EVALUATION OF PHYSICOCHEMICAL AND SENSORY PARAMETERS OF FIBRE ENRICHED *CHIKKI* DEVELOPED FROM *PEPITA*

Ms. Harsha Hirdyani*

Ms. Bharti Charak**

Abstract

Introduction: Pumkpin seeds (pepita) are known to have very high potential to prevent many chronic diseases, due to its quality fat and fibre content. Chikki, an Indian sweet was fortified with the pepita to enhance the nutritional value of the standard product.

Materials and methods: Pepita were utilized to replace peanuts in the traditional peanut chikkiat 50% and 100%. The developed product was then evaluated for its nutritional and sensory parameters using standard procedures as stated by AOAC (2000). **Results and discussions:** Results showed that incorporation of pepita increased the nutritional quality of chikki significantly especially in fat, fiber and protein content, 5%, 1% and 4% respectively. Storage studies (30 days) revealed that the addition of pepita increased the peroxide value of samples during storage (~10 meq/kg), thereby making the samples more prone to rancidity. **Conclusion:** Considering the fibre, protein content and organoleptic evaluation it can be concluded that pepita incorporated chikki acceptable by panelists and inclusion of such fortified common daily use snacks will help community to maintain a healthy life.

Keywords: Pumpkin seeds, Pepita chikki, Physicochemical characteristics, Sensory evaluation, Storage study

* Assistant Professor, Dept. of Food Technology and Nutrition, Lovely Professional University, Phagwara

** Student (M.Sc Nutrition and Dietetics), Dept. of Food Technology and Nutrition, Lovely Professional University, Phagwara

1. Introduction

Pumpkin belonging to the family Cucurbitaceae, is a perennial plant and is consumed traditionally in a variety of foods such as fresh or cooked vegetables, as well as being stored frozen or canned. Undoubtedly, pumpkin seeds known as Pepita are quite beneficial but still the untapped potential of these seeds is yet to be explored.

The seeds are typically rather flat and asymmetrically oval, and light green in color and may have a white outer hull. Some cultivars are hullers, and are grown only for their seed.The seeds are nutrient-rich, with especially high content of protein, dietary fiber and numerous micronutrients (Song, 2011)

Elinge *et al* in 2012 conducted a study in which Pepita were analysed for their nutritional and anti-nutritional composition, the results obtained were; moisture content (5.00%), ash (5.50%), crude lipid (38.00%, crude fibre (1.00%), crude protein (27.48%), Available carbohydrate (28.03%) and calorific value (564kcal/100g). studies have proved that pepita if properly utilized can serve as good source of minerals (Glew *et al* in2006). The fatty acid composition of pepita is also wholesome and good for health. (Gohari*et al*, 2011) Table 1.

Also these are rich in antioxidants and else then playing a major role in reduction of cholesterol levels. (Xanthopoulou *et al* 2009)

Fatty acids	**Concentration%**
Palmitic (C16:0	10.68 ± 0.42
Palmitoleic (C16:1)	0.58 ± 0.14
Stearic (C18:0)	8.67 ± 0.27
Oleic (C18:1)	38.42 ± 0.37

Linoleic (C18:2)	39.84 ± 0.08
Linolenic (C18:3)	0.68 ± 0.14

Table 1. Fatty acids composition of Pepita (Goharii*et al*, 2011)

Researches indicates that a diet rich in foods contain beta-carotene may reduce the risk of developing certain types of cancer and offers protection against heart disease and hypercholesterolemia (Zuhairu *et al.*, 1997; Çelik *et al.*, 2011; Takada *et al.*, 1994). Pepita are also known to have positive effects on atherogenesis (Showayman 2011). Pepita have also shown positive health effects on diabetics, thus can be considered as an antidiabetic functional food (Sefi, 2010; Makni, 2011) Pepita are known to have many medicinal and nutritional properties that can further impact many research developments and further can prove as a potential source of functional foods (Tawheed *et al* 2013) Thus this study was developed with the intention of incorporating these underutilized pepita to the traditional Indian sweet Chikki, which is popular throughout the country and consumed by all the sections of the population.

2. Materials and methods

Peanuts, pepita and jaggery were purchased from the local market of Ludhiana because of its easy proximity. Both peanut seeds and pepita were roasted (110-120 °C) until sufficiently dried and became crisp and brittle to touch. These were then peeled and crushed coarsely.

2.1. Preparation of chikki

Peanut chikki (A-control) was made by using the traditional standard recipe. Jaggery and peanuts were taken in equal amounts; jaggery was crushed and heated till the hard crack stage was developed (150 °C). Pre weighed crushed peanuts were added to this jaggery syrup and were mixed thoroughly to cover the peanuts properly. Hot mass was then transferred on to a wooden board which was already greased. The mass was then spread uniformly with help of a roller.

Vertical and horizontal lines were marked with a knife or cutter to make uniform pieces and then cooled to room temperature (~27°C). The chikki was then packed in polypropylene pouches.

2.2. Preparation of chikki with pepita

Roasted and crushed pepita were added to the standard peanut chikki (sample A) at 50% (Sample B) and 100% (Sample C) replacement of peanuts. This 50% and 100% replacement was based on sensory evaluation and thus was chosen for further studies. Remaining procedure, was used same as mentioned for the standard recipe. Both the samples were stored at room temperature (~27°C) in polypropylene pouches

2.3. Physico-chemical characteristics of chikki

2.3.1. Moisture estimation

Moisture content was determined by following the oven drying method. (AOAC, 2010)

2.3.2. Texture measurement

Universal Texture Measuring system (Model LR-5K, Lloyds, UK) was used to measure the snap (breaking strength of the chikki). The uniform size *chikki* was taken and 3-point bending/breaking test was performed using a load cell of 100 N with 3 replicates with a cross head speed of 50 mm/min. The force required to break the *chikki* into 2 pieces was recorded as the breaking strength (snap) and expressed in Newton (N).

2.3.3. Fibre estimation

Moisture and fat free sample (2g) were digested with 200ml of 1.25 per cent H_2SO_4 by gentle boiling for half an hour. The contents were filtered and the residue was washed

several times with hot distilled water till it became free from acid. Acid free residue was then transferred to the same flask to which 200ml of 1.25 per cent NaOH was added. The contents were digested again for half an hour, filtered it and residue was again washed with hot distilled till it became alkali free. The residue was dried in an oven overnight at 100ºC and weighed and then placed in muffle furnace at 600ºC (±50ºC) for 4hours. The loss in weight after ignition the sample represented the fibre in the sample. (AOAC, 2010)

2.3.4. Protein estimation

Protein was determined by using the Folin-Ciocalteu regents, which reacts with aromatic residues of proteins and yields blue color which in turn is read in colorimeter.(Sadasivam and Manickam, 2007)

2.3.5. Fat estimation

Fat content was determined by Soxhlet extraction method.(AOAC, 2010)

2.3.6. Peroxide value

Peroxide value is a measure of the peroxides contained in the oil. The peroxides present were determined by titration against thiosulphate in the presence of potassium iodide. Starch was used as an indicator. (Sadasivam and Manickam, 2007)

2.3.7. Carbohydrates

Carbohydrate estimation was done by using the formula given below:

%Carbohydrate= 100-[moisture+ash+protein+fat]

2.3.8. Calorific value

Energy value was calculated by using the undermentioned formula:

Energy= [(9×g.fat)+(4×g.protein)+(4×g.carbohydrate)]

2.3.9. Sensory evaluation

To assess the quality, acceptability, the product were presented to a panel of ten judges and the evaluation for sensory parameters such as color, taste, flavour, texture and overall acceptability characteristics were carried out using a 9 point hedonic scale. *Chikki* samples with code number were served one at a time for evaluation. Sensory evaluation was carried out for freshly prepared *Chikki* products and those stored for 30 days at 27 ± 2 °C.

2.3.10. Storage study

Chikki were packed in polypropylene pouches and kept at ambient temperatures (~27°C) for 30 days. The storage stability was determined by estimating moisture content, peroxide value and sensory evaluation by 10 panel members.

2.3.11. Statistical analysis

All analyses were carried out in triplicate. Critical difference (CD) was studies in between the values to differentiate among the means of different samples ($p \leq 0.05$)

3. Results and discussion

3.1. Moisture content

Moisture of *chikki* is very critical as it determines the quality and stability of the product. All the products had a moisture content of 2.6 - 3.2%. The moisture content in the sample C (pepita) was highest i.e 3.2%. This was followed by the other two samples. No significant difference was seen amongst the 3 samples. However, the moisture content increased during storage. It was estimated in the range of 4.8 to 6.4% in the samples B (peanut and pepita), C(only pepita) and A(control) respectively. (Fig 1)

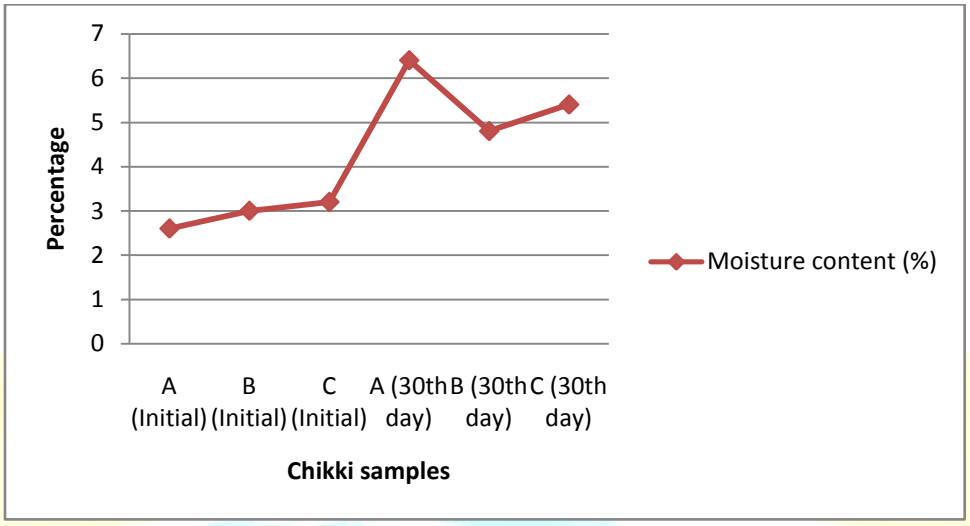

Figure 1. Moisture content of chikkis at initial and 30th day of storage

*Mean (n=3)

3.2. Texture analysis

Chikki was found to have a good crunchy and brittle texture at first. The Breaking strength (snap) was measured as 66.2 -70.1 N initially which then gradually reduced to 43.8 - 46.4 N at the 30th day of storage. This could be due to the absorption of moisture by the chikki. (Fig 2)

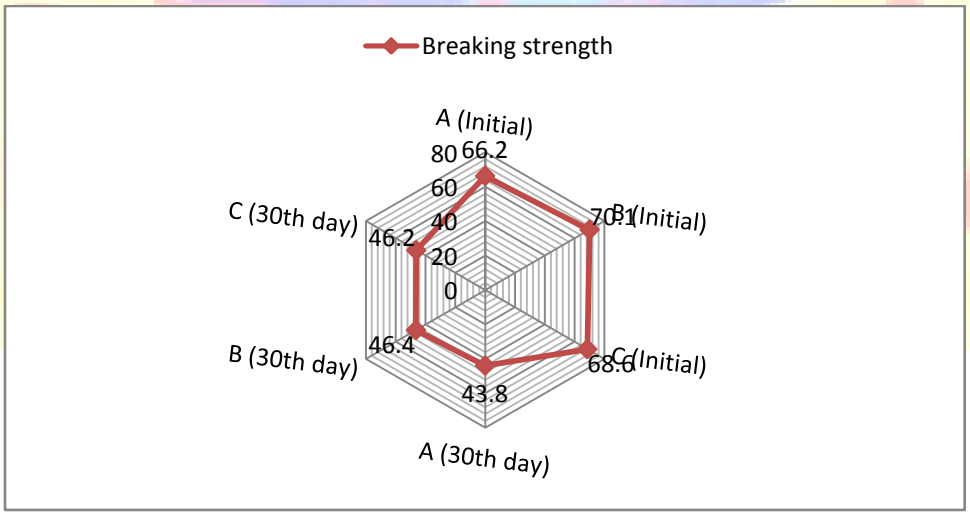

Figure 2. Texture analysis of chikkis at initial and 30th day of storage

*Mean (n=3)

3.3. Fibre content

Fibre content is the crucial aspect of this research study. Fibre content was found to be increased on addition of pepita to the standard chikki. Total fibre content of three samples were in between 1.6-2.5%, least present in the control sample. Fibre content gradually increased by increasing the composition of pepita.

3.4. Fat content

The fat content in the samples was in the range 17.5 – 22.5%. The sample contributing to the highest fat content was sample C containing only pepita. The increased concentration of fat was due to the increased concentration of pepita, thereby improving the product quality in terms of good fatty acids.

3.5. Protein content

The protein content in the samples was in the range 10.1%-14.2%.

3.6. Calorific value

In terms of energy all the samples (Table 2) came out to be in range 464.7 kcal- 486.5 kcal. The sample possessing the highest energy content was C (pepita) and least total energy content was found in sample A (control).

Quality Parameters	A (control peanut chikki)	B (Peanut + Pepita chikki)	C (Pepita chikki)
Moisture (%)	2.6± 0.02	3.±0.05	3.2± 0.01
Ash (%)	1.5± 0.01	1± 0.01	1± 0.05

Fat (%)	17.5± 0.10	22 ±0.05	22.5±0.03
Fiber (%)	1.6± 0.01	2± 0.05	2.5± 0.05
Protein (%)	10.1± 0.05	14.2± 0.15	13.6± 0.07
Carbohydrate (%)	66.7	57.6	57.4
Calorific value (kcal)	464.7	485.2	486.5

Table 2: Quality parameters of peanut and pepita chikki

* Mean ± standard deviation (n=3)

3.7. Peroxide value:

Peroxide value is relatively a measure of the peroxides content in the oil. Peroxide value thus gives an indication about the rancidity of a sample. In this particular study peroxide value was determined between 1-2 days after preparation of samples. Therefore in this experiment conducted resulting peroxide value of the samples which were tested ranged between 2.1-3.8 meq/kg. The highest peroxide value was found to be in sample C (3.8meq/kg) containing only pepita and least was found in the control sample. Thus concluding that, addition of pepita to increase the good fatty acids, made the chikki more prone to rancidity. Also PV was found to be increased during the entire storage period of 30 days. With highest of 15meq/kg in sample C, only pepita chikki. (Fig 3)

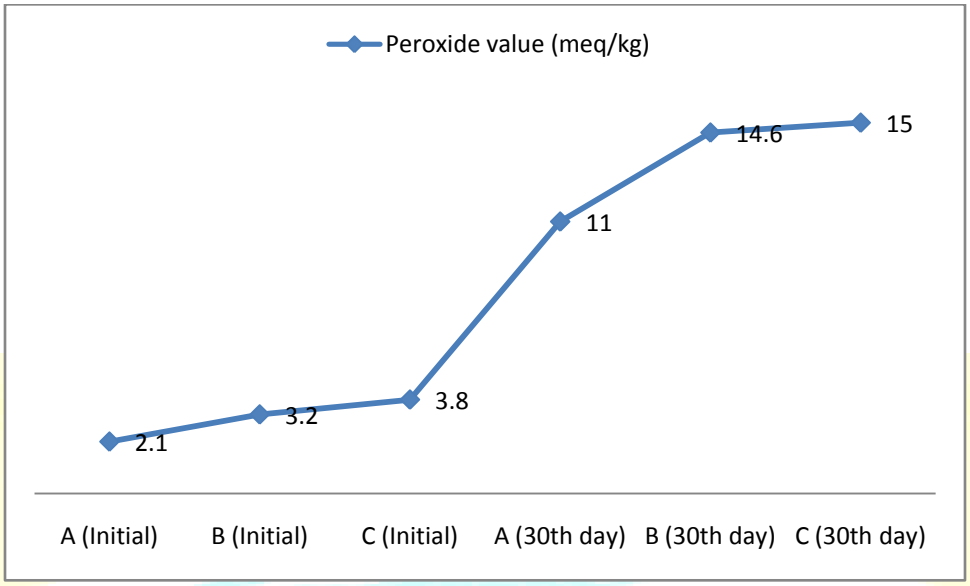

Figure 3. Peroxide value of chikkis at initial and 30th day of storage

*Mean (n=3)

3.8. Sensory analysis

Sensory analysis of *chikki* showed that the products were similar in all desirable quality attributes. (Table 3) Addition of pepita, increased the acceptability of the product. Significant difference were observed in the taste, appearance and overall acceptability of the pepita chikkis (B and C). Similar results were also reported by Chetana et al (2011) using flaxseeds and peanut chikki in combination. (Fig 4)

Sensory Parameters	A (control peanut chikki)	B (Peanut + Pepita chikki)	C (Pepita chikki)
Appearance	7.6± 0.69	8.3± 0.48	8.3± 0.48
Colour	7.5± 0.70	8.3± 0.48	8.3± 0.48
Taste	7.5± 0.91	7.8± 0.78	7.9±0.73

Texture	7.8± 0.78	8.1± 0.56	8.1± 0.56
Flavor	7.7±0.67	8.1±0.56	7.8±0.42
Overall acceptability	7.5±0.64	8.2±0.47	8.5±0.50

Table 3: Sensory evaluation of the chikkis

*Mean ± standard deviation (n=10)

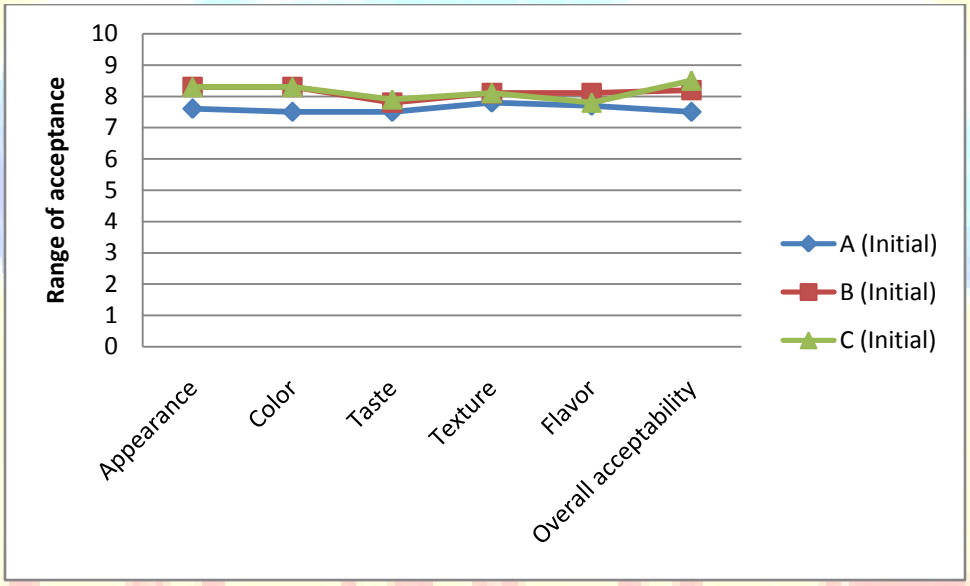

Figure 4. Index of acceptance of chikkis (Initial)

Sensory scores of all desirable attributes decreased slightly at the ambient conditions at the end of 30 days when compared to the initial values but were still acceptable. Slight off taste and rancidity was evident in C*hikki*. (Fig 5)

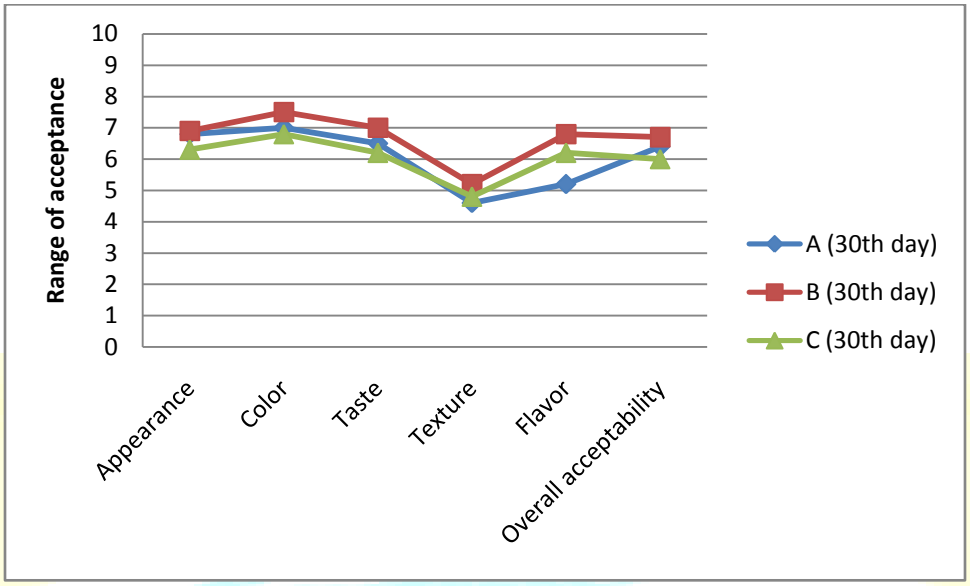

Figure 5. Index of acceptance of chikkis (30th day)

4. Conclusion

Pepita chikki was acceptable and thus could be incorporated in convectional food items to improve the nutritional quality of the product as well as add variety in the diet. Roasting of seeds enhanced its flavor and taste. The nutritional parameters of the pepita chikki with 100% incorporation were superior as compared to the peanut chikki. Fibre (2.5%) and fat (22.5%) significantly increased in the 100% pepita chikki, while protein content (14.2%) was found in the 50% incorporated sample. Work in pursuit of this strategy includes continuing efforts to ensure that dietary diversification, food fortification, supplementation, and public health measures are taken comprehensively to combat many chronic disease complications.

Conflict of interest

No conflict of interested reported

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