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Fermented beverages from spices-a new nutraceutical drink

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Abstract

An investigation was carried out to develop herbal and spice beverages. Spices viz. black pepper, fennel, dill, coriander and cumin were used. The possibility of making spice wines more appropriately called as "Elixirs" was examined. The nutritive value in terms of chemical components and mineral composition and keeping quality of the product under ambient temperature were worked out. The cost economics was also calculated.

Key words: beverages, fermentation products, spices.

Introduction

Fruit beverages are important in human diet, as they are pleasant and satisfying. Because of their aesthetic and refreshing qualities, they are in greater demand. Many of the beverages available in the market attract the consumer mainly due to their colour and tactile sensations. However, most of the carbonated beverages are only thirst quenchers and do not provide nutrients. Besides, they are known to have many side effects. If at all, a few nutritious beverages are available; they are priced high and beyond the reach of common man. Thus, there is plenty of scope for development of low cost beverages of high nutritive value using locally available seed spices (Asha 1985).

The method of preparation of beverages either from fruits or seeds of spices is normally through decoction and infusion, wherein vitamins and volatile substances present in them are lost. Further, these may not be fully utilized by our body. However, fruits and seed spices can also be fermented along with sugar syrup, yeast and made into wines/elixirs. Fermentation adds the advantage of acid formation and removal of fermentable sugars, which prevents growth of pathogenic microorganisms and stabilizes the products. Alcohol thus produced is useful for our body build up and better absorption of minerals. In addition, fermentation offers the potential for flavour enhancement in the products and makes them even more tastier. Wines or fermented beverages not only provide calories but vitamin B complex as well, thus preventing beriberi and pellagra (nutritional deficiencies). They even contain small amounts of proteins and amino acids. Besides, the use of spices as fermented beverages may provide added medicinal or nutraceutical value (Steinkraus 1983).

Based on the nutraceutical value, several spices were used for preparation of fermented beverages. The present investigation was taken up with the objectives of developing spice wines, to analyze these processed products for their nutritive value, to study their shelf life as well as working out the cost economics of best accepted products.

Materials and methods

The present study was carried out during 2000-2001 at the Division of Horticulture, University of Agricultural Sciences, GKVK, Bangalore. The experiment consisted of five spices viz. fennel, black pepper, coriander, dill and cumin. The spices (1.75 g each) were cleaned, washed and surface dried using a vessel on a low flame. They were crushed lightly and added to a sugar syrup prepared by mixing 125 g sugar in 375 ml water. Inoculum was prepared using dry yeast and water (6 ml) and added to the mixture. Finally, the mixture was filled into bottles (500 ml) and plugged using cotton and the bottles were covered with polythene cover. The bottles filled with wines were left for fermentation for a period of 21 days with shaking on alternate days. The analysis was conducted at an interval of three weeks (3, 6 and 9 weeks of storage).

The various chemical parameters namely, total soluble solids measured in (° Brix), titratable acidity as acetic acid content and alcohol content were estimated. Reducing sugars, non-reducing sugars and total sugars were also estimated by Shaffer Somogyi micro method. Ascorbic acid content was estimated by titration method. Trace elements like copper, iron, zinc and manganese were estimated with the help of atomic absorption spectrophotometer. Later the samples were analyzed organoleptically. A panel of 15 judges evaluated the wine samples. The numerical scoring method suggested by Ough & Baker (1961) was adopted. The cost economics for the production of spice beverage was computed by taking into account the actual cost incurred for preparation which included the costs of all inputs and labour requirements. This was compared with the selling price of arishta (DKT Kashaya – M.R.P. Rs. 59.28 for 100 ml).

All the data were subjected to analysis of variance as suggested by Fisher (1960). The level of significance used in 'F' test and 't' test was at P = 0.05.

Results and discussion

The data on total soluble solids (TSS), titratable acidity, pH, brix acid ratio and ascorbic acid are given in Table 1. The total soluble solids can be related to the sugar content of the product but in these cases the contents are very less. Among the wines, black pepper wine had the highest total soluble solids (23.97 to 23.02°B) and lowest was in fennel (22.42 and 21.15°B) and dill (21.07°B) wines. There was a fall in TSS during storage, which may be due to the complete conversion of sugar to alcohol. Similar results were obtained by Kulkarni *et al.* (1980) in case of mango wine and it was also opined that mango pulp low in TSS was required to be ameliorated by adding cane sugar to raise TSS to 20°B for attaining a desired level of alcohol. Dill wine had the highest titratable acidity (1.35 to 1.39%) and lowest was in cumin (1.20 to 1.24%) and coriander (1.21 and 1.24%) wines. These findings are comparable with the investigations of Shukla & Revis (1985), where the total acidity in wines of different orange cultivars ranged from 0.68 to 0.96 per cent. Fennel wine had the maximum pH (2.91 to 3.12) and also dill wine (2.91-3.05) and minimum in black pepper wine (2.7 to 2.8). The increase in pH of the wine noticed may be due to the precipitation of acids during and after fermentation. It has been reported that potassium acid tartarate present in grapes as super saturated solution which is less soluble in alcoholic fermentation, increased the pH of the wine (Amerine *et al.* 1972). Cumin wine recorded higher brix acid ratio (17.62 to 19.05) and it was low in fennel (15.41 and 16.70) and dill (15.14-16.54) wines. The decrease in brix acid ratio may be due to the variation in total soluble solids and acidity. Coriander wine had significantly higher ascorbic acid (99.50 to 99.77 mg l^{-1}) and lower value was recorded in dill wine (74.52 to 74.8 mg l^{-1}). There was an increase in ascorbic acid content during storage.

Information on reducing, non reducing and total sugars and alcohol contents of the

beverages is presented in Table 2. Higher values for reducing sugars were recorded in fennel, black pepper and cumin wines and lower value was observed in dill and coriander wines. These results are in accordance with the results obtained by Karni & Shant (1984) for apple ciders that showed an increase in reducing sugar. Black pepper wine had significantly higher value (1.43 - 1.48%) of total sugars and it was low in cumin (1.33 - 1.42%) and fennel (1.39-1.43%) wines. Jacquinet *et al.* (1985) found that the seedless grape varieties produced best wines because of high amount of sugars coupled with low malic acid. Significantly higher amounts of non reducing sugars was recorded in black pepper wine and it was low in cumin and fennel wines. Coria-nder wine had significantly higher alcohol content (7.05 - 7.37%) and it was low in black pepper wine (5.07 - 5.60%). The increase in alcohol content was due to complete conversion of sugars to alcohol. The results obtained in this study are in conformity to that reported by several workers (Ough & Singleton, 1968; Ough & Alley 1970; Padshetty, 1978). Wines can have alcohol ranging from 5 to 20 per cent.

Table 1. Effect of storage on the quality parameters of the beverages

Weeks of storage / Beverage	TSS (°B)			Titratable acidity (%)			pH			Brix acid ratio			Ascorbic acid ratio		
	3	6	9	3	6	9	3	6	9	3	6	9	3	6	9
Fennel wine	22.42	21.82	21.15	1.34	1.35	1.37	2.91	3.01	3.12	16.70	16.14	15.41	83.42	83.50	83.62
Black pepper wine	23.97	23.25	23.02	1.31	1.33	1.35	2.70	2.76	2.80	18.28	17.49	17.06	91.27	91.40	91.52
Dill wine	22.32	22.10	21.07	1.35	1.37	1.39	2.91	2.95	3.05	16.54	16.16	15.14	74.52	74.62	74.80
Coriander wine	22.95	22.25	21.70	1.21	1.23	1.24	2.87	2.85	2.94	18.88	18.12	17.53	99.50	99.57	99.77
Cumin wine	22.95	22.15	22.00	1.20	1.23	1.24	2.90	2.97	3.01	19.05	18.26	17.62	83.3	83.42	83.52
S.Em±	0.31	0.34	0.29	0.018	0.019	0.019	0.017	0.019	0.019	0.35	0.33	0.28	0.19	0.18	0.17
C.D. at 5%	-	1.04	0.88	0.054	0.057	0.057	0.050	0.59	0.057	1.06	1.00	0.85	0.58	0.54	0.51

Mineral composition of the wines after fermentation are given in Table 3. Minerals estimated were copper, manganese, zinc and iron. An increase in content of these minerals was observed during storage.

Copper is an essential element for the formation of haemoglobin and its deficiency is known to cause anaemia. The daily requirement of copper is for adults (2 mg day^{-1}), expectant mothers (3 mg day^{-1}), nursing mothers (3 mg day^{-1}), children (2 mg day^{-1}) and adolescents (3 mg day^{-1}) (Swaminathan 1977). Cumin wine had a significantly higher copper content (8.02 to 8.05 ppm) and it was low in coriander wine (3.00 to 3.5 ppm). Similar analysis was conducted by Dikanovic *et al.* (1993) for estimation of copper content in croatian wines. Deficiency of manganese can cause impaired growth, skeletal abnormalities, depressed reproductive function and

ataxia of the new born (Swaminathan 1977). Black pepper wine had a significantly higher content of manganese (10.32 - 10.50 ppm) and lower value was noticed in fennel (8.19 - 9.15 ppm) and coriander (8.45 - 8.50 ppm) wines. Zinc deficiency is known to cause anaemia, growth retardation, and delayed maturation (dwarfism). There is high requirement of zinc for adults (15 mg day^{-1}), expectant and nursing mothers (20-25 mg day^{-1}) (Swaminathan 1977). Zinc content was high in fennel wine (21.20 - 22.11 ppm) and low in black pepper wine (15.19 - 17.12 ppm). Similar results have been reported in apricot, plum and pear wines (Bhutani 1989). Deficiency of iron may cause anaemia among children, adolescent girls and expectant and nursing mothers. Similarly iron too is required daily for children (25 mg day^{-1}), adolescent girls (35 mg day^{-1}), expectant mothers (40 mg day^{-1}) and nursing mothers (30 mg day^{-1}) (Swaminathan 1977). Fennel wine had the high iron content (29.09 - 29.77 ppm) and it was low in cumin (15.05 ppm) and coriander (16.04 and 16.05 to 18.09 ppm) wines. Dikanovic *et al.* (1993) recorded the iron content in croatian wines. It was reported that red wines had an iron content of 2.13 to 5.88 mg l^{-1} and white wines contained 1.54 to 4.45 mg l^{-1}.

Organoleptic evaluation of the wines is presented in Table 4. Dill wine had maximum score for appearance (1.00 out of 2.00), vin-

Table 2. Effect of storage on reducing, total, non-reducing sugars and alcohol content of the spice beverages

Beverage \ Weeks of storage	Reducing sugars (%)			Total sugars (%)			Non-reducing sugars (%)			Alcohol content (%)		
	3	6	9	3	6	9	3	6	9	3	6	9
Fennel wine	1.15	1.12	1.00	1.43	1.40	1.39	1.44	1.41	0.28	6.52	6.72	7.17
Black pepper wine	1.14	1.13	0.98	1.48	1.46	1.43	1.50	1.45	0.33	5.07	5.45	5.60
Dill wine	1.02	1.01	0.96	1.45	1.42	1.41	1.47	1.43	0.41	6.12	6.5	6.60
Coriander wine	1.11	0.98	0.94	1.45	1.42	1.41	1.47	1.44	0.44	7.05	7.22	7.37
Cumin wine	1.14	1.13	1.03	1.39	1.42	1.33	1.41	1.34	0.29	6.52	6.55	6.8
S.Em±	0.004	0.005	0.004	0.003	0.003	0.005	0.004	0.003	0.006	0.055	0.079	0.119
C.D. at 5%	0.011	0.014	0.012	0.011	0.008	0.014	0.012	0.10	0.017	0.165	0.238	0.36

Table 3. Mineral compositions of the spice beverages at different weeks of storage

Beverage \ Weeks of storage	Copper (ppm)			Manganese (ppm)			Zinc (ppm)			Iron (ppm)		
	3	6	9	3	6	9	3	6	9	3	6	9
Fennel wine	5.00	5.02	5.02	8.19	8.68	9.15	21.20	21.89	22.11	29.09	29.59	29.77
Black pepper wine	7.00	7.51	7.81	10.32	10.41	10.50	15.19	15.61	17.12	19.06	19.78	20.02
Dill wine	4.17	5.65	6.59	9.45	9.54	9.61	19.30	19.45	19.60	28.09	28.65	29.00
Coriander wine	3.00	3.33	3.50	8.45	8.50	8.50	16.15	17.22	18.29	16.05	16.04	16.05
Cumin wine	8.02	8.04	8.05	8.78	8.90	9.01	18.00	19.03	20.15	15.05	16.71	18.09
S.Em±	0.017	0.033	0.098	0.011	0.022	0.022	0.031	0.135	0.026	0.019	0.133	0.28
C.D. at 5%	0.053	0.010	0.294	0.033	0.067	0.067	0.094	0.408	0.077	0.056	0.401	0.859

Table 4. Mean scores of organoleptic evaluation of spice beverages

Beverage	Appear-ance	Colour	Aroma & bouquet	Vinegary	Total acidity	Sugar	Body	Flavour	Astrin-gency	General quality
Fennel wine	0.40	1.27	2.67	0.87	0.93	1.13	0.87	1.27	1.20	11.3
Black pepper wine	0.87	0.73	2.53	0.93	1.07	0.73	0.73	0.93	1.07	8.7
Dill wine	1.00	1.13	2.4	1.13	1.00	1.13	1.00	1.27	1.20	12.0
Coriander wine	0.87	1.47	2.73	0.73	0.6	1.00	0.93	1.33	1.40	12.0
Cumin wine	0.53	0.67	2.73	0.93	0.73	0.53	0.87	1.07	1.13	9.3

Note: Scores are out of 2.00 for all characters except for aroma & bouquet which is out of 4.00.

Table 5. Cost economics of best accepted products per 100 ml

Material	Quantity	Cost of	
		Dill wine (Rs.)	Coriander wine (Rs.)
Seeds	1 g	1.00	0.50
Sugar	33 g	0.50	0.50
Yeast	1.6 ml	0.50	0.50
Bottle	1 (No.)	0.50	0.50
Cotton	1 (plug)	1.00	1.00
Polythene bag	1 (No.)	0.50	0.50
Rubber band	1 (No.)	0.50	0.50
Labour for cleaning, stirring	1 (30 min.)	8.00	8.00
Total		12.50	12.00

egary (1.13 out of 2.00), sweetness (1.13 out of 2.00), body (1.00 out of 2.00) and general quality (12.00 out of 20.00). Coriander wine had highest score for colour (1.47 out of 2.00), aroma and bouquet (2.73 out of 4.00), flavour (1.33 out of 2.00), astringency (1.4 out of 2.0) and general quality (12.0 out of 20.00). In addition, cumin wine recorded highest score for aroma and bouquet (2.73 out of 4.00). These results are in agreement with Kulkarni *et al.* (1980) indicating that Fazli variety had the highest rank (14.2 out of 20.00) for general quality.

The cost incurred was Rs. 12.50 per 100 ml of dill wine and Rs. 12.05 per 100 ml of coriander wine (Table 5). If we compare this with arishta (DKT kashaya M.R.P. Rs. 57.28 per 100 ml), the rates of these fermented spice beverages were more economical.

From the present study it is clear that these wines can be very well prepared at homes. The cost economics shows that it is a low cost beverage with the added advantage of having good quantities of vitamin C and seve-ral minerals essential for the body build up.

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