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High fiber biscuits using carrot pomace powder: A nutritional evaluation

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Abstract

Biscuit may be regarded as one of the earliest snack food. Improvement of nutritional quality of biscuit through fortification with fiber rich vegetable and other plant has been the point of attention for food scientists. Carrot Pomace powder is a source of insoluble fiber which is effective in increasing feeling of fullness, stool size, bulk and helps reduce constipation and hemorrhoids and also reduce colon cancer and diverticulitis. Carrot Pomace powder was prepared, analyzed for proximate composition and fiber. Then the sweet biscuit recipe was standardized. The powder was incorporated in biscuit at 10%, 20% and 30% level and finally 20% fiber rich powder incorporated biscuits was highly acceptable. Both types of biscuit were evaluated for various sensory attributes and proximate nutrient analysis and also do statistical analysis between both products. Result showed that mean scores for Carrot Pomace Powder incorporated biscuits were found to be higher than standard biscuits. In all sensory attributes as per z value there was no significant difference present between both products except appearance. Carrot Pomace Powder had attained good scores in all attributes. In case of nutrient analysis as per 't' test ash, crude fiber, protein content were found to be significantly higher in carrot pomace powder biscuits as compared to standard biscuits. Concluding, the fiber rich powders developed was suitable for adding in biscuits and therefore the biscuits developed were rich in fiber. Carrot Pomace powder rich biscuits were highly acceptable as compared to the standard.

Keywords: High fiber biscuits, fiber rich vegetable, snack food

Introduction

Health is not, in the mind of most people; a unitary concept, it is multidimensional, and it is quite possible to have 'Good' health in one respect, but 'Bad' in another (Blaxtex 1990) [1]. In India, the habitual diet pattern is similar although the type and amount of foods included in the diet may depend upon the region and socio-economic level of the individual. Each food in our diets, although contains a wider range of nutrients, serve as a major source of one or two major nutrients. The major cereals and millets consumed in India are rice, wheat (cereals), jawar, bajra, ragi (millets). These grains are the main source of energy in India diets contributing as they do 70-80% of daily energy intake is the highest among the poor income families and it decreases with increasing income. Even with the highest income groups, cereals account for at least 50- 60% of the energy intake.

The globalization scenario in new millennium era has increased the demand for bakery products along with ready to eat (RTE) food due to change in perception, economic consideration westernization, urbanization, busy life, increased women employment and increased per capita income. Baked products, especially biscuits, cookies and crackers, which are most popular and versatile snack foods, are widely consumed to satisfy the occasional 'pangs' of hunger and are an integral part of the society. Biscuits are widely accepted and consumed by almost all profiles of consumers in most countries and therefore offer a valuable supplementation vehicle for nutritional improvement (Arshad *et al.*, 2007) [2].

Dietary importance of Biscuit

Biscuit may be regarded as one of the earliest snack food, their palatability and appeal makes them a ready to eat snack at any time of day in the UK alone consumers. Biscuit can also play a useful role an emergency food in famine or relief feeding. However these products differ from other cereal based products in that they are baked to a moisture content of less than 5%.

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This low moisture content makes them microbiologically safe for protected periods of time. Their low moisture content also affords another advantage – they are a concentrated source of energy.

Role of biscuits in supplementary feeding and emergency feeding

Biscuit are an ideal source of food in those situations:

- They require no further cooking before consumption.
- They are highly palatable and acceptable in most instances.
- They have a long storage life.
- They provide a good source of energy.
- They can be modified to suit specific nutritional needs of any target population.
- They are produced in convenient bite sized form.

Nutrient Concern

These products are rich in starch, fat and energy but depleted of fiber. Various epidemiological studies have shown that diet lacking in fiber may be the cause of various gastrointestinal and cardiovascular disease (Morris *et al* 1977) [3]. Improvement of nutritional quality of biscuit through fortification with fiber rich vegetable and other plant has been the point of attention for food scientists (Prabhakaran and Srinivasan 1971) [4]. Dietary Fiber is the part of food that is not digested by the gut and is considered as unavailable carbohydrate. It is not single entity, but consists of a wide range of complex carbohydrate. The role of indigestible components of plants materials in providing roughage and bulk and in contributing to a healthy condition of the intestine has long been recognized. Cellulose, hemicelluloses, pectin, lignins and other plant substances that are not readily digested perform this role and are collectively referred to as fiber or dietary fiber. All of these substances hold water tend to soften stools and decrease stools transit time through the large intestine. In addition to these benefits of a diet adequate in fiber, research over the past few decades has revealed further physiological action of fiber under specific condition. These include the lowering of plasma cholesterol levels, decreasing the incidence of colon cancer, lowering insulin requirement of diabetics, and others. Further, grinding and other processing can affect the physical properties (e.g; particle size) and, in turn, the water holding capacity of fiber from a particular source. Persons suffering from constipation and/or degenerative disorders like CVD and DM, colon cancer, coronary heart disease, and gastrointestinal disorder can be expected to benefit from high fiber supplements.

The cultivated carrot (*varsativus*) or Gajar are grown all over the world. The colour of the root in the cultivated types varies from white to yellow, orange yellow, light purple, deep red and deep violet. The shape varies from short stumps to tapering cones. The various types of carrots are grown in India. Carrots are rich source of carotene (which is maximum in orange carrots) and thus of vitamins A. Their high sugar content is indicated by their sweetness (Manay *et al* 1998) [5]. Carrot (*Daucus carotal*) is one of the most important root vegetables grown extensively in various countries particularly during winter season. It finds wide application in the day-to-day use of making curries, salads, juices, pickles, preserves, sweet meat and soups (Suman and Krishna kumari 2002) [6].

Carrot is available in plenty only at a particular period of the year. During the peak season, due to abundant supply of carrots the selling price becomes too low leading to heavy losses to the growers. To preserve the carrots for a longer time and to use it during of seasons, dehydration is one of the most

important methods, because it lowers the cost of packaging, storage and transportation by reducing both weight as well as volume of the final product (Sagar *et al* 2005) [7]. Large quantity of carrots are being processed for sweet or utilized for making juice. As a result, huge amount of carrot pomace (CP) is obtained after extraction of juice which is a waste material. CP contains high total solids and may be a good source of fiber and if processed properly, it can be utilized for enriching food products like biscuits (Kumari *et al* 2007) [8]. Blanching and boiling were the major pretreatments employed for the preparation of carrot powder. Analysis revealed significantly high of β - carotene content and total dietary fiber content in carrot powder prepared by boiling method (Singh 2006) [9]. Given the important role of vegetable and cereals, particularly in controlling / preventing chronic degenerative diseases, the present study goes with an innovative idea to develop the sweet biscuit by incorporation of carrot pomace powder biscuits prepared which are not only appetizers but are also a snack item, appropriate for all groups.

Therefore, this study on carrot pomace powder sweet biscuits was carried out. The specific objectives of the research work have been outlined herewith.

Objectives

Objectives can be divided in two types.

Broad objectives: To develop high fiber biscuits by incorporation of carrot pomace powder.

Specific objectives

- To estimate amount of fiber in carrot pomace powder.
- To standardized the sweet biscuit recipe.
- To develop carrot pomace powder incorporated biscuits.
- To estimate the nutritional quality of the product.
- To evaluate the product for sensory attributes.

Methodology

Research Methodology is a very to systematically solve the research problem. We can say that research methodology has many dimensions and research methods do constitute a part of research methodology. Thus, when we talk about research methods but also consider the logic behind the methods we use in the context of our work, so that research results are capably evaluated either by the researcher himself or by others. (Kothari 2001) [10]. In the undertaken study, product development was done with the inkling to problem such as transit time, absorption, constipation, colon cancer, diverticular and gastrointestinal diseases and by using of fiber in product development were reduced to some extent these problem. It was also decided that the product should be such that, it is ---

1. Low in cost
2. Can be processed at home
3. Made up of easily available fiber rich plant
4. Semi or non-perishable
5. Good fiber content

The various aspects of products development have been discussed here:

Selection of fiber rich vegetative food plant

Fiber is widely distributed in plants Carrot Pomace Powder is one of the vegetables respectively with high concentration of fiber to make high fiber product. Carrot was procured from local market.

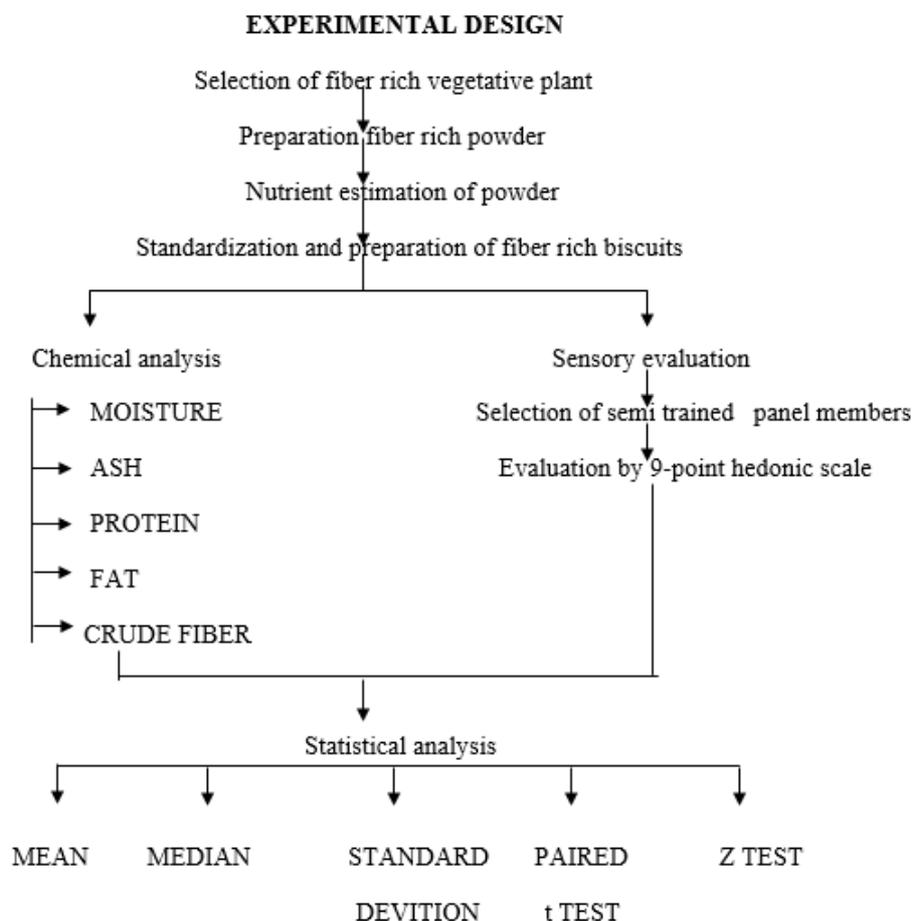
Preparation of fiber rich powder For Carrot Pomace powder

Carrots were sorted, cleaned, washed in tap water and cut into small pieces and pieces were put in juicer and then juice was extracted from carrots to obtain carrot pomace and for drying of carrot pomace at sun drying for 12- 14 hours and then dried sample were ground using a house hold electric grinder to fine

powder and passed through 40 mesh sieve.

Nutrient estimation of the powder

Proximate nutrient via moisture, ash, protein, fat and crude fiber were analyzed in lab using standard method (Sharma 2007) [11]. Detailed descriptions of these methods are included with nutrient analysis detailed of the prepared products.



Standardization and preparation of fiber rich Biscuit Development of product

Refined wheat flour was used for preparation of sweet and sweet 'n' salty biscuits, respectively. Different recipes of making were reviewed in different books, magazines etc. The process for preparation of both types of biscuits was standardized. The proportions of ingredients in standardized formulae of biscuits (Usha Raina and Sushma Kashyap 1986) [12]. The above sweet and sweet 'n' salty biscuits were evaluated informally in terms of overall acceptability. Sweet biscuits were selected as it was better in taste and liked (fig.1). Further again three variation of each biscuits incorporated with carrot pomace powder respectively was developed in which the basic recipe was same but the proportion of carrot pomace powder was different viz. 10%,20% & 30% (6 gm, 12 gm,18 gm).

Again, these three different fiber rich plant concentrate of sweet biscuits were informally evaluated in terms of overall acceptability. The latter was liked by all but the 20% (12gm) of carrot pomace powder was selected as it was most liked, it

was the obvious choice for standardized (fig.2)

Standardization of Biscuit

The standard as well as 12gm carrot pomace powder add in biscuit (table no.1) was standardized for matching carbohydrate and fiber content (approximately, carrot pomace biscuit carbohydrate 39.4, fiber 2.586) followed by ingredients, their weights and measure dough consistency (proportion of flour to water), dough keeping time, biscuit shape and size plus the baking temperature and time. Repeat batches of standard and carrot pomace powder rich biscuits were produced till consistent trials were attained. Evaluation of the biscuits after the standardization was done by a semi trained panel.

Sensory Evaluation of Biscuits

The biscuits were evaluated for sensory attributes by panel of 8 semi-trained judges using 9-point hedonic scale. The biscuits were evaluated for colour, appearance, aroma, taste and mouthfeel by the judges and mean of the scores for all the sensory characteristics was expressed as overall acceptability.

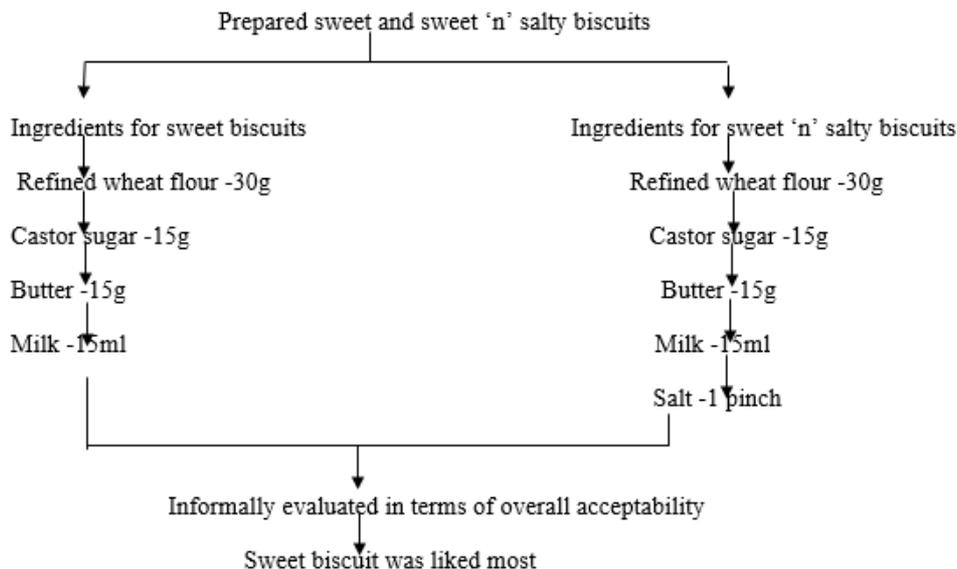


Fig 1: Flow Chart of Food Product Development

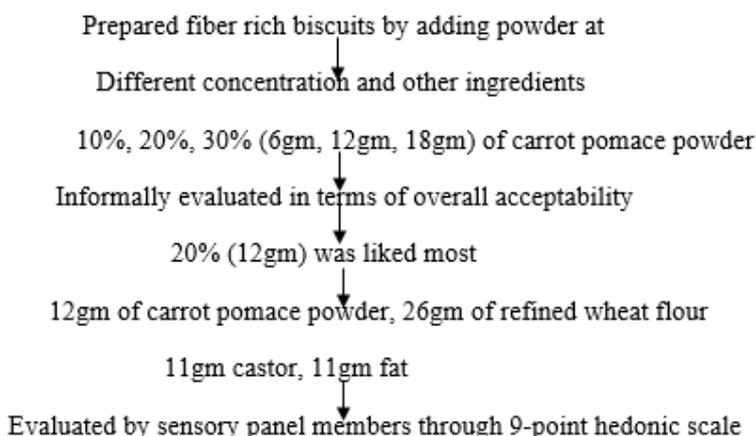


Fig 2: Flow Chart of Food Product Development

Table 1: Nutrient and Composition Of Biscuits

Carrot Pomace Biscuit				Standard Biscuit			
Ingredient	Amount (g)	CHO (g)	Fiber (g)	Ingredient	Amount (g)	CHO(g)	Fiber (g)
Refined wheat flour	26	19.21	0.07	Refined wheat flour	30	22.17	0.09
Castor sugar	11	10.93	----	Castor sugar	15	14.19	----
Butter	11	----	----	Butter	15	----	----
Milk	15	0.66	----	Milk	15	0.66	----
Carrot Pomace powder	12	8.59	2.50	-----			
Total	----	39.4	2.58	Total	----	37.74	0.09

Statistical analysis

Statistics is concerned with scientific methods for collecting, organizing, summarizing, presenting and analyzing data as well as with drawing valid conclusions and making reasonable decisions on the basis of such analysis. (Spiegel and Stephens 2001) [13]. The data was analyzed for mean, median, standard deviation and z test for accurate analysis.

Result and discussion

Nutrient content of fiber rich powder

The Carrot Pomace powder contained 5.9% moisture, 4.1% ash, 0.5%protein, 0.8% fat and 22.6% crude fiber (table 2). The results indicated that carrot pomace powder was a good source of crude fiber.

Table 2: Nutrient content of carrot pomace powder

Sr. No.	Nutrient	Mean ± S.D.	Median
1.	Moisture	5.9 ± 1.0	5.2
2.	Ash	4.1 ± 0.3	4.5
3.	Protein	0.5± 0.03	0.4
4.	Fat	0.8 ± 0.01	0.7
5.	Crude fiber	22.6 ± 1.7	20.3

Sensory attributes of the products

Sensory evaluation consists of judging the quality of food by a panel of judges. In this phase of study, sensory evaluation was carried out using 9 point hedonic scale. Sensory evaluation was designed to reflect common preference to maintain the quality of food at given standard for the

assessment of process variation, cost reduction, product improvement, new market development and market analysis. Carrot Pomace powder rich biscuits colour mean score was 8.37, appearance mean score 8.74, aroma mean score 8.14, mouthfeel mean score 8.2, taste mean score 8.4 and over all

acceptability mean score 8.45. From the mean score carrot pomace powder rich biscuits was highly acceptable comparative standard biscuit (table3). As per z test there was no significance difference between both products (table 4).

Table 3: Mean Hedonic Score of the Product

S. No.	Attributes	Mean * ± S.D.	Median	Mean * ± S.D.	Median
1.	Colour	8.22 ± 0.74	8	8.37 ± 0.76	9
2.	Appearance	8.05 ± 0.75	8	8.74 ± 0.67	9
3.	Aroma	8.08 ± 0.90	8	8.14 ± 1.04	8
4.	Mouthfeel	8.2 ± 1.0	8	8.2 ± 0.86	8
5.	Taste	8.2 ± 0.82	9	8.4 ± 0.71	9
6.	Over all acceptability	8.25 ± 0.88	8	8.45 ± 0.80	9

Standard biscuits Carrot Pomace biscuits

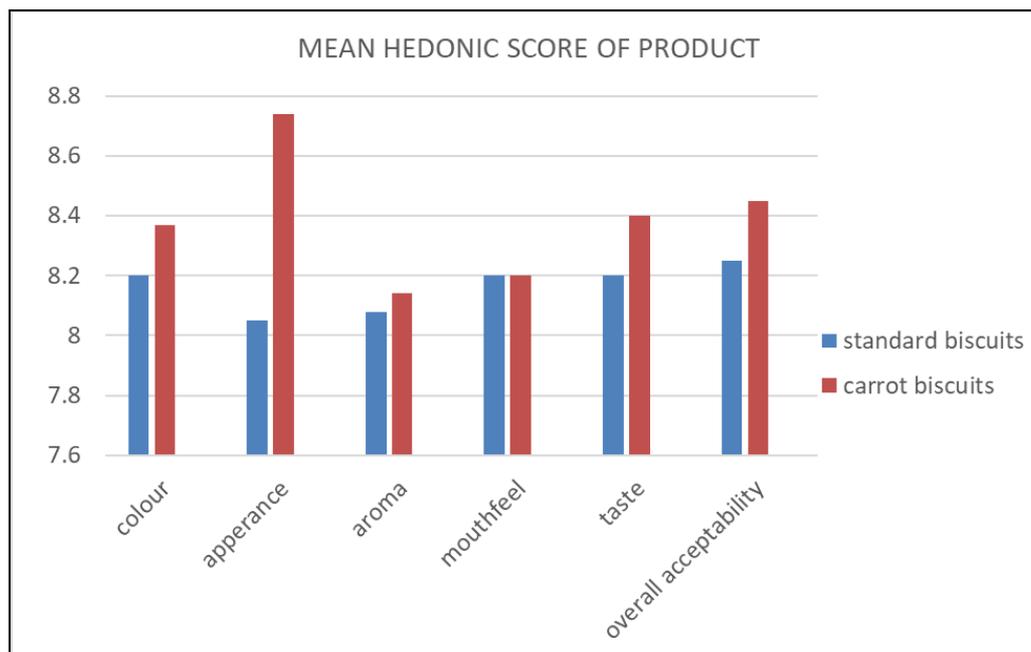


Fig 1: Mean Hedonic Score of Product

Table 4: Z test

Sr. No.	Attributes	Standard vs. carrot pomace biscuits
1.	Colour	0.83 ^{NS}
2.	Appearance	4.0*
3.	Aroma	0.26 ^{NS}
4.	Mouthfeel	0 ^{NS}
5.	Taste	1.11 ^{NS}
6.	Over all acceptability	0.85 ^{NS}

Nutrient content of Biscuit-

Biscuit were analyzed for moisture, ash, crude fiber, protein and fat. The result has been discussed. Carrot pomace powder rich biscuit contained 0.8% moisture, 0.3% ash, 10.7% protein, 23.2% fat and 3.8% crude fiber (table 5). As per Carrot pomace biscuits all nutrient was high comparatively standard biscuit except fat and moisture. According to ‘t’

value for standard biscuit and carrot pomace biscuit estimation of moisture content showed no significant difference. ‘t’ value for ash, crude fiber and protein estimation were found significant difference between both products. In the fat content estimation showed that there was no significant difference between both products (table 6).

Table 5: Nutrient content of biscuits

Standard Biscuits				Carrot Pomace Biscuits			
Sr.no.	Nutrient	Mean ± S.D.	Median	Sr.no.	Nutrient	Mean ± S.D.	Median
1.	Moisture	1.9 ± 0.4	2.1	1.	Moisture	0.8 ± 0.6	0.3
2.	Ash	1.9 ± 0.4	1.0	2.	Ash	0.3 ± 0.4	1.0
3.	Protein	8.9 ± 0.7	8.4	3.	Protein	10.7 ± 0.7	9.8
4.	Fat	24.2 ± 0.2	24.6	4.	Fat	23.2 ± 0.2	22.4
5.	Crude fiber	0.5 ± 0.09	0.1	5.	Crude fiber	3.8 ± 0.4	4.02

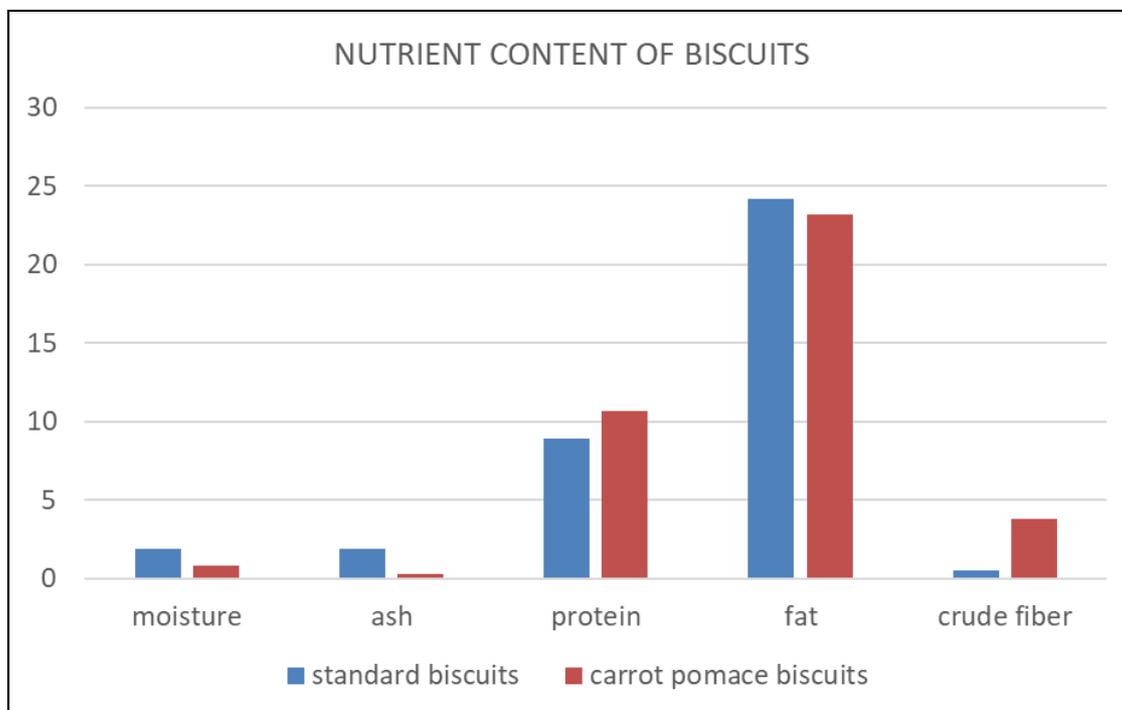


Fig 2: Nutrient Content of Biscuits

Table 6: 't' Test

Sr.no.	Nutrient	Standard vs. carrot pomace biscuits
1.	Moisture	1.93 ^{NS}
2.	Ash	2.38*
3.	Crude fiber	3.22*
4.	Fat	1.69 ^{NS}
5.	Protein	2.55*

Conclusion

It was concluded from results that carrot pomace powder which was a waste byproduct was processed to prepare carrot pomace powder which is a good source of fiber and it was incorporated up to 20% for preparation of high fiber sweet biscuits without significantly affecting sensory characteristics. This study shows that high fiber value added biscuits can be prepared with the use of carrot pomace powder.

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