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Nutritional Evaluation of Maize-Oat-*Tulsi* Leaves and its Blend Flour in Different Ratios

***Nutan Narwal & **Saroj Dahiya**

* Research Scholar Department of Foods and Nutrition, CCS Haryana Agricultural University, Hisar - 125004 Haryana.
Email nutannarwal@gmail.com
** Prof. Department of Foods and Nutrition, CCS Haryana Agricultural University, Hisar
Email nutannarwal@gmail.com

Abstract

This study aims to evaluate the nutritional evaluation of maize- oat- tulsi- leaves and their blend flours. The blend flour prepared with maize, oat and tulsi leaves. Six types of blend flour were prepared. Type 1, Type-II, Type III blend flour was prepared from maize: oat in ratio 85:15, 70:30 and 55:45 (W/W) and Type IV, Type V, Type VI blend flour was prepared from maize: oat: tulsi in ratio of 80:15:5, 65:30:5 and 50:45:5(W/W). Whole flours of QPM (QPM mixture), oat (HJ-8), tulsi leaves and different types of blend flours were studied for their proximate composition, sugars and starch. Oat flour had significantly ($p \leq 0.05$) higher crude protein, crude fat, crude fiber and ash contents than maize. Tulsi leaves powder was found to have significantly ($p \leq 0.05$) higher crude fiber and ash than oat and maize flour. In term of sugars, total soluble sugars and non- reducing sugars was significantly higher in maize flour than oats and tulsi leaves. Study revealed that crude protein, crude fat, crude fiber and ash content was significantly higher in Type-III (Maize:Oat 55:45) and Type-IV (Maize:Oat:Tulsi 50:45:5) blend flour as compared to other Types. Crude fiber content of blend flours ranged from 2.54 to 3.58 percent which increased significantly ($P<0.05$) upon supplementation of tulsi leaves and increased level of oat flour. Whereas total carbohydrate content was significantly higher in Type-I (80.29%) and Type-IV (79.63%) blend flours. There was significant difference ($P > 0.05$) recorded for sugars and starch content of different blend flours with or without addition of tulsi leaves. Total soluble sugar and starch content was higher in Type-I and Type- IV blend flour whereas reducing sugar content was significantly higher in Type-III and Type-VI blend flour.

Keywords: Maize; oat; *tulsi* leaves; blend flours; nutritional quality

Introduction

Cereals are the most important source of the world's food and have significant impact in human diet throughout the world (Adebayo et al., 2010). These cereals can supply sufficient qualities of carbohydrates, fat, protein and many minerals, but diet consisting primarily of cereals is high in carbohydrate and deficient in vitamins and protein. The main cereals grown in India are wheat, rice, maize, millet and sorghum. 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). 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. While oats are suitable for human consumption as oatmeal and rolled oats, one of the most common uses is as livestock feed. Oats are grown throughout the

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temperature zones. Oat products are well accepted in human nutrition. 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 (Sadiq Butt et al. 2008, Peterson, 2001; Panfili et al. 2003). 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.

Tulsi (*Ocimum tenuiflorum*) is an aromatic plant belongs to family Lamiaceae which is native throughout the old world. *Tulsi* also contain sufficient quantity of antioxidants and fixed oil 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, protection from radiation and cataracts, anti-hyperlipidemic and cardio-protective effects.

Despite a recent advance in formulation of non-wheat flour from maize-oat combination, with or without addition of *tulsi* leaves powder, such as biscuit, cake and pasta. 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 to investigate the proximate composition, sugars and starch content of grains flours and different composites of maize-oat-*tulsi* leaves blend flours.

Material and Method

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*) from Forage section, *tulsi* (*Ocimum sanctum L.*) leaves procured from section Medicinal Aromatic and Underutilized Plants Section, Department of Genetics and Plant Breeding, College of Agriculture, Choudhary 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 proximate composition

Moisture in the samples was calculated by employing the standard methods of analysis (AOAC, 2000).Crude Protein was estimated using micro-kjeldahl method with KELPLUS nitrogen estimation system. Crude fiber, ash and total carbohydrate was estimated by the standard method of analysis (AOAC, 2000). Crude fat was estimated by standard method (AOAC, 2000) using soxhlet extraction apparatus.

Determination of sugars and starch content

Total soluble sugars

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Total soluble sugars other than starch were extracted according to the procedure of Cerning and Guilhot (1973) and estimated by using the method of Yemm and Willis (1954). Reducing sugars were estimated by using Somogyi's modified method (Somogyi, 1945). The amount of non-reducing sugar was calculated as the difference between total soluble sugars and reducing sugars.

Starch

Starch from the sugar free pellet was estimated by using the method of Clegg (1956).

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

Results and discussion

Results of proximate composition of maize, oat and *tulsi* leaves are presented in Table-.1

Moisture content of maize and oat varied from 6.69 to 8.93 percent (Table 2). Bhutta *et al.*, (2010) also reported much higher values of moisture content (14.9) percent in maize whereas, moisture content in oat (8.93 percent) is in agreement with the results reported earlier by Kaur *et al.* (2014). The *tulsi* leaves had highest moisture content i.e 83.57percent (fresh weight basis). Findings of the present study are in association with the results reported by Sarfraj *et al*., (2011) and Tewari *et al*. (2012), which stated that moisture content of 86.35 percent and 93.3 percent was present in *tulsi* leaves. Crude protein content of the maize and oat was in range of 11.58- 12.05 per cent respectively. Significant ($P<0.05$) difference was observed in crude protein content of maize, oat and *tulsi* leaves. The protein content (11.57 percent) observed in maize (Table 1) was similar to that reported earlier by Nagi *et al.*, (2005) who also found 8.14-11.30 percent protein in maize. Crude fat content of maize, oat and *tulsi* leaves varied significantly ($P<0.05$) from 1.2 per cent to 3.26 per cent. Highest amount of crude fat was found in oat (3.26 %) and lowest in *tulsi* leaves (1.2 %). Findings of present study regarding crude fat content i.e (3.27 and 6.9 percent) are similar to those reported by Masih *et al.* (2013) and Ahmad *et al*. (2014). Highest amount of crude fibre was present in *tulsi* leaves (6.79%) followed by oat (3.47%) and maize (2.38%). Crude fibre (2.38 percent) reported in the present study was similar to that reported by Nagi *et al.*, (2005) who found 2.19-2.43 percent in maize. Ash content of maize, oat and *tulsi* leaves was observed as 1.3, 1.93 and 9.46 percent, respectively. Total carbohydrate content of maize, oat and *tulsi* leaves varied significantly ($P<0.05$). Maximum amount of total carbohydrates was present in maize (82.07 %) and minimum amount was observed in *tulsi* leaves (71.78%). Cisse *et al.* (2013) showed similar total carbohydrate content (83.70 percent) in maize.

Sugar

The results of total soluble sugar, reducing sugar and non-reducing sugar content of grains and *tulsi* leaves are depicted in Table 2. Total soluble sugar content in maize, oat and *tulsi* leaves was observed as 2.31, 1.68 and 1.71 g/100g, respectively. Significantly ($P<0.05$) higher total soluble sugar content was observed in maize followed by *tulsi* leaves and oat. Reducing sugar content of maize, oat and *tulsi* leaves ranged from 0.38, 0.50 and 0.26 g/100g, respectively. Maximum amount of non-reducing sugar content was found in maize (1.92 g/100g) and minimum amount was observed in oat (1.18 g/100g). Arya (2002) reported that total, reducing and non-reducing sugar contents in maize ranged from 1.23, 0.92 and 0.31 g/100g, respectively. Maize had highest amount of starch content (69.1 g/100g) followed by oat (67.47 g/100g) and *tulsi* leaves (5.09 g/100g). These findings are quite similar to the values reported by Arya (2002), Yadav and Yadav

(2002) who found 70.44 percent and 68.15 to 71.67 per cent starch in maize.

Proximate composition of grain blends flours

Results of proximate composition of maize, oat blend flours indicating (Table 3) that moisture, crude protein, crude fat, crude fiber and ash content in Type-I blend flour was 7.13, 11.63, 3.53, 2.54 and 2.0 percent which increased gradually and significantly on increasing the level of oat flour supplementation whereas total carbohydrate content was decreased significantly with increasing the level of oat flour. Kadam *et al* (2012) observed that proximate composition of blend flour (wheat flour, chickpea flour, soy flour and *methi* leaves powder) contained higher amount of protein, fat, fibre, ash and carbohydrates. This study was agreement with the findings of (Adeoti *et al*. 2013) observed that addition of cirina forda flour to maize flour increased the protein content and fat content of the blends while, the carbohydrate content of the blend was significantly lower to that of the control sample. In case of *tulsi* supplemented blend flours crude protein, crude fat, crude fiber and ash content was increased gradually with increased supplementation of oat flour and *tulsi* leaves powder whereas, total carbohydrate content was decreased with increasing the level of oat flour. Mamilla and Khan (2011) reported that composites mixture (safflower petals, curry leaves, *tulsi* leaves and amla) contain highest amount of crude fiber, calcium, iron and lowest amount of fat content.

Sugar

Table 4 depicts the total soluble sugar, reducing sugar, non-reducing sugar and starch content of grain flour blends. Total soluble sugar of blend flours ranged from 1.19 to 2.21 g/100g, being highest in Type-I blend flours (2.21 g/100g). A non-significant difference was found between Type-I, Type-II whereas, a significant difference was observed in Type-I and Type-III blend flours with respect to their total soluble sugar content. A significant difference ($P<0.05$) was observed in *tulsi* leaves supplemented blend flours with respect to their total soluble sugar content. Reducing sugar content of flour blends ranged from 0.38 to 0.48 g/100g. The Type-VI blend flours had highest reducing sugar content whereas, Type-I had lowest reducing sugar content. Type-I and Type-IV had almost similar reducing sugar content (0.38 and 0.39 g/100g), respectively. Non-reducing sugar of Type-I, Type-II, Type-III, Type-IV, Type-V and Type-VI blend flours was 1.83, 1.72, 1.56, 1.80, 1.67 and 1.52 g/100g, respectively. As the supplementation of oat flour and *tulsi* leaves powder increased, the content of non-reducing sugars was found to be decreased. Starch content of blend flours varied from 65.15 to 68.83 g/100g. The Type-I blend flour (68.83g/100g) had highest content of starch followed by Type-II (68.60g/100g), Type-III (68.35 g/100g), Type-IV (65.63 g/100g) and Type-V blend flours (65.39 g/100g) whereas, Type-VI blend flour had lowest content of starch.

Summary

This study revealed the proximate composition and sugar content of different grain flours, *tulsi* leaves and blend flours. Results of proximate composition and sugars of raw ingredients showed that oat flour contained highest amount of crude protein (12.05%) and crude fat (3.26%) whereas, crude fiber (6.79%) and ash (9.46%) content was maximum in *tulsi* leaves. Higher amount of total carbohydrate (82.07%) was observed in maize. Maximum amount of total soluble sugar (2.31 g/100g), non- reducing sugars (1.92 g/100g) and starch (69.1 g/100g) was observed in maize and reducing sugar (0.50 g/100g) was found maximum in oat. The results of blend flours indicated that moisture (7.30 and 7.34%), crude protein (11.78 and 11.25%), crude fat (4.13 and 4.02%), crude fiber (2.84

and 3.58%), ash (2.60 and 2.86%) content was significantly higher in Type-III and Type-VI blend flours. Total soluble sugar, non-reducing sugar and starch content was observed maximum in Type-I and Type-IV blend flour while reducing sugar content was higher in Type-III and Type-VI blend flour due to increasing the level of oat flour.

Referances

1. Adebayo, G.B., Otunola, G. A. and Ajao, T. A. 2010. Physicochemical, microbiological and sensory characteristics of kunu prepared from millet, maize and guinea corn and stored at selected temperature. *Advance Journal of Food Science and Technolog.* **2** (1): 41-46.
2. Adeoti, O.A., Elutilo, O.O., Babalola, J.O., Jimoh, K.O, Azeez, L.A and Rafiu, K.A. 2013. Proximate, mineral, amino acid and fatty acid compositions of maize tuwo-cirina forda flour blends. *Greener Journal of Biological Sciences.* **3** (4): 165-171
3. Ahmad, M., Gul-Zaffar, Z.A. and Habib, M. 2014. A review on oat (Avena sativa L.) as a dual-purpose crop. *Scientific Research and Essays Academic Journal*. **9** (4):52-59.
4. AOAC. 2000. Official Methods of Analysis. Association of official analytical chemist. Washington, D.C.
5. Arya, L. 2002. Nutritional changes in insect infested maize (Zea mays L.) during storage, M.Sc. Thesis, Department of Food Science and Nutrition, (SK. HPKV, Palampur).
6. Bhutta, A.R., Rizzi, R. and Pannacciulli, D.G. 2010. Mineral composition in hulled wheat grains: a comparison between emmer (Triticum dicoccon Schrank) and spelt (T. spelta L.) accessions. *Int. J. Food Sci. Nutr.* **48**: 381-386.
7. 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.
8. Cerning, J. and Guilbot, J. 1973. Change in carbohydrate composition during maturation of wheat and barley kernel. *Cereal Chem*. **77**: 479-488.
9. Cisse, M., Magnanou, R., Kra, K.A.S., Soro, R.Y. and Niamke S. 2013. Physicochemical, biochemical and nutritive properties of QPM and regular maize flours grown in coted'lvoire. *International J. Res. Bio. Sci.* **2** (2):26-32.
10. Clegg, K.M. 1956. The application of anthrone reagent to the estimation of starch in cereals. *J. Sci. Food. Agri*. **7**: 40-44.
11. 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
12. Kadam, M.L., Salve, R.V., Mehrajfatema, Z.M. and More, S.G. 2012. Development and evaluation of composite flour for *missi roti /chapatti*. *J. Food Process. Technol*. **3** (1): 134-140.
13. Kaur, J., Kaur, A. and Aggarwal, P. 2014. Dehulling characteristics of oat (OL-9 variety) as affected by grain moisture content. *International Journal of Research in Engineering and Technology*. **3** (9):2319-2321
14. Mamilla, V. V and Khan, T. N. 2011. Development, nutritional and

organoleptic evaluation of herbal composite. *Bionano Frontier*. **4** (2): 345-352.

15. Masih, A., Raj, A. S., Rubila, S., Patil, R. R. and Ranaganathan, T. V. 2013. Preparation of laminated baked product using oats. *Journal of Food Processing and Technology*. **4** (3) : 110.115.
16. Nagi, H.P.S., Rehal, J. and Sharma, S. 2005. Evaluation of physico-chemical and processing characteristics of Punjab maize varieties. *J. Food Sci. Tech*. **42** (2): 169-172.
17. Panfili G, Fratianni A & Irano M (2003) Normal phase high-performance liquid chromatography method for the determination of tocopherols and tocotrienols in cereals. *J Agric Food Chem* **51**: 3940–3944.
18. Peterson D.M., Emmons Ch.L., Hibbs A.H. (2001): Phenolic antioxidants and antioxidant activity in pearling fractions of oat groats. *Journal of Cereal Science*, **33**: 97–103.
19. Sarfraj, Z., Anjum, F. M., Khan, M. I. Arshad, M.S. and Muhammad, N. 2011. Characterization of basil (ocimum basilicum L.) parts for antioxidant potential. *African Journal of Food Science and Technology*. **2** (9):204-213.
20. Somogyi, M. 1945. A new reagent for determination of sugers. *J. Biol. Chem.* **160**: 61-62.
21. Tewari, D., Pandy, HK., Meena, HS., Manchanda. A, and Patni. P. 2012. Pharmacognostical, biochemical and elemental investigation of *Ocimum Basilicum* plants available in western Himalayas. *International Journal of Research in Pharmaceutical and Biomedical Sciences*. **3** (2): 2229-3701
22. WHO, 2003. Diet nutrition and the prevention of chronic disease. WHO *Tech. Rep. Ser*. **2**(4): 206-212
23. Yadav, S.S. and Yadav, R.P. 2002. Studies on some quality traits of maize (*Zea mays* L.) genotypes. In: Adv. Maize Prodn. Tech. and Quality Impvt. Proc. *Proceedings of National Seminar on Science- Industry Interface on Maize Production, Processing and Utilization*, HPKV, Palampur, Nov 3-4, 2000. pp: 181-183.
24. Yemm, E.W. and Willis, A. J. 1954. The estimation of carbohydrates in plant extract by anthrone. *Biochem. J.* **54**: 508-509

Table 1: Proximate composition of grains and *tulsi* leaves (%, dry weight basis)

Grain/Variety (raw)	Moisture (%)	Crude protein (%)	Crude fat (%)	Crude fibre (%)	Ash (%)	Total carbohydrates (%)
Maize	6.69±0.29	11.58±0.03	2.66±0.22	2.38±0.03	1.3±0.06	82.07±0.18
Oat	8.93±0.24	12.05±0.02	3.26±0.03	3.47±0.06	1.93±0.06	79.27±0.09
***Tulsi* leaves**	83.57±0.06*	0.75±0.05	1.2±0.05	6.79±0.03	9.46±0.05	71.78±0.05
CD (P<0.05)	0.76	0.03	0.44	0.01	0.19	0.42

*Moisture content on fresh weight basis

Values are mean ± SE of three independent determinations

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Table 2: Sugar and starch content of grains and *tulsi* leaves (g/100g, dry weight basis)

Grain (raw)	Total soluble sugars	Reducing sugars	Non-reducing sugars	Starch
Maize	2.31±0.01	0.38±0.01	1.92±0.03	69.1±0.05
Oat	1.68±0.09	0.50±0.02	1.18±0.01	67.47±0.02
***Tulsi* leaves**	1.71±0.09	0.26±0.01	1.44±0.03	5.09±0.01
CD (P<0.05)	0.03	0.05	0.03	0.12

Values are mean ± SE of three independent determinations

Table 3: Proximate composition of grain blends flours (%, dry weight basis)

Flour blends	Moisture	Crude protein	Crude fat	Crude fibre	Ash	Total carbohydrates
Maize : oat						
Type-I (85 : 15)	7.13±0.4	11.63±0.03	3.53±0.06	2.54±0.06	2±0.04	80.29±0.06
Type-II (70 : 30)	7.2±0.2	11.71±0.07	4±0.05	2.71±0.06	2.26±0.06	79.31±0.08
Type-III (55 : 45)	7.30±0.73	11.78±0.03	4.13±0.03	2.84±0.02	2.6±0.04	78.64±0.04
CD(P<0.05)	1.81	0.01	0.18	0.04	0.13	0.22
Maize : oat : *tulsi* leaves						
Type-IV (80 : 15 : 5)	7.15±0.3	11.17±0.03	3.50±0.03	3.26±0.07	2.39±0.01	79.63±0.03
Type-V (65 : 30 : 5)	7.23±0.9	11.19±0.03	3.81±0.05	3.41±0.09	2.53±0.06	79.05±0.08
Type-VI (50 : 45 : 5)	7.34±0.6	11.25±0.03	4.02±0.03	3.58±0.07	2.86±0.02	78.42±0.02
CD(P<0.05)	2.32	0.01	0.14	0.02	0.13	0.19

Values are mean ± SE of three independent determinations

Table 4: Sugar and starch content of grain blends flours (g/100g, dry weight basis)

Flour blend	Total soluble sugars	Reducing Sugars	Non-reducing sugars	Starch
Maize : oat				
Type-I (85 : 15)	2.21±0.05	0.38±0.01	1.83±0.01	68.83±0.02
Type-II (70 : 30)	2.14±0.07	0.41±0.02	1.72±0.07	68.6±0.06
Type-III (55 : 45)	2.03±0.02	0.46±0.04	1.56±0.05	68.35±0.02
CD(P<0.05)	0.15	0.08	0.18	0.07
Maize : oat : *tulsi* leaves				
Type-IV (80 : 15 : 5)	2.18±0.05	0.39±0.07	1.80±0.07	65.63±0.06
Type-V (65 : 30 : 5)	2.08±0.04	0.43±0.01	1.67±0.01	65.39±0.01
Type-VI (50 : 45 : 5)	1.99±0.01	0.48±0.03	1.52±0.05	65.15±0.07
CD(P<0.05)	0.01	0.15	0.14	0.14

Values are mean ± SE of three independent determinations