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RESEARCH ARTICLE

METHOD OF DEVELOPMENT AND SENSORY EVALUATION OF NOODLES FROM *IPOMOES BATATAS, ORYZA SATIVA* AND *CICER ARIETINUM* FLOUR

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ABSTRACT

Nutritional Food product development is the need of the today's world because a number of snacks and food variety is available all over the market but they lack nutrition. The noodles were prepared from the Sweet Potato (*Ipomoes batatas*), Rice flakes (*Oryzae sativa*) and Chickpea (*Cicer arietinum*) flour. All these flours are of high nutritive value i.e rich in Proteins, Vitamin A & C, Calcium and Folic acid. Sweet potatoes are good source of pro vitamin A and C. Rice flakes are rich sources of carbohydrates proteins and Iron. The third ingredient Chickpea is a good source of vitamins such as riboflavin, niacin, thiamin, folate and the vitamin A precursor, β-carotene. The noodles making involved processes such as Drying, Pressing, soaking, grinding and sieving. Finally all the flours were mixed and this dough was passed through an extruder to get the final product. The final product underwent sensory evaluation for its acceptability. The results indicated that the panelist accepted the noodles prepared from different level of sweet potato flour with highest acceptability at 50% sweet potato flour level followed by 20% sweet potato flour level.

INTRODUCTION

Sweet potato is the world's seventh most important food crop. More than 95% of the sweet potato crop is grown in developing countries–over 80% in China alone–mainly by small farmers with limited land, labor, and capital (Woolfe, 1992). The crop has limited production costs and does well even under marginal conditions (poor soils with limited water supplies). Among the world's major food crops, sweet potato produces the highest amount of edible energy per hectare per day. Sweet potato yields both roots and green tops from the same plant which serves as nutritious food for humans and animals (Woolfe, 1992). Sweet-potatoes are an underutilized crop in the United States primarily because it is difficult for food processors to control textural properties. In sweet-potato, starch content and cell wall architecture exert a significant influence on textural properties.

Rice flakes (*Oryza sativa* L.) a major cereal crop is the staple food sources for half of the world population, grown as a monocarpic annual part, although in tropical areas. The edible seed is an important source of energy, hypoallergenic, easily digested, provides protein with higher nutritional quality and has versatile functional properties. The rice grain contains 5% bran, of which 12-18.5% is oil. The rice kernel comprises 20% hull, 8-12% of bran and embryo and 70-72% endosperm or milled rice based on the degree of milling. Rice flakes, Poha rice or Flattened Rice are known by other names also like pressed rice, flattened rice or flaked rice. Poha may be precisely described as one of world's first ever "fast foods". The highest quality of poha I (rice flakes) is one that is paper thin and translucent and is also a bit more expensive. Healthy Poha dish for enjoyment and energy.

Chickpeas are an ancient crop usually grown for their seed which is nutritionally of a very high quality (Saxena, 1990). Their high protein content makes it a popular protein supplement for vegetarians. Ranging among varieties, the seeds contain approximately 12.4-31.5% crude protein, 3.8-10.2% fat, 52.4-70.9% total carbohydrate and 1.7-10.1% crude fibre. True digestibility, biological value and net protein utilization of chickpea seed ranges from 85-89 %, 83-85 % and 92-97 % respectively (Williams and Singh, 1987).

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Table 1. Nutritional Composition (Raw food material)

Nutrients	*Ipomoes Batatas* (sweet potato) 30g	*Oryza sativa* (rice flakes) 30g	*Cicer arietinum* flour (chick pea) 30g
Protein	1.2	1.98	6.7
Fat	0.09	0.36	2.0
CHO	8.46	23.1	17.3
Fibre	0.24	0.21	3.2
Calcium	13.8	6	13.5
Iron	0.06	6	1.5
Calories	36	103.8	116.1
Phosphorus	15	71.4	95.4

*ICMR – Nutritive value of Indian foods (1998)

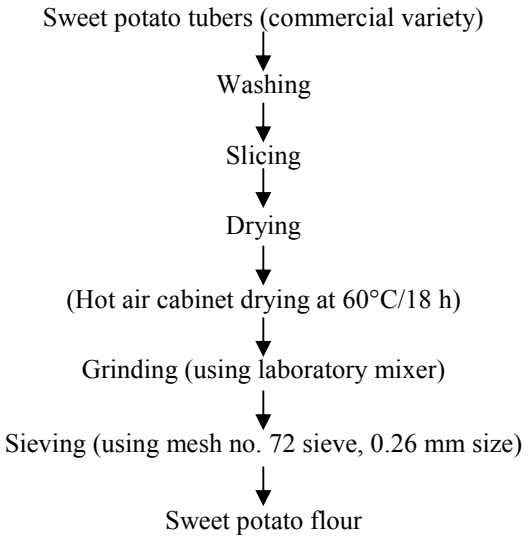
Nutritional Importance of Ipomoea Batatas, Oryza Sativa and Cicer Arietinum

To make sweet potatoes available throughout the year and to provide a sweet potato product for institutional use, dehydrated flakes were developed (Hoover, 1967). However, due to the low protein calorie to total calorie ratio (PCR), meals designed to provide a weekly supply of vitamin A sweet potato flakes may exceed calorie requirements before satisfying protein needs. It is believed that improvement in the PCR of this product may produce greater institutional consumption of sweet potato flakes as one means of in increasing the intake of vitamin A. Global rice production is expected to increase to 720 million tonnes (480 million milled) or 3% in 2011 in a recent report released by the United Nation's FAO. The cost of rice is higher than that of corn and wheat; however its application in value-added products could give the industry new avenues of use, thus increasing its demand. Some unique functional properties of rice make it a desirable grain to be used in value-added products. Some examples of these products include gluten-free rice bread, tortillas, beverages, processed meats, and low-fat sauces, puddings, or salad dressing. Normally eaten as a breakfast item, Poha (rice flakes) can be fried with chilly and spices to make a tasty dish or can be eaten with curd or made into a sweet dessert also (healthy breakfast ideas). An easily digestible product, the Rice flakes preparations can be cooked even at short notice and this product is an available easily item. Rice flour has soft taste, colorless, hypoallergenic properties, low levels of sodium & easy digestible carbohydrates. Owing these properties, rice flour is the most suitable cereal to make gluten free products (Lopez *et al*., 2004). Chickpea (*Cicer arietinum* L.) is an important pulse crop grown and consumed all over the world, especially in the Afro-Asian countries. It is a good source of carbohydrates and protein, and the protein quality is considered to be better than other pulses. Chickpea has significant amounts of all the essential amino acids except sulfur containing types, which can be complemented by adding cereals to daily diet. Starch is the major storage carbohydrate followed by dietary fibre, oligosaccharides and simple sugars like glucose and sucrose. Lipids are present in low amounts but chickpea is rich in nutritionally important unsaturated fatty acids like linoleic and oleic acid. β-sitosterol, campesterol and stigmasterol are important sterols present in chickpea oil. Calcium, magnesium, phosphorus and especially potassium are also present in chickpea seeds. Chickpea has several potential health benefits and, in combination with other pulses and cereals, it could have beneficial effects on some of the important human diseases like cardiovascular disease, type 2 diabetes, digestive diseases and some cancers. Overall, chickpea is an important pulse crop with a diverse array of potential nutritional and health benefits. There is a growing demand for chickpea due to its nutritional value. In the semi-arid tropics chickpea is an important component of the diets of those individuals who cannot afford animal proteins or those who are vegetarian by choice. The two cultivars, Desi and Kabuli, are grouped according to seed colour and geographic distribution. Desi are common to India. They are smaller and range in colour from fawn to brown, yellow, orange, black or green. They are eaten either whole, as dhal (puree) or dhal flour. Chickpeas are a rich source of vitamins, minerals and phytoestrogens. They contain folate, thiamine, riboflavin, niacin, pantothenic acid, vitamins C, A and E. Chickpeas have a higher content of calcium and phosphorus than other pulses and are a good source of iron and zinc. They also contain magnesium, copper, manganese and selenium. Chickpeas are abundant in the isoflavones formononetin and biochanin A, phytoestrogens common to many pulses. Chickpeas are relatively free of antinutrients, such as lectins, but do contain small amounts of saponins, oligosaccharides, some tannins and phytate.

Materials and methods used for preparation of Noodles

Sweet potato flour is a good source of energy. When made from orange-fleshed cultivars, the flour has a high content of β-carotene and reasonable levels of vitamin C, calcium, phosphorus, iron, and potassium. Chemical composition and the resulting nutritional value of sweet potato flour are largely dependent on the chemical composition of the roots which is related to harvest time. Previous researchers have noted a lack of information on sweet potato flour quality. Rice flakes and Chickpea were grinded in Laboratory mixer and flour was made.

Method of Making Noodles from Three flour



Processing of Sweet potato

Drying

Drying a solid is usually regarded as the removal of water or other liquid from the solid material till an acceptable low value (McCabe *et al*. 1993). Many authors use the word 'drying' to describe the natural process of water removal by exposure to the sun (Brennan, 1994) and 'dehydration' as the artificial

drying under controlled conditions (Potter and Hotchkiss, 1998)

Drying process

Raw material

To produce good quality flour from sweet potato roots, they should be low in total free sugar content, reducing sugar content, amylase activity, polyphenoloxidase content, and have high dry matter (Collado *et al*. 1997). The first and the fourth are related to discoloration during processing. Roots are still acceptable for processing if the reducing sugars do not exceed 2% (dry weight basis) (Lizado and Guzman, 1982). Sweetpotato varieties with high dry matter are preferred since this favors the percentage of flour recovered by drying and as such reduce the costs. Sweetpotatoes are selected based on the size of the roots and on other standards set by the processor.

Washing and peeling

The roots are washed to remove as much soil and other dirt as possible (Palomar *et al*. 1987). Peeling to remove dirt from the roots can substitute for washing if (clean) water is not available. More sophisticated peeling methods are lye peeling and steam peeling.Thorough washing is necessary after the use of this method. Even though lye peeling is widely used in industry, it results in the highest peeling (yield of 86% peeled sweetpotato). Steam peeling is superior in this respect since yields as high as 98% can be achieved. Peeled sweetpotato roots must be submerged in water to avoid browning.

Slicing / Shredding

The sweet potatoes are cut into slices, shreds, or cubes to speed up drying. Thinner the pieces, the shorter the drying time (Gakonyo, 1993). The thickness of the slices can be 1.5–5.5 mm, with 2–3 mm the most commonly used (Gakonyo, 1993; Tantidham, 1992), and length up to 5 cm (Walter *et al*. 1983). Equipment used may be:

- Hand-held slicer, which produces remarkably good slices of even thickness with a minimum of fuss (Gakonyo ,1993);
- Hand-cranked slicer based on a rotating disc (capacity 70–80 kg/hr) (Woolfe , 1992);
- Hand-held grater (Peters, 1997);
- Pedal-driven slicer (Odaga and Wanzie, 1993) with a capacity of 60–70 kg/h;
- Lever-type slicer with a capacity of 130 kg/h (Den *et al*. 1990);
- Manually operated electric cuber (Den *et al*. 1990); and
- Motor-operated slicer.

Soaking and pressing

The sweetpotato slices can be dipped in water (cold / boiling) or in solutions which contain sodium sulfite, sodium metabisulphite, citric acid, acetic acid or potassium, to prevent browning. Before drying, the slices / shreds can be pressed to remove surface moisture. However, pressing can reduce the content of total protein, some of the sugar and the soluble minerals.

Spreading and drying

The slices/shreds are evenly spread on trays made from perforated metal trays, plastic sheeting, aluminum screening, aluminum sheeting painted black, mosquito netting, and nylon mesh to dry (Peters and Wheatley, 1997; Lizado and Guzman, 1982; Diamante, 1987). Sweetpotato flour has also been used for its specific properties to form new products. A significant contribution to pro-vitamin A intake and a yellow or orange coloration can be obtained by the utilization of sweetpotato flours rich in β-carotene (absent in wheat) (Woolfe, 1992).

Flour processing

Sweetpotato flour can serve as a source of energy and nutrients (carbohydrates, beta-carotene (pro-vitamin A), minerals (Ca, P, Fe, and K)), and can add natural sweetness, color, and flavor to processed food products. The success of sweetpotato flour as part of composite flours lies in its properties and consumer preferences. Sweetpotato flour has generally been more acceptable as a substitute for these types of bakery products rather than as all-purpose flour.

Final product Noodles

Noodles are important foods consumed in Asian countries Reungmaneepaitoon, (1996) studied that quality of the dry noodle or instant noodle is judged by its color, symmetry, cooking quality and texture. The noodle should have a white appearance and cook as quickly as possible, remain firm and not lose solids in the cooking water, and should not become sticky and soggy when standing after cooking. Recently modified starch or other ingredients are added in preparation of oriental noodle for improving the texture of noodle.

ANALYSIS OF NOODLES

Cooking characteristics of Noodles

Cooking time

To determine the cooking time, A.A.C.C. (1995) method was followed.

Table 2. Sensory scores of noodles

Parameters	Sweet potato flour: rice flour: chickpea flour				
	20:40:40	30:35:35	40:30:30	50:25:25	60:20:20
Color	6.4±0.699^{c}	6.8±0.788^{b}	6.8±0.918^{b}	7.5±0.527^{a}	5.2±0.421^{d}
Taste	6.4±1.074^{b}	6.2±0.918^{b}	6.3±0.483^{b}	8±0.316^{a}	5.1±0.316^{c}
Firmness	7.2±0.632^{b}	6.5±0.527^{c}	6.4±0.699^{d}	7.6±0.516^{a}	5.2±0.423^{e}
Stickiness	6.2±0.920^{b}	5.2±0.421^{c}	5.1±0.316^{d}	5.0±0.699^{d}	7.3±0.483^{a}
Overall acceptability	7.1±0.737^{b}	6.3±0.483^{d}	6.8±1.135^{c}	7.5±0.527^{a}	5.1±0.316^{e}

Mean ± S.D. with different superscripts in a row differ significantly ($p< 0.05$) (n=3)

In this method, 5 g of the noodle samples were placed in 300 ml of boiling water in a 500 ml beaker. Noodle strands were removed at regular intervals and pressed between two glass plates. Time required for the opaque part in the strand to be gelatinized was considered as cooking time.

Cooked weight

Cooked weight is a measure of the degree of the noodle hydration. To determine the cooked weight, A.A.C.C. (1995) method was followed. In this method, 25g of dry noodles were cooked in 300 ml boiling water. Noodles were cooked till disappearance of white core as judged by squeezing between glass plates. The beaker was covered with aluminum foil to minimize the evaporation losses of water. Cooked weight of noodles was determined by weighing the wet mass after the cooked noodles were drained for 2.5 min.

Gruel solids loss

Noodles (10 g) were cooked to optimum time (defined as the time till there is disappearance of white core in the noodles; 4-5 min) in 300 mL of distilled water in a beaker, rinsed in cold water and drained for 15 min before being weighed. Gruel solid loss was determined by drying overnight at 105°C (A.A.C.C. 1995).

Sensory evaluation of Noodles

The sensory quality and overall acceptability of noodles were carried out on a 9 point hedonic rating scale where the samples were rated on the basis of the following criteria: 9-liked extremely, 8-liked very much, 7-liked moderately, 6-liked slightly, 5-neither liked nor disliked, 4-disliked slightly, 3-disliked moderately, 2—disliked very much and 1-disliked extremely. The noodles were cooked and served to 10 semi-trained panelists formed from the department of Food Science and Technology, Punjab Agricultural University, Ludhiana. Panelists evaluated the samples for their color, flavor, appearance and overall acceptability. The results are as follows: Table 2 shows the result of the sensory evaluation of the different noodle samples. The sample containing 50% sweet potato flour was significantly rated best (7.5) followed by sample containing 20% sweet potato flour addition (7.1), while sample containing 60% sweet potato flour addition had the least color rating (5.2). The results showed that as the level of sweet potato flour increased (upto 50% substitution) the sensory scores for sensory color, taste, firmness, stickiness and overall acceptability increased.

The results thus indicated that the panelist accepted the noodles prepared from different level of sweet potato flour with highest acceptability at 50% sweet potato flour level followed by 20% sweet potato flour level.

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