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Acceptability evaluation of fibre rich cookies using carrot pomace and lotus stem

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Abstract
Dietary fibre is an essential component of the diet. Several components and ingredients can be used as a source of fibre and this study is aimed at using carrot pomace and lotus stem as a major substitute. Carrot pomace is the by-product obtained during carrot juice extraction process. It is rich in fibre and contains good amounts of carotenoids and phenol compound. Nelumbo Nucifera (Lotus Stem) contains saturated fat, it is moderate in calories and rich in Dietary fibre. It is also rich in calcium, vitamin, and iron. In this study carrot pomace powder and Nelumbo Nucifera powder were obtained by sun drying and were incorporated into cookies in order to improve their fibre content. Cookies were prepared using fibre rich powder, oats, wheat and other ingredients. Three variations of cookies were prepared viz., A, B and C with the incorporation of 10 grams, 15 grams and 20 grams of Fibre Rich Powder. Mean and Standard Deviation were used to statistically analyse the results obtained after sensory evaluation of the prepared cookies. The result showed Sample A i.e. with 10 grams of incorporation as the most acceptable product. The nutritive value of the most acceptable product was calculated.

Keywords: fibre rich powder, cookies, carrot pomace, lotus stem

Introduction
Fibre is the most complex carbohydrate. There are two types of fibre soluble and insoluble both are needed for the proper bowel function. Dietary fibre is the important part of a healthy diet. Pectin and gums are examples of soluble fibres. It lowers the risk of type 2 diabetes and improved insulin sensitivity. It also lowers the basal glucose concentration [1]. The waste products of fruits and vegetables are source of dietary fibre[2]. Dietary fibre is an essential constituent of a healthy diet. It helps in physiological and metabolic function. The curative effects of dietary fibres are in inflammatory bowel disease colon cancer, gall stones, diverticulitis, constipation, ischemic heart disease, hypertension, diabetes mellitus and obesity[3].

Lotus Stem (*Nelumbo Nucifera Garten*): It is also known as Indian Lotus. It is an aquatic herb with stout creeping yellowish white coloured rhizome. The Rhizomes of Nelumbo Nucifera shows ant diabetic and anti-inflammatory effects. Its extracts showed antipyretic effect and leaves and stamens showed antioxidant effect and beside this its seeds showed hepatoprotective and free radicals scavenging effects [4]. Lotus stem contains saturated fat, it is moderate in calories and rich in Dietary fibre. It is a great nutritious vegetable and good for weight loss seekers. It helps in constipation as it is rich in fibre content with complex carbohydrate which helps in lowering the blood glucose level. Calcium and iron content are also high in lotus stem [5].

Carrot Pomace: The By-product obtained after carrot (*Daucus carota*) juice extraction is called as carrot pomace. They are rich in insoluble fiber, and it reduces cholesterol levels. Carrot pomace can be utilized in food such as bread, cake, dressing, and for cookies and drinks [6]. The carotene content of carrot juice is 60-70% while that of carrot pomace is around 80% [7]. It is a very good source of all vitamins, minerals and dietary fiber[8]. The dried powder of carrot pomace contains around 0.87-11.57 mg/100g of carotene and around 13.53- 22.95 mg/100g of Ascorbic acid [9]. On Dry weight basis, the carrot pomace comprises of 28% cellulose, 2.1% pectin, 6.7% hemicellulose, and 17.5% lignin [10]. The fibre content of carrot pomace might vary depending upon the processing method. As per studies, the carrot pomace obtained from carrot peels had a lower ratio between insoluble and soluble fiber [11].

Wheat flour [*Triticum sativum*]: Wheat is consumed globally and is one the major grain [12]. It is a major staple crop of India and is commonly consumed in the form of various products like flour, semolina, cracked wheat etc. It is commonly used in baking because of its unique rheological properties which have a positive effect on baked goods [13]. Wheat is chiefly composed of carbohydrate (78.10%), Proteins (14.70%), Fats (5.1%) and Minerals (2.10%) [14]. It also contains substantial amount of Iron and Zinc, including some vitamins and sugars [15].

Oats [*Avena sativa*]: Oats are one of the functional foods and are highly nutritious. They are very good source of source of different β-glucan, arabinoxylans and cellulose. They also contain relatively high levels of protein, lipids (unsaturated fatty acids), vitamins, antioxidants, phenolic compounds and minerals [16, 17]. The fiber present in oats is rich in β-glucan, which is a potent bioactive compound which has a profound effect on reducing the postprandial glucose and insulin responses, regulating blood lipid levels, glycaemic control and also helps in improving insulin [18-21].

2. Materials and methods
Procurement of Raw Materials: Lotus stem and Carrots were purchased from the local market of Gurgaon. The raw materials were physically examined to ensure they were disease free and then stored properly. To prepare the fibre rich powder, both

carrot and lotus stem were cut into small pieces, sundried for two days and ground into a fine powder using household grinder. Wheat flour, Butter, Baking Powder, Sugar, Oats and Vanilla essence, were purchased from Departmental Store in Amity university Haryana, Gurgaon.

Standardisation of food product: The recipe for cookies was standardised using the following ingredient.

Table 1: Ingredients used for making cookies

S. No	Ingredients	Amount [in grams]
1	Wheat flour	150
2	Oats	50
3	Castor sugar	100
4	Butter	225
6	Vanilla essence	Few Drops
5	FIBRE RICH POWDER (Lotus Stem+ Carrot Pomace	As per the three variations

Development of food product [cookies]: The fibre content of lotus stem and carrot pomace is high therefore it is taken as a substrate for product development. Three Variations of cookies were prepared by incorporating the fibre rich powder. The prepared variations were as follows:

Table 2: The Variations of Cookies prepared

S. No	Variations	Quantity [In Grams]
1	Variation A	10
2	Variation B	15
3	Variation C	20

Sensory evaluation of the product: Then sensory evaluation was being done using 9-point hedonic scale. A panel of 20 semi-trained members were selected to conduct the sensory evaluation. Each panel member was presented with all the 3 variations and was told to evaluate the samples on the basis of various attributes. The cookies were evaluated on the basis of taste, color, texture, firmness, crispness, overall Acceptability. Each individual gave his rating on the basis of his likes & dislikes. After conducting the sensory evaluation, statistical analysis was done.

3. Results and discussion

The samples were analysed statistically using Mean and Standard Deviation, which were calculated on the basis of ratings given by the panel of judges. The samples were analysed on the basis of various organoleptic attributes, which showed slight variations from each other. Table-2 shows the comparison among the various samples of cookies on the basis of their organoleptic quality factors.

Table 3: Mean and Standard Deviation of different samples

Attributes	Sample a [10%]	Sample b [15%]	Sample c [20%]
Taste	8.55 ± 0.75	8.75 ± 0.76	8.5 ± 0.86
Colour	8.95 ± 0.60	9.05 ± 0.99	8.55 ± 0.86
Texture	9.25 ± 0.62	8.9 ± 0.7	8.9 ± 0.62
Firmness	8.7 ± 0.78	8.7 ± 0.95	8.7 ± 0.64
Crispiness	9.1 ± 0.62	8.95 ± 0.08	8.85 ± 0.65
Overall Acceptibility	9.15 ± 0.57	8.85 ± 0.96	8.75 ± 0.76

Sample A

- **Taste-** The sample had mean 8.55±0.75 scores depicting the taste factor. It was felt by the panel of judges that both the cookies had a slightly different taste as it contained some unconventional ingredients like lotus stem and carrot pomace.
- **Color-** The sample had mean 8.95±0.60. The color was dark and light brownish. As color factor is very important because the food is first seen by eyes.
- **Texture-**The sample had mean 9.25±0.62. It was observed to be thick and crumbly in texture.
- **Firmness-** The sample had mean 8.7±0.78. It was little difficult to break so firmness factor was not ideal.
- **Crispness-**The sample had mean 9.1±0.62. It had a crispy texture and rated first in this aspect. It had all the ideal factors which is required in a cookie.
- **Overall acceptability:** The overall acceptability of Sample A was the best. It was the most acceptable product and did not had any unacceptable flavor or taste.

Sample B

- **Taste-** The sample had mean 8.75±0.76. It was felt that the bitterness in the sample was not very pronounced despite the fact that it contained around 15% FRP.
- **Color-** The sample had mean 9.05±0.99. The color of this sample was mostly acceptable. It was attractive and appealing. It was almost similar to any normal cookie.
- **Texture-** The sample had mean 8.9±0.7 It was also observed to be thick and crumbly in texture. It was similar to Sample A in texture.
- **Firmness-** The sample had mean 8.7±0.95. It was easy to break so firmness factor was ideal.
- **Crispness-** The sample had mean 8.95±0.08. This sample rated third in crispiness.
- **Overall acceptability-** The sample had mean 8.85±0.96. This sample scored second in overall acceptability.

Sample C

- **Taste-** The sample has mean 8.5±0.86. Sample C had a bitter aftertaste to it.
- **Color:** The sample had mean 8.55±0.86. The color of this sample was not so good It was dark brown in color. It was not appealing to the eyes.
- **Texture:** The sample had mean 8.9±0.62. It was very thick and it was difficult to break.
- **Firmness:** The sample had mean 8.7±0.64. It was difficult to break and so the firmness factor was not ideal.
- **Crispness:** the sample had mean 8.85±0.65. This sample

rated second in crispiness.

- **Overall acceptability:** The sample had mean 8.75±0.76. This sample scored third in overall acceptability.

It is clearly seen that sample [A] containing 10 gram lotus stem and carrot pomace is rated best followed by sample [B] which is 15 grams. The effect of all these results are calculated on the basis of Mean and Standard Deviation of different samples. Sample A was also found to be significant on other attributes like color, texture, firmness, crispiness.

The cookies prepared by incorporating 15 grams FRP were hard and difficult to break. Their firmness was above average and their texture was also not much appealing. It was also seen that the cookies prepared by incorporating 20 grams FRP were bitter in taste.

Thus, it can be concluded that incorporation of FRP can be done up to a level of 10 grams in the cookie sample, without altering its taste and other organoleptic attributes.

The Nutritive Value of the most acceptable sample i.e. Sample A, prepared by incorporating 10 grams of Fiber Rich Powder, was calculated.

Table 4: Nutritive Value of the prepared cookies

Ingredients	Amount (g)	Energy (Kcal)	Protein (g)	Fat (g)	Carbohydrates (g)	Crude Fiber (g)
Whole Wheat Flour	150	511.5	1.5	2.55	104.1	2.85
Oats	50	187	6.8	3.8	31.4	1.75
Lotus Stem	10	23.4	0.41	0.13	5.14	2.5
Sugar	100	398	0.1	0	99.4	0
Total		1119.9	8.81	6.48	240.04	7.1

4. Conclusion

The main objective behind product development was to develop a product which is nutritionally rich. For product development, a fibre rich powder was prepared using lotus stem and carrot pomace. It may be concluded from the research carried out that the prepared fibre rich powder can be used for the incorporation in cookies up to a level of 10 grams and with this incorporation, the fibre content of the cookies can be enhanced to around 7.1 g/100g.

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