Asian J. Dairy & Food Res., **32** (4) : 318-322, 2013

AGRICULTURAL RESEARCH COMMUNICATION CENTRE
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OPTIMIZATION OF INGREDIENTS FOR A HERBAL BEVERAGE WITH MEDICINAL ATTRIBUTES

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Received: 03-01-2013 Accepted: 24-10-2013

ABSTRACT

Health oriented individuals are turning to medicinal or herbal preparations as alternative to caffeinated beverages. An organoleptically acceptable arjuna-ginger medicinal mix blended with natural colour (safflower florets) and sweetener (stevia leaves) was developed. Medicinal mix was optimized at 14.64% stevia leaves, 27.45% ginger shreds, 45.73% arjuna bark and 12.18% safflower petals. About 1.64 g of this formulation is appropriate to make 100 ml of hot beverage. The mix contained 9.99-10.54% protein, 20.04-20.53% ash, 42.30-45.39% carbohydrates, 54.0-71.5 mg P, 147-242 mg S, 167-208 mg Ca, 75.7-77.8 mg Mg, 17.9-21.9 mg Fe, 0.7-1.1 mg Cu, 0.48-0.7 mg Zn, 5.7-7.9 mg Mn, 0.1 to 1.0 ^{0}Brix TSS, 0.006 to 0.011% titrable acidity and 35.6-37.6 mg ascorbic acid per 100g of herbal mix. Bright, sparkling and clear infusion of orangish brown colour with pleasant strong aroma and taste was obtained from optimized medicinal formulation. Microbial quality of the product packed in aluminum foil bag was well up to 3 months storage at ambient temperature.

Key words: Arjuna (*Terminalia arjuna*), Beverage mix, Ginger (*Zingiber officinale*), Safflower (*Carthamus tinctorius*), Stevia (*Stevia rebaudiana*)

INTRODUCTION

Herbal infusions are prepared by combining hot water with fruits, leaves, flowers, bark, roots. The extraction of herbs with hot water is an ancient tradition. These herbal Infusions are more readily absorbed into the system and known to cure various ailments. Tea decoctions are popular because of their fragrance, antioxidant properties, therapeutic applications, stimulant, relaxant or sedative properties and generally thought to posses natural health promoting qualities.

Bark of Arjuna (*Terminalia arjuna*) is sweet, cooling, anti dysenteric, useful in fracture, ulcers, blood diseases, intoxications, urinary discharges, coughs, heart diseases, anemia, excessive perspiration, asthma, tumors, and fatigue. Arjuna bark powder contains arjunone, arjunolone, leteilin, gallic acid, ellagic acid, phytosterols, and minerals like calcium, magnesium, zinc and copper. Arjuna enhances the removal of cholesterol by accelerating the conversion of LDL cholesterol in the liver.

Ginger(*Zingiber officinale)* consumed as a delicacy, medicine or spice. Ginger has a sialagogue action, stimulating the production of saliva, which makes swallowing easier. Other constituents in ginger, gingerols and shogaols, help relieve cold symptoms because they reduce pain and fever, suppress coughing and have a mild sedative effect. The gingerols increase the motility of the gastrointestinal tract and have analgesic, antipyretic and antibacterial properties, (O hara *et al* 1998). The chemo preventive potentials of [6]-gingerol present a promising future alternative to expensive and toxic therapeutic agents (Oyagbemi *et al* 2010).

The safflower (*Carthamus tinctorius*) is widely grown in India. Safflower produces brightly colored flowers (a source of natural color for food) and also has many pharmaceutical properties. Dried safflower flowers are used for treatment of coronary heart disease, hypertension, respiratory diseases, renal thrombosis, gynecological diseases such as male sterility, female infertility (Sarojini *et al* 1995).

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It is useful for treatment of cerebral thrombosis and embolism (Zhang, 1996). Quercetin (flavonoid) present in safflower is antioxidative and reduces the inflammation resulting from bursitis, gout, and arthritis. Interest in safflower as a source of color for use in food is gaining importance owning to the ban on the use of synthetic colors in foods.

Stevia adds sweet taste that is similar to that of sucrose without calories. The sweetening nature of stevia leaves is due to stevioside and rebaudioside which are about 250-300 times sweeter than sugar (Tateo & Sanchez 1999). It does not alter blood sugar levels and used in countering dental caries. Extracts of stevia leaves have been found to have cardiotonic, hypotonic and hypoglycemic properties. The herb is nutrient rich, containing substantial amount of protein, calcium, phosphorus as well as sodium, magnesium, zinc and vitamin A and C.

The long term use of stevia caused no harm and showed beneficial effects in obese or diabetic laboratory animals (Lisitsin and Kovalev 2000). Smirnova (2001) reported that stevioside is nontoxic natural sweetener with high sweetness, good solubility and low energy value. Barathi (2003) discussed the uses of stevioside, in bakery, soft drinks, beverage sector, and its household and medicinal uses. Herbal tea based on dried stevia leaves has been developed by the Russian company Lis-V (Lisitsin and Kovalev 2000). Looking to the diversified benefits and medicinal value of all these herbs, the present study was conducted on organoleptic quality, nutrient composition, physico-chemical and shelf life of herbal mix.

MATERIALS AND METHODS

Arjuna bark and fresh ginger were obtained from Medicinal and Herbal Garden, Jawaharlal Nehru Krishi Vishva Vidyalaya, Jabalpur. Ginger were cleaned, peeled, shredded and shade dried. Dried stevia leaves and safflower florets were obtained from department of Plant Breeding and Genetics, College of Agriculture, Indore, (MP).The herbal mixes were added in freshly boiled water, covered and kept for 7 min, strained and served to sensory panelists. The infusions were served to a panel of 20 semi trained judges to evaluate appearance, colour, taste, flavour, brightness and strength by using 9-point hedonic scale (Amerine *et al* 1965). Finally four formulations i.e. F_1, F_2, F_3 and F_4 were tried using 18.29, 21.35, 24.39 and 27.45% dried ginger shreds and 21.34, 18.28, 15.24 and 12.18% safflower florets respectively. The amount of stevia (14.64%) and arjuna bark (45.73%) were kept constant in all formulations.

The herbal formulations were analysed for moisture, ash, fat and protein (AOAC 1995), carbohydrate by acid hydrolysis process of Hassid and Abraham (1973), ascorbic acid by method of Ranganna (1979) and Titrable acidity (AOAC 1970). Total Soluble Solids (TSS) were measured by using hand refractometer of 0-32^0 Brix range. Ca and Mg were determined by varsenate titration method of Black (1965), S content by method of Bardslay and Lancaster (1965) and P content by vanadomolybdate method of Koenig and Johnson (1942). The micronutrients Fe, Cu, Zn and Mn were determined by atomic absorption spectroscopy (Yarian Techtron Model aa-120 Australia).

The samples were packed in LDPE (50 guage), HDPE (100 guage) and aluminum foil bags for storage studies for 3 months at ambient temperature (28 ± 2 ^{0}C, RH 80 ± 5%). The samples were analysed periodically for total plate count (Aneja 1996). All the experiments were carried out in triplicate. Data were analysed statistically using analysis of variance (ANOVA) and differences among the means were determined for significance at $p< 0.05$ using Duncan's multiple range test (Steel *et al* 1997).

RESULTS AND DISCUSSION

In the primary sensory evaluation test, the panelists judged the formulation containing 12-15% dried stevia leaves, 12-22% Safflower florets, 42-46% arjuna bark and 18-28% ginger as acceptable in terms of colour, flavour and sweetness. They found that incorporation of higher amount of stevia in the infusions adversely affected the taste and aroma of the final product .The addition of ginger powder and ground arjuna bark created the problem during preparation of herbal infusion by developing turbidity and therefore adversely affected the quality of the infusion. The panel members observed that the dried ginger shreds and small pieces of arjuna bark are suitable for texture and colour of herbal infusion.

The optimum levels of all herbs were finalized by further sensory analysis of infusions (Table 1). The formulation F_4 was the most optimum. Its herbal

TABLE 1: Sensory Quality attributes of different medicinal infusions.

	F_1	F_2	F_3	F_4	SEm	CD at 5%
Sensory Quality (n= 20)						
Appearance	7.60	7.60	7.70	7.80	0.06	NS
Brightness	8.00	8.00	8.00	8.00	0.058	NS
Taste	7.50	7.70	7.90	8.20	0.06	0.19
FlavorColourStrengh	7.40LBMT	7.60LBMT	7.70BST	8.00OBST	0.29–	NS–

B- Brown, OB- Orangish Brown, LB- Light Brown, MT-Mild , ST-Strong F_1-F_4 - As in text.TABLE: 2. - Chemical parameters of different medicinal formulations.Chemical parameters (n= 3) F1 F2 F3 F4 SEm CD at 5%

infusion exhibited orangish brown colour with strong flavour and pungent taste. Panelists designated it as a strong infusion. All the infusions were smooth, clear with distinct glow in it. An appropriate amount (27.45%) of dried ginger shreds enhanced the pleasant aroma of the infusion. The characteristic odor and flavor of ginger is caused by a mixture ofzingerone,shogaolsandgingerols.Volatileoil[6]-gingerol (1-[4'-hydroxy-3'-methoxyphenyl]-5-hydroxy-3-decanone) is the major pungent principle of ginger. Ginger contains up to three percent of a fragrant essential oil whose main constituents aresesquiterpenoidswithzingibereneasthemain component. The pungent taste of ginger is also due tononvolatilephenylpropanoidderivedcompounds particularlygingerolsandshogaols,whengingeris dried or cooked. Zingerone is also produced from gingerols during this process. This compound is less pungent and has a spicy-sweet aroma (Mc Gee, 2004). Arjuna bark gives a triterpine glycosides like arjunetosides I, II, III, IV, arjunine and arjunetein (Bhatia *et al.* 1977). The scores for brightness and strength of the infusion showed no perceivable variation between the formulations.

The best formulation (F_4) was optimized with 14.64% stevia leaves, 27.45% ginger shreds, 45.73% arjuna bark and 12.18% safflower petals. It is recommended that 1.64 g of this formulation is appropriate to make 100 ml of the beverage. Savita *et al* (2004) also standardized the quantity of stevia for tea as small as 0.2 to 1.0 g which is in accordance with the present findings.

Satwadhar and Nandane (2003) and NARI (2005) reported that safflower petal combined with other herbs produced good quality safflower tea. The presence of water soluble yellow carotenoids , "saffor yellow" A and B provide the desirable colour to the herbal tea infusions as suggested by Takahashi (1982).

The carbohydrate, crude fiber, sulphur, manganese and phosphorus content increased with incorporation of dried ginger at higher levels in formulations (Table 2). Similarly stevia and arjuna bark also contain good amount of carbohydrate and

TABLE 2: Chemical parameters of different medicinal formulations.

Chemical parameters (n= 3)	F1	F2	F3	F4	SEm	CD at 5%
Moisture %	8.29	8.60	8.57	8.57	0.58	NS
Protein %	10.54	10.35	10.17	9.99	0.58	NS
Fat %	3.49	3.36	3.25	3.14	0.58	NS
Carbohydrate %	42.30	43.36	44.92	45.39	0.58	1.88
Ash %	20.53	20.37	20.21	20.04	0.58	NS
Crude fiber %	10.70	10.88	11.06	11.24	0.58	NS
P mg/100g	54.05	59.45	65.17	71.58	0.58	1.88
Ca mg/100g	208	194	181	167	0.58	1.88
Mg mg/100g	77.82	77.12	76.42	75.72	0.58	NS
S mg/100g	147	183	208	242	0.58	1.88
Zn mg/100g	0.70	0.62	0.55	0.48	0.005	0.02
Cu mg/100g	1.09	0.96	0.83	0.70	0.29	NS
Fe mg/100g	21.92	20.57	19.23	17.90	0.58	1.88
Mn mg/100g	5.77	6.45	7.12	7.90	0.58	NS
TSS^{0}Brix	0.1	1.0	1.0	0.9		
Titrable acidity %	0.006	0.011	0.010	0.010		
Ascorbic acid mg/100g	37.64	36.96	36.45	35.66		

NS-Not significant, F_1-F_4 - As in text

fibers. These results are in line with the findings reported by Genus (2000) and Savita *et al* (2004). Whereas decline in other macro and micro nutrients may be attributed to lower concentration of safflower florets incorporated. These findings are in agreement with the results of NARI (2005). TSS 0.1 to 1.0 ^{0}Brix, titrable acidity 0.006 to 0.011% and ascorbic acid 35.66 to 37.64 mg/100g was observed in all the formulations .The concentration of ginger and safflower did not affect these parameters appreciably. This may be due to lower amount of blend used for the preparation of infusions.

The total viable count of all formulations increased with increase in storage period in all packaging materials (Table 3). Uptake of moisture from atmosphere having high humidity also adversely affected the microbial quality of herbal formulation. Least microbial population (34-38 x 10^5 cfu/g) was noted in the formulation packed in aluminum foil bags on 90th day of storage. The reason may be due to low water vapor transmission rate of aluminum foil.

TABLE 3: Total viable count (10^5cfu/g) of medicinal formulation (F_4) during storage.

Storage Days	Packaging Materials		
	LDPE	HDPE	Aluminum Foil
0 day	27-32	27-32	27-32
45 day	39-44	33-37	28-32
90 day	50-55	45-49	34-38

CONCLUSION

Arjuna , ginger, stevia and safflower are useful herbs with medicinal benefits. An acceptable herbal infusion of orangish brown colour with pleasant strong aroma and taste was obtained from optimized formulation containing 14.64% dried stevia leaves, 27.45% dried ginger shreds, 45.73% arjuna bark and 12.18% safflower florets. Aluminum foil bags were more suitable for packaging herbal formulations than LDPE and HDPE at ambient temperature. The herbal mix is expected to provide a refreshing drink with sweet taste and minimal calories for those who have to restrict sugar in their diet.

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