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Research Paper

Development and Quality Evaluation of Extruded Product of Rice Flour Incorporated With Beetroot (Beta Vulgaris) Pomace and Pulse Powder

Engineering

KEYWORDS : Beetroot incorporated noodles, beetroot pomace powder, rice flour, pulse powder and physiochemical analysis.

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ABSTRACT

Studies were conducted on incorporation of beetroot pomace powder and pulse powder of different fractions in noodles and its quality were analyzed. Different levels of rice flour, pulse powder and beetroot pomace powder were added in the ratio of 100:00:00, 85:7.5:7.5, 80:10:10, 75:12.5:12.5 and 70:15:15 for the development of beetroot incorporated noodles. Physiochemical analysis was carried out for control and beetroot fortified noodles. As quantity of beetroot pomace powder increased fibre content increased. Color became darken as proportion of beetroot pomace increased. There was increase in protein with increase in content of pulse powder. Phosphorus, Iron and fat contents were increased with increased proportion of beetroot pomace powder. Noodles develop with addition of beetroot powder had desirable organoleptic properties as indicated by the taste panel studies as compared to control sample. However, based on sensory analysis, noodles with (T3) 75:12.5:12.5 rice flour, beetroot powder and pulse powder were found more acceptable than other levels and were found optimum for incorporation rice flour noodles for development of beetroot incorporated noodles. Beetroot incorporated noodles was packed in LDPE and stored at room temperature. The storage studies were conducted at the interval of 0-45 days. Protein, fat, crude fibre, phosphorus, iron percentage was decreased during storage.

I INTRODUCTION

Fruit and vegetable wastes are inexpensive, available in large quantities, characterized by a high dietary fibre content resulting with high water binding capacity and relatively low enzyme digestible organic matter (Serena and Knudsen, 2007). A number of researchers have used fruits and vegetable by-products such as apple, pear, orange, peach, blackcurrant, cherry, artichoke, asparagus, onion, carrot pomace (Nawirska and Kwasnievska, 2005) as sources of dietary fibre supplements in refined food. Cereal grains are generally used as major raw material for development of extruded Snack foods due to their good expansion characteristics because of high starch content.

The broken rice is a byproduct of modern rice milling process. The rice portion can have varying percentages (5 - 7%) of broken kernels which contain nutritive value similar to whole rice and are available readily at relatively lower cost. Rice contains approximately 7.3% protein, 2.2% fat, 64.3% available carbohydrate, 0.8% fiber and 1.4% ash content (Zhoul *et al.,* 2002)

Rice flour has become an attractive ingredient in the extrusion industry due to its bland taste, attractive white color, hypoallergenicity and ease of digestion (Kadan *et al*., 2003).

The beetroot is a root vegetable, usually red in color, with a crisp texture when fresh. Beetroot is grown all over the world in temperate areas. World production was 241 985 317 Mt in the year 2005.The beetroot is one of the most valuable plant in chenopodioideae, is a subfamily of the flowering plant family Amaranthaceae. Beetroot contains approximately 7% 1.61% protein, 17 % fat, 9.56 % available carbohydrate, 2.8% fiber, 0.008 % iron and 0.04% phosphorus content.

Beetroot is an excellent source of folate and a good source of manganese, and contains betaines which may function to reduce the concentration of homocysteine, a homolog of the naturally occurring amino acid cysteine. High circulating levels of homocysteine may be harmful to blood vessels and thus contribute to the development of heart disease, stroke, or peripheral vascular disease. (A.D.A.M., Inc., ed. (2002). *Betaine*). Beetroot is known to contain large amounts of soluble fibres, flavanoids and betacyanin. It helps to reduce the oxidation of LDL cholesterol and does not allow it to deposit on the walls of the artery. This protects the heart from potential heart attacks and stroke reducing the need for medication. Beetroot is an excellent source of iron, which serves to regenerate and reactivate the red blood cells and supply fresh oxygen to body. The copper content in beetroot facilitates the absorption of iron by the body. Beetroot possesses healing and medicinal values, which work effectively in normalizing blood pressure.

The incorporation of cauliflower trimmings into ready-to- eat expanded products up to 10% level was suggested by Stojceska *et al*. (2008). Altan *et al*. (2008) processed the blends of barley flour and tomato pomace; barley flour and grape pomace and corn flour and tomato pomace in a co-rotating twin-screw extruder. Reference researches indicate that no published work research on the incorporation of rice flour with BPPP is available. Cereal grains having good expansion characteristics because of high starch content. Rice flour has become an attractive ingredient in the extrusion industry due to its bland taste, ease of digestion and beneficial for celiac disease patients. Pigeon pea is a valuable source of protein, minerals and vitamins. Beetroot is a good source of foliate, phosphorous and iron. Incorporation of above components such as rice powder, pulse powder and beetroot pomace in extruded products such as noodles will enhance their protein, phosphorus and iron content. The objective of this study was to incorporate beetroot by-products as a source of dietary fibre into ready-to-cook snacks.

II MATERIALS AND METHODS

The experiments were carried out in the Dept. of Food Process Engineering, Vaugh School of Agricultural Engineering and Technology, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad.

Dry beetroot pomace powder preparation

Commercial variety (*Beta vulgaris*) was procured from local market, Allahabad, India. These were washed in running tap water two times to remove extraneous material. Trashes

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were removed with a plane stainless steel knife and trimming was also done. A juice mixer grinder cum food processor was used to extract beetroot juice. The pomace was collected for further studies. A hot air oven was used for drying beetroot pomace, which could regulate drying air temperature up to 250°C with ± 2°C accuracy. The samples were spread over the trays and the temperature of the dryer was set at 60°C. The drying procedure continued till the moisture content of the sample was reduced to about 5 ± 1% (wet basis). The grinding was performed using the same food processor with grinder attachment. The material was ground to pass through the sieve of 2 mm size. The pomace was stored in sealed LDPE bag for further use (Kumar *et al.,* 2010).

Sample preparation

Ingredient formulations for extrusion products are given in Table 1. The beetroot pomace powder and pulse powder were mixed in equal proportion in a food processor with mixer attachment. The moisture content of the formulation was estimated by hot air oven method (Ranganna, 1995). Rice flour was replaced with BPPP mixture at levels of 15, 20, 25 and 30%. The moisture was adjusted by sprinkling distilled water in dry ingredients. All the ingredients were weighed and then mixed in the Supremo DLX food processor for 10 min based on preliminary study. After mixing, samples were stored in LDPE bags at room temperature. (Stojceska *et al*., 2008).

Extrudates preparation

Sample was passed in single- screw extruder through feed hopper and Product was collected at die end. Product was kept in hot air oven at 60^{oc} for 1-2 hr. then product is stored in LDPE bag for further study.

Chemical Composition

The chemical composition of the different samples was determined. These analyses included the contents of protein, fat, crude fibre, using AOAC (1990) methods were carried out in SHIATS, Allahabad, while phosphorus, iron contents were determined by using UV-Visible method (Ranganna, 1995) were carried out in Allahabad university.

Statistical Analysis

Five samples were analyzed for each property. Data were assessed by analysis of variance (ANOVA).

III RESULTS AND DISCUSSION

The protein, fiber, fat, phosphorus and iron content were determined for the control noodles (100% rice flour) and the noodles supplemented with different levels of pulse powder and beetroot pomace powder as indicated in fig-1 to fig-5.It could be noticed that supplementation of noodles with beetroot pomace powder associated with the increasing of protein, fiber, fat, phosphorus and iron content. This increase in protein, fiber and fat due to relative increase of these nutrients in beetroot pomace powder. The storage studies were conducted at the interval of 0-45 days. During storage protein percentage was decreased due to proteolysis. Fat content was decreased during storage due to oxidation of fat. A storage study revealed that Crude fibre percentage was decreased due to hydration of fibre due to moisture gain. During storage phosphorus percentage was decreased due to hydrolysis of phosphate. Iron percentage was decreased during storage due to oxidation of iron.

Statistical analysis revealed no significant differences among treatments contained 7.5, 10, 12.5 and 15% beetroot pomace powder or compared to the control noodles for all organoleptic characteristics. While, noodles incorporated with 12.5% beetroot pomace powder showed a significance differences (P ≤0.05) compared with other beetroot pomace powder substituted noodles and control sample.

IV CONCLUSION

Formulation and sensory evaluation of beetroot incorporated noodles with different levels of incorporation of the beetroot and pulse powder has shown significant changes during the storage studies from 0 day to 45 days. Control and beetroot pomace powder with 12.5% of incorporation has shown the best outcome in all respects according to the sensory analysis made on behalf of the storage conducted from 0 day to 45 days. It is quite clearly depicted that there was no significant change observed in the color of treatment in other treatments but noodles incorporated with 12.5% beetroot pomace powder has gained maximum score and therefore, could be considered a source of dietary fibre, and minerals in ready-to-cook snacks.

Table 1. Formulation of Control noodle and noodle supplemented with beetroot pomace and pulse powder:

product	Rice flour (%)	Pulse powder (%)	Beetroot pomace powder (%)	Moisture (%)
Control (T_0)	100	0	0	10
T_1	85	7.5	7.5	10
T_2	80	10	10	10
T_3	75	12.5	12.5	10
T_4	70	15	15v	10

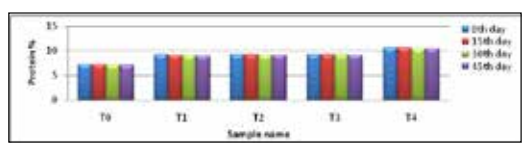

Fig.1 Protein (%) of beetroot incorporated noodles packed in LDPE during 45 days of ambient storage.

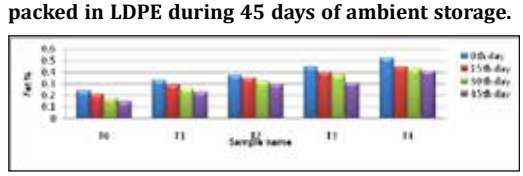

Fig 2 Fat (%) of beetroot incorporated noodles packed in LDPE during 45 days of ambient storage

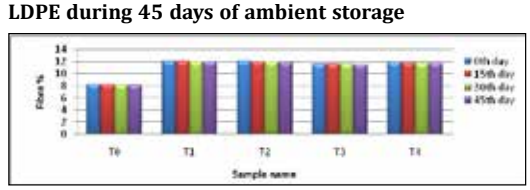

Fig 3 Fibre (%) of beetroot incorporated noodles packed in LDPE during 45 days of ambient storage

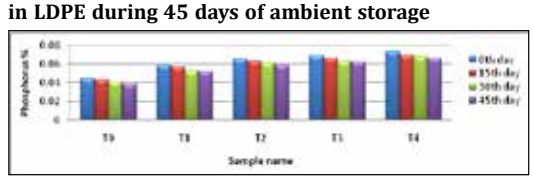

Fig 4 Phosphorus (%) of beetroot incorporated noodles packed in LDPE during 45 days of ambient storage

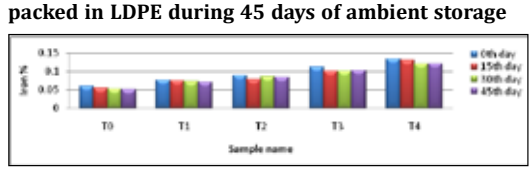

Fig 5 Iron (%) of beetroot incorporated noodles packed in LDPE during 45 days of ambient storage

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