J. of Food and Dairy Sci., Mansoura Univ., Vol 11 (8): 227-230, 2020

Journal of Food and Dairy Sciences

Journal homepage: www.jfds.mans.edu.eg
Available online at: www.jfds.journals.ekb.eg

Preparation of Drink of Naturally Colored Milk Mixed with Root Beet

Sahar A. Nasser *

Food & Dairy Science and Technology Department, Faculty of Agriculture, Damanhour University, Egypt.

Cross Mark

ABSTRACT

The production of a milk drink naturally colored and rich in antioxidants . Being a color drink attracts consumers to reverse white milk which many consumers do not like. Beetroot is one of the richest vegetables in antioxidants. The drink was made with cow´s milk, the juice of beet was added to the milk at different percent (3,5 and 10 %). The chemical analysis of the drink was done, the acidity was measured, the antioxidants were evaluated at different concentrations, Microbiology and sensory tests during storage. total solids increased in the drink while protein, fat and ash decreased, and the increase in total solids due to high carbohydrate content in beet juice . The acidity increased during the storage period to 15 days, but did not coagulated at boiling temperature for up to 10 days while coagulated with boiling after 10 days. The content of milk with beet increased the antioxidants by increasing the percentage of added beet juice.

keywords: Naturally colored milk , root beet , Chemical composition, antioxidant activity .

INTRODUCTION

Beetroot (Beta vulgaris) is classified as an herbaceous biennial from Chenopodiaceae, can contribute to protection from age-related diseases and[1, 2]can. It could be considered as a factor in cancer prevention, of an inhibitory cervical ovarian and bladder cancer cells in vitro.[3] It have nutritive value such as vitamin A,niacin,riboflavin, iron and thiamine alsoit a great source for antioxidant and arich in a number of polyphenolic compounds.[4]. It is known to have antioxidantseffect because of the presence of nitrogen pigments called betalains, mainly comprise of red–violet-colored betacyanins (betanin,isobetanin, probetanin and neobetanin) and yellow–orange-colored betaxanthyns.[5]The ingestion of a single dose of red beet juice resulted in an increase of antioxidant compounds including betalains in urinary excretion. Betalainsand other phenolic compounds presented in red beet decreases oxidative damage of lipids and improves antioxidant status in humans.[6] The Antioxidant activity is associated with involvement of it in the scavenging of free radicals and consequently in the prevention of diseases like cancer, cardiovascular diseases.[7] Antioxidant activity was also reported to enrich human low-density lipoproteins by betalains, which increase resistance to oxidation.[8]There is growing interest in the use of natural food colors, because artificial colors have many questions and health concerns, beetroot extract is used as a natural colorant in many dairy products, beverages, meat products, traditional medicine, and additive to cosmetics. However betaline isa water-soluble pigments stable between pH 3 and 7, it is less used in the food industry than anthocyanins and carotenoids[9]. Milk is a natural product for the mammary glands, and it is considered one of the natural products with a high nutritional value, as it contains lactose sugar, casein proteins, and many vitamins dissolved in water or in fat and mineral salts such as calcium, which is one of the most important elements for building bones and human health[10]. However, many people, especially children, do not prefer drinking milk in its natural form, and they prefer flavored milk or other dairy product from hereadding beets root to the milk will improve the acceptance of the color of milk and it improve its health benefits.

The objective of the study:

1- Making different milk products of an attractive color to the consumer and increase the intake of dairy products.
2- Enhance the nutritional value of milk by increasing the antioxidant and phenolic compound by adding the beetroot extract in different concentration to liquid milk.

MATERIALS AND METHODS

Cow milk was obtained from the herd of Damanhour Agricultural Secondary School, Egypt. Beetroots were obtained from the local market of Kom Hamada city, Egypt. All the chemical used in the analysis(Butylatedhydroxy toluene (BHT), 2, 2-diphenyl-1-picrylhydrazyl (DPPH) and solvents used for spectral and HPLC analyses) were purchased from Sigma Chemical Company, USA.

For microbiological analysis of the examined treatments, plate count agar, MaCconkey broth, potato dextrose agar (PDA) were obtained from Oxoid Ltd., Basingstoke, Hampshire, England.

Beets were washed with water and peeled, cut into small cubes then weighing five hundred grams and add to liter of distilled water and boiled. Three hundred grams of sugar was added to the extract, filtered and added to milk at different concentrations.

For preparing the milk-beet drink, cow milk was heated at 90 ° C for 10 minutes. divided into 4 treatments control, 5, and 10%, respectively. the beets juice added to

* **Corresponding author.**
E-mail address: saharnasser9@gmail.com
DOI: 10.21608/jfds.2020.112882

the other 3 treatment (3%),by adding 3 ml of beet juice and 97 ml of milk (3%), 5 ml(5%) beet juice and 95 ml of milk (5%), and 10 beet juice and 90 ml milk (10%), respectively, while the last was only beet juice. The product was kept for 15 days in refrigerator and analyzed every 5 days.

Samples were analyzed for total solids, protein, fat, carbohydrates, pH and titratable acidity. Total solids was determined by drying in oven at 105°C for 6 hr as described in AOAC (1990)(11).Protein content, fat content and pH were estimated in all samples as described by ling (1963)(12). Carbohydrates content were calculated according to Abd El-Aziz *et al*. (2004)(13).Titratable acidity (TA)was measured as described by Hooi *et al*. (2004)(14).Total phenolic content (TPC) was determined according to Jayaprakasha *et al*. (2001)(15). Different beet-milk drink samples were analyzed to determine its antioxidant activity .Free radical scavenging activity (RSA) of the samples were measured using the method of Brand-Williams *et al*.(1995)(16).

Antioxidant activity (%) = [1– (Abs sample /Abs control)] × 100.

Samples were detected for total bacterial count on Plate Count Agar (Houghtby *et al*., 1992)(17), coliforms according to (APHA, 1992)(18), and yeasts and molds on Potato dextrose agar (PDA) (Frank *et al*, 1992)(19)

Sensory evaluation of the examined samples was carried out under normal lighting in transparent glass cups The sensory evaluation of milk drinks was carried out after 1, 5, 10 and 15 days. Fifteen untrained consumers (made up of 6 females and 9 males, aged between 15 and 45 years old), were asked to describe the sensory attributes of beet-milk drink. Color, odor, taste, and overall acceptability of each milk drinks were evaluated using a hedonic scale from 9 to 1 (9 = like extremely, 8 = like very much, 7 = like moderately, 6 = like slightly, 5 = neither like nor dislike, 4 = dislikeslightly, 3 = dislike moderately, 2 = dislike very much, 1 = dislike extremely).Water was also provided to the assessors to cleanse their mouths before and after tasting each sample. The average value scores of all sensory evaluations used in the analysis.

RESULTS AND DISCUSSION

Results obtained of the chemical composition of milk, beet juice and milk- beet drink with different concentration of beet are presented in Table (1). Significant difference($p<0.05$) between milk ,the three treatment (3%,5%and 10%)and beet juice was detected in fat, protein , Ash , total solid and carbohydrate, except moisture .

In general, the beet juice content of total solid (16.52%) is higher than that of milk content (10.53%). Adding the beet juice with different concentration to the milk the total solid content slightly increased in all treatment. It ranged from (10.63% to 10.95%) in treatment (3%to 10%).

The milk contents of protein, fat and ash are higher than that in the beet juice, after adding the beet juice extraction with different concentration to the milk the protein, fat and ash content slightly decrease.

Protein , fat and ash content decrease significantly in the milk- beet drink treatment, the protein content was (3%,2.65% and 2.25%) in treatment(3%,5%and 10%) respectively . the fat content was (2.7%, 2.25% and 2%) in treatment (3%,5% and 10%) respectively . Also the Ash content was (0.65%, 0.64%,0.62%) in treatment (3%,5%and 10%) respectively.

Beet juice content of carbohydrate (12.4%) is higher than the milk content (3.99%), therefore adding the beet juice extraction with different concentration to the milk resulted in an increase in the carbohydrate content in all of the examined treatments. It ranged from (4.31% to 5.45%) in treatment (3%to 10%).

Finally as shown, in the Table (1) the content of total solids and carbohydrate in beet juice is higher than both in milk. Also the protein ,fat and ash content in milk is higher than that in beet juice which is followed by a decrease in the three elements content in different treatments depending on the ratio of the addition the beet juice . It can be attributed to the proportion of dilution because of the addition of beet juice.

Table 1. Chemical composition of milk, beet juice and milk-beet drink

Sample	Moisture %	Total Solids%	Protein %	Fat %	Ash%	Carbohydrate%
Milk	89.35	10.35	3.15	2.80	0.71	3.99
3%	89.65	10.63	3	2.7	0.65	4.31
5%	89.37	10.65	2.65	2.25	0.64	5.41
10%	89.05	10.95	2.25	2	0.62	5.45
Beet extract	83.48	16.52	2.2	0.5	0.42	12.4

Data illustrated in Table (2) show that there is no change in the pH value of milk, and beet-milk drink in all of fresh treatments. The pH slightly decreased during storage in all treatment in the case of 3%, it ranged from (6.57 to 5.79) at the end of the storage, also in (5%) and (10%) it ranged from (6.55 to 5.74) and (6.60 to 4.93), respectively, in the end of storage. The total acidity show stability in t its values in the all fresh treatment, followed with slight increase during the storage period, and by adding a different concentration of beet juice to milk. It ranged from (0.19 to 0.26) by using 3% and ranged from 0.19 to 0.25 and from 0.18 to 0.27 in the case of 5% and 10%, respectively. These results are consistent with scientists Roshan S. *et al* (2017). (20)

There was no coagulation reaction after boiling beet-milk drink to day 10, while the coagulation occurrence after boiling beet-milk drink after 15 day.

Table 2. pH value and acidity of milk and beet-milk drink

Samples	pH				TA			
	Storage period(day)				Storage period(day)			
	Fresh	5	10	15	Fresh	5	10	15
Milk	6.62	6.37	5.98	5.59	0.194	0.19	0.22	0.23
3%	6.64	6.57	6.47	5.79	0.185	0.19	0.22	0.26
samples	6.64	6.55	6.50	5.74	0.189	0.19	0.22	0.25
10%	6.65	6.60	6.50	4.93	0.194	0.18	0.21	0.27

TA: (Total Acidity)

Results obtained in Table(3) show an increase of the total bacterial count in fresh samples, and increased under the cold storage for 15 days. As with the molds and yeasts, it could be seen their absence in all fresh and cold stored treatments.

In respect to the presence of coliform bacteria in the examined treatments, it could be seen that all of the examined treatments while fresh or cold stored were found completely free of E.coli.

Table 3. Total bacterial count, yeasts andmolds, coliform group and E.coli in milk, beet juice and beet-milk drink

	Milk		3%		5%		10%		
Test	**Fresh**	**After15 days**	**Fresh**	**After15 days**	**Fresh**	**After15 days**	**Fresh**	**After15 days**	**beet**
Total Bacterial Count (c.f.u./ml)	$16*10^4$	$22*10^4$	$14*10^3$	$45*10^3$	$12*10^3$	$26*10^4$	$15*10^4$	$56*10^5$	40*10
Molds &Yeasts Count (c.f.u./ml)	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d
Coliform group Count (c.f.u./ml)	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d

Total phenolic compounds and antioxidant activity of milk, beet juice and beet-milk drink:

Obtained data in Table (4) show that the beet juice was of the highest content of anti-oxidant and phenolic compound (75.9 %and 583.35mg/I),respectively, whereas the lowest content of anti-oxidant and phenolic compounds of 7.07 % and 147.65 mg/I, respectively, were detected in milk. Beet- milk drink in all treatment (3%, 5% and 10 %) contained the highest concentrations of both of total phenols and higher activity antioxidant scavenging activity, compared to milk. These values are increased with increasing the added beet juice to milk, which ranged from 161.1 to 191.22 and 9.329 to 14.6 for phenolic compound and antioxidant scavenging activity, respectively. This is due to the high content of antioxidants in beetroot. Beet juice could be considered as a source of phenolic compound as reported by Vinson, Hao (1998)[1] and Žitňanová *et al*. (2006). [2]

Results in Table (5) show the changes in sensory evaluation of milk ,beet juice and milk - beet drinkin different storage period fresh ,5 days, 10days and 15 days at room temperature. Significant difference ($p<0.05$) were found for all treatments during storage period, in general the results indicate that allmilk - beet drink with different concentration of beet juice recorded acceptability in all treatments in all storage period

Table 4. antioxidant activity (%) and total phenolic compounds (TPC) of milk, beet juice and beet-milk drink

samples	RSA%	TPC(mg/l)
Milk	7.07	147.65
3%	9.329	161.1
5%	10.83	169.44
10%	14.6	191.22
Beet	75.9	583.35

RSA: radical scavenging activity TPC:total phenolic compounds

In the case of the fresh samples, milk and beet juice were good in terms of overall acceptability and odor while the treatment (3%, 5%and 10%) were desirable in terms of (odor ,over all acceptability and color). After storage for 5 and 10 days the three treatment (3%,5%,10%) show higher acceptance than milk and beet juice in terms of color ,odor, and overall acceptability . After storage for 15, all samples show low acceptance in term taste and over all acceptability than the previous storage period. These results are consistent with scientistsRoshan S. *et al* (2017). [20]

Table 5. Sensory evaluation of different beet-milk drink samples during cold storage:

Period storage	Attributes	Beet	Milk	3%	5%	10%
Fresh	Color	7.66±0.41	7.66±0.41	8.00±0.05	9.00±0.05	7.66±0.41
	Taste	8.00±0.05	7.00±0.05	7.00±0.05	7.50±0.71	7.50±0.71
	Odor	8.00±0.05	8.00±0.05	9.00±0.05	9.00±0.05	9.50±0.70
	Overall acceptability	8.00±0.05	7.66±0.57	8.66±0.57	8.00±0.05	8.00±0.05
5days	Color	7.66±0.41	7.66±0.41	9.50±0.35	7.66±0.41	7.66±0.41
	Taste	7.00±0.05	8.00±0.05	7.50±0.71	8.00±0.05	8.00±0.05
	Odor	8.00±0.05	8.50±0.70	8.00±0.05	8.50±0.70	9.50±0.70
	Overall acceptability	8.00±0.05	7.50±0.28	8.66±0.0.28	8.00±0.05	7.66±0.28
10 days	Color	8.25±0.35	8.00±0.05	8.25±0.35	8.50±0.70	8.25±0.35
	Taste	7.50±0.70	7.50±0.70	7.00±0.05	7.50±0.71	7.50±0.71
	Odor	8.00±0.05	8.00±0.05	9.00±0.05	8.50±0.70	8.50±0.70
	Overall acceptability	7.33±0.28	7.00±0.05	8.66±0.28	7.66±0.28	7.33±0.28
15 days	Color	7.50±0.70	8.28±0.35	7.25±0.35	7.25±0.35	7.25±0.35
	Taste	7.33±0.28	7.00±0.05	6.66±0.28	6.66±0.28	7.00±0.05
	Odor	7.50±0.70	7.00±0.05	7.50±0.70	8.50±0.70	8.50±0.70
	Overall acceptability	7.00±0.05	7.00±0.05	8.00±0.05	7.50±0.28	7.50±0.28

REFERENCES

Abd El-Aziz M., Ahmed N. S., Sayed A.F.,Mahran G.A., and HammadY.A.. Production of low-fat ice milk using some milk fat Replacers. Proceedings the 4th Scientific Conference of Agricultural Sciences, Assiut.2004; 290-301.

APHA, Standard methods for the examination of Dairy products. American PublicHealth Association, Washington, D.C. 1992

Association of official analytical chemist (AOAC).Book of official methods of analysis.15th ed Washington, DC: (AOAC);(1990).

Babarykinl D , Smirnoval G , Pundinsh I , Vasiljeva S , Krumina1 G, Agejchenkol V . red beet (Beta vulgaris) Impact on human health. Journal of biosciences and medicines, 2019; 7:61-79.

Brand-Williams W, Cuvelier ME, Berset C. Use of free radical method to evaluate antioxidant activity. LebensmWiss Technology 1995; 28:25-30.

Delgado-Vargas F, Jiménez A and Paredes-López O.Natural Pigments: carotenoids, anthocyanins, and betalains characteristics, biosynthesis processing, and stability.Critical reviews in food science and nutrition. 2000; 40(3):173–289.

E.R Ling. A Text book of dairy chemistry. 3rd - London, UK. Cropman and Hall Ltd.,1963.

Frank, FJ, Christen, LG, Bullerman, LB,. Tests for Groups ofMicroorganisms. In: Marshal, R.T., (Ed.), and Standard Methods for theExamination of Dairy Products. 16th Edn., American Public HealthAssociation, Washington, DC, USA,. 1992; 271-86.

Gokhale.S.Vand leles.s.Betalain content and antioxidant activity of beta vulgaris: effect of hot air convective drying and storage. Journal of food processing and preservation. 2014; 38: 585–90.

Govind J. Kapadia and G. Subba Rao. Chapter 7 anticancer effects of red beet Pigments. red beet biotechnology: Food and pharmaceutical applications. Springer Science: Business Media New York. 2013.

Hooi *et al*. Chapter 15: Chemical and Physical Methods. Standard Methods for the Examination of Dairy Products .2004;480-510.

Houghtby AG, Maturin LJ. Koenig KE. Microbiological Count Methods. In: Marshal, R.T, Standard Methods for the Examination of Dairy Products. 16th, American Public Health Association, Washington, DC, USA,:1992; 213-46.

Jayaprakasha, G.K.; Singh, R.P. and Sakariah, K.K. Antioxidant activity of grape seed (Vitisvinifera) extracts on peroxidation models in vitro. Food Chem.2001; 73: 285-90

Kaur and Kapoor.Anti-oxidant activity and total phenolic content of some Asian vegetables.International Journal of Food science & technology.2002; 37(2):153 – 61.

OnurGünes_er. Pigment and color stability of beetroot betalains in cow milk during thermal treatment. Food chemistry. 2016; 196: 220–7.

Pieter W, Jan T. WoutersM ,Tom J. Dairy Science and Technology. 2nd. Taylor & Francis Group .london.2006

Roshan S. *et al*. Effect of beetroot extract on colour and sensory quality of flavored m ilk. Int. J. Pure App. Biosci.2017; 5 (5): 1177-82.

Tesoriere L, Allegra M, Butera D, Livrea MA. Absorption, excretion, and distribution of dietary antioxidant betalains in LDLs: Potential health effects of betalains in humans. Am J ClinNutr. 2004; 80(4):941-5.

Vinson, J., Hao Y., and Zubik L. Phenolic antioxidant quantity and quality in Foods: vegetables. Journal of agricultural and food chemistry. 1998; 46:3630-4.

Žitňanová1 I *et al* .Antioxidative activity of selected fruits and vegetables.Biologia, Bratislava. 2006: 279-84.

إنتاج مشروب لبني ملون طبيعيًا باستخدام البنجر

سحر عبد الله ناصر

قسم علوم وتكنولوجيا الأغذية والألبان، كلية الزراعة، جامعة دمنهور

إنتاج مشروب حليب ملون طبيعياً وغني بمضادات الأكسدة. كونه مشروبًا ملوّنًا يجذب المستهلكين إلى عكس الحليب الأبيض الذي لا يعجب العديد من المستهلكين. البنجرهو احد أغنى الخضروات في المواد المضادة للاكسدة. تم صنع الشراب من لبن بقري ، وتم إضافة عصير البنجر إلى اللبن بنسب مختلفة (3،5 و 10٪). تم إجراء التحليل الكيميائي للمشروب ، وتم قياس الحموضة ، وتم تقييم مضادات الأكسدة بتركيزات مختلفة ، والتحليل الميكروبيولوجي والاختبارات الحسية أثناء التخزين. زادت محتوي المواد الصلبة الكلية في الشراب بينما انخفض محتوي البروتين والدهون والرماد ، والزيادة في إجمالي المواد الصلبة بسبب محتوى الكربوهيدرات المرتفع في عصير البنجر. قد تكون الزيادة في المواد الجوامد الصلبة ناتجة عن ارتفاع محتوى الكربوهيدرات. زادت الحموضة خلال فترة التخزين إلى 15 يومًا ، ولكن لم يتم تخثرها عند درجة حرارة غليان لمدة تصل إلى 10 أيام مع تجمد الغليان عند 15 يومًا. محتوى اللبن مع البنجر زاد من مضادات الأكسدة عن طريق زيادة النسبة المئوية من البنجر .

الكلمات المفتاحية: اللبن، ملون طبيعيا ، البنجر، تضاد الأكسدة .