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Original Research Article

Development of Nutritious *Parantha* using Coarse Cereals and *Tulsi* Leaves Powder

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A B S T R A C T

The present investigation was undertaken to develop *paranthas* from six types of composite flours of coarse cereals with and without *tulsi* leaves powder. The *parantha* prepared from composite flours of blanched pearl millet: sorghum: dehusked oat: germinated chickpea in ratios of 60:10:10:20 (Type-II) and blanched pearl millet: sorghum: dehusked oat: germinated chickpea: *tulsi* leaves in ratios of 60:10:10:15:5 (Type-V) were organoleptically most acceptable and fell in the category of 'liked moderately'. Nutritional value of *parantha* prepared from composite flours of coarse cereals with and without *tulsi* leaves powder was significantly higher than control wheat *parantha*. Supplementation of *tulsi* leaves powder at 5% level further increased the nutritional value in respect of crude fibre, ash, total dietary fibre, soluble dietary fibre and insoluble dietary fibre, total and available minerals (calcium, iron and zinc), *in vitro* protein and starch digestibility and antioxidants activity (total phenolic content and DPPH free radical scavenging activity) of coarse cereals *parantha*. Consumption of coarse cereals in the form of traditional functional foods will encourage farmers to grow them for providing food and nutritional security to the masses. The addition of the *tulsi* leaves powder increased the health-promoting qualities of *parantha* and makes it desired by the consumers.

Keywords

Coarse cereals, Tulsi, Parantha, Nutritional, antioxidant

Introduction

Coarse cereals such as pearl millet, finger millet, sorghum, amaranth, oat and barley are highly valued as functional foods with nutritional and pharmacological properties. These coarse cereals are utilized in several parts of the world. They are generally popular and well-known for their ability to be utilized as food, feed and fodder. These coarse cereals have become successful in attracting a broad spectrum of consumers which includes people from both poor and rich community, and people who belong to both rural and urban setting in both developed and underdeveloped economies and resources (Das *et al.*, 2012). All of these coarse grains and millets are abundant in various phytochemicals and insoluble dietary fibre with antioxidant properties, a variety of minerals (mainly micronutrients such as zinc, magnesium and iron), dietary energy and several vitamins (Agil and Hosseinian, 2012). Pearl millet (*Pennisetum glaucum* L.), a well known crop under coarse grains, is also often referred to as the poor man's crop, despite its nutritional value pearl millet has been neglected in multiple ways including lack of investment of research, development and food system from the commercial view point (Rathore, 2016). Pearl millet is rightly termed as "nutricereal" as it is a good source of energy, carbohydrate, protein, fat, ash, dietary fiber and micro nutrients (Abdalla *et al.,* 2009).Sorghum contains more abundant and diverse phenolic compounds compared to other major cereal crops; it contains nearly all classes of phenolic compounds, with simple phenolic acids, flavonoids, and tannins being the dominant groups (Shen *et al.,* 2018). The unique phenolic profile confers sorghum with a number of human health benefits such as reducing oxidative stress and cancer prevention (González-Montilla *et al.,* 2012). Oats (*Avena sativa* L.) have received considerable attention for their high content of dietary fibres, phytochemicals and nutritional value. It is believed that consumption of oats possesses various health benefits such as hypoglycaemia, hypoinsulinaemia, hypocholesterolaemic and anticancerous properties (Wani *et al.,* 2014).

There is a growing demand for chickpea due to its nutritional value. In the semi-arid tropics chickpea is an important component of the diets of those individuals who cannot afford animal proteins or those who are vegetarian by choice. Chickpea has significant amounts of all the essential amino acids except sulfur containing types, which can be complemented by adding cereals to daily diet. Furthermore, chickpea is of interest as a functional food with potential beneficial effects on human health. (Jukanti *et al.,* 2012) Developing novel food products by utilizing local plant resources such as that of legumes assumes higher importance.

Tulsi (*Ocimum sanctum* L.) popularly known as "holy basil or sacred basil" is present in almost every household in Indian sub-continent due to its medicinal, nutritional and spiritual properties. It is known as the queen of herbs." It possesses good nutritional value like fatty acid, β-carotene, calcium, vitamin C, and volatile substances. It enhances the immune system. It has many vital properties such as anti-oxidants, anti-stress, anti-cancers, anti-diabetic, anti-aging, anti-inflammatory, anti-microbial, anti-radiation, flavoring, coloring and many other uncountable properties (Sah *et al.,* 2018).

Flat loaves of bread or *chapatti* are commonly eaten in Indian meals. *Paranthas* are the popular unleavened flatbreads of the Indian Subcontinent made from wheat flour and fried with ghee. *Parantha* types differ depending on geographic region, although *parantha* itself is probably derived from the Punjab. The possibility of introducing *parantha* into a range of functional food may be an interesting alternative. Promotion of coarse grains through substitution of wheat flour and supplementation with *tulsi* leaves powder in development of staple food like *parantha* will go a long way in ensuring the food and nutrition security for the burgeoning population.

Such product if consumed regularly will help in alleviating the micronutrients deficiencies among poor and vulnerable section of the society and for overcoming degenerative diseases like obesity, cardio vascular diseases diabetes and cancer among elite section of the society. Keeping this in view the present investigation was carried out to develop *parantha* from composite flour of coarse cereals supplemented with *tulsi* leaves powder.

Materials and Methods

Procurement of material

Seeds of pearl millet (HHB-272) were procured from bajra section, sorghum (HJ-513) and oat (HJ-8) from forage section, chickpea (HC-5) from pulses section and *Tulsi* leaves at optimum maturity level were procured in a single lot from Medicinal, Aromatic and Underutilized Plant Section, Department of Genetics and Plant Breeding, College of Agriculture, CCSHAU.

All the seeds were cleaned and made free of dust, dirt and foreign material prior to primary processing. Raw materials were stored in clean and hygienic condition for further use.

Processing of grains

Pearl millet was blanched by the process of Chavan and Kachare (1994). The grains were subjected to boiling water (1:5 ratio of seeds to boiling water) for 30 seconds and dried at 50°C for 60 minutes. Grains of oats were dehusked. Chickpea grains were soaked in tap water for 12 h at 37°C. Seed to water ratio of 1:5 (W/V) was used. The unimbibed seeds were discarded. The soaked seeds were germinated in sterile petri dishes lined with wet filter paper for 48 h at 37°C with frequent watering.

The sprouts were rinsed in distilled water and dried at 50-55°C. The *Tulsi* leaves (*Ocimum sanctum* L.) were trimmed in order to remove any dead or spoiled part. Then washed and dried at -50°C temperature using freeze dryer. The dried unprocessed samples of sorghum, dehusked oat, germinated chickpea and blanched pearl millet were ground to fine powder in an electric grinder and then stored in plastic containers at room temperature (32°C)**.**

Standardization and development of *parantha*

Six types of *paranthas* were developed using different types of composite flours of coarse cereals and *tulsi*. Three *paranthas* were prepared using composite flours of blanched pearl millet: sorghum: dehusked oat: germinated chickpea in ratios of 80:5:5:10 (Type-I), 60:10:10:20 (Type-II) and 40:15:15:30 (Type-III) (W/W) and three *paranthas* were prepared from composite flours of blanched pearl millet: sorghum: dehusked oat: germinated chickpea: *Tulsi* leaves in ratios of 80:5:5:5:5 (Type-IV), 60:10:10:15:5 (Type-V) and 40:15:15:25:5 (Type-VI) (W/W). Control *parantha* was developed using wheat flour (100%).

Sensory evaluation of *parantha*

The developed *paranthas* were subjected to sensory evaluation with respect to color, appearance, aroma, texture, taste and overall acceptability by a panel of 10 judges using the Nine-point Hedonic Rating Scale.

Nutritional evaluation of *parantha*

The organoleptically most acceptable *paranthas* were oven dried at 55-60°C to a constant weight, ground in an electric grinder (cyclotec, M/S Tecator, Hoganas, Sweden using 0.5 mm sieve size) to a fine powder, stored in air tight polythene sheets and were analyzed for nutritional composition. The moisture, crude protein, crude fat, ash and crude fibre in the samples were estimated by using standard (AOAC, 2012) method. Dietary fibre contents were assessed as per the enzymatic method of Furda (1981). For total minerals, the samples were wet acid digested using diacid mixture (HNO_3: $HClO_4$:: 5:1, v/v). The total calcium, potassium, iron and zinc in acid digested samples were determined by atomic absorption spectrophotometer as per the method of Lindsey and Norwell (1969) while phosphorus in acid digested samples was determined colorimetrically (Chen *et al.*, 1956). The available calcium and zinc were extracted by the method of Kim and Zemel (1986)and available iron was extracted as per the procedure of Rao and Prabhavathi (1978). The *in vitro* protein digestibility was carried out by using the modified method of Mertz *et al.,* (1983) and phytic acid content by the method given by Davies and Reid (1979).Total phenolic content was estimated as per Singleton and Rossi (1965). DPPH free radical scavenging activity was determined by the method of Hatano *et al.,* (1988).

Statistical analysis

The data were statistically analyzed in a completely randomized design using analysis of variance to test the significant differences among treatments (Sheoran and Pannu, 1999).

Results and Discussion

The data presented in Table 1 indicated that wheat flour based control *parantha* rated as 'liked very much' for all the organoleptic characteristics. Type II composite flours based *paranthahad* highest mean scores for overall acceptability as compared to Type I and Type III *parantha*. Mean scores for overall acceptability of Type I, Type II and Type III composite flours based *parantha* were in the category of 'liked moderately'. The mean scores for colour, appearance, aroma, texture, taste and overall acceptability of Type II *parantha* were 7.9, 7.9, 7.9, 7.8, 8.0 and 7.9, respectively, which were higher than that of Type I *and* Type III *parantha* with mean scores of 7.7, 7.6, 7.8, 7.7, 7.8 and 7.72and 7.3, 7.2, 7.6, 7.5, 7.4 and 7.40, respectively. Among *tulsi* leaves powder supplemented composite flours based *paranthas,* Type V *parantha* had highest mean scores i.e. 7.6, 7.6, 7.5, 7.8, 7.7 and 7.64 for colour, appearance, aroma, texture, taste and overall acceptability, respectively, whereas, mean scores for colour, appearance, aroma, texture, taste and overall acceptability were 7.3, 7.4, 7.4, 7.6, 7.4 and 7.42, respectively in Type IV and 7.1, 7.2, 7.0, 7.3, 7.0 and 7.12, respectively for Type VI *parantha*. *Tulsi* leaves powder supplemented Type IV, Type V and Type VI composite flours based *parantha* fell in the category of 'liked moderately' on the basis of overall acceptability. Johari (2013) reported that *Parantha* prepared by using 50:50:20:5 (pearl millet: rice: soy flour: amaranth grain powder) were 'liked moderately' in terms of all sensory parameters. *Parantha* prepared with incorporation of 5 per cent *batha* leaves powder was organoleptically acceptable and found to be 'liked moderately' as reported by Singh *et al.*, (2007).

Data regarding the proximate composition of *parantha* based on composite flours are given in Table 2. The moisture content of both types of composite flours based *parantha* was higher than that of control *parantha*. In control *parantha*, it was 22.13 per cent, whereas, it was 23.43 per cent in composite flour based *parantha* and 23.07 per cent in composite flour based *parantha* supplemented with *tulsi*. The crude protein content of composite flour based *parantha* (13.76%) followed by composite flour *tulsi parantha* (13.04%) was significantly ($P<0.05$) higher as compared to control *parantha* (9.54%). Composite flour based *parantha* (10.46%) and composite flour *tulsi parantha* (10.19%) had significantly ($P<0.05$) higher crude fat content as compared to control *parantha* (8.26%).The ash content of composite flour based *parantha* (3.42%) was significantly ($P<0.05$) higher as compared to control *parantha* (1.24%). Supplementation of *tulsi* leaves powder further increased the ash content of composite flour based *parantha*(3.85%). The control *parantha* exhibited 1.34 per cent crude fibre which increased significantly (P<0.05) in both types of composite flours based *paranthas*. The crude fibre content of composite flour based *parantha* was 2.32 per cent. Significantly (P<0.05) maximum amount of crude fibre was observed in composite flour based *parantha* supplemented with *tulsi* leaves powder (2.85%).These results are in agreement with those reported by earlier workers in legume flour supplemented *parantha* (Inam *et al.,* 2010; Mundra *et al.,* 2010 and Mamata *et al.,* 2012). It was found that incorporation of *methi* leaves powder in composite flour (wheat flour, chickpea flour and soy flour) *parantha* increased the crude fiber and ash content as reported by Kadam *et al.,* (2012).

The results regarding total dietary fibre, soluble dietary fibre and insoluble dietary fibre content of composite flours based *parantha* are presented in Table 3.

A significant difference was observed in total, soluble and insoluble dietary fibre content among all types of *parantha*. Maximum amount of total dietary fibre was observed in *parantha* supplemented with *tulsi* leaves powder (14.38 g/100g) and lowest amount in control *parantha* (11.18 g/100g).

Soluble dietary fibre content of composite flour based *parantha* was 3.41 g/100g which further increased with the supplementation of *tulsi* leaves powder (3.76 g/100g). The insoluble dietary fibre content of composite flour based *parantha* supplemented with *tulsi* leaves powder (10.62 g/100 g) was significantly (P<0.05) higher as compared to composite flour based *parantha* (9.44 g/100g and control (8.70 g/100g). Mundra *et al.*, (2010) reported also 12 per cent increase in total dietary fibre contents of whole bengal gram flour supplemented *parantha*. Similar results were also observed by Hung and Nithianandan (1993) and Goni and Valentin-Gamazo (2003) who reported that total dietary fibre content in food products increased by three to five times when supplemented with chickpea flour.

The results of total and available mineral content of composite flours based *parantha* are presented in Table 4. The total calcium, iron and zinc content in control *parantha* were 42.15, 4.12 and 1.14 mg/100g, respectively.

Composite flour based *parantha* had significantly (P<0.05) higher total calcium (84.72mg/100g), iron (5.04 mg/100g) and zinc (2.75 mg/100g) content as compared to control *parantha*. Supplementation of *tulsi* leaves powder further significantly (P<0.05) increased the total calcium (142.11 mg/100g), iron (7.90 mg/100g) and zinc(3.36 mg/100g) content of composite flour based *parantha*.

Tulsi leaves powder supplemented composite flour based *parantha* had maximum amount of available calcium (58.77%), iron (25.50%) and zinc (54.15%) content as compared to control and composite flour based *parantha.* The available calcium, iron and zinc content in composite flour based *parantha* was 56.12, 24.86 and 53.42 per cent, respectively which was significantly higher as compared to control *parantha* i.e. 42.32, 22.34 and 48.56 per cent, respectively.

The results of *in-vitro* protein, starch digestibility and phytic acid of composite flours based *parantha* are presented in Table 5. Composite flour *parantha* supplemented with *tulsi* leaves powder had significantly (P<0.05) higher *in vitro* protein digestibility (76.66%) as compared to control (72.09%) and composite flour *parantha* (74.14%).

Table.1 Mean scores of organoleptic acceptability of *parantha* based on composite flours

Level of supplementation	Colour	Appearance	Aroma	Texture	Taste	Overall acceptability
Control (100% wheat flour)	8.2±0.11	8.2±0.18	8.2±0.25	8.3±0.12	8.2±0.05	8.22±0.13
Type I P:S:O:C::80:5:5:10	7.7±0.16	7.6±0.23	7.8±0.25	7.7±0.17	7.8±0.11	7.72±0.18
Type II P:S:O:C::60:10:10:20	7.9±0.24	7.9±0.12	7.9±0.15	7.8±0.14	8.0±0.23	7.90±0.12
Type III P:S:O:C::40:15:15:30	7.3±0.18	7.2±0.09	7.6±0.11	7.5±0.13	7.4±0.15	7.40±0.22
Type IV P:S:O:C:T::80:5:5:5:5	7.3±0.13	7.4±0.16	7.4±0.13	7.6±0.22	7.4±0.28	7.42±0.29
Type V P:S:O:C:T::60:10:10:15 :5	7.6±0.15	7.6±0.22	7.5±0.25	7.8±0.12	7.7±0.17	7.64±0.15
Type VI P:S:O:C:T::40:15:15:25 :5	7.1±0.14	7.2±0.26	7.0±0.23	7.3±0.15	7.0±0.26	7.12±0.20
CD (P≤0.05)	0.33	0.36	0.38	0.46	0.49	0.37

Values are mean ± SE of ten independent determinations
P: Pearl millet S: sorghum O: Oat
C: Chickpea T: Tulsi leaves powder

Table.2 Proximate composition of *parantha* based on composite flours (%, dry weight basis)

Types	Moisture	Crude protein	Crude fat	Ash	Crude fibre
Control (100% wheat flour)	22.13±0.04	9.54±0.25	8.26±0.16	1.24±0.06	1.34±0.03
Coarse cereals *parantha* P:S:O:C::60:10:10:20	23.43±0.13	13.76±0.06	10.46±0.05	3.42±0.14	2.32±0.11
Coarse cereals tulsi*parantha* P:S:O:C:T::60:10:10:15:5	23.07±0.08	13.04±0.15	10.19±0.23	3.85±0.15	2.85±0.18
CD (P≤0.05)	0.55	0.68	0.24	0.16	0.14

Values are mean ± SE of three independent determinations
P: Pearl millet S: sorghum O: Oat
C: Chickpea T: Tulsi leaves powder

Table.3 Dietary fibres content of *parantha* based on composite flours (g/100g, dry matter basis)

Types	Total dietary fibre	Soluble dietary fibre	Insoluble dietary fibre
Control (100% wheat flour)	11.18±0.21	2.48±0.02	8.70±0.14
Coarse cereals *parantha* P:S:O:C::60:10:10:20	12.85±0.06	3.41±0.08	9.44±0.04
Coarse cereals tulsi*parantha* P:S:O:C:T::60:10:10:15:5	14.38±0.15	3.76±0.11	10.62±0.18
CD (P≤0.05)	0.98	0.28	0.81

Values are mean ± SE of three independent determinations
P: Pearl millet S: sorghum O: Oat
C: Chickpea T: Tulsi leaves powder

Table.4 Total (mg/100g) and available mineral (%) content of *parantha* based on composite flours (dry matter basis)

Types	Total Calcium	Available calcium	Total Iron	Available iron	Total Zinc	Available zinc
Control (100% wheat flour)	42.15.±1.32	42.32±0.75	4.12±0.07	22.34±0.18	1.14±0.02	48.56±0.15
Coarse cereals *parantha* P:S:O:C::60:10:10:20	84.72±0.64	56.12±0.38	5.04±0.12	24.86±0.32	2.75±0.06	53.42±0.38
Coarse cereals tulsi*parantha* P:S:O:C:T::60:10:10:15:5	142.11±1.24	58.77±1.86	7.90±0.25	25.50±0.07	3.36±0.08	54.15±0.25
CD (P≤0.05)	2.64	1.34	0.21	0.43	0.11	1.05

Values are mean ± SE of three independent determinations
P: Pearl millet S: sorghum O: Oat
C: Chickpea T: Tulsi leaves powder

Table.5 *In vitro* digestibility and anti-nutrient content of *parantha* based on composite flours (dry matter basis)

Types	In *vitro* digestibility		Antinutrient
	Protein (%)	Starch (mg maltose released/g)	Phytic acid (mg/100g)
Control (100% wheat flour)	72.09±0.17	36.62±0.16	182.43±3.68
Coarse cereals *parantha* P:S:O:C::60:10:10:20	74.14±0.14	38.16±0.22	224.64±2.36
Coarse cereals tulsi*parantha* P:S:O:C:T::60:10:10:15:5	76.66±0.27	38.85±0.28	212.06±3.18
CD (P≤0.05)	1.42	0.96	12.63

Values are mean ± SE of three independent determinations
P: Pearl millet S: sorghum O: Oat
C: Chickpea T: Tulsi leaves powder

Table.6 Antioxidant activity of *parantha* based on composite flours (dry matter basis)

Types	Total phenolic content (mg GAE/g)	DPPH free radical scavenging activity (%)
Control (100% wheat flour)	1.20±0.16	12.53±0.12
Coarse cereals *parantha* P:S:O:C::60:10:10:20	11.62±0.24	44.61±0.28
Coarse cereals tulsi *parantha* P:S:O:C:T::60:10:10:15:5	16.88±0.09	48.94±0.35
CD (P≤0.05)	0.53	0.88

Values are mean ± SE of three independent determinations
P: Pearl millet S: sorghum O: Oat
C: Chickpea T: Tulsi leaves powder

The *In vitro* starch digestibility of composite flours based *parantha* supplemented with *tulsi* leaves powder (38.85 mg maltose released/g) was significantly (P<0.05) higher as compared to control (36.62 mg maltose released/g) and composite flour *parantha* (38.16mg maltose released/g).

The phytic acid content of control *parantha* was 182.43 mg/100g which increased significantly (P<0.05) in composite flours *parantha*. This may be due to the fact that pearl millet, sorghum and mung bean had higher content of phytic acid. However, blanching of pearl millet and germination of chickpea cause the significant reduction in phytic acid but wheat flour contained lowest amount of phytic acid and polyphenol as reported by Archana *et al.*, (2000) and Grewal and Jood (2006). A significantly lower amount of phytic acid content was observed in *tulsi* leaves powder supplemented *parantha* (212.06 mg/100g) as compared to composite flour based *parantha* (224.64 mg/100g). Drumstic leaves supplemented products had lower level of phytates as reported by Pant *et al.*, (2012).

Data regarding antioxidant activity of composite flours based *parantha* are depicted in Table 6. The composite flours based *paranthas* exhibited higher antioxidant activity as compared to control *parantha*. Composite flour based *parantha* had significantly (P<0.05) higher total phenolic content (11.62 mg GAE/g) and DPPH free radical scavenging activity (44.61%) as compared to those of control *parantha*(1.20 mg GAE/g and 12.53%). Supplementation of *tulsi* leaves powder significantly (P<0.05) increased the total phenolic content (16.88 mg GAE/g) and DPPH free radical scavenging activity (48.94%) of composite flour based *parantha*. This increase in antioxidant activity might be due to the high antioxidant activity of pearl millet, sorghum, oat, germinated chickpea and *tulsi* leaves powder. Control products contained lowest amount of total phenolic content and DPPH free radical scavenging activity. Gallegos-Infante *et al.*, (2012) also reported an improvement in antioxidant activity of semolina spaghetti after incorporation of bean flour. Enrichment of traditional food staple with natural food ingredients has enhanced the antioxidant content in food products Sridevi *et al.*, (2010).

It may be concluded from the present study that *parantha* prepared from composite flour of coarse cereal blended with *tulsi* leaves powder possesses a very good sensory score and have superior nutritional quality than control wheat flour *parantha*. Thus, consumption of coarse cereals *parantha* supplemented with *tulsi* leaves powder helps in improving the health status of masses.

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