

## Original Research Article

### Studies on Nutritional Quality of Pomegranate Peel Powder Peanut *chikki*

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#### ABSTRACT

Pomegranate peel powder peanut *chikki* was prepared by incorporation of 2 per cent peel powder in *chikki*. The selected *chikki* was evaluated for sensory quality, chemical parameter, microbial count etc. The selected treatments were packed in LDPE and PP and stored at ambient ( $30 \pm 4^{\circ}\text{C}$ ) for 90 days to study their storage feasibility. The chemical composition of fresh pomegranate peel powder peanut *chikki* that showed protein content 14.16 per cent, the fat content 23.73 per cent. The crude fibers, carbohydrates, ash content of selected peel powder *chikki* were 2.70, 51.03, 1.02 per cent respectively. The calcium, iron and total polyphenol content of peel powder *chikki* were obtained 86.54, 1.69, 58.82 mg/100g respectively. During storage study the chemical parameter such as moisture content of peel powder *chikki*. The chemical parameter such as fat, protein, crude fibre, ash, calcium, iron, total polyphenol etc. were decreased in both the packaging material and this might be due to increase in moisture content. The organoleptic properties were judged on the basis of colour and appearance, texture, flavour, taste and overall acceptability by using 9 point Hedonic scale. During storage study by concerning the all parameter of organoleptic quality the peel powder peanut *chikki* liked most by the judges. The microbial count of *chikki* was increased slightly during storage but *chikki* was acceptable to the up to 90 days.

#### Keywords

Pomegranate peel,  
peanut, *chikki*,  
nutritional value,  
organoleptic  
properties

#### Introduction

There are many traditional foods in India, which also include confectionary products that give us good and unique taste and also healthy for human beings. Among those, *chikki* plays an important role in ready to eat traditional sweet products that is preferred by all age groups of our population. In *chikki*, there are different types based on the added ingredients such as groundnut *chikki*, sesame *chikki*, roasted bengal gram *chikki* etc. Nowadays, multigrain are included for preparing these kinds of traditional snack items for optimal health benefits. In view of

this, the study aimed to prepare *nutri-chikki* with multigrain such as pumpkin seed, flax seed, groundnut, almond, foxtail millet, black sesame seed and roasted bengal gram for providing multi nutrients (K Abhirami and L Karpagapandi2018).

Peanut is a legume crop that belongs to the family of Fabaceae, genus *Arachis*, and botanically named as *Arachis hypogaea*. Peanuts are consumed in many forms such as boiled sweets and sweet snacks are being prepared for joyful and celebratory occasions (Panneerselvam *et al.*, 2015). Peanut nut brittle is most common due to its delicious

taste and cost effectiveness. Groundnut or peanut (*Arachis hypogaea*) is generally referred as a poor man's nut and contains 49.66 g fats, 21.51g carbohydrates, 23.68 g protein per 100 g of groundnut and supplies about 2448 kJ energy per 100 g of groundnut in roasted form (USDA, 2011).

Gur (jaggery) is a natural, traditional product of sugarcane. It can be defined as a honey brown coloured raw lump of sugar (Amit and Dwivedi, 2010). Jaggery has magnesium which enhances the strength of nervous system and relaxes the muscles. It helps to relieve from fatigue and protects the blood vessels. Jaggery also helps to increase iron content in blood and is recommended for anemia patients.

The pomegranate (*Punica granatum* L.) fruit is a rich source of ellagitannins (ETs) such as punicalagin, punicalin, pedunculagin, gallic and ellagic acid esters of glucose, and ellagic acid (Vegara *et al.*, 2014), which contribute to antioxidative, anti-inflammatory and antiapoptotic activity of pomegranate and are believed to play an essential role in its wide range of health benefits. A lot of research on the neuroprotective activity of pomegranate juice and extract has been done. Supplementation with pomegranate juice in the drinking water of pregnant and nursing dams has been demonstrated to protect the neonatal brain in an inflammatory (Ginsberg *et al.*, 2018) and a hypoxic-ischemic (H-I) models (West *et al.*, 2007). These neuroprotective effects have been shown to be attributed to the inhibition of oxidative stress, and a decrease in the production of proinflammatory cytokines and apoptotic proteins (Ginsberg *et al.*, 2018).

Pomegranate peels are being discarded after juice production and ready to eat arils. Pomegranate peel is nutritive rich byproduct of pomegranate fruit. Pomegranate peel

attracts attention due to its apparent wound healing properties (Chidambara *et al.*, 2004), immune modulatory activity (Gracious *et al.*, 2001), and antibacterial activity (Navarro *et al.*, 1996) antiatherosclerotic and antioxidative capacities (Tzulker *et al.*, 2007). Antioxidative activity has often been associated with a decreased risk of various diseases (Whitley *et al.*, 2003). Pomegranate peel extract has got consideration due to its noticeable wound healing properties, immune modulatory activity, and antimicrobial activity, anti-atherosclerotic and oxidative capacities.

## **Materials and Methods**

### **Ingredients**

The major ingredients for the preparation of products were pomegranate fruits of Bhagwa variety was procured from local fruit market. The peanut and jaggery was procured from local market.

### **Packaging material**

The packaging material *viz.*, PP and LDPE bags were procured from local market and used for packaging of *chikki* for storage study.

### **Treatment details**

The pomegranate peel powder peanut *chikki* were prepared by using different levels of pomegranate peel powder and peanut as shown below:

### **Procedure for preparation of pomegranate peel powder**

The pomegranate variety of *Bhagwa* was used for the preparation of peel powder and juice as shown in Fig.1. The pomegranate peel powder was prepared by the procedure given

by Mukherjee *et al.*, (2014) with slight modification.

Pomegranate peel powder peanut *chikki* procedure given by Sharaynyarani and Chaturvedi (2014) with slight modification. The procedure of *chikki* were given in Fig.2.

### **Physical characteristics of raw material**

The raw material peanut was analyzed for different physical characteristics like thousand kernel weight, shape and colour. Pomegranate peel powder was analysed for different physic

### **Chemical properties of raw materials, *chikki***

Chemical constituents like moisture, fat, protein, carbohydrate, crude fiber and minerals like calcium, iron and total polyphenols content of raw material, *chikki* were determined as per the standard procedure.

### **Physico-chemical analysis of raw material, *chikki***

The method described in A.A.C.C. (2000) for determining moisture, fat, crude fiber was used. The protein content of *chikki* was estimated by determining total nitrogen content using standard Micro-Kjeldhal method and fat content of the *chikki* estimated by the soxhlet method A.A.C.C (2000). The crude fiber content in the products was estimated by A.A.A.C. (2000). The carbohydrate content in the selected *chikki* were obtained by subtracting from 100, the sum of values of moisture, protein and fat content per 100 g of the sample (Raghuramulu, *et al.*, 1993). The method described in A.O.A.C. (2005) for determining the ash content was used. Calcium and iron were analyzed using atomic absorption

spectrometry (AAS). These methods give a good precision and accuracy (Ojeka and Ayodele 1995.) The total polyphenols content of *chikki* was estimated by method given by (Bray and Thorpe 1954).

### **Packaging and storage of pomegranate peel powder peanut *chikki***

The selected treatments of *chikki* were packed in PP and LDPE and stored at ambient ( $30\pm 4^{\circ}\text{C}$ ) for 3 months. The samples were drawn at an interval of 1 month and evaluated for chemical and sensory quality.

### **Sensory evaluation of pomegranate peel powder peanut *chikki***

Sensory evaluation of pomegranate peel powder *chikki* was carried on 9 point hedonic scale. The average scores of the ten judges for different quality characteristics *viz.* colour and appearance, flavour, texture, taste and overall acceptability were recorded.

### **Statistical analysis**

All experiments were carried out by using Factorial Completely Randomized Design (FCRD). The results obtained in the present investigation were analyzed for the statistical significance according to the procedure given by Rangaswamy (2010).

## **Results and Discussion**

### **Physico-chemical properties of peanut**

The results obtained for physico-chemical properties of peanut are presented below:

Colour of peanut seeds were light brown. Shape of peanut seed are oblong 1000 kernel weight of peanut seed was 365.45g. The chemical composition of peanut was also presented in Table 2. The moisture

percentage of peanut was 6.24. The protein, fat, crude fibre, ash, carbohydrates content of peanut was 24.17, 46.10, 3.07, 2.27, 18.15 per cent, respectively. The value obtained for calcium content in peanut 128.52mg/100 gm and iron content 3.02mg/100 g. The value obtained for peanut fat and protein were 47.80 and 24.67 per cent which were similar to findings of Savage and Keenan, (1994) and Tidke *et al.*, (2017).

### **Physico-chemical properties of pomegranate peel powder**

The results obtained for physico-chemical properties of pomegranate peel powder are presented here:

The physico-chemical parameter of pomegranate peel powder was presented in Table 3. The result reveals that colour of pomegranate peel powder was dark brown. The values of moisture, protein, fat and crude fibre were 7.88, 3.99, 2.10 and 12.60 per cent, respectively. The result also shows that 64.56 mg/100g calcium, 23250 mg/100g iron, 4.07 mg/100g total polyphenols present in pomegranate peel powder.

### **Sensory evaluations of fresh pomegranate peel powder peanut *chikki***

The results obtained for sensory evaluation regarding colour and appearance, texture, flavour, taste and overall acceptability are presented in Table 4. The results indicate 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. The treatment T<sub>4</sub> (2 % pomegranate peel powder peanut *chikki*) obtained higher score as compared to control

and other treatments. The statistical analysis shows that addition of pomegranate peel powder upto 2 per cent had no any significant effect on colour and appearance, texture but it have significant effect on taste and flavour. Flavour being a combination of taste, smell and mouth feel, has multifaceted impact on sensory quality of a product (Amerine *et al.*, 1980). From the present results it is indicated only 2 per cent pomegranate peel powder can be used in the *chikki*. Similar results shown by Munde *et al.*, (2018) for preparation of peanut nut brittle (*chikki*) fortified with pumpkin seed and 2 per cent basil leaves powder.

The data in above Table 5 shows that results on changes in nutritional value of peel powder *chikki* during storage. It was observed from Table 5 moisture increased for treatment T<sub>0</sub> from 3.97 to 4 % in PP and 3.96 to 3.97 per cent in LDPE was observed for 90 days of the storage. Treatment T<sub>1</sub> showed increase in the moisture content 3.97 to 3.99 per cent in PP and 3.96 to 3.97 per cent in LDPE. It was observed that the protein decreased for control treatment T<sub>0</sub> from 14.17 to 14.14 per cent in PP and from 14.17 to 14.15 per cent in LDPE was observed for 90 days of storage. Treatment T<sub>1</sub> showed decrease in protein content from 14.17 to 14.13 per cent in PP and from 14.16 to 14.14 per cent in LDPE. The fat decreased for treatment T<sub>0</sub> from 23.78 to 23.75 per cent in PP and from 23.78 to 23.76 per cent in LDPE was observed for 90 days of storage.

Treatment T<sub>1</sub> showed 23.73 to 23.70 per cent decrease in PP and 23.73 to 23.71 per cent decrease in LDPE. From the results it was observed that the crude fiber decreased for treatment T<sub>0</sub> from 2.08 to 2.05 per cent in PP and from 2.10 to 2.07 per cent in LDPE was observed for 90 days of storage.

**Table.1** Treatment details for preparation pomegranate peel powder peanut *chikki*

Treatments	Pomegranate peel powder (%)	Peanut (%)	Jaggery (%)	Liquid glucose (%)
T <sub>0</sub>	00	100	90	10
T <sub>1</sub>	0.5	99.5	90	10
T <sub>2</sub>	1.0	99.0	90	10
T <sub>3</sub>	1.5	98.5	90	10
T <sub>4</sub>	2.0	98.0	90	10
T <sub>5</sub>	2.5	97.5	90	10
T <sub>6</sub>	3.0	97.0	90	10
T <sub>7</sub>	3.5	96.5	90	10
T <sub>8</sub>	4.0	96.0	90	10
T <sub>9</sub>	4.5	95.5	90	10
T <sub>10</sub>	5.0	95.0	90	10

**Table.2** Physico-chemical properties of peanut

Sr. No.	Physico-chemical constituent	Peanut
1.	Colour	Light brown
2.	Shape	Oblong
3.	1000 kernel weight (g)	365.45
4.	Moisture (%)	6.24
5.	Protein (%)	24.17
6.	Fat (%)	46.10
7.	Crude fiber (%)	3.07
8.	Ash (%)	2.27
9.	Carbohydrates (%)	18.15
10.	Calcium (mg/100 g)	128.52
11.	Iron (mg/100 g)	3.02

**Table.3** Physico-chemical properties of pomegranate peel powder

Sr. No.	Physico-chemical constituents	Mean value (Pomegranate peel powder)
1.	Colour	Dark brown
2.	Moisture (%)	7.88
3.	Protein (%)	3.99
4.	Fat (%)	2.10
5.	Crude fibre (%)	12.60
6.	Calcium (mg/100g)	64.56
7.	Iron (mg/100g)	23250
8.	Total polyphenol (mg/100g)	4.07

\*Each value is the average of three determinations

**Table.4** Sensory evaluations of fresh pomegranate peel powder peanut *chikki*

Treatments	Colour and appearance	Texture	Flavour	Taste	Overall acceptability
T <sub>0</sub>	8.50	8.47	8.43	8.43	8.27
T <sub>1</sub>	8.00	8.00	8.00	8.03	8.00
T <sub>2</sub>	7.93	7.90	7.90	7.99	8.03
T <sub>3</sub>	7.80	7.97	7.83	7.80	7.77
T <sub>4</sub>	8.37	8.37	8.43	8.30	8.20
T <sub>5</sub>	7.70	7.70	7.53	7.60	7.53
T <sub>6</sub>	7.63	7.50	7.40	7.53	7.57
T <sub>7</sub>	7.63	7.63	7.63	7.63	7.77
T <sub>8</sub>	7.77	7.73	7.60	7.50	7.67
T <sub>9</sub>	7.50	7.40	7.30	7.40	7.37
T <sub>10</sub>	7.30	7.20	7.17	7.17	7.30
Mean	7.83	7.81	7.75	7.76	7.77
S.E. ±	0.13	0.15	0.12	0.11	0.12
CD at 5 %	0.39	0.44	0.35	0.33	0.34

T<sub>4</sub> = 2 % pomegranate peel powder peanut *chikki*

\* Maximum score out of 9

**Table.5** Nutritional value changes in pomegranate peel powder peanut *chikki* during storage

Parameters	Initial				Final			
	TOP1	TOP2	T1P1	T1P2	TOP1	TOP2	T1P1	T1P2
Chemical constituent								
Moisture (%)	3.96	3.96	3.94	3.94	3.97	4	3.97	3.99
Protein (%)	14.17	14.17	14.16	14.16	14.15	14.14	14.14	14.13
Fat (%)	23.78	23.78	23.73	23.73	23.76	23.75	23.71	23.70
Crude fiber (%)	2.10	2.10	2.70	2.70	2.07	2.05	2.65	2.61
Carbohydrate (%)	51.04	51.04	51.03	51.03	50.94	50.91	50.95	50.89
Ash (%)	1.03	1.03	1.02	1.02	0.99	0.97	0.97	0.96
Calcium (mg/100g)	86.60	86.60	86.54	86.54	86.50	86.49	86.49	86.45
Iron (mg/100g)	1.73	1.73	1.69	1.69	1.66	1.60	1.62	1.60
Total polyphenol (mg/100g)	8.53	8.53	58.82	58.82	8.45	8.42	58.74	58.72

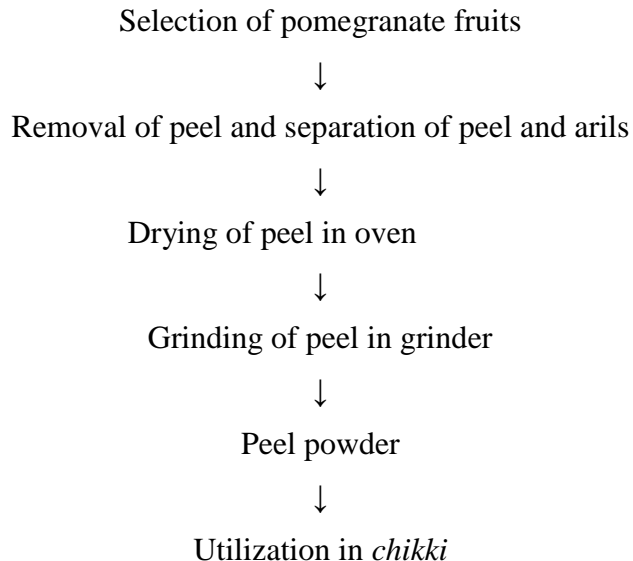
Where, T<sub>0</sub> = Control peanut *chikki* (100%)

T<sub>1</sub> = Pomegranate peel powder peanut *chikki* (2 % peel powder)

P<sub>1</sub> = Polypropylene (PP)

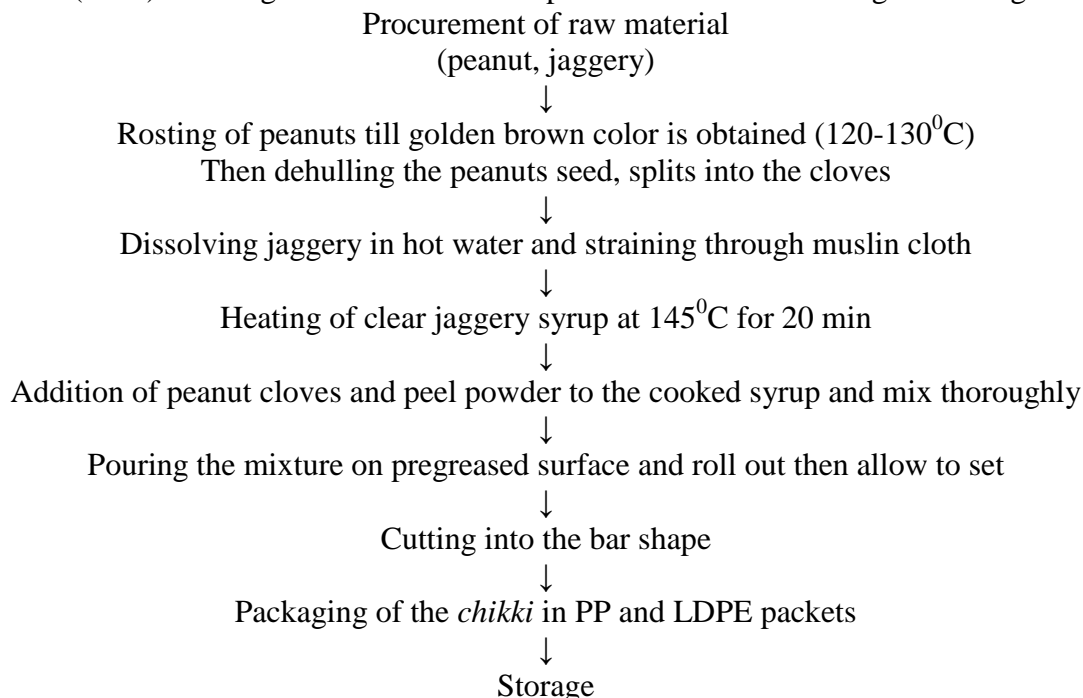
P<sub>2</sub> = Low density polyethylene (LDPE)

**Fig.1** Flow chart for preparation of pomegranate peel powder



**Fig.2** Flow chart for preparation of pomegranate peel powder peanut *chikki*

Pomegranate peel powder peanut *chikki* procedure given by Sharaynyarani and Chaturvedi (2014) with slight modification. The procedure of *chikki* were given in Fig.2.



The sample T<sub>1</sub> showed crude fibre content 2.67 to 2.61 per cent in PP and from 2.68 to 2.65 per cent in LDPE. The carbohydrates decreased for T<sub>0</sub> from 51.02 to 50.91 per cent

in PP and from 51.03 to 50.94 per cent in LDPE observed for 90 days of storage. The sample T<sub>1</sub> showed carbohydrate content 51.02 to 50.89 % in PP and from 51.02 to



50.95 per cent in LDPE. The ash content decreased for treatment T<sub>0</sub> from 1.02 to 0.97 per cent in PP and from 1.03 to 0.99 per cent in LDPE was observed for 90 days. The sample T<sub>1</sub> showed decrease from 1.01 to 0.96 per cent in PP and from 1.01 to 0.97 per cent in LDPE. The calcium content decreased for treatment T<sub>0</sub> from 86.58 to 86.49 mg/100 g in PP and from 86.59 to 86.50 mg/100 g in LDPE was observed for 90 days. The sample T<sub>1</sub> showed decrease from 86.53 to 86.45 mg/100 g in PP and from 86.53 to 86.49 mg/100 g in LDPE. The iron content decreased for treatment T<sub>0</sub> from 1.71 to 1.60 mg/100 g in PP and 1.72 to 1.66 mg/100 g in LDPE was observed for 90 days. The sample T<sub>1</sub> showed decrease from 1.67 to 1.60 mg/100 g in PP and from 1.68 to 1.62 mg/100 g in LDPE. The total polyphenols content decreased for treatment T<sub>0</sub> from 8.52 to 8.42 mg/100 g in PP and 8.52 to 8.45 mg/100 g in LDPE was observed for 90 days. The sample T<sub>1</sub> showed decrease from 58.80 to 58.72 mg/100 g in PP and from 58.81 to 58.74 mg/100 g in LDPE. The peanut *chikki* initial low microbial count detected it showed 0x10<sup>5</sup>, 1x10<sup>5</sup> and final 90days 2x10<sup>5</sup>, 2x10<sup>5</sup> respectively. The total cost of production for pomogranate peel powder *chikki* was 150.69 Rs/kg.

The results obtained in the present investigation indicated that good quality *chikki* could be prepared with 2% pomegranate peel powder, 98% peanut, 90% jaggery and 10% liquid glucose. The selected treatment also showed superior sensory score in respect of quality over other treatments. These *chikki* could be stored in low density polyethylene (LDPE) showed better chemical properties.

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