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Combating Micronutrient Deficiencies through Value Added Foods Using Underutilized Greens

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Abstract

Iron deficiency anaemia along with vitamin A deficiency continuously posing a significant challenge to public health all over India. Iron and β-carotene rich value added foods were developed to combat anaemia. Six *Prash* combinations were developed by using amla, fresh cauliflower leaves and cauliflower leaf powder, extracts of ginger, mint, lemon, mishri, spices and honey. Sensory evaluation revealed that *ginger prash* had the highest overall acceptability scores (8.7) while *amla prash* IV had the minimum scores as 7.2. Nutritionally energy and protein content ranged from 259 to 322 kcals and 2.7 to 6.1 % in fresh weight basis in various formulations. These were good source of calcium and iron ranging from 215 and 7.7 mg (*amla prash* I) to 413 and 20.1 (*mint prash*). Ascorbic acid ranged from 17.2 mg in *ginger prash* to 69.3 in *amla prash* IV. *Amla prash* I had the minimum b- carotene as 1551 µg where as *mint prash* had maximum value as 3359 µg. Taking 30 g as per day serving these formulated health foods can contribute 64.6 to 124.0 mg of calcium, 2.31 to 6.04 mg of iron, 5.12 to 20.80 mg of vitamin C and 465 to 1009 ìg of b-carotene in adult woman's diet.

Keywords: Value added foods, *Prash*, β-carotene, Sensory evaluation, Nutritional evaluation

Introduction

In India, the consumption of green leafy vegetables is very low and is much less than the recommended allowances. Therefore, majority of Indians do not get sufficient vitamins and minerals present in leafy vegetables. Iron and vitamin A deficiencies are two major nutritional health problems affecting vulnerable groups of population in many developing countries. Anaemia is estimated to affect 3.5 billion individuals in developing world and more than 320 million people in India with highest prevalence among women and children, 40-80% pregnant women, 60-70% children and 50% of adolescent girls (Devadas, 2001).

There are approximately 720 million preschool children with vitamin A deficiency and out of this 4.4 million have xeropthalmia (WHO, 2001). Vitamin A deficiency affects many tissues in the body; the most dramatic changes are seen in the eyes resulting in tragic consequences of total loss of vision in the early life. UNICEF (2004) estimates that VAD is public health concern in 72 countries in Asia and Africa and is known to cause blindness.

Average consumption of iron is 50% of RDA (ICMR, 2001). The bioavailability of dietary iron depends on quality of heam and non-heam iron in the diet and also on the balance between absorption enhancers and inhibitors which affect the absorption of non-heam iron. Ascorbic acid is a potent enhancer of non-heam iron absorption that can overcome the inhibiting effect of phytic acid which decreases bioavailability of iron (Davidsson, 2003).

It has been emphasized that most

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appropriate and sustainable approach for correcting nutritional deficiencies is the dietary improvement through a better choice of foods, improved quality and greater variety (Scrimshaw,1994). The diverse agro-climatic conditions never blessed India with vast resources of greeneries, many of which are still under exploited whose nutrient potential have not yet been adequately studied.

Cauliflower leaves which are generally thrown away as waste are rich source of iron and b-carotene and can significantly contribute these nutrients to the diet. Kumar and Bhavani (2004) reported that anaemia can be prevented and blood haemoglobin levels can be successfully elevated in adolescent girls by incorporating cauliflower leaves in their dietaries.

Amla (*phyllanthus emblica*) commonly called Indian gooseberry is one of the indigenous fruit of India which is grown on a wide range of soils demanding little attention. The fruit is valued for its high ascorbic acid content (600-700 mg/100g) and its therapeutic uses. The fruit because of its high acidity and astringent taste is not palatable for direct consumption. Its excellent nutritional and therapeutic values offer enormous potentiality for its processing. It needs to be processed to make it palatable and available through out the year. It is commonly used in the preparation of chawan prash. The retention of ascorbic acid after heating and storage varies between 12-26%. Keeping in view the importance of nutrification of recipes, the present study was conducted to develop cheap and nutritious recipes mainly from amla pulp, dried cauliflower green powder and cauliflower green pulp providing significant amount of b-carotene, vitamin C and iron which help in reducing micronutrient deficiencies.

Materials and Methods

Value added foods were developed using locally available food combinations of amla (*phyllanthus emblica*), fresh cauliflower leaves (*Brassica oleracea*) and dry cauliflower leaf powder, ginger (*Zinziber officinale*) and mint (*Menta spicata*). The bulk samples of cauliflower leaves and amlas were procured from Vegetables department of Punjab Agricultural University, Ludhiana, Punjab. Various combinations of "*prash*" were developed using amla pulp, cauliflower green pulp, cauliflower leaf powder, ginger and mint extract as described below.

(Amla Prash (I to IV)

Ingredients: *Amla* pulp 100g , *Mishri* 110g , Cauliflower Leaf Powder (CLP) 7.5/10/12.5/ 15 g, Honey 5 g, Cinnamon, Clove, Cardamom 1g (each).

Method: Steam *amla* for 3-4 minutes. After cooling deseed the *amlas*. Mash *amlas* to form pulp. Add *mishri* (big crystalline sugar) and cook on the fire. When whole of the moisture is removed and *prash* is having thick consistency add cauliflower leaf powder (at different levels) and spices. Mix well .Remove from fire and mix honey and store in sterilized bottles.

Ginger/Mint Prash

Ingredients: Cauliflower green pulp 100 g, Jaggery 100 g, Lemon juice 7 ml, Honey 5 g, ginger extract 2 ml/mint extract 5 ml.

Method: Boil cauliflower green leaves. Blend these in a blender. Sieve it to remove fiber. Add jaggery in the pulp and heat by stirring. When it attains jam consistency add ginger extract/ mint extract and honey. Store in sterilized bottles.

Sensory Evaluation: Products were sensory evaluated thrice by a panel of 12 judges selected at random from the faculty of Food and Nutrition department, College of Home Science, Punjab Agricultural University, Ludhiana. The products were evaluated using 9 point hedonic scale for appearance, colour, texture, flavor, taste, and overall acceptability (Rangana, 1986).

Chemical Analysis: Three identical preparations of each food used for sensory

evaluations were pooled together into one sample, homogenized and nutritionally evaluated.

Developed health foods were nutritionally analyzed in triplicates for proximate composition, iron and calcium (AOAC, 1990), B-carotene (Rao, 1967) and ascorbic acid (AOVC, 1996). Total carbohydrates contents were calculated by difference and energy content was calculated by factorial method AOAC (1990).

Statistical Analysis: Statistical analysis of the data was done using analysis of variance using standard methods of analysis (Snedecor and Cochran, 1967). Critical differences (CD) at P<0.05 were also estimated.

Results and Discussion

The results of organoleptic characteristics of developed value added foods have been presented in Table 1.

The scores for colour of developed products varied from 8.1±0.96 in *amla prash* IV to 8.9±0.49 in ginger *prash* indicating non-significant differences among the colour of various formulations. Health foods when evaluated in terms of texture, ginger *prash* got the best scores as 8.4±0.61 followed by mint *prash* and *amla prash* I each as 8.3±0.47 while *amla prash* IV was found to have least scores as 6.7±0.68. *Amla prash* III and *amla prash* IV had statistically lower scores for their texture as compared to ginger, mint and *amla prash* I developed as iron rich health food. The scores for flavor ranged from 6.6±0.8 being minimum in *amla prash* IV to 8.5±0.49 as maximum in ginger *prash*. When statistically analyzed, it was found that *amla prash* IV obtained significantly (P<0.05) lower scores for flavour as compared to other developed foods. Regarding appearance no significant difference was observed among the scores of ginger, mint, *amla prash* I and *amla prash* II whereas *amla prash* III and IV obtained significantly lower scores when compared with above said formulations. Sensory evaluation for taste revealed that ginger *prash* obtained maximum scores as 8.5±0.49 followed by *amla prash* I as 8.4±0.69 and mint *prash* as 8.3±0.59. *Amla prash* IV obtained least scores for taste as 7.3±0.69. Least scores were due to the highest level of supplementation of CLP as 15%. Keeping in view the above mentioned individual parameters ginger *prash* had the highest overall acceptability scores as 8.7±0.49 followed by *amla prash* I as 8.6±0.49 and mint *prash* 8.5±0.49. When statistically analyzed *amla prash* III and *amla prash* IV had significantly (pd”0.05) lower

Table 1: Sensory Evaluation of Iron Rich Health Foods

Name of the product	Colour	Texture	Flavour	Appearance	Taste	Doneness	Overall acceptability
***Amla prash* I**	8.6 ± 0.8	8.3 ± 0.92	8.0 ± 0.63	8.4 ± 0.81	8.4 ± .69	8.5 ± 0.62	8.6 ± 0.49
***Amla prash* II**	8.5 ±0.81	8.1 ±0.62	8.1 ±0.77	8.5 ±0.81	8.2 ±0.54	8.3 ±0.68	8.3 ±0.69
***Amla prash* III**	8.3 ±0.94	7.2 ±1.64	7.5 ±1.02	7.7 ±0.69	7.8 ±0.98	7.3 ±0.77	7.7 ±0.59
***Amla prash* IV**	8.1 ±0.96	6.7 ±0.68	6.6 ±0.8	6.5 ±0.81	7.3 ±0.69	7.1 ±0.77	7.2 ±0.75
Ginger *prash*	8.9 ±0.49	8.4 ±0.61	8.5 ±0.49	8.6 ±0.49	8.5 ±0.49	8.7 ±0.47	8.7 ±0.44
Mint *prash*	8.6 ±0.71	8.3 ±0.47	8.2 ±0.65	8.3 ±0.44	8.3 ±0.59	8.4 ±0.61	8.5 ±0.49
CD (5%)	NS	0.633	0.796	0.856	0.693	0.508	0.587
F-Ratio	1.61	11.91	6.92	8.92	4.07	16.71	9.84