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Deepak
Department of Food Science and Nutrition, UAS, GKVK, Bangalore, University of Agricultural Sciences, GKVK, Bangalore, Karnataka, India

Dr. Umadevi S Hiremath
Department of Food Science and Nutrition, UAS, GKVK, Bangalore, University of Agricultural Sciences, GKVK, Bangalore, Karnataka, India

Dr. Jamuna KV
Department of Food Science and Nutrition, UAS, GKVK, Bangalore, University of Agricultural Sciences, GKVK, Bangalore, Karnataka, India

Correspondence
Deepak
Department of Food Science and Nutrition, UAS, GKVK, Bangalore, University of Agricultural Sciences, GKVK, Bangalore, Karnataka, India

Organoleptic evaluation of products formulated from (*Tamarindus indica* L.) tender tamarind leaves

Deepak, Dr. Umadevi S Hiremath and Dr. Jamuna KV

Abstract
Tamarind is one of the medicinally important tree got good nutritional and medicinal values and also having pharmacological effects based on the finding the main objective of this study is organoleptic evaluation of products formulated from tender tamarind leaves, the products were prepared using standard procedure and were given for the sensory evaluation (Organoleptic evaluation) to 20 panelists to test for appearance, colour, texture, aroma, taste and overall acceptability using 9-Point hedonic scale. It was found that in roasted bangal gram chutney powder, (RBCP-1) has got good sensory score in all the parameters 7.65, 7.6, 7.65, 7.65, 7.4 and 7.6 in appearance, colour, texture, aroma, taste and in overall acceptability respectively compared to other two variation. Where as in Niger seed chutney powder, (NSCP-1) scored highest in all the sensory attributes, (NSCP-2) and (NSCP-3) scored low in all the attributes because of more sourness. Among all variation hurigalu-2 (HG-2) scored highest in all the sensory attributes with appearance (7.6), colour (7.4), texture (7.35), aroma (7.5), taste (7.5) and overall acceptability (7.95). This might be due to less incorporation of tender tamarind leaves and amla powder which results in less sourness when compared to other two variations. Hence all the products were nutridense and got good sensory scores for the acceptability which can be promoted for regular consumption.

Keywords: acceptability, chutney powder, nutridense, organoleptic evaluation, sensory score, tender tamarind leaves

Introduction
Tamarind (*Tamarindus indica* L.) is a Dicotyledonous tree belongs to family Caesalpiniaceae. It is an economically important and most useful tree grows wild in central and southern parts of India. Tamarind is the third largest family of flowering plants with a total of 727 genera and 19,327 species (Lewis *et al.* 2005). Tamarindus indica is evergreen tree that can reach 24 m height and 7 m girth that has pale yellow and pink flowers (Bhadoriya *et al.* 2011) [1].

It is a multipurpose tree and considered as medicinal tree of which almost every part of tree finds at least some use, either nutritional or medicinal (Kumar and Bhattacharya 2008) [10]. Tamarind plant is used as traditional medicine in Africa for the treatment of many diseases such as jaundice, gonococci, dysentery fever and gastrointestinal disorders (Kobayashi *et al.*, 1996) [7]. Tamarind leaves have several health benefits like antioxidant, anti-bacterial and diuretic effect. Tamarind is valued mostly for its fruit especially for the pulp, which is used for the wide variety of domestic and industrial uses (Kulkarni *et al.* 1993) [8].

Tamarindus indica L. is used in traditional medicine for the treatment of stomach disorder, cold, fever, jaundice and diarrhea and used as skin cleanser. To evaluate the scientific basis for the use of the plant, the antimicrobial activates of extracts of the leaves and steam bark were evaluated against some common gram positive bacteria and gram negative fungi. The seeds of *Tamarindus indica* are reported to possess pharmacological activities such as antidiabetic, hypoglycemic, antioxidant, antiulcer, anti-venom, hepatoprotective, antibacterial, inhibition of nitric oxide production and serine proteinase inhibitor (Bhadoria *et al.* 2011) [1]. Fruits and leaves of *Tamarindus indica* are reported with anti-asthmatic, hepatoprotective and antimicrobial activities (Fabiyi *et al.* 1993) [3].

Tamarind leaves are abundantly available in all the tropical regions of the world in addition to it is used as green leafy vegetable (GLV) and also used in many food preparations which can be eaten as vegetable and fruit which yields acidic pulpy material and hence widely used for souring curries, sauces, chutneys and certain beverages. It is also considered as green leafy vegetable which contains a high level of protein with many essential amino acids which help to build strong and efficient muscles. It is also high in carbohydrate, which provides energy,

rich in the minerals, potassium, phosphorus, calcium and magnesium. *Tamarindus indica* can also provide smaller amounts of iron and vitamin A. *Tamarindus indica* is an important leafy vegetable and food resource for the Thai population the flower and leaf are eaten as vegetables (Prakash and Misra 1988 [12].

Every part of tamarind plant (root, body, fruit, and leaves) not only has rich nutritional value and broad usage area in medicine but also has industrial and economic importance. Tamarind can be the most acidic and sweet fruit according to its growing season (De Caluw *et al.* 2010) [2]. According to World Health Organization report, tamarind fruit is an ideal source of all essential amino acids except tryptophan (82%) (Glew *et al*. 2005) [4]. Its seeds also have similar properties so it becomes an important, accessible protein source especially in countries where protein malnutrition is a common problem. Tamarind leaves ground into a paste with lime juice and heartwood of Acacia tundra wild, are used in the treatment of boils to prevent suppuration and inflammatory swellings. The leaves are also used in the treatment of ulcers and the juice of the leaves is applied externally to treat rheumatism and external swelling in the Philippines and West Africa (Jayaweera, 1981; Rama Rao, 1975) [6, 13].

Material and Methods

A. Procurement of the materials

The study was carried out in the department of Food Science & Nutrition, UAS, GKVK, Bengaluru. Medium mature leaves of tamarind were collected from a fully grown tree in University of Agricultural Sciences, GKVK campus, Bangalore. And other materials were procured from the local market viz., Roasted Bengal gram, Niger seeds, ground nut, green gram, house gram, soybean, cumin seeds, curry leaves, mint leaves, amla powder, challi powder and common salt.

B. Pre-preparation for the product development

Pre-preparation of ingredients for preparation of chutney powders and hurigalu (Mixed spicy pulses) was done by cleaning, dehydrating and grinding them.

C. Development of chutney powders and hurigalu.

Roasted Bengal gram chutney powder (RBCP-1, RBCP-2 and RBCP-3), Niger seed chutney powder (NSCP-1, NSCP-2 and NSCP-3) and Hurigalu (HU-1, HU-2 and HU-3) were developed by using standard procedure. Organoleptic evaluation was conducted and three best accepted products (RBCP-1, NSCP-1 and HU-2) were selected and these prodcts were also tested for shelflife.

1. Roasted Bengal gram chutney powder procedure

The tender tamarind leaves were dried in the in hot air oven at 60 ^{O}C for 6 hours after drying the dried leaves were made into powder, remaining roasted bengal gram and other ingredients were ground in a mixer, blending was done and packed in aluminum foil cover.

2. Niger seed chutney powder procedure

The tender tamarind leaves were dried in the in hot air oven at 60 ^{O}C for 6 hours after drying the dried leaves were made into powder, niger seed powder and other igradients were blended and packed in a allumium foil cover.

3. Hurigalu (Mixed spicy pulses)

All the pulses were soaked overnight**,** the soaked pulses and ground nut were roasted for 10 to 15 minutes and slurry was made with mixing of tamarind, mint and curry leaves powder and other ingredients were also added, after that the slurry were mixed properly with the roasted pulses and ground nut and kept it for cooling for 5 to 10 minutes after that packed in aluminum foil cover.

Table 1: Formulation of Roasted Bengal Gram Chutney Powder

Ingredients	RBCP 1 Quantity (gm)	RBCP 2 Quantity (gm)	RBCP 3 Quantity (gm)
Roasted Bengal gram	60	50	40
Raw tamarind leaves powder	20	30	40
Curry leaves powder	10	10	10
Cumin seeds	05	05	05
Chilli powder	04	04	04
Salt	01	01	01
Total	100	100	100

Table 2: Formulation of Niger Seed Chutney Powder

Ingredients	NSCP 1 Quantity (gm)	NSCP 2 Quantity (gm)	NSCP 3 Quantity (gm)
Niger seed	60	50	40
Raw tamarind leaves powder	20	30	40
Curry leaves powder	10	10	10
Cumin seeds	5	5	5
Chilli powder	4	4	4
Salt	1	1	1
Total	100	100	100

Table 3: Formulations Hurigalu

Ingredients	HG 1 Quantity (g)	HG 2 Quantity (g)	HG 3 Quantity (g)
Ground nut	15	20	20
Green gram	20	10	5
Horse gram	20	10	5
Soya bean	5	10	10
Roasted Bengal gram	15	15	15
Raw tamarind leaves powder	10	20	30
Mint + Amla powder	8+2	6+4	4+6
Chilli powder	5	5	5
Salt	1	1	1
Total	100	100	100

D. Organoleptic evaluation of the formulated products

Evaluation of sensory acceptability of developed products from formulated mixes was conducted by 20 semi-trained panel members for the sensory attributes namely appearance, colour, texture/consistency, aroma, taste and overall acceptability using 9 point hedonic scale.

Results and Discussion

Table no. 4. Revealed sensory scores of roasted Bengal gram chutney powders it was found that among all the variations, the roasted Bengal gram chutney powder-1(RBCP-1) scored the highest about 7.65, 7.6, 7.65, 7.65, 7.4 and 7.6 in appearance, colour, texture, aroma, taste and in overall acceptability respectively. Whereas in roasted Bengal gram chutney powder-2 (RBCP-2) and roasted Bengal gram chutney powder-3 (RBCP-3) the sensory scores were not differ each other. Among the variations roasted Bengal gram chutney powder-1 (RBCP-1) was best accepted by the panelists due to good sensory attributes.

The sensory scores of (NSCP-1) showed in Table no. 5. It was found that niger seed chutney powder-1 (NSCP-1) scored highest in all the sensory attributes *viz.*, appearance, colour, texture, aroma, taste and overall acceptability that is about 7.8, 7.75, 7.85, 7.5, 7.5 and 7.7 respectively. Whereas the Niger seed chutney powder-2 (NSCP-2) and Niger seed chutney powder-3 (NSCP-3) scored low in all the attributes because of more sourness. Only there was no significant difference found the colour and aroma in all the variations but there was a significant difference found in appearance, texture, taste and overall acceptability. Variation-1 was the best accepted by the panelists. These results were equipollent with study conducted by Kumari and Grewal (2007) [9] on preparation of high fibre biscuits with carrot pomace powder and revealed that, the mean scores for sweet biscuits prepared from wheat flour were 8.0, 8.1, 7.8, 7.6, and 7.8 for colour, appearance, texture, taste and overall acceptability respectively.

Table no.6 depicts the sensory scores of hurigalu. It was found that the among all variation hurigalu-2 (HG-2) scored highest in all the sensory attributes with appearance (7.6), colour (7.4), texture (7.35), aroma (7.5), taste (7.5) and overall acceptability (7.95). This might be due to less incorporation of tender tamarind leaves and amla powder which results in less sourness when compared to other two variations. In case of hurigalu-3 (HG-3) was scored with appearance (7.2), colour (7.6), texture (7.55), aroma (6.9), taste (7.1) and overall acceptability (7.6). There was no significant difference in appearance, colour, texture and taste but in aroma there was significant difference in all the variations. Among all variation hurigalu-2 (HG-2) was best accepted because of good sensory attributes which was selected for shelf life study. These results were in line with study conducted by (Pandey *et al.* 2006) [11] reported the sensory characteristics of Leafy vegetable incorporated 'Parantha'. The green leafy vegetable namely bathua, palak and chaulai were mixed with wheat flour separately for preparation of paranthas. The bathua parantha were liked moderately and scored 7, whereas, chauli and palak paranthas scored 8 points each and were very much liked by the panelists.

Table 4: Sensory score of roasted Bengal gram chutney powder (RBCP)

Products	Appearance	Colour	Texture	Aroma	Taste	Overall acceptability
RBCP-1	7.65	7.6	7.65	7.65	7.4	7.6
RBCP-2	7.25	7.3	7.55	6.55	6.65	7.45
RBCP-3	6.75	7.6	7.6	7.1	6.7	7.35
F-value	*	NS	NS	*	*	NS
S Em ±	0.251	0.232	0.255	0.253	0.273	0.225
CD at 5%	0.712	-	-	0.718	0.926	-

***** Significant at 5% level, NS- Non-significant. RBCP-1-Roasted Bengal gram chutney powder-1, RBCP-2-Roasted Bengal gram chutney powder-2, RBCP-3-Roasted Bengal gram chutney powder-3.

Table 5: Sensory score of Niger seed chutney powder (NSCP)

Products	Appearance	Colour	Texture	Aroma	Taste	Overall acceptability
NSCP-1	7.8	7.75	7.85	7.5	7.5	7.7
NSCP-2	7.1	7.4	7.25	7.2	6.7	7.35
NSCP-3	6.55	7.3	7.0	7.1	6.7	6.80
F-value	*	NS	*	NS	*	*
S Em ±	0.205	0.164	0.192	0.205	0.199	0.197
CD at 5%	0.581	-	0.545	-	0.565	0.530

***** Significant at 5% level, NS- Non-significant. NSCP-1: Niger seed chutney powder-1, NSCP-2: Niger seed chutney powder -2, NSCP-3: Niger seed chutney powder-3.

Table 6: Sensory score of hurigalu (HG)

Products	Appearance	Colour	Texture	Aroma	Taste	Overall acceptability
HG-1	7.4	7.8	7.3	7.5	7.5	7.85
HG-2	7.6	7.4	7.35	7.5	7.5	7.95
HG-3	7.2	7.6	7.55	6.9	7.1	7.6
F-value	NS	NS	NS	*	NS	NS
S Em ±	0.214	0.206	0.212	0.181	0.220	0.192
CD at 5%	-	-	-	0.516	-	-

***** Significant at 5% level, NS- Non-significant. HG-1: Hurigalu -1, HG-2: Hurigalu- 2, HG-3: Hurigalu-3.

RBCP-1 **RBCP-2** **RBCP-3**

Fig 1: Roasted bengal gram chutney powder

NSCP-1 **NSCP-2** **NSCP-3**

Fig 2: Niger seed chutney powders

HU-1 **HU-2** **HU-3**

Fig 4: Hurigalu (Mixed spicy pulses)

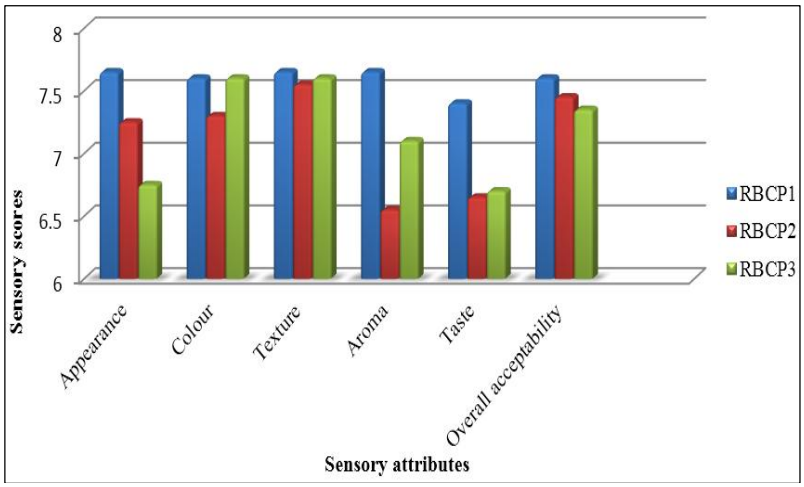

Fig 5: Sensory score of roasted bengal gram chutney powder

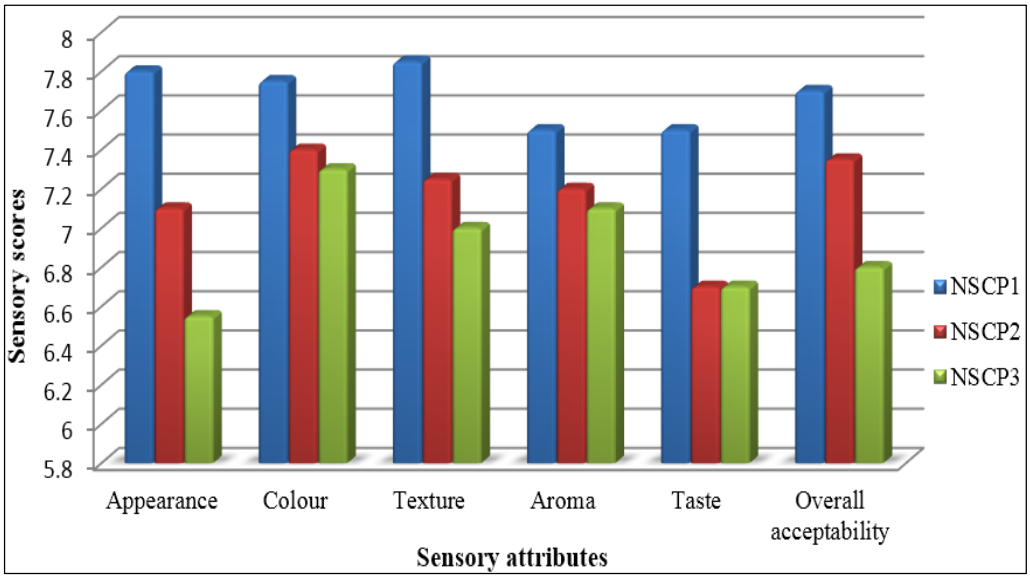

Fig 6: Sensory score of Niger seed chutney powder (NSCP)

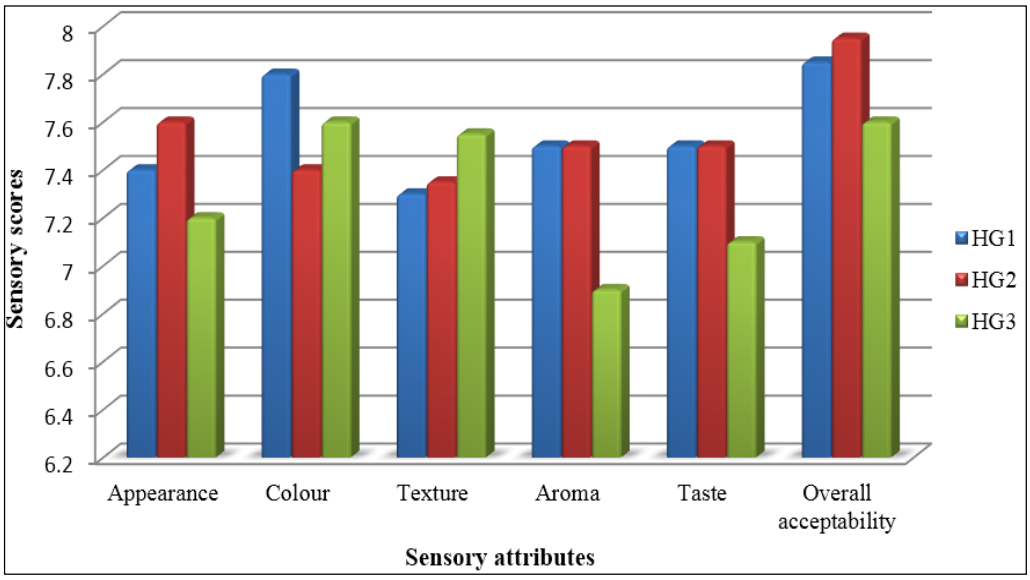

Fig 7: Sensory score of Hurigalu (HU)

Conclusion

Hence, it can be concluded from the study that the formulated products such as chutney powders and hurigalu (Mixed spicy pulses) were nutri dense and got good sensory scores for the acceptability and having fairly good storage stability which can be promoted for regular consumption.

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