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Nutritional Evaluation of Peanut Chikki Incorporated with Amla Pomace Powder

Raju, C. A. [a++*], Shamshad Begum, S. [b#] and Kalpana, B. [c†]

[a] Department of Food Science and Nutrition, University of Agricultural Sciences, GKVK, Bengaluru- 560065, India.
[b] Department of Food Science and Nutrition, University of Agricultural Sciences, GKVK, Bengaluru–560 065, Karnataka, India.
[c] University of Agricultural Sciences, GKVK, Bengaluru – 560 065, Karnataka, India.

Authors' contributions

This work was carried out in collaboration among all authors. Author RCA did the designing, execution, data analysis and drafting of the manuscript. Authors SBS and KB did the monitored and critical revision of the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Amla processing generates a significant amount of amla residue, known as amla pomace, which is a valuable byproduct. Amla pomace is rich in nutrients and can be utilized as a raw material for further processing and value addition. In this study, peanut chikki was developed by adding amla pomace powder as a functional ingredient at different levels (2%, 4%, and 6%) along with peanuts, and compared with a control sample. The chikki with 6% amla pomace (T3) had the highest overall acceptability score (7.85) compared to other variations. The nutrient composition of the most preferred chikki included protein (10.2g), fat (15.6g), dietary fiber (6.5g), carbohydrates (50g), and

[++] Ph.D. Scholar;
[#] Professor;
[†] Professor and State Nodal Officer (DESAI);
**Corresponding author: Email: rajuca80@gmail.com;*

26 mg/100g of ascorbic acid. Storage studies showed an increase in moisture, and peroxide value, a decrease in sensory scores and ascorbic acid content over time. However, the microbiological load remained within acceptable limits. This study demonstrates that amla pomace powder can be successfully incorporated into peanut chikki, providing nutritional and health benefits while addressing waste management issues.

Keywords: Amla pomace; byproduct utilisation; consumer acceptability; peanut chikki; waste to health.

1. INTRODUCTION

Amla (*Phyllanthus emblica*) also known as Indian gooseberry, is a minor fruit belongs to the family Euphorbiaceae and said to be native to India. In India, it is commercially cultivated in Uttar Pradesh followed by Gujarat, Tamil Nadu, Rajasthan, Karnataka and West Bengal [1]. It has 89 to 94 per cent pulp, 0.8 to 2 per cent fibre, 10 to 14 per cent total soluble solids, 1.4 to 2.4 acidity, 700 to 900 mg vitamin C per 100 g, 2.4 to 3.1 per cent pectin and 2 to 3 per cent phenols make up the amla fruit [2]. Due to its potent bioactive and antioxidant qualities, amla eliminates a wide variety of diseases and has the greatest concentration of vitamin C. It can be exploited to the nutraceuticals and biopharmaceuticals sectors as well as a prospective food additive. Amla fruits have been used as remedies since the ancient Indian system because of their medicinal properties. It is used to cure common colds, gastrointestinal problems, constipation, enlarged liver headaches, and other ailments. They also have several jobs in our bodies, including as cleaning blood, lowering cholesterol, and providing energy to the heart, brain, and liver, as well as aiding in the detection of diarrhoea [3,4] This has led to an increase in interest in new elements relating to the utilisation of these wastes as by-products for further exploitation on the fabrication of food additives or supplements with high nutritional quality. These are expensive goods, and retrieving them might be lucrative commercially. Utilization of these wastes can contribute to a lower production cost in the food industry and also accomplish the creating of new sources of food for human consumption [5].

Amla fruit is utilised at industrial level to process into amla juice and the byproduct generated after juice extraction is amla pomace, a waste substance with high nutritional value [6]. In general fruit pomace is the byproduct obtained immensely both at domestic as well as industrial level. Fruit pomace includes a variety of nutrients and bioactive compounds, but a large quantity of it is wasted at the food business level every day, which is a major issue that must be addressed. The urge for innovation in the field of fruit pomace integration in goods has increased in relevance due to its health-beneficial characteristics. The utilization of fruit pomace as a source of therapeutic substances for the treatment of various metabolic illnesses is an entirely novel subject of interest in medical research [7]. Also, it has been found that after juice extraction about 25 % of the fresh fruit is lost in the form of fruit pomace [8]. Although, the fruit pomace is a waste but it is a good source of dietary fibres, carbohydrates, minerals, vitamin C and high moisture content [9]. The fruit pomace contains 14-30% of crude fiber of the dry weights. Utilising these wastes might result in the development of alternative functional foods for human consumption. This waste load might be converted to health thereby boosting dietary intake, product development, and industrial waste utilization, which leads to fundamental exploratory studies on the features of processing food waste [7]. Also, amla pomace was found to be very good store house of nutrients especially with abundant dietary fibre and minerals.

Chikki as delicious snack and easily available in market for less price. It can be prepared from different ingredients like peanuts, jaggery and ghee. It contains good nutritional content too however the need for additional nutrient content can be explored to include it as nutraceutical. Hence, developing chikki that is incorporated with amla pomace powder improves the nutritional quality without much alterations in its sensory attributes. Incorporation of amla pomace powder can increase the ascorbic acid and dietary fiber composition of chikki. Hence, the present study addresses the enhancement of vitamin C and fiber by utilizing amla pomace in chikki preparation. Based on the nutritional and health benefits of amla pomace powder, the present work has been undertaken to study the “development of chikki by utilization of amla pomace powder”.

2. MATERIALS AND METHODS

The present investigation was carried out at the Department of Food Science and Nutrition, University of Agricultural Sciences, Bangalore.

2.1 Selection and Collection of Sample

The fresh and matured amla fruits were procured from the local market of Bengaluru, Karnataka, India.

2.2 Processing and Dehydration

The amla fruits were washed with water and they were wiped using a clean dry cloth. Amla fruits were cut into pieces by using a stainless-steel knife and the seeds were separated by slicing the pulp into small pieces. Then, the amla pieces were ground into pulp in the laboratory mixer, after that the juice was extracted from the pulp and the residue (pomace) was separated. Dehydration was carried out by weighing fresh pomace sample and subjected to dehydration in a laboratory model ezidri ULTRAFD1000 tray dryer at 45° C for 4 hours. The dried pomace was ground to fine powder and sieved through a scientific sieve and stored in the air tight zip lock covers in refrigerated temperature conditions for further use.

2.3 Formulation of Amla Pomace Chikki

The chikki was developed by incorporating amla pomace powder with peanuts, jaggery and ghee. Three variations of chikki were developed by incorporating a pomace powder at different variations like (2 %, 4 %, and 6 %) and compared with control. Amla pomace chikki preparation is represented in Fig. 1.

2.4 Organoleptic Evaluation of the Developed Products

The products were subjected to sensory evaluation of sensory quality attributes by a panel of 21 semi-trained members using a nine-point hedonic scale [10]. The products were evaluated for their appearance, colour, texture, flavour, taste and overall acceptability.

2.5 Microbial Load

The microbial load of the stored samples was enumerated by dilution plate method. The media used for bacteria was nutrient agar media, for mold, Martin's rose bengal agar and for yeast, yeast extract malt extract agar medium [11].

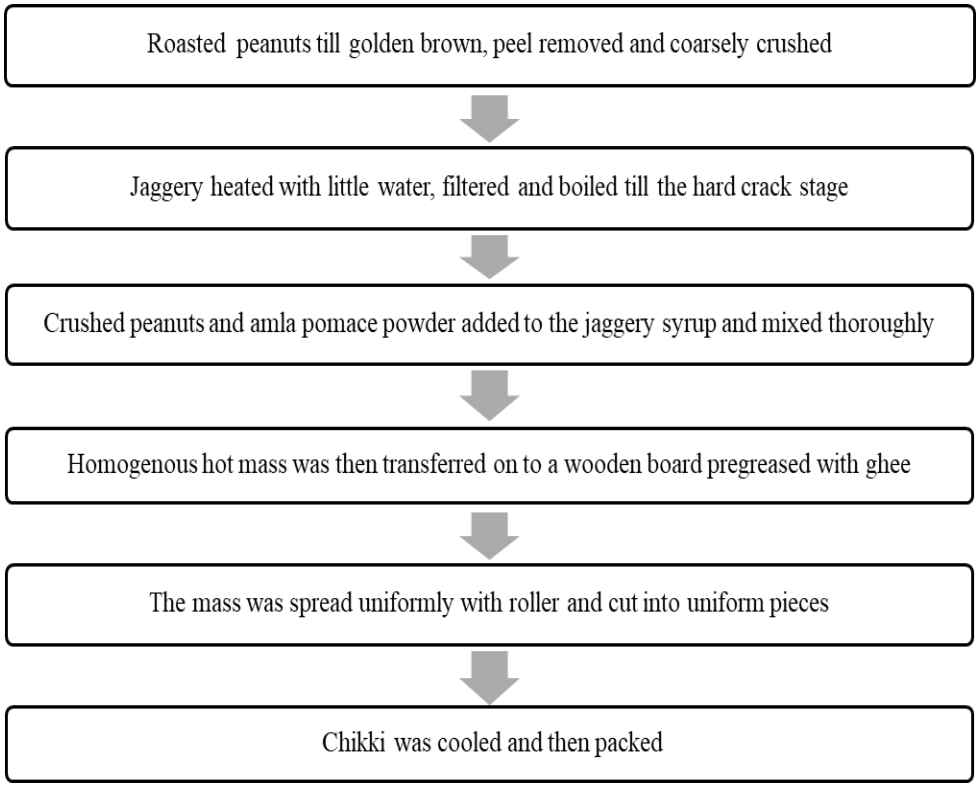

Fig. 1. Preparation of amla pomace chikki

2.6 Storage Studies

The shelf-life study was conducted for a period of 45 days. The amla pomace chikki were prepared, packed and stored in metallised polypropylene pouches. Then, the products were kept in both ambient and refrigerated conditions. The products were evaluated on initial, 15th, 30th and 45th day for sensory attributes and biochemical parameters (moisture, ascorbic acid and peroxide value) as [12,13,14].

2.7 Consumer Acceptability of the Developed Products

The consumer acceptability of amla pomace chikki was assessed by using the FACT scale by the consumers (n=50) [15].

2.8 Cost Estimation of the Developed Products

Cost of the best accepted chikki was calculated by considering the cost of the raw material purchased from the local market along with 30 per cent overhead charges (fuel cost, labour charge, electricity, machinery, packaging cost, etc.) and 25 per cent profit. The total price was calculated for 100 g of the product.

2.9 Computation of Nutritional Composition for Best Accepted Chikki

The nutrient composition for the best accepted products was computed by using Indian food composition table [16].

2.10 Statistical Analysis

The data obtained were subjected to complete randomised design (CRD) analysis to find out the impact of treatments, storage period and packaging material on the quality of the samples during storage of chikki by using the statistics *i.e.* software statistical package for social sciences (SPSS) [17].

3. RESULTS AND DISCUSSION

3.1 Sensory Evaluation of the Chikki

Sensory evaluation of the chikki was carried out by 21 semi-trained sensory panellists on a nine-point hedonic scale. The result of the sensory evaluation of chikki incorporated with amla pomace powder is presented in Table 1. The sensory scores for appearance ranged from 7.59 to 8.14 for appearance, 7.69 to 8.14 for colour, 6.97 to 8.00 for texture, 7.50 to 7.80 for flavour, 7.28 to 7.71 for taste and 7.40 to 7.85 for overall acceptability. Control variation had highest score for all of the sensory parameters. However, among the experimental variations, T_3 with 6 per cent amla pomace powder was found to be best accepted with respect to all sensory parameters. The statistical analysis indicated difference in sensory parameters among different variations and was found to be statistically significant at 5 per cent. Hence, the addition of amla pomace, increased the acceptability of chikki by the panellists. Present study reveals that the amla pomace incorporated chikki have good organoleptic scores. Similarly, results were observed in a study on pomegranate peel powder incorporated peanut chikki [18] indicated that the score for the colour and appearance of chikki ranged from 7.30-8.50, while texture and flavour ranged from 7.20-8.47 and 7.17-8.43, respectively, taste score ranged from 7.17-8.43 and overall acceptability ranged from 7.30-8.27.

Table 1. Sensory parameters of chikki incorporated with amla pomace powder

Treatments	Sensory parameters					
	Appearance	Colour	Texture	Aroma	Taste	Overall acceptability
Control	8.28±0.56	8.42±0.59	8.47±0.60	8.42±0.67	8.61±0.49	8.52±0.60
T_1	7.59±0.94	7.69±0.81	6.97±0.95	7.50±1.09	7.28±0.90	7.40±0.83
T_2	7.38±0.97	7.23±0.99	7.16±1.06	7.47±1.03	7.23±0.76	7.28±0.78
T_3	8.14±0.65	8.14±0.65	8.00±1.00	7.80±1.07	7.71±1.05	7.85±0.85
F value	*	*	*	*	*	*
SEm±	0.17	0.17	0.20	0.21	0.18	0.16
CD@5%	0.49	0.48	0.56	0.60	0.51	0.47

*T_1 = 2% amla pomace powder, T_2 = 4% amla pomace powder, T3 = 6% amla pomace powder, NS = Non-significant and * = Significant at 5%.*

Table 2. Sensory scores of chikki during storage at both ambient and refrigerated temperature

Product	Duration	Appearance	Colour	Texture	Flavour	Taste	Overall acceptability
Control	Initial	8.28±0.56	8.42±0.59	8.47±0.60	8.42±0.67	8.61±0.49	8.52±0.60
	15th day	7.90±0.43	8.09±0.62	8.04±0.38	7.95±0.66	8.00±0.54	7.95±0.21
	30th day	7.66±0.48	7.85±0.47	7.71±0.46	7.85±0.65	7.76±0.53	7.71±0.46
	45th day	7.57±0.50	7.66±0.48	7.57±0.50	7.61±0.49	7.57±0.50	7.57±0.50
	F value	*	*	*	*	*	*
	SEm±	0.10	0.12	0.10	0.13	0.11	0.10
	CD@5%	0.30	0.33	0.30	0.38	0.32	0.28
T_3	Initial	8.14±0.65	8.14±0.65	8.00±1.00	7.80±1.07	7.71±1.05	7.85±0.85
	15th day	7.66±0.48	7.76±0.43	7.71±0.46	7.42±0.50	7.66±0.48	7.66±0.48
	30th day	7.57±0.50	7.57±0.50	7.57±0.50	7.38±0.49	7.52±0.51	7.57±0.50
	45th day	7.52±0.51	7.42±0.50	7.19±0.40	7.33±0.48	7.47±0.51	7.42±0.50
	F value	*	*	*	NS	NS	NS
	SEm±	0.11	0.11	0.13	0.15	0.14	0.13
	CD@5%	0.33	0.32	0.39	-	-	-
Control	Initial	8.28±0.56	8.42±0.59	8.47±0.60	8.42±0.67	8.61±0.49	8.52±0.60
	15th day	7.80±0.40	7.95±0.49	7.95±0.21	7.80.±0.51	7.85±0.47	7.85±0.35
	30th day	7.57±0.50	7.76±0.43	7.61±0.49	7.76±0.53	7.66±0.48	7.66±0.48
	45th day	7.47±0.50	7.57±0.50	7.47±0.51	7.52±0.51	7.52±0.51	7.52±0.51
	F value	*	*	NS	NS	NS	*
	SEm±	0.13	0.12	0.17	0.16	0.16	0.13
	CD@5%	0.36	0.35	-	-	-	0.36
T_3	Initial	8.14±0.65	8.14±0.65	8.00±1.00	7.80±1.07	7.71±1.05	7.85±0.85
	15th day	7.71±0.46	7.47±0.51	7.42±0.59	7.33±0.48	7.42±0.50	7.52±0.51
	30th day	7.47±0.51	7.28±0.46	7.19±0.40	7.14±0.47	7.09±0.62	7.23±0.43
	45th day	7.28±0.46	7.04±0.49	7.04±0.38	7.04±0.49	6.95±0.38	7.09±0.30
	F value	*	NS	*	*	NS	*
	SEm±	0.13	0.12	0.12	0.12	0.13	0.11
	CD@5%	0.37	-	0.34	0.35	-	0.30

*T_3 = 6% amla pomace powder, NS = Non-significant and * = Significant at 5%.*

3.2 Storage Studies

Changes in sensory scores of chikki incorporated with amla pomace powder during storage at ambient temperature: The mean sensory scores of amla pomace powder incorporated chikki stored at ambient temperature (25±2 °C) is presented in Table 2. It was observed that a significant difference was found between control and best accepted chikki variation T_3 (6%). As the storage period increased, there was a gradual decrease in the sensory parameters were observed from initial period to the end of storage period. Control sample had mean sensory scores of 7.57, 7.66, 7.57, 7.61, 7.57 and 7.57 for appearance, colour, texture, flavour, taste and overall acceptability respectively. Whereas, the experimental variation T_3 had scores of 7.52 for appearance, 7.42 for colour, 7.19 for texture, 7.33 for flavour, 7.47 for taste and 7.42 for overall acceptability at 45th day of storage. Statistically there was significant difference at five per cent level for sensory attributes like appearance, colour and texture for both control and experimental (T_3) sample. However, it was observed that the sensory parameters like flavour, taste and overall acceptability was found to be non-significant for experimental T_3 and significance difference was observed for control sample. It was evident from sensory scores that even at 45th day of storage period, T_3 samples were moderately liked by the panel members when compared with control sample. During storage period, similar results were observed in peanut chikki incorporated with flaxseeds and their shelf life [19]. The sensory scores of all desirable attributes decreased slightly at both ambient and accelerated conditions at the end of 30 days when compared to the initial values but were still acceptable. Hence, the mean sensory scores declined with the increase in the storage period in the present study too.

Changes in sensory scores of chikki incorporated with amla pomace powder during storage at refrigerated temperature: As indicated in Table 2, it was observed that control sample had scores of 7.47, 7.57, 7.47, 7.52, 7.52 and 7.52 for appearance, colour, texture, flavour, taste and overall acceptability, respectively. Among experimental samples it was observed that, T_3 sample had scores of 7.04 for appearance, 7.04 for colour, 6.95 for texture, 7.04 for flavour, 7.04 for taste and 7.04 for overall acceptability at the end of the 45th day. It was observed that T_3 was acceptable even at 45th day of storage period when compared to control. As the storage period increased sensory scores of the amla pomace chikki decreased. Statistically there was a significant difference at five per cent level for all the sensory parameters of control and experimental T_3 sample. As a result, as compared to the original values, sensory ratings of chikki declined somewhat at both ambient and refrigerated temperatures after 45 days, but remained acceptable.

Effect of storage on moisture, peroxide value and ascorbic acid content of chikki: The best accepted chikki incorporated with amla pomace powder was analyzed for moisture, ascorbic acid and peroxide value during storage period at both ambient temperature (25±2 °C) and refrigerated temperatures (4 °C) as indicated in Fig. 2. The moisture and peroxide values were found to be increased during storage period, whereas the ascorbic acid content is decreased as the storage period extended. The moisture content in both ambient and refrigerated chikki ranged between 4.64 to 5.23 and 4.64 to 5.15 per cent, respectively and peroxide values ranged between 2.27 to 5.89 and 2.37 to 5.17 meq/kg, respectively. Whereas the ascorbic content is ranged between 23.28 to 17.36 and 23.28 to 21.75 mg, respectively during 45 days of storage. However, the inclusion of amla pomace increased the oxidative stability of chikki, as seen by lower peroxide readings at both ambient and refrigerated temperatures. Hence, it is observed that the products were less prone to degradation by hindering rancidity. The data (Fig. 2) showed similar results were observed in guava bar *i.e.* gradual decrease in ascorbic acid content during storage period [20]. Increased trend of moisture content and peroxide value in chikki with moisture content of 3.4 - 3.8 per cent initially and 5.2 to 5.8 per cent in all the samples after 30 days of storage [21] and the peroxide value of the samples ranged between 2.1-4.2 meq/kg initially and addition of flaxseeds increased the peroxide value of samples during storage (~12 meq/kg), thereby making the samples more prone to rancidity. In the present study peroxide value was lower (2.27-5.89 meq/kg) than the peroxide value of chikki ranged from 14.16 - 18.10 meq/kg [22]. Hence, it can be concluded that there is a tendency of increase in moisture content and peroxide value and decrease in ascorbic acid content at the end of storage period and the reason can be attributed to increase in oxidation, variation in temperature and time.

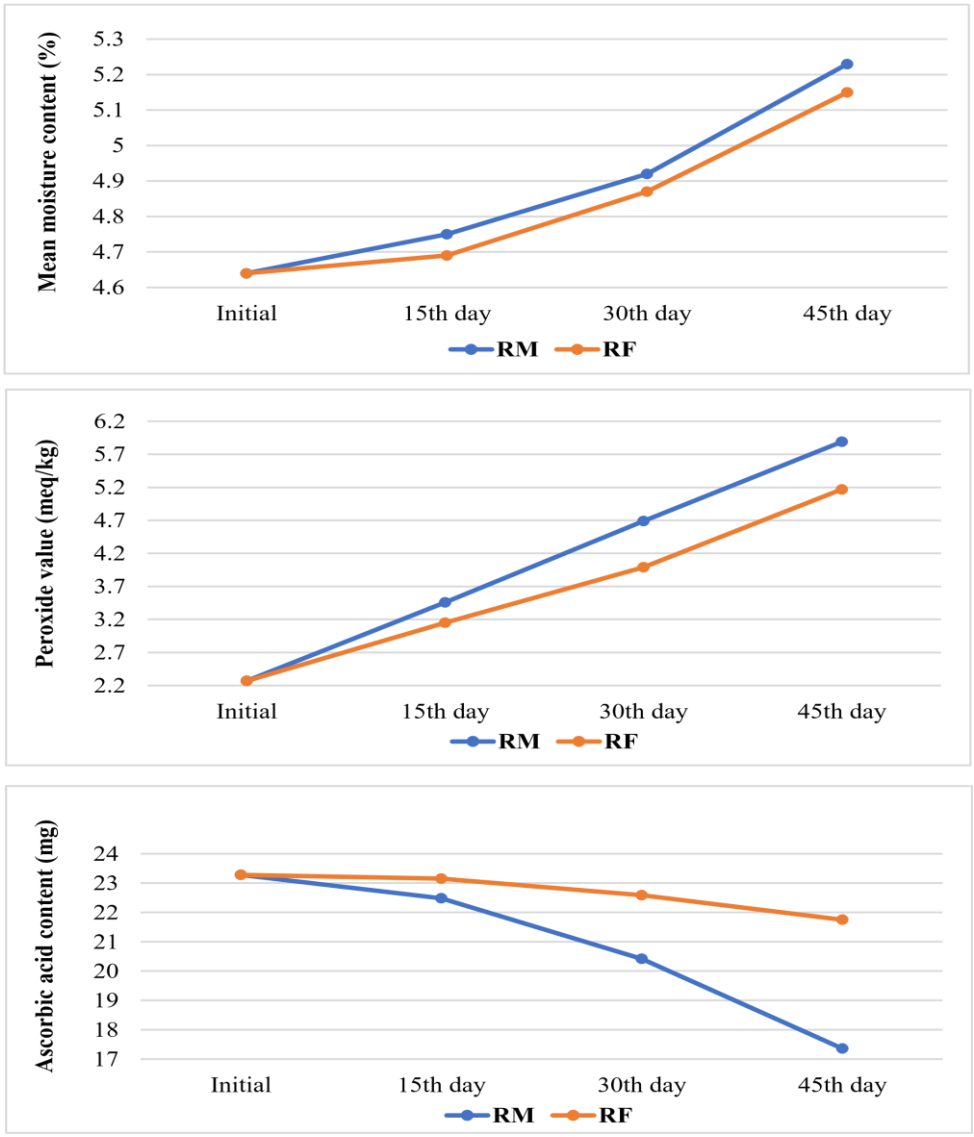

Fig. 2. Effect of storage on moisture, peroxide value and ascorbic acid content of chikki at ambient temperature (AM) and refrigerated temperature (RF)

3.3 Microbial Load of Chikki on Storage

The microbial load of bacteria, yeast and mold for best accepted chikki is presented in Table 3. The microbial load was estimated at the intervals of the initial, 15th, 30th and 45th day of storage. Initially, there were no microbial counts of bacteria, yeast and mold. However, as the storage period increased the bacteria, yeast and mold counts also increased simultaneously. At the 45th day of storage period, there was a significant increase in all the microbial counts. The bacteria, yeast and mold count were (2.33×10^5 cfu/g), (1.66×10^2 cfu/g), (1.66×10^3 cfu/g) and (1.66×10^5 cfu/g), (1.33×10^2 cfu/g), (1.66×10^3 cfu/g) both at ambient temperature as well as refrigerated temperature, respectively. However, it was observed that the microbial counts were within the permissible limits. Statistically, it was observed that there was a significant difference at 5 per cent for total bacterial count and their interaction effect was non-significant. Thus, concluding that, the addition of amla pomace improved the shelf life of the products. In line with the above results (Table 4), the juice mixed peanut chikki showed initially low microbial growth 0×10^5 cfu/g, 1×10^5 cfu/g and the count of microorganisms increased to 2×10^5 cfu/g and 3×10^5 cfu/g, respectively at 90 days of storage [23] Also, substantially increase in the microbial load (bacteria, yeast and mold) of stored chikki throughout the storage period of 60 days [18].

Table 3. Microbial load of chikki on storage

Storage condition	Duration	TBC (×10^{5}cfu/g)	Yeast (×10^2 cfu/g)	Mold (×10^{3}cfu/g)
Ambient temperature	Initial	Nil	Nil	Nil
	15th day	0.33	0.66	Nil1
	30th day	1.33	1.33	1
	45th day	2.33	1.66	1.66
	F value	*	*	*
	SEm±	0.28	0.28	0.16
	CD@5%	0.95	0.95	0.55
Refrigerated temperature	Initial	Nil	Nil	Nil
	15th day	Nil	0.33	Nil
	30th day	1	1	1
	45th day	1.66	1.33	1.66
	F value	*	*	*
	SEm±	0.16	0.23	0.16
	CD@5%	0.55	0.78	0.55

*NS = Non-significant, * = Significant at 5% and TBC = Total bacterial count.*

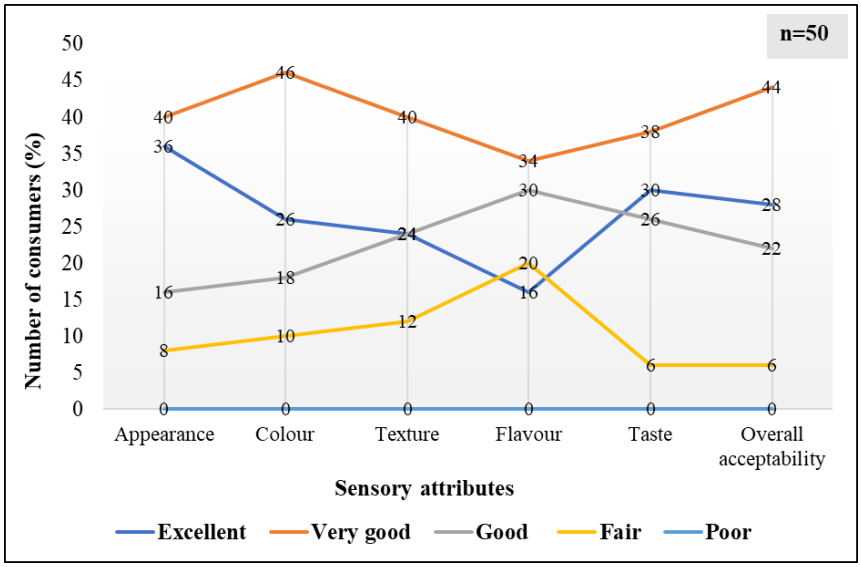

Fig. 3. Consumer acceptability of best accepted chikki

3.4 Consumer Acceptability of Chikki

Chikki was subjected to consumer acceptability for respondents (n=50), to know their extent of likability and dislikability on five-point hedonic scale Fig. 3. It was observed that for appearance out of 50 respondents, 36 per cent of them rated as excellent and 40, 16 and 8 per cent, respectively for very good, good and fair. For colour 26, 46, 18 and 10 per cent respondents quoted as excellent, very good, good and fair, respectively. With respect to texture 24, 40, 24 and 12 per cent and for flavour 16, 34, 30 and 20 per cent respondents quoted it as excellent, very good, good and fair, respectively. However, for taste 30, 38, 26 and 6 per cent respondents quoted it as excellent, very good, good and fair, respectively. Lastly for overall acceptability 28, 44, 22 and 6 respondents quoted it as excellent, very good, good and fair, respectively. As a result, the amla pomace incorporated chikki was found to be acceptable among consumers. The consumer acceptability in the present study (Fig. 3) is in par with quinoa incorporated products (quinoa upma and kesaribath) [24], biscuits substituted with 20 per cent mango peel powder [25], composite flour crackers produced with unripe mango peel [26] and for biscuits incorporated with 20 per cent carrot pomace [27].

Nutrient composition of experimental and best accepted amla pomace chikki (Per 100 g): The nutritional composition for the best accepted products was computed as per the

guidelines of Indian Food Composition Tables, NIN, ICMR Hyderabad [16]. The nutrient composition of best accepted chikki is presented in Table 4. The best accepted *chikki* had protein, fat and calorific value of 10.2 g, 15.6 g and 427 kcal per 100 g which is slightly lower than the control chikki with values being 11.6 g, 17.9 g and 456 kcal for protein, fat and calorific value respectively. The ash and carbohydrate content were found to be same 1.9 g per 100 g in both products. The dietary fibre fractions, *viz*, total dietary fibre, insoluble dietary fibre and soluble dietary fibre was found to be 6.5, 5 and 1.6 g, respectively which is higher than that of control chikki with values of dietary fibre fractions being total dietary fibre (4.7 g), insoluble dietary fibre (3.9 g) and soluble dietary fibre (0.8 g) per 100 g. The ascorbic acid content was 26 mg/100 g of chikki with 6 per cent of amla pomace powder where as it is nil in the control chikki. Hence, it was found that chikki incorporated with amla pomace has better nutritional quality and adds variety to the diet. In this study, incorporation of amla pomace can improve the nutritional quality of chikki and also add variety to the diet. Similar results were detected in nutritional composition of chikki containing pomegranate peel flour and results revealed that protein (14.17 g), ash (1.03 g), fat (23.78 g), crude fibre (2.10 g) and carbohydrate (51 g) in control and protein (14.16 g), ash (1.02 g), fat (23.73 g), crude fibre (2.70 g) and carbohydrate (51 g), respectively. The nutritional value of chikki was similar compared with control [18].

3.5 Cost Estimation for the Developed Products

The cost of production is an important consideration for commercialization and successful marketing. The cost of any product depends upon a number of variable factors like cost of raw materials, cost of processing and packaging of the product, *etc*. Here, the approximate cost of best accepted products (per 100 gm) is indicated. Overhead charges at 30 per cent of expenditure on manufacturing, which includes labour cost, depreciation cost on machinery, equipment, building *etc*., and profit at 25 per cent was included. The production cost of chikki is indicated in Table 5. And the results revealed that the total production cost was found to be Rs. 16 per 100 g. As a result, the new product is far more cost-effective than competing items on the market. The cost of the product was found to be lesser than that of the cost of chikki made from ragi and groundnut [28,29].

Table 4. Nutrient composition of experimental and best accepted chikki (Per 100g)

Nutrients	Control	Best accepted product (T_3)
Protein (g)	11.6	10.2
Ash (g)	1.9	1.9
Fat (g)	17.9	15.6
TDF (g)	4.7	6.5
IDF (g)	3.9	5.0
SDF (g)	0.8	1.6
Carbohydrates (g)	50	50
Energy (kcal)	456	427
Ascorbic acid (mg)	00	26

T_3 = 6% amla pomace powder, IDF = Insoluble dietary fibre, SDF = Soluble dietary fibre and TDF = Total dietary fibre

Table 5. Production cost of chikki

Ingredients	Quantity (g)	Rate (Rs.)	Cost (Rs.)
Jaggery	50	60/kg	3
Peanuts	39	140/kg	5.46
Ghee	5	405/kg	2.02
Amla pomace	6	-	-
Total	100		10.48
Overhead charges @30%			3.14
Profit (25%)			2.62
Cost of the product			16.24
		Round off to Rs. 16	

4. CONCLUSION

Incorporating amla pomace powder to chikki can augment the nutritional value of the chikki especially dietary fibre and ascorbic acid while also brings more diversity in the diet. It can be well received by consumers and it is feasible to produce chikki with enhanced functional and nutraceuticals using amla pomace, a byproduct of amla at household as well as by amla processing industries. Work in pursuit of this approach requires continuous efforts to ensure dietary diversification with incorporation of amla pomace that can promise less economical investments too.

DATA AVAILABILITY STATEMENT

The availability of supporting data is with the corresponding author and will be provided at any point of time if demanded and feel that it is required.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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