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(Original Article)

Manufacture of Probiotic Soft Cheese by Using *Bifidobacterium breve* and Fortification by Yeast Extract

Hager N. Tawfiq*; Ahmed M. Hamdy; Aly I. Hassan; Dalia G. Kamel and Dina M. Osman

Dairy Science Department, Faculty of Agriculture, Assiut University, Assiut, Egypt.

*Corresponding author email: hagernasser@aun.edu.eg
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Abstract

Cheese has recently been the focus of a number of marketing and scientific investigations, due to its effectiveness in delivering probiotics to the digestive tract. The objective of this study was to examine the effect of using yeast extract (YE) 0.1, 0.5, and 1% with cheese cultures (*Lactococcus lactis* sub sp *lactis* 2% *and Lactococcus lactis* sub sp *cremoris* 2%) and *Bifidobacterium breve* at 1, 3, and 5% on the chemical composition, microbiological quality, organoleptic properties, and shelf-life stability of probiotic soft cheese (PSC) during storage at 5°± 2°C for 60 days. The acidity, moisture, salt, Lactic acid bacteria (LAB) count, total bacterial count (TBC), *Bif. breve* count, yeasts & molds, coliform count, and organoleptic properties were examined in the PSC after 0, 15, 30, 45, and 60 days of storage. The addition of YE increased the total CFU of *Bif. breve*, LAB, TBC, content of salt, and development titratable acidity (DTA) during storage. On the other side, moisture content was decreased ($P < 0.05$) during storage. The antimicrobial activity of *Bif. breve* delayed the growth of yeast, molds, and coliform bacteria during storage. The overall acceptability of PSC had improved ($P < 0.05$) by the addition of synbiotics (*Bif. breve* and YE), as compared with the control. using 5% *Bif. breve* + 0.1, 0.5, and 1% YE and 3% *Bif. breve* +1% YE resulted increase in significant flavor, texture, and overall acceptability, compared with the control.

***Keywords**: Probiotic cheese, Bifidobacterium breve, Soft cheese, Yeast extract, Growth-promoting*

Introduction

Cheese is of better potential for delivering probiotic microorganisms to the human digestive tract in comparison to fermented milk. This is because of its unique chemical and physical properties (higher pH value and lower titratable acidity, higher buffering capacity, higher nutrient availability, lower oxygen content, and denser matrix of the texture). The availability of a wide range of cheese varieties worldwide, the inclusion of cheese in everyone's long-term diets, and the nutritional benefits of cheese have all contributed to the consistent expansion of the probiotic cheese industry. Probiotics must remain viable in food

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products above a threshold level 10^6 CFU g^{-1} when it reaches the intestines in order to be deemed to provide health benefits to human (Cruz *et al*., 2009).

For the bacteria to arrive a sufficient count to produce a positive health effect, the daily intake should be 100g or 100 ml of food containing probiotic bacteria at an average rate of 10^6 to 10^8 CFU /g would provide 10^8 to 10^{10} CFU/d. In Japan, products must contain probiotic bacteria at least 10^7 colony-forming units (CFU)/g, In the USA, the probiotic content must be at least 10^8 CFU/g in products, and in Canada, the content of probiotics in products should not be less than 10^9 CFU/g. Generally, $>10^6$–10^8 CFU/g, or $>10^8$–10^{10} CFU/d of viable cells are considered efficacious (Escobar *et al*., 2012; Kim *et al*., 2018).

One of the first digestive system inhabitants, *Bifidobacteria* considers the colon as their primary habitat. It is a bacterium that produces acetic and lactic acid as a result of sugar fermentation. It has a role in preserving milk by producing some compounds that have an antimicrobial effect, producing lactic acid and flavoring compounds, and metabolites that provide products with sensory properties desired by the consumers (Mahajan and Manjot, 2022).

Most of the first commercially evaluated prebiotics that has been used in humans have been shown to stimulate *Lactobacillus* and *Bifidobacterium* specifically, but not to promote pathogenic bacteria of the genus *Clostridia* and *Escherichia coli* (Gibson *et al*., 2017).

Bacteria have been added to and incorporated into cheese for years due to its firm texture and high solids content. Cheese is a suitable environment for the growth of probiotic bacteria during passage through the digestive tract and storage.

Add probiotics and prebiotics to different foods and they act as nutritional supplements. There is also a variety of probiotic dairy products, including cheese with functional properties, on the global market (Iqbal *et al*., 2017).

The term functional food generally refers to products that, along with basic nutrition, provide specific health benefits, such as nutritional supplements and food for medical use (Alongi and Anese, 2021).

Cheese is a curdled and concentrated milk product, which accounts for about one-third of all worldwide milk production. Recorded history has shown that it is a traditional product. Cheese has multiple uses and high nutritional value in a wide variety of flavors, varieties, shapes, and textures. It is rich in protein, various types of vitamins, including vitamins A and B_{12}, and minerals, including calcium, phosphorous, and zinc. Where is considered calcium is the most important nutrient lacking in our diet and is found abundantly in milk (Iqbal *et al*., 2017).

Yeast extract has been used as a growth-promoting substance for bacteria and contains yeast extract that contributes to supplying the body with vitamins, the most important of which are vitamin B complex and some nutrients, including iron, magnesium, zinc, potassium, chromium, and selenium. This enhances the product's health benefits and the growth of the strains used.

The aim of this study was to produce probiotic cheese made from cow's milk and fortified with yeast extract. The different treatments were manufactured with different ratios of probiotics and growth-promoting to enhance the health benefits and improve the organoleptic properties of probiotic soft cheese.

Material and Methods

Material

Milk

Fresh cow’s milk was obtained from the herd of Faculty of Agriculture, Assiut University, Assiut.

Starters

(*Lac. lactis* sub sp *cremoris* (DSM 20069), (*Lac. lactis* sub sp *lactis* (ATCC 11454), and *Bif. breve* (ATCC 15700)*)* are from the Faculty of Agriculture, Ain Shams University's Microbiological Resources Center (Cairo mircen).

Salt

Salt (Cooks Iodized Table sodium chloride, El-Nasr company for salt, Alexandria, Egypt).

Rennet

Rennet powder (DSM France) by commercial name (Fromase R 2200).

Methods

Probiotic soft cheese (PSC) was made as previously described by (Reshma Devi *et al*., 2023) with some modification as follows:

Fresh cow’s milk, as soon milk arrived to the laboratory it was pasteurized at 73˚C / 15s, and then cooled to 40.

Milk was divided into 13 equal portions, which was inoculated by starter culture as follow:

C = (*Lac. lactis* 2% and *Lac. cremoris* 2%) + 5% salt.

B1 = (*Lac. lactis* 2% and *Lac. cremoris* 2%) + 1% *Bif. breve* + 5% salt.

B3 = (*Lac. lactis* 2% and *Lac. cremoris* 2%) + 3% *Bif. breve* + 5% salt.

B5 = (*Lac. lactis* 2% and *Lac. cremoris* 2%) + 5% *Bif. breve* + 5% salt.

B1a = (*Lac. lactis* 2% and *Lac. cremoris* 2%) + 1% *Bif. breve* + 0.1% yeast extract+ 5% salt.

B1b = (*Lac. lactis* 2% and *Lac. cremoris* 2%) + 1% *Bif. breve* + 0.5% yeast extract+ 5% salt.

B1c = (*Lac. lactis* 2% and *Lac. cremoris* 2%) + 1% *Bif. breve* + 1% yeast extract+ 5% salt.

B3a = (*Lac. lactis* 2% and *Lac. cremoris* 2%) + 3% *Bif. breve* + 0.1% yeast extract+ 5% salt.

B3b = (*Lac. lactis* 2% and *Lac. cremoris* 2%) + 3% *Bif. breve* + 0.5% yeast extract+ 5% salt.

B3C = (*Lac. lactis* 2% and *Lac. cremoris* 2%) + 3% *Bif. breve* + 1% yeast extract+ 5% salt.

B5a = (*Lac. lactis* 2% and *Lac. cremoris* 2%) + 5% *Bif. breve* + 0.1% yeast extract+ 5% salt.

B5b = (*Lac. lactis* 2% and *Lac. cremoris* 2%) + 5% *Bif. breve* + 0.5% yeast extract+ 5% salt.

B5C = (*Lac. lactis* 2% and *Lac. cremoris* 2%) + 5% *Bif. breve* + 1% yeast extract+ 5% salt.

All samples were kept at 40 ˚C till acidity was reached 0.2%.

5% salt was dissolved into milk.

0.04% rennet powder was added to milk, kept at 40 ˚C until complete coagulation, approximately after 4 h.

Curd was cut and subjected to drain in cheesecloth overnight. Then curd was cut into cubes, packed into sterilized plastic containers, and stared at 5±2°C.

Chemical determination, microbiological analysis, and sensory evaluation were performed when fresh cheese and after, 15, 30, 45, and 60 days of storage at 5±2°C. The experiment was carried out in triplicates.

Chemical Determination

Cheese samples were analyzed for titratable acidity, moisture, and salt. Titratable acidity was determined by the method as described by (Sadler and Murphy, 2010). Moisture content was determined using the method of (AOAC, 2000). Salt was determination using the method as described by Johnson & Olson, (1985).

Microbiological Determination

Total bacterial count (TBC) was determined by using the Nutrient Agar medium, and Lactic acid bacterial counts were determined using the MRS agar medium, *Bif. breve* count plates were determined using the MRS-modified agar medium. The coliform count was enumerated on MacConkey broth media, Yeast and mold counts were also enumerated using potato dextrose agar media (Ahmed *et al*., 2021; Wehr and Frank, 2004).

Sensory evaluation

Sensory characteristics of probiotic soft cheese were evaluated by 10–15 trained panelists from the Dairy Science Department, Assiut University. The probiotic soft cheese was examined as described in a previous study (Ahmed *et al*., 2021) with some modifications. Samples were evaluated for color and appearance (20 points), flavor (30 points), and body and texture (50 points) to have 100 points in total. The mean values and their standard deviation were calculated. The organoleptic characteristics were evaluated at fresh, 15, 30, 45, and 60 days.

Statistical analysis

Obtained data were analyzed by using R software (R ×64-3.3.3, R Foundation for Statistical Computing) to study the effects of treatment and storage time, and the interaction of these two factors on growth promoting (YE) and *Bif. breve* in the rate of change in the chemical composition and microbiological quality, of PSC. Two-way ANOVA was performed to compare Mean sat P<0.05 using the Tukey test.

Result and Discussion

Effect of inoculum content of *Bif. breve* (1, 3, and 5%) and growth-promoting (yeast extract 0.1, 0.5, and 1%) on probiotic soft cheese

Table 1. changes in percentage of developed titratable acidity in PSC manufacture by using *Bif. breve* and fortified by yeast extract during storage for 60 days at 5°± 2°C

Treatments	percentage of DTA					Mean
	Storage period (days)					
	0	15	30	45	60	
C	0.33	0.67	0.83	1.06	1.32	0.84^{h}
B1	0.33	0.69	0.85	1.09	1.33	0.86^{g}
B3	0.34	0.71	0.86	1.11	1.37	0.88^{ef}
B5	0.35	0.73	0.88	1.11	1.40	0.89^{cd}
B1a	0.34	0.70	0.87	1.10	1.35	0.87^{fg}
B3a	0.34	0.72	0.89	1.13	1.38	0.89^{de}
B5a	0.35	0.74	0.90	1.21	1.45	0.93^{b}
B1b	0.34	0.70	0.88	1.11	1.36	0.88^{ef}
B3b	0.34	0.72	0.89	1.13	1.40	0.90^{cd}
B5b	0.35	0.74	0.91	1.24	1.47	0.94^{b}
B1c	0.34	0.71	0.89	1.12	1.38	0.89^{de}
B3c	0.34	0.74	0.90	1.14	1.43	0.91^{c}
B5c	0.35	0.75	0.93	1.25	1.51	0.96^{a}
Mean	0.34^{e}	0.72^{d}	0.88^{c}	1.14^{b}	1.40^{a}	

C = (*Lac. lactis* 2% and *Lac. cremoris* 2%) + 5% salt.
B1 = (*Lac. lactis* 2% and *Lac. cremoris* 2%) + 1% *Bif. breve* + 5% salt.
B3 = (*Lac. lactis* 2% and *Lac. cremoris* 2%) + 3% *Bif. breve* + 5% salt.
B5 = (*Lac. lactis* 2% and *Lac. cremoris* 2%) + 5% *Bif. breve* + 5% salt.
B1a = (*Lac. lactis* 2% and *Lac. cremoris* 2%) + 1% *Bif. breve* + 0.1% yeast extract+ 5% salt.
B1b = (*Lac. lactis* 2% and *Lac. cremoris* 2%) + 1% *Bif. breve* + 0.5% yeast extract+ 5% salt.
B1c = (*Lac. lactis* 2% and *Lac. cremoris* 2%) + 1% *Bif. breve* + 1% yeast extract+ 5% salt.
B3a = (*Lac. lactis* 2% and *Lac. cremoris* 2%) + 3% *Bif. breve* + 0.1% yeast extract+ 5% salt.
B3b = (*Lac. lactis* 2% and *Lac. cremoris* 2%) + 3% *Bif. breve* + 0.5% yeast extract+ 5% salt.
B3C = (*Lac. lactis* 2% and *Lac. cremoris* 2%) + 3% *Bif. breve* + 1% yeast extract+ 5% salt.
B5a = (*Lac. lactis* 2% and *Lac. cremoris* 2%) + 5% *Bif. breve* + 0.1% yeast extract+ 5% salt.
B5b = (*Lac. lactis* 2% and *Lac. cremoris* 2%) + 5% *Bif. breve* + 0.5% yeast extract+ 5% salt.
B5C = (*Lac. lactis* 2% and *Lac. cremoris* 2%) + 5% *Bif. breve* + 1% yeast extract+ 5% salt.
a,b,..: Means with different subscripts are significantly different at 0.05.

The effect on acidity of PSC

The evolution of the changes in developed titratable acidity during the growth of *Bif. breve* and addition of YE are presenting in Table 1. When analyzing the results obtained during the storage period, show that there was a significant ($P < 0.05$) increase in acidity among the treatments B5a, B5b, and B5c compared to the control, and the highest levels of acidity of 1.45, 1.47, and 1.51 respectively, compared to the control that recorded 1.32 after 60 days of storage. Treatment B5a recorded the highest increase significance ($P < 0.05$) after 60 days of storage. These results agreed with (Yerlikaya and Ozer, 2014), who manufactured soft cheese with some types of probiotics and noticed an increase in acidity during the storage period. (Moneeb *et al*., 2022) made low-fat soft cheese with different rates of *Bifidobacterium bifidum*, and found that there was an increase in acidity during the storage period, and with increasing the proportions of *Bifidobacterium bifidum*, the acidity increased. (Nasr *et al*., 2022) found a decrease in pH and an increase in acidity during the storage period in bioactive cheese.

Effect on salt content in PSC

Results obtained by changing of salt content in PSC fortified by YE during storage are presented in Table 2. The obtained results show a non-significant increase in the salt content during storage, due to the decrease in the moisture content of the cheese. Treatment B5c was the highest in its salt content of 4.23%, compared to 4.10 % in control after 60 days of storage. Results in agreement with these obtained by (Moneeb *et al*., 2022) in low-fat soft cheese supporting vitality with the *Bifidobacterium bifidum* strain in five different proportions, and noted the increase in the salt percentage in the treatments during the storage period.

Table 2. Changes in percentage of salt content in PSC manufacture by using *Bif. breve* and fortified by yeast extract during storage for 60 days at 5°± 2°C

Treatments*	percentage of salt					Mean
	Storage period (days)					
	0	15	30	45	60	
C	3.22	3.61	3.87	4.03	4.10	3.77^{a}
B1	3.22	3.61	3.87	4.03	4.10	3.77^{a}
B3	3.22	3.61	3.93	4.03	4.10	3.78^{a}
B5	3.22	3.61	3.93	4.03	4.10	3.78^{a}
B1a	3.22	3.61	3.87	4.03	4.10	3.77^{a}
B3a	3.22	3.61	3.93	4.03	4.10	3.78^{a}
B5a	3.22	3.61	3.93	4.10	4.13	3.80^{a}
B1b	3.22	3.61	3.87	3.93	4.10	3.77^{a}
B3b	3.22	3.61	3.93	4.03	4.10	3.78^{a}
B5b	3.22	3.61	3.93	4.10	4.17	3.81^{a}
B1c	3.22	3.61	3.87	4.03	4.10	3.77^{a}
B3c	3.22	3.61	4.03	4.10	4.13	3.82^{a}
B5c	3.22	3.61	4.07	4.10	4.23	3.85^{a}
Mean	3.22^{d}	3.61^{c}	3.93^{b}	4.05^{ab}	4.12^{a}	

*The definition of treatments is mentioned in Table 1, a,b,.. : Means with different superscripts are significantly different at 0.05

Effect on moisture content in PSC

Results obtained of changing the moisture content in PSC fortified by YE during storage are presented in Table 3. Moisture content of the cheese decreased significantly ($P < 0.05$) as a result of the increase in acidity, which led to an increase in the expulsion of the whey from the curd, which resulted in a rise in total solids in the stored cheese samples. Treatment B5c was of the least treatments in its moisture content of 57.32%, compared to the highest of 58.91% in the control after 60 days. Treatment B5c recorded the highest decrease significant ($P < 0.05$) after 60 days. Similar results were also obtained by Nasr *et al*., (2022) and Moneeb *et al*., (2022)

Table 3. changes in percentage of moisture content in PSC manufacture by using *Bif. breve* and fortified by yeast extract during storage for 60 days at 5°± 2°C

Treatments*	Percentage of moisture					Mean
	Storage period (days)					
	0	15	30	45	60	
C	59.41	59.35	59.14	59.09	58.91	59.18^{a}
B1	59.46	59.26	59.11	59.05	58.87	59.15^{a}
B3	59.40	59.11	58.84	58.60	58.38	58.87^{ab}
B5	59.43	59.09	58.79	58.55	58.24	58.82^{ab}
B1a	59.46	59.25	59.07	58.84	58.59	59.04^{ab}
B3a	59.44	58.94	58.70	58.54	58.24	58.77^{ab}
B5a	59.46	58.67	58.51	58.30	57.94	58.58^{ab}
B1b	59.45	59.20	59.04	58.76	58.47	58.98^{ab}
B3b	59.46	58.83	58.57	58.37	58.13	58.67^{ab}
B5b	59.56	58.54	58.31	58.17	57.67	58.45^{ab}
B1c	59.46	59.06	58.79	58.54	58.12	58.79^{ab}
B3c	59.47	58.73	58.45	58.30	57.91	58.57^{ab}
B5c	59.47	58.38	58.00	58.35	57.32	58.27^{b}
Mean	59.46^{a}	58.95^{b}	58.73^{b}	58.55^{bc}	58.22^{c}	

*The definition of treatments is mentioned in Table 1, a,b,.. : Means with different superscripts are significantly different at 0.05.

***Bifidobacterium breve* count in PSC**

Results obtained in Table 4 reveal the changes in *Bif. breve* count in PSC fortified by YE during storage for 60 days at 5°± 2°C. There was a significant ($P < 0.05$) increase among the treatments in the numbers of *Bif. breve*, where treatment B5 recorded the highest of numbers 14.45 log CFU gm-1 without the growth promoter. When using the growth promoter with a different ratio treatment B5c recorded the highest numbers of 14.90 log CFU gm-1 in all treatments after 60 days of storage. Treatment B5c recorded the highest significance numbers, compared with treatment B1. Addition of growth promoter increased the number of *Bif. breve* during the storage period. These observed results come in harmony with those of Yerlikaya and Ozer (2014), in soft cheese with some types of probiotics and noticed an increase in the number of probiotics during the storage period.

Table 4. Changes in *Bif. breve* count (log CFU gm^{-1}) in PSC manufactured by using *Bif. breve* and fortified by YE during storage for 60 days at 5˚± 2˚C

Treatments	*Bif. breve* Storage period (days)					Mean
	0	15	30	45	60	
B1	8.96	11.55	13.11	13.77	14.08	12.29^{f}
B3	9.35	11.70	13.22	13.83	14.16	12.45^{de}
B5	9.36	11.78	13.34	13.90	14.24	12.53^{cd}
B1a	8.97	11.59	13.17	13.85	14.13	12.34^{ef}
B3a	9.36	11.82	13.36	13.88	14.25	12.53^{cd}
B5a	9.37	11.94	13.49	13.95	14.29	12.61^{bc}
B1b	8.98	11.66	13.33	13.88	14.30	12.43^{de}
B3b	9.37	11.86	13.42	13.98	14.39	12.60^{bc}
B5b	9.38	12.02	13.58	14.02	14.46	12.69^{b}
B1c	8.99	11.75	13.45	13.97	14.44	12.52^{cd}
B3c	9.38	11.92	13.48	14.09	14.59	12.69^{b}
B5c	9.39	12.15	13.67	14.16	14.74	12.82^{a}
Mean	8.53^{e}	10.90^{d}	12.36^{c}	12.87^{b}	13.24^{a}	

*The definition of treatments is mentioned in Table 1, a,b,.. : Means with different superscripts are significantly different at 0.05

Counts of Lactic acid bacteria count during storage of PSC

results indicated in Table 5 reveal the changes in LAB counts in PSC fortified by YE during storage for 60 days at 5˚± 2˚C. Significant ($P < 0.05$) increase was detected in the numbers of LAB as treatment B5c recorded the highest significant increase of 14.89 log CFU gm-1, compared to 14.64 log CFU gm-1 in the control after 60 days of storage. Present results are not in agreement with this obtained by Kamel *et al*. (2023); Kasimoğlu *et al*. (2004) who found that count of LAB count decreased after 15 days of storage, which might be due to the type of starter being used.

In the same time our results are in agreement with these obtained by (Kiliç *et al*., (2009) who found that colons count of LAB was increase during the first 60 days probiotic soft cheese storage and there decreased after 90 days of storage.

Total bacterial counts in PSC

Result detected in Table 6 reveal the changes in TBC counts in PSC fortified by YE during storage for 60 days at 5˚± 2˚C. Significant ($P < 0.05$) increase was observed in the numbers of TBC during the storage period, treatment B5c recorded the highest of 14.90 log CFU gm-1, compared to 14.15 log CFU gm-1 in the control after the 60 days of storage (Nasr *et al*., 2022). The obtained results showed an increase in the number of TBC during the storage period of soft cheese in the presence of the probiotics.

Table 5. Changes in LAB count (log CFU gm-1) in PSC manufactured by using Bif. breve and fortified by YE during storage for 60 days at 5°± 2°C

Treatments*	LAB					Mean
	Storage period (days)					
	0	15	30	45	60	
C	9.42	11.65	13.55	14.43	14.64	12.74^{h}
B1	9.44	11.67	13.61	14.45	14.65	12.77^{gh}
B3	9.51	11.70	13.65	14.49	14.67	12.81^{fg}
B5	9.54	11.73	13.75	14.56	14.71	12.86^{def}
B1a	9.50	11.69	13.69	14.49	14.67	12.81^{fg}
B3a	9.61	11.72	13.70	14.61	14.70	12.87^{de}
B5a	9.65	11.76	13.95	14.72	14.80	12.98^{b}
B1b	9.52	11.71	13.71	14.53	14.69	12.83^{ef}
B3b	9.62	11.73	13.82	14.68	14.71	12.91^{cd}
B5b	9.66	11.78	13.98	14.74	14.84	13.00^{b}
B1c	9.54	11.72	13.78	14.56	14.71	12.86^{de}
B3c	9.66	11.75	13.91	14.72	14.75	12.96^{bc}
B5c	9.72	11.84	14.09	14.77	14.89	13.06^{a}
Mean	9.57^{e}	11.73^{d}	13.78^{c}	14.60^{b}	14.72^{a}	

*The definition of treatments is mentioned in Table 1, a,b,.. : Means with different superscripts are significantly different at 0.05

Table 6. Changes in TBC (log CFU gm-1) in PSC manufactured by using *Bif. breve* and fortified by YE during storage for 60 days at 5°± 2°C

Treatments*	TBC					Mean
	Storage period (days)					
	0	15	30	45	60	
C	9.75	11.20	13.05	13.68	14.15	12.36^{i}
B1	9.76	11.22	13.17	13.71	14.33	12.44^{h}
B3	9.79	11.39	13.17	13.77	14.45	12.51^{g}
B5	9.80	11.59	13.27	13.83	14.57	12.61^{ef}
B1a	9.77	11.37	13.20	13.78	14.45	12.51^{g}
B3a	9.81	11.54	13.38	13.82	14.52	12.61^{ef}
B5a	9.83	11.82	13.46	13.89	14.70	12.74^{cd}
B1b	9.78	11.44	13.33	13.81	14.54	12.58^{f}
B3b	9.84	11.67	13.49	13.85	14.66	12.70^{d}
B5b	9.85	11.88	13.59	13.95	14.82	12.82^{b}
B1c	9.79	11.49	13.42	13.84	14.62	12.63^{e}
B3c	9.85	11.78	13.56	13.89	14.68	12.75^{c}
B5c	9.86	12.01	13.74	13.98	14.90	12.90^{a}
Mean	9.81^{e}	11.57^{d}	13.37^{c}	13.83^{b}	14.57^{a}	

*The definition of treatments is mentioned in Table 1, a,b,.. : Means with different superscripts are significantly different at 0.05

Yeasts & Mold in PSC

Yeast and molds were not detected in all up to the end of the storage period. Which indicate the effect of hygienic conditions during cheese manufactured were good and it was eliminate any contamination.

Coliform bacteria in PSC

Coliform bacteria couldn't be not detected in all cheese samples during 60 days, due to the good hygienic conditions during cheese making. In addition, it is well known that *Bif. breve* has anti-bacterial activity against the coliform group and a proper sterilization regime is followed in the laboratory to ensure no contamination. *Bifidobacterium* genera, previously isolated from various sources and commercially available were screened against 12 pathogenic strains belonging to *S. aureus, E. coli, S. chromogenes*, and *S. hyicus* species by well diffusion assay method (Cizeikiene and Jagelaviciute, 2021).

Sensory evaluation

The organoleptic score obtained for all cheese samples are presented in (Tables 7, 8, and 9). The obtained results showed that the overall acceptability had improved significantly ($p<0.05$). In addition, B5a, B5b, B5c, and B3c had recorded the high score for overall acceptability. These results are in agreement with these result obtained by Angelin and Kavitha, (2020); Prasanna *et al.* (2014); Yerlikaya and Ozer, (2014) who found that probiotics had improved the organoleptic properties of cheese.

Table 7. Evaluation of Flavor of PSC manufactured from liquid cow's milk by *Bif. breve* and fortified by yeast extract in PSC during storage for 60 days at 5±2℃.

Treatments*	Flavor					Mean
	Storage period (days)					
	0	15	30	45	60	
C	13.00	17.00	19.00	21.00	22.67	18.53^{g}
B1	13.00	17.00	19.00	21.00	22.67	18.53^{g}
B3	13.33	17.67	20.00	22.00	24.00	19.40^{defg}
B5	13.67	18.00	21.00	23.00	24.67	20.07^{cde}
B1a	13.00	17.00	19.00	21.33	23.00	18.67^{fg}
B3a	13.33	18.00	20.67	23.33	24.33	19.93^{cdef}
B5a	13.67	18.33	22.33	24.00	25.33	20.73^{bc}
B1b	13.00	17.33	19.00	21.67	23.00	18.80^{efg}
B3b	13.33	18.00	21.33	23.67	24.33	20.13^{cd}
B5b	13.67	19.33	23.67	25.00	26.00	21.53^{ab}
B1c	13.00	17.33	19.00	21.67	23.33	18.87^{defg}
B3c	13.33	19.00	22.33	24.33	25.00	20.80^{bc}
B5c	13.67	20.33	24.33	26.00	28.00	22.47^{a}
Mean	13.31^{e}	18.03^{d}	20.82^{c}	22.92^{b}	24.33^{a}	

*The definition of treatments is mentioned in Table 1, a,b,.. : Means with different superscripts are significantly different at 0.05

Table 8. Evaluation of Texture and Body of PSC manufactured from liquid cow's milk by *Bif. breve* and fortified by yeast extract in PSC during storage for 60 days at 5±2℃.

Treatments*	Texture and Body					Mean
	Storage period (days)					
	0	15	30	45	60	
C	25.67	27.00	31.00	37.67	41.33	32.53^{f}
B1	25.67	27.00	34.33	37.67	41.33	33.13^{ef}
B3	25.67	28.33	35.00	40.00	42.00	34.20^{cdef}
B5	26.00	30.33	36.33	42.67	44.00	35.87^{abcde}
B1a	25.67	27.00	34.33	37.67	41.33	33.13^{ef}
B3a	25.67	28.67	36.00	41.00	43.00	34.87^{bcdef}
B5a	26.33	32.00	37.67	43.67	46.00	37.13^{abc}
B1b	25.67	27.00	35.00	38.33	41.00	33.13^{ef}
B3b	26.33	29.33	37.00	41.67	44.00	35.67^{bcde}
B5b	26.33	33.33	38.00	44.33	47.00	37.80^{ab}
B1c	26.00	28.33	36.00	38.33	41.00	33.93^{def}
B3c	26.33	30.33	38.67	43.00	45.67	36.80^{abcd}
B5c	26.33	34.67	38.67	45.33	48.33	38.67^{a}
Mean	25.97^{e}	29.44^{d}	36.00^{c}	40.87^{b}	43.51^{a}	

*The definition of treatments is mentioned in Table 1, a,b,.. : Means with different superscripts are significantly different at 0.05

Table 9. Evaluation of Appearance of PSC manufactured from liquid cow's milk by *Bif. breve* and fortified by yeast extract in PSC during storage for 60 days at 5±2℃.

Treatments*	Appearance					Mean
	Storage period (days)					
	0	15	30	45	60	
C	13.00	14.00	14.67	15.33	16.00	14.60^{e}
B1	13.00	14.00	14.67	15.33	16.00	14.60^{e}
B3	13.00	15.00	15.33	16.00	17.00	15.27^{cde}
B5	13.33	15.33	16.00	17.00	17.67	15.87^{abc}
B1a	13.00	14.00	14.67	15.33	16.00	14.60^{e}
B3a	13.00	15.33	16.00	16.33	17.33	15.60^{bcd}
B5a	13.33	15.67	16.33	17.33	18.33	16.20^{abc}
B1b	13.00	14.00	15.00	15.67	16.33	14.80^{de}
B3b	13.00	15.67	16.67	17.00	17.67	16.00^{abc}
B5b	13.33	16.33	16.67	17.67	18.33	16.47^{ab}
B1c	13.00	14.00	15.00	15.67	16.33	14.80^{de}
B3c	13.00	16.00	16.67	17.00	17.67	16.07^{abc}
B5c	13.33	16.67	17.33	17.67	19.33	16.60^{a}
Mean	13.10^{e}	15.08^{d}	15.72^{c}	16.41^{b}	17.18^{a}	

*The definition of treatments is mentioned in Table 1, a,b,.. : Means with different superscripts are significantly different at 0.05

Conclusion

The addition of yeast extract as a growth-promoting to PSC improved the functional characteristics and the viability of *Bifidobacterium*, as well as increased the shelf-life of PSC. yeast extract has potential health benefits, such as supplying the body with vitamins, the most important of which are vitamin B complex and some nutrients, including iron, magnesium, zinc, potassium, chromium, and selenium. Yeast extract can have a promising application to supplement other dairy products, such as soft cheese, ice cream, and drinks.

The percentage of *Bif. breve* 5% + 0.1%, 0.5%, and 1% yeast extract and the percentage of 3% *Bif. breve* +1% YE resulted in significant acidity, where these percentages had the best results in improving texture and taste in PSC made from cow's milk and added more health benefits to PSC.

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تصنيع الجبن الطري الداعم للحيوية باستخدام *Bifidobacterium breve* والمدعم بمستخلص الخميرة

هاجر ناصر توفيق*، احمد محمود حمدي، علي اسماعيل حسن، داليا جمال كامل، دينا مصطفي عثمان

قسم الالبان، كلية الزراعة، جامعة أسيوط، مصر.

الملخص

ان الجبن مؤخراً محور عدد من الأبحاث التسويقية والعلمية، وذلك بسبب فعاليته في إيصال البكتريا الداعمة للحيوية إلى الجهاز الهضـــمي. كان الهدف من هذه الدراســـة هو فحص تأثير استخدام مستخلص الخميرة (0.1, 0.5, 1%) مع بادئ الجبن

(*Lactococcus lactis* sub sp *lactis* 2% *and Lactococcus lactis* sub sp *cremoris* 2**%)** و *Bifidobacterium breve* بنسب 1, 3, 5% على التركيب الكيميائي، الجودة الميكروبيولوجية، الخصائص الحسية، وطول فترة التخزين للجبن الطري الداعم للحيوية أثناء التخزين عند 5°± 2 °م لمدة 60 يوما.

الحموضــة، الرطوبة، الملح، بكتيريا حمض اللاكتيك، العدد الكلي للبكتيريا,عدد خلايا *Bif. breve* , الخمائر والفطريات، وبكتريا القولون، والخواص الحسـية فى الجبن الطري الداعم للحيوية بعد 0 و 15 و 30 و 45 و 60 يومًا من التخزين. وأدت إضــــافة مســـتخلص الخميرة إلى زيادة اعداد الخلايــا فى بكتريــا حــامض اللاكتيــك والعــدد الكلى للبكتريــا و *Bif. breve* ومحتوى الملح والحموضـــــة أثناء التخزين. وعلى الجانب الآخر، انخفض محتوى الرطوبة (P <0.05) أثناء التخزين. النشــاط المضــاد للميكروبات لــــــ *Bif. breve* تؤخر نمو الخميرة، الفطريات، وبكتيريا القولون أثناء التخزين. وقد تحسن القبول العام لـــلجبن الطرى الداعم للحيوية (P <0.05) بإضافة *Bif. breve* و مســتخلص الخميرة، مقارنة مع الكنترول. اسـتخدام *Bif. breve* بنسـبة 5% مع مسـتخلص الخميرة بنسـب (0.1, 0.5, 1%) و *Bif. breve* بنسـبة 3% مع مسـتخلص الخميرة بنسبة 1% ادى الى زيادة معنوية فى النكهة والقوام والقبول العام مقارنة مع الكنترول.