

Development and Quality Evaluation of Carrot Pomace and Fenugreek Leaves Incorporated Cookies

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Abstract— The study on incorporation of carrot pomace powder (CPP) and Fenugreek leaves powder (FLP) in cookies was undertaken to upgrade the nutritional quality, assess acceptability and the effect of cookies quality on storage was also studied. Carrot Pomace and fenugreek leaves were incorporated to wheat flour at levels of 91.5:6:2.5, 89:6:5, 86.5:6:7.5, 84:6:10 (wheat: carrot pomace: fenugreek) as T₁, T₂, T₃, T₄. Cookies prepared without carrot pomace and fenugreek was kept as control sample T₀. The cookies were analyzed for their physical properties, chemical composition and sensory properties. With increase in the concentration of CPP and FLP, there was an increase β carotene and Vitamin C content. β carotene and vitamin C content was found highest in the cookies incorporated with (84:6:10). The protein content decreases as the incorporation level of CPP and FLP increases. Cookies with 89:6:5 were found to be most acceptable due to attractive appearance, better taste and flavour. Effect of quality on cookies at storage was observed after every 20 days interval for 60 days. The result found that β carotene, vitamin C and protein content decreases with increase storage time where as moisture content increases with increase storage time.

Key words— Cookies; carrot pomace; fenugreek.

I. INTRODUCTION

Among vegetables, carrot (*Daucus carota L.*) is being considered as good examples of functional foods. They are also most promising foods due to their pleasant flavor, and higher contents of vitamin, mineral, dietary fiber, natural antioxidants, carotenoids and phenolic compounds (Ptitchkina et al., 1998; Alasalvar et al., 2001; Chau et al., 2004; Escalada Pla et al., 2006; Chantaro et al., 2008). As an important vegetable, carrot has usually been used for juice production. Carrot pomace is a by-product obtained during carrot juice processing containing high amount of dietary fiber and even upto 80 % of carotene (Bohm et al., 1999). Dried carrot pomace has a carotene and ascorbic acid in the range of 9.87 to 11.57 mg and 13.53 to 22.95 mg per 100g respectively Navneet Kumar et al (2011) Many studies have also reported that dietary fibers can be produced from fiber-rich agricultural by-products of vegetables (Rehman et al., 2003; Yoon et al., 2005). Thus it can be efficiently utilized for value addition to

deliver nutritious, tasty and convenient products having optimal phytochemical and fibre content (Sharma et al., 2012).

Bakery products are important sources of nutrients viz. carbohydrates, protein, fat etc by incorporating healthy compounds (Ktenioudaki, 2013). Most bakery products can easily be enriched and fortified to meet the specific needs of the target groups and vulnerable sections of the populations who are undernourished. Different plant fibre products are also added to various bakedfood products in order to increase their fibre content (Masoodi et al., 2001).

Fenugreek (*Trigonella foenum*) also called as *methi* in vernacular language. In India a variety of green leafy vegetables are available in plenty during winter season. These are highly seasonal and in the peak season they are sold at throw away prices resulting in heavy losses to the growers. Green leafy vegetables are good sources of ascorbic acid, carotene, Vitamin B-complex, minerals and dietary fibre. Preservation of these vegetables can prevent huge wastage and increase their availability in off season. Dehydration is a simple and economical method of preservation for these leafy vegetables Rajeswari et al (2011).

Fresh fenugreek leaves are widely used in meat preparations and with other vegetables, stir fries, curries and salads. The dried leaves are used in teas, baked into breads, or sprinkled as a garnish on nearly any savory dish. Fresh green have a high content of minerals and necessary supplements for a low amount of calories. They are known to be very high in iron as well as having significant levels of potassium, fiber, and calcium. Few diet experts say that the leaves are nearly healthier than the spinach in providing an excellent dose of vitamin K. Ethan Basch (2003).

The quality of cookies depends on quantity and quality of ingredients. It was found that mixing of two or more ingredients will help to solve the deficiency problem of cereal based as well nutritional value. The present Study focus on as a source of vitamins, minerals by incorporating carrot pomace and fenugreek leaves on cookies to increase the nutritive value of the product.

Cookie formulation and preparation

Table 1. Formulation of cookies

| Ingredients | Samples | | | | |
|------------------|----------------|----------------|----------------|----------------|----------------|
| | T ₀ | T ₁ | T ₂ | T ₃ | T ₄ |
| Flour | 100 g | 91.5g | 89g | 86.5g | 84g |
| Carrot Pomace | Nil | 6g | 6g | 6g | 6g |
| Fenugreek leaves | Nil | 2.5g | 5g | 7g | 10g |
| Vanaspati ghee | 40g | 40g | 40g | 40g | 40g |
| Sugar | 40g | 40g | 40g | 40g | 40g |
| Baking powder | 1.2g | 1.2g | 1.2g | 1.2g | 1.2g |
| Salt | 5g | 5g | 5g | 5g | 5g |

The present study was undertaken with the specific objectives

Objectives

- i. To develop carrot pomace and fenugreek leaves incorporated cookies.
- ii. To study the sensory and Physico-chemical properties of developed cookies.
- iii. To study the textural properties of the developed product

II. MATERIALS AND METHODS

The wheat flour, carrot and fenugreek leaves were procured from local market of Allahabad. Fresh carrots was selected and washed to remove dust and microorganisms. Juice was extracted from the carrots (*Daucus carota*) by using grinder to obtain carrot pomace and dried in a dehydrator till 98% of moisture is loss. Dried carrot pomace was grinded of fine powder and sieved by using 40 mesh sieves and packed in polythene bags. Fresh fenugreek leaves was sundried in a tray drier at 40-60°C for 4-6 hr. Dried fenugreek leaves was then crushed and packed in polythene bags.

Shown in Table 1. The ingredients were weighed using an analytical balance and thoroughly mixed in mixer. Shortening was added and rubbed in until uniform and the dough was kneaded thoroughly. The dough was then rolled and cut with a round cutter with a diameter of 32mm and thickness of 5mm and baked at 180°C for 20 min in an OTG oven. The cookies were cooled on a wire racks and packed in airtight container prior to physical and chemical evaluation.

Chemical analysis

The moisture, protein, β -carotene, vitamin C and sucrose content of the samples were determined by the AOAC method (2000). Moisture was determined based on AOAC Method 934.01: Air oven method (AOAC 2000). Crude protein was determined based on AOAC Method 960.52: Micro-Kjeldahl Method (AOAC, 2000). Ascorbic acid was determined by the procedure proposed by Rangana(1986) using Metaphosphoric acid (HPO_3) solution, 2,6-dichlorophenol-indophenol dye indicator, Standard ascorbic acid solution as reagents. β -carotene content was determined by the procedure proposed by Srivastava (1993) using petroleum ether as blank.

Sensory evaluation

A 14 member panel (6 males, 8 females) comprising of faculty staffs and students from the Food technology Department evaluated the samples using the 9 points hedonic scale Rangana, (2011) method: 9 (excellent) to 1(very poor).

Evaluation of the cookies was conducted after every 20 days interval. Sensory analysis was done on all 4 types of cookies. Each panelists was presented with 4 coded randomized samples. The score was analysed by ANOVA.

III. RESULT AND DISCUSSION

Effect of incorporation of carrot Pomace powder and Fenugreek leaves powder on Physico chemical properties of Cookies was studied and given in Table 2. It was observed that with increasing level of Carrot Pomace powder and Fenugreek Leaves Powder there was decrease in protein level of the cookies where as β -Carotene, Vitamin C and sucrose content increases with increasing level of Carrot pomace powder and Fenugreek leaves Powder on cookies. Difference on moisture content was also found after the incorporation of Carrot Pomace powder and Fenugreek Leaves Powder on Cookies.

Table 2. Effect of incorporation of carrot Pomace powder and Fenugreek leaves powder on Physico-chemical properties of Cookies

| Samples (WF:CPP:FLP) | Moisture (%) | Protein (%) | β -Carotene | Vitamin C | Sucrose |
|----------------------|--------------|-------------|-------------------|-----------|---------|
| 100:0:0 | 2.92 | 8.06 | 0.54 | 0 | 28.42 |
| 91.5:6:2.5 | 3.13 | 7.52 | 1.26 | 2.83 | 28.70 |
| 89:6:5 | 3.13 | 7.46 | 2.16 | 3.80 | 28.69 |
| 86.7:6:7 | 3.13 | 7.33 | 3.06 | 4.72 | 28.68 |
| 84:6:10 | 3.13 | 7.23 | 3.86 | 5.75 | 28.66 |

Table 3. Effect of quality on Carrot pomace and Fenugreek leaves incorporated cookies on storage

| Samples (WF:CPP:FLP) | Moisture (%), 0 day | Moisture (%), 20 days | Moisture (%), 40-60 days |
|----------------------|---------------------|-----------------------|--------------------------|
| T0 (100:0:0) | 2.92 | 2.96 | 2.98 |
| T1 (91.5:6:2.5) | 3.13 | 3.14 | 3.15 |
| T2 (89:6:5) | 3.13 | 3.14 | 3.16 |
| T3 (86.7:6:7) | 3.13 | 3.15 | 3.16 |
| T4 (84:6:10) | 3.13 | 3.14 | 3.16 |

Table 4. Effect of quality on Carrot pomace and Fenugreek leaves incorporated cookies on storage

| Samples (WF:CPP:FLP) | Protein (%), 0-20 days | Protein (%), 20-40 days | Protein (%), 40-60 days |
|-----------------------------|------------------------|-------------------------|-------------------------|
| T ₀ (100:0:0) | 8.06 | 8.04 | 8.03 |
| T ₁ (91.5:6:2.5) | 7.52 | 7.51 | 7.50 |
| T ₂ (89:6:5) | 7.46 | 7.42 | 7.41 |
| T ₃ (86.7:6:7) | 7.33 | 7.30 | 7.29 |
| T ₄ (84:6:10) | 7.23 | 7.20 | 7.18 |

Table 5. Effect of quality on Carrot pomace and Fenugreek leaves incorporated cookies on storage

| Samples (WF:CPP:FLP) | β -Carotene, 0 day | β -Carotene, 20-40 days | β -Carotene, 40-60 days | β -Carotene, 40-60 days |
|-----------------------------|--------------------------|-------------------------------|-------------------------------|-------------------------------|
| T ₀ (100:0:0) | 0.54 | 0.52 | 0.46 | 0.45 |
| T ₁ (91.5:6:2.5) | 1.26 | 1.24 | 1.20 | 1.16 |
| T ₂ (89:6:5) | 2.16 | 2.14 | 2.12 | 2.06 |
| T ₃ (86.7:6:7) | 3.06 | 3.02 | 2.98 | 2.97 |
| T ₄ (84:6:10) | 3.86 | 3.83 | 3.80 | 3.79 |

Table 6. Effect of quality on Carrot pomace and Fenugreek leaves incorporated cookies on storage

| Samples (WF:CPP:FLP) | Vitamin C 0 day | Vitamin C 20-40 days | Vitamin C 40-60 days | Vitamin C 40-60 days |
|-----------------------------|-----------------|----------------------|----------------------|----------------------|
| T ₀ (100:0:0) | - | - | - | - |
| T ₁ (91.5:6:2.5) | 2.83 | 2.80 | 2.76 | 2.71 |
| T ₂ (89:6:5) | 3.80 | 3.76 | 3.73 | 3.70 |
| T ₃ (86.7:6:7) | 4.77 | 4.72 | 4.69 | 4.65 |
| T ₄ (84:6:10) | 5.75 | 5.70 | 5.66 | 5.63 |

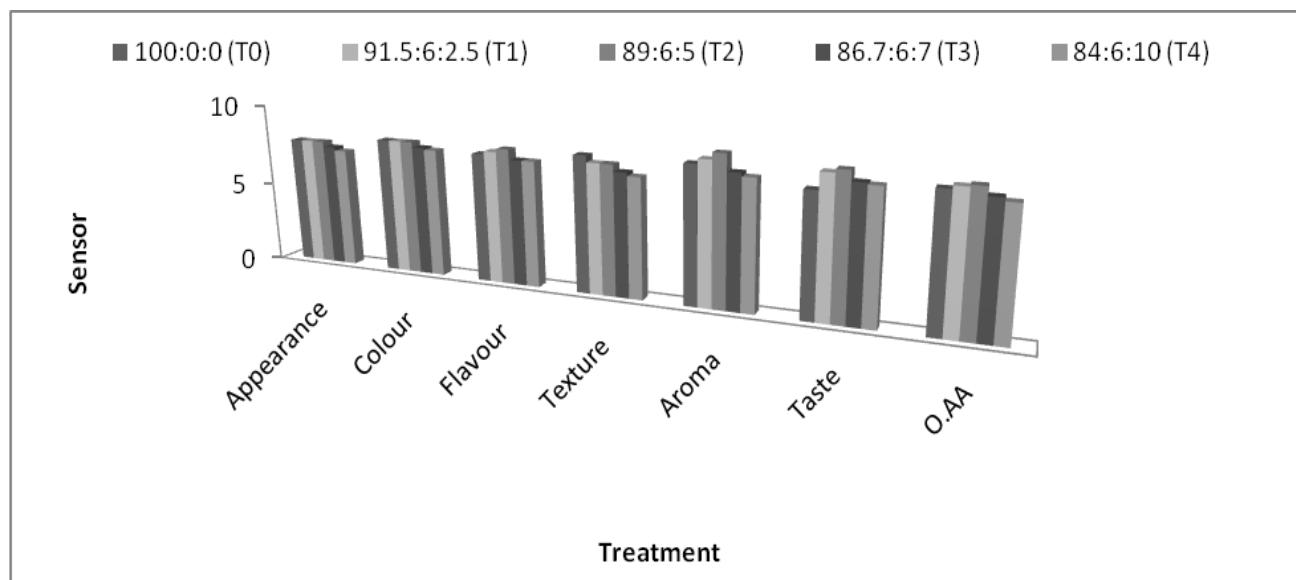


Fig 1: Effect of Carrot Pomace and fenugreek leaves powder on sensory characters of the Cookies

Effect of incorporation of carrot Pomace powder and Fenugreek leaves powder on Physico-chemical properties of Cookies was studied and given in Table 2. It was observed that with increasing level of Carrot Pomace powder and Fenugreek Leaves Powder there was decrease in protein level of the cookies where as β -Carotene, Vitamin C and sucrose content increases with increasing level of Carrot pomace powder and Fenugreek leaves Powder on cookies. Difference on moisture content was also found after the incorporation of Carrot Pomace powder and Fenugreek Leaves Powder on Cookies.

The percent moisture content score for control sample was 2.92 percent on zero day, 2.98 percent after 60 days storage, T₁ scored 3.13 percent on zero day, and 3.15 percent from 40 to 60 days, T₂ scored 3.14 percent on zero to 20 days and 3.16 percent from 40 to 60 days storage, T₃ scored 3.13 percent on zero day, 3.15 percent after 20 days and 3.16 percent from 40 to 60 days storage, T₄ scored 3.13 percent on zero day, 3.14 percent from 20 to 40 days and 3.16 percent after 60 days storage

The protein content of control (T₀) sample was 8.06 on zero to 20 days storage, 8.03 from 40 to 60 days storage. T₁ scored 7.52 from zero to 20 days, 7.51 after 40 days and 7.50 after 60 days storage. T₂ scored 7.46 on zero day, 7.42 after 20 days, 7.41 from 40 to 60 days storage. T₃ Scored 7.33 on zero day, 7.30 after 20 days, 7.29 from 40 to 60 days storage. T₄ scored 7.23 on zero day, 7.20 from 20 to 40 days storage and 7.18 after 60 days.

The β -carotene content of control sample (T₀) was found 0.54 On zero day and 0.45 mg/100g after 60 days storage. experimental sample T₁ was found 1.26 On zero day and after 60 days 1.16 mg/100g. Experimental sample T₂ scored 2.16 On zero day and after 60 days storage it was found 2.06 mg/100g. T₃ scored 3.06 On zero day and after 60 days storage it was found 2.97 mg/100g. T₄ scored 3.86 On zero day and after 60 days storage it was found 3.79 mg/100g.

The vitamin C content of experimental sample T₁ was found 2.83 On zero day, 2.80 after 20 days storage, 2.76 after 40 days storage and after 60 days 2.71 mg/100g. Experimental sample T₂ scored 3.80 On zero day, 3.76 after 20 days storage, 3.73 after 40 days storage and after 60 days storage it was found 3.70 mg/100g. T₃ scored 4.77 On zero day, 4.72 after 20 days storage, 4.69 after 40 days storage and after 60 days storage it was found 4.65 mg/100g. T₄ scored 5.75 On zero day, 5.70 after 20 days storage, 5.66 after 40 days storage and after 60 days storage it was found 5.63 mg/100g.

Effect of Carrot Pomace and fenugreek leaves on sensory characters of the biscuit was evaluated. It was found that incorporated cookies with 89:6:5 scored the highest with 8.20 on a nine point hedonic scale for overall acceptability.

IV. CONCLUSION

Cookies were prepared by incorporating Carrot Pomace and Fenugreek Leaves in different ratios. The result from the sensory analysis of Carrot Pomace and Fenugreek Leaves incorporated Cookies revealed that the Cookies Prepared from the Wheat Flour by incorporating Carrot Pomace and Fenugreek Leaves in the ratio of 89:6:5 score the highest of overall acceptability, followed by 91.5; physico-chemical analysis of Carrot Pomace and Fenugreek Leaves incorporated Cookies found that there was slight increase in moisture content of the Cookies as the storage days increases, it was also observed that there was an increase in β -carotene, Vitamin C due to the incorporation of carrot pomace and fenugreek leaves where as protein content decreases as the incorporation levels of carrot pomace and fenugreek leaves increases. There were not much significant changes in sugar content.

V. ACKNOWLEDGEMENT

All glory to almighty, whose blessing behind this thesis. Praise pride and perfection belong to Almighty, so first of all I

would like to express my deepest sense of gratitude to Almighty God.

I express my sincere thanks to my advisor, Er Dorcus Masih Asst. professor, Department of Food Process Engineering and Technology, Sam Higginbottom institute of Agriculture Technology and Sciences, for her excellence guidance, keen interest, enthusiasm and encouragement during the course of this research studies, without her help and guidance the work would not have been a success. Her kind composure towards me shall forever be in my memories.

I also express my deep gratitude to all my wonderful friends and batch mates who stood by me at the time of help and need.

People who much deserve my thanks are my beloved parents and family who have always been there for me, taking care of me and helped me to achieve. Their pure affection, concern, inspirations and guidance have always been my lifeline and joy of living.

“Trust in the Lord with all your heart and lean not on your own understanding, in all your ways acknowledge him, and he will make your paths straight” Proverbs 3: 5-6

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