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Vanishree S
Department of Home Science, AEEC Lingasugur, Karnataka, India

Udaykumar Nidoni
Department of Processing and Food Engineering, College of Agriculture Engineering, Raichur, Karnataka, India

Shilpa Huchchannanavar
Department of Home Science, KVK Hagari, Karnataka, India

Ambresh Ganachari
Department of Processing and Food Engineering, College of Agriculture Engineering, Kalburgi University of Agricultural Sciences, Raichur, Karnataka, India

Corresponding Author:
Vanishree S
Department of Home Science, AEEC Lingasugur, Karnataka, India

Development and evaluation of ready to cook sambar powder using pigeon pea (*Cajanus cajan*)

Vanishree S, Udaykumar Nidoni, Shilpa Huchchannanavar and Ambresh Ganachari

Abstract
Pigeon pea (*Cajanus cajan*) value added ready to cook sambar powder was developed using milling residues of pigeon pea like grits (broken dal) and the recipe was optimized by sensory evaluation. The proximate analysis of the developed product and the influence of different packaging material on shelf life of RTC sambar powder was studied. Microbial and sensory evaluation was done on initial, 30th day, 60th day and 90th day of storage life. Based on test results, the developed powder was found to be 'liked extremely' by evaluators with respect to taste and appearance whereas, 'very much liked' with respect to texture, aroma and overall acceptability**.** Regarding shelf life, the powder stored in retort pouch found to be having good shelf life with less microbial load.

Keywords: Sensory evaluation, ready to cook, grits, shelf life, retort pouch

Introduction
Red gram (*Cajanus cajan*) is an important pulse crop in India. It is also known as arhar, pigeon pea and tur. This crop is widely grown in India. India is the largest producer and consumer of red gram in the world. Red gram supplies a major share of protein requirement of vegetarian population of the country. Protein content in pigeon pea ranges from 18.4% to 21.49% and concentrated more in the outer cell layers of the cotyledons than in the central portion (Goyal *et al*., 2005) [2]. Milling of pulse is second largest agro food processing industry after cotton ginning industries. De-husking and splitting of red gram into dhal is an essential process as red gram dal is an important food ingredient in the regular vegetarian meals of India. During pulse milling due to abrasive de-husking in commercial mills, only 70% dal is recovered against the potential dal recovery of 85% (Lal and Verma 2017) [3] and about 30% of grain mass is lost in the form of husk and cotyledon powder. Husk, grits and powder come as byproduct of dal milling. Out of which grits accounts 15% which will go as feed for poultry or cattle. Being good source of protein, these grits can be better used to develop some value added products.
Owing to rapid urbanization and more women joining the workforce, use of ready-to-eat and ready-to-use convenience foods is gaining increasing popularity. Women require dhal that cooks fast and increases in volume when cooked/ they need a packet of powder to cook instantly just by adding it to the hot water. Motivated by the consumer demand there is a need for development of short cooking time, microbial safety and high quality foods. Pulses being cheaper source of plant protein than nuts, milk, cheese, meat and fish can be used in bakery products like pasta, bread, snacks *etc*. Pulses provide ample opportunities to be used in processed foods. They can fortify breakfast cereals, microwaveable or partly prepared pulse based meal in order to fulfill consumer demand of convenient meal solution. Food service sector also prefer quick cooking pulse products. Considering the need of the hour an effort has been made to develop convenience dhal based food *i.e* ready to cook sambar powder to satisfy the needs of the consumers as well as to utilize the broken grits effectively after milling process.

Methodology
Broken dal (grits) were collected from dal mills and other ingredients were procured from local market to develop the product.

Methodology for RTC Sambar mix

Redgram grits, bengalgram dhal and blackgram dhal were dry roasted for 8min

↓

All the spices were dry roasted individually at low flame till pleasant aroma comes out of it

↓

Dhal and spices were powdered and blended thoroughly in chilly pounding machine

Recipe optimization

The ingredients were optimized by sensory evaluation using nine point hedonic scale. Best scored recipe was subjected to nutritional analysis.

Methodology for sambar preparation

Add 30 gm RTC sambar powder, chopped tomatoes and vegetables to 250 ml of boiling water and boil for 6-8mins

↓

Add Mustard seeds, jeera, to the heated oil for seasoning

↓

Serve it for sensory evaluation

Sensory evaluation: The prepared sambar was served to semi trained panel members for sensory evaluation using 9 point hedonic scale with score 9 as excellent and 1 as disliking. The sensory properties such as appearance, colour, consistency, flavor, taste and overall acceptability of finished product were evaluated.

Nutrient analysis

Nutrients like proteins, carbohydrates, fibre, fats, total minerals were analyzed (AOAC 1990).

Shelf life studies

Developed and standardized product was packed in suitable storage materials and kept for microbial and sensory analysis. Microbial and sensory evaluation was conducted on initial, 30th day, 60th day and 90th day of storage life. Bacterial microbes in food sample were measured in CFU (Colony Forming Units) i.e., CFU/gm (Syeda *et al*., 2016) [7]

Results and Discussion

Table 1: Optimised recipe for ready to cook sambar powder (For 1kg powder)

Ingredients	Quantity (g)
Red gram grits	250
Bengal gram	62.5
Black gram	37.5
Red chilly	250
Tamarind	125
Jaggery	50
Jeera	50
Coriander seeds	62.5
Dry coconut and mustard seeds	25g each
Fenugreek seeds	12.5
Pepper	25
Cardamom, chakke (cinnamon), turmeric powder, curry leaves and asafoetida	5g each

It is noted from the table-1 that, 250 grams of pigeon pea grits yielded 1000 grams of ready to cook sambar powder along with other pulses (Bengal gram and black gram) and spices.

Table 2: Sensory qualities of the developed product

Products	Appearance	Texture/ Consistency	Aroma/ Smell	Taste/ Flavour	Overall acceptability
Ready to cook sambar powder	9	8	8	9	8

The product developed was found to be ‘liked extremely’ by evaluators with respect to taste and appearance whereas, ‘very much liked’ with respect to texture, aroma and overall acceptability as depicted in table-2.

Table 3: Nutrient composition of the developed product (For 100gm)

Product	Moisture (%)	Carbohydrate (g)	Protein (g)	Crude Fat (g)	Crude fibre(g)	Total ash (g)
Ready to cook sambar powder	7.53	74.94	14.84	7.73	0.05	9.63

It is observed from the table-3 that moisture content of developed product is 7.53 per cent which helps to limit the growth of microbes and infestation. The higher the moisture content lesser the shelf life (Nalladurai *et al.*, 2006). About 75 g of carbohydrate and 14.84 g of protein was observed which fulfills nearly one fourth per cent of protein requirement per day. Total ash content and crude fibre found to be 9.63 g and 7.73 g respectively.

Table 4: Influence of packaging materials and duration on shelf life

Packaging material	Microbial load CFU X 10^4		
	0 Days	30 Days	60 Days
Retort Pouch	0	01	04
PET	0	03	08
LDPE	0	17	19
PP	0	20	24

It is evident from the table that microbial load was not detected initially before storage. However, microbial load of ready to cook sambar powder stored in retort pouch (aluminum foil pouch) and PET was very less after storage period of 30 days and 60 days compared to LDPE and PP. Similar results were observed in the study conducted by Pawase *et al*., 2019 [5]. It is also observed that there was no infestation even after 60th day of storage in all the packaging materials.

Conclusion

It can be concluded that pigeon pea milling by-products (grits) can be better utilized to develop value added products. Sensory qualities of Ready to cook sambar powder reveals that the product was very well accepted and saves time in preparing sambar. Addition of this powder to seasoned boiling water will yield sambar in very less time (<10 min). Vegetables can also be added at the time of seasoning. This powder can be stored up to 3 months in retort pouch. This can be a good product for enterprisers.

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