Biological Sciences

Pak. J. Sci. Ind. Res. 2003 46 (3) 174-176

Comparative Analysis and Nutiritional Composition of Mulberry Fruit *Morus alba* Plus Seabuckthorn *(Hippophae)* and their Products

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(Received 7 July 2001; accepted 29 August 2002)

The fruits of mulberry produced in Northern Pakistan were subjected to hot air dehydration to preserve without losing its natural flavour and nutrients. The dehydrated mulberry powder which is called mulberry beverage base (MBB) yielded good fruit tasty drink when mixed with suitable amount of water. Shelf-life assessment was also conducted. The fresh fruit extract and the dehydrated mulberry beverage base (MBB) were analysed for juice/pulp, MBB, moisture, acidity as citric acid, total soluble solids, sugars, ascorbic acid and ash minerals like calcium, potassium, phosphorous, sodium and iron in fresh fruit extract was also determined. Mulberry pulp was mixed with seabuckthorn pulp prior to dehydration. Dehydrated product was found better in taste, colour and flavour.

Key words: Mulberry composition, Minerals, Seabuckthorn *(Hippophae)*, Beverage base.

Introduction

Mulberries (i.e.) *Morus alba* and *Morus nigra* are widely planted in Pakistan. These can be found scattered all over in four provinces and Northern areas of Pakistan. Its transportation is difficult due to the softness of the fruit plus its deteriorative nature caused bruising, smashing during handling the fruit. It has been reported that fraction of the fruit produced in Bharat was employed in juice squashes, stews and tart production (Anon 1962). Nothing has been reported for dehydrating mulberry juice/pulp to make powder or mulberry beverage base (Mohammad 1996). It is important to mention the richness in amino acids content besides the natural fruit flavour (Bender 1992). If suitable precautions are taken to preserve the natural flavour and other nutrients, the dehydrated mulberry powder can form distinguished base for instant mulberry drink. It has been tried to find different ways to make mulberry *(Morus alba)* beverage base with combination of other fruit pulps to get higher nutritional value powder than other fruit powders already available in local markets. In this case seabuckthorn pulp has been combined with mullberry pulp.

Seabuckthorn or *Hippophae* is an incredibly useful plant named as a millenium plant found scattered wild in Northern areas of Pakistan, China and Russia. Analytical data shows that fruit is rich in nutrient such as various vitamins organic acids, amino acids and carbohytdrates (Tauqir 1997). Vitamin contents of seabuckthorn are much higher than other fruits and vegetables whereas vitamins C (ascorbic acid) is 3 to 16 times higher than that of Kivi fruit. The yellow pigments of seabuckthorn consisted of flavonoides, carotene and vitamin E are widely used as very useful food additives (Shah 2000). Comparative analysis were conducted for MBB instant drink nutritional constituents and fresh fruit pulp constituents.

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Materials and Methods

Freshly picked fruit with good quality was purchased from local market and was transported to Laboratory in hygenic conditions.

Fruit product. Fruit was thoroughly washed prior to 1-2 min of hot water blanching. Mulberry fruit was then pressed and passed through muslin cloth. 23.5% total soluble solid as required from extract was uniformly distributed over the surface in stainless steel trays (39.0 x 77.5 cms) nearly 1.5 kg per tray were used. Trays were placed in cabinet shelf dryer already heated to 70°C. After 2-3h the temperature was reduced to 60°C and trays were kept in dehydrator over night. Desired moisture level was achieved as 4%, the product was removed from trays using stainless steel knives. The dehydrated product was mixed with equal amount of sugar, 2% citric acid and 0.02% colour and passed through grinder to get instant juice powder, mulberry beverage base of 60 mesh. Powder was packed in laminated polyethylene sachets or small glass bottles containing 250-500 g net weight of the powder. The shelf life of the powder was monitered for more than 6-8 months.

Seabuckthorn plus mulberry pulp. Prior to dehydration, seabuckthorn pulp was mixed with mulberry pulp in 30:70 ratio. Mixture was stirred more than 10 min to homogenize the material. Mixed pulp was uniformaly distributed over the stainless steel trays already covered with polyethylene plastic. Trays were kept at 60°C for more than forty hours in cabinet dehydrators. Product was cut into small pieces of 1/2 square inch each. Taste of the product was enhanced with addition of seabuckthorn pulp.

Analysis. The mulberry fruit was physically studied for weight, size, juice, pressed residue, specific gravity of juice and edible portion (Table 1).The extracted pulp from the fresh fruit and mulberry beverage base (MBB) was examined for their composition (Table 3 and 4). Ruck (1963) method was used to determine the moisture. Total acidity was estimated by titration against 0.1 NaOH and the result was expressed as percent acidity. Total soluble solids were directly recorded by an Abbe's refractometer. Sugar and ascorbic acid were also assessed. Ash was prepared in furnance at 525°C. AOAC (1975) methods were employed for determining sugar and ascorbic acid contents in the product.

Calcium, magnesium, phosphorous, potassium and sodium were determined in the ash. Calcium was estimated as oxalate and tested titrametrically. The filtrate and washing were consumed for magnesium. It was precipitated, dried, ignited and weighed as $Mg_2P_2O_5$. Phosphorous was assessed spectrophotometrically utilizing a Shimadzu double beam spectrophotometer UV 200S. The measurements of sodium and potassium were made by Jenway PEP 7 model digital flame photometer (Jabbar *et al* 1989). All chemical used in these findings were of Analar grade.

Table 1
Physical characteristics of mulberry fruit.

Average[a] weight per fruit (g)	Average size[b] LxB cm	juice %	Pressed residue %	Specific gravity of juice at 33°C	Edible portion
1.82	3.70 x 0.99	71.00	29.000	$1.10x10^{-3}$	100%
0.40	0.75 x 0.12	0.14	0.0550	1.08×10^{-3}	

Values are means standard deviation
[a]average of 51 fruit
[b] L = length, [b]B = Breadth
[c]Computer notation for $1.08x10^{-3}$

Table 2
Composition of mulberrv beverage base (MBB)

Ground, dehydrated, mulberry juice/pulp (Kg)%	Sugar (Kg)%	Citric acid (Kg)%	Food colour (Kg)%
100	100	2.0	0.02

Table 3
Composition of mulberry (pulp/juice) mulberry compound (MBB)

Sample	Mulberry (pulp/juice) %	Mulberry beverage base (MBB) %	Moisture %	Acidity as citric%	Total solids %	Total sugar %	Reducing sugar %	Non reducing sugar %	Ascorbic acid mg%	Ash %
Mulberry fruit (pulp/juice) without seed	47	...	71.40±14.1	0.41±0.10	23.50±4.50	22.60±4.40	10.90±2.10	11.70±2.10	1.00±0.20	1.00±0.00
Freshly dehydrated beverage base, (MBB)[a]	24	24	3.20±0.60	0.50±0.10	--	89.70±17.10	1.20±0.30	88.50±17.00	3.50±0.00	
Seabuckthorn pulp processed from PCSIR centre Skardu (N.A)	--	--	81.10±12.10	2.24	12.20	4.79	2.12	--	38mg/ 100g	0.83

[a] Composition of mulberry beverage base (MBB)

Results and Discussion

Table 1 presented physical characteristics of fresh fruits, average weight per fruit along with average size of the fruits. Juice percent was estimated with pressed residue. Edible portion constitutes as 100% of the fruit.

Table 4
Mineral composition of fresh mulberry fruit

Calcium mg/100g	Potassium mg/ 100g	Phosphorous mg/100	Magnesium mg/100g	Sodium mg/100g	Iron mg/100g	Sodium to potassium ratio
1820.0 ± 360.1	95.7 ± 18.0	71.3 ± 13.1	38.3 ± 6.7	22.1 ± 3.7	4.45 ± 0.8	4.4 ± 0.8

Values represent mean ±S.D

Table 5
Organoleptic evolution of mulberry products plus seabuckthorn

Mulberry product	Taste in 10%	Color in 10%	Flavour, in 10 %	Total score, in 30%
Mulberry juice powder (fresh)	7.0	6.5	7.0	20.5
Mulberry squash I	6.5	7.0	8.0	21.5
Mulberry syrup II	6.0	7.5	6.0	19.5
Mulberry plus seabuckthorn	8.0	7.5	8.0	23.0

Table 2 presented composition of mulberry beverages base (MBB) dehydrated in powder form with sugar, citric acid and food colouring addition to final product before grinding and mixing to fine powder.

Table 3 presented the proximate analysis of fresh fruits and the end product as MBB. Mulberry fruit (pulp/juice) without seed freshly dehydrated beverages base were analysed separately for moisture, acidity, total solid, sugar as reducing/non-reducing sugar, ascorbic acid and ash.

It may be noted that dry natural fruits are known to be highly hygroscopic and can easily take up moisture from the atmosphere (Bolin and Hux soll 1989). Preliminary tests showed the equilibrium relative humidity of freshly prepared mulberry beverage base to be approximately 22.0%.

Table 4 presented the mineral composition of the fresh fruits in which calcium, potassium, phosphorous, magnesium, iron as mg/100 g and sodium to potassium ratio is indicated.

Table 5 showed organoleptic evolution of the mulberry and its products i.e. mulberry fresh juice, mulberry squash, mulberry pulp, seabuckthorn, mulberry syrup comparing taste, colour, flavour etc.

The shelf life of the powder was more than eight months. No change in colour, taste and flavour were observed during storage time. Although taste of dry product was enhanced with addition of seabuckthorn pulp and the colour of mix pulp powder was found darking.

Conclusion

The fruit of mulberry has been thoroughly investigated as fresh fruit and their juices alongwith MBB, mulberry beverage base as powder. Comparative study of all these forms were conducted which showed enhancement of the material by adding anticaking other characteristics materials like gelatin (0.1%), gum (0.2%), magnesium carbonate (4%), synthetic silica (syloid silica) (2%) and modified starch (2%). Taste of the mulberry product was enhanced more than two folds with addition of seabuckthorn pulp.

Presence of minerals in mulberry are highlighted to indicate that mulberry is a perfect fruit which can be consumed alone for different deficiencies in human body. It is worth mentioning that seabuckthorn pulp is by itself has very high nutritional contents and is a perfect food for human consumption. Its addition to any food product multiplicates higher folds of vitamin plus mineral contents already present in that vary fruit or vegetable.

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