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PRODUCTION OF HEALTHY BIFIDO FLAVOURED BEVERAGES FROM MILK BYPRODUCTS

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ABSTRACT

Healthy beverages were prepared from skim milk or sweet whey as byproducts by using 0.1% *Bifidobacterium lactis Bb-12* and incubated at 37°C for 3 h. Fresh strawberry and guava juices were added separately at rate 20% (w/w) and 15% sucrose was added to both beverages. The resultant beverages were freshly analyzed for pH, total solids, total protein, mineral contents, amino acid contents, protein efficiency ratio (PER) and biological value (BV). Organoleptic properties were also evaluated. Microbiological examinations were conducted on the stored samples until 15 days. The results showed that guava beverages had gained higher score either for skim milk or sweet whey for colour, flavor as well as appearance compared to strawberry beverages. Strawberry beverages had higher essential amino acid contents, PER and BV than that contain guava. Same trend had been observed for mineral contents. Over storage; *Bifidobacterium lactis Bb-12* was increased by time increasing, reaching the highest level after 10 days in sweet whey flavoured with guava.

INTRODUCTION

Whey is the by-product of cheese making, it contains lactose, whey proteins, minerals, its total solids content is typically 6.4% which is 75% is lactose. Whey applications include ice cream, beverages, soups, sauces and spreads. Collectively, whey proteins have all the essential amino acids and in higher concentrations **(Marshall, 2004)**. Many attempts have been done for utilization of whey in the formulation of some foods, but still there is a lot of scope to explore the possibilities for its utilization in beverage industries **(Patel *et al* 2007)**. 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 **(Divya and Kumari, 2009)**. Skimmed milk is a by-product obtained during the manufacture of cream. It is a cheaper source for nutritious nonfat milk solids than whole milk, so it could be considered for development into a beverage **(Shukla *et al* 2003)**.

Neutral antioxidants, particularly in fruits and vegetables, have been of increasing interest to both consumers and scientists, because the frequent consumption of natural antioxidants is associated with a lower risk of cardiovascular diseases and cancer **(Renaud *et al* 1998; Temple, 2000)**. Guava fruit contains a high level of antioxidant compounds, such as vitamin C **(Nakasone & Paull, 1998)**, carotenoids, **(Mercadante *et al* 1999)**. Addition of guava adds excellent nutritive value, flavor and meditational properties. It is useful in scurvey, digestion and cough **(Divya & Kumari, 2009)**. Strawberries are a good source of natural antioxidants, there is a positive correlation between the antioxidant activity and total phenolic content **(Wang *et al* 1996; Wang & Lin, 2000)**. In addition to the usual nutrients, such as vitamins

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and minerals, strawberries are rich in anthocyanins, flavonoids, and phenolic acids (**Heinonen *et al* 1998; Rice-Evans & Miller, 1996**), and they have shown a remarkably high scavenging activity toward chemically generated radicals, making them effective in inhibiting oxidation of human low-density lipoproteins (**Rice-Evans & Miller, 1996**). Strawberries are highly valued for there sweetness, flavor and pleasant color, and are one of the most frequently consumed fruits (**Golaszewski *et al* 1998**).

On the other hand, bifidobacteria have antitumoral activity and anti-cholesterolemic as well as immune system activation effects (**Trojanova & Rada, 2005**). The number of bifidobacteria is further reduced during old age, accompanied by increases of *Clostridium* and other species. The most important physiological effect is the action of intestinal conditioning, which includes improvement of the intestinal flora, inhibition of intestinal putrefactive substances, and improvement of the faecal properties and defecation state (**Ishibashi *et al* 1997**).

However, fermented milk products represent a rich source of nutrients and may improve lactose digestion through splitting lactose into glucose and galactose by bacterial enzymes (**Kolars *et al* 1984**). Fermented milk products also help enhance the immune system via modulation of the cellular immune response through bioactive peptides whose activity may extend beyond the immune functions by some mechanisms still unclear (**Trojanova & Rada, 2005**).

Today, consumers are looking for ways to promote their own health, to enhance their"health span", not just their life span. In recent years, rising medical costs have forced people to find cheaper and effective means of protecting their health, and, thus, interest in functional food products has increased (**Ozer & Kirmaci, 2010**). Hense, the issue of this work was to prepare healthy beverages either from skim milk or sweet whey inoculated with *Bifidobacterium lactis Bb-12*, and flavoured with guava or strawberry juice.

MATERIALS AND METHODS

I- Materials

Fresh skim milk (protein 3.5%, fat 0.5% and T.S. 11.2 %) and fresh sweet whey (protein 0.8% and T.S. 7.4%) were obtained from Faculty of Agric. Cairo Univ. Giza, Egypt. High quality guava and strawberry fruits were obtained from local market. *Bifidobacterium lactis Bb-12* was obtained from Ch., Hansen's Lab. Denmark.

Preparation of fruit juices

Fresh high quality guava and strawberry fruits were well washed, cut to pieces and then pulped in a blender. The homogenized mixtures of both types were filtered through a musline cloth, the resultant juice was filled into polyethylene bags and stored at -18°C until use.

Preparation of skim milk and whey flavoured beverages

Fifteen percent of sucrose was added to both skim milk and sweet whey. Each batch was heated to 80°C, cooled to 37°C, inoculated with 0.1% *Bifidobacterium lactis Bb-12* and incubated anaerobicly at 37°C for 3 h. Strawberry and guava juices were added separately at rate of 20% (w/w) to skim milk and sweet whey. The beverages were chemically analyzed when fresh, while microbiological examinations were carried out when fresh and during cold storage at 4°C until 15 days.

II- Methods

-Chemical analysis

Total solids (TS) and total protein (TP) contents of obtained beverages were determined according to **AOAC, (2006)**. pH values were measured using a Laboratory pH meter (HANNA, Instrument, Portogal). Mineral contents were determined by Microwave Digestion Lab. Station, ICP technique optima 2000 DV.

Amino acids determination except methionine, cystine and tryptophan were performed according to **AOAC, (2006)**, using an amino acid analyzer (Biochrom 30). The protein efficiency ratios (PER) of the tested samples were based on their amino acid contents according to the recommendations of **Alsmeyer *et al* (1974)**, the following equations were used:

PER_1 = - 0.684 + 0.456 (Leucine) - 0.047 (Proline) (for adults)

PER_2 = -0.468+0.454 (Leucine) – 0.105 (Tyrosine) (for juveniles)

Biological value (BV) was assayed according to the following equation as recommended to **Ahmed *et al* (1995)**:

$$BV = 49.9 + 10.53\ PER$$

-Microbiological examinations

- Total Bacterial counts (TBC) were estimated on glucose yeast extract nutrient agar medium using pouring plate technique **(ISO, 2002)**. Plates were counted after incubation of 37°C for 24h.
- Coliform and faecal coliform counts were estimated on Violet Red Bile Lactose agar (VRBL) **((ISO, 2005)** using pouring plate technique. Plates were counted after 24 h at 37°C and 44.5°C for total coliform and faecal coliform counts, respectively.
- MRS agar medium supplemented with 0.09% cystein-HCL was used to determine Bifidobacteria counts **(Denis, 2001)**. Plates were counted after 48 h at 37 °C under anaerobic conditions.

-Sensory evaluation

Beverages were sensory evaluated using scale of 40 points for appearance, 20 points for color and 40 points for flavor.

-Statistical analysis

Statistical analysis was performed using the GLM procedure with **SAS (2004)** software. Duncan's multiple comparison procedure was used to compare the means. A probability to P≤0.05 was used to establish the statistical significance.

RESULTS AND DISCUSSION

Table (1) represents pH values, TS and TP contents of bifido beverages flavoured with guava or strawberry juices. Sweet whey beverages had the lowest pH values, TS and TP contents compared with skim milk beverages (P≤0.05). Fortification with guava juice caused significant increased in pH values and total solid contents, which is in accordance with those found by **Divya & Kumari, (2009)**. No significant differences shown between guava and strawberry juices for total protein content.

For mineral contents; bifidus skim milk beverages had higher contents of Ca, P than bifidus sweet whey beverages **Table (2)**. The average recommended dietary allowance (RDA) or adequate intake (AI) of calcium and phosphorus are about 900, 700 mg per day respectively (800 to 1000 mg, depending on the country) for adults. These RDAs are safety levels designed to provide adults with maximum protection against a negative calcium balance and, hence, against bone loss. There is no doubt that milk provides large amounts of calcium. While there is also no question of the nutritional effectiveness of the calcium provided by milk, there is still some debate as to whether this source of calcium is biologically better than other sources **(FNB, 1997; Gueguen & Pointillart, 2000)**. Fortification with strawberry increased Ca, K and P contents compared with these beverages fortified with guava juice. These results are in agreement with **Quaranta *et al* (1986)**.

Table (3) illustrates that either of sweet whey or skim milk strawberry beverages had higher amino acid contents than those of guava beverages. Essential amino acids such as: Therionine, Valine, Isoleucine, Leucine, Phenylalanine, Tytosine and Lysine, are also in higher content in either of sweet whey or skim milk strawberry beverages than in guava beverages. This trend is in similar of **Perez *et al* (2002); Beekwilder *et al* (2004)**.

On the other hand, PER and BV of bifido beverages flavoured with strawberry juice were higher than those beverages flavoured with guava juice **(Table 4)** for both adults and juveniles, which may be attributed to strawberry juice, due to its higher amino acids content than guava juice.

For microbiological analysis, total bacterial count (TBC) and bifidobacteria of skim milk or sweet whey beverages as affected by fortification with guava and strawberry juices are illustrated in **Fig. (1) and Fig. (2)**, respectively. TBC of bifido beverages samples increased until 5 days and declined thereafter, the decreasing in TBC may correlated with acidity development **(Matijevic *et al* 2009)**. Also in **Fig. (2)** *Bifidobacterium lactis* increased along the storage period reaching its highest level after 10 days in sweet whey beverage flavoured with guava. These results is in agreement with **Masco *et al* (2005)** who reported that, either Dicloxa cillin-propionic acid media or bifidobacterium media from yoghurt and dairy fruit drinks were in the ranges of 10^3 - 10^8 CFU/ml and 10^4-10^6 CFU/ml respectively. All samples are free from coliform bacteria.

Generally it seems that the incidence and the gradual increase of *Bifidobacterium lactis* during storage period played an inhibitory action **(Gupta *et al* 1996)** which causes the decreasing of total viable counts.

As shown in **Table (5)** no significant differences were found in color score between sweet whey beverages fortified with strawberry or guava juices, which were significantly higher than skim milk beverages fortified with strawberry and guava ($p \leq 0.05$). However, sweet whey beverages fortified with guava juice and skim milk fortified with strawberry juice gained higher scores for flavor and appearance ($p \leq 0.05$). These results are in agreement with these reported by **Behrens *et al* (2004)**.

Table 1. Chemical properties of sweet whey or skim milk beverages inoculated with *Bifidobacterium lactis*, and flavoured with guava or strawberry juices

Beverage treatments*	pH	Total Solids (%)	Total Protein (%)
Sweet whey+ 20%strawberry juice	4.376 ^{D}	21.98 ^{D}	1.30 ^{B}
Sweet whey + 20%guava juice	4.486 ^{C}	23.00 ^{C}	1.10 ^{B}
Skim milk + 20%strawberry juice	4.540 ^{B}	25.02 ^{B}	3.61 ^{A}
Skim milk + 20%guava juice	4.630 ^{A}	26.04 ^{A}	3.72 ^{A}

*Average of three replicates

Table 2. Mineral contents in sweet whey or skim milk beverages inoculated with 0.1% *Bifidobacterium lactis*, and flavoured with guava or strawberry juices

Beverage treatments	Minerals	Mean (ppm)
Sweet whey+ 20% strawberry juice	Ca	500.3
	K	1524
	P	540.0
	Zn	4.799
Sweet whey + 20% guava juice	Ca	465.2
	K	1274
	P	454.9
	Zn	3.778
Skim milk + 20% strawberry juice	Ca	707.2
	K	1520
	P	660.1
	Zn	5.995
Skim milk + 20% guava juice	Ca	570.1
	K	1221
	P	522.0
	Zn	3.973

Table 3. Amino acids contents (mg/100ml) in sweet whey or skim milk beverages inoculated with 0.1% *Bifidobacterium lactis*, and flavoured with guava or strawberry juices

Amino acids	Sweet whey + 20% strawberry juice	Sweet whey+ 20% guava juice	Skim milk + 20% strawberry juice	Skim milk + 20% guava juice
Aspartic	142.08	88.67	262	204.23
Therionine *	63.79	51.98	117.03	105.09
Serine	55.03	43.28	138.50	121.82
Glutamic	267.01	205.95	592.04	526.66
Proline	68.12	59.07	248.01	227.05
Glycine	33.02	27.08	64.63	58.34
Alanine	83.34	64.62	128.93	111.08
Valine *	63.30	51.90	159.84	140.83
Iso-leucine *	53.28	43.76	127.25	112.35
Leucine *	98.70	81.17	257.59	229.50
Tyrosine *	36.88	30.12	121.55	103.89
Phenylalanine*	43.52	35.30	132.00	116.27
Histidine	23.46	19.12	71.10	62.77
Lysine *	93.10	77.24	219.39	193.85
Arginine	39.54	31.31	100.65	87.20

*: Essential amino acids

Table 4. Protein efficiency ratio (PER) and biological value (BV) of sweet whey or skim milk beverages inoculated with 0.1%*Bifidobacterium lactis*, and flavoured with guava or strawberry juices

Beverage treatments	PER_1	PER_2	BV_1	BV_2
Sweet whey + 20% strawberry juice	41.12	40.47	483	476
Sweet whey + 20% guava juice	33.55	33.22	403	340
Skim milk + 20% strawberry juice	105.12	103.72	1157	1140
Skim milk + 20% guava juice	93.29	92.82	1032	1027

1: Adults 2: Juveniles

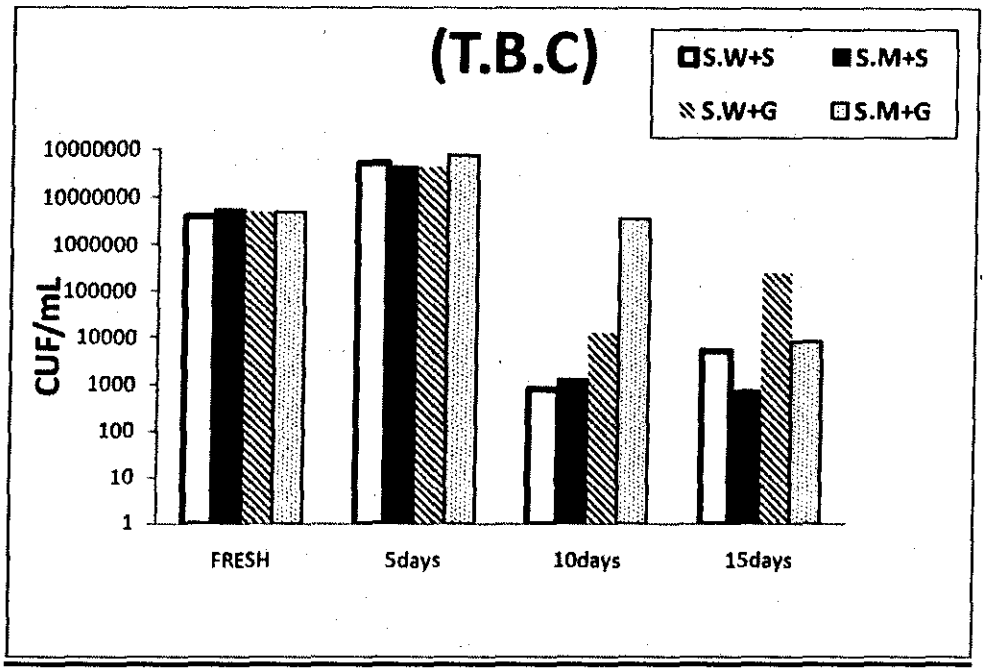

Fig. 1. Total Bacterial Count (T.B.C.) in different dairy beverages (Sweet Whey + Strawberry (S.W.+S), Skim milk + Strawberry (S.M. + S), Sweet Whey + Guava (S.W.+G) and Skim Milk + Guava (S.M. +G) during cold storage for 15 days.

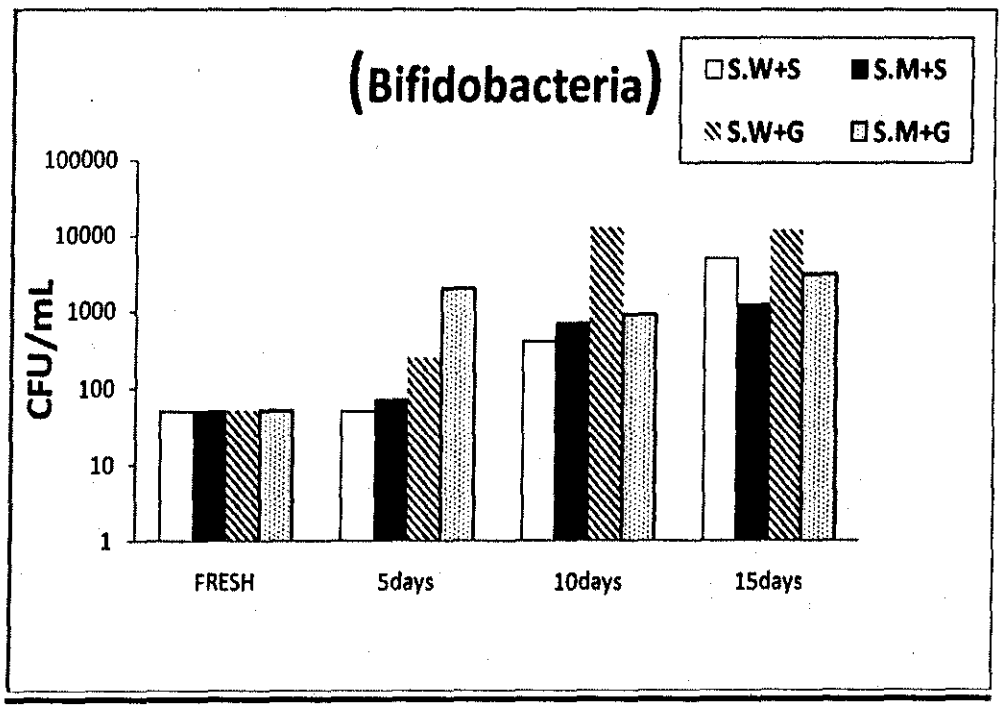

Fig. 2. Bifidobacteria count in different dairy beverages (Sweet Whey + Strawberry (S.W.+S), Skim milk + Strawberry (S.M. + S), Sweet Whey + Guava(S.W.+G) and Skim Milk + Guava (S.M. +G) during cold storage for 15 days

Table 5. Organoleptic properties of sweet whey or skim milk beverages inoculated with 0.1% *Bifidobacterium lactis*, and flavoured with guava or strawberry juices

Beverage treatments *	Color (20)	Flavor (40)	Appearance (40)
Sweet whey+ 20%strawberry juice	19.17 ^{A}	30.33 ^{B}	34.50 ^{B}
Sweet whey + 20%guava juice	20.00 ^{A}	34.63 ^{A}	37.66 ^{A}
Skim milk + 20%strawberry juice	17.50 ^{B}	36.17 ^{A}	33.50 ^{B}
Skim milk + 20%guava juice	17.66 ^{B}	36.66 ^{A}	37.00 ^{A}

*: Average of six replicates

CONCLUSION

Fortification of milk by-products, namely sweet whey and skim milk with bifidobacteria and fruit juices to produce flavoured healthy beverages, had gained different acceptability. Guava beverages had the highest scores, while strawberry beverages had higher levels of minerals such as (Ca, P, K, and Zn), amino acids, BV, PER. Inoculation with *Bifidobacterium lactis* makes these beverages healthier; and its count increased along the cold storage period reaching its highest level after 10 days with sweet whey guava beverages.

REFERENCES

Ahmed, N.S.; F.A.M. Hassan; F.M.M. Salama and A.K.M. Enb, (1995). Utilization of plant proteins in manufacture of cheese analogs. **Egyptian J. Food Sci., 23(1-2): 34-45.**

Alsmeyer, R.H.; A.E. Cunninglam and M.L. Happich (1974). Equations predict PER amino acids analysis. **Food Technology. 28(7): 34.**

AOAC (2006). Official Methods of the Association of Analytical Chemists. **18th Ed. Chapter 4, pp. 17-19.** Published by the Association of Official Agriculture Chemists, No.994.12, Current through revision, Washington. D.C.

Beekwilder, J.; M. Alvarez-Huerto; E. Neef; F.W.A. Verstappen; J.H. Bouwmeester and A. Aharoni (2004). Functional characterization of enzymes forming volatile esters from strawberry and banana. **Plant Physiology, 135: 1865-1878.**

Behrens, J.H.; S.M. Roig and M.A. Silva (2004). Fermentation of soy milk by commercial lactic cultures: Development of a product with market potential. **Acta Alimentaria, 33(2): 101-109.**

Denis, R. (2001). Media for the isolation and enumeration of bifidobacteria in dairy products. **International Journal of Food Microbiology, 69: 167-182.**

Divya and A. Kumari (2009). Effect of different temperatures, timings and storage periods on the physico – chemical and nutritional characteristics of whey-guava beverage. **World Journal of Dairy & Food Science, 4(2):118-122.**

FNB (1997). Food and Nutrition Board, Institute of Medicine. **Dietary Reference Intakes**: Calcium, Phosphorus, Magnesium, Vitamin D, and Fluoride. **pp. 146-189,** National Academy Press, Washington, D.C., USA.

Golaszewski, R.; C.A. Sims; S.F. O'Keefe; R.J. Braddock and R.C. Littell (1998). Sensory attributes and volatile components of stored strawberry juice. **Journal of Food Science, 63(4): 734-738.**

Gueguen, L. and A. Pointillart (2000). The bioavailability of dietary calcium. **Journal of the American College of Nutrition, 19, No. 90002: 119S-136S.**

Gupta, P.K.; B.K. Mital and S.K. Garg (1996). Inhibitory activity of *Lactobacillus acidophilus* against different pathogens in milk. **Journal of Food Science and Technology of India. 33: 147-179.**

Heinonen, I.M.; A.S. Meyer and E.N. Frankel (1998). Antioxidant activity of berry phenolics on human low-density lipoprotein and liposome oxidation. **Journal Agric. Food Chem. 46: 4107-4112.**

ISO/FDIS 4833 (2002). International Standard Organization. Microbiology of Food and Animal Feeding Stuff- Horizontal method for the enumeration of microorganisms colony count technique. Case postate 56-CH-1211, Geneva 20.

ISO/FDIS 4832 (2005) International Standard Organization. Microbiology of Food and Animal Feeding Stuff- Horizontal method for the enumeration of coliforms colony count. Case postate 56-CH-1211, Geneva 20.

Ishibashi, N.; T. Yaeshima and H. Hayasawa (1997). Bifidobacteria: their significance in human intestinal health. **Mal. Journal of Nutrition. 3: 149-159.**

Kolars, J.C.; M.D. Levitt; M. Aouji and D.A. Savaiano (1984). Yoghurt-an auto digesting source of lactose. **New England Journal of Medicine, 310: 1-3.**

Marshall, K. (2004). Therapeutic applications of whey protein. **Alternat. Medic. Rev., June 9(2): 136-56.**

Masco, L.; G. Huys; E. De Brant; R. Temmerman and J. Swings (2005). Culture-dependent and culture-independent qualitative analysis of probiotic products claimed to contain bifidobacteria. **Int. Journal Food Microbiol., July 15, 102(2): 221-230.**

Matijevic, B.; R. Bozanic and L. Tratnik (2009). The influence of lactulose on growth and survival of probiotic bacteria *Lactobacillus acidophilus* La-5 and *Bifidobacterium animalis* subsp. *lactis* BB-12 in reconstituted sweet whey. **Mljekarstvo, 59(1): 20-27.**

Mercadante, A.Z; Z. Steck and H. Pfander (1999). Carotenoids from guava (*Psidium guajava L.*): isolation and structure elucidation. **Journal Agric. Food Chem. 47: 145-51.**

Nakasone, H.Y. and R.E. Paull (1998). Tropical Fruits. p. 445. CAB International, Wallingford, UK

Ozer, B.H. and H.A. Kirmaci (2010). Functional milks and dairy beverages. **International Journal of Dairy Technology, 63: 1-15.**

Patel, S.; S. Prasanth; P.L. Choudhary and C. Sahu (2007). Techno- economic feasibility of whey based mango hebal (Ginger) beverage. **Indian Journal Dairy Science, 60(3): 149-155.**

Perez, A.G.; O. Raquel; L. Pilar and S. Carlos (2002). Biosynthesis of strawberry aroma compounds through amino acid metabolism. **Journal Agric. Food Chem., 50(14): 4037-4042.**

Prendergast. (1985). Whey drink, technology processing and marketing. **Journal Science, Dairy Technology, 38: 103-105.**

Quaranta, H.O.; J.E. Eterovic and J.L. Piccini (1986). Essential elements in fresh and irradiated strawberries and strawberry marmalade. **International Journal of Radiation Applications and Instrumentation, Part A, Applied Radiation and Isotopes, 37(7): 633-634.**

Renaud, S.C.; R. Guenguen; J. Schenker and A. d' Houtand, (1998). Alcohol and mortality in middle aged men from Eastern France. **Epidemiology, 9: 184-8.**

Rice-Evans, C.A. and N.J. Miller, (1996). Antioxidant activities of flavonoids as bioactive components of food. **Biochem., Soc. Trans. 24: 790-795.**

SAS (2004). Statistical Analysis System. SAS User's Guide. Statistics SAS Institute, Cary, NC.

Shukla, F.C.; A. Sharma and B. Singh, (2003). Studies on the development of beverages using fruit/pulp, separated milk and reconstituted skim milk. **International Journal of Dairy Tech., 56(4): 243-246.**

Temple, N.J. (2000). Antioxidants and disease: more questions than answers. **Nutr. Research, 2: 449-59.**

Trojanova, I. and V. Rada (2005). Enzymatic activity in fermented milk products containing bifidobacteria. **Czech Journal Food Science, 23: 224-229.**

Wang, L.; G. Cao and R.L. Prio, (1996). Total antioxidant capacity of fruits. **Journal Agric. Food Chem., 44: 701-705.**

Wang, S.Y. and H.S. Lin (2000). Antioxidant activity in fruit and leaves of blackberry, raspberry and strawberry varies with cultivar and development stage. **Journal Agric. Food Chem. 48: 140-146.**

حوليـــات العلـــوم الزراعية
جامعة عين شمس ، القاهرة
مجلد(٥٥)، عدد (٢)، ٢٧٣-٢٨١، ٢٠١٠

إنتاج مشروبات البيفيدو الصحية وذات النكهة من منتجات الالبان الثانوية

[٢١]

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١- المركـــز القومـــى للبحـــوث - الجيـــزة - مصـــر

٢- مركـــز البحـــوث الزراعيـــة - الجيـــزة - مصـــر

الموجـــز

ان الـــشرش واللـــبن الفـــرز مـــن المنتجـــات الثانوية التى تم الاهتمـــام بهـــا مـــؤخرا والالتفـــات الى أهميتهـــا الغذائيـــة والـــصحية ، وقـــد كثـــرت محـــاولات انتـــاج منتجـــات لبنيـــة مختلفـــة منهـــا. وبمعرفة أهمية البيفيدو بكتريا الـــصحية فقـــد كـــان الاهتمام فى هـــذا البحـــث بمحاولـــة اضـــافة هـــذه البكتيريا مع نوعين مـــن هـــذه المنتجـــات الثانويـــة فى منتج صـــحى وغنـــى أيـــضا فـــى الاحمـــاض الأمينية والمعادن ، عن طريـــق اضـــافة مـــدعمات غنيـــة بهـــــذه الأحمـــاض والمعـــادن مثـــل الفراولة والجوافـــة. فلقـــد تـــم اعـــداد مـــشروبات ملقحـــــة ب ١,٠% مـــــن البيفيـــــدوبكتيريا *Bifidobacterium lactis* Bb-12 مـــع كـــلا مـــن اللبن الفرز والـــشرش الحلـــو والتحـــضين لمـــدة ٣ ساعات ، وقد تم اضافة كلا من عـــصير الفراولـــة والجوافـــة منفـــصلين بنـــسبة ٢٠% (وزن/وزن)، وأحـــرزت نتـــائج التحكـــيم الحـــسى لكـــلا مـــن مشروبات اللبن الفرز والـــشرش الحلـــو المـــدعمين بالجوافـــــة أفـــضل نتائـــــج للـــون والطعـــــم والمظهـــــر بالمقارنـــــة بالمـــــشروبات المدعمـــــة بالفراولة. كمـــا أظهـــرت النتـــائج أن المـــشروبات المدعمـــة بالفراولـــة بهـــا أعلـــى محتـــوى مـــن الأحمـــــاض اللأمينيـــــة وPER و B.V. عـــــن المحتوية على الجوافة. وقـــد زادت أعـــداد بكتريـــا *Bifidobacterium lactis* Bb-12 أثنـــاء التخـــزين حتى وصلت الـــى أعلـــى مـــستوى بعـــد ١٠ أيـــام وذلك فـــى مـــشروبات الـــشرش الحلـــو المدعمـــة بالجوافة. وبذلك فالتـــدعيم بالفرالـــة والجوافـــة مـــع البيفيدو بكتيريـــا يكـــسب المنـــتج خـــواص صـــحية وقيمة غذائية عالية.

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