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UTILIZATION SWEET WHEY IN PRODUCTION OF WHEY GUAVA BEVERAGES.

Yonis, A.A.M.; Rasha M. Nagib and Lobna,A. AboNishouk.
Home Economics Dept , Fac. of Specific Education Mans. Univ., Egypt

ABSTRACT

Whey and juice of guava (*Pisdium guajava*) were utilized at various combinations (85:15, 80:20, 75:25 and 70:30) for preparation of nutritious beverages and evaluated for various chemicals, microbial and sensory attributes during storage. The study revealed that the beverage prepared with 75% whey and 25% guava juice scored maximum for almost all sensorial quality attributes such as appearance, color, flavor, taste and over all acceptability. As well as the juice was high content of ascorbic acid (18.87mg/100g). A reducing trend was observed in total sugars and ascorbic acid and increasing trend was observed in reducing sugars and acidity content during the storage of beverage at refrigeration temperature over a period of 30 days. The Total Counts (TC) was high ranging from 1120 - 2500 CFU/mL. Mould and yeast count varied between 0.0 -18 CFU/mL. This research is aimed at production of whey/guava beverage. At later stages of the project, whey will be introduced into whey guava beverage (75% whey and 25%guava juice).

INTRODUCTION

Consumers are usually looking for ways to improve their health whether it's changing their diet, lifestyle. Whey is enriched by biologically active ingredients or valuable organic complements gained from nature's resources e.g., nutritious protein source which is a high-quality that provides all of the essential amino acids necessary for good health (Kimball & Jefferson, 2001and Layman, 2002).

Sweet whey shows great potential for the development of dairy products due to its nutritional value, since it is not only a source of the most biologically valuable proteins, but also rich in minerals and vitamins, mainly riboflavin (Ha & Zemel, 2003). Whey contains about 50% of the milk solids together with 100% of the lactose and 20% of the protein. The lactose makes up about 75% of the total whey solids (Siso, 1996). Whey comprises about 80 to 90% of the volume of milk from which it is obtained (Khamrui & Rajorhia, 1998). The main biological activities of whey proteins are suggested to include cancer prevention, increase of glutathione levels, antimicrobial function and increase of satiety response (Madureira *et al*., 2007). However, in spite of being a nutritive product, whey is still little used in human diet (Drgalic *et al*., 2005). Previously, whey was used mainly in animal feed or surplus. With advances in technology and recent discoveries of functional and bioactive roles of whey proteins, whey and whey components are now viewed as precious ingredients. The recognition of whey as a source of unique physiological and functional attributes provides opportunity for the food industry to incorporate whey and whey components into a variety of foods (National Dairy Council, 2003).

Obviously, development of any process for its economical utilization would be of great benefit to the dairy industry. At this stage, product diversification using whey as a infrastructure replacer of water without much change in the existing infrastructure is quite feasible. Market demand for beverages is growing all over the world and Egypt is no exception to it. Whey beverages have been recognized as a genuine thirst quencher, light, refreshing, healthful and nutritious (Prendergast, 1985). Whey based fruits beverages are more suitable for health as compared to other drinks (Sarvana Kumar, 2005). Whey and its biological components has proven it's effects in treatments of servical chronic diseases like cancer, cardiovascular, etc. As it is nutritionally too rich it can also be used in beverages infant Geriatric and Atheletic food (Deveraj, 2005).

Guava is popularly known as “poor man's apple” available in plenty at a low price during the season. It emits a sweet aroma which is pleasant sweet refreshing and a fleshy texture. Guavas are often considered as super fruits being rich in vitamins A and C in the pericarp, omega-3 and -6 polyunsaturated fatty acids in the seeds and especially have high levels of dietary fibre. A single guava fruit weighing 160-170 g contains over four times more of vitamin C compared to a single orange (220-230mg/100g) and also has adequate levels of dietary minerals, potassium, magnesium and an otherwise broad, low-calorie profile of essential nutrients (Mahendran, 2010). Single guava fruit without seed (90g) provides 46 kilocalories energy, contains 78% water, 5 gram dietary fiber, 1g fat, 11g carbohydrate, 1 g protein, 18mg calcium, 256 mg potassium, 9mg magnesium, 23 mg phosphorus, 71 RE vitamin A, 165 mg vitamin C and 1mg of niacin and vitamin E each (Murdock, 2002).

Addition of guava adds nutritive value, flavor and meditational properties and show great potential for processing into valuable products. It is highly perishable in nature leading to spoilage during storage. This study will lead to the development of such a product using guava making it available at a very remunerative price during the season of processing. The aim of this research was to standardize whey guava beverage, evaluate the physicochemical characteristics and also to estimate the shelf life of the product.

MATERIALS AND METHODS

Sweet whey was obtained from Dina Company for food and agricultural project. Guava (*Pisdium guajava*) Balady white guava variety and sugar were obtained from the super market in Mansoura.

Preparation of Guava pulp

Fresh quality guava (*Pisdium guajava*) was chosen from the local market for the pulp extraction. It was peeled and cut into small pieces. The fruit pieces were grinded in a mixture and the pulp was then filtered through a double layered muslin cloth for a clear guava juice and stored at 4± 1°C until use.

Preparation of whey based guava

The whey based guava beverages were prepared by blending of whey and guava juice in different proportions like T_1 (85:15), T_2 (80:20), T_3 (75:25) and T_4 (70:30) respectively. The sugar 10% and 0.1% (w/v) sodium alginate were dissolved in whey and guava juice by heating to 60°C and then filtered through muslin cloth. Thus prepared beverages were filled in previously sterilized glass bottles (200 ml) leaving 2.5 cm head space and sealed air tight by crown corking. Then in bottle sterilization was done at 105°C for10 min and cooled to room temperature and stored at 7 ± 1°C for storage studies. Samples were drawn at a regular interval of 10 days and evaluated for various quality attributes.

Analytical methods

The proximate analysis of whey, guava juice and beverages were done for different parameters. Moisture, crude protein, ascorbic acid and total and reducing sugars were estimated by the standard methods described by (Ranganna, 1986). The total acidity was calculated in terms of lactic acid for whey and citric acid for guava juice by titrating against0.1 N NaOH (AOAC, 1995). Fat content was determined by Gerber's centrifuge method as described in the (BIS, 1977). Solids not fat of whey were estimated by measuring the density of the sample with the help of lactometer and the readings were converted into % SNF as per (BIS, 1982).

Microbial Analysis

Microbial analysis were carried out by taking 10 ml representative samples and aseptically mixed with 90 ml distilled water and homogenized by shaking. Subsequent decimal dilutions were prepared with the same diluents and in all cases duplicate-counting plates were prepared of appropriate dilutions (Harrigan and Mac-Cance, 1976). Total viable count was carried out using the pour plate method (Harrigan, 1998), where as yeasts and mould were enumerated by surface plating on malt extract agar (Oxoid) with 0.01% chloramphenicol as bacterial inhibitor and incubated aerobically at 25°C for 2-3 days (Harrigan and Mac-Cance, 1976).

Sensory quality evaluation

The beverage samples were evaluated as described by (Djuric *et al.*, 2004)for their sensory characteristics namely color and appearance, taste, flavor and overall acceptability by a trained panels comprising of 15 panelists drawn from faculty members and post graduate students of the Department. The panelists were asked to record their observations on the sensory sheet based on a 9 point hedonic scale (9 and 1 points showing like extremely and dislike extremely).

RESULTS AND DISCUSSION

Analysis of whey and guava juice

The data pertaining to the various chemical characteristics of sweet whey and guava juice are presented in Table 1. It clearly indicates that guava juice was as expected rich in SNF and respectively. Guava juice was found better in TS, SNF, ascorbic acid, total and reducing sugars contents than

whey. The results obtained with respect to chemical characteristic are in agreement with the earlier studies (Wazir, 1999 ; Ingale*et al*., 2009 and Divya *et al*., 2014).

Table 1: Chemical composition of sweet whey and guava juice.

Parameter	Sweet whey	Guava pulp
Moisture %	94.88	85.50
Total solids% (TS)	6.27	13.50
Acidity (%)	0.18	0.42
Total sugar (%)	4.62	10.16
Reducing sugar (%)	Not detected	5.38
Ascorbic acid (mg/100g)	Not detected	65.00
Fat (%)	0.39	0.37
Solids not fat % (SNF)	5.88	13.13
Protein (%)	0.95	1.00

Effect of storage on chemical parameters of whey guava beverages

Effect of addition of guava juice on physic-chemical parameters of whey guava beverage and changes during storage was studied and obtained results is presented in Table 2. Physico-chemical properties of beverages such as, protein, lactose, acidity and ascorbic acid were affected by the level of guava juice whereas it did not affect total sugars, reducing sugars and non reducing sugar (Pate *et al*., 2006).A reducing trend was observed in protein, total lactose and ascorbic acid where as an increasing trend was observed in acidity content during storage. No significant change was observed in total sugars, reducing sugars and non reducing sugars the beverages during 30 days of storage. Decreasing trend in total sugar and increasing trend in reducing sugar and titrable acidity was observed during 30 days storage. Increase in reducing sugars may be due to the conversion of sugar into reducing sugar in presence of citric acid. Also increase in percent acidity might be due to the slight growth of micro-organism in the beverage. The results obtained are in conformity with those of earlier results (Sakhale *et al*., 2012). Also results pertaining to ascorbic acid showed decreasing trend. This might be due to loss of ascorbic acid during storage due to auto-oxidation and light. Noted decline in the ascorbic acid content of muskmelon beverage during six months storage (Teotia *et al*., 1997).

Microbial analysis

The beverage samples were analysis periodically for total plate count and mould and yeast count. The data obtained with respect to microbial load are summarized in Table 3. Total count of bacteria increases and after the completion of (30 days) storage it reaches to 2730 CFU/ml, 2580 CFU/ml 2500CFU/ml and 2490 CFU/ml in the beverage samples T_1, T_2, T_3 and T_4 respectively. Mould and yeast count was not detected in all four samples (T_1, T_2, T_3 and T_4) at zero day storage whereas it increases to 20, 18, 18 and 16 CFU/ml respectively after 30 days of storage. Similar results of total plate count were reported for whey-based mango beverage (Ismail *et al*., 2011). In spite of the potential benefits offered by fruit juices, concerns over their safety

and quality have been raised; as freshly prepared juices have no process or steps to minimize the microorganisms if they are contaminated (Mahale *et al*., 2008).

Table 2 :Effect of chemical composition on different treatments of whey guava beverage during storage.

Physicochemical properties	Days	T_1	T_2	T_3	T_4
Protein %	0	0.315	0.318	0.328	0.336
	10	0.315	0.317	0.326	0.334
	20	0.313	0.316	0.326	0.333
	30	0.311	0.316	0.322	0.331
Lactose %	0	4.22	4.02	3.82	3.02
	10	4.19	4.00	3.80	3.00
	20	4.16	3.96	3.71	2.91
	30	4.08	3.88	3.65	2.87
Acidity %	0	0.21	0.23	0.24	0.25
	10	0.22	0.24	0.24	0.26
	20	0.23	0.25	0.26	0.26
	30	0.25	0.26	0.26	0.27
Ascorbic acid (mg/100g)	0	11.78	14.78	18.78	24.85
	10	11.34	14.55	18.67	23.76
	20	10.83	13.47	17.43	23.67
	30	9.57	12.92	16.67	21.36
Total Sugar %	0	24.72	24.56	24.58	24.85
	10	24.72	24.55	24.58	24.84
	20	24.70	24.54	24.57	24.84
	30	24.69	24.51	24.55	24.83
Reducing sugar %	0	5.280	5.170	5.120	5.100
	10	5.280	5.170	5.130	5.110
	20	5.294	5.176	5.137	5.112
	30	5.303	5.192	5.148	5.123
Non reducing Sugar %	0	19.44	19.38	19.46	19.75
	10	19.44	19.38	19.45	19.73
	20	19.41	19.36	19.43	19.73
	30	19.39	19.32	19.40	19.71

T1=(85w:15j), T2=(80w:20j), T3=(75w:25j) and T4=(70w:30j) w=whey j=guava juice

Table 3: Microbial analysis of whey guava beverages.

Parameter	**Storage period**	**Samples**			
		T_1	T_2	T_3	T_4
Bacterial count (CFU/ml)	0	1220	1150	1120	1010
	10	2300	2300	2200	2190
	20	2550	2410	2390	2380
	30	2730	2580	2500	2490
Mould and yeast count (CFU/ml)	0	Nd	Nd	Nd	Nd
	10	5	5	6	5
	20	9	9	8	7
	30	20	18	18	16

T_1 =(85w:15j), T_2 =(80w:20j), T_3 =(75w:25j), T_4 =(70w:30j) and Nd= not detected

Sensory evaluation

The beverages prepared by blending of whey and guava juice in different combination were analyzed for various sensorial attributes for their acceptance by using 9 point hedonic scale. The sensory scores obtained with respect to color, flavor, taste and overall acceptability are presented in Table 4. It is observed that beverage sample (T_3) prepared by addition of 30% juice was liked most by sensory panel members as compared to the other combinations. The color, flavor and taste of C_3beverage maintained the highest organoleptic score other than the T_1, $T_2$and T_4 beverages respectively. The result revealed that decrease in level mango pulp lower down the sensory score of beverage. (Shekilango *et al*., 1997) also found that a blend of three parts (w/w) acid whey to two parts (w/w) banana was the most acceptable formula in terms of flavor. The storage study of whey based mango beverage revealed that all the characteristics i.e. appearance, color, flavor, taste and over all acceptability of sensory evaluation was in decreasing trend. This might be due to changes occurred during storage of beverage.

Table 4: Sensory parameters of guava whey beverage samples during refrigerated storage for 30 days (5 ± 2ºC)

Treatments	Day	T_1	T_2	T_3	T_4
Appearance	0	7.8	7.9	8.5	8.1
	10	7.3	7.6	8.0	7.8
	20	7.1	7.5	7.9	7.8
	30	7.1	7.4	7.4	7.5
Color	0	7.1	7.8	8.4	8.1
	10	6.9	7.5	8.2	7.9
	20	6.5	7.4	8.1	7.5
	30	6.4	7.1	8.0	7.4
Flavor	0	7.1	7.5	8.7	8.7
	10	6.9	7.4	8.6	8.6
	20	6.8	7.0	8.5	8.5
	30	6.6	6.8	8.3	8.4
Taste	0	6.9	7.3	8.1	8.0
	10	7.6	7.0	7.8	7.7
	20	6.7	6.9	7.7	7.5
	30	6.4	6.4	7.4	7.2
Overall acceptability	0	7.2	7.6	8.4	8.2
	10	7.2	7.4	8.2	8.0
	20	6.8	7.1	8.1	7.8
	30	6.6	6.9	7.8	7.6

T1=(85:15), T2=(80:20), T3=(75:25) and T4=(70:30)

CONCLUSION

It can be concluded that whey can be found successful for the development of whey based guava beverages with optimum sensory characteristics. The nutritious beverages with better storage life could be developed by addition of whey up to certain extent. Guava based whey beverage have excellent color, flavor and stability was estimated to be high

which means that guava juice covered unpleasant taste of whey very successfully. The sweetness of the product seems to be highly appreciated characteristic that must be related to the consumer habits.

REFERENCES

AOAC. (1995).Official Methods of Analysis (16th Edn.), Association of Official Analytical Chemists, Washington, DC.

BIS. (1977). IS: 1224: Part – II, Determination of fat by Gerber's method-Milk products. Bureau of Indian Standards, New Delhi.

BIS. (1982). IS: 10083: Method of test for determination of SNF (Solid-not-fat) in milk by the use of lactometer. Bureau of Indian Standards, New Delhi.

Deveraj. (2005). Whey proteins a potent nutraceutial. Indian Dairyman, 58(6): 35-38.

Divya, S., Rongen, S., and Farhaan, B. (2014). Development, uality Evaluation and Shelf Life Studies of Whey Guava Beverage.International Journal of Current Engineering and Technology 4: 2347 – 5161.

Djuric M, Caric M, Milanovic S, Tekic M, Panic M (2004). Development of whey-based beverages. Europ. Food Res. Technol. 219:321–328.

Drgalic, I., Tratnik, L., and Bozanic, R. (2005). Growth and survival of probiotic bacteria in reconstituted whey. Le Lait: Dairy Science and Technology, 85, 171–179.

Ha, E., and Zemel, M.B.(2003).Functional properties of whey, whey components, and essential amino acids: mechanisms underlying health benefits for active people.Journal of Nutritional Biochemistry,14,251–258.

Harrigan, W.F. (1998). Laboratory methods in food microbiology (3rd Edn). Academic Press, London.

Harrigan, W.F., and Mac-Cance, M.E. (1976). Laboratory methods in food and dairy microbiology. Academic Press, London.

Ingale, M.P., Ranveer, R.C., and Nagargoje, K.D. (2009). Development of whey based custard apple (*Annona Squamosa*L.) beverage. Beverage Food world 36: 43-44.

Ismail, A.E., Abdelgader, M.O., and Azhari, Ali A.(2011). Microbial and Chemical Evaluation of Whey-Based Mango Beverage. Advance Journal of Food Science and Technology 3: 250-253.

Khamrui, K., and Rajorhia, G.S. (1998). Making profits from whey. Indian Dairyman 50:13-18.

Kimball, S.R., and Jefferson, L.S.(2001).Regulation of protein synthesis by branched—chain amino acids.Curr.Opin.Clin.Nutr.Metab.Care.,4:39-43.

Layman, D.K. (2002). Role of leucine in protein metabolism during exercise and recovery. Can. J. Appl. Physiol., 27: 646-663.

Madureira, A. R., Pereira, C. I., Gomes, A. M. P., Pintado, M.E., and Malcata, F.X. (2007). Bovine whey proteins—Overview on their main biological properties. Food Res. Int. 40:1197–1211.

Mahale, D.P., Khade, R.G., and Vaidya, V.K. (2008). Microbiological Analysis of Street Vended Fruit Juices from Mumbai City, India. Internet Journal of Food Safety 10: 31-34.

Mahendran,P.A. (2010). Physico-Chemical properties and sensory characteristics of dehydrated guava concentrate: effect of drying method and maltodextrin concentration. Tropic. Agric. Res. Ext. 13(2)

Murdock, H.D. (2002). Encyclopedia of foods, a guide to healthy nutrition.Academic Press San Diego, California, USA.

National Dairy Council (2003). Whey protein.www.nationaldairycouncil.org.

Patel, S., Prashant, S., Choudhary, P.L., and Bakane, P.H. (2006). Development and evaluation of whey based mango herbal (ginger) beverages. Beverage Food World 33: 15-19.

Prendergast. (1985). Whey drink, Technology Processing and Marketing J. Sci. Dairy Technolo., 38: 103.

Ranganna, S. (1986). Handbook of Analysis and Quality Control for Fruits and Vegetable Products. Tata MaGraw hill Publishing Company Limited, New Delhi.

Sakhale, B.K., Pawar, V.N., and Ranveer, R.C. (2012). Studies on the Development and Storage of Whey based RTS Beverage from Mango cv. Kesar. J Food Process Technol, 3: 2157-7110.

Sarvana Kumar, R. (2005). Whey beverage A review .beverage and food world, pp: 58-60.

Shekilango, S.A., Jelen, P., and Bagdan, G.C. (1997). Production of whey-banana beverages from acid whey and over ripe bananas. Milchwissenschaft 52: 209-212.

Siso, M.I.G. (1996). The biotechnological utilization of cheese whey: A review. Bioresource Tech. 57:1–11

Teotia, M.S., Kaur, S., and Berry, S.K. (1997). Utilization of muskmelon ready to serve beverage from enzyme clarified juice. Indian Food Packer 51: 11-17.

Wazir, S. (1999). Standardization of technology for the manufacture of guava whey beverage. *J. Dairy Sci*., 52: 268-2711.

استخدام الشرش الحلو فى انتاج مشروب الشرش بالجوافه

علاء الدين أحمد مرسي ، رشا محمد نجيب و لبنى عبد الغنى أبو نشوق
كلية التربية النوعية – قسم الاقتصاد المنزلى – جامعة المنصورة – مصر.

تم استخدام خليط من الشرش وعصير الجوافه بنسب مختلفه من الشرش : عصير الجوافه حيث تم تحضير أربع مخاليط على النحو التالى (١٥:٨٥ و٢٠:٨٠ و٢٥:٧٥ و ٣٠:٧٠) لتحضير مشروب مغذى ثم قدرت الخصائص الكيميائيه والميكروبيولوجيه والحسيه لهذا المشروب سواء طازجا أو أثناء التخزين لمدة شهر.ولقد أظهرت النتائج أن أفضل المخاليط كانت المنتجه من الخليط ٧٥% شرش و ٢٥% عصير جوافه فقد حصل على أعلى درجات القبول من حيث الخصائص الحسيه (المظهر واللون والنكهه). كما احتوى على نسبه عاليه من حمض الاسكوربيك وصلت الى ١٨.٨٧ ملجرام/١٠٠ جم. كما أظهرت النتائج أيضا اتجاه السكريات الكليه وحمض الاسكوربيك نحو النقصان على عكس نسبة السكريات المختزله والحموضه فكانت فى حالة زيادة أثناء فترة التخزين لمدة شهر على درجة حراره الثلاجه, وقد أظهرت النتائج الميكروبيولوجية زيادة العد الكلى لكل من البكتريا (من ١١٢٠ الى ٢٥٠٠خلية) والفطريات والخمائر (من ٠ الى ١٨خلية) بعد ثلاثين يوم من التخزين . ونتيجة لما سبق من نتائج نوصى بإستخدام المشروب المحتوى على ٧٥% شرش و٢٥% عصير جوافه كمشروب شرش بالجوافة.