



RESEARCH ARTICLE

NUTRITIONAL EVALUATION AND ORGANOLEPTIC ACCEPTABILITY OF BAKED PRODUCTS BASED ON BLEND FLOUR (MAIZE-OAT-TULSI)

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ABSTRACT

The study was conducted on Maize (QPM mixture), Oat (HJ-8) and *Tulsi* leaves. Six types of blend flours i.e Type-I, Type-II and Type-III blend flour were prepared from maize: oat in ratios of 85:15, 70:30, 55:45(W/W), Type-IV, Type-V and Type-VI blend flours were prepared from maize: oat: *tulsi* leaves in ratio of 80:15:5, 65:30:5, 50:45:5 (W/W). Different types of baked products (Cake and Biscuit) were developed using blend flours and assessed organoleptically. Most acceptable products were nutritionally analyzed. Among baked products, mean scores for overall acceptability of Type-II cake were in category of 'like moderately' whereas mean scores for overall acceptability of Type-V based cake were in the range of 'like slightly'. Mean scores for overall acceptability of Type-II and Type-V blend flour biscuits were in the category of 'like moderately'. Nutritional evaluation of cakes and biscuits depicted that Type-II cake and biscuit contained significantly highest amount of crude protein (13.90 and 8.57 %) while crude fiber (3.07 and 3.11%) and ash (2.02 and 0.8%) content was significantly higher in Type-V cake and biscuit. Thus it can be concluded that incorporation of *tulsi* leaves in blend flour of maize and oat can serve as functional ingredients for combating degenerative disorders such as obesity, heart diseases, cancer, diabetes etc.

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INTRODUCTION

Biscuits have become a traditional and significant food in many countries. They are staple foods, snacks, dietary products, infant foods and with additions of chocolate and cream. Since the major ingredients of all biscuits are flour, sugar and fat, they are a major source of energy (Manley, 2000). Generally soft wheat with weak gluten and low protein content are preferred for biscuit making. Wheat flour is deficient in certain essential amino acids, specially, lysine. Quality protein maize are higher in proteins (18–24%) than other cereal grains and could be used to support certain amino acids such as lysine, tryptophan and methionine. Composite 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 coarse cereals – green leaves combination for the production of various products (Nagares *et al*, 2010; Rachna 2006). It can be deduced from these reports that the qualities of product depend on the proportional composition of the composites and flour

properties (Oladunmoye *et al*, 2010). Thus the aim of study to investigate the organoleptic and nutritional evaluation of baked products.

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. Then washed and freeze dried at - 40C⁰ temperature and stored in clean and hygienic condition for further use. The dried unprocessed samples of maize and oat

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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.

(AOAC, 2000). Crude fat was estimated by standard method (AOAC, 2000) using soxhlet extraction apparatus.

Statistical analysis

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

RESULTS AND DISCUSSION

Result of organoleptic acceptability of baked products

Table 1 showed that the mean scores of overall acceptability was highest in control cake.

Table 1. Mean scores of organoleptic characteristics of maize-oat-*tulsi* flour blends based cake

Level of supplementation	Colour	Appearance	Aroma	Texture	Taste	Over all acceptability
Control (RF::100%)	8.4±0.22	8.4±0.22	8.44±0.22	8.4±0.22	8.4±0.22	8.4±0.22
Maize : oat						
Type-I (85 : 15)	7.7±0.21	7.4±0.16	7.9±0.10	6.8±0.20	7.4±0.22	7.44±0.11
Type-II (70 : 30)	7.40±0.22	7.6±0.16	7.7±0.15	7.7±0.15	7.5±0.16	7.58±0.11
Type-III (55 : 45)	6.6±0.22	6.5±0.16	6.8±0.20	6.4±0.16	6.6±0.22	6.58±0.12
CD (P<0.05)	0.13	0.11	0.16	0.18	0.15	0.19
Maize: oat: <i>tulsi</i> leaves						
Type-IV (80 : 15 : 5)	6.6±0.22	6.5±0.16	6.5±0.21	6.5±0.22	6.6±0.20	6.54±0.16
Type-V (65 : 30 : 5)	6.7±0.21	6.6±0.22	6.7±0.15	6.4±0.16	6.8±0.20	6.64±0.16
Type-VI (50 : 45 : 5)	6.4±0.22	6.3±0.15	6.6±0.16	6.2±0.20	6.5±0.22	6.4±0.09
CD (P<0.05)	0.18	0.11	0.07	0.16	0.15	0.19
CD (P<0.05) for all treatments	0.61	0.51	0.49	0.53	0.58	0.41

Values are mean ± SE of ten independent determinations
RF = Refined flour

Table 2. Mean scores of organoleptic characteristics of maize-oat-*tulsi* flour blends based biscuits

Level of supplementation	Colour	Appearance	Aroma	Texture	Taste	Over all acceptability
Control (RF::100%)	8.6±0.16	8.40±0.22	8.50±0.22	8.30±0.26	8.30±0.21	8.42±0.19
Maize : oat						
Type-I (85 : 15)	7.90±0.24	7.60±0.24	7.54±0.23	7.77±0.21	7.8±0.21	7.70±0.22
Type-II (70 : 30)	7.93±0.22	7.90±0.15	7.72±0.16	7.82±0.21	7.97±0.21	7.8±0.17
Type-III (55 : 45)	7.81±0.22	7.5±0.16	7.50±0.26	7.65±0.20	7.76±0.25	7.64±0.18
CD (P<0.05)	0.14	0.16	0.19	0.20	0.16	0.24
Maize: oat: <i>tulsi</i> leaves						
Type-IV (80:15:5)	7.6±0.21	7.4±0.21	7.51±0.24	7.67±0.27	7.71±0.21	7.57±0.21
Type-V (65:30:5)	7.7±0.23	7.52±0.23	7.57±0.23	7.71±0.23	7.78±0.21	7.65±0.22
Type-VI (50:45:5)	7.6±0.22	7.5±0.26	7.5±0.26	7.6±0.22	7.5±0.16	7.54±0.21
CD (P<0.05)	0.15	0.17	0.11	0.18	0.21	0.25
CD (P<0.05) for all treatments	0.61	0.61	0.66	0.65	0.60	0.57

Values are mean ± SE of ten independent determinations
RF = Refined flour

Organoleptic evaluation of flour blends based baked products

For selecting the acceptable products for further study, the above mentioned baked products were subjected to organoleptic evaluation by a panel of ten judges drawn from the I.C. College of Home Science, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana. The judges were asked to record the quality characteristics i.e. colour, appearance, aroma, texture and taste by employing a nine-point Hedonic Rating Scale as given in Annexure-I.

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

The mean scores of colour, appearance, aroma, texture, taste and overall acceptability of Type-I (7.44) and Type-II (7.58) cake was in the category of 'liked moderately' while Type-III (6.58) cake was fall in the category of 'liked slightly'. Vishakha, (2006) reported that mean scores for overall acceptability of all maize based cake fell in 'liked moderately' category. *Tulsi* leaves supplemented Type-IV, Type-V and Type-VI cake of all sensory parameters were in the category of 'liked slightly'. Colour, appearance, aroma, texture, taste and overall acceptability were observed in control biscuit. The mean scores for overall acceptability of Type-I, II and III blend flours based biscuit were 7.70, 7.80 and 7.64, respectively (Table 2). The biscuit prepared with supplementation of *tulsi* leaves showed lower scores for overall acceptability i.e 7.57, 7.65 and 7.54 for Type-IV, V and VI biscuit, respectively as compare to unsupplemented biscuit and rated as 'liked moderately'. Findings of the present study are similar to the results reported by Honey, (2011); Sangwan and Dahiya (2013).

Table 3. Proximate composition of cake based on flour blends (% , dry weight basis)

Cake	Moisture*	Crude protein	Crude fat	Crude fibre	Ash	Total carbohydrates
Control	23.45±0.83 ^a	12.10±0.09 ^c	10.66±0.17 ^a	0.20±0.03 ^c	1.02±0.01 ^a	76.02±0.18 ^a
Type-II	23.67±0.44 ^a	13.90±0.03 ^a	11.60±0.52 ^a	2.42±0.01 ^b	1.53±0.01 ^a	69.57±0.54 ^b
Type-V	23.96±0.13 ^a	13.37±0.03 ^b	11.33±0.17 ^a	3.07±0.07 ^a	2.02±0.01 ^a	69.21±0.16 ^b
CD (P<0.05)	1.91	0.02	1.16	0.02	0.02	1.19

Values are mean ± SE of three independent determinations

*Moisture on fresh weight basis

Control (RF 100%) Type-II (M:O 70:30) Type-V (M:O:T 65:30:5)

RF = Refined flour, M = Maize, O = Oat, T= *Tulsi* leaves

Table 4. Proximate composition of biscuit based on flour blends (% , dry weight basis)

Biscuits	Moisture*	Crude protein	Crude fat	Crude fibre	Ash	Total carbohydrates
Control	1.56±0.09 ^b	6.14±0.09 ^c	27.46±0.7 ^b	0.26±0.01 ^c	0.4±0.03 ^b	65.73±0.74 ^a
Type-II	3.26±0.54 ^a	8.57±0.03 ^a	28.53±0.29 ^b	2.48±0.09 ^b	0.8±0.04 ^a	59.61±0.2 ^b
Type-V	3.24±0.53 ^a	7.73±0.06 ^b	30.2±0.2 ^a	3.11±0.06 ^a	0.8±0.02 ^a	58.16±0.2 ^b
CD (P<0.05)	1.53	0.02	1.64	0.02	0.0	1.64

Values are mean ± SE of three independent determinations

*Moisture on fresh weight basis

Control (RF 100%) Type-II (M:O 70:30) Type-V (M:O:T 65:30:5)

RF = Refined flour, M = Maize, O = Oat, T= *Tulsi* leaves

Similarly, Ariful *et al.*, (2014) and Nwakalor- Chizoba (2014) reported *tulsi* (10g) and moringa (5g) leaves supplemented biscuits were acceptable by the judges.

Proximate composition

In case of proximate composition of cake, significantly higher amount of crude protein was observed in Type-II cake while, moisture, crude fiber and ash content were higher in Type-V cake (Table 3). Similar results were reported by earlier workers in respect that incorporation of leaves for development of biscuits increased the crude fiber and ash content (Wani *et al.*, 2011; Sihag, 2007; Hafez, 2012). Maximum amount of total carbohydrates was exhibited by control cake. Proximate composition of control, Type-II and Type-V biscuit differed significantly except in moisture content (Table 4). Crude protein content was significantly higher in Type-II biscuit. Blend flours (oats and finger millet) based cookies contained significantly higher content of protein, ash, dietary fiber as compare to control cookies (refined flour) as reported by Vijayakumar *et al.* (2013). While, crude fat, crude fibre and ash content were higher in Type-V biscuit as compared to Type-II and control biscuit. Similarly, Ariful *et al.*, (2014) reported *tulsi* and moringa leaves supplemented biscuits were contain higher amount of fiber, ash and lower content total carbohydrate. Total carbohydrate content was significantly higher in control biscuit in the present study.

Summary

In baked products, mean scores for overall acceptability of Type-II cake were in category of 'like moderately' whereas mean scores for overall acceptability of Type-V based cake were in the range of 'like slightly'. Mean scores for overall acceptability of Type-II and Type-V blend flour biscuits were in the category of 'like moderately'. Nutritional evaluation of cakes and biscuits depicted that Type-II cake and biscuit contained significantly highest amount of crude protein (13.90 and 8.57 %) while crude fiber (3.07 and 3.11%) and ash (2.02 and 0.8%) content was significantly higher in Type-V cake and biscuit. Total carbohydrates (76.02 and 65.73%) were significantly higher in control cake and biscuit.

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