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Development of value added Pasta with incorporation of malted finger millet flour

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Abstract: This study considers the replacement of Semolina with malted finger millet flour containing wide range of nutrients in enrichment of pasta. The changes in nutritional constituents and bioactive compounds (TPC, Radical Scavenging Activity) of pasta were examined by adding malted finger millet flour to the pasta formulations at the level of 0 (T_0), 10 (T_1), 20 (T_2), 30 (T_3) ,40 (T_4) and 50 (T_5) per cent flour replacement. The results indicated that T_4 sample of finger millet flour added pasta contained more protein content i.e. 12.65 g compared to that of control pasta (T_0) i.e. 7 g. Same way the calorie content of value added pasta was higher i.e. 409.94 Kcal/100 g as compared to control pasta (T_0) i.e. 324.40 Kcal/100 g. Calcium content of value added pasta was comparatively very high i.e. 170.4 mg/100 g as compared to 15.3 mg/100 g of control. As far TPC content & DPPH % were considered, T_4 sample of pasta have higher amount of both i.e. 220 mg Gallic acid eq. & 53.38 % as compared to control pasta (T_0) i.e.220 mg Gallic acid eq. & 17.59 % respectively. Pasta and related products are the most popular are the most popular food worldwide. Usually pasta and other extruded products are high in starch but low in dietary fiber, minerals and vitamins. The present study clearly indicates that the use of malted finger millet flour will improve nutritional quality of pasta in terms of antioxidant activity.

Keywords: Bioactive compounds, Finger millet, Malting, Pasta, Radical scavenging activity

INTRODUCTION

Nowadays demands for ready to eat foods like extruded products has been increased because of change in economic scenario, urbanization, increased women employment and increased per capita income. Pasta products are normally high in starch but low in dietary fiber, minerals, vitamins, phenolic compounds, etc. With an increasing concern by the health conscious population, more nutritious pasta products rich in minerals, phenolic compounds, and dietary fiber with low glycemic index, have become the subject of prior significance. Emphasizing on this, an effort was put forth to develop health pasta supplemented with malted finger millet (*Eleusine coracana*) flour which are rich vitamins, minerals, and antioxidants. Finger millet (*Eleusine coracana*) is an important staple food in the eastern and central Africa as well some parts of India (Mazumdar et. al 2006). Finger millet is usually used for preparation of flour, pudding, porridge and roti (Chaturvedi and Srivastava, 2008). With the changes in scenario of utilization of processed products and awareness of the consumers about the health benefits, finger millet has gained importance because of its functional components, such as slowly digestible starch and resistant starch (Wadikar *et al*., 2007). The calcium content is higher than all cereals and iodine content is said to be highest among all the food grains. Ragi has best quality protein along with the presence of essential amino acids, vitamin A, vitamin B and phosphorus. Thus ragi is a good source of diet for growing children, expecting women's, old age people and patients (Desai *et al.,* 2010). Traditionally finger millet is processed either by malting or fermentation (Rao and Muralikrishna, 2001). Malting of finger millet improves its digestibility, sensory and nutritional quality as well as pronounced effect in the lowering the antinutrients. Malting characteristics of finger millet are superior to other millets and ranks next to barley malt (Pawar and Dhanvijay, 2007). The malted and fermented finger millet flour are extensively used in preparation of weaning food, instant mixes, beverages and pharmaceutical products (Rao and Muralikrishna, 2001). Therefore, an attempt has been made through this study to utilise the malted finger millet to produce tasty and nutritious pasta, the demand of which has been increased among individuals.

MATERIALS AND METHODS

Test Materials: The present study was carried out in the Centre of Food Technology, University of Allahabad, Allahabad during January 2013- May 2013. Semolina and finger millet in a single lot were procured from the local market of Allahabad, India. To optimize the

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soaking period, germination period and germination temperature of finger millet, response surface methodology (RSM) was used while rest of the ingredients levels were kept constant on the basis of hit and trial method. The lower and upper limits for soaking period, germination temperature and germination period were taken as 8- 24 hours, 25-37^0c and 24-72 hours, respectively. The soaking period (16 hours), germination temperature (31^0c) and germination period (48 hours) was optimized for malting. The Optimized finger millet was then dried in hot air oven at 50^0c for 24 hours. Vegetative parts were removed by rubbing and the millets were ground to power followed by storing in air-tight containers.

Malted finger millet Flour + Semolina

↓

Added vegetable fat and water required and prepared the Dough

↓

Passed the Dough through Pasta maker (Dolly Mini P_3 Pasta Maker)

↓

Cut into Pieces of 15-20 mm using a cutter

↓

Dried in Hot air oven at 55^o C for 4 hours, Cooled and packed in Air tight containers

Fig. 1. *Flow sheet for preparation of Pasta.*

Table 1. Details of control and treatment combinations.

Ingredients	Treatments					
	T_0	**T_1**	**T_2**	**T_3**	**T_4**	**T_5**
Semolina (%)	100	0	0	0	0	0
Finger Millet (%)	0	10	20	30	40	50

Chemical analysis: The proximate composition, calcium and iron content of malted finger millet flour and developed product was determined by AOAC (2007), whereas for estimation of total phenolic content, Folin-Ciocalteaue method was adopted Singleton *et al.* (1999). The radical scavenging activity was estimated by DPPH method given by De Ancos *et al* (2002).

Preparation of pasta: There were six combinations made for formulation of pasta as given in table 1. The procedure of making pasta is given in figure 1. Incorporation of malted finger millet flour to semolina was on replacement basis and incorporation level was 0, 10, 20, 30, 40, 50 percent, respectively.

RESULTS AND DISCUSSION

Proximate composition of malted finger millet flour and semolina: Malting of finger millet improves digestibility and bioavailability of nutrients, improves sensory and nutritional quality. From the table 2, it has been found that comparison of proximate composition of malted finger millet flour and semolina did not revealed any major difference. Rao (1994) also reported 8.2 and 11.3% protein content in brown and white varieties of malted finger millet, respectively. Kamath and Belavady (1980) found 18.6% dietary fibre and 3.6% crude fibre in finger millet.

Calcium and iron content of malted finger millet flour: Calcium and iron content of malted finger millet flour were 386 mg and 4.6 mg, respectively whereas the same of semolina were 14.5 mg and 1.23 mg, respectively as shown in table 2. **Mamiro *et al.* (2001)** also reported that germination of finger millet for 48 hours has increased the in vitro extractability of calcium, iron and zinc.

Total phenolic content (TPC) and radical scavenging activity (DPPH) of malted finger millet flour: Table 3 shows that total phenolic content (TPC) and radical scavenging activity (DPPH) of malted finger millet flour was comparatively higher i.e., 124mg/100g Gallic acid eq. and 47.78 percent, respectively that that of

Table 2. Proximate and mineral composition of semolina, raw finger millet and malted finger millet (Mean ±SD of three replicates).

Particulars	Moisture %	Crude Fat %	Protein %	Crude Fiber %	Ash %	Calcium mg/100 g	Iron mg/100 g
Semolina	0.51±0.11	0.83±0.15	10.65±0.12	0.4±0.15	1.31±0.17	14.5±0.11	1.23±0.13
Raw Flour	7.05±0.13	1.1±0.12	7.2±0.08	3.3±0.26	2.8±0.15	337±0.20	3.4±0.12
Malted Flour	7.82±0.14	2.48±0.17	10.5±0.10	3.16±0.20	3.66±0.09	386±0.13	4.6±0.16

Table 3. Phyto-chemical composition of semolina, raw finger millet and malted finger millet (Mean ±SD of three replicates).

Particulars	TPC mg/100g Gallic Acid Eq.	DPPH %
Semolina	118 ± 1.01	37.30 ± 0.98
Raw Finger Millet Flour	335±0.92	35.16±0.88
Malted Finger Millet flour	124 ± 0.98	47.78 ± 0.92

semolina i.e. 118 mg/100g Gallic acid eq. and 37.30 percent, respectively.

Sensory evaluation: Table 4 shows that on the hedonic scale the scores for overall acceptability of pasta at 40 percent level of replacement was highest whereas all the treatments of pasta were also found to be acceptable by panel members. It is obvious from table that the pasta at level of 40 percent replacement was optimized and found best regarding the colour, texture, taste and overall acceptability. Suparat and Chomdao (2008) also studied the acceptability of pasta developed from brown rice and found the 30% replacement as acceptable.

Nutritional and phyto-chemical composition of malted finger millet incorporated pasta: Proximate composition of pasta incorporated with malted finger millet flour is given in table 5. Results showed that the crude fat percent and crude fibre percent and total ash value of optimized pasta increased slightly, whereas protein, energy value decreased. It might be due to replacement of semolina which is rich in protein and calories as compared to finger millet.

Mineral and phyto-chemical content of malted finger millet incorporated pasta: The calcium and iron content of pasta with and without incorporation of malted finger millet flour is given in table 6. Results revealed that calcium and iron content increased after incorporating malted finger millet flour. Calcium content of malted finger millet incorporated pasta was very high i.e., 170.4 mg/100 g as compared to as compared to control pasta i.e., 15.3 mg/100g. So this malted finger millet flour incorporated pasta can also be recommended to post menopausal stage individuals who face calcium deficiency and bone related problems as the product is highly rich in calcium. Kulkarni *et al.* (2012) also reported that noodles supplemented with malted ragi lour was rich in protein, crude fibres and minerals especially calcium, iron and phosphorus as compared to the control sample.The present study indicated that total phenolic content (TPC) and radical scavenging activity (DPPH) of malted finger millet flour incorporated pasta was comparatively higher i.e. 220mg/100g gallic acid eq. and 53.38 % respectively that that of control pasta i.e. 130 mg/100g gallic acid eq. and 17.59 %, respectively.

Conclusion

It was concluded that incorporation of malted finger millet flour to pasta development improved the antioxidant and neutraceuticals properties of pasta by increasing its content of minerals (calcium and iron). Therefore, malted cereals hold a good potential as a source of neutraceuticals in food formulations. The products made from different malted millet flours are nutritionally superior to controls and can be successfully used for supplementary feeding programmers. Efforts should be made to educate people about nutritive value and health benefits of finger millet and its food products.

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Table 4. Effect of malted finger millet flour quantities on sensory attributes of pasta (Mean ±SD of three replicates).

Treatments	Colour	Texture	Taste	Overall Acceptability
T_0	7.13±0.05	7.05±0.06	7.60±0.07	7.18±0.18
T_1	6.26±0.09	6.73±0.04	6.40±0.06	6.83±0.11
T_2	6.81±0.13	6.63±0.09	6.81±0.09	6.53±0.23
T_3	7.18±0.20	7.11±0.13	7.20±0.15	6.93±0.09
T_4	7.0±0.04	8.03±0.19	7.54±0.07	7.23±0.15
T_5	7.2±0.23	7.18±0.04	7.12±0.03	6.76±0.12

Table 5. Proximate composition of control and optimized pasta (Mean ±SD of three replicates).

Particulars	Moisture %	Crude Fat %	Protein %	Crude fiber %	Ash %
Control Pasta	5.89±0.19	7.63±014	13.78±0.12	1.45±0.15	1.56±0.15
Optimized Pasta	5.69±0.17	12.65±0.15	8.48±0.11	1.50±0.13	1.76±0.14

Table 6. Mineral and phyto-chemical composition of control and optimized pasta (Mean ±SD of three replicates).

Particulars	Calcium mg/100 g	Iron mg/100 g	TPC mg/100 g Gallic acid eq.	DPPH %
Control Pasta	15.3±0.56	1.29±0.09	130±1.08	17.59±0.97
Optimized Pasta	170.4±0.59	2.46±0.11	220±1.04	53.38±0.93

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