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Mulberry Leaf Based Chapathi Mix : A Value Added Product

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ABSTRACT

In the present fast growing rapidly changing global society, attaining good health has become a challenge for all age groups. Now a day's consumption of food made from the leaves has increased and few are considered as wastes, but they are actually beneficial for health. The study was conducted to utilize mulberry leaves in different form through value-addition, thus reducing the wastage and providing inexpensive, healthy product. Mulberry leaves contain a good amount of high protein, vitamin C, beta-carotene and calcium. It can be easily grown in different parts of India and hence can help to meet the recommended dietary allowance of various micronutrients and improve the health status of vulnerable groups. Four variations of mulberry leaves masala biscuits were developed using mulberry leaves in different proportions *viz.,* 2.5, 5, 7.5, 10 per cent in preparation of Chapathi mix with other commonly used ingredients. The acceptability of four variations of developed mulberry leaves powder were studied by evaluating different organoleptic characteristics by 21 semi trained panel members. Mulberry leaves powder chutney with proportion of 5 per cent secured highest acceptability scores and the same is subjected for nutrient and cost analysis.

Keywords: Mulberry leaves, Chapathi mix, Organoleptic evaluation, Nutrient analysis, Cost analysis

OVER the years, medicinal plants have been found useful in the treatment and management of various health problems. About 80 per cent of the world population relies on the use of traditional medicine, which is predominantly based on plant material (WHO, 1993). The genus *Morus* comprised with approximately 16 members of family Moraceae, occurring primarily in northern temperate regions with some extending into tropical areas of Africa and the South American Andes. There are 11 species distributed widely in China. Genus *Morus* (Mulberry) is one of such example that consists of over 150 species, among these, *M. alba* L. is dominant. It is used as foliage to feed the silkworms (*Bombyx mori* L.) and ruminants.

Plant Description

The plant is usually a monoecious shrub or a medium sized tree with a cylindrical stem and rough, brown, vertically fissured bark. Leaves are variable in size and shape, usually 5 to 7.5 cm long, often deeply lobed, margins serrate or crenate-serrate, apex acute or shortly acuminate, base cordate or truncate; 3 basal nerves, lateral nerves forked near the margins. Flowers are inconspicuous and greenish: male spikes (catkins) are broad, cylindrical or ovoid, female spikes are ovoid and stalked. Fruit (syncarp) consists of many drupes enclosed in a fleshy perianth, ovoid or sub-globose, up to 5 cm long, white to pinkish white, purple or black when ripe (Anonymous, 2001).

Reported Phyto-Constituents

The leaves are a good source of ascorbic acid, with 2 to 3 mg/g, of which over 90 per cent is present in the reduced form. They contain carotene, vitamin B1, folic acid, folinic acid, and vitamin D. Volatile constituents identified in steam-distillates of the leaves are n-butanol, betagamma-hexenol, methyl-ethyl acetaldehyde, n-butylaldehyde, isobutylaldehyde, valeraldehyde, hexaldehyde, alpha-beta-hexenal, methyl-ethyl ketone, methyl-hexyl ketone, butylamine and acetic, propionic and isobutyric acids. The leaves also contain calcium malate, succinic, and tartaric acids, xanthophyll and isoquercitrin (quercetin 3-glucoside) and tannins (Anonymous, 2001).

New polyhydroxylated alkaloids, (2R,3R,4R) -2-hydroxymethy l-3, 4-dihydroxy-pyrrolidine-N-propionamide from the root bark of *M. alba* L. and 4-O-α-Dgalactopyranosyl-calystegine B2 and 3β, 6β- dihydroxynortropane from the fruits were isolated by column chromatography using a variety of ion-exchange resins. Fifteen other polyhydroxylated alkaloids were also isolated. 1-deoxynojirimycin (DNJ), a polyhydroxylated piperidine alkaloid present in both leaves and bark is known to be one of the most potent α-glycosidase inhibitors.

A new glycoprotein was purified from the aqueous methanolic extract of the root bark of *M. alba* which has been used as a component of antidiabetic remedy in Oriental medicine. This new glycoprotein was named as Moran 20K. Mulberrofuran G and albanol B were isolated from the root bark of *M. alba* L. (Moraceae). The purity of isolated compounds evaluated by reversed-phase high-performance liquid chromatography (HPLC) was above 95 per cent (w/w) and the structure of prenylated flavonoids used in the study was identified by spectral data analysis.

Methodology

Four variations of mulberry leaves masala biscuit and one control without mulberry leaf Chapathi mix were developed by using mulberry leaves powder, wheat flour, dried carrot, dried onion and dried chilli, salt. Developed variations of mulberry leaves Chapathi mix were evaluated for organoleptic characteristics.

Preparation of Mulberry Leaves Powder

The collected medium matured mulberry leaves were manually separated and the leaves were washed in tap water to remove extraneous matter. Fresh leaves were boiled for 5 minutes at 80 °C where blanching is done to inhibit enzyme activity and then dried in tray drier at 60 ± 5 °C for 3 hours.

Development of Mulberry Leaves Chapathi Mix

Four variations of mulberry leaves Chapathi mix was prepared using dried mulberry leaves powder (2.5, 5, 7.5 and 5 per cent) (Table 1).

Table 1

Ingredients used for Chapathi mix preparation

Ingredients (g)	I	II	III	IV	Control
Wheat flour	16.63	16	15.38	14.75	17.25
Mulberry leaves (%)	2.5	5	7.5	10	-
Dried Onion	4	4	4	4	4
Dried carrot	2	2	2	2	2
Dried Chilli	0.75	0.75	0.75	0.75	0.75
Salt	1	1	1	1	1

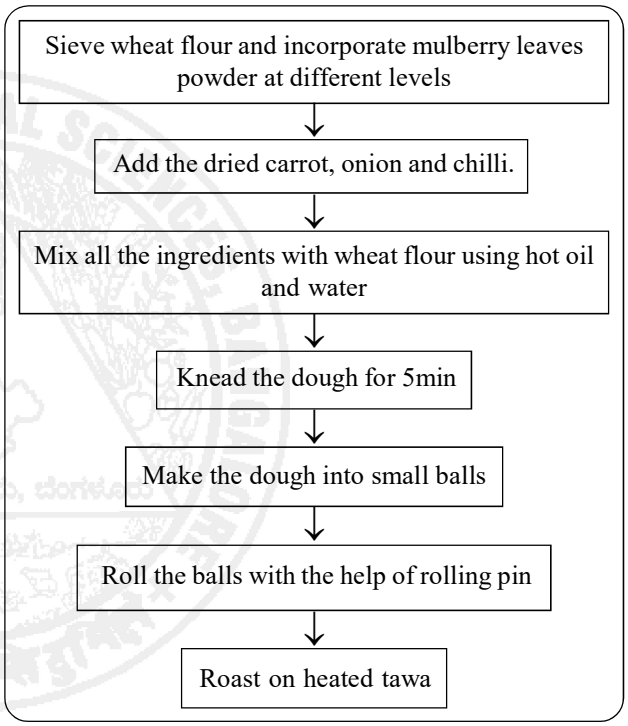

Fig. 1: Preparation of Chapathi mix

Nutrient Analysis

The nutrient content of highly accepted variation of mulberry leaves Chapathi mix was analysed. Moisture free sample was used for analysis. The proximate composition (moisture, total protein, fat, fibre and total minerals) was carried out as per procedures prescribed by A.O.A.C. (1980). Carbohydrate content was calculated by difference method. Calcium was estimated by EDTA method. Trace elements (iron, copper, zinc and magnesium) were estimated by Atomic Absorption Spectrophotometer (Perkin R Elmer Model - 3110). The values for all

nutrients were averages of triplicate value on dry weight basis.

The data of acceptability of developed four variations of mulberry leaves Chapathi mix were statistically analysed by one-way analysis of variance and 'F' values were calculated to find out the difference among the developed variations of herbal composite.

Results and Discussion

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads:

Sensory Evaluation of Mulberry Leaves Chapathi mix (MLCM)

Four variations of Chapathi mix were prepared by incorporating dried mulberry leaves powder at 2.5, 5, 7.5 and 10 per cent, respectively and compared with control without dehydrated mulberry leaf powder. Sensory evaluation was carried out by using 9 point hedonic scale by 21 semi trained panellists. The sensory score for mulberry leaves Chapathi mix ranged from 6.5 to 7.5 for appearance, 7.5 to 8 for colour, 7.5 for texture, 7 to 8 for flavour, 7 to 8 for taste and 7.00 to 8.00 for overall acceptability.

The mulberry leaf Chapathi mix at 5 per cent had highest scores for all sensory attributes such as appearance (8.00), colour (8.00), flavour (8.00) and overall acceptability (7.5), texture (8.00) and taste (8.00) (Table 1).

The mulberry leaf Chapathi mix at 5 per cent level scored same as the control (with no mulberry leaf incorporation) for colour, flavour and taste.

The control with no mulberry leaf incorporation found best for overall acceptability with mean score 8 followed by mulberry leaf Chapathi mix at 5 per cent with the mean score of 7.5.

Shanthala and Prakash (2005) carried out studies to know the possibility of incorporating dried curry leaf powder (CLP) at 5 or 10 per cent level to common dishes to increase the intake of greens as a source of micronutrients. Dried curry leaf powder (CLP) was incorporated into Chapathi as a source of micronutrients and acceptability of the products evaluated by 53 panel members who responded to the initial survey. The addition of CLP affected the appearance and colour of the products. At the lower level (5 per cent) of incorporation, the odour, taste and texture of Chapathi were not affected. The spice mixture with CLP was highly accepted by the panel members. There were no differences in taste or texture of the Chapathi. At the 10 per cent level of CLP incorporation in Chapathi, significant differences were observed in all of the attributes assessed. The incorporation of small amounts of CLP into the Chapathi influences the colour and appearance more than its other attributes. The respondents expressed willingness to use CLP-incorporated products in their diet for health reasons.

Kadam *et al.* (2012) reported that Chapathi which was prepared using different blends of composite flour *i.e.,* A- wheat flour: chickpea flour (80:20), B - wheat flour: full fat soy flour (90:10), C - wheat flour: chickpea flour: soy flour (80: 10: 10) and D - wheat flour: chickpea flour: soy flour: Methi leaves powder (75:10:10:05) were acceptable. The 5 per cent supplementation of methi powder was best acceptable in nutritional point of view and increased the nutritional quality of flour particularly in minerals (Ca and Fe) and fibres. All these blended flours were found to have good sensory characteristics of products compared to control.

Khan *et al.* (2013) studied effect of spinach powder on sensory characteristics on Chapathi premixes by incorporating spinach powder at different concentrations from 1 per cent to 10 per cent based on wheat flour. Organoleptic characteristics of Chapathi were determined by evaluating different attributes like colour, aroma, taste, texture and overall acceptability (OAA) by a 25 semi trained panel of the laboratory on a 9-point hedonic scale. Incorporation of spinach powder at 5 per cent to wheat flour was found to be optimum for Chapathi preparation.

TABLE 2

Mean sensory score of mulberry leaves Chapathi mix (MLCM)

Products	Sensory attributes					
	Appearance	Texture	Colour	Flavour	Taste	Overall acceptability
MLCM (2.5 %)	7.5 ^{b}	7.5 ^{b}	7.5 ^{b}	7	7 ^{c}	7 ^{c}
MLCM (5 %)	8 ^{a}	8 ^{a}	8 ^{a}	8	8 ^{a}	7.5 ^{b}
MLCM (7.5 %)	7.5 ^{b}	7.5 ^{b}	7.5 ^{b}	8	8 ^{a}	7.5 ^{b}
MLCM (10 %)	7 ^{c}	7 ^{c}	7.5 ^{b}	7.5	7.5 ^{b}	7.5 ^{b}
Control	6.5 ^{d}	7.5 ^{b}	8 ^{a}	8	8 ^{a}	8 ^{a}
F test	*	*	*	NS	*	*
S. Em ±	0.0231	0.0287	0.0284	0.0572	0.0355	0.0299
CD @ 5 %	0.0679	0.0843	0.0835	-	0.104	0.0879

*Significance, at 5per cent level, NS- Non significant MLCM- Mulberry leaves Chapathi mix

Proximate Composition of Chapathi Mix

It was found that control (with no mulberry leaf powder) Chapathi mix had moisture (5.31 per cent), protein (12.01 g), fat (17.10 g), fibre (5.4 g), ash (11 g), carbohydrate (49.18 g) and energy (398.66 K cal) which is significantly lower than mulberry leaves Chapathi mix at 5 per cent (MLCM) with moisture (7.9 per cent), protein (12.83 g), fat (17.68 g), fibre (6 g), ash (12.56 g), carbohydrate (43.03 g) and energy (382.56 K cal). Whereas energy content of both the variations did not differ significantly.

Shanthala and Prakash (2005) carried out studies to know the nutritive value of products prepared by incorporating dried curry leaf powder (CLP) at 5 or 10 per cent level to common dishes to increase the intake of greens as a source of micronutrients. It was found that increase in curry leaf concentration increased the nutritive value of Chapathi. Chapathi prepared using curry leaf at 5 per cent contain protein (6.05 g), Fat (0.94 g), carotene (525), iron (2.65 g), calcium (74 mg) and fibre (2.40 g).

TABLE 3

Proximate compositions of Chapathi mix

Proximate	Control	MLCM (5 %)	t value
Moisture (%)	5.31	7.9	84.97 *
Protein (g)	12.01	12.83	5.08 *
Fat (g)	17.10	17.68	4.97 *
Fibre (g)	5.4	6	3.41 *
Ash (g)	11	12.56	14.24 *
CHO (g)	49.18 *	43.03 *	26.21 *
Energy (Kcal)	398.66 NS	382.56 NS	-

T test NS- non significant, * significant, MLCM- mulberry leaves Chapathi mix

Mineral Composition of Chapathi Mix

The difference in characteristics *viz.* zinc, iron, copper and manganese among the variations was found to be statistically significant at 5 per cent level. Chapathi mix prepared using different levelsof mulberry leaves and best accepted sample was analysed for mineral composition. Masala biscuit at 7.5 per cent contain zinc (2.74 mg), iron (11.8 mg), manganese of (2.79 mg) copper (3.72 mg) and calcium (16.72 mg). Where as in control zinc (2.52 mg), iron (8.58 mg), manganese (2.33 mg), copper (1.98 mg) and calcium (14.13 mg). (Table 4).

The present results were accordance with Khan *et al.* (2013) and Shanthala and Prakash (2005) except for manganese.

Khan *et al.* (2013) studied the effect of spinach powder on the physico-chemical, nutritional Chapathi premixes by incorporating spinach powder at different

TABLE 4

Mineral composition of Chapathi mix

Micro nutrients (mg)	Control	MLCM (5 %)	t value
Zinc	2.52	2.74	5.88 *
Iron	8.58	11.8	81.50 *
Manganese	2.33	2.79	9.48 *
Copper	1.98	3.72	34.1 *
Calcium	14.13	16.72	91.2 *

T test- NS- non significant , * significant, MLCM- mulberry leaves Chapathi mix

concentrations from 1 per cent to 10 per cent based on wheat flour. Minerals (mg/100 g) were calcium content was 12.39 mg, Iron content was 6.92 mg, zinc content was 2.88 mg, Magnesium content was 7.73 mg.

Shanthala and Prakash (2005) carried out a study to know the nutritive value of Chapathi prepared by incorporating dried curry leaf powder (CLP) at 5 or 10 per cent level to common dishes to increase the intake of greens as a source of micronutrients, iron (2.65 mg), calcium (74 mg). However, the iron content of mulberry leaves Chapathi mix found high (11.8 mg) was due to high iron content in mulberry leaves, hence the product can be used for iron supplementation in case of iron deficiencies.

Anti-Nutrient Content of Chapathi Mix

The Chapathi mix analysed for anti-nutrients like phytates and oxalates varied significantly, where tannin content was non-significant. The best accepted Chapathi mix prepared using 5 per cent mulberry leaf was analysed for anti-nutrient content. Where in control Chapathi mix contained phytic acid about (29.36 mg), oxalic acid content (26.05 mg) and tannin (0.624 mg). Chapathi mix prepared using mulberry leaf at 5 per cent hadphytic acid (28.2 mg), oxalates (25.67 mg) and tannin (0.606 mg) (Table 5).

Chutney powder incorporated with 10 per cent dehydrated mulberry leaves

TABLE 5

Anti-nutrient contents of Chapathi mix

Anti-nutrients	Control	MLCM (2.5%)	t value
Phytates	29.36	28.2	4.20 *
Oxalates	26.05	25.67	2.82 *
Tannin (mg/100g)	0.624	0.606	-

T-test-*Significance, NS- Non significant at 5per cent level, MLP- Mulberry leaves Chapathi mix (5 per cent), Control- with no mulberry leaf.

The present study was in comparable with Manohar Lal (2011), The products were prepared using curry leaves and analysed for anti-nutrient content. The kulcha prepared using curry leaves contained phytates (26.60mg) and oxalate (23.5mg).

Orally Chapathi mix prepared using mulberry leaves at 5 per cent has been best accepted and it has highest proximate and mineral composition with less anti-nutrients compared to control. Hence, it can be used in the daily diet as a nutrient rich product. Addition of dehydrated mulberry leaves increased the nutrient density of masala biscuit. A remarkable increase in micronutrient content was observed. The nutrient density increased progressively with addition of mulberry leaves compared to control. Hence, value addition of traditional products with dehydrated mulberry leaves can be advocated as a feasible food based approach to combat micronutrient malnutrition.

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