

Nutritional Evaluation and Utilization of Pea Pod Powder for Preparation of Jaggery Biscuits

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Abstract

Food industry generates massive waste, which is a concern not only to environment but also loss of valuable biomass. The foremost benefit of industrial waste is that it is available at zero cost and in immense quantities. Pea pods which otherwise are discarded in bins or at finest used for animal feed is exploited for its nutritional benefits in present study. Pea powder formulated was found rich in crude protein, fibre and ash with exceptional good amounts of iron. Composition of powder was 5% ash, 0.43% fat, 14.88% protein, 77.86% crude fibre, 61.43% total carbohydrates and 309.11Kcal energy content. The concept of healthy eating is addressed in current analysis whereby, value added biscuits are devised by substituting pea pod powder in place of refined wheat flour at 10%, 20% and 30% level. Sensory evaluation conducted using a 9-point hedonic scale revealed 20% level as optimum level of incorporation. Water activity decreased slightly on storage. The biscuits are advantageous for people suffering from lifestyle diseases as these contain high amount of fibre and minerals. In this way peels can also be utilized for human consumption otherwise this important source of nutrients goes wasted.

Research Highlights

- Food industry waste, pea pods are transformed to powder.
- Pea pod fibre thus, obtained has high protein, fibre and minerals especially iron
- Value added biscuits are prepared by substituting wheat flour with pea pod powder at various concentrations
- Sensory and physical evaluation of biscuits revealed high acceptability

Keywords: Pea pod; Nutritional evaluation; Sensory evaluation; Biscuits; Jaggery

Introduction

Outsized amount of waste either solid or liquid in nature is being produced by food industry nowadays on regular basis. The unwanted artifacts pose not merely disposable concerns but furthermore massive loss of nutrients. Many studies indicate food-processing waste might have potential for reutilizing into raw useful products or by-products of higher value [1]. Fruit and vegetable waste has been established to stand good source of numerous polyphenols [2-7]. Vegetable waste yet remains unexploited source of phytonutrients in comparison to fruit waste. Carrot peels [8], outer leaves of cabbage have been used to produce antioxidant rich dietary fibre powder [9]. Arora and Camire [10] reported potato peels as dietary fibre supplement in muffins and cookies. Cauliflower by-products incorporation increased not only dietary fibre but also protein content in ready-to-eat snacks [11]. A lot of work has been done on antioxidant properties of tomato peel [12-14]. There are many other vegetable waste sources, which are yet to be discovered and utilized like pea pod. India is the second largest producer of green peas next to China [15]. Established upon supposition, 30% of the total pea weight is owing to pea pods (fresh weight basis). Thus based on India's yearly production of pea, more than 1 million ton of pea pod waste is generated annually alone in India, of which sizeable extent is discarded as waste [16]. Use of pea pod waste for cellulolytic enzyme production, feed for goat bucks [17], ruminants [18-21] has been reported. Literature reveals pea pods have high protein and dietary fibre [22].

Amid gigantic changes in working environments and economics, there is an equal comparable change in lifestyle. The demand for processed food has sky rocketed. Baked products have made their

space in Indian kitchen since time immemorial. Baked foods especially biscuits are low in cost; can be stored for long time at room temperature. Consumer today wants to consume food, which can fit into their concept of holistic and healthy eating. Manufacturers and researchers around the globe are working to replace unhealthy ingredients and supplement them with therapeutic value [23-28]. Aim of the present work was to develop pea pod powder and showcase it as a potential source of nutrient. Pea pod powder produced thus is used as a prospective dietary fiber supplement in biscuits with sugar replaced by jaggery to further enhance the nutritive value.

Materials and Methods

Commercial refined wheat flour (brand Rajdhani Flour Mill Ltd) was purchased from local supermarket (Sanjay Store, Possangipur, New Delhi, India). Peas were purchased from local vegetable market (Azadpur mandi, New Delhi, India). Seeds were removed from pea pods. Pea pods were subjected to standard washing using Veg Fru Wash. Cleaned pods were dried in tray drier (Assembled at Agro Life Science Solutions Pvt Ltd., New Delhi, India) at 65°C for 5 hrs [20].

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Preparation of pea pod powder

Pods after drying were subjected to grinding (Model MXAC555, Panasonic India) to obtain fine pea pod powder.

Composition of biscuit flour

Blends of pea pod powder with refined wheat flours were prepared by combinations of 90:10, 90:20 and 90:30 of refined wheat flour with pea pod powder.

Preparation of biscuits

Biscuits were prepared from composite flours of wheat flour, pea pod powder and other ingredients such as shortenings, jaggery, salt and sodium bicarbonate (Table 1). Ingredients were weighed using an electric balance (Model ATX series, Shimadzu Corporation, Tokyo). Pea pod powder was incorporated at 10, 20 and 30% level in the standardized formula of biscuits by substituting refined flour. Dough was prepared and rolled. Square pieces of 0.6 cm thickness were cut and baked at 180°C for 15 min.

Chemical analysis of pea pod powder

Pea pod powder was analyzed for moisture, ash, protein and fat, according to the standard AACC methods [19]. Water activity was calculated using water activity meter (Model 4TE, Aqua Lab, Pullman, WA, USA).

Evaluation of biscuits

Physical properties of biscuits such as weight and thickness were determined by AACC, 1955. The biscuits were evaluated for sensory attributes by panel of 10 semi-trained judges using 9-point hedonic scale. The biscuits were evaluated for color, appearance, aroma, texture and taste by the judges and mean of the scores for all the sensory characteristic was expressed as overall acceptability.

Results and Discussion

All formulations showed good dough handling characteristics, sheeting and cutting. Average weight and thickness of standard biscuit was 10 gram and 0.6cm respectively. Figures 1-4 shows biscuits prepared from composite flours.

Chemical analysis of pea pod powder

Nutritional composition of pea pod powder is given in Table 2. Data presented shows that main component was carbohydrate. Crude protein content of pea pod powder was estimated to be 14.88%, which was found to be higher than reported by Aparicio et al. [22]. The results also showed that pea pod powder is rich in ash content which is 5% ash and higher than other vegetable waste like tomato peel fibre [12]. Our studies indicate low amount of crude fat making them healthier. Literature reports high amount of calcium in pea pods in comparison to by-products broad bean pod and okara [22]. The results indicate that pea pod powder is a good source of crude fibre with 7.86 % content. The calcium, iron and zinc content computed is 0.83 %, 0.83 % and

Ingredients	Quantity (%)
Composite flour	100
Jaggery	50
Fat	50
Baking powder	0.01
Milk	0.2

Table 1: Ingredients used in biscuit preparation.



Figure 1: Standard biscuit (0%Peapod powder).



Figure 2: 10% Peapod powder Biscuits.



Figure 3: 20% Peapod powder Biscuits.

0.56%, respectively which is in agreement with previous findings by Aparicio et al. [22]. Analysis confirms that pea pod powder has very good amount of minerals particularly iron.

Physical evaluation of biscuits

Biscuits prepared using 0%, 10%, 20% and 30% of pea peapod powder were evaluated for various physical and sensory characteristics. The thickness was slightly affected with increase in level of pea pod powder (Table 3). The thickness of biscuits incorporated with pea pod

powder decreased from standard but highest thickness was observed with 20% pea pod powder. Further decrease observed at 30% level might be due to dilution of gluten, also reported by Ajila et al. [29].

Sensory evaluation of biscuits

Sensory evaluation of biscuits prepared by substituting wheat flour with pea pod powder is presented in Table 4. The overall acceptability declined at 30% level. No significant difference was observed in color up till 20% level of addition. The taste and flavor of biscuits improved on incorporation of pea pod powder at 20%. Considering the parameters: color, appearance, aroma, texture and taste, it could be deduced that 20% level of incorporation of pea pod powder was ideal.

Influence of pea pod powder on water activity of biscuits

At 30°C, water activity of standard biscuits was 0.35, 10% pea pod biscuits had 0.38, 20% pea pod biscuits contained 0.42 and 30% biscuits had 0.46 water activity (Figure 5). This showed increased value of water activity on increasing the percentage of pea pod powder. This also showed that product can be stored for long time at room temperature as it has low water activity.

Conclusions

This study illustrates the feasibility of producing powder rich in protein, minerals and dietary fibre from industry waste, pea pod. Pea

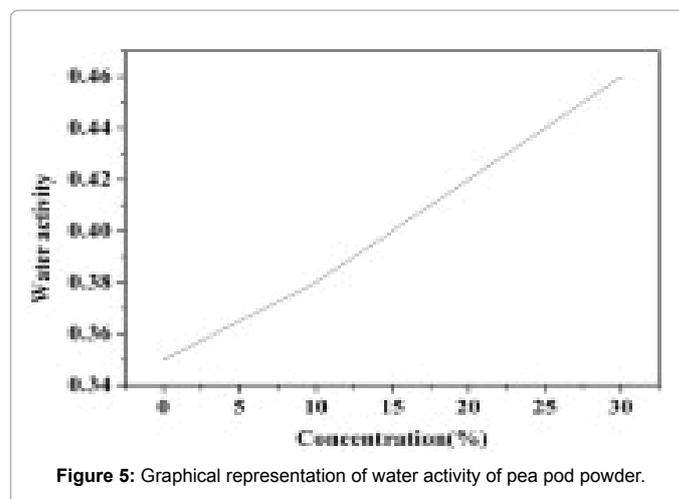


Figure 5: Graphical representation of water activity of pea pod powder.

Pea pod powder level (%)	Color	Appearance	Aroma	Texture	Taste	Overall acceptability
0	7.1 ± 0.8	7 ± 0.66	6.2 ± 0.63	8 ± 0.66	7.2 ± 0.63	7 ± 0.66
10	7.5 ± 1.08	7.6 ± 0.84	6.1 ± 0.73	7.2 ± 0.78	7.0 ± 0.66	7 ± 0.66
20	6.9 ± 0.73	8.1 ± 0.73	7.2 ± 0.63	7.0 ± 0.66	7.9 ± 0.56	7.9 ± 0.56
30	6.3 ± 0.48	6 ± 0.66	6.8 ± 0.63	6.1 ± 0.56	7.1 ± 0.56	6.1 ± 0.73

Table 4: Sensory characteristics of pea pod powder biscuits.

pod powder can be exploited to enhance the nutritive value of biscuits. Biscuits containing 20% pea pod powder were highly acceptable. Thus, it can be concluded that pea pods which otherwise are discarded in bins or used in animal feed can be used for value addition in various food.

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Figure 4: 30% Peapod powder Biscuits.

Nutrient	Content (g/100g dry matter)
Protein	14.88 ± 0.44
Fat	0.43 ± 0.03
Ash	5 ± 0.50
Total carbohydrates	61.43 ± 0.03
Crude fibre	7.86 ± 1.0
Calcium	0.83 ± 0.03
Iron	0.83 ± 0.08
Zinc	0.56 ± 0.06
Energy	309.1kcal

Table 2: Nutritional composition (g/100g) of pea pod powder.

Pea pod powder level (%)	Weight (gm)	Thickness (cm)
0 (standard)	10 ± 1.00	0.6 ± 0.2
10	9.66 ± 0.67	0.55 ± 0.09
20	11.06 ± 0.45	0.62 ± 0.05
30	10.73 ± 0.55	0.61 ± 0.04

Table 3: Physical characteristics of biscuits.

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