

Productions of a beverage orange juice and sweet whey mixture

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□ ABSTRACT □

Attempts were made to develop a soft beverage of orange juice and sweet whey mixture using different concentrations of pectin. The beverage prepared composition was 50% sweet whey cheese, 50% orange juice and three different concentrations of pectin (0.5,1,1.5%) and pasteurized at 80C° for 15 minutes and it evaluated of chemical characteristics(viscosity, sedimentation and degree of separation) at 7±2 C° for 20 days . The results showed an increasing of TSS (Total soluble solids), acidity, viscosity, sedimentation and the degree of separation, and a decreasing of pH values during applicated conditions . and also showed that the 1% pectin beverage had the best storage stability.

Key words: Sweet Whey, Orange juice, Beverage, Pectin, Storage.

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إنتاج المشروبات من مصّل الجبن وعصير البرتقال

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□ ملخّص □

تم إجراء العديد من المحاولات لتطوير المشروبات المصنعة من مصّل الجبن الحلو وعصير البرتقال وبإضافة تراكيز مختلفة من البكتين. تم تحضير مشروبات مكونة من 50% مصّل الجبن الحلو و50% عصير البرتقال وثلاث تراكيز (0.5، 1، 1.5%).
بستر الشراب المحضر على الدرجة 80 م° لمدة 15 دقيقة. كما تم تقييم الخصائص الفيزيوكيماوية للشراب (اللزوجة، الراسب، مقدار الانفصال) وذلك خلال فترة التخزين على الدرجة 7 ± 2 م° لمدة 20 يوم.
أظهرت النتائج ارتفاع في قيمة كل من المواد الصلبة الذائبة والحموضة واللزوجة والراسب ومقدار الانفصال، وانخفاض في قيمة الأس الهيدروجيني، كما أظهرت النتائج أن النسبة 1% من البكتين المضافة كانت الأفضل لتحقيق الثباتية خلال فترة التخزين.

الكلمات المفتاحية: مصّل الجبن، عصير البرتقال، المشروبات، البكتين، التخزين.

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Introduction:

Whey is the by-product of cheese or casein production, it is of relative importance in the dairy industry due to the large volumes produced and the nutritional composition. Whey is about 95% water but contains more than half of the solids present in the original whole milk, including whey proteins (0.7%) and most of the lactose (5%) , water-soluble vitamins and minerals. Consequently, whey can be considered a valuable by-product with several applications in the food and pharmaceutical industries (Khamrui and Rajorhia,1998).

Nowadays, beverages based on whey are very familiar in the market place reflecting their high nutritional importance, especially in the developed countries. The total world production of whey was about 125 million tons in 2011 and about 64% of those was produced in European countries and 24% in North America (Raju *et al.*, 2005).

Whey has been used to prepare various dairy products as babies food but the possibility of its utilization in beverage industries needs more exploration (Harper,2000).

However, the sensitivity of whey proteins to heat is a critical property for the industrial whey processing and the production of whey drinks, that they are dissolved but they denature partially during heating. So, the heating process could lead to an undesired coagulation and sedimentation of the protein in the whey drinks products (Patel *et al.*,2007).

One of the best method for this problem is to add the pectin that could prove the positive influence on the heat stability of whey protein under industrial heating treatments, but the production of stable whey drinks depends also on the technology conditions

(heating, fabrication steps, homogenization) and other parameters such as the pH, protein content and ionic strength which affect the optimal pectin dosage (Kacvinsky,2005).

Indeed, several essays have been made to develop whey beverages with different fruits. For example, in Russia pasteurized and clarified whey with sugar and raisins was one of the most successful beverages (Penna *et al.*, 2003). In addition to other fruits including peach puree (20%), strawberry (10%) and red raspberry (10%) that were successfully developed (Sikder *et al.*, 2001),but the most acceptable beverage was with addition orange juice. In the present study we aim to develop a whey drink mix with orange juice and different concentrations of pectin.

Materials and Methods:

Preparation of whey:

The sweet whey was obtained by enzymatic manufacturing cheese process. So, bovine milk was heated at 72 C° for 15 second, then it was cooled to 40 C° and it was coagulated by the addition of (0.2%) calcium chloride and rennet enzyme. Then, the final solution was filtered and stored under refrigerated conditions .

Preparation of Orange juice:

The Valencia orange were washed with clean water and filtered after pressing.

Preparation of soft drink:

The whey base orange juice beverages were prepared as follows: 50 % orange juice, 50% sweet whey and different concentrations of pectin made from Titumbiotechltd-India company (0.5, 1, 1.5 %).

The formed beverages were heated to dissolve the pectin, then we did pasteurized at 80 C° for 15 minutes and deposited in sterilized glass bottles, then the bottles were cooled at room temperature and stored at (7±2 C°).

Chemical analysis:

Total acidity was calculated according to the AOCA(1995) method , pH was determined using pH meter (Philip Harris Limited) . The total soluble solids were determined using the refractometer . The Serum separation and sedimentation were determined according to (Koffi *et al.*,2003), and the Viscosity was measured by viscometer (Expotech USA model 35).

Results and Discussion :

Chemical properties of whey, orange juice and whey beverage:

The chemical characteristics are important, indicator of quality measures of soft drink. total soluble solids (TSS), total acidity, pH and protein, content of the whey, orange juice and Soft drink was determined, Results are shown in Table 1.

Table 1 : Chemical characteristics of whey , orange juice and fresh whey beverage.

Characteristics	Whey	Orange juice	Whey beverage (before treatment)	Whey beverage (after treatment)
Tss ° <i>Brix</i>	6.25 ± 0.2	8.71 ± 0.3	7.98 ± 0.3	0.3 ± 8.44
Ph	6.04 ± 0.06	4.02 ± 0.05	3.98 ± 0.15	0.15 ± 3.65
Acidity (%)	0.093 ± 0.01	1.1 ± 0.04	0.44 ± 0.02	0.02 ± 0.57
Protein (%)	0.8 ± 0.03	Not determined	0.41 ± 0.02	0.02 ± 0.41

The data obtained indicates in table (1) that the use of orange juice increased the TSS value from 6.25 of whey to 7.98 of beverage and decreased the pH value from 6.04 of whey to 4.8 and decreased the value to 3.98 by adding citric acid (0.5%) to low the value of beverage that could be very useful to overcome the problem of shelf life capacity of whey. However, here we did not add anything else because the orange juice used could adjust the pH that could be suitable for long storage duration, which is an advantage of this study. Contrarily, Naik *et al.*, (2009) adjust the pH value by using acids to improve the beverage and dissolve pectin.

Effect of Pasteurization on chemical properties of whey beverage:

Effect of pectin concentration and storage on chemical properties of whey beverage:

The results showed that the Tss content of fresh beverage of the control, 0.5 %, 1%, and 1.5% were 8,44 ,8.64 ,8.60 and 8.70 Brix respectively (Table 2). This means that pectin concentration had a significant effect on the Tss content of beverage compared with control (p<0.05). Whereas, the storage period did not affect the average Tss of beverage stored from 0 to 20 days. The increase of Tss during this storage period due to low hydrolysis of sucrose. Barwal *et al.*, (2005) observed a similar increase in the Tss of the developed bitter gourd RTs drink during 30 days storage. Analogous results were also

reported by Yadav et al., (2010) in whey based on banana herbal beverage with 60 days storage period.

Our results also showed that the acidity values of whey beverage of the control 0.5%, 1% and 1.5% were 0.57, 0.59, 0.62 and 0.65 respectively (Table 2). This means that there was not a significant effect of the storage period on the acidity of beverages that the mean acidity value was 0.60% for control, and increased to 0.65% in the samples stored for 20 days. Our results are in agreement with the findings reported by Yadav et al .(2010) where they formulated different blends of whey beverages by using 8-12% of mango pulp.

The statistical analysis showed that the pH values of whey beverage of the control 0.5% ,1% and 1.5% were 3.65, 3.63, 3.60 and 3.57 respectively (table2). That indicates no significant effect of the storage period on the pH of the beverages, so the mean pH value decreased from 3.61 to 3.57 in the fresh beverages and in the samples stored for 20 days. Similar results have been also reported by Kalra *et al.*, (1991).

Table 2. Effect of treatment (pectin concentration) and storage period on TSS(Brix°), pH and acidity % of whey beverage.

Storage period (days)	TSS(Brix)					Acidity %					pH				
	Pectin g % ml					Pectin g % ml					Pectin g % ml				
	Contro l	0.5%	%1	%1.5	Mean for storage period	Control	0.5%	%1	%1.5	Mean for storage period	Contro l	0.5%	%1	%1.5	Mean for storage period
0	8.44	8.64	8.60	8.70	8.59	0.57	0.59	0.62	0.65	0.60	3.65	3.63	3.60	3.57	3.61
3	8.45	8.64	8.60	8.70	8.59	0.59	0.61	0.64	0.67	0.62	3.64	3.62	3.60	3.57	3.60
7	8.46	8.65	8.61	8.71	8.60	0.59	0.61	0.64	0.67	0.62	3.62	3.61	3.59	3.56	3.59
10	8.48	8.66	8.61	8.72	8.61	0.61	0.62	0.65	0.68	0.64	3.62	3.61	3.58	3.55	3.59
14	8.48	8.67	8.62	8.73	8.62	0.62	0.63	0.66	0.68	0.64	3.61	3.60	3.58	3.55	3.58
20	8.50	8.68	8.63	8.74	8.63	0.63	0.64	0.66	0.69	0.65	3.60	3.59	3.57	3.54	3.57
Mean for treatment	8.46	8.65	8.61	8.71		0.60	0.61	0.64	0.67		3.62	3.61	3.58	3.55	
	0.0223	0.0163	0.0117	0.0163		0.0222	0.0175	0.0151	0.0136		0.0186	0.0141	0.0121	0.0121	
	0.0171					0.0174					0.0145				

Physico-chemical characteristics of whey beverage:

The results of this study showed that the serum separation values of fresh whey beverage of control 0.5%, 1% and 1.5% were 1.02 , 0.98 , 0.5 and 1% respectively (table3). These findings signify that there was an effect of the storage period on the average serum separation of the beverage compared with control($p < 0.05$), whereas there was no effect of the storage period on the different treatment ($p < 0.05$). the pectin concentration showed a significant effect($p < 0.05$) between 1% and different treatment. So, the addition of 0.5 % pectin decreased the serum separation from 1.02% in the control to 0.98%, whereas with 1% pectin this separation was 0.5%. But the addition of higher concentration of pectin caused an increase of serum separation after 3 days of storage. These observations were also recorded for the sedimentation and viscosity of beverage. These changes of the three physico-chemical characteristics studied could be explained by the deficiency of 0.5% of pectin to achieve the stability of the beverage that depends on the existence of proteins in suspended form and accomplish the beverage stability. Whereas

the 1.5% pectin concentration was higher than the total whey proteins amount in the beverage.

Table 3: Effect of treatment(pectin concentration) and storage period on serum separation, sediment and viscosity of whey beverage.

Storage period (days)	Serum separation					sediment					viscosity				
	Pectin g% ml					Pectin g% ml					Pectin g% ml				
	Control	0.5%	%1	%1.5	Mean for storage period	Control	0.5%	%1	%1.5	Mean for storage period	Control	0.5%	%1	%1.5	Mean for storage period
0	0	0	0	0	0	0	0	0	0	0	1.75	1.45	1.15	1.85	
3	1.02	0.98	0.5	1	0.87	18	16.5	14.2	17.3	16.5	1.75	1.45	1.15	1.85	
7	1.05	0.99	0.5	1.01	0.88	18.2	16.7	14.3	17.6	16.7	1.76	1.46	1.16	1.86	
10	1.2	1	0.6	1.02	0.95	18.5	16.9	14.4	17.6	16.8	1.76	1.47	1.16	1.87	
14	1.5	1.1	0.6	1.04	1.06	19	17	14.4	17.9	17	1.77	1.48	1.16	1.88	
20	1.7	1.2	0.7	1.05	1.16	19.5	17.2	14.5	18	17.3	1.78	1.49	1.17	1.89	
Mean for treatment	1.29	1.05	0.58	1.02		18.64	16.86	14.36	17.68		1.76	1.46	1.15	1.86	
	0.296	0.094	0.083	0.027		0.611	0.270	0.114	0.277		0.008	0.013	0.005	0.013	
	0.1613					0.366					0.0105				

Conclusion:

The physico-chemical characteristics and storability of a developed orange juice-sweet whey mixture were evaluated using different concentrations of pectin. An increasing of TSS (Total soluble solids), acidity, viscosity, sedimentation and the degree of separation, and a decreasing of pH values during the storage were observed. The 1% pectin concentration in the prepared beverage had the best storage stability. However the prepared beverage with or without pectin could be stored at 7 ± 2 C° up to 20 days.

The suggestions and recommendations:

- Manufacturing of this type of beverage through the establishment of factories to manufacture and provide them with whey resulting from manufacturing cheeses.
- Add stabilizers such as pectin to improve the physicochemical properties of the treatment beverage.
- Using other types of stabilizers such as Karaginat.
- Using pectin from plant sources such as orange peels.

References:

- AOAC (1995). Official Methods of Analysis. 16 th end . Association of Official Analytical Chemists, Washington DC.
- Barwal, V.S., Singh, T.K. and Alkesh. 2005. Studies on processing and development of ready-to-serve drink from bitter ground fruit. Journal of Food Science and Technology 42(3): 217-220 .
- Harper, W.J. (2000). Biological properties of whey components: A Review. The American Dairy Products Institute .Chicago, IL pp. 23-29 .
- Kacvinsky, A.M.(2005). Whey beverages: Stabilizer and process technology options. 4 th Intl. Whey Conf., Sep. 11-14, 2005, Chicago pp.45-57.

- Kalra, S.K., Tandon, D.K., Garg, N. and Singh, B.P. 1991. Quality evaluation of some market drinks . Indian Food Packer 45:40-53.
- Khamrui, K., Rajorhia, G.S. (1998). Making profits from whey. Indian Dairyman 50:13-18.
- Koffi, E., Shewfelt, R., Wicker, L. (2005). Storage stability and sensory analysis of UHT processed whey- banana beverage. J. Food Quality 28:386-401.
- Naik, Y.K., Khare, A., Choudhary, P.L., Goel, B.K. and Shrivastava , A. (2009) Studies on Physico- chemical and Sensory Characteristics of Whey Based Watermelon Beverage. Asian J. Research Chem .2(1): Jan- Mar.
- Patel, S., Prasanth , S., Choudhary, P.L., Sahu, C.(2007). Techno-economic feasibility of whey based mango herbal (Ginger) beverage .Indian J. Dairy Sci. 60:149-155.
- Penna , A.L.B., Oliveria, m.n.,Tamime, A.Y. (2003) .Influence of carrageenan and total solids content on the rheological properties of lactic beverage made with yogurt and whey .J. Text .Stud. 34:95-113.
- Raju, P.N., Rao,L.H.,Devi, N.L. (2005). Whey protein and their uses in food industry . Indian Food Ind. 24:19-27.
- Sikder, B., Sarkar, K., Ray, P.R. and Ghatak, P.K. (2001) . Studies on shelf-life of whey-based mango beverages. Beverages Food World 28:53-54.
- Yadav, R.B., Yadav, B.S. and Kalia, N.(2010). Development and storage studies on whey- based banana herbal (Mentha arvensis) beverage. American Journal of Food Technology 5:121-129.