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RESEARCH ARTICLE

Compatibility studies on development of pearl millet flour based pasta

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ABSTRACT

Convenience and palatability make the pasta more popular worldwide and very recently it is gaining popularity among the common man in India too. This traditional cereal based food is a result of dough or moisture enriched flour, shaped in various forms. Spaghetti, macaroni and vermicelli are the popular pasta forms. Normally, this product is high in starch but low in dietary fiber, minerals, vitamins and phenolic compounds. Increased concern for health consciousness, nutritious pasta products richin fibre and various essential micronutrients having low glycemic index may be of preference. Pearl millet is an extensively grown tiny millet grain and found rich in dietary fibre and essential minerals. High polyphenol content of seed coat gives this millet a dark brown tinge. Addition of pearl millet flour to semolina in making the pasta not only improves the nutritional properties but also found an attractive colour and thus affected the appearance. The extent of tinge may thus be considered as an indicator of pearl millet addition and reflects the nutritional enhancement. Physical, chemical, cooking rheological and sensory evaluation was carried out for the developed pasta and found the optimal cooking time lesser than control pasta with softer texture. Therefore, quality pasta by substituting semolina with pearl millet flour could be developed, which not only enrich the pasta with various phytochemicals but also give variety to the range of pasta and options to use the millet in value addition.

Keywords: Pearl millet, phytochemicals, semolina, cooking quality, texture and sensory properties.

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INTRODUCTION

Pasta is a general term for fresh or dried dough with various shapes. It is usually made from durum wheat to get an elastic texture. Pasta consumption is steadily increasing around the world mainly due to convenience. These products are normally high in starch but low in dietary fiber, minerals, vitamins and phenolic compounds. With an increasing concern by the health conscious population, more nutritious pasta products rich in minerals, phenolic compounds and dietary fiber become the subject of prior significance. Emphasizing on this, an effort was put forth to develop pasta supplemented with pearl millet (*Eleucina coracana*) flour which are rich in vitamins, minerals, and dietary fiber. As small millet it is commonly known as ragi or manduain India. It has assumed a status of important staple food in East and Central Africa and in India (Jenkins *et al*., 1982). India is the major producer of pearl millet contributing nearly 60% of the global production (Shukla and Srivastava, 2011).

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Karnataka, Tamil Nadu, Andhra Pradesh and parts of North India witness the production at the larger scale (Vijayakumari *et al*., 2003). It is consumed generally by a as porridge and roti. The tiny millet grain has a dark brown seed coat, rich in polyphenols compared with other continental cereals such as barley, rice, maize, and wheat. Use of pearl millet in pasta may thus reflect the nutritional enhancement and to give variety to the range of pasta and options to use the millet in value addition.

MATERIALS AND METHODS

Semolina and pearl millet were procured from local market Sangrur, Punjab. The samples were grounded to flour in an electric grinder and passed through 60 mesh sieve. Semolina and pearl millet flours were used in a ratio of 100:0, 20:80,40:60, 60:40, and 80:20 to make the pasta using the extruder. Pasta was prepared from a mixture of semolina and pearl millet dough with 30 ml of water. Mixing and kneading the mass for 15 min was done to produce stiff, plastic, homogeneous dough. The dough was then passed through an extruder fitted with an adjustable die. The extruded pasta was cut into pieces of uniform size with a knife moving over the outer die surface. Extruded samples were dried in cabinet drier at 45 °C for 2hr and packed in commercially available low density poly ethylene pouches (Badwaik *et al*., 2014; Singh et al. 2004). Proximate analysis of semolina and pearl millet flour was carried out and hardness of the uncooked and cooked pasta was carried out using Kramer Shear Cell of a texture analyzer. Rapid Visco Analyzer (RVA) was used to determine the pasting properties. Optimum cooking time for each type of pasta was determined (AACC, 2000). For the determination of solid loss and water absorption, ten gram of pasta was weighed and cooked it in 250 ml boiling water for optimal cooking time. The cooked sample was taken out from water and cooking water was drained into 250 ml volumetric flask and volume was made up to 250 ml. 25 ml of cooking water was evaporated in an hot air oven at 100 °C to determine the weight of residue. The sensory analysis of freshly cooked pasta was carried out and average values are reported.

RESULTS AND DISCUSSION

The semolina and pearl millet flour were found to have the moisture content of 9.43 and 12.06%; while the protein content was 12.37 and 7.63%; fat content 1.81 and 2.33% and the ash content found were 0.71 and 2.13%, respectively. The pasting properties of semolina and pearl millet flour admixture clearly indicate the partial gelatinization of starch during the pasta making (Table 1). As per reduction in all kinds of viscosities with the increase in the peak time and pasting temperature further confirms the facts. The cooking performance of pasta variants in terms of optimal cooking time, water absorption and solid loss are presented (Table 2). It was found that optimal cooking time (OCT) decreased as pearl millet content was increased ($p \leq 0.05$) with the durum wheat semolina. The optimal cooking time of pasta from durum wheat semolina (DMS) and pearl millet flour (FMF) ranged from 7 to 4 minutes. Pasta prepared from 100% DMS required maximum cooking time i.e. 7 minutes to reach the optimal cooking, whereas lowest OCT was shown by the pasta prepared from 80:20 (DMS) and (FMF). Water absorption of pasta prepared from different blends was in the range of 113.73 to 177.33% depending upon the cooking time. Water absorption was maximum in the control sample being 177.33% after 7 minutes of cooking, respectively (Table 2) .With the increase in cooking time, water absorption of pastas prepared from different levels of FMF decreased ($p \leq 0.05$) for 80 and 60% use of pearl millet, respectively. However, for a given cooking time water absorption decreased as the FMF concentration increased from 40- 80%. The total solid loss of control pasta was found as 14.66% after 7 minutes of cooking. It was observed that as the cooking time was increased from 5 to 6 minutes there was substantial increase in total solid loss. They reported that the total solid losses in the range of 6.1 to 12.9% with the increase in cooking time from 10 to 25 minutes. Control raw and cooked pasta had the firmness value of 50.13 and 6.86 kg (Table 3) and observed the change in the firmness on substitution of semolina with pearl millet flour. Variation in the firmness of the pasta linked with the sensory score revealed that acceptable quality pasta with nutritional enhancement can be prepared by substituting the semolina till 60 % level.

Table 1: Pasting characteristics of flour admixture of pearl millet and pasta flour

	Flours	Peak Viscosity	Trough Viscosity	Break down	Final Viscosity	Set Back	Peak Time	Pasting Temperature
Raw Flour	P0:S100	3384	2558	826	4659	2101	5.67	83.15
	P20:S80	3586	2457	1129	4311	1854	5.80	74.20
	P40:S60	3343	2386	957	4257	1871	5.73	75.00
	P60:S40	3592	2544	1048	4452	1908	5.80	75.05
	P80:S20	3336	2433	903	4437	2004	5.67	79.90
Pasta Flour	P0:S100	1985	1634	351	3713	2079	5.80	87015
	P20:S80	2206	1713	493	3416	1703	6.00	88.05
	P40:S60	1833	1516	317	3102	1586	5.93	89.55
	P60:S40	2160	1721	439	3299	1557	6.07	88.85
	P80:S20	1519	1181	338	2373	1192	7.00	92.80

Viscosity in centi poise, S – Samolina flour, p – Pearl millet flour

Table 2: Cooking and sensory characteristics of pasta

Flours	Cooking Time(min.)	Water absorption(/10g)	Cooking loss (%)	Sensory Appearance	Sensory Firmness	Sensory Texture	Sensory over all acceptance
P0:S100	7.20±0.26	177.33±1.16	14.66±0.57	8.65±0.54	8.23±0.83	8.42±0.54	8.08±0.73
P20:S80	4.33±0.10	161.30±1.70	11.02±0.05	8.02±1.03	8.04±1.03	8.23±0.81	7.63±0.57
P40:S60	5.31±0.10	148.10±2.56	10.01±0.03	6.85±1.04	7.02±0.74	7.01±0.76	7.21±0.82
P60:S40	5.55±0.10	115.80±3.27	14.66±0.57	6.26±1.33	7.03±1.11	7.09±1.73	7.24±1.31
P80:S20	6.52±0.20	113.77±2.83	14.33±2.30	5.68±1.23	6.86±1.38	6.42±1.92	6.62±0.56

Table 3: Firmness of raw and cooked pasta

Flours	Uncooked	Cooked
P0:S100	50.130±3.25	6.86±0.75
P20:S80	44.56±2.34	6.04±1.23
P40:S60	27.56±3.45	7.60±0.42
P60:S40	27.46±2.24	6.99±1.32
P80:S20	47.57±2.56	8.38±1.29

CONCLUSION

Addition of pearl millet flour to semolina in making the pasta improved its nutritional properties as well as its overall acceptable appearance. The optimal cooking time of developed pasta was lesser than control pasta with softer texture

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