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STUDIES ON THE PREPARATION AND COMPOSITION OF DEHYDRATED GUAVA BEVERAGE BASE

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Locally produced guava fruit has been subjected to hot air dehydration laying emphasis on the preservation of flavour and nutrients. The dry guava powder-guava beverage base (GBB) yielded good flavouring drink when mixed with suitable amount of water. Shelf life assesment was also made. The dry (GBB), fresh as wel l as one year old sample, and the drink made from it, were analyzed for nutritional and other constituents like moisture, dry matter, ash, sugars, soluble pectin, ascorbic acid and minerals such as Ca, Mg, Na, K and P and comparison made with fresh fuit.

Key words: Guava, Dehydration, Powdered beverage base, Nutrients, Minerals.

Introduction

Guava (*Psidium guajava* L.) is an important fruit of Pakistan. There seems to be little utilization of the fruit in commercial products, although one report [1] suggests a fraction of the fruit produced is employed in jelly production. Dehydration of the fruit has been reported earlier with the objective of its utilization into pectin and jelly [2,3]. Apparently no attempt, seems to have been made previously, for dehydrating guava pulp, with the object of preparing dehydrated base for guava beverage. It may be mentioned that besides its exotic flavour, guava is one of those fruits which contains very high amount of ascorbic acid not only in the fresh condition but also in its dehydrated form [4]. If proper measures are taken to preserve the flavour and nutrients, the dehydrated guava powder could form a promising base for instant guava drink. With this object in view, it was considered worthwhile to undertake investigation on the transformation of the fresh guava fruit pulp into powder form with special emphasis on the preservation of flavour and nutrients in order to explore its use as instant guava beverage base (GBB). The dry beverage base and the drink prepared from it has also been assessed for its nutritional constituents and its comparison was made with that of the fresh fruit pulp.

Materials and Methods

Fresh Kohati guava fruit procured from the local market was sorted; discarding damaged, bruised and un-ripe, selecting only the whole some and good quality fruit. While major part of the fruit was immediately processed, a small representative part was preserved in polyethylene sacs in a freezer for analysis. The fruit was cut into slices and the seeds were removed, using stainless steel knives. After short blanching treatment (in boiling water for 2-3 mins), and addition of a little water enough to just cover the fruit, it was passed through pulper machine. To the slurry, so obtained (11.5° Brix), was added cane sugar (20% w/w) other stabilizer and flavour enhancers, preservating agents like gums (0.2%), gelatin (0.1%), modified starch (2%), synthetic silica etc., upto a level of 2% (w/w). The mixture was thoroughly blended to a uniform consistency. The pulp thus obtained was evenly spread in stainless steel trays (area 3.38 sq, ft) approximately 1.5 kg/tray and placed in a cabinet shelf dryer previously heated to a temperature of 150°F. After about 2-4 hrs the temperature was gradually reduced to 75°F and the dryer was run over-night when the desired level of moisture (approx. 3%) was obtained. The product was scratched from the trays by special stainless steel knives and packed in polyethylene packets of airtight plastic bottles which could be stored under suitable conditions of temperature and moisture. Alternatively, part of the dehydrated product may be mixed with an equal amount of sugar and, 1% (w/w) citric acid, and passed through grinders to obtain instant fruit juice powder (guava beverage base) of 60 mesh size. The powder may be packed in suitable laminated polyethylene/propylene sachets which on mixing with water gives excellent tasting ready to serve guava drink. The approximate shelf life of the powder has been estimated at 6 months or more when stored at 8°.

Analysis. Besides the fresh fruit, the product was analysed for its nutrients composition at three levels, viz., (a) Freshly dehydrated product (b) one year stored dehydrated product (c) drink (14% w/w) prepared from (a) and (b) above.

The pH , wherever practicable, was determined using digital corning 102 pH meter. For the estimation of moisture, soluble pectin and tannins the methods described by Ruck [5] were used. Total soluble solids were measured by Abbe's refractometer at 20°. Total acidity was estimated by the usual titration against 0.IN NaOH and the results were expressed as percent citric acid. Ascorbic acid and sugars were assessed by the methods of AOAC [6].

Ash was prepared, from the fruit after removing the seeds as well as the powdered product at 525° in a furnace. Calcium, magnesium, phosphorous, potassium and sodium were determined in the ash. Calcium was estimated in the solution of the ash, by precipitating as calcium oxalate and determining titrimetrically [6] while the filterate and washings, obtained from the above, were used for the magnesium determination. The Mg was precipitated, dried, ignited and weighed as $Mg_2P_2O_7$ [6]. Phosphorous was assessed by spectrophotometric method using a Shimadzu double beam spectrophotometer UV 200S [6].

Sodium and potassium estimations were made by flame photometery. A Jenway PEP 7 Model digital flame photometer was used. All the chemicals used in these analysis were of A.R. quality manufactured by E. Merck Darmstadt Germany.

Results and Discussion

The dehydrated guava pulp obtained in the form of small lumps gives guava beverage base powder (GBB) after mixing with appropriate amount of sugar citric acid and grinding. The composition of the freshly dehydrated and one year stored, guava beverage base (GBB) is given in Table 1.

It can be seen from Table 1 that initially the guava powder base contained 2.6% moisture which after storage for one year, has increased and the dry matter correspondingly decreased by about 2%. It may be mentioned that the dry natural juices/pulps are known to be highly hygroscopic [7] and can easily take up moisture from the atmosphere which adequately explains the rise in the moisture content in the stored sample. Preliminary experiments indicated the equilibrium relative humidity of the freshly prepared and one year stored dehydrated guava pulp to be approx: 31.1 and 45.7, respectively. The ash content of the stored sample was also found to be higher than the freshly dehydrated guava beverage base. The increase, however, could be attributed to the inorganic materials like $MgCo_3$ synthetic silica (Sylloid silica 244) etc. added to the product meant for storage as anticaking agents. Our finding of soluble pectin in guava fruit and powder are somewhat lower than that reported [8], but it is said to decrease during ripening and we had taken fully ripe fruit for our product. It was also found to decrease during one year storage which as reported [9] may be the result of the degradative changes commonly taking place during storage. On the other hand tannins were found to increase during the storage. The enzymatic and non-enzymatic browning reactions and complex formation commonly taking place in the dehydrated fruits during storage may, in some way, be related to the higher value.

Table 2 shows the nutritional constituents of the freshly dehydrated and one year stored sample of guava beverage base. Total sugars were found to be a little higher than those reported by others [9] but taking into consideration the externally added sugar during processing, the values could be regarded comparable.

The reducing sugars in the stored sample have slightly increased while the non-reducing have correspondingly decreased indicating the conversion of the latter into the former probably through hydrolytic reaction. Acidity % was within the range reported in the literature. There was a tremendous decrease in the ascorbic acid to less than half of the original value, in the one year stored sample. The ascorbic acid content of the freshly dehydrated sample was found to be 205.9 mg/100gm which is well within the range reported for the guava powder [10]. After storage for as long as one year the guava beverage base still had 76.8 mg/100gm of the vitamin which is an appreciable amount when compared with other preserved fruit products like jams, jellies, squashes etc. [11]. Guava powder has been reported as a rich source of ascorbic acid [4]. The loss of ascorbic acid during storage is not unexpected in view of its high susceptibility to light, heat and oxygen. These losses could possibly be minimized by taking

TABLE 1. COMPOSITION OF DEHYDRATED GUAVA PRODUCTS.

	Moisture (%)	Ash (%)	Soluble pectin (%)	Tannins (%)
Freshly dehydrated	2.6	1.11	1.600	0.0557
One year old (stored)	4.5	1.34	1.282	0.0735

TABLE 2. NUTRITIONAL CONSTITUENTS OF DEHYDRATED GUAVA PRODUCTS (i.e. FRESHLY DEHYDRATED AND ONE YEAR OLD (STORED) SAMPLES.

Sample	Sugars			Acids as	Ascorbic
	Reducing (%)	Non-reducing (%)	Total (%)	citric (%)	acid mg/100gm
Freshly dehydrated	11.8	80.7	92.5	1.39	205.9
One year old (Stored)	12.0	78.1	90.2	1.20	76.8

TABLE 3. COMPOSITION OF FRESH GUAVA PULP AND RECONSTITUTED DRINKS (14% W/W SUSPENSION IN WATER) MADE FROM THE DEHYDRATED PRODUCTS.

	Moisture (%)	Dry matter (%)	Ash (%)	pH	Soluble pectin (%)	Tannins (%)
Fresh guava pulp (w/o seed)	85.5	14.5	0.38	3.88	0.806	0.337
Freshly dehydrated	86.0	14.0	0.16	4.34	0.230	0.008
One year old (stored)	85.7	14.3	0.20	4.14	0.190	0.011
Range	85.5-86.0	14.0-14.5	0.16-0.38	3.88-4.34	0.190-0.806	0.008-0.337
Average	85.7	14.3	0.25	4.12	0.409	0.119
Standard deviation	± 0.3	± 0.3	± 0.12	± 0.23	± 0.344	± 0.189

TABLE 4. NUTRITIONAL CONSTITUENTS OF FRESH GUAVA PULP AND RECONSTITUTED DRINK (14% w/w SUSPENSION IN WATER) MADE FROM THE DEHYDRATED PRODUCTS.

	Total soluble solids (%)	Sugars Reducing (%)	Non-reducing (%)	Total (%)	Titratable acidity as citric acid (%)	Ascorbic acid mg (%)
Fresh guava pulp (w/o seed)	11.5	4.5	3.5	8.0	0.55	135.0
Fresh dehydrated	13.6	1.7	11.6	13.3	0.20	29.6
One year old (stored)	13.6	1.8	11.7	13.5	0.18	11.5
Range	11.5 - 13.6	1.7 - 4.5	3.5 - 11.7	8.0 - 13.5	0.1.8 - 0.55	11.5 - 135.0
Average	12.9	2.7	8.9	11.6	0.31	58.7
Standard deviation	± 1.2	± 1.6	± 4.7	± 3.1	±.21	± 66.7

suitable measures during air drying [12] and selecting proper packaging materials [13].

Several experimental trials had shown that guava beverage base makes good tasting and refreshing drink when mixed with water (14% w/v). It would be interesting to know as to how much nutrients, the drink made from dry base, would supply and also to compare the nutrients with the fresh guava fruit/pulp. Table 3 shows the composition of the reconstitued guava beverage drink prepared from freshly dehydrated and one year stored sample of guava beverage base as well as that of fresh guava pulp. Our value of dry matter and pH for the fresh fruit juice was very close to that reported earlier [14], but the moisture content was slightly higher. The ash content is almost half of the reported values [14] while soluble pectin is within the range reported for common Indian varieties [15]. Compared to these values for the dehydrated/reconstitued drinks it was observed that various parameters are either similar or the differences are not appreciable. The arguments, advanced earlier for the changes in these constituents in freshly dehydrated and one year old smaple, hold equally well for the reconstitued guava beverage as well. The ash content of the reconstitued drink was found to be much less than the fresh fruit as was the pectin and tannins which apparently is due to dilution caused by addition of water while preparing the drink.

Table 4 shows a comparison of different nutrients supplied by the guava drink prepared from fresh and one year old dehydrated samples as well as the fresh guava pulp. The values for TSS and total acids of the fresh fruit were similar to that reported for Indian fruit [15]. The sugar content however, was on the higher side as compared to the reported one [16]. When we compare the nutrients of reconstitued beverage (drink) and the fresh guava we find that where there is only a small variation in TSS of different reconstitued samples, the reducing, non-reducing and total sugars in all samples show considerable increase over that of the fresh fruit pulp which is mainly due to the addition of cane sugar. The lower citric and ascorbic acid in the reconstitued guava drink as compared to the fresh guava pulp is understandable, as not only the dried guava beverage bases, from which the drinks were prepared, undergo losses in vit. C during dehydration but also during storage. The % concentration of titratable acidity (organic acid as citric) and vitamin C in the fresh fruit pulp/juice was intermediate of the reported values [15,16] for guava. Ascorbic acid content in the fruit is, however, known, to be a varietal characteristics [9] and the variation in this regard may be more than ten fold [17].

The ascorbic acid of the drink prepared from dehydrated guava beverage was obviously much lower than the fresh fruit Table 4. It, nevertheless, supplied a reasonable amount of vit. C which is more than enough for the prevention of scurvy [18]. Composition of one year stored sample showed that storage has adversely affected the ascorbic acid in the dry guava beverage base under our conditions (Table 4). Special measures, such as packing under anaeorbic and storage under controlled atmospheric conditions, could imporve the situation.

Minerals constituents as determined in fresh guava (edible portion) were found to be calcium 0.028%, magnesium 0.0340% phosphorous 0.0103°, sodium 0.0092% and potassium 0.454%.

Wide variations are to be found in the reported mineral constituents from different countries. Hardlicka has reported calcium content of 43 mg/100 gm [19] while Wills *et al.* found only 10 mg/100 gm of the mineral in Australian fruit [16]. Our values of 28mg/100gm, in this regard, are intermediary between these reported values. Similar variations are to be found in sodium and potassium contents also. Our values of potassium are lower but sodium is higher than that reported for the Indian fruit [20]. These variations are not altogether surprising since other constituents e.g. ascorbic acid, has been reported [20] to vary as much as ten fold in guava fruits from different areas which may possibly be due to variations in ecological conditions etc.

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References

1. D. M. Khedkar, K. W. Ansarwadkar, R. S. Dabhade and A. L. Ballal, Indian Fd. Packer, **36** (2), 49 (1982).
2. A. R. Mann and S. A. Tremazi, Pak. j. sci. ind. res., **19**, 8 (1967).
3. J. S. Pruthi, K. K. Mookerji and G. Lal, CFTRI Mysore, 47 (1960).
4. R. Ahmed (1961), Cited by A. R. Mann and S. A. Termazi, Pak. j. sci. ind. res., **19**, 11 (1967).
5. J. A. Ruck, Chemical Methods for Analysis of Fruits and Vegetable Products (Department of Agriculture Canada, 1963).
6. AOAC., *Official Methods of Analysis* (Washington DC, 1975), 12th ed.
7. M. J. Copley, V. F. Kaufman and C. L. Rasmussen, Fd. Technology, **10**, (12), 589 (1956).
8. Rita Singh, A. C. Kapoor and O. P. Gupta, Indian Fd. Packer, **37** (5), 71 (1983).
9. M. K. R. Siddiqui and M. A. Farooqui, J. Sci. Res., **11**, 29 (1959).
10. C. E. Wright, Fd. Engg., **24** (3), 141 (1952).
11. Geetha and H. B. Shivaleela, Indian Fd. Packer, **36** (2), 64 (1982).
12. M. Mishkin, I. Saguy, and M. Karel, Minimizing Ascorbic Acid Losses During Air Drying, CA 100 Abst. 190415t. (1984).
13. R. S. Dabhade and D. M. Khedkar, Indian Fd. Packer, **36** (2), 16 (1982).
14. A. Jabbar, M. R. Khan, N. A. Sufi and S. Iqbal, J. Sci. Tech., Univ. Peshawar, **12**, 45 (1988).
15. I. S. Singh and S. S. Dhawan, Indian Fd. Packer, **37** (3), 47 (1983).
16. A. H. Wills, T. S. K. Limand and H. Greenfield, Fd. Tech. Australia, **38** (3), 118 (1986).
17. A. Pollard and C. F. Timberlake *Biochemistry of Fruits and their Products*, edited by A. C. Hulme (Academic Press London, 1971), Vol. II, pp. 587.
18. L. W. Mapson *Biochemistry of Fruits and their Products* , edited by A. C. Hulme (Academic Press, London, 1971), Vol. I, pp. 372.
19. J. Hardlicka, Fd. Engg., **24** (3), 141 (1959).
20. M. B. Mehta and N. S. Dodd, J. Fd. Sci. Tech., **27** (2), 119 (1990).