdel-Nabey (1999).

From the data in Table (1), it could be observed that the DSP had the highest water holding capacity (4.34 g/g). This may be attributed to the high fiber content of the DSP. This result agreed with Garcia-Perez *et al*. (2005) who found that the high fiber content of date palm pits led to high water holding capacity.

In addition, the total bacterial count was 110 cfu/g, while, mould and yeast counts were not detected. The low moisture content permitted better conservation of DSP and inhibited the development of bacteria.

Table 1. physicochemical and microbiological properties of DSP

Component	Value*
Proximate composition (%)	
Moisture	6.80± 0.41
Crude protein	6.20± 0.22
Crude fiber	15.12 ± 0.32
Crude fat	0.07 ± 0.23
Ash	1.14± 0.35
Nitrogen free extract (NFE)**	77.47± 0.49
Dietary fiber (%)	
NDF	63.0 ± 0.49
ADF	52.5± 0.34
Hemicellulose (NDF- ADF)	10.5± 0.05
Bioactive compounds	
Total phenolic compounds (mg/100g)***	70.72
Antioxidant activity (%)	45.44
Minerals (mg/100g)	
Calcium (Ca)	289 ± 0.74
Potassium (K)	605 ± 0.88
Sodium (Na)	34.8 ± 0.37
Magnesium (Mg)	67 ± 0.42
Iron (Fe)	7.7± 0.22
(Zinc) Zn	1.2 ± 0.08
Water Holding Capacity (WHC)	4.34 ± 0.07
pH	6.35± 0.08
Microbiological analysis	
Total bacterial counts (cfu/g)	110 ± 17
Yeast and mould counts	ND

NDF: neutral detergent fiber, ADF: acid detergent fiber, ND: Not Detected
*Mean of three replicates ± SD **Calculated by difference *** Gallic acid equivalent

Physicochemical properties of probiotic set yoghurt

Titratable acidity:

The titratable acidity of probiotic set yoghurt (Figure 1) decreased with increasing DSP concentrations. This may be due to the pH of DSP (6.35), also high absorption of water by DSP and the water becomes unavailable for starter cultures. Which, results in reducing activity of starter cultures (Tamime & Robinson, 1999) and lactic acid production. The highest titratable acidity content was found in sample C (control) in the range of 0.972–1.091%, and the lowest values were found in samples T_3 in the range of 0.918–0.994%. In general, the titratable acidity of all samples increased during storage period, which could be due to the presence of the three bacterial strains of ABT-2 starter culture and a commercial classic yoghurt starter. This can be explained by further metabolic activity of starter cultures during storage. The lowest value of titratable acidity was found in fresh sample, but the highest value was found on 14th day of storage for the control sample and the other samples containing the different concentration of DSP (Figure 1).

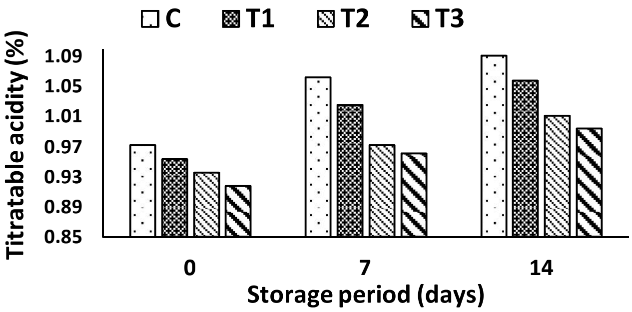

Fig. 1. Titratable acidity of probiotic set yoghurt during the storage period

Water-holding capacity (WHC):

Figure (2) illustrates the WHC of probiotic set yoghurt prepared using different concentrations of DSP. The plain yoghurt (C) exhibited low value of WHC as compared to the probiotic set yoghurt samples treated with various concentrations of DSP. Figure (2) shows that there was an increase in the WHC of samples with increasing of DSP concentrations. This could be explained by the availability of fiber from DSP, which has high WHC (Garcia-Perez *et al.* 2005). In general, storage period affected WHC. The values of WHC obtained in fresh sample were lower than those found after 7 and 14 days of refrigerated storage period. Guler-Akin & Akin (2007) obtained similar results they found that the addition of prebiotics as a water-structuring agents, act as a thickeners and can form complexes (H-bridge formation) with the protein aggregates in the yoghurt.

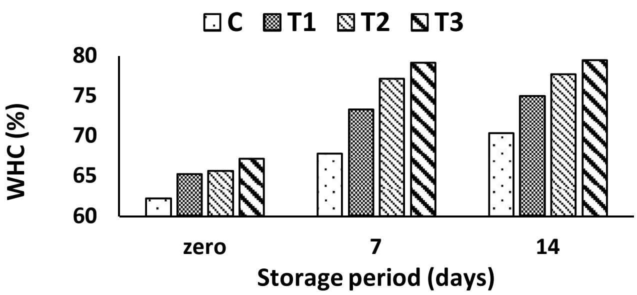

Fig. 2. WHC values of probiotic set yoghurt during the storage period.

Rheological properties of probiotic set yoghurt

The effects of DSP and storage period on rheological properties of probiotic set yoghurt during storage period are given in Figure 3 (a, b, c, d, e and f). The following parameter were evaluated:

Hardness

Hardness values were shown in Figure (3.a). Adding DSP and increasing their concentrations resulted in decreased of hardness values in comparison to plain yoghurt (C). During storage period the hardness of yoghurt increased till the end of storage period. Similar results were obtained during storage of probiotic Torba yoghurt (Kasenkas, 2010). The increase of hardness could be due to the reduction of pH during storage, causing the gel to contract and consequently increased gel firmness (Coggins *et al*. 2010). The hardness of probiotic set yoghurt was found to be affected by its composition and pH.

Adhesiveness

Probiotic set yoghurt with different concentrations of DSP had the lowest adhesiveness values comparing with the plain yoghurt (Figure 3.b). Additionally, the probiotic set yoghurt with 0.5% DSP (T_3) had lower adhesiveness values than that containing low concentration of DSP (T_1). During storage period the adhesiveness of probiotic set yoghurt increased till the end of storage period. Probably, the high content of DSP reflected the low adhesiveness values for those samples and produced yoghurt with soft. The results revealed an inverse relationship between adhesiveness and hardness.

Cohesiveness:

The data in figure (3.c) showed that cohesiveness values of yoghurts were affected by DSP. Adding DSP and increasing their concentrations resulted in a decrement of cohesiveness in comparison to the plain yoghurt (C). Addition of DSP increased the cohesiveness values in probiotic set yoghurt with 0.5% DSP (T_3) after 7 days, and then decreased with increasing the storage period. Addition of DSP may be responsible for the observed differences in the cohesiveness.

Springiness:

Addition of DSP influenced the springiness values of probiotic set yoghurt. Adding DSP and increasing their concentrations resulted in an increment of springiness in comparison to the plain yoghurt (C). The data in figure (3.d) showed that the springiness of probiotic set yoghurt with 0.5% DSP (T_3) gained a high value than plain yoghurt (C). The data in figure (3.d) showed that the springiness decreased during storage except.

Gumminess

The data in figure (3.e) showed that the gumminess tended to increase during 7 days in all treatment, and then decreased during storage period. The lowest gumminess values were observed after 7 days with 0.5% DSP (T_3).

Chewiness

Chewiness showed similar trends as in case of gumminess. The data in figure (3.f) showed that the chewiness of probiotic set yoghurt increased during 7 days of storage for all treatments then decreased tell the end of storage period.

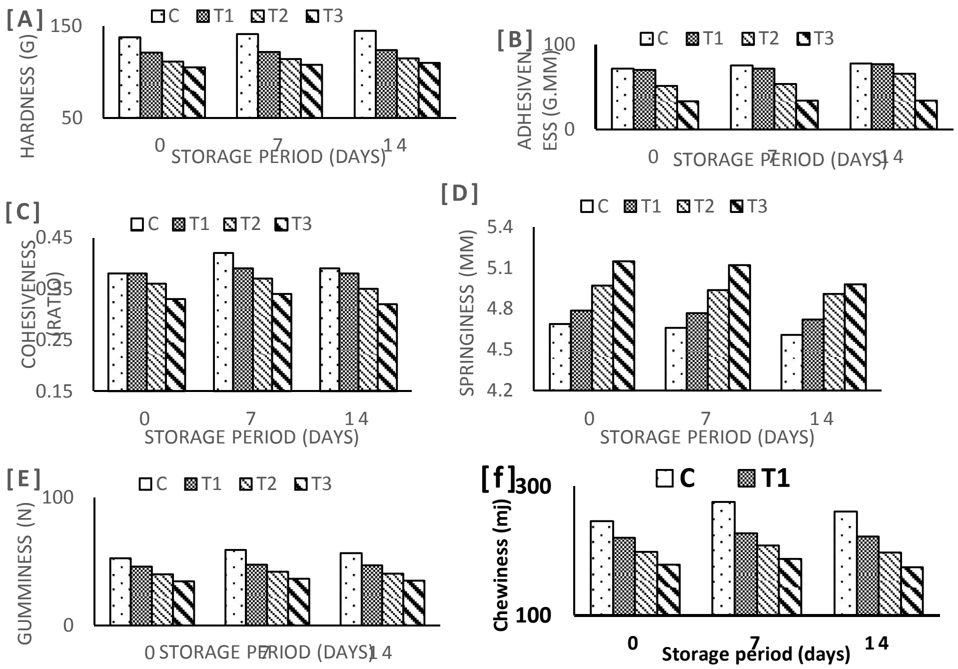

Fig. 3. Rheological properties of probiotic set yoghurt during the storage period (a, Hardness; b, adhesiveness; c, Cohesiveness; d, Springiness; e, Gumminess; f, Chewiness)

Microbiological properties of probiotic set yoghurt

Total bacterial count

Total bacterial count (log cfu/g) of probiotic set yoghurt containing DSP are presented in Figure (4.a). The obtained results indicated that during storage period, the total bacterial count gradually decreased until the end of the storage period. These results may be due to the low storage temperature. Total bacterial counts of probiotic set yoghurt containing DSP in all concentrations were higher than that of the control sample at the end of the storage period. From these results, it might be said that the highest degree of DSP added to the probiotic set yoghurt caused a positive effect on the total bacterial count during the storage period. . Similarly, Dave & Shah (1998) reported that the addition of prebiotics to ABT yoghurts stimulated the growth of probiotic bacteria.

L. bulgaricus* and *S. thermophiles

The viability of *L. bulgaricus* and S*. thermophiles* of probiotic set yoghurt containing DSP during storage period are presented in Figure (4.b and 4.c). The viable cell counts of *L. bulgaricus* (Figure 4.b) decreased from 8.99-9.59 log cfu/g at the beginning of storage to 8.72-9.32 log cfu/g at the end of the storage period. Also the results obtained for the probiotic set yoghurt (Figure 4.c) showed that *S. thermophilus* was present at the level of 8.52-9.39 log cfu/g during storage. It was observed that counts of *L. bulgaricus and S. thermophiles* strains decreased during storage. The highest mean of *L. bulgaricus and S. thermophiles* count was found in T_3, while the lowest mean value was obtained in C and T_1. Similar results were also reported by Dave & Shah, (1998). From these results, it might be noted that the highest concentration of DSP added to the probiotic set yoghurt caused a positive effect on the *L. bulgaricus and S. thermophiles* count during storage. Moreover, several studies have shown that yoghurt bacteria (*S. thermophilus* and *L. bulgaricus*) survive well in yoghurt throughout the shelf life (Pescuma *et al*. 2010).

L. acidophilus LA-5* and *Bifidobacterium BB-12

The changes of viable counts of *L. acidophilus* LA-5 and *B. bifidum* BB-12 in the probiotic set yoghurt containing DSP during storage period are shown in Figure (4.d and 4.e). The amount of *L. acidophilus* LA-5 and *B. bifidum* BB-12 were 6.88-8.18 and 6.8-8.25 log cfu/g during storage period. The highest mean count was found in sample T_3, and the lowest mean count was found in sample C (control). It was observed that a higher addition of DSP leads to an increase in the viable counts of these bacteria. The number of viable of *L. acidophilus* LA-5 and *B. bifidum* BB-12 decreased slightly during the storage period, but remained at sufficient levels (> 6 log cfu/g) for up to 14 days. Bakirci & Kavaz (2008) mentioned that the total viable counts of *S. thermophilus, L. acidophilus* and *B. bifidum* of banana yoghurt decreased slightly during the refrigerated storage, but remained at sufficient levels (>6 log cfu/g) for up to 14 days. According to the variance analysis, there were no statistically significant ($P > 0.05$) differences in the viable counts of *L. acidophilus* LA-5 and *B. bifidum* BB-12 during days of storage.

Coliform, mould & yeast counts

The coliform, mould & yeast counts were not detected in all the probiotic set yoghurt samples containing DSP during storage period in both fresh and at the end of the storage period. This is due to good hygienic conditions during preparation and storage. These results are in agreement with those of Salman *et al*. (2012).

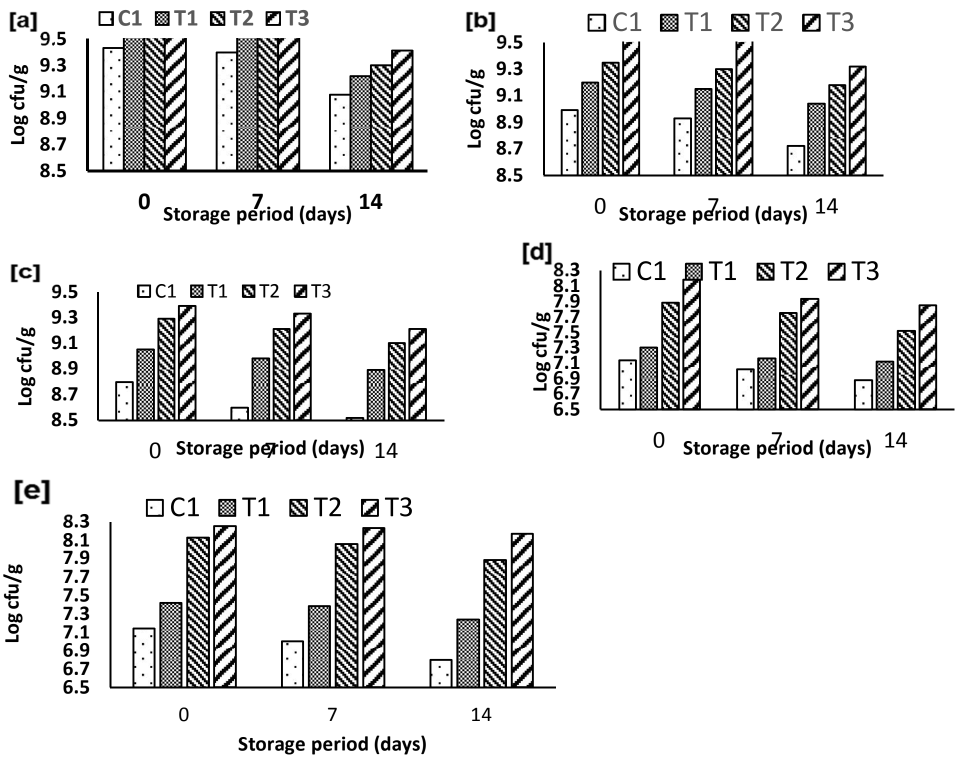

Fig. 4. Microbiological properties of probiotic set yoghurt during the storage period (a, Total bacterial; b, *L. bulgaricus*; c, *S. thermophilus*; d, *L. acidophilus* and e, *B. bifidum* count

Sensory properties

The mean scores for the sensory characteristics of probiotic set yoghurt containing different concentrations of DSP are presented in Table 2. Generally, all samples were acceptable. Addition of DSP had a positive effect ($P < 0.05$) in the scores for taste, body & texture and overall acceptability of the set yoghurt samples.

However, no significant effect ($P > 0.05$) was observed on the appearance & colour and odour scores by the addition of DSP. The storage period did not affect all the sensory parameters tested (Table 2). As noted from Table (2), the highest body & texture scores were obtained in sample T3 (0.5% DSP).

Table 2. Sensory properties of probiotic set yoghurt during the storage period

Treatments	Storage period (days)		
	Fresh	7	14
	Taste (45)		
C	$44.40\pm0.64^{A\ a}$	$44.60\pm0.73^{A\ a}$	$44.30\pm0.62^{A\ a}$
T_1	$43.60\pm1.07^{AB\ a}$	$43.80\pm1.17^{AB\ a}$	$43.90\pm0.43^{AB\ a}$
T_2	$43.10\pm1.22^{AB\ a}$	$43.60\pm1.17^{AB\ a}$	$42.90\pm0.77^{AB\ a}$
T_3	$43.00\pm1.13^{AB\ a}$	$43.40\pm1.32^{AB\ a}$	$43.70\pm1.15^{AB\ a}$
	Body and texture (35)		
C	$28.10\pm1.56^{C\ a}$	$27.10\pm1.32^{C\ ab}$	$26.10\pm0.71^{C\ bc}$
T_1	$30.00\pm1.42^{B\ a}$	$28.80\pm1.11^{B\ ab}$	$28.10\pm1.71^{B\ bc}$
T_2	$30.60\pm2.11^{AB\ a}$	$29.80\pm2.45^{A\ a}$	$29.80\pm1.11^{B\ b}$
T_3	$31.00\pm1.45^{A\ a}$	$30.60\pm0.63^{A\ ab}$	$30.00\pm2.43^{A\ b}$
	Appearance and colour(10)		
C	$8.30\pm0.33^{A\ a}$	$8.30\pm1.11^{A\ a}$	$8.20\pm1.23^{A\ a}$
T_1	$8.20\pm1.16^{A\ a}$	$8.20\pm1.11^{A\ a}$	$8.15\pm1.43^{A\ a}$
T_2	$8.20\pm1.22^{A\ a}$	$8.20\pm0.71^{A\ a}$	$8.15\pm1.13^{A\ a}$
T_3	$8.15\pm1.56^{A\ a}$	$8.10\pm1.00^{A\ a}$	$8.05\pm1.32^{A\ a}$
	Odour (10)		
C	$9.10\pm1.11^{A\ a}$	$8.90\pm1.23^{A\ a}$	$8.90\pm1.21^{A\ a}$
T_1	$9.00\pm0.12^{A\ a}$	$8.80\pm1.12^{A\ a}$	$8.75\pm1.11^{A\ a}$
T_2	$9.00\pm0.76^{A\ a}$	$8.80\pm0.76^{A\ a}$	$8.70\pm1.04^{A\ a}$
T_3	$9.00\pm1.40^{A\ a}$	$8.70\pm1.12^{A\ a}$	$8.65\pm1.34^{A\ a}$
	overall acceptability (100)		
C	$89.90\pm2.10^{B\ a}$	$88.90\pm3.55^{C\ a}$	$87.50\pm2.17^{C\ b}$
T_1	$90.80\pm3.10^{B\ a}$	$89.60\pm2.21^{BC\ a}$	$88.90\pm2.50^{B\ ab}$
T_2	90.90 ± 2.231^{Aa}	$90.40\pm0.45^{A\ ab}$	$89.55\pm2.24^{A\ bc}$
T_3	91.15 ± 2.00^{Aa}	$90.80\pm2.32^{B\ a}$	$90.40\pm2.16^{BC\ b}$

C: control without DSP, T_1: 0.1% DSP, T_2: 0.3% DSP and T_3: 0.5% DSP
(A - E) Different capital superscripts in the same column indicate significant differences (P<0.05); (a - c) Different lowercase superscripts in the same row indicate significant differences (P<0.05).

CONCLUSION

Prebiotic stabilizer (DSP) has many benefits when added to yoghurt. These benefits include: prebiotic effects on probiotics, nutraceutical health benefits, texture improvement, nutritional enrichment, reduced syneresis and extended the shelf-life of yoghurt. Prebiotic stabilizer (DSP) is added to probiotic set yoghurt in order to support the viability of probiotic strains to make these products, synbiotics, beneficial for consumers' health. Analysis of prebiotic stabilizer (DSP) suggested that DSP can be used in foods as an inexpensive source of dietary fiber and other functional components, e.g. resistant starch. Prebiotic stabilizer (DSP) exhibited a positive relationship with yoghurt quality parameters.

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إنتاج يوغورت حيوي مدعم بمسحوق نوي البلح كبريبيوتك ومثبت طبيعي

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قسم بحوث الالبان – معهد بحوث تكنولوجيا الأغذية – مركز البحوث الزراعية

هدفت هذه الدراسة إلى تقييم استخدام مسحوق نوي البلح (DSP) كبريبيوتك ومثبت طبيعي في تصنيع اليوغورت الداعم للحيوية وتأثيره على بعض الخصائص الفيزيوكيميائية والميكروبيولوجية والريولوجية والحسية لليوغورت الناتج خلال فترات التخزين علي ٤°م ± ١. تم إنتاج اليوغورت الداعم حيوية باستخدام بادئ اليوغورت وبادئ و ABT-2. أظهرت الحموضة انخفاضاً طفيفاً نتيجة لزيادة النسبة المئوية لمستوىDSP. وقد وجد أن القدرة على الاحتفاظ بالمياه تتراوح بين ٦٢,١٧٪ إلى ٧٩,٤٣.٪ خلال فترة التخزين. أثبتت الدراسة أن إضافة DSP كبريبيوتك إلى االيوغورت الداعم للحيوية حفز من نمو البكتيريا الداعمة للحيوية. متوسط العدد الكلي للبكتريا *S. thermophilus, L. acidophilus* and *B. bifidum* BB-12) انخفض قليلا" خلال التخزين المبرد ولكنها بقيت عند مستويات كافية (>6 log cfu/g) خلال ١٤ يوما من التخزين. وأخيرا لوحظ عدم ظهور الكوليفورم والخمائر، والفطريات في جميع المعاملات سواء الطازجة وحتى نهاية فترة التخزين. هذا وقد أدي اضافة DSP كبريبيوتك ومثبت طبيعي عند تركيز ٠،٥٪ الي اليوغورت الداعم للحيوية الي تحسين الصفات الحسية والريولوجية مقارنة باليوغورت المعامل بالتركيزات الأخرى.