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Utilization of Finger Millet in Traditional Recipes of Tribal for Household Nutritional Security in Jharkhand

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ABSTRACT

Background: Each region has its own traditional food habits. One of the ways to combat malnutrition is through enriching the traditional recipes, which are liked and accepted by the population. Thus, value addition was given to traditional recipes by incorporating finger millet for nutritional security of tribal in Jharkhand.

Methods: Two popular recipes of tribal namely *Laddoo* and *Dhuska* were selected under study for enrichment through incorporation of finger millet to provide micronutrient security to selected population. Many initial trials were conducted during the year 2017-18 in the laboratory to standardize the extent of incorporation. The developed recipes were tested organoleptically by a panel of twenty semi trained judges using 9-point hedonic rating scale. Both finger millet enriched recipes were analyzed for proximate composition, Ca, Fe, Cu, Zn and β-carotene.

Result: Two types of *laddoo* were tried out and score of majority of sensory characteristics fell in the category of 'Liked very much' where as majority of organoleptic characteristics of finger millet incorporated *dhuska* were in the Category of 'Moderately Liked'. Incorporation of finger millet enhanced the content of total mineral, fiber, Ca, Cu, Zn and β carotene.

Key words: Acceptability, Finger millet, Micronutrient, Traditional recipes, Tribal.

INTRODUCTION

Millets are neglected and underutilized crops , but very vital for sustainable agriculture (Eyzaguirre *et al*., 1999; Bhag Mal, 2007; Dutta *et al*., 2007). These plant genetic resources are climate smart as they play a critical role in enhancing adaptation and resilience of agricultural production systems (Jarvis *et al*. 2007). Millet offers immense potential in our battle against climate change, malnutrition and provides food and nutritional security. Being hardy crop, they can tolerate a wide range of biotic and abiotic stress. The cultivation of millets in India has been steadily declining over the last few decades because of their lower economic competitiveness compared with other crops. Such lower competitiveness is resulting from a variety of factors, including the lack of higher yielding varieties, good quality seed, better management practices, proper food processing technology for households and communities, as well as poor value chains (Gautam *et al*., 2009; Gruère *et al*., 2009). These constraints need to be addressed so as to allow economically viable perspectives to small and marginal farmers in dry land areas where wheat and rice may gradually recede due to climate change.

Finger millet (*Eleusine coracana*) locally called *'Marua'* is the important traditional millet crop after rice in rain fed farming system of Jharkhand. Because of its nutritional strength in terms of dietary fiber, unique starch pattern as well as high calcium and iron content, it has acquired a status of nutri-cereal (Wadikar *et al.,* 2006). The carbohydrate of finger millet has the unique property in having starch molecules which are relatively slow in absorption when consumed as food. This property of finger millet grains has an added advantage of being recommended food in the management of diabetes. The grain also has high fibre content and helpful in prevention of constipation. However, despite its nutritional and health benefits, the utilization and cropped area under finger millet has decreased significantly, which is a matter of concern particularly in the state like Jharkhand where undernutrition is still rampant. Utilization of finger millet in the daily dietary at present is largely confined to rural areas and that too is declining due to modernization, changing food preferences and lack of diversified products of local interest (Sinha and Sharma, 2017).

Each region has its own traditional food habits and one of the ways to combat malnutrition is through enriching the traditional recipes, which are liked and accepted by the population. With a view to revive the consumption of finger millet in the daily diet of tribal people of the State, two most commonly used traditional products of tribal namely, *Laddoo* and *Dhuska* were selected for value addition through incorporation of finger millet to provide micro nutrient security to population.

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MATERIALS AND METHODS

The experiment was conducted during the year 2017-18 in the Department of Community Science of Birsa Agricultural University, Kanke, Ranchi. The seeds of white (JWM-1) and brown (A404) cultivar of finger millet were procured in a single lot from the Department of Plant Breeding and Genetics, Ranchi Agriculture College, Birsa Agricultural University, Ranchi. The seeds were cleaned of dust. Cracked and broken seeds and other foreign materials were handpicked. Other raw ingredients for development of value added products were procured in a lot from local market.

For preparation of finger millet flour, the seeds were washed thoroughly in tap water and sun dried for two days. The dried seeds were conditioned with 5 per cent water, tempered for about 10 minutes, milled using Plate mill and sieved through 60 mesh sieve [British Standard]. The flour was packed in HDPE bags until used for product development.

Both brown and white cultivars were used for finger millet *Laddoos* preparation. *laddoos* prepared from *besan* only were kept as Control. Many initial trials were conducted to test different combinations and two combinations prepared by mixing ingredients in the different proportions. For type I, finger millet flour and wheat flour (1:1) were roasted till brown colour/aroma developed. *Gond* (Acacia gum) was deep fried and ground coarsely. Other ingredients namely dry fruits; fat and sugar were mixed properly and made into small size balls, whereas for type II, *besan* and finger millet flour (1:1) were fried till brown colour developed. Other ingredients like roasted groundnut powder, fat, sugar, cardamom were mixed and made into small balls.

For preparation of finger millet *dhuska*, overnight soaked rice or finger millet, bengal gram and black gram dal (2:1:1) were ground separately and mixed together to make a batter. Salt, green chili, ginger and garlic paste as per taste was added, mixed thoroughly and one spoonful batter was deep fried from both side till light brown. *Dhuska* prepared from rice was kept as control.

The sensory quality of products was judged by 20 semi - trained panelist using 9-point Hedonic scale (Lawless and Klein, 1991). The sensory panel consisted of food scientists, home scientists, housewives and students representing most sections of the society.

Three identical preparation of each type of *Laddoo* and *dhuska* preparaed from brown cultivar were pooled together into one sample, ground in cyclotech grinder and kept in a airtight container for future chemical analysis. All analysis was done in triplicate. *Dhuska* and *laddoos* were analyzed for moisture, total nitrogen, crude fiber and total ash and a factor of 6.25 was used to convert nitrogen into protein (AOAC, 1990).

For determination of calcium and iron about 0.5 g of sample was digested with diacid mixture (HNO_3: $HClo_4$: 5:1, V/V). After complete digestion, the sample was heated to near dryness and volume was made to 50 ml with double distilled water. Estimation of calcium and iron was done using atomic absorption spectrophotometer (Lindsey and Norwell, 1969). Phosphorus was determined colorimetrically by using acid digested sample by the method of Chen *et al.* (1956). β-Carotene was separated by column chromatography and estimated colorimetrically (AOAC, 1985).

Data were subjected to analysis of variance (ANOVA) using complete randomized design (Panse and Sukhatme, 1961). Critical difference at $P \leq 0.05$ was estimated and used to find significant difference, if any.

RESULTS AND DISCUSSION

Sensory evaluation of *laddoo*

The scores for the organoleptic evaluation of *laddoo* are summarized in Table 1. Two types of *laddoos* were tried out using both black and white cultivar of finger millet. *Laddoo* made from chickpea flour alone was kept as a control. All the *laddoos* were organoleptic acceptable and score of majority of characteristic fell in the category of 'liked very much' . Except colour there were non significant differences among all the organoleptic characteristics of all types of *laddoo*. Though colour of both cultivar of type II *laddoo* containing ragi flour upto 50 per cent, were found significantly different from its control and type I *laddoo*, yet were organoleptically acceptable.

Table 1: Sensory evaluation of *laddoo.*

Products	Colour	Appearance	Aroma	Texture	Taste	Overall acceptability
Control	8.20±0.13	8.30±0.15	8.30±0.15	8.20±0.13	8.20±0.13	8.20±0.13
Type I (B)	8.00±0.21	8.00±0.14	8.00±0.14	7.90±0.18	8.30±0.15	7.90±0.18
Type I (W)	8.20±0.20	8.20±0.13	8.20±0.15	8.00±0.14	8.30±0.15	8.20±0.14
Type II (B)	7.50±0.16	7.90±0.10	8.00±0.21	7.90±0.10	8.00±0.00	8.14±0.06
Type II (W)	7.70±0.13	8.00±0.14	8.10±0.18	8.00±0.00	8.00±0.00	8.00±0.00
CD	0.49	N.S	N.S	N.S	N.S	N.S

Values are±SE of ten replications.

Control- Besan ka ladoo.

Type I (B)- *Gond*- finger millet (Black cultivar) laddoo.

Type I (W)- *Gond*- finger millet (White cultivar) laddoo.

Type II (B)- Plain finger millet (Black cultivar) laddoo.

Type II (W)- Plain finger millet (White cultivar) laddoo.

Sensory score of *dhuska*

Sensory score of *Dhuska* is given in Table 2. *Dhuska* is a deep fat fried product widely eaten as snack in many regions of the Jharkhand. It is generally prepared from rice and pulse mixture. An attempt was made under the project to replace rice with finger millet. Both black and white cultivar was used in the preparation. As it is evident from the table that *Dhuska* prepared from both black and white cultivar of finger millet was acceptable and except colour it was comparable to control. Though colour of finger millet incorporated *Dhuska* was different from control, yet it was acceptable and liked by judges. Majority of organoleptic characteristic of finger millet incorporated *Dhuska* were in the category of 'moderately liked'. That means *Dhuska* could be prepared by replacing rice with finger millet without altering much of their characteristics.

Chemical composition of *laddoo*

Chemical composition of finger millet incorporated *laddoo* is given in Table 3. *Laddoo* prepared from Bengal gram flour only served as control. Composition of type I *laddoo* was finger millet flour, wheat flour, gond, sugar, fat and dry fruits, whereas that of type II consisted of finger millet flour, bengal gram flour, groundnut, fat, sugar and cardamom. Moisture content of three types of *laddoo* ranged from 2.79-3.87 per cent. Significantly higher protein content was observed in type II *laddoo* followed by control which might be due to incorporation of bengal gram flour and ground nut. Fat content of all the *laddoos* were significantly (P≤0.05) different from each other. Fat content in control, type I and Type II *laddoos* was 30.06, 19.64 and 31.59 per cent, respectively. Significantly, higher ash and fibre content was observed in finger millet-incorporated *laddoos*. Type I *laddoo* exhibited significantly higher iron content, while non significant difference in iron content was observed between control and type II *laddoos*. Similarly significantly higher calcium and phosphorus content was observed in type I followed by type II, which might be attributed to incorporation of finger millet. Significantly higher β-carotene and copper content was observed in control followed by type II, while maximum zinc content was observed in type I.

Chemical composition of finger millet incorporated *Dhuska*

Chemical composition of finger millet incorporated *Dhuska* is given in Table 4. Non significant difference (P≤0.05) in moisture and protein content was observed in *Dhuska* prepared from rice (control) and finger millet. A range of 12.86 to 15.05 per cent of mean values for fat content was observed in two types of *Dhuska*. The observed high fat content in control *Dhuska* might be due to higher absorption of fat during deep fat frying as compared to finger millet

Table 2: Sensory score of *dhuska.*

Products	Colour	Appearance	Aroma	Texture	Taste	Overall acceptability
Control	8.4±0.16	7.8±0.24	7.6±0.16	8.2±0.20	8.2±0.24	8.1±0.13
Black Ragi	7 .0±0.25	7.1±0.27	7.6±0.22	7.7±0.31	8.1±0.31	7.4±0.18
White Ragi	7.5±0.16	7.4±0.22	7.6±0.16	8.0±0.21	7.9±0.27	7.5±0.19
CD at 5%	0.58	N.S	N.S	N.S	N.S	N.S

Values are ±SE of ten replications.

Control= Rice based *dhuska*.

Type I= Finger millet based *dhuska* (Black cultivar).

Type II= Finger millet based *dhuska* (White cultivar).

Table 3: Chemical composition of finger millet incorporated laddoo (On dry weight basis).

Name of the nutrient	Control	Type- I	Type- II	C.D (P≤0.05)
Moisture (%)	3.15±0.02	2.79±0.01	3.87±0.007	0.17
Protein (%)	6.63±0.01	5.11±0.02	8.14±0.08	0.17
Fat (%)	30.06±0.08	19.64±0.14	31.59±0.21	0.55
Ash (%)	1.17±0.01	1.28±0.06	1.34±0.01	0.03
Fiber (%)	0.46±0.01	0.95±0.01	0.81±0.006	0.03
Iron (mg/100 g)	2.05±0.02	2.52±0.01	2.07±0.006	0.06
Calcium (mg/100 g)	24.25±0.38	127.00±1.52	83.66±1.85	4.95
Phosphorus (mg/100 g)	107.66±1.45	138.3±0.88	135.66±0.88	3.9
β-carotene (mg/100 g)	31.66±0.88	11.66±0.88	21.50±0.28	2.6
Copper (mg/100 g)	0.36±0.01	0.18±0.01	0.22±0.006	0.028
Zinc (mg/100 g)	0.48±0.01	0.92±0.01	0.52±0.01	0.043

Values are mean±SE of three replications.

Control- *Besan ka ladoo.*

Type I- Finger millet- *Gond ladoo.*

Type II- Plain finger millet *laddoo.*

Table 4: Chemical composition of finger millet incorporated *Dhuska* (on dry weight basis).

Name of the nutrient	Control	Type-I	C.D (P≤0.05)
Moisture (%)	38.46±0.058	39.16±0.16	NS
Protein (%)	12.03±0.19	12.23±0.12	NS
Fat (%)	15.05±0.26	12.86±0.02	0.23
Ash (%)	1.77±0.01	3.25±0.024	0.08
Fiber (%)	0.52±0.00	1.33±0.03	0.10
Iron (mg/100 g)	3.00±0.01	4.70±0.02	0.07
Calcium (mg/100 g)	54.00±2.08	227.66±1.45	7.23
Phosphorus (mg/100 g)	238.66±0.66	335.00±0.57	2.51
β-carotene (mg/100 g)	36.35±0.88	66.00±0.57	3.00
Copper (mg/100 g)	0.52±0.01	0.733±0.009	0.04
Zinc (mg/100 g)	1.61±0.01	2.21±0.01	0.03

Values are mean±SE of three replications.

Control= Rice based *dhuska*.

Type I= Finger millet based *dhuska*.

incorporated *Dhuska*. Finger millet incorporated *Dhuska* exhibited higher content of ash, fibre, calcium, iron, phosphorus. β-carotene, copper and zinc as compared to control which might be attributed to higher content of these nutrients in finger millet as compared to rice (Gopalan *et al.*, 2000).

CONCLUSION

Revival of finger millet in daily diet of local people in Jharkhand needs diversification of recipes of local interest. Finger millet can be successfully be utilized in the preparation of nutritious *laddoo* and *dhuska*. Substitution of finger millet in the recipes increased the mineral and fibre content of the products, which have potential to bring diversity and value addition to the product of specific dietary importance.

Conflict of interest: None.

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