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PRODUCTION OF PROBIOTIC LOW-CALORIE SOUR CREAM

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Fayed[1], A.E.; Gehan A.M. Hussein[1] and Azza M. Farahat[1]

ABSTRACT

The production of probiotic low calorie sour cream was aimed to experiment in relation to its compositional, bacteriological, biochemical, rheological and organoleptic properties along the cold storage period of the product. Cream based on 36% total solids (TS) and 30 % fat was made using the obtained fresh cream (54 % TS and 50 % fat) and liquid skimmed milk (9 % TS).To produce low-calorie sour cream, fat content was lowered to 20 and 10 % depending on the addition of Simplesse100® to mimic milk fat on the basic of 0.1% fat mimetic is instead of 1.0% fat. Dried whey protein concentrate (DWPC, 95 % TS) was used as bulking agent to overcome the loss occurred in the TS content due to the reduction in the fat content. Thereafter, all creams were homogenized at 55-60°C and further heat treated to 74°C for 30 sec. followed by rapidly cooling to the appropriate temperatures. Then creams were inoculated with 2% freshly prepared bacterial starter culture and incubated at 30 or 37 °C, to reach pH value about 4.6, for cream cultured with R-704 or ABT-2 type starter culture, respectively. The results indicated that, the proportional fat replacement of cream led to gradual increase in the protein, carbohydrate and ash contents, and decreased the caloric value. There are a backward relationship between the bacterial population and the fat content of the sour cream. Where, in the product cultured with ABT-2 type, *Lactobacillus acidophilus* grew and predominated in all other accompanying strains overlooking either the fat content or the cold storage period (CSP). *Streptococcus thermophilus* populated the 2nd predominance order followed by *Bifidobacterium* sp., which tended to proximate and preceded, actually, *Str. thermophilus* by prolonging the CSP of the lowest fat-content cream (10%). The increase rate of the bacterial count continued until 3rd weak for *Lb. acidophilus* and to 1st weak for *Bifidobacterium* sp.. Thereafter, gradual decreases were occurred. However, *Str. thermophilus* began to decrease from the 1st day of CSP. Although the count of bacterial type R-704 was always higher, it behaved a trend similar to that of *Bifidobacterium* sp. toward the CSP. Sour cream of ABT-2 type contained higher titratable acidity (TA) % as well as lower pH, acetaldehyde (AC) and diacetyl (DA) values than that cultured with R-704 type. Along CSP of sour cream the increment in AC, DA and TA contents continued, in order, until the 7th , 14th and the end of the

1- Food Science Dept., Fac. Agric., Ain Shams Univ., Shoubra El-Khaima, Cairo, Egypt

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experimental period. As the protein content raised at the expanse of the fat content *via* adding DWPC, which was in the denatured form, the firmness, consistency coefficient, and yield stress of sour cream increased, especially when ABT-2 type was used and the CSP progressed. Furthermore, ABT-2 sour cream was sensory distinguished with, nearly, similar appearance as will as better flavour and consistency rather than that of R-704. The fat reduction to 20 % did not influence the overall sensory quality, while that of 10% fat attained panel score averaged 93.5 % of the control when ABT-2 type was used. As a conclusion, it is successfully possible to produce probiotic low calorie sour cream with excellent sensory attributes using Simplesse100® as fat mimetic and bacterial type ABT-2 as starter culture.

Keywords: Sour cream, Rheological profile, *Lactobacillus acidophilus*, *Streptococcus thermophilus*, *Bifidobacterium* sp., Simplesse®

INTRODUCTION

The human gastrointestinal tract is a diverse and complex ecosystem harboring more than 400 species of bacteria. Their importance is demonstrated by their impressive presence. The large intestine alone contains about 1.5 Kg of bacteria. This quantity of bacteria is not surprising given the tremendous effect of bacterial growth and metabolism on human health. Not all bacteria are created or act equally, however, some benefit the body and are required for optimal health, whereas others harm the body by producing toxins and even carcinogens. An optimal balance of microbial organisms in the intestine is an important aspect of maintaining good health **(Hekmat & McMahon, 1992)**. When lactic acid-producing bacteria are in short supply, undesirable bacteria can increase in number. The results can range from simple digestive discomfort to more serious gastrointestinal disease. Imbalance - a scarcity of "good" bacteria or a surplus of "bad" bacteria - can set the stage for a cascade of events that may ultimately trigger disease. Certain bacteria, such as *Bifidobacterium* sp., *Lactobacillus acidophilus*, *Lb. casei*, *Lb. returei*, *Lb. delbrueckii* ssp. *bulgaricus* and *Streptococcus thermophilus* help maintain such a favorable balance **(Hansen, 1985)**. Bifidobacteria are the predominant gut flora in breastfed infants, where they prefer to reside in the large intestine. While, *Lb. acidophilus* can survive in abundance in the small intestine. As person ages, the number of intestinal bifidobacteria decrease and the numbers of clostridia, streptococci and coliforms increase **(Start & Lee, 1982; Rasic & Kurmann, 1983 and Hoover, 1993)**.

The health, whether the prophylactic or therapeutic, and nutritional benefits ascribed to both *Bifidobacterium* sp. and *Lb. acidophilus* are many and variable, including potential roles in human intestinal tract, anti-carcinogenic effect by suppressing the formation of cancer-causing amines and cancer-promoting enzymes in the intestine. Increasing immune-competence and antagonistic effect toward enteropathogenic bacteria by producing antibiotics and organic acids as well as lowering the pH of the colon. Besides, they act as barriers to prevent pathogenic bacteria from colonizing the

intestines,aiding absorption of minerals, especially calcium, due to increasing intestinal acidity and improving the lactose digestibility for lactose maldigestors. Moreover, the consumption of such strains interferes with cholesterol absorption from intestine leading to reduce its level in the blood serum. The dietary administration of them in patients with hepatic disease reduces ammonia, free serum phenol and free amino nitrogen in the blood. Furthermore, they are resistant to intestinal bile salts and produce vitamins, especially B-vitamins and vitamin K **(Poupard *et al* 1973; Harrison & Peat 1975; Oda *et al* 1983; Rasic, 1983; Kim & Gilliland, 1984; Anand *et al* 1984; Robinson, 1991 and Kebary *et al* 1998)**.

In recent years, because of their reported health benefits, the dairy industry has begun incorporating probiotic cultures into many products such as yoghurt and cheese. Besides, some trials have been carried out for the production of probiotic sour cream **(El-Kenany, 1996 and Wilson *et al* 2004**). But, it becomes logic to suppose that, it would be more suitable to improve the beneficial purpose of this product when probiotic strains are rather cultured in the low calorie cream preferring rich in protein. Especially, with the current upward trend in nutritional and health awareness, the consumer's demand for reduced or low calorie food has been accelerated **(Tharp & Gottemoller 1990; Coninck 1996 and Fayed *et al* 2006)**.

Therefore, the aim of this work was to study the overlapping influences of the partial fat mimetic in addition to the cream culturing with probiotic strains on the varied attributes of the resultant sour cream.

MATERIAL AND METHODS

Materials

Fresh buffalo's milk was obtained from the herd of Fac. Agric., Ain Shams Univ., Egypt. Dried whey protein concentrate (consisted of 95% dry matter, 68% protein, 14% lactose, 12% ash and less than 0.5% fat) made by SFK DATA-BIAD, Hvidovre and Viborg, Denmark, was obtained from the local market. Simplesse 100® (modified dairy whey concentrate) made by CPKelco, Penrhyn Road, Knowsley Business Park, Denmark, was obtained from the Egyptian Office for Trading and Agencies (eta), Cairo. Tow commercial lyophilized bacterial cultures were obtained from Chr. Hansen Laboratory, Copenhagen, Denmark. The first one was mesophilic homofermentative culture type R-704 DVS and the second was thermophilic culture type ABT-2 DVS containing *Lb. acidophilus, Bifidobacterium* sp. and *Str. thermophilus.*

Experimental procedure

1. Cream separation

Fresh cream (54% total solids and 50% fat) was mechanically separated from fresh buffalo's milk.

2. Preparation of bacterial starter cultures

Lyophilized bacterial cultures were separately inoculated in previously autoclaved (121°C/15 min.) skimmed milk and incubated at 30°C for the type R-704 or at 37°C for the ABT-2 type. The complete curdling occurred within 8 h. Starter cultures were freshly used.

3. Preparation of sour cream

Cream based on 36% total solids (TS) and 30 % fat was made using the obtained fresh cream and liquid skimmed milk (9 % TS). To produce low-calorie sour cream, fat content was lowered to 20 and 10 % depending on the addition of Simplesse 100® to mimic milk fat on the basic of 0.1% fat mimetic is instead of 1.0 % fat. Dried whey protein concentrate (DWPC) was used as bulking agent to overcome the loss occurred in the TS content due to the reduction in the fat content **(Table, 1)**. The quantities of DWPC and liquid skimmed milk required for low-calorie cream blends were calculated by fitting their compositions to the equations suggested by **Fayed *et al* (2006).** Thereafter, all creams were homogenized using X520, UAC 30-R, Chicago II G064 (3000 rpm/min.) homogenizer at 55-60°C and further heat treated to 74°C for 30 sec. followed by rapidly cooling to the appropriate temperatures. Then, creams were inoculated with 2% freshly prepared bacterial starter culture and incubated at 30 or 37°C, to reach pH value of about 4.6, for cream cultured with R-704 or ABT-2 type starter culture, respectively. The resultant sour creams were held 21 days at refrigerator temperature (7 ±1°C) for 7 days interval analyses. Three replicates were carried out for every treatment.

Table 1. Low calorie sour cream blends (kg/100 kg)

Ingredient	Designed fat content		
	30%	20%	10%
Cream (54 % TS,50 % fat)	60.00	40.00	20.00
Skim milk (9% TS)	40.00	47.92	58.35
Simplesse 100®	0.00	1.00	2.00
DWPC (95% TS)	0.00	11.08	19.65

4. Analytical methods

Dry matter, fat, total nitrogen, ash and titratable acidity contents were determined **(AOAC, 2000)**. Acetaldehyde (AC) and diacetyl (DA) contents were determined according to **Lees & Jago (1969) and (1970),** respectively. pH values was measured using pH meter model Cole-Armer Instrument Co., USA. Rheological parameters were measured using a Coaxial rotational viscometer (Rheotest II, Medingen, Germany) at 10 ±1°C at shear rates ranging from 3 to 1312 $sec.^{-1}$. Consistency coefficient and yield stress were calculated from the ascending flow curve as described by **Toledo (1980) and Bourne (1982),** respectively. While, the firmness was measured at 10±1°C using penetrometer model SUR, BERLIN, PNR6 as described by **Bourne (1982)**. The depth (per mm) to which a loaded

perforated disc (cone weight 41.4570 g, total 49.7820g) penetrates into the set sour cream in given time (5 sec.) is recorded. Caloric value was calorimetericaly determined according to the method described by **Walstra & Jenness (1984).** While the theoretic caloric value was calculated using figures of **Renner & Renz-Schauen (1986).** Samples were prepared for the bacterial analyses as in **Marshall (1992).** Mesophilic bacteria type R-704 were enumerated, using M17 agar medium, after the incubation at 30°C for 48 h. as in **Terzaghi & Sandine (1975)**. Whilst, *Str. thermophilus, Lb. acidophilus* and *Bifidobacterium* sp. were enumerated using ST agar, MRS-sorbitol agar and MRS (Oxoid) agar supplemented with L-cystein and lithium chloride, respectively, after the incubation at 37°C for 72 h as in **Dave and Shah (1996).** Organoleptic evaluation was carried out according to the scheme of **Bodyfelt *et al* (1988).** The obtained data were statistically analyzed according to **SPSS (1998).**

RESULTS AND DISCUSSION

1. Gross composition of sour cream prior culturing

As present in **Table (2)**, the proportional fat replacement in cream yielded an increase in the protein, carbohydrate and ash contents ($p<0.01$) since the DWPC (68 % protein, 14% lactose and 12 % ash) was used as bulking agent to maintain the TS %, of cream at the designed level of 36 %. Similar observations were reported by **Fayed *et al* (2006).**

2. Energy load of sour cream

As shown also in **Table (2)**, the caloric value of sour cream, whether calorimetrically determined or theortically calculated, decreased gradually as the fat was replaced by Simplesse 100®. Moreover, the figures obtained by the former method were, at any given fat content, about the double of those theoretically expressed. Similar findings were reported by **Fayed *et al* (2006).**

Table 2. Gross composition and caloric value of sour cream prior culturing as affected by the fat replacement with Simplesse 100®

Property	Designed fat content		
	30%	20%	10%
Total solids %	36.15	36.20	36.10
Fat %	30.20	20.15	10.10
Total protein % (TN x 6.38)	2.27	10.60	17.35
Carbohydrate %*	3.68	5.45	8.65
Ash %	0.58	0.76	0.92
Calorimeterical caloric value (K. cal/100g)	607.9	513.9	402.8
Theoretical caloric value (K. cal/100g)	305.3	253.2	200.5

* Calculated by the difference.

3. Bacterial population of sour cream

Data given in **Table (3)** reveal that as beginning, there are reverse relationships between the fat content and the bacterial count among all strains experimented in sour cream whether when fresh or along the cold storage period (p<0.01). That would clearly indicate that the fat reduction may improve the bacterial viability in sour cream. Besides, the sour cream solids recovery by adding DWPC could be considered at the same time as growth-factors supplementation for the sour cream medium.

Regarding the bacterial strains contributing the ABT-2 type starter culture, *Lb. acidophilus* predominated in all other accompanying strains (p<0.01) overlooking either the fat content of cream or the cold storage period. *Str. thermophilus* populated the second predominance order followed by *Bifidobacterium* sp., which stilled to live and grow until the end of the experimental period (21 days), so that it approximated and preceded *Str. thermophilus* if the fat content of cream was lowered to 10% occupying its predominated position, i.e. the second order **(Table, 3)**. As the cold storage period pro longed, the count of *Lb. acidophilus* continued strongly to increase until the 3rd weak ranging log 7.91- 8.04, i.e. $8.1x10^7$- $1.1x10^8$ cfu/g sour cream. The highest count belonged to the lowest fat content and *visa versa*. Then it began to decrease. Nevertheless, the count of *Str. thermophilus* started to decline from the first day of cold storage period. However, *Bifidobacterium* sp. remained increasingly grow until the 1st week log counted 5.73 - 6.84, i.e. $5.4x10^5$- $6.9x10^6$ cfu/g sour cream. The highest count pertained to the lowest fat content and *visa versa*. Then it followed by gradual reduction as the cold storage period progressed therefore. But it stilled to possess valuable count (10^5-10^6 cfu/g) as good as recommended by **Schuler-Malyoth *et al* (1968) and Kurmann & Rasic (1991).** Likewise, the mesophilic bacteria of starter culture type R-704 exhibited a growth behavior like to that of *Bifidobacterium* sp., where their count increased to log 7.94-9.00, i.e. $8.7x10^7$- $1x10^9$ cfu/g, in inverse order with the fat content, at the end of the 1st week then it trended gradually to decrease as the cold storage period of sour cream prolonged. These results agree with those reported by **El-Kenany (1996).**

4. Biochemical properties of sour cream

As seen in **Table (4)**, the titratable acidity (TA%), acetaldehyde (AC) and diacetyl (DA) contents of sour cream increased and hence the pH value decreased as the fat content reduced by replacing it with Simplesse 100® (p<0.01) indicating the foregoing finding of such relationship between the fat content and bacterial viability. Moreover, the acidity produced by ABT-2 type starter culture was significantly (p<0.01) higher than that formed by R-704 type in sour cream, whether when fresh or cold stored, although, both of AC and DA produced by the former starter culture were lower than those produced by the latter.

By duration of the cold storage of sour cream, the TA% increased gradually as well as the pH value proportionally decreased providing that the highest TA% remained always so at a certain any period of the cold storage (p<0.01).

Table 3. Bacterial log count (cfu[1]/g) of sour cream during cold storage period as affected by the fat replacement with Simplesse 100® as well as the kind of bacterial starter culture.

Cold storage period (day)	Designed fat content											
	30%				20%				10%			
	R-704[2]	ABT-2[3]			R-704	ABT-2			R-704	ABT-2		
		A[4]	B	T		A	B	T		A	B	T
0	7.30	7.46	4.00	6.34	8.26	7.69	5.36	6.51	8.88	7.89	6.89	6.71
7	7.94	7.83	5.73	4.48	8.70	7.93	5.54	5.61	9.00	8.00	6.84	6.67
14	6.96	7.91	4.40	3.90	7.63	7.98	4.85	4.69	7.91	8.04	5.60	5.60
21	6.58	6.83	2.34	3.30	7.18	6.90	3.04	4.23	7.34	6.93	4.43	4.32

[1]cfu / g: Colony forming unit per gram. [2]R-704: mesophilic homofermentative culture.
[3]ABT-2: thermophilic culture. [4]A: *Lb. acidophilus* B: *Bifidobacterium* sp. T: *Str. thermophilus*

Table 4. Biochemical properties of sour cream during cold storage period as affected by the fat replacement with Simplesse 100® as well as the kind of bacterial starter culture.

Cold storage period (day)	Designed fat content					
	30%		20%		10%	
	R-704*	ABT-2*	R-704	ABT-2	R-704	ABT-2
	Titratable acidity % (as lactic acid)					
0	0.70	0.75	0.72	0.77	0.78	0.83
7	0.73	0.78	0.76	0.81	0.83	0.89
14	0.75	0.80	0.78	0.84	0.87	0.94
21	0.76	0.81	0.79	0.85	0.89	0.97
	pH value					
0	4.65	4.62	4.63	4.60	4.60	4.55
7	4.60	4.58	4.58	4.57	4.56	4.54
14	4.57	4.55	4.55	4.54	4.53	4.52
21	4.55	4.53	4.53	4.52	4.51	4.50
	Acetaldehyde (μmol/ml)					
0	239	173	265	188	298	195
7	244	181	297	225	314	220
14	238	175	251	201	283	185
21	198	124	205	189	248	135
	Diacetyl (μmol/ml)					
0	55	3	95	7	118	8
7	84	11	118	13	135	17
14	103	19	138	27	158	25
21	90	11	126	17	140	18

*See Table: 3.

The increment rate in the AC content continued until the 2nd week, while that of DA content continued up to 3rd week, then reductions were took place in both components by prolonging the period of cold storage (p<0.01). This trend is in coincidence with that found by **El-Kenany (1996).**

5. Rheological profile of sour cream

Data displayed in **Table (5)** appear that, all rheological parameters measured namely the firmness, which reflected from the penetration value, consistency coefficient and yield stress, raised as the fat reduced (p<0.01). These phenomena might be related to the increase in the protein content rather than the reduction in the fat content of sour cream because of its increasingly forward reaction toward the developed acidity during cold storage period, especially the whey proteins of the bulking agent used were in the denatured form, i.e. they would behave completely as casein towards acid. Besides, their attained water holding capacity due to the denaturization. Similar observations were reported by **El-Kenany (1996) and Fayed *et al* (2006)** toward the duration of cold storage of sour cream and protein enrichment of whipped cream, respectively.

Concerning the kind of starter culture, the sour cream cultured with the type of ABT-2 achieved always the higher figures for the consistency coefficient and yield stress and consequently the lower penetration value *vis-à-vis* that cultured with the type of R-704 (p<0.01), that could be explained by the relatively higher acidity attained in the former **(Table, 4)**.

6. Organoleptic quality of sour cream

Organoleptically, the appearance of sour cream was not influenced by the partial replacement of fat by Simplesse 100® except of some yellowness in colour seemed due to the increasing level of bulking agent (DPWC) that led sour cream to attain also a body firmer than that of the control **(Table, 6)**. Similar observations were reported by **Fayed *et al* (2006).** A slight increment in the consistency score was recorded towards the sour cream cultured by bacterial starter type ABT-2. The effect of variability in the kind of bacterial starter culture became more pronounced with regard to the flavour criterion of the product. Where, the type ABT-2 imparted it palatability better than that gained when the type R-704 was used. All samples kept, along the cold storage period, their sensory quality being nearly as good as their fresh ones with slight reduction in the panel score, especially when the culture type R-704 was used.

As a conclusion, it is successfully possible to produce probiotic low calorie sour cream with excellent sensory attributes using Simplesse 100® as fat mimetic and bacterial type ABT-2 as starter culture.

Table 5. Rheological parameters of sour cream during cold storage period as affected by the fat replacement with Simplesse 100® as well as the kind of bacterial starter culture.

Cold storage period (day)	Designed fat content					
	30%		20%		10%	
	R-704*	ABT-2*	R-704	ABT-2	R-704	ABT-2
	Penetration value (mm)					
0	21.5	21.8	22.2	23.0	23.5	24.1
7	21.9	22.2	22.6	23.3	23.9	24.5
14	22.4	22.8	23.2	23.7	24.2	24.9
21	23.1	23.5	23.9	24.2	24.7	25.3
	Consistency coefficient (dyne.sec./cm^2)					
0	20.74	21.49	23.57	23.79	24.37	24.55
7	22.03	22.81	25.62	25.88	25.10	27.14
14	23.23	24.00	27.10	27.53	28.32	29.08
21	24.68	25.02	28.00	28.62	29.14	30.16
	Yield stress (dyne./cm^2)					
0	135.05	189.13	203.53	216.40	306.79	333.01
7	146.41	200.30	244.62	253.14	346.43	390.31
14	160.12	239.14	290.31	310.81	392.15	435.00
21	178.36	275.50	303.45	344.52	425.50	480.66

*See Table: 3.

Table 6. Organoleptic scores of sour cream during cold storage period as affected by the fat replacement with Simplesse 100® as well as the kind of bacterial starter culture

Cold storage period (day)	Designed fat content					
	30%		20%		10%	
	R-704*	ABT-2*	R-704	ABT-2	R-704	ABT-2
	Appearance (25)					
0	25	25	23	23	20	20
7	25	25	23	23	20	20
14	24	24	23	23	20	20
21	23	24	21	23	18	19
	Consistency (25)					
0	25	25	25	25	24	24
7	25	25	25	25	23	24
14	25	24	25	25	22	23
21	24	24	23	24	20	23
	Flavour (50)					
0	50	50	50	50	45	48
7	48	50	46	50	43	48
14	46	48	43	49	40	46
21	45	47	41	49	38	45
	Total score (100)					
0	100	100	98	98	89	92
7	98	100	94	98	86	92
14	95	96	91	97	82	89
21	92	95	85	96	76	87

*See Table: 3.

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إنتاج قشدة متخمرة حيوية منخفضة السعرات الحرارية

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عاطف السيد فايد[1] – جيهان علي مصطفى حسين[1]– عزة محمود فرحات[1]

1– قسم علوم الأغذية– كلية الزراعة– جامعة عين شمس– شبرا الخيمة– القاهرة– مصر

استهدف البحث إنتاج قشدة متخمرة حيوية منخفضة السعرات الحرارية مع دراسة علاقة ذلك بالخواص التركيبية والكيماوية والبكتيريولوجية والريولوجية والحسية مع التركيز على الحمل البكتيرى الحيوى نوعيا على مدار 21 يوما خلال التخزين بالثلاجة. ولتحقيق ذلك تم إنتاج قشدة أساسية تحتوى علي 36% جوامد كلية، 30% دهن وذلك بإستخدام قشدة طازجة (50% دهن) ولبن فرز (9% جوامد كلية). ولإنتاج قشدة السعرات الحرارية تم خفض الدهن إلى 20% و10% إعتمادا علي إستخدام الدهن المقلد سمبلس 100® Simplesse علي أساس أن 0.1% بديل دهنى يحل محل 1% دهن ، كما تم إستخدام مسحوق مركز بروتينات شرش (95% جوامد كلية) لتعويض النقص الحادث في محتوى القشدة من الجوامد الكلية ليظل دائما 36% جوامد كلية إسوة بالكنترول . وقد تم تجنيس جميع المعاملات وذلك عند 55 -60°م ثم تم إجراء معاملة حرارية علي 74°م/ 30ث ثم التبريد السريع إلى درجة الحرارة المناسبة حيث لقحت بنسبة 2% بإستخدام بادئات حديثة التحضير وحضنت للوصول إلى pH حوالى 6و4 عند 30°م للمتخمرة ببادئ من نوع R-704 وعند 37°م للمتخمرة ببادئ من نوع ABT-2.

أوضحت النتائج حدوث زيادة في محتوى القشدة المتخمرة من البروتين والكربوهيدرات والرماد والحموضة مع استبدال الدهن بينما حدث انخفاض في كل من قيم الـ pH والسعرات الحرارية. كما حدث زيادة تدريجية في الحمل البكتيرى بإنخفاض الدهن بالقشدة المتخمرة . حيث إنه فى المنتج المتخمر ببادئ المزرعة الثانية نمى *Lb. acidophilus* وساد سائر السلالات المصاحبة له بغض النظر عن نسبة الدهن أو مدة التخزين بالثلاجة . بينما أحتل *Str. thermophilus* المركز الثانى من حيث العدد وتلاه *Bifidobacterium* sp. والذى أقترب بعد ذلك بل فاق عدد بكتيريا *Str. thermophilus* بتقدم مدة تخزين القشدة المحتوية على 10% دهن . ولقد أستمر التزايد العددى حتى الأسبوع الثانى لميكروب *Lb. acidophilus* وحتى الأسبوع الأول لميكروب *Bifidobacterium* sp. بينما بدأ ميكروب *Str. thermophilus* فى

الإنخفاض منذ اليوم الأول للتخزين بالثلاجة. أما بالنسبة للقشدة المتخمرة ببادئ المزرعة R-704 فبالرغم من إنها كانت دائما محتوية على أعداد كبيرة إلا إنها سلكت إتجاها مشابها لميكروب *Bifidobacterium* sp. أثناء التخزين بالثلاجة. احتوت القشدة المتخمرة ببادئ مزرعة ABT-2 على نسبة حموضة أعلى وقيم أقل من الـ pH والأسيتالدهيد والداى أستيل عن القشدة المتخمرة ببادئ المزرعة الأخرى. ولقد أستمرت الزيادة فى الأسيتالدهيد والداى أستيل والحموضة حتى اليوم السابع والرابع عشر والحادى والعشرين، على التوالي . ونتيجة لزيادة المحتوى البروتينى على حساب الدهن بإضافة مسحوق مركز بروتينات الشرش التي كانت في الصورة المدنترة ، فقد زادت الصلابة ومعامل القوام وجهد القص الأبتدائى للقشدة المتخمرة وخاصة ببادئ مزرعة ABT-2 أوبزيادة مدة التخزين . ولقد أظهر الفحص الحسى أيضا تميز القشدة المتخمرة بمزرعة ABT-2 بالتساوى فى المظهر والأفضلية فى النكهة والقوام والتركيب بالمقارنة بالناتجة بإستخدام R-704 . ولم يؤثر خفض نسنة الدهن إلى 20% على الجودة الحسية الكلية بينما حصلت القشدة المحتوية على 10% دهن والمخمرة بإستخدام ABT-2 على درجات تحكيم بلغت 93% بالنسبة للكنترول. ومما سبق يمكن الأستنتاج أنه يمكن بنجاح إنتاج قشدة متخمرة حيوية منخفضة السعرات الحرارية بخواص حسية ممتازة بإستخدام السمبلس كدهن مقلد والمزرعة ABT-2 كبادئ بكتيري.

تحكيم: أ.د عبده السيد شحاتة
أ.د سنيه محمود عبده