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Microbiological and Chemical Characteristics of Pickled White Cheese Made with Different Salt Concentrations in The Presence of *Bifidobacterium longum*.

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ABSTRACT

The present study aimed to make white soft cheese (WSC) with different salt concentrations, using *Bifidobacterium longum* cultures (5%), microbial rennet (0.2%). Cheese samples were divided into 5 treatments; control contained 5% salt, T1 contained 6% salt, T2 contained 7% salt, T3 contained 8% salt and T4 contained 9% salt. Then, cheese treatments are stored at 5±1ºC for 90 days. The chemical and microbiological analysis were carried when fresh and after 15, 30, 45, 60, 75 & 90 days of storage periods. Statistical analysis showed that there was a highly significant difference ($p < 0.0001$) in the acidity (%), moisture content, fat (%), salt (%), total protein (%) and soluble nitrogen (%) between cheese treatments. Also a highly significant difference ($p < 0.0001$) was found during the 90 days of pickled time. Microbiological analysis showed that there was a negative correlation between the salt level and the numbers of *Bifidobacterium longum* in control samples, which made with lowest salt content (%). which maintained a high numbers of *Bifidobacterium longum* of 5-7 log CFU / g. after 75 days.

Keywords: White soft cheese, *Bifidobacterium*, Chemical analysis, and microbiological characteristics.

INTRODUCTION

Functional foods are products containing health-promoting components beyond the traditional nutrients. One way for modifying cheese to become functional is by incorporating probiotics. Freshly fermented dairy products such as cheese, yoghurt, ice cream, desserts and cultured milks are the most popular food delivery systems for probiotics. Dairy products, supplemented with probiotics that produce natural antimicrobial substances to order inhibit undesirable microorganisms. Unripened cheese is flavored by bacteria that produce a fresh acidic flavor. In addition, probiotics play many essential steps are taken to produce volatile flavor compounds such as diacetyl and aldehydes, synthesis of the following enzymes lipolytic and proteolytic which are used in cheese ripening. Therefore, in cheese manufacture are very important for the quality enhancement of cheese. The best nutritional and health care function is from the white soft cheese (WSC), which is one of the oldest cheese obtained from milk (Leroy and De Vuyest, 2004, Ong *et al.*, 2007, Karimi *et al*., 2012 and Vinderola *et al*., 2000a).

(Hammam *et al*., 2020). Cheese supplemented with probiotics and has been linked to a number of beneficial health properties, including improving lactose intolerance, forwarding immune functioning system and good health, and control of pathogenic agents. *Bifidobacteria* are well known as dominant bacteria set up in the intestinal flora of a breastfed infant, and it has been known to provide many physiological, furthermore is known to provide many nutrients to the human body. proved that *Bifidobacteria* was first isolated by Soured milk containing bacteria may have positive effects on intestinal health (Tissier 1990, Metchnikoff 1908, Karimi *et al*., 2012 and Albenzio *et al.*, 2013. Turroni *et al*. (2009), on the other hand, pointed out that the bifidobacteria can be uniquely identified in the human gut and showed it to be a part of the dominant bacterial family, bacterial flora, of breastfed infants. Various physiological properties have shown to provide by the *Bifidobacteria* of the human, such as; suppressed of putrefactive bacteria, inhibiting of production toxic amines, and digestion of phosphor protein phosphatase of human milk casein and inhibited the pathogenic bacteria (Osman, 2019).

The target of the study was planned to make synbiotic WSC with different salt concentratios supplemented with *Bifidobacterium longum* and investigate the microbiological and chemical properties of the resultant cheese at refrigeration temperature 5±1ºC. of during 90 days.

MATERIALS AND METHODS

Fresh buffalo's milk 6% fat obtained from the Farm of Faculty of Agriculture, Assiut University, Egypt was heated at 73°C/16 s., followed by cooling to 40°C. The milk was divided into five portions as follows:

1. The first portion was made as control of WSC, which was inoculated with 5% *Bifidobacterium longum* (Egyptian Microbial Culture Collection: EMCC, Cairo MIRCEA, Faculty of Agriculture, Ain Shams University, Cairo, Egypt) + 5% Salt (sodium chloride).
2. The second portion (T1) was inoculated with 5% *Bifi. longum* + 6% Salt.
3. The third portion (T2) was inoculated with 5% *Bifi. longum* + 7% Salt.

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4.The fourth portion (T3) was inoculated with 5% *Bifi. longum* + 8% Salt.
5.The fifth portion (T4) was inoculated with 5% *Bifi. longum* + 9 % Salt.

Also, microbial rennet (Chr. Hansen, Copenhagen, Denmark) was added to all treatments at approximately 0.2% when the acidity reached to 0.2%. The fermentation process lasts for about 2 hours at 40°C, after which the curd is reduced, subject to the drainage in cheesecloth overnight at 4°C. The cheese, which was then collected with a cloth and wrapped up, and collected and placed in sterilized jars and stored in a refrigerator (5 ± 1°C). The chemical and microbiological characteristics are carried out on the cheese when fresh, and, after 15, 30, 45, 60, 75 & 90 days of storage. The experiment was carried out in triplicate.

As with the chemical analysis, chemicals and their sources were BDH, Sigma and Prolabo for analysis. The total protein, titratable acidity, soluble nitrogen, moisture, fat and salt contents were measured as described by Hooi *et al*. (2004). Monitoring of the obtained results was taken from the examined samples when fresh and after 15, 30, 45, 60, 75 & 90 days.

For the microbiological analysis 1 G. sample was weighed in a sterile environment and placed in a pre-sterilized jar. An addition of phosphate buffer 9 ml was mixed well to obtain a ratio of 1: 10 dilutions. (Mehta *et al*, 2019) used it for the preparation of a solution of a sequence of dilution. By default, count methods were used for the counting platelet bacterial count (BC). (Wehr and Frank, 2004). Duplicate samples were taken for the dilution on plates on a nutrient agar medium inoculations at 32°C for 48-72 hr, used on the plated medium before the enumeration of the colonies. *Bifidobacterium* counts were enumerated according to the method of Dava and Shah (1996) using modified MRS agar medium (m-MRS), supplemented with 0.05% L-Cysteine HCl and 0.3% lithium chloride. Incubation of the plates were up to 37°C for 48 hrs under anaerobic condition. The coliform counted incubated at 32±1°C for 24 hr (Ashenafi, 1990). Potato dextrose agar media were, used to enumerate the amount of fungi and yeast and incubated for the next 5 days at a temperature 25±1°C (Wehr & Frank, 2004). The performance of the microbiological analysis was at fresh and after 15, 30, 45, 60, 75 & 90 days of storage time.

Statistical analysis was performed to research the outcome of treatments, time (storage period) and salt percentage on the chemical properties of WSC made with probiotics. An ANOVA was done to obtain the mean squares (MS) and P-values using the GLM procedure available in R software (R x 64 3.3.3 using R studio). When a significant difference ($P < 0.0001$) was detected between treatments, time, or their interaction, differences were tested using the least significant difference (LSD) comparison test (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Chemical analyses:

The titratable acidity of WSC made with *Bifidobacterium longum* is recorded in Table 1. The acidity of control samples was the highest value, compared to other examined samples, and the value increased from 0.25 to 1.57% during the 90 days of storage at refrigeration temperature. However, the acidity of T4 was lower than in the control, and ranged from 0.17 to 0.77% during the storage time. It could also be observed that, there is a proportional relationship between the increase of the in the salt concentration and the decrease in acidity, which is attributed to the weak activity of *Bifidobacterium* under high salt levels. The present outcomes were in general agreement with those obtained by Mahmoud *et al*. (2013), who established that the acidity of probiotic white soft cheese content ranged between 0.81-1.31%, which is equivalent to the present study. Data in the same Table show that, there is a highly significant difference ($p < 0.0001$) in the acidity percent between treatments. Also a highly significant difference ($p < 0.0001$) was found during the 90 days of the time to ripen the WSC.

For all treatments, it was noted that the acidity values in all cheese samples were low, which might possibly due to the slow growth of *Bifidobacteria* in milk during the storage period, and produced acidity in slight quantities (Blanchette *et al*., 1996).

Table 1. The titratable acidity % of WSC ripened for 90 days at refrigerator temperature.

Treatments	Storage period (day)							Mean
	Fresh	15	30	45	60	75	90	
Control	0.25	0.55	0.79	1.01	1.24	1.46	1.57	0.98^{A}
T1	0.23	0.55	0.79	0.84	1.24	1.46	1.57	0.95^{A}
T2	0.22	0.38	0.55	0.82	0.96	1.35	1.23	0.79^{B}
T3	0.22	0.28	0.33	0.49	0.70	0.82	0.91	0.54^{C}
T4	0.17	0.24	0.25	0.40	0.56	0.67	0.77	0.44^{D}
Mean	0.22^{F}	0.40^{E}	0.54^{D}	0.71^{C}	0.94^{B}	1.15^{A}	1.21^{A}	

Control = Probiotic WSC produced with starter cultures (*Bifi. longum*) + rennet + 5% salt;
T1 = Probiotic WSC produced with starter cultures (*Bifi. longum*) + rennet + 6% salt;
T2 = Probiotic WSC produced with starter cultures (*Bifi. longum*) + rennet + 7% salt;
T3 = Probiotic WSC produced with starter cultures (*Bifi. longum*) + rennet + 8% salt;
T4 = Probiotic WSC produced with starter cultures (*Bifi. longum*) + rennet + 9% salt.

The titratable acidity (%) of control samples was the highest, compared with the other experimented treatments due to the presence of the lowest concentration of the salt content, compared to other treatments. Furthermore, T4 recorded the lowest value of acidity, which might be due to its high salt concentration of 9%, which inhibits *Bifidobacteria*. It has also been observed that the acidity of cheese increased as the storage period increased, which might be explained by the effect of the starters in breaking down the lactose in the curd or the whey to form lactic acid. The acidity development during the refrigeration period was in a direct relation with the residual lactose in cheese conversion to lactic acid by the available microflora (Mehanna *et al*., 2002). In addition, Fooks *et al*. (1999) revealed that the decrease in the pH values were possibly due to short-chain fatty acids, which are produced in varying quantities as probiotic bacteria end produce, which were metabolic.

The moisture content of the WSC being made with *Bifidobacterium longum* is illustrated in Table 2. The moisture content was lower during the period of storage for any of the examined treatments. The moisture content of

the control samples was the lowest, and ranged between by 67.36% to 57.26%, with a life span of 90 days, at the refrigeration temperature. Moisture content of T4 was higher, and ranged from 68.61 to 63.06% during 90 days in the fridge. Data shown in the same Table also revealed that there is a highly significant difference ($p < 0.001$) in moisture between treatments. A highly significant difference ($p < 0.001$) was also observed within 90 days of WSC maturation.

Table 2. The moisture content of WSC ripened for 90 days at refrigerator temperature.

Treatments	Storage period (day)							Mean
	Fresh	15	30	45	60	75	90	
Control	67.36	65.08	63.52	61.99	60.33	58.53	57.26	62.01^{E}
T1	67.54	65.61	64.12	62.93	61.57	59.70	58.38	62.84^{D}
T2	68.01	66.95	65.51	64.37	63.23	61.68	60.12	64.27^{C}
T3	68.37	67.72	66.58	65.05	64.01	62.26	61.30	65.04^{B}
T4	68.61	68.01	67.33	65.81	65.06	63.75	63.06	65.95^{A}
Mean	67.98^{A}	66.67^{B}	65.41^{C}	64.03^{D}	62.84^{E}	61.18^{F}	60.02^{G}	

In conclusion, the obtained data show a gradual decrease in the moisture content, of all of the cheese over the entire life cycle. This might be due to the reduction in cheese, which was a result of the development of the acid, which helps to replace the whey of the cheese mass. Control samples showed the highest moisture loss, which is because of high acidity(Gafour, 2005 and Hammam *et al.*, 2018). The highest amount of moisture was detected in T4, which could be due to the high salt content, which leads to low acidity levels, during the process These results are consistent with the results obtained by (Effet *et al*, 2018 and Korish and Abd El-Hameed (2012), This may probably be, because of the activation of mixed strains for producing acidity. Ahmed *et al.* (2020) documented that the percentage of moisture, of white cheese produced by probiotic bacteria, was 74.0%, similar to the current study.

Results presented in Table3 revealed the fat content of the examined treatments of WSC made with *Bifidobacterium longum.* Throughout the treatment, as the end time progresses, the fat content has gradually increased to reach the highest fat percentage at the end. This increment in fat is owing to a decrement in moisture percentage (Table 2).The same results were obtained by Dawood (2002), reported fat percentage in WSC increased the total solids during the time of storage.

Table 3. The fat percentages of WSC ripened for 90 days at refrigerator temperature.

Treatments	Storage period (day)							Mean
	Fresh	15	30	45	60	75	90	
Control	14.69	15.19	15.80	15.99	16.70	17.02	17.43	16.12^{A}
T1	14.14	14.46	14.76	14.88	14.99	16.06	17.03	15.19^{B}
T2	13.77	14.26	14.62	14.78	15.01	15.87	16.68	15.00^{B}
T3	13.61	13.93	14.43	14.68	14.74	15.10	16.07	14.65^{C}
T4	13.53	13.82	14.16	14.61	14.65	14.71	15.55	14.43^{C}
Mean	13.95^{F}	14.33^{E}	14.75^{D}	14.99^{CD}	15.22^{C}	15.75^{B}	16.55^{A}	

Generally, the present outcomes are consistent with the results obtained by Al-Eswy *et al*. (2017), who researched and found the fat percentage in the WSC were ranged between 12-15%, as in our study.

Data presented in Table 4 illustrate the salt contents (%) of the examined treatments of WSC being made with *Bifidobacterium longum.* For all treatments of the WSC, Salt content in all of the examined treatments of WSC slightly decreased during the last period. The salt percent of control samples was the lowest, and increased from 2.96 to 3.66% during the period of 90 days. It could also be noted that there was a difference in the salt percentage between the treatments, due to differences in salt concentrations, which were added during cheese making. This led to differences in the salt percentage of treatments. The data in the same table showed that, there was a highly significant difference ($p < 0.0001$) in the salt percent between treatments. A highly significant difference ($p < 0.0001$) was also found during the 90 days of storage.

Table 4. The salt percentages of WSC ripened for 90 days at refrigerator temperature.

Treatments	Storage period (day)							Mean
	Fresh	15	30	45	60	75	90	
Control	2.96	3.11	3.22	3.33	3.48	3.55	3.66	3.33^{E}
T1	3.69	3.84	3.95	4.06	4.20	4.28	4.39	4.06^{D}
T2	4.42	4.57	4.68	4.79	4.94	5.01	5.12	4.79^{C}
T3	5.16	5.30	5.42	5.48	5.67	5.74	5.85	5.52^{B}
T4	5.89	6.03	6.15	6.22	6.36	6.47	6.58	6.24^{A}
Mean	4.42^{E}	4.57^{D}	4.68^{CD}	4.78^{C}	4.93^{B}	5.01^{AB}	5.12^{A}	

It has also been shown that in all the studies, there is a progressive increase in the proportion of salt, until the end of the last period in all processing. These results are comparable with those obtained by other researchers in the field. (Shehata *et al*. 2001 and Mehanna *et al*. 2002). This increase in the salt percentage is partly due to (a) decrement in moisture percentage (Table 2). and (b) was mainly to the amount of salt absorbed from the whey, resulting from the equilibrium, which took place between the pickling solution and the cheese (Blassy and Ismail 2003). The starter did not impact the salt percentage of cheese. These results were consistent with the results obtained by Al-Esawy (2017), who reported that the use of different probiotic bacteria strains in the production of WSC, had no effect of the salt percentage in the cheese.

The total protein contents of WSC made with *Bifidobacterium longum* are presented in Table 5. The TP content of the examined WSC gradually decreased until the end of periods in all of the treatments. The highest TP content was detected in control samples, and decreased from 16.22 to 13.77% with a life span of 90 days, in the refrigerator temperature. However, the TP content of T4 was the lowest, compared with the other treatments, and decreased from 14.74 to 11.39% during the time of storage. Data in the the same Table appeared to be a highly significant difference ($p < 0.0001$) in the TP percent between treatments. A highly significant difference ($p < 0.0001$) was also found during the 90 days of ripening time of WSC.

Table 5.The TP percentages of WSC ripened for 90 days at refrigerator temperature.

Treatments	Storage period (day)							Mean
	Fresh	15	30	45	60	75	90	
Control	16.22	15.83	15.48	15.16	14.57	14.20	13.77	15.03^{A}
T1	15.71	14.81	14.98	14.46	14.01	13.61	13.10	14.38^{AB}
T2	15.27	14.35	14.04	13.42	13.19	13.01	12.69	13.71^{BC}
T3	14.93	13.75	13.44	12.76	12.46	12.18	11.84	13.05^{CD}
T4	14.74	13.39	12.87	12.46	12.05	11.69	11.39	12.66^{D}
Mean	15.37^{A}	14.43^{B}	14.16^{BC}	13.65^{BCD}	13.26^{CDE}	12.94^{DE}	12.56^{E}	

A correlation between an increment in the protein content was observed in probiotic white cheese is by Mahmoud *et al.* (2013 and Hammam *et al.*, 2018) For Instance, treatment 4 (9% salt had the lowest total protein values were recorded during the period of storage, in comparison with the other treatments, due to the high percentage of salt, which in turn leads to a low level of acidity and the increase in the percentage of moisture in the samples. Furthermore, the control samples recorded the highest values of total protein during storage, as compared with the other treatments, due to their low salt content, leading to high acidity, and a decrease in the moisture percentage of samples. On the whole, the data show that the shelf-life increase and the percentage of total protein are decreasing, which means that it is a part of the protein is lost in the whey, and the activity of the rennet enzymes hydrolyzes the second part of the protein. Furthermore endogenous enzymes of the milk, starter enzymes, Also, endogenous milk enzymes, and the starter enzymes had a part in protein hydrolysis obtained by Blassy and Ismail (2003), who explained that the protein content in the white cheese and increased life expectancy in 28 days, from 9.50 to 15.80%, which is comparable with our study.

The soluble nitrogen content of the examined treatments made with *Bifidobacterium Longum* is shown in Table 6. It is obvious to notice that with all processing from soft, white cheese, such as the shelf-life increase, and the content of soluble nitrogen increased during the entire period of maturation, which could be due to the result of degradation of the protein, being found in the operation and development of the microflora and/or proteolysis, with the help of a protolithic enzyme. These results are consistent with those found by Elewa et al. (2009).. The content of soluble nitrogen in treatment 4 was the lowest compared to the other treatments, and this value can be increased by 0.172% to 0.264% over the last 90 days of refrigeration. However, the SN percent of control samples was the highest of other treatments and boosted from 0.225 to 0.389% during the storage period. The data in the same Table shows that, there was a highly significant difference ($p < 0.0001$) in the SN percent between treatments. A highly significant difference ($p < 0.0001$) was also found during the 90 days of ripening time of WSC.

Table 6. The SN percentages of WSC ripened for 90 days at refrigerator temperature.

Treatments	Storage period (day)							Mean
	fresh	15	30	45	60	75	90	
Control	0.225	0.245	0.269	0.367	0.382	0.386	0.389	0.323^{A}
T1	0.196	0.213	0.245	0.283	0.327	0.338	0.351	0.279^{B}
T2	0.181	0.206	0.230	0.258	0.303	0.317	0.331	0.261^{B}
T3	0.173	0.194	0.215	0.239	0.256	0.258	0.271	0.229^{C}
T4	0.172	0.184	0.201	0.229	0.244	0.253	0.264	0.221^{C}
Mean	0.189^{D}	0.208^{CD}	0.232^{C}	0.275^{B}	0.302^{AB}	0.310^{AB}	0.321^{a}	

Moreover, it was found that there is a correlation between the increase level of salinity, and a low rate of soluble nitrogen, perhaps it is due to the fact that, with the increase of the salt percentage and the ability of bifidobacteria to break down the protein, decreases. For instance, the proportion of SN of T4 was the lowest, compared to other treatments, resulting in a high salt percentage. The present results are generally consistent with those obtained (Blassy and Ismail. 2003, Mahmoud *et al*., 2013and Hamdy *et al*., 2021).

Microbiological analysis:

Data obtained concerning the TBC numbers of WSC made with bifidobacteria longum, after 90 days storage in the refrigerator are shown in the Fig.1. The highest numbers of TBC were detected in control samples ,compared to other treatment due to its lowest salt content, which can promote bacterial growth (El Sayed *et al*., 2011). Counts were then increased to the last 30 days of the last period and were recorded at 7.38 log CFU / g., Until they dropped to the last day, recording 6.24 log CFU / g after the last 90 days.

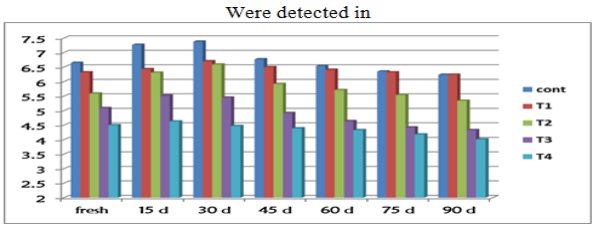

Fig .1. The TBC (log CFU/g) of WSC ripened for 90 days at refrigerator temperature.

Treatment 4 was significantly lower, compared to other treatments, which might be due to its high salt content, which reduces bacterial growth.(Charlier *et al*., 2008 and Peirotén *et al*., 2019). Counts then increased until 15 days of storage to 4.63 log CFU/g, which is stored, then it will have to be reduced,untill the last period of storage, and 4.01 log CFU/g was recorded. It could also be observed that there is a correlation between the increase in of salt concentration and the decrease in the total number of bacteria. Data in the same Fig. it show that during the first 30 days, the total number of bacteria increased in all samples, with the exception ofT3 andT 4 treatments. The decrease in the total number of bacteria in cheese could be resulted in by the suppression of cheese bacteria. In addition, other metabolites such as H2O2, are released during bacterial growth. These results are consistent with the results obtained by Kholif *et al*., 2010, Effat *et al*. 2018 and Zimmermann *et al*., 2010).

Numbers of bifidobacteria that were estimated in the soft, white cheese after 90 days, refrigerated are shown in the Fig.2. For all samples, except for the control samples, the number of colonies gradually increased until 15 days of storage. The total amount of bifidobacteria in treatment 4 was considerably lower, compared with other treatments, which might be due to the high salt content in the treatment, which suppresses the growth of bifidobacteria (Vinderola *et al*., 2000b).The total amount of *Bifidobacteria* of Treatment 4, declined from 4.60 log CFU / g to 4.36 log CFU / g after the last two weeks and dropped to 3.94 log CFU / g for the last 45 days, and no colonies were found at the end of the last period.

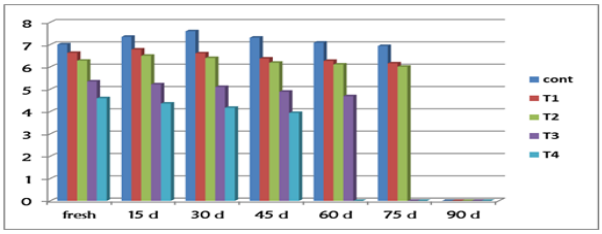

Fig .2. The *Bifidobacteria* count (log cfu/g) of WSC ripened for 90 days at refrigerator temperature.

However, the total amount of bifidobacteria in control samples was higher than in other treatments, which may be caused by a low concentration of salt, which promotes the growth of bifidobacteria (Vinderola *et al*., 2000b). Bifidobacteria in control samples boosted from 7.01 log CFU / g to 7.60 log CFU / g two weeks ago, and it fell to 6.94 log CFU / g in the last 75 days. No, the colonies have been identified as the last period of time. These results are consistent with those obtained by Ahmed et al. (2021) Therefore, probiotics can reach the intestines and supply health benefits. (Bosnea *et al.* 2009).

Yeast & Molds and Coliform group:

Research has been done to test the yeast, mold, and Escherichia coli while processing pure white cheese. Results were negative for all tests, for all the treatments over the period of time (90 days). This is because of the heat treatment of the cheese-producing milk, and also, the hygienic condition during the process of testing the soft white cheese of all treatments led to those results. These findings are consistent with the findings of investigators. (Rashed *et al*., 1991; Zottola & Smith, 1993; Ordonez *et al*., 1999 and Shehata *et al*., 2001). In addition, Effat et al. (2018), which found that yeast, mold, and intestinal bacteria were not found in soft, probiotic cheese. This may be because of the role of starters in inhibiting coliform bacteria, as they produce a variety of antibacterial agents.

CONCLUSION

Soft white cheese is made using Bifidobacteria cultures with different concentrations of 5, 6, 7, 8, and 9% salts; respectively. Control, T1, and T2 have very low salt levels that keep Bifidobacteria high up to 75 d in storage. *Bifidobacteria* numbers ranged from 5 to 7 log CFU / g in soft white cheese, so it could offer potential health benefits to consumers. Therefore, we concluded that, using the previous salt ratios (5, 6 and 7%) with (5%) the culture of initiating *Bifidobacteria* in WSC production to reach the bioactive value of *Bifidobacteria* in the last period.

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تأثير تركيزالملح على الخواص الكيميائية والميكروبيولوجية للجبن الأبيض الطري المصنع بإضافة البكتريا *Bifidobacterium longum*

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تهدف هذه الدراسة إلى تصنيع جبن أبيض طازج مدعم حيويا باستخدام *Bifidobacterium longum* بنسبة 5% ، منفحة ميكروبية بنسبة 0.2% ، مع نسب مختلفة من الملح (5، 6، 7، 8، 9%) ، وخزنت عينات الجبن على درجة حرارة الثلاجة (5مْ) لمدة 90 يوم ، وأجريت عليها التحليلات الكيميائية والميكروبيولوجية أثناء فترات التخزين (الطازجة ، 15 ، 30 ، 45 ، 75 ، 90 يوم) ، وأظهر التحليل الإحصائي وجود فرق معنوي "p< 0.0001" في كل من نسبة الحموضة ، نسبة الرطوبة ، نسبة الملح ، نسبة الدهن ، نسبة البروتين ، نسبة النيتروجين الذائب خلال 90 يوما من وقت إنضاج الجبن الطازج ، كما أظهر التحليل الميكروبيولوجي وجود علاقة عكسية بين نسبة الملح وعدد بكتريا ال *Bifidobacterium longum* ، حيث سجلت المعاملات التي تحتوي على نسبة ملح أقل على أكبر عدد من ال *Bifidobacterium longum* بينما سجلت المعاملات التي تحتوي علي نسبة ملح أعلي على اقل عدد من *Bifidobacterium longum* بعد 75 يومًا من التخزين.