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Development and evaluation of ridge gourd peel incorporated pasta

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Abstract
A considerable amount of bio waste is generated while processing foods in the form of peel, seed and inedible pulp material, which can be re- used for edible purposes after appropriate processing. Ridge gourd peel is an edible bio waste which is not used due to high dietary fiber content and a rough texture. The present study was planned to explore the possibility of utilizing ridge gourd peel in the extruded food product. Dried ridge gourd peel was incorporated to a pasta at 2.5, 5, 7.5 percent levels and the products were evaluated for sensory quality, nutritional composition, cooking quality and microbial analysis. Result showed that value addition of ridge gourd peel increased the fiber and protein content in the product significantly. The 5 percent levels of incorporation were organoleptically acceptable. Hence it can be concluded that ridge gourd peel can be utilized for value addition.

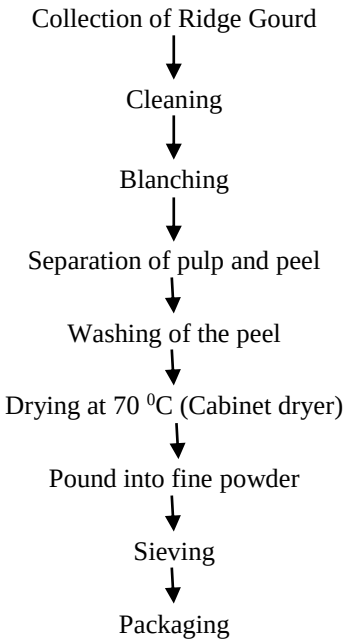
Keywords: Ridgegourd, peel powder, pasta

1. Introduction
Ridge gourd (*Luffa acutangula* L. Roxb), popularly known as Kalitori belongs to genus Luffa of Cucurbitaceae family is a popular vegetable in India and other Asian countries generally used for vegetable purpose. Ridge gourd has been also used extensively in Indian traditional system of medicines as diuretic, expectorant, laxative, purgative, hypoglycemic agent and bitter tonic. Ridge gourd has a sweet taste after cooking, cooling in nature and easy to digest. They form a low calorie diet, which is considered good for diabetes. Both the soft pulp and skin of ridge gourd are used in making various recipes, especially in South Indian cuisine. Chutneys made from the pulp and the peel of ridge gourd is known for their health benefits (Pullaiah *et al*, 2006) [1]. It is reported to contain many phytochemicals such as flavonoids, saponins, luffangulin, sapogenin, oleanolic acid and cucurbitacin B. Ridge gourd acts as an appetizer and it is a healthy food and contains good amount of fiber, vitamins and minerals including Vitamin B2, Vitamin B3, Vitamin C, carotene, calcium, phosphorus and iron in small quantities. Peel of ridge gourd is a rich source of dietary fiber and other nutrients and low in calories. The use of peel is limited because of fibrous and tough texture, though it is edible. The utilization of ridge gourd powder with wheat flour in extruded products has not been studied extensively. Therefore, the research was undertaken to develop the pasta incorporated with ridge gourd peel powder and evaluate the effect of substitution of wheat flour with different levels of ridge gourd peel powder on the cooking and nutritional properties.

2. Objectives
- To prepare dehydrated ridge gourd peel powder.
- To develop the ridge gourd peel incorporated pasta.
- To find out the acceptability of ridge gourd peel pasta by organoleptic evaluation.
- To analyse the cooking quality of ridge gourd peel incorporated pasta.
- To analyse the nutrient content (carbohydrate, protein, fat, energy, fibre and vitamin C) of ridge gourd peel powder incorporated pasta

3. Methods

A. Preparation of ridge gourd peel powder



B. Standardization of ridge gourd peel incorporated pasta

The ridge gourd peel incorporated pasta was standardized using three different variations such as sample A (2.5%), sample B (5.0%), and sample C (7.5%).

Table 1: Ingredients used for the preparation of pasta

Name of the ingredients	Control	Sample A	Sample B	Sample C
Wheat flour (g)	50	50	60	70
Sprouted legume flour(g)	50	47.5	35	22.5
Ridge gourd peel powder (g)	-	2.5	5	7.5

C. Organoleptic evaluation

The control and ridge gourd peel incorporated pasta samples were evaluated in terms of appearance, flavor, texture, taste, mouth feel and over all acceptability using 5 point hedonic scale (Like extremely, like moderately, neither like nor dislike, Dislike moderately and Dislike extremely).

D. Nutritive analysis of Ridge gourd peel powder incorporated pasta

The developed pasta samples were analysed for energy by bomb colorimeter Method, Protein by Kjeldahl procedure, fat using soxhlet extraction, carbohydrate by anthrone method, vitamin C by titrimetric method (Ragaee *et al*, 2006) [3].

E. Microbial analysis

Microbiological analyses of the pasta samples were determined as described by AOAC (2004) [2]. The analyses were done on days 1, 15 and 30 of the storage at room temperature of the products.

F. Physical characteristics of ridge gourd peel incorporated pasta

The physical characteristics of pasta can be established by measuring the most important pasta quality parameters, such as colour and cooking qualities (cooking time, cooked weight, cooking loss and shear force).

1. Colour

High quality pasta (either fresh or dried) is normally yellow in colour and can be measured using the colorimetry. The measuring of the colour using colorimetry involves the use of a reflectance spectrophotometer which, through a beam of light in the visible range (400-800 nm), makes it possible to measure the three colorimetric coordinates L*, a* and b* in the CIELAB measuring system. The colorimetric coordinate L* represents the lightness value in the range 0 (black) – 100 (white); the colorimetric coordinate a* represents the green (negative values) – red (positive values) colour range and the colorimetric coordinate b* (yellowness) represents the blue (negative values) – yellow (positive values) colour range. As far as pasta is concerned, it is the colorimetric coordinate b* that assumes the greatest importance, as it represents the colour yellow. The instrument is simple to use and results can be obtained rapidly. It is therefore ideal for taking measurements during in-line product controls.

2. Cooking Qualities

To evaluate the cooking quality of pasta samples, 10g of raw pasta was broken into lengths of approximately 5 cm and cooked in 200ml of boiled distilled water for 10 min. Cooking tolerance of pasta samples was determined by evaluating different parameters in samples cooked for 20 minutes.

3. Cooking Loss

Cooking loss of different samples was carried out according to BIS method (IS 1485: 1993) [5] with some modifications. Ten grams of pasta was broken into lengths of ~ 5 cm and was cooked in 200 ml of boiling distilled water for a period of 10 min with occasional stirring. After cooking, the sample was drained and rinsed with stream of distilled water (~ 50 ml, room temperature) for about 30s on a Buchner funnel and allowed to drain for 2 min. Total volume of the gruel and the rinsed water collected was measured. The gruel was shaken well for even distribution of the solid content. Twenty milliliters of the above gruel was pipetted out into a tared petri dish and evaporated to dryness on a water bath. The petri dish was transferred to a hot air oven maintained at 105 ± 2 ^{0}C and dried to constant mass.

$$\text{Total solids in gruel, percent by mass} = \frac{(M2 - M1)\,V}{2}$$

Where, M2 = Mass, in g of petri dish with total solids
M1 = Mass, in g of empty petri dish
V = Volume of gruel in ml

4. Cooked Weight

Cooked weight was determined by weighing the drained and rinsed pasta and reported in grams.

5. Cooking time

The method involves cooking a given quantity of pasta in distilled water, and then compressing a single strand of pasta between two thin glass plates at different cooking times. The optimum cooking time corresponds to the time required for the disappearance of the 'white core' (non gelatinised starch) in the heart of the strand following compression. Also for the other pasta shapes, representative samples have to be prepared and then compressed in order to evaluate the disappearance of their 'white core'. After cooking, the pasta must be carefully drained and cooled for a standardised period of time that is always kept constant, before proceeding with the planned analyses.

6. Water absorption

The water absorbed during cooking (water-absorbing capacity) can be measured by weighing the pasta after cooking, and comparing this with its initial weight. The calculation of the solids lost to cooking is one of the most important parameters for determining the quality of cooked pasta. These parameters (Cooking time, Cooked Weight and Cooking Loss) are helpful in determining the firmness of pasta and are measured by determining the water absorbed during cooking and the solids lost to cooking.

7. Pasta Firmness (Shear Force to break)

Pasta firmness was measured according to the method described by Walsh and Gilles (1971) with slight modifications. Cooked pasta samples were immediately transferred to a 250 ml beaker containing distilled water, at room temperature. Two cooked pasta strands, at a time, were removed from the water and sheared within 0.5 mm distance from the base plate at a 90º angle using a specially designed aluminum shearing blade with a contact surface of 1 mm. The shear was performed at a cross head speed of 10 mm /min and a load cell of 5 kg. The force (gf) required to shear the pasta was measured in triplicate and the average value was reported. A higher shear value indicates a firmer product.

4. Result & Discussion

Fig 1: Ridge gourd peel powder

Organoleptic evaluation is the ultimate authority regarding the determination of sensory properties of foods. The developed pasta samples were subjected to organoleptic evaluation by panel members and the mean score given in the table 2.

Table 2: Organoleptic Evaluation of Pasta

Pasta	Appearance	Taste	Flavour	Texture	Overall acceptability
Control	8.0	8.0	6.5	7.8	8.4
Sample A	7.5	8.6	7.2	7.	7.1
Sample B	7.1	8.0	7.5	7.1	7.6
Sample C	6.0	7.1	8.1	6.5	6.5

The results revealed that the pasta incorporated with 5% received the highest sensory score compared to the other samples.

Table 3: Cooking quality and shear force data for pasta

Pasta	Cooking time (min)	Cooked weight (g/25g)	Cooking loss (%)	Shear force (N)
Control	7.44 ± 0.19	73.3 ± 2.71	6.20 ± 0.06	3.64 ± 0.70
Sample A	8.51 ± 0.20	64.4 ± 2.98	7.54 ± 0.15	4.22 ± 0.23
Sample B	8.75 ± 0.26	60.8 ± 1.01	7.89 ± 0.01	5.54 ± 0.10
Sample C	9.15 ± 0.25	54.8 ± 1.07	8.29 ± 0.50	6.97 ± 0.11

The nutrient composition of the control and sample B pasta given in the table 4.

Table 4: Nutrient analysis of pasta

Composition	Control	Sample B	Commercial
Energy Values in Kcal / 100g	347	369	380
carbohydrates values in %	58.7	52.8	61.9
Protein values in %	2.9	4.6	1.8
Fat values in %	1.2	0.8	1.5
Fibre values in %	31	39.6	22
Vitamin C Values in ppm	1.5	7.3	0.5

The storage study for the acceptable ridge gourd peel powder incorporated pasta, i.e., Sample B was carried out for a period of one month at the 15 days interval. The results of microbial analysis of ridge gourd peel powder and incorporated pasta are given in the table 5. There is no microbial growth observed until 15th day in the pasta samples. So the pasta samples can be stored for 15 days without spoilage in the room temperature.

Table 5: Microbial analysis of pasta

Sample	Microbiological count		
	Initial	15th day CFU / ml	30th day CFU / ml
Control	-	-	TFTC
Ridge gourd peel incorporated pasta (Sample B)	-	-	TFTC

*TFTC – Too Few To Count

5. Concussion

The nutrient analysis of ridge gourd peel incorporated pasta showed that the incorporated pasta is rich in protein, fibre and vitamins when compared to control. The pasta with 7.5 percent ridge gourd peel showed some change in cooking quality in comparison with the other percentage of substitution. Microbiological examination shows that the incorporated pasta can be stored upto 15 days. The results of cost analysis reveals the fact that the cost of incorporated pasta is low when compared to control. The results indicated that ridge gourd peel powder can be used in food and improve its nutritional quality without affecting the product sensory quality.

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