PREPARATION AND PROPERTIES OF FRUIT WHEY BEVERAGE

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ABSTRACT

Sweet whey was heated at 71ºC for 30 sec. after adding 0.2% stabilizer. Heated whey was divided to three parts, to first part ABT culture (3%) was added without incubation, while the second part was incubated at 45ºC after adding the same concentration of ABT culture. The incubation continued until pH reached 4.6±1. The third part considered as control. Fruit juices (30%) mango, guava and strawberry, also 10% sucrose were added to all previous treatments, after which all treatments were stored at refrigerator (7ºC ±1) for 10 days. Chemical and microbiological analysis were followed at 0,3,7 and 10 days of storage. Sensory evaluation were done immediately after processing. Results could be summarized as follows: pH-values gradually decreased in all samples during storage. Total solid (T.S) content of beverage with incubated ABT-culture was higher than that other treatments, while it had slightly lower lactose, total protein and calcium content as compared with other treatments. All whey-fruit beverages showed the highest contents of asperity, glutamic, leisure and lysine acids. Changes in vitamins content of all samples due to added fruit-juices.

Gradually increased during storage in total bacterial content (T.B.C) of all samples. Finally all whey-based beverage had good sensory properties but non-fermentation whey showed higher scores in sensory evaluation test than fermented whey.

INTRODUCTION

In dairy technology whey is a by product of cheese making. It was the residue from milk after removal of casein and most of the fat. Sweet whey results from the production of partially all other natural cheese that are made from rennet coagulated curd. Cheese whey has an important biological and nutritive value, in addition to its contents of lactose and whey proteins, it can be a good source of several vitamins and minerals Zall (1984). Holsinger *et al.,* (1974) reviewed the use of cheese whey as a base for preparation of several varieties of beverages. Schuster (1977), Reddy *et al.,*(1987), Barabas and Albrecht (1988) and Vojnovic *et al.,* (1993) used the whey as a base ingredient for the production of beverage containing fruit syrup and fruit pulp.

On the other hand, A mixed culture containing L.acidophilus is now available for use in the manufacture of fermented milks, it consists of L.acidophilus, Bifid, bacterium bifidum, Streptococcus thermophilus It has been reported that when this culture is used, a mild and very aromatic product is obtained (Chr-Hansen `s Dairy cultures pamphlet). Moreover, Bifidobacterium bifidum is able to assimilate higher concentrations of lactose leading to acidity increase in the istestinal tract and so create a condition which favour the assimilation of more calcium and phosphorus. Moreover, Khanna and singh (1979) pointed out that the antibacterial activity of mixed

cultures is greater that of single ones. Hofi (1989), Ismail *et al.,* (1992) and Mahran *et al.,* (1992) utilized cheese whey to produce beverages with Kefir aroma. Parak *et al.,* (1988), Molochnikov *et al.,* (1992), Gandhi and Patel (1994), studied the production of a whey drink with lactic acid bacteria.

The objective of this study was the use of sweet whey to prepared different flavoured beverages with and without ABT-culture.

MATERIALS AND METHODS

I- Materials :

Fresh sweet whey was obtained from the Food Technology Research Institute, Ministry of Agriculture during the manufacture of Ras cheese. Selected fresh mango, guava and strawberry fruits and fine powdered cane sugar were obtained from the local market. ABT- culture (Lactobacillus acidophilus, Bifido bacterium bifidum, Streptococcus thermophilus) No. 8 Redi-set obtained from Chr-Hansen`s Laboratories Copenhagen, Denmark was used. Commercial carboxymethyl cellulose sodium salt (CMC) and carrageenan (BDH, U.K.) were used.

II- Experimental procedure :

1- Preparation of fruit Juices :

Guava fruits were thoroughly washed, cut into pieces then mixed in a blender and filtered through a cheese cloth. The resulting mixed pulp was heated in a stainless steel container at 87.5 ^{o}C / 1 min to inactivate pectin's enzymes, cooled rapidly to 20 ^{o}C then filled into poly-ethylene bags and stored in a deep freezer (-18 ^{o}C) until required. Selected mango fruits variety Alphonso were washed with water, peeled off and destined. The flesh was packed in ploy-ethylene bags and stored in a deep-freezer (-18 ^{o}C) until required. Strawberry were washed with water, cut into pieces then mixed in a blender. The obtained mix filled into ploy-ethylene bags and stored in deep freezer (-18 ^{o}C) until used .

III- Methods of analysis :

Samples were analysed for total solid (T.S) was determined according to the methods reported by Ling (1963), total protein (T.P) as described by Rowland (1938). Lactose was determined according to the Nickerson (1976), Calcium as described by AOAC method (1970). The pH was measured using pH meter with a glass electrodes (Orion Research digital analyzer). Amino acids were determined according to the method reported by Widar and Eggum (1966), while vitamins by my Bognar (1992). Total bacterial counts (T.B.C) were estimated using the appropriate media as recommended by the A.P.H.A (1978).

Sensory evaluation :

The samples were evaluated for flovour (60 points), body and texture (30 points) and colour (10 points) by a panal of 10 trained Judges according to Deka et al., (1984).

RESULTS AND DISCUSSION

A. Chemical Analysis

1. pH-values :

Data presented in tables 1 and Fig. (1) show the changes in pH of mango, guava and strawberry-sweet whey beverage with different treatments during cold storage. The pH values of beverages without ABT-culture (control) reached 6.14, 5.65 and 4.92 for Mango, guava and strawberry beverages at zero time. There differences may be due to the different chemical composition of mango, guava and strawberry juices. During storage, the pH values of all samples gradually decreased. This slight decrease in pH values could be attributed to acid formation during storage. These findings are in agreement with those reported by Reddy et al., (1987) and Rao and Gandhi (1988) for sour acidophilus milk.

Table (1): Changes in pH-values of mango, guava and strawberry sweet whey beverage with different treatments during cold storage.

Kind of Juices	Treatments	Cold storage period in days			
		0	3	7	10
Mango	A	6.14	5.94	5.46	5.27
	B	5.25	4.94	4.89	4.8
	C	4.69	4.6	4.57	4.49
Guava	A	5.65	5.42	5.39	5.24
	B	5.00	4.94	4.81	4.79
	C	4.70	4.69	4.56	4.44
Strawberry	A	4.92	4.91	4.9	4.85
	B	4.64	4.48	4.46	4.29
	C	4.34	4.28	4.25	4.21

A: Untreated beverage (control)
B: beverage treated with ABT-culture.
C: beverage treated with ABT-culture and incubated at 45°C.

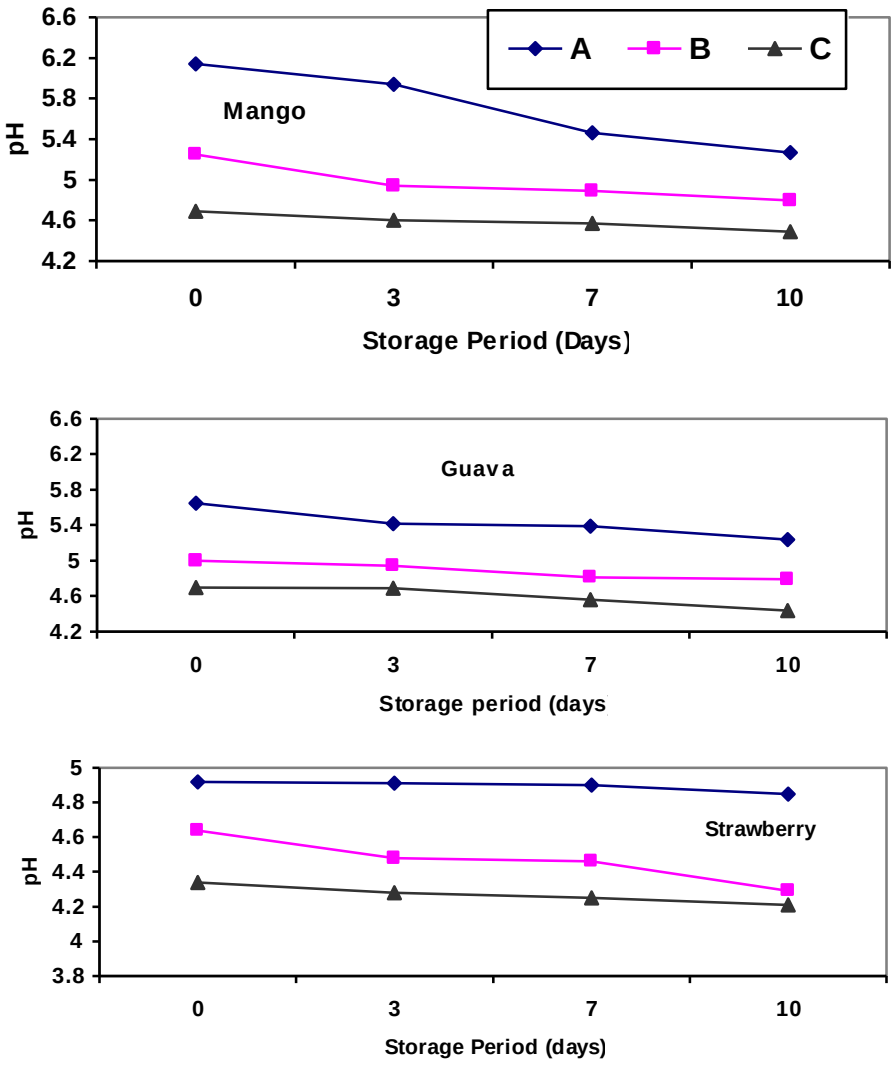


Fig. (1): Changes in pH - values of mango, guava, and strawberry sweet whey beverages with different treatment during cold storage.

A: Untreated beverage (control).
B: Beverage treated with ABT - culture.
C: Beverage treated with ABT-culture and incubated 45°C.

2.Total solid content (T.S.):

The total solid content of mango, guava and strawberry-sweet whey beverages are shown in table (2) at the obtained results showed that T.S content of beverage with incubated ABT culture at 45°C was higher than that of beverage with ABT-culture without incubation and untreated beverage (control). This may be due to the effect of incubation temperature, which increase water evaporation.

3.Lactose content:

The total lactose content of mango, guava and strawberry sweet whey beverages are shown in table (2), results showed that beverage with incubated ABT-culture had slightly lower lactose content (3.15, 3.11 and 3.19) comparing to untreated beverage (control – 3.75, 3.98 and 3.19%). The values of ABT-culture treatments without incubation were in between. This finding could be attributed to lactose hydrolysis due to culture adding and incubation. Addition of ABT-culture decreased lactose content of beverage treatments due to formation into lactic acid (Khanna and Singh, 1979).

4.Total protein content:

The total protein content of mango, guava and strawberry-sweet whey beverages are shown in table (2). The obtained results indicated that the untreated beverage had more total protein content than all treatments. This finding could be attributed to the effect of adding ABT culture, which had slight proteolytic activity (Barabas and Albrecht 1988)

5.Calcium content:

The calcium content of mango, guava and strawberry-sweet whey beverages are shown in table (2), results showed that beverage with incubated ABT-culture had less calcium content than both untreated beverage and beverage with ABT-culture without incubation.

Table (2): Chemical composition of mango, guava and strawberry sweet-whey beverage with different treatments (at the end period).

Kind Of Juices	Treatments	T.S. %	Lactose %	T.P. %	Ca %
Mango	A	19.77	3.75	0.88	0.174
	B	21.10	3.47	0.78	0.179
	C	20.92	3.15	0.73	0.170
Guava	A	18.58	3.98	0.79	0.167
	B	19.34	3.60	0.64	0.175
	C	18.40	3.11	0.64	0.150
Strawberry	A	19.77	3.19	0.69	0.175
	B	19.96	3.12	0.66	0.177
	C	19.00	3.19	0.63	0.170

A: Untreated beverage (control)
B: Beverage treated with ABT-culture.
C: Beverage treated with ABT-culture and incubated at 45°C.

6. Amino acid content:

Data in tables 3, 4 and 5 show the amino acid content of mango, guava and strawberry-sweet whey beverages when fresh and during cold storage. It is clear from the obtained results, that incubated whey beverage with ABT culture (mango) showed the highest contents of aspartic, glutamic, leucine and lysine acids, they were 71.4, 101.6, 46.0 and 39.6 g/100 ml respectively, as compared with untreated whey-beverage (control) they reached to 56.0, 73.0, 44.0 and 39.0 respectively. These may be due to the proteolytic action of ABT culture. The same trend was also observed with other fruit juices whey beverages (guava and strawberry). The obtained value were 97.8, 166.0, 70.0 and 62.8 g/100ml. For guava sweet whey beverage, while they reached 59.0, 92.0, 44.0 and 40.0 g/100 ml for untreated one.

As regards strawberry sweet whey beverage the corresponding values of the same amino acids were 126.0, 154.0, 63.0 and 39.0 g/100ml, while they reached 115.0, 113.0, 42.0 and 37.0 g/100 mL for untreated beverage. The same tables also showed that guava whey beverages had the highest values of amino acids. These findings are in agreement with those recorded by Zall (1984), Bowes and Church's (1998).

Table (3): Content of amino acid in mango sweet whey beverage with different treatments (mg/100 ml).

Amino acid	Sweet mango whey	Mango with ABT-culture	Incubated ABT-culture with mango beverages	Whey
Aspartic (Asp)	56.0	63.7	71.4	83.0
Threonine (Thr)	26.0	23.3	26.9	59.8
Serine (Ser.)	21.0	16.8	16.9	33.7
Glutamic (Glu)	73.0	61.9	101.6	13.7
Proline (Pro.)	27.0	00	00	29.0
Glysine (Gly)	18.0	14.0	14.0	13.3
Alanine (Ala)	33.0	26.4	45.6	34.6
Cystin (Cys)	14.0	00	00	16.4
Valine (Val)	19.0	16.0	22.9	36.5
Isoleucine (Iso)	15.0	14.0	18.4	33.8
Leucine (Leu)	44.0	40.7	46.0	64.6
Tyrosine (Tyr)	9.0	6.0	00	4.50
Phenylalanine (Phe)	18.0	9.9	00	27.9
Histidine (His)	12.0	11.1	00	00
Lysine (Lys)	39.0	35.4	39.6	53.8

Table (4): Content of amino acid in guava sweet whey beverage with different treatments (mg/100 ml).

Amino acid	Sweet Guava whey	Guava with ABT-culture	Incubated ABT-culture with Guava beverages
Aspartic (Asp)	59.0	78.0	97.8
Threonine (Thr)	30.0	38.0	49.0
Serine (Ser.)	27.0	34.9	44.0
Glutamic (Glu)	92.0	129.0	166.0
Proline (Pro.)	29.0	00	00
Glysine (Gly)	16.0	20.5	25.0
Alanine (Ala)	31.0	45.0	48.0
Cystin (Cys)	11.0	00	00
Valine (Val)	19.0	26.0	31.0
Isoleucine (Iso)	14.0	17.7	23.0
Leucine (Leu)	44.0	44.0	70.0
Tyrosine (Tyr)	9.0	10.3	11.8
Phenylalanine (Phe)	20.0	27.0	34.0
Histidine (His)	10.0	13.0	18.56
Lysine (Lys)	40.0	50.34	62.8

Table (5): Content of amino acid in strawberry sweet whey beverage with different treatments (mg/100 ml).

Amino acid	Sweet Strawberry whey	Strawberry with ABT-culture	Incubated ABT-culture with Strawberry beverages
Aspartic (Asp)	115.0	125.0	126.0
Threonine (Thr)	31.0	33.0	39.0
Serine (Ser.)	29.0	30.0	32.0
Glutamic (Glu)	113.0	122.0	154.0
Proline (Pro.)	26.0	00	00
Glysine (Gly)	16.0	18.0	10.0
Alanine (Ala)	37.0	37.0	27.0
Cystin (Cys)	92.0	00	00
Valine (Val)	18.0	20.0	20.5
Isoleucine (Iso)	14.0	16.0	18.0
Leucine (Leu)	42.0	63.0	63.0
Tyrosine (Tyr)	9.0	6.6	00
Phenylalanine (Phe)	21.0	23.0	00
Histidine (His)	11.0	8.5	9.8
Lysine (Lys)	37.0	38.0	39

7.Vitamin Content:

Data presented in Table (6) show the vitamin content of different treatments of mango, guava and strawberry-sweet whey beverages. The data obtained showed that vitamin B_1 (thiamin and B_2 (ribovlavin) contents of mango and strawberry untreated whey-beverage (control) were higher than beverage with ABT-culture, while vitamin B_1 content was higher of guava

whey-beverage with incubated ABT-culture than vitamin B_1 content of untreated beverage (control). Generally, the differences of vitamin contents in whey beverages may be due to the vitamin contents of added fruit-juices, bacterial culture used and biological activity of ABT culture.

Table (6): Vitamin content (mg/Kg) of mango, guava and strawberry sweet beverages with different treatments

Treatments	Mango whey Beverage		Guava whey beverage		Strawberry-whey-beverage	
	Vitamin B_1	Vitamin B_2	Vitamin B_1	Vitamin B_2	Vitamin B_1	Vitamin B_2
A	0.07	1.00	0.17	0.80	0.26	0.56
B	0.03	1.80	0.19	0.76	0.12	0.38
C	0.04	0.75	0.24	0.72	0.11	0.44

A: Untreated beverage (control)
B: Beverage treated with ABT-culture
C: Beverage treated with ABT culture and incubated at 45°C

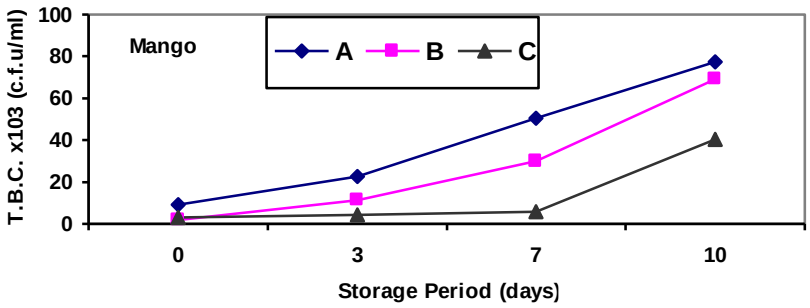
B. Microbiological analysis:

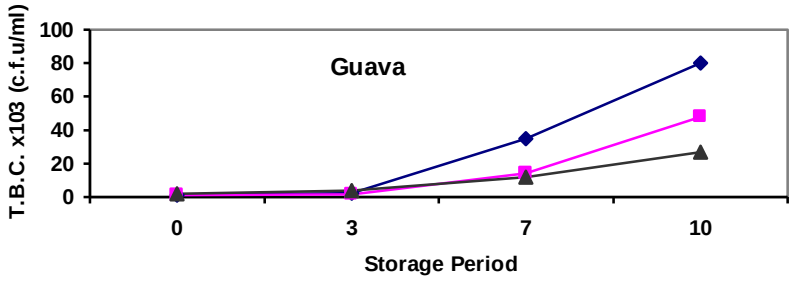
Data in table (7) and Fig. (2) show the changes in total bacterial count (TBC) of different treatments of mango, guava and strawberry-sweet whey beverages when fresh and through cold storage period. Fresh beverage for control (A) and treatments (B) and (C) had 9.3×10^3, 1.7×10^3, 3.3×10^3 and 1.1×10^3, 1.1×10^3, 1.8×10^3 and 2.4×10^3, 0.9×10^3, 1.7×10^3 CFU/ml respectively. It is clear from these results that the (TBC) gradually increased during storage for control and other treatments. These increasing could be attributed to the growth of psychrotrophic bacteria, at low temperature, T.B.C. rang of pasteurized cow`s milk (50-250 $\times 10^3$ CFU/ml) was reported by Robinson (1983).

Table (7): Changes in total bacterial count (TBC) of mango, guava and strawberry sweet whey beverages with different treatments during cold storage (CFU/ml.).

Kind of Juices	Treatments	Cold storage period in days			
		0	3	7	10
Mango	A	9.3×10^3	22.6×10^3	50.6×10^3	77.3×10^3
	B	1.7×10^3	11.2×10^3	30.0×10^3	69.2×10^3
	C	3.3×10^3	4.4×10^3	5.8×10^3	40.5×10^3
Guava	A	1.1×10^3	23.3×10^3	35×10^3	80×10^3
	B	1.1×10^3	1.4×10^3	14×10^3	48×10^3
	C	1.8×10^3	3.8×10^3	12×10^3	27×10^3
Strawberry	A	2.4×10^3	6.1×10^3	44.5×10^3	50×10^3
	B	0.9×10^3	3.0×10^3	10×10^3	23×10^3
	C	1.7×10^3	5.5×10^3	10×10^3	18.8×10^3

A: Untreated beverage (control)
B: Beverage treated with ABT-culture.
C: Beverage treated with ABT-culture and incubated at 45°C.





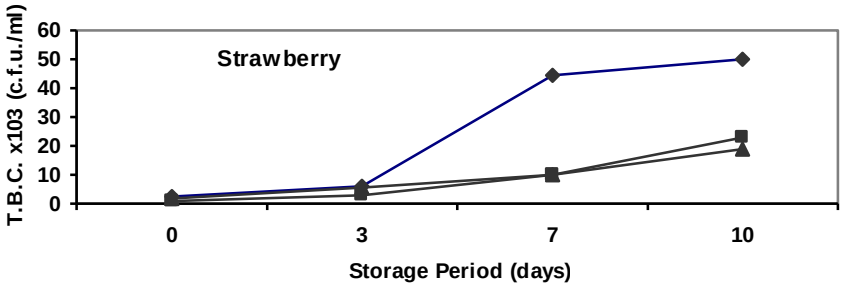


Fig. (2): Changes in total bacterial count (TBC) of mango, guava and strawberry sweet whey beverages with different treatments during cold storage.

A: Untreated beverage (control)
B: beverage treated with ABT-culture.
C: beverage treated with ABT-culture and incubated at 45°C.

Sensory evaluation:

Data in table (8) shows the sensory evaluation of mango, guava and strawberry-sweet whey beverages after processing. Organoleptic tests revealed a decrease in the acceptability of incubated whey beverages with ABT-cultures. There were not high difference in the acceptability of the all three treatments except for the mango-whey beverage, it gave high score at treatment with ABT-culture as compared with both without culture and with incubated whey beverage with ABT-culture respectively.

Table (8): Sensory evaluation of different treatments of mango, guava and strawberry sweet-whey beverages (at the end period).

Treatments	Mango-whey beverage				Guava-whey beverage				Strawberry-whey beverage			
	Colour (10)	Appear-ance (30)	Flavour (60)	Total (100)	Colour (10)	Appear-ance (30)	Flavour (60)	Total (100)	Colour (10)	Appear-ance (30)	Flavour (60)	Total (100)
A	9	26	52	87	9	27	52	88	8	28	50	86
B	10	28	57	95	9	25	53	87	8	26	53	87
C	8	24	40	72	9	27	37	73	9	25	48	82

A: Untreated beverage (control)
B: Beverage treated with ABT-culture.
C: Beverage treated with ABT-culture and incubated at 45°C.

These results agree with Park et al., (1988) they reported that non-fermentation whey showed higher scores in sensory evaluation tests than fermented whey, this was attributed to the presence of succinic acid and other products of the fermentation process which gave the drink off flavour.

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تحضير مشروب الشرش المطعم بالفاكهه ودراسة خواصه

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تم تحضير مشروبات الشرش المطعم بالفاكهه حيث تم بسترة الشرش الحلو على ٧١ م° لمدة ٣٠ ثانية بعد اضافة ٠,٢ % مثبت ثم قسم الشرش إلى ثلاثة أجزاء - الجزء الأول أضيف له ٣ % من مزرعة الـ ABT بدون تحضينه ، الجزء الثانى تم تحضينه على ٤٥ م° بعد اضافة نفس التركيز من المزرعة حتى تصل درجة الـ pH إلى ٤,٦ أما الجزء الثالث لم يعامل بالـ ABT (كنترول) . (٣%) من عصير الفاكهه (مانجو - جوافه - فراوله) ، ١٠ % من السكر كانت تضاف لكل المعاملات ثم حفظت فى الثلاجة (٧ م°) لمدة ١٠ يوم . حللت العينات على فترات صفر ، ٣ ، ٧ ، ١٠ يوم كميائيا وبكتريولوجيا خلال فترات التخزين . أجرى التقييم الحسى للعينات عقب الصناعة مباشرة وقد أوضحت النتائج مايلى :

١- إنخفاض تدريجى فى درجات الـ pH لجميع العينات خلال فترات التخزين
٢- مشروب الشرش المحضن مع مزرعة الـ ABT إحتوى على نسبة أعلى من الجوامد الكلية بينما إنخفض فيه كل من نسبة اللاكتوز والبروتين الكلى والكالسيوم إذا ماقورن ذلك بكل من مشروب الشرش غير المحضن والكنترول
٣- زادت محتوى العينات من الأحماض الأمنية إسبارتك - جلوتاميك - ليوسين - ليسين . غير أنها إختلفت فى محتواها من الفيتامينات
٤- إرتفاع تدريجى فى المحتوى البكتيرى لجميع العينات خلال فترات التخزين
٥- ظهر التحكيم الحسى درجات قبول جيدة - غير أن المشروب غير المتخمر أعطى درجات تحكيم أعلى من المشروب المتخمر ٠