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Dietary Fiber and Anti-Nutritional Evaluation of Maize-Oat and *Tulsi* Leaves and its Blend Flour.

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Abstract

This study aims at examining the dietary fiber and anti-nutritional factor of grains and their blend flours. The blend flour prepared with maize, oat and *tulsi* leaves. Two types of blend flour were prepared. Type 1 blend flour was prepared from maize: oat in ratio 85:15, 70:30 and 55:45 (W/W), Type 2 blend flour was prepared from maize: oat: *tulsi* in ratio of 80:15:5, 65:30:5 and 50:45:5(W/W). Blend flour were subjected to dietary fiber i.e total dietary fiber, soluble dietary fiber, insoluble dietary fiber and anti-nutrients i.e phytic acid or polyphenols. Total dietary fibre content of maize, oat and *tulsi* leaves was observed as 14.97, 13.51 and 35.92 g/100g, respectively. Significantly highest amount of total dietary fibre, soluble and insoluble dietary fibre content was present in *tulsi* leaves (35.92g/100g), (8.14 g/100g) and (27.77 g/100g) respectively. Phytic acid content of maize, oat and *tulsi* leaves ranged from 151.45 to 205.38 mg/100g, being highest in oat. *Tulsi* leaves had highest polyphenol content whereas, maize had lowest polyphenols. Highest amount of dietary fibre was present in *tulsi* leaves supplemented Type-IV blend flours (15.76%) followed by Type-V (15.58%) and Type-VI (15.34%) blend flours. Significant ($P<0.05$) difference was observed in the phytic acid content of blend flours. The highest phytic acid content observed by Type-III (163.27 mg/100g) followed by Type-II (157.0 mg/100g) and Type-I (149.48 mg/100g) blend flours. Similar trend was noticed in blend flours prepared with *tulsi* leaves. The phytic acid content was 151.53, 158.93 and 165.02 mg/100g, in Type-IV, V and Type-VI blend flours, respectively. The polyphenols content of Type-I blend flour was 40.28 mg/100g which increased significantly with increasing the level of oat in blend flours.

Introduction

Maize (Zea mays L.) is the third most important cereal crop and major source of energy (starch), protein and other nutrients for human (Jompuk et al., 2011). The maize contain low levels of essential amino acids, lysine (<2%) and tryptophan (0.35%) and imbalance in the ratio of leucine (14.76%) to isoleucine (4.13%) (Anonymous, 2001). The increasing demand throughout the world for high-energy, micronutrient rich value-added foods has prompted considerable interest in the growing of nutrient dence cereal crop. “Opaque -2-mutant” through intensive breeding have succeeded in producing Quality protein maize (QPM) which is richer in lysine, tryptophan and other amino acids than the existing maize lines.QPM contains twice the amount of essential amino acids than in normal maize (CIMMYT, 2000). Maize is utilized in the preparation of many traditional, bakery, and extruded products.

Oat (Avena sativa), another major millet crop of India is becoming more and more popular as part of a functional food. Oats are suitable for human consumption as oatmeal and rolled oats. Compared with other grains, the nutritive value of oat contains high concentration of protein with beneficial amino acid composition, advantageous profile of fatty acids, with high amount of PUFA, and excellent source of different dietary fiber, starch, phenolic compounds, minerals, vitamins and antioxidants (Butt et al. 2008). Oat protein is nearly equivalent in quality to soya protein which has been shown by the WHO (2003) to be equal to meat, milk and egg protein. Additionally, oats are source of several natural antioxidants such as tocopherols, alkylresorcinols, and phenolic acids and their derivatives, and a unique source of avenanthramides (N-cinnamoylanthranilate alkaloids) and avenalumic acids (ethylenic homologues of cinnamic acids), which are not present in other cereal grains (Bryngelsson *et al*., 2002). All of these phenolic compounds possess potential health-promoting properties because of their antioxidant activities and/or membrane-modulating effects.

Tulsi (*Ocimum tenuiflorum*) is an aromatic plant belongs to family Lamiaceae which is native throughout the old world (Prakash and Gupta 2005). The *Tulsi* also contain sufficient quantity of antioxidants and fixed oil (Suanarunsawat *et al*. 2010, Kuhn *et al*. 2007) i.e Oleanolic acid, Eugenol, Carvacrol, Linalool and β-caryophyllene. *Tulsi* can be effective for diabetes treatment by reducing blood glucose levels and can also reduce significantly the total cholesterol levels (Jyoti and Anjana 2004), protection from radiation and cataracts (Suanarunsawat and Ayutthaya 2010), anti-hyperlipidemic and cardio-protective effects (Biswas *et al*. 2005). *Tulsi* extracts are used for common colds, headaches, stomach disorders, inflammation, heart disease, healing power**,** coughs, sore throat, respiratory disorders, kidney stone, heart disorder, children's ailments, stress mouth infections, insect bites, skin disorders, eye disorders, etc (AOAC 2002), .

Blend flour technology refers to the process of mixing various different cereals flours with or without addition of green leaves powder in proper proportions to make economic use of local cultivated crops to produce high quality food products. Some studies were reported on the use of course cereals

– green leaves combination for the production of various products (Nagares *et al*. 2010). It can be deduced from these reports that the qualities of product depend on the proportional composition of the blend and flour properties (Oladunmoye *et al*., 2010). Physical and functional properties may affect the behaviour of food systems during processing and storage. Adequate knowledge of the dietary fibere and anti-nutritional factors indicates the usefulness and acceptability for industrial and consumption purpose. This study is one of the efforts to promote the use of blend flours in which flour from quality protein maize and oat with high protein content was used to produce protein-enriched blend flour. Thus, the aim of this study is to investigate the total dietary fiber and anti-nutritional content in grains and their flours. It also investigated the total dietary fibre and anti-nutritional content of different composites of maize-oat-*tulsi* blend flours.

Material and Methods

Procurement of material

The seeds of QPM mixture (quality protein maize) was procured from experimental farms at Regional Research Station, CCS HAU, Uchani, Karnal, oat (*Avena sativa*) HJ-8 from Forage section, *tulsi* (*Ocimum sanctum L*.) leaves procured from Medicinal Aromatic and Underutilized Plants Section, Department of Genetics and Plant Breeding, College of Agriculture, Chaudhary Charan Singh Haryana Agriculture University, Hisar.

Processing of grains

The *tulsi* leaves were trimmed in order to remove any dead or spoiled part. Than washed and freeze dried at -40 C^0 temperature and stored in clean and hygienic condition for further use. The dried unprocessed samples of maize and oat were ground to fine powder in an electric grinder and then stored in plastic containers at room temperature for future use**.**

Preparation of blend flours

Ground unprocessed maize, unprocessed oat flour and dried *tulsi* leaves powder were used to prepare blend flour. Six types of blend flours were prepared. Type I, II and III blend flours were prepared from maize: oat in ratio 85:15, 70:30 and 55:45 (W/W), Type IV, V and VI blend flours were prepared from maize: oat: *tulsi* leaves in ratio of 80:15:5, 65:30:5 and 50:45:5(W/W). The resultant blends were passed through 60 mesh size sieve to obtain uniform mixing.

Determination of dietary fibre and anti-nutritional factors

Total, soluble and insoluble dietary fibre constituents were determined by the enzymatic method given by Furda (1981). Total dietary fibre (TDF) was calculated by the sum of insoluble dietary fibre and soluble dietary fibre. Phytic acid content was determined by the method of Davies and Reid (1979). Total polyphenols were extracted by the method of Singh and Jambunathan (1981).

Statistical analysis

The obtained data were statistically analysed using ANOVA and t-test.

Result

Total dietary fibre content of maize, oat and *tulsi* leaves was observed as 14.97, 13.51 and 35.92 g/100g, respectively. Table 1 showed the highest amount of total dietary fibre content was present in *tulsi* leaves and lowest in oat. *Tulsi* leaves had maximum value of soluble dietary fibre content followed by oat and maize. Insoluble dietary fibre content of *tulsi* leaves was highest followed by maize and oat. All grains showed a significant ($P<0.05$) difference in total dietary fiber, soluble dietary fiber, insoluble dietary fibre, phytic acid and polyphenol content. It is evident from Table 2 that phytic acid content of maize, oat and *tulsi* leaves ranged from 151.45 to 205.38 mg/100g, being highest in oat. Table 2 showed that polyphenol content of maize, oat and *tulsi* leaves was 30.55, 106.19 and 192.82mg/100g, respectively. *Tulsi* leaves had highest polyphenol content whereas, maize had lowest polyphenols. A significant ($P<0.05$) difference in dietary fiber was observed in maize-oat blend flours due to high fiber content in maize (Table 3). Highest amount of dietary fibre was present in *tulsi* leaves supplemented Type-IV blend flours followed by Type-V and Type-VI blend flours. All blend flours differed significantly ($P<0.05$) from each other with respect to their total dietary fiber content, soluble dietary fibre and insoluble dietary fibre content. Soluble dietary fiber of blend flours varied from 2.06 to 4.21 g/100g. Highest amount of dietary fibre was present in *tulsi* leaves supplemented Type-VI blend flours followed by Type-V and Type-IV blend flours. Table 3 further indicates that Type-IV blend flours had highest insoluble dietary fibre content whereas, Type-III blend flour had lowest insoluble dietary fibre content. Significant ($P<0.05$) difference was observed in the phytic acid content of blend flours. The highest phytic acid content observed by Type-III followed by Type-II and Type-I blend flours (Table 4). Similar trend was noticed in blend flours prepared with *tulsi* leaves. The polyphenols content of Type-I blend flour was 40.28 mg/100g which increased significantly with increasing the level of oat in blend flours (Table 4). Addition of *tulsi* leaves in blend flours exhibit similar trends. Type-IV blend flours had minimum content of polyphenol followed by Type-V and maximum in Type-VI blend flours.

Table 1: Dietary fibre content of grains and *tulsi* leaves (g/100g, dry weight basis)

Grain (raw)	Total dietary fiber	Soluble dietary fiber	Insoluble dietary fiber
Maize	14.97±0.06	1.15±0.09	13.76±0.02
Oat	13.51±0.01	7.32±0.01	6.20±0.01
***Tulsi* leaves**	35.92±0.01	8.14±0.09	27.77±0.01
CD (P<0.05)	0.04	0.03	0.06

Values are mean ± SE of three independent determinations

Table 2: Anti-nutrient contents of grains and *tulsi* leaves

Grain (raw)	Anti-nutrients	
	Phytic acid (mg/100g)	**Polyphenol (mg/100g)**
Maize	151.45±0.08	30.55±0.02
Oat	205.38±0.13	106.19±0.01
***Tulsi* leaves**	200.53±0.02	192.82±0.07
CD (P<0.05)	0.32	0.16

Values are mean ± SE of three independent determinations

Table 3: Dietary fibre content of grain blends flours (g/100g, dry weight basis)

Flour blend	Total dietary fibre	Soluble dietary fibre	Insoluble dietary fibre
Maize : oat			
Type-I (85 : 15)	14.68±0.02^{a}	2.06±0.06^{c}	12.62±0.02^{a}
Type-II (70 : 30)	14.52±0.02^{b}	2.95±0.01^{b}	11.51±0.03^{b}
Type-III (55 : 45)	14.29±0.01^{c}	3.93±0.01^{a}	10.34±0.01^{c}
CD(P<0.05)	0.07	0.04	0.07
Maize : oat: *tulsi* leaves			
Type-IV (80 : 15 : 5)	15.76±0.02^{a}	2.39±0.09^{c}	13.34±0.06^{a}
Type-V (65 : 30 : 5)	15.58±0.01^{b}	3.33±0.01^{b}	12.23±0.01^{b}
Type-VI (50 : 45 : 5)	15.34±0.01^{c}	4.21±0.02^{a}	11.12±0.01^{c}
CD(P<0.05)	0.06	0.06	0.05

Values are mean ± SE of three independent determinations

Table 4: *In vitro* digestibility and anti-nutrient contents of grains blend flours

Grain (raw)	Anti-nutrients	
	Phytic acid (mg/100g)	**Polyphenol (mg/100g)**
Type-I (85 : 15)	149.48±0.13^{c}	40.28±0.06^{c}
Type-II (70 : 30)	157.00±0.05^{b}	51.12±0.07^{b}
Type-III (55: 45)	163.27±0.08^{a}	52.56±0.09^{a}
CD(P<0.05)	0.19	0.09
Type-IV (80 : 15 : 5)	151.53±0.11^{c}	46.61±0.15^{c}
Type-V (65 : 30 : 5)	158.93±0.15^{b}	56.89±0.17^{b}
Type-VI (50 : 45 : 5)	165.02±0.17^{a}	59.27±0.19^{a}
CD(P<0.05)	0.08	0.11

Values are mean ± SE of three independent determinations

References:

Anonymous, 2001. Production technology of quality protein maize. Directorate of Maize Research, ICAR, New Delhi. p-4.

AOAC. 2002. Method of analysis. Washington.

Biswas, N.P. and Biswas, A.K. 2005. Evaluation of some leaf dusts as grain protectant against rice weevil Sitophilus oryzae (Linn.). *Environ Ecol*. **23**: 485-488.

Butt, S. M., Tahir-Nadeem, M., Khan, M. K. I., Shabir, R. and Butt, M. S. 2008. Oat: unique among the cereals. *Eur. J. Nutr*. **47**: 68-79.

Bryngelsson, S., Mannerstedt-Fogelfors, B. and Kamal- Eldin, A. 2002. Lipids and antioxidants in groats and hulls of Swedish oats (*Avena sativa* L.). *Journal of the Science of Food and Agriculture*. **82**: 606–614.

CIMMYT. 2000. CIMMYT in 1999-2000. Science and Sustenance. Mexico D.F.: CIMMYT. ISSN: 0188-9214, pp.6-7.

Davies, N. T. and Reid, H. 1979. An evaluation of phytate, zinc, copper, iron and manganese content and availability of soya based textured vegetable protein, meat substitute or meat extrudes. *Brit. J. Nutr.* **41**: 579-589.

Furda, I. 1981. Simultaneous analysis of soluble and insoluble dietary fiber. In W.P.T. James, and O. Theander (Eds.), The Analysis of Dietary Fibre in Food. Marcel Dekker, New York. 163-172.

Jompuk C, Cheuchart P, Jompuk P, Apisitwanich S (2011). Improved Tryptophan content in maize with opaque-2 gene using Marker Assisted Selection (MAS) in backcross and selfing generations. Kasetsart J. Nat. Sci. 45: 666-674

Nagares, N., Hurtada, W. A. Rodriguez, F. M. and Dizon, E.I. 2011. Nutritional value, physic-chemical properties and acceptability of rice (Oeyza sativa L.)- corn (Zea mays L.) composites. *The Asian International Journal of Life Sciences.* **20** (1):199-214.

Oladunmoye, O.O., Akinoso, R. and Olapade, A. A. 2010. Evaluation of some physical-chemical properties of wheat, cassava, maize and cowpea flours for bread making. *Journal of Food Quality.* **33**: 693-708.

Prakash, P. and N. Gupta, 2005. Therapeutic uses of *Ocimum sanctum* Linn with a note on eugenol and its pharmacological actions: Review Article. Indian J. Physiol. Phamacol., 49(2): 125-131.

Singh, U., Khedekar, M. S. and Jambunathan, R. 1982. Studies on desi and kabuli chickpea cultivars: The level of amylase inhibitors, level of oligosaccharides and in vitro starch digestibility. *J. food Sci. Tech.* **47**:510-516

Suanarunsawat, T., T. Boonnak and W.D. Ayutthaya, 2010. Anti-hyperlipidemic and cardioprotective effects of Ocimum sanctum L. fixed oil in rats fed a high fat diet. J. Basic Clin. Physiol. Pharmacol., 21(4): 387-400.

WHO, 2003. Diet nutrition and the prevention of chronic disease. WHO *Tech. Rep. Ser*. 2(4): 206-212