Storage Stability of Crisper Incorporated with Coconut Flour

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Introduction

Snacks contribute an important part of daily nutrient and calorie intake for many consumers. A snack is a portion of food often smaller than a regular meal, generally eaten between meals. Snacks come in a variety of forms including packaged and processed foods and items made from fresh ingredients. Today's health conscious consumers have shown a preference towards value added products, and in general, more nutritious food items (Brady, 2007). Extrusion offers a way to cook, shape, and pasteurize different products. In this particular study ready-to-eat extruded flakes products having good texture and appearance are produced with good protein levels by extruding locally available cereals, legumes and oil seed at a controlled temperature range at moderate moisture levels. Direct expanded product snack food gets its name because it is formed on extruder, and expands immediately, as it emerges from the die, requiring only additional drying or frying to bring down the moisture content and is ready for consumption.

Direct expanded product are usually light- meaning they have low bulk density (typically 50-160 g/l), and are coated with flavours and seasonings for additional taste and mouth feel. The raw ingredients contain moisture usually less than 20% on wet basis, and are processed at high temperature (150- 188°C) causing the product to expand or puff-up immediately. It is cut by die face cutter into small lengths. The expanded product, still contains moisture at 6-8% and is dried out to which brings down the total moisture content to around 1-1.5%. Drying time is short due to low product density. Drying times vary between 4-6 minutes and temperature 180°C. It should be allowed to cool to 75-91° C before application of seasonings. For additional taste and mouth feel, the product is sprayed with oil and dry seasoning and flavour

Standard *Variant*

Table-I. Composition of Crisper		
Ingredients	Quantity (gm/100g)	
	SC	VC
Wheat flour	50	45
Rice flour	50	45
Coconut flour	-	10
Salt	5	5
Masala powder	5	5
Vegetable oil	5	5

dusted. Alternatively oil, flavours, spices, etc. are mixed together and then applied to the snack.

Coconut is a versatile product and has multiple uses. Almost all the parts of a freshly grown coconut, eatable or otherwise, are used in some form or the other. Coconut flour contains almost double the amount of fiber found in wheat bran. Fiber has numerous health benefits, from reducing the absorption of sugar into the blood stream, to lowering cholesterol. Therefore, coconut flour can be used as a partial substitute to other refined flour for therapeutic purposes. The present study aims to develop crispers using coconut flour and evaluate its nutritional and sensory characteristics and storage stability.

Materials and methods

Selection of ingredients

The ingredients used for the preparation of crispers were whole wheat flour, rice flour, corn flour and salt. Vegetable oil and masala powder were added on crisper. All the ingredients were purchased from reputed departmental stores in Coimbatore. Coconut was obtained fresh from the farm.

Preparation of Coconut Flour

Coconut flour was prepared from coconut residue called "sapal" which is the meal usually discarded after milk extraction. Medium seized coconuts were selected and grated for extraction of milk. Milk was extracted from the grated coconuts by grinding process. The meal remaining, called the sapal was washed in hot water to reduce the oil content. The flour obtained was stored at room temperature and used for product formulation and further analysis.

Formulation of Crispers

Extrusion processing is one method to produce snack foods. Under high temperature, high pressure conditions it is possible to create a product with a desirable crispy, aerated textural structure. Two different crispers were formulated namely standard crisper (SC) and the variant crisper (VC). SC was prepared with wheat flour, rice flour and salt. VC was prepared with wheat flour, rice flour, coconut flour and salt. In both the crispers vegetable oil and masala powder were sprayed for flavour and taste. Composition of crisper is given in Table-I.

Organoleptic Evaluation of Crispers

Sensory evaluation has been defined as a scientific method used to evoke, measure, analyse and interpret those responses to products as perceived through the sense of sight, smell, touch, taste and hearing (Stone and Sidel, 2004).

Organoleptic evaluation of the prepared crispers was carried out by 10 semi trained panellists for appearance, texture, taste, flavour and overall acceptability. A nine point hedonic scale was developed for the purpose of evaluation of the acceptance of colour, flavour, taste, and texture and scores were given according to the acceptance of the product.

Evaluation of Nutrient Content of Crispers

Samples of SC and VC were analysed for moisture (hot air oven method, AOAC, 1980), protein (Microkjeldhal method, AOAC, 2000), fat (Soxhlet method, AOAC, 1970), carbohydrate (Anthrone method, 1962) and fiber (AOAC, 1995) content. They were analyzed for SC and VC on the 0th day and 90th day.

Microbial Count of Crispers

The formulated food products were subjected to microbial analysis and the food homogenate was prepared by dissolving 1gm of powdered sample and mixed with distilled water and mixed vigorously. From this the sample dilutions were prepared. For each dilution fresh pipette was used. Pipetted 1ml of food homogenate

Mean Organoleptic Scores of Crispers

Figure-1

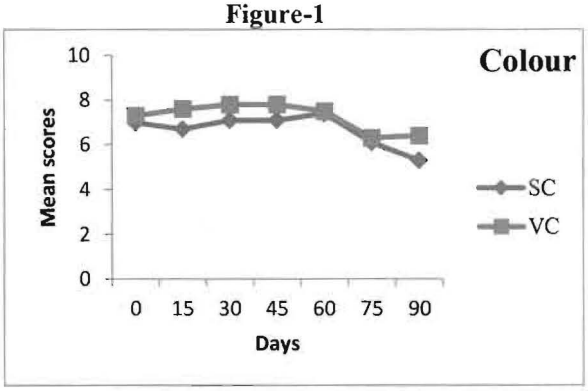


Figure-2

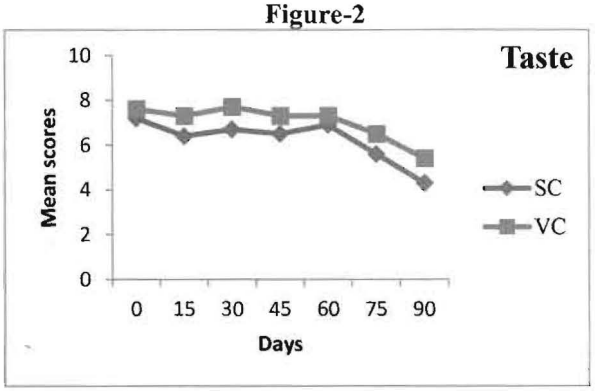


Figure-3

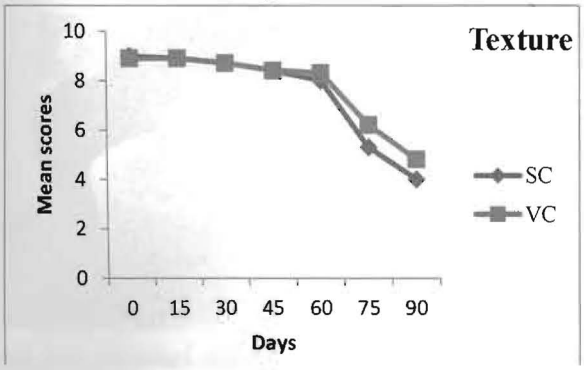
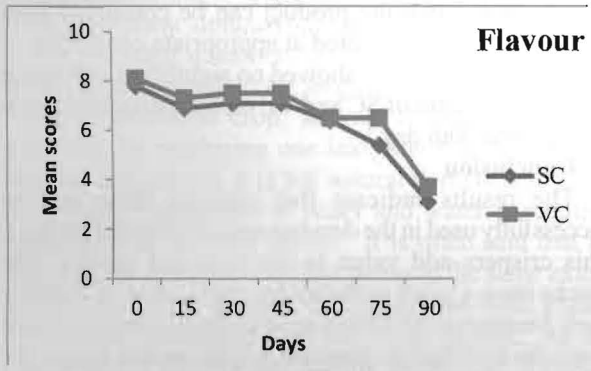


Figure-4



into tube containing 9 ml of distilled water, from the first dilution transferred 1 ml to second tube and so on till seventh dilution.

About 0.1 ml of 5th and 6th dilution was plated on sterile Nutrient agar plates. The plates were incubated at 37° C for 24 h in inverted position. Following the incubation all the colonies present on the plates were counted. Total number of colonies present in 1 g of the sample was calculated using the formulae

$$N = \frac{(\sum c)}{((N1+0.1N2)D)}$$

$\sum C$ is the sum of colonies counted on all the dishes retained
N1 is the number of dishes retained in the first dilution
N2 is the number of dishes retained in the second dilution
D is the dilution factor corresponding to first dilution

The total microbial count was analysed on first day and then periodically every 15 days upto 90 days.

The shelf life study was carried out at an interval of every 15 days and upto 90th day.

Results and discussion

Organoleptic Evaluation of Crispers

The organoleptic scores are presented in Figures – 1,2,3,4 and 5.

The mean scores for colour of SC and VC which were 7.0 and 7.3 on the 0th day respectively gradually decreased over the storage period and were the least on 90th day with 5.3±0.45 and 6.4±0.66 respectively. The textural quality of the crispers determines their acceptability to consumers. If the crispers are very soft and soggy, they stick to the teeth and affect mouth feel during consumption. The texture of the SC and VC was 9.0 and 8.9 on 0th day respectively and gradually decreased to 4.0 and 4.8 on 90th day respectively.

The mean flavour scores of SC and VC was 7.8 and 8.1 on 0th day and gradually decreased to 3.1 and 3.7 on 90th day.

The mean scores for taste obtained by SC and VC was 7.2 and 7.6 on 0th day. Thereafter the scores started decreasing gradually and was least for SC (4.3) compared to VC (5.4). A study conducted by Khan et al. (2015) on the effect of 10% virgin coconut meal on the rice based ready-to-eat extruded snack which received highest score of 8.5 for taste, thus revealing that the addition of coconut flour at 10% level in the production of extruded food product is more acceptable.

A derimental change in colour and texture has affected the taste also. Storage has affected the flavor of the food products, yet upto 90 days of storage the crispers remained acceptable. The overall acceptability scores were 7.4 and 8.1 for SC and VC respectively on the 0th day. Similar to the other criteria, the scores decreased and was 6.9 and 8.0 on the 15th day. The mean scores gradually declined over the storage period and was 4.0 and 4.5 on the 90th day. Deshpande and Poshadri (2011) prepared ready to eat extruded snack from whole Foxtail millet flour and other flours namely; rice flour, chick pea, amaranth seed flour and cow pea and reported that

Table – II. Nutrient Content of Crisper

Nutrient Content of Crisper/100g					't' value	
Nutrients	0^{th} day		90^{th} day		0^{th} day SC Vs VC	90^{th} day SC Vs VC
	SC	VC	SC	VC		
Protein (g)	6.08	6.12	5.79	6.01	0.120 NS	1.782 NS
Fat (g)	0.19	0.11	0.11	0.09	1.841 NS	3.500*
Carbohydrate (g)	84.07	84.74	82.96	82.78	0.438 NS	0.139 NS
Fiber (g)	1.0	1.0	1.120	1.2	1.00 NS	1.379NS

NS-Not Significant, p≤0.05 - significant

increase in acceptability due to the increase in proportion of foxtail millet flour. Thus in terms of sensory quality, the study revealed that millet flour from 60% levels was very close to control samples.

The results of General Linear Model comparing organoleptic scores of crisper indicate that there was a significant difference ($p \leq 0.01$) observed between groups and group Vs days for colour, taste, texture, flavour and overall acceptability.

Nutrient Content of Crispers

The nutrient content of the SC and VC on 0th day and 90th is given in Table-II.

Protein content of SC was slightly greater than the VC, it could be due to the removal of coconut milk from coconut flour which is a good source of protein. Similarly carbohydrate content of VC was slightly greater than SC due to the presence of sugar in coconut flour. Fiber content was similar for both SC and VC. The present results of fiber content of crisper are highly comparable with the results of Gabriel and Faith (2014) who have reported 1.0% of fiber content in extruded snacks prepared with coconut flour. Fat level of SC is higher than the VC. On 0th day SC and VC was not statistically significant. On the 90th day, the fat content of VC was significantly ($p \leq 0.05$) higher than SC. There was no significant difference in the protein, carbohydrate and fiber content of the products estimated on the 90th day.

Microbial Count of Crispers

The formulated crispers were examined initially and on every 15th day of storage until three months for their microbial content to evaluate the shelf life of the crispers. The total microbial load of the crispers ranged from TFTC to 0.45X 103 cfu/g. Microbial load of crispers was in the acceptable limit for a period of 90 days from preparation (Table-III).

Table-III. Microbial Count of Crispers

Days	Standard ×103 Cfu/g	Variant ×103 Cfu/g
0 th Day	TFTC	TFTC
15th Day	TFTC	TFTC
30th Day	TFTC	TFTC
45th Day	TFTC	TFTC
60th Day	0.12	0.05
75th Day	0.22	0.15
90th Day	0.45	0.25

The results revealed that the growth of microorganisms till 90th day was within the permissible limit according

to BIS standards (IS 11536:2006) this indicating that the colony count was less than 1 CFU/ g. Therefore, it is recommended that the product can be consumed upto 90 days of storage if stored at appropriate conditions.

The results of t-test showed no significant difference in microbial count of SC and VC on comparison between 0th day and 90th day.

Conclusion

The results indicate that coconut flour can be successfully used in the development of extruded product. This crispers add value to the extruded snacks. The snacks have a great potential for application as diabetic food, because of the fibre source in their formulation that could be modified to generate a near perfect recipe for production of diabetic snacks. The results obtained were useful for the food manufacturers to utilise coconut flour as a alternative to cereal flours for extruded products. Thus the study concluded that coconut which is an indigenous food can be used for therapeutic purpose. This in turn will promote the economy of the country by providing revenue for farmers.

Reference

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