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CONTENTS

Effect of partial substitution of potato by fresh pea shells (*Pisum sativum*) in *tikki* development and their quality evaluation

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ABSTRACT: Today's changing lifestyles and demand for junk or ready-to-eat meals lead to micronutrient deficiency,which affects cognitive and physical development. To minimize micronutrient deficiency, the substitution of meals with plant-based by-products can be beneficial. In the present investigation, partial substitution of potato developed four *tikki* formulations with fresh pea shells to evaluate the effect on the sensory and nutritional properties of the product.The fibrous coat of pea pods turned into eliminated and the digestive layer was further used for adding *tikki* at 10, 20 and 30% levels.The study result showed that the sensorial properties of *tikki* were influenced by the addition of fresh pea shells and increasing the nutritional quality. The nutritional parameters showed a significant ($p<0.05$) increase in protein (3.57 to 4.14 gm/100gm), crude fiber (0.88 to 1.47 gm/100gm), dietary fiber (1.56 to 2.35 gm/100gm) content of value-added *tikki* and a significant increased in mineral content like magnesium (46.61 to 85.93 mg/100gm) and calcium (23.33 to 54.52 mg/100gm), which increased twice compared to control. From the present investigation, we concluded that value-added *tikki* with the digestive fibrous coat of pea shells provides an appreciable amount of nutrients and an improved nutritional profile.

Key words: Fresh pea shells, nutritional, sensory, significant,*tikki*, value-added

Pea (*Pisum Sativum*) is the maximum essential vegetation of the temperate climatic regions, the cause of both human intake and animal feeding (Mmihailovic *et al.,* 2005). In India, approximately 1 million tons of pea peel waste is generated yearly from the total pea production and a huge portion is discarded as waste (Upasana and Vinay, 2018). Due to the seasonal production of peas, their limited supply in some areas creates the need for their preservation by drying (Garg, 2014). It's creating a huge amount of pea waste. The waste generated from vegetables, fruits, or by-products is a good source of bioactive compounds, which can develop functional and supplemental foods by industries (Sagar, 2018) due to their nutritional and techno-functional properties (Aparicio *et al.,*2010).The vegetables and micro green rich in vitamins, phyto-chemicals, antioxidant and they are effective in regulating plasma lipoprotein, cholesterol metabolism, and chronic diseases (Zhang *et al.,* 2021). Value-added foods alternative way to consume plant components (Carle *et al.,* 2001) in a diet that may have helped to prevent health diseases like colon irritation, degenerative diseases, and constipation and improve nutritional status (Kiran and Neetu, 2017, Sahin *et al.,* 2008).

Now a day's industrial by-products have gained attention in recent advancements and research due to their low cost and protection of the environment by reduction of bio-waste (Gowe, 2015). Peapod storage is difficult due to its high moisture content (Garg, 2015) and they contain a good source of fiber and other nutrients. However, changing the amount of ingredients to decrease calorie content can compromise balance, mouth feel, flavor, and presentation. Snack meals are popular and well used around the world. Allo *tikki* is a famous street food in India and varies from state to state, loved by millions of people. Today's individuals pulled more towards quick, fast, or processed foods, not due to their great taste, because it is cheap and easy to eat. The taste of food or products is decided by destiny and persistent buying of the same food. The frying medium is the mystery behind the quality of fried products in termsof tasteand texture. In the present investigation, we attempted to get nutritionally *tikki* by the value addition of fresh pea shells and found

various ways to make them nutritious by loading ingredients in the traditional recipes. Previous studies have revealed that the pea peel is an abundant source of nutrients (Beniwal *et al.,* 2022) and that discarded pea pods used as a source of nutrients in biscuits, rusks, cake, breads and instant soup preparation as powder form. However, the utilization of fresh pea peels in product development has not been investigated yet. The nutritional quality of the fresh pea shells was also evaluated to exploit their potentialities for application in food industries.The present work aimedto develop fresh pea shells by separating fibrous layer and used as a food ingredients in *tikki* preparation and find out the effect of their sensorial and nutritional attributes.

MATERIALS AND METHODS

Sample collection and preparation (Figure 1)

Fresh peapods obtained from the local vegetable market in Hisar, Haryana, in single lots. Peapods were shelled, washed, dipped in sodiummeta bisulphite 0.2% solution and then dipped in hot water at 60^0C for 10 minutes. The pea shells are spread over filter paper to drain water. The inner fibrous layer was separated manually. The edible portion is chopped finely and blended with potatoes in different ratios to develop *tikki*.

Formulation of *tikki*

The fresh pea shells were incorporated into the potato *tikki* at levels of 10, 20, and 30 % by weight. The ingredients e.g. bread crumbs (5 gm),oil (10 ml), green chilli (1 small), salt ($^1/_4{}^{th}$), chat masala ($^1/_5{}^{th}$), amchur powder ($^1/_5{}^{th}$) tea spoon, and red chilli powder (1 pinch) were added for enhancing taste or cooking.

***Tikki* development**

All the ingredients were added, mixed well with the mashed potatoes and chopped fresh pea shells. After that, prepare the small-sized balls with the mixture and flatten them. Then apply breadcrumbs to both sides of the *tikki* and heat the non-stick tavafor shallow frying (2teaspoons oil). The *tikki* was putover oil, cooked till it turned golden brown in colour on both sides, and transferred to absorbent paper to remove extra oil (Plate 1).

Weight

The weight of a raw, cooked, or dried *tikki* examined by a weighing balance (Table Top ASWS-10 Single Pan Balance). Before weighing the food, firstly calibration and switched on before (5-10 minutes) weighing for stability (room temp., electricity voltage etc.). Calculating the weighing by difference method formula.

Mass of sample transferred (calculated by difference) = Initial reading (gm)–Final reading (gm)

Sensory evaluation

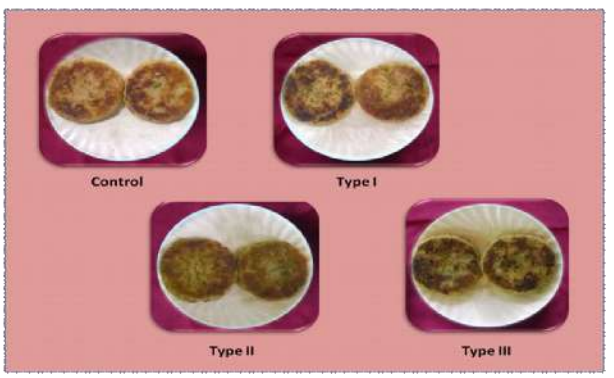
Fifteen semi-trained panel members from the department of Food and Nutrition, I.C. College of Home Science, CCS HAU, Hisar conducted sensory evaluation by adopting 9-pointhedonic scales(Peryam and Pilgrim, 1957). Sensory evaluation was done at room temperature.

Nutritional evaluation

The proximate composition of samples is examined by the standard methods (AOAC, 2000). Moisture was measured by drying in a hot air oven at 100^0C for 6 hours.Five-gram sample were taken in pre weighted petri dish and kept in hot air oven. The loss in moisture content after drying estimated.

$$\text{Moisture (\%)} = \frac{W_2\text{-}W_3}{W_2\text{-}W_1} \text{x } 100$$

Where, $W_1$is the weight (gm) of the empty petri dish, W_2 is the weight of the petri dish+weight of the sample before drying (gm) and W_3 is the weight of the petri dish+weight of dried sample (gm).



Crude protein content was determined by the Micro Kjeldahl method (AOAC, 2000) using the Automatic KEL PLUS CLASSIC–DX apparatus. The sample (0.2gm) was digested with sulphuric acid (10ml) and catalysts mixture (1gm) till the solution became colourless. After that the samples were distilled in distillation unit with 40% NaOH, 4% boric acid and mix indicator (few drops). The distilled sample was then titrated against HCl (0.1N) till colour changed slightly pinkish.

$$\text{Nitrogen (\%)} = \frac{(\text{sample titrate - blank titrate}) \times \text{normality of HCl} \times 14}{\text{Sample weight (gm)} \times 1000} \times 100$$

Crude protein= 6.25 (conversion factor)× Nitrogen %

Crude fat was determined by AOAC (2000) using a standard method, using the auto solvent (petroleum ether) in the extraction apparatus (Automatic SOCS plus). Two gram of sample were taken in thimbles and extracted for 1:30 hours with petroleum ether in apparatus to pre weighted beakers. The beakers were removed, dried overnight at 100^0C in hot air oven and then cooled in desiccator for constant weight. The difference between two weights gave the amount of ether extract in sample.

$$\text{Fat (\%)} = \frac{W_2 - W_1}{W} \times 100$$

Where, W is the weight (gm) of sample weight, W_1 is the weight (gm) of empty beaker, and W_2 is the weight (gm) of beaker with fat.

Ash contentis evaluated by employing the standard AOAC (2000) method by ashing in an electric muffle furnace at 550-650^0C for 6 hours until constant weight.Two-gram sample was kept in pre weighed crucible for charring and kept the sample in muffle furnace. The crucible was removed, cooled in desiccator and weighing.

$$\text{Ash (\%)} = \frac{W_2 - W_3}{W_2 - W_1} \times 100$$

W_1 is the weight of empty silica crucible (gm), W_2 is the weight of sample+weight of crucible before ashing (gm), and W_3 is the weight of sample+weight of crucible after ashing (gm).

The crude fiber contentwas detected by the AOAC (2000) method by digesting a defatted sample (petroleum ether) with 1.25% H_2SO_4 owed by 1.25% NaOH under bulb condensers for 30 minutes of boiling. The samplewas washed with distilled water (2 times), alcohol (2 times), and acetone (3 times). After that, the sample was dried at 100^0C and ash for 1 hour (550^0C) in the furnace (muffle). The fiber content was measured by the weight of the left after ignition and expressed in term of the weight of the sample before ignition.

$$\text{Calculation: (\%) Crude Fiber} = \frac{W_2 - W_3}{W_1} \times 100$$

W_1 is the weight of sample (gm), W_2 weight of the insoluble matter (crucible weight+insoluble matter–crucible weight) (gm), and W_3 is the weight of ash (crucible+ash–wt. of crucible) (gm).

The **total carbohydrate** (%) content was analyzed by the difference method (Das *et al.,* 2015).
Calculation=(%) Total carbohydrate= 100 – [(%) moisture + (%) crude protein + (%) crude fat + (%) crude fiber + (%) total ash]

Energy (caloric value) is estimated by the calculation method (James, 1990) of the sum of protein, carbohydrate, and fat multiplied by factors.
Calculation= Energy (kcal/g) Protein (%) × 4 + carbohydrate (%) × 4 + fat (%) × 9

Dietary fiber (total, insoluble, and soluble) in samples was determined by Furda (1981). The defatted sample was digested in (0.005N) HCl, boiled for 20 minutes,added EDTA, and pH calibration (5.0 to 6.5). The sample was extracted at 60^0C for 40 minutes (pH 6.0 to 6.5), the suspension cooled (20 to 30^0C), and the 10 mg enzymes (bacterial protease and alpha-amylase) added. The suspension was filtered through a crucible (coarse tared gooch) and washed the sample with distilled water, alcohol, and acetone before drying (70^0C) for 24 hours.The soluble residue was acidified with HCl at pH 2-3, added ethanol (4 volumes) and left the suspension for 1 hour. After that, repeat the washing steps (insoluble residue) for soluble residue.

Calculation: TDF= IDF+SDF
TDF=Total dietary fiber, IDF=Insoluble dietary fiber, SDF=Soluble dietary fiber

Total Minerals investigated by Lindsey and Norwell (1969) method by atomic absorption spectrophotometer 2380, (PERKIN-ELMER, USA). Digested the sample with adiacid mixture (25-30ml) of $HClO_4$:HNO_3: 1:5 (v/v) and left overnight. The samples were heated on a hot plate until clear, visualized white precipitates were on the surface of a conical flask. The Whatman (42) filter is used for crystal filtration using distilled water and prepared at the volume (50 ml) with double distilled water for estimation of total mineral content in samples. Now take the readings on the spectrophotometer, flame photometer, and titration.

$$\text{Calculation} = \text{Minerals (mg/100g)} = \frac{\text{Reading (concentration } \mu\text{/ml)} \times \text{volume made}}{\text{Sample weight (gm)} \times 1000} \times 100$$

Statistical analysis

The obtained data was processed for analysis of variance (ANOVA) using a statistical method (Sheoran and Pannu, 1999) to work out the significance ($p<0.05$) of the test, standard error of mean, and the critical differences between treatments. Three replicates were used for experiments. A completely randomized design was adopted to study the different attributes of sensorial and nutritional. Hypothesis: for value addition replace *aallo* with fresh pea shells in *tikki* formulations, will it affect the sensory and nutritional attributes. Null hypothesis, H_0, $\mu=\mu_0$in this case, the sensory and nutritional attributes of the *tikki* will be the same. Alternative hypothesis, H_a: $\mu < \mu_0$ and $\mu > \mu_0$ (one tailed test); the sensory and nutritional attributes of the *tikki* will be greater or smaller than the control. $\mu \neq \mu_0$(two tailed test); the sensory and nutritional attributes of the *tikki* will be different than the control.

RESULTS AND DISCUSSION

Observations

The trials were conducted with different levels of incorporation (fresh pea shells) for *tikki* preparation. The weight (Table 1) increased by incorporating *tikki* and decreased after drying,whichmay be due to the higher moisture content in pea shells. The weight providesa downward force or bulkiness to a thing.The similar results reported by Beniwal *et al.*(2022)were previously studied on cutlets prepared with fresh pea shells. Another studycarried out by Mousa *et al.*(2021) supported the present results that the curd pea peels added to crakers increased their weight and thickness.

Sensory evaluations

Sensory evaluation is an important parameter to determine food quality. The mean sensory scores of *tikki* and their blends are presented in Table 2. All types of *tikki* were found to be organoleptically acceptable, being in the “like very much” category except control (“like moderately”). The mean score of colour, appearance, aroma, texture, and taste improved (from 7.2 to 8.1 mean score) with the incremental addition of fresh pea shells. In a similar study, cutlets were developed with a combination of potato and fresh pea shells in different ratios and supplemented cutlets were "liked very much" and control cutlets were "liked moderately" by the panelists, as reported by Beniwal *et al.* (2022) and Diksha and Modgil (2021) reported similar results of sensory (mean score 7 to 8) street *tikki*. Previously, *tikki* prepared with cauliflower leaf powder (10%) by Mogra *et al.* (2012) also yielded acceptable results for sensory evaluation and were" liked very much” by the panel of judges. Singh and Lakshmi (2015) and Kaur *et al.* (2015) reported that increasing the acceptability score of allo *tikki* mushroom and dal. In this present study, the colour and appearance score were lower in deep frying (cutlets) compared to shallow frying (*tikki*). The similar results were evaluated by Joshi and Mathur(2015), who found

Table: 1 Cooking observation of *tikki*

Types of *tikki*	Observation (per 100gm)			
	Total Cooked wt.	No. of pieces	One piece wt. cooked	Total Dry wt.
Control	86g	2	43 g	34.88g
Type I	88g	2	44 g	32.74g
Type II	90g	2	45 g	30.33g
Type III	92g	2	46 g	29.41 g

Control = (Potato: FPS: 100:0), Type I = (Potato: FPS: 90:10), Type II = (Potato: FPS: 80:20), Type III = (Potato: FPS: 70:30), FPS = Fresh Pea Shells, g = gm, wt. = weight

Table 2: Mean scores of sensory evaluation of *tikki*

Sensory characteristics	Types of *tikki*			
	Control	Type I	Type II	Type III
Colour	7.20±0.13	7.80±0.13	8.00±0.15*	8.00±0.00*
Appearance	7.20±0.13	7.90±0.10	8.00±0.15	8.10±0.10*
Aroma	7.30±0.15	7.80±0.13	8.00±0.15	8.10±0.10*
Texture	7.20±0.13	7.80±0.13	8.10±0.18*	8.10±0.10*
Taste	7.20±0.13	7.80±0.13	8.10±0.18*	8.10±0.10*

Table 3: Proximate compositions of *tikki* (%dry weight basis)

Proximate composition	Types of *tikki*				
	Control	Type I	Type II	Type III	CD (≥0.05)
Moisture*	59.44±0.45	62.74±0.58	66.30±0.39	68.03±0.53	1.63
Crudeprotein	3.57±0.05	3.74±0.06	3.92±0.05	4.14±0.05	0.16
Fat	3.37±0.02	3.44±0.05	3.51±0.04	3.65±0.03	0.12
Crude fiber	0.88±0.04	1.05±0.03	1.25±0.04	1.47±0.04	0.14
Ash	3.41±0.04	3.44±0.05	3.74±0.05	3.98±0.05	0.15
Total CHO	72.16±1.35	68.83±1.16	63.09±1.44	58.59±1.21	4.29
Energy (kcal/100g)	333.27±1.79	321.01±1.45	299.63±1.91	283.7±1.51	5.59

Values are mean ± SE of 15 independent observations,Control = (Potato: FPS: 100:0), Type I = (Potato: FPS: 90:10), Type II= (Potato: FPS: 80:20), Type III = (Potato: FPS: 70:30), FPS = Fresh Pea Shells,* = on fresh weight basis, CHO= Carbohydrate

Table 4: Dietary fiber content of *tikki* (dry weight basis)

Dietary Fiber	Types of *tikki*				
	Control	Type I	Type II	Type III	CD (P≥.05)
Total	1.56±0.04	1.84±0.02	2.05±0.06	2.35±0.07	0.17
Insoluble	1.16±0.03	1.38±0.06	1.56±0.05	1.81±0.05	0.16
Soluble	0.40±0.03	0.46±0.02	0.49±0.02	0.54±0.02	0.06

Values are mean ± SE of 15 independent observations,Control = (Potato: FPS: 100:0), Type I = (Potato: FPS: 90:10), Type II= (Potato: FPS: 80:20), Type III = (Potato: FPS: 70:30), FPS = Fresh Pea Shells,

Table 5: Total minerals content of *tikki* (mg/100g, dry weight basis)

Total minerals	Types of *tikki*				
	Control	Type I	Type II	Type III	CD (P≥0.05)
Iron	1.15±0.02	1.28±0.02	1.39±0.04	1.53±0.03	0.09
Calcium	23.33±1.73	31.93±1.73	42.83±2.31	54.52±1.73	6.27
Magnesium	46.61±2.03	60.27±1.73	71.18±2.65	85.93±2.93	7.89
Zinc	0.63±0.02	0.67±0.02	0.70±0.02	0.73±0.01	0.06
Sodium	12.25±0.19	12.74±0.15	13.25±0.14	13.85±0.09	0.48
Potassium	240.42±2.82	250.70±2.31	260.95±2.89	273.28±3.63	9.77
Manganese	0.30±0.02	0.32±0.02	0.34±0.03	0.35±0.01	N/S

Values are mean ± SE of 15 independent observations,Control = (Potato: FPS: 100:0), Type I = (Potato: FPS: 90:10), Type II= (Potato: FPS: 80:20), Type III = (Potato: FPS: 70:30), FPS = Fresh Pea Shells,

that the acceptability score was higher in shallow frying than in deep frying.The other studies showed that the pea pods powder increased the colour or sensorial score and made it look appealing in soup (Hanan *et al.,* 2020), biscuit (Garg, 2015) cake (Fendri *et al.,* 2016). The colour (green) due to the presence of natural phytochemicals which increase the sensory qualities in terms of colour, smell and taste (Zang *et al.,* 2021). The results of the present study showed that fresh pea shells have an influence

on sensory characteristics and have a major role in making fried food crispier or tastier. The taste buds stimulate the secretion of digestive juices.This pleasant experience provides mouth-watering that indicates enjoyment of food.

Nutritional Content

Proximate Composition

From the nutritional point of view protein and fiber play important role in human nutrition. The nutritional analysis of *tikk*i showed that the addition of fresh pea shells significantly increased crude protein (3.57 to 4.14%), moisture (59.44 to 68.03%), ash (3.41 to 3.98%), crude fiber (0.88 to 1.47%), and decreased energy (333. 27 to 283.70 kcal/ 100gm) or carbohydrate (72.16 to 58.59%) content compared to control *tikki* (Table 3). A non-significant difference existed among all types of *tikki,* but a significant difference in fat content was observed in Type II (3.51%) and Type III (3.65%) *tikki.*The proximate compositions are similar to the earlier reports of Beniwal *et al*. (2022), on the nutritive value of cutlets prepared with fresh pea shells at different ratios. The results of the present study are in agreement with previous findings of Mogra *et al.* (2012) who reported that 60.74% moisture, 3.99gm protein, 3.55gm fat, 1.71gm fiber, 3.25gm/100gm ash content in *tikki* supplemented with cauliflower leaf powder (10%). The findings of Nazni and Jaganathan (2014) reported that street and homemade foods contain the nutrients in cutlets like protein (5.4 to 13.0gm), ash (4.5 to 7.10gm), carbohydrate (2.5 to 4.6 gm) and fiber (50 to 60 gm) in different ranges. Similar trends were also reported by Diksha and Modgil (2021) and Kaur *et al.* (2015) fornutrients of *tikki* e.g. ash (3.63 to 5.60%), crude fiber (0.78 to 3.38%), crude protein (3.20 to 5.27%) and carbohydrate (51.50 to 61.64%), respectively. The results agreed with the study of Singh and Lakshmi (2015) which stated that the nutrients, e.g., ash (2.94%), carbohydrate (78.06%), fat (0.58%), fiber (6.57%), and protein (3.15%) were present in *tikki* prepared with potato and mushroom. Another study (Mousa *et al.,* 2021) supported the current study's finding that replacing pea pods (15%) increment the nutrients content of crackers such as ash (1.48 to 1.89%), total carbohydrate (69.02 to 62.21%), energy (375.43 to 376. 20 kcal/100gm). The other literatures found that adding fresh pea shells to dry vegetables (Beniwal *et al.,* 2022) and pea pods incorporated in soup (Hanan *et al.,* 2020) increased nutrient content at different levels.

Dietary fiber

The findings of the study showed (Table 4) that the addition of fresh pea shells brought about a significant increase (1.84 to 2.35%) in dietary fiber content in *tikki* compared to control (1.56%). The results are in conformity with the findings of Beniwal *et al.*(2022) who stated that fresh pea shells dry vegetables (100%) have a good source of dietary fiber contain 23.81 gm/100gm. Literature supports that plants are precise sources of dietary fiber (Ramulu and Udayasekhararao, 1997). Slavin (2013) stated that pea fiber has 3 times more binding water capacity, which shows lower viscosity compared to potato fibers, and a higher intake of fiber in the diet is associated with a lower body weight. Now a day's fibers are used in the food industry as an additive or

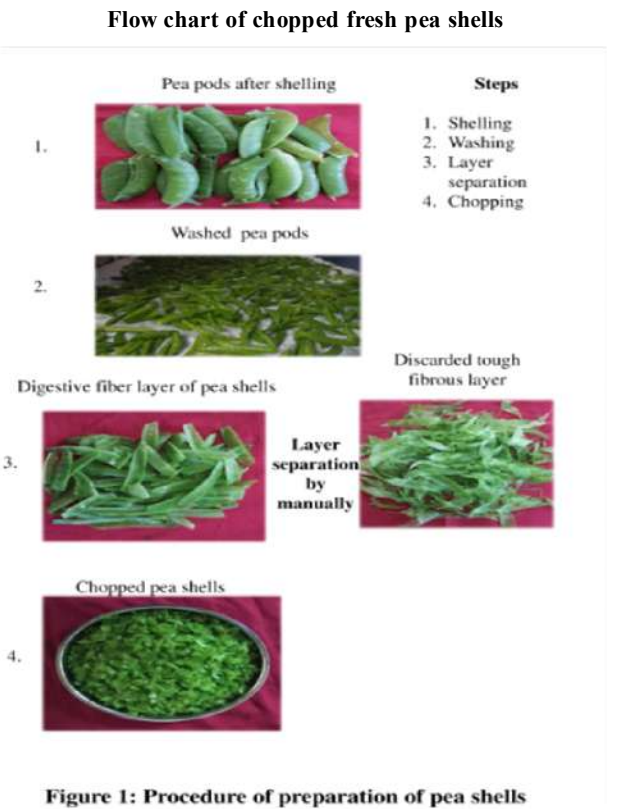


Figure 1: Procedure of preparation of pea shells

texturing agent to increase the volume due to their water absorption capacity and value addition. In particular, those deficient in dietary fiber have great economic value and a good standpoint in human nutrition (Rowayshed *et al.,* 2013).

Total minerals

The micronutrients analysis (Table 5) revealed that the minerals like calcium (23.33 to 54.53mg/100g), iron (1.15 to 1.53mg/100g), potassium (240.42 to 273.28 mg/100g), magnesium (46.61 to 85.93 mg/100g) and sodium (12.25 to 13.85 mg/100g) increased to a significant extent,and a non-significant difference was observed in zinc and manganese content in *tikki* after the incorporation of fresh pea shells at different levels. The results showed that the calcium content increased two times (54.52 mg/100g), compared to control. The data obtained in present study correspond to the study Beniwal *et al.*(2022) reported that fresh pea shells significant improvement in minerals content in cutlets and dry vegetable.Variation in results was obtained in studies earlier conducted by Mogra *et al.* (2012), Nazni and Jaganathan (2014), Diksha and Modgil (2021) and Kaur *et al.* (2015) stated that value added *tikki*contain minerals e.g. calcium (47.77 to 1320mg/100g), iron (0.17 to 4.8mg/100g), zinc (1.00 to 1.52 mg/100g).The result is in accordance with Beniwal *et al.*(2022), which showed that fresh pea shells dry vegetables (100%) contain a high amount (twice or thrice more) of minerals compared to potato vegetables.The results of the present study are in agreement with the previous findings by Garg (2015) and Mousa *et al.*(2021), who reported that pea pod powder isa good source of nutrients as it increases the supplementation levels of minerals significantly. The amount of minerals in the present study was recorded to be different than results earlier revealed by Sharoba *et al.*(2013)in pea peels by products, whichwere 25.78, 8.29, and 6.82% potassium, calcium, and magnesium, respectively. The literature supports that peas and their peels are rich sources of nutrients like vitamins and minerals, have health benefits (Robinson *et al.,* 2019), andare advantageous for people suffering from lifestyle diseases due to their high nutrient content in plant-based food.Warkentin (2020) stated that peas are a rich source of iron, zinc, manganese and naturally low in phytic groups, that can be utilized in bio fortification and can be a hidden solution for nutrient deficient hunger.

CONCLUSION

It can be concluded from the study that fresh pea shells have the potency to be utilized as a potato substitute in *tikki* preparation without altering the sensory characteristics of the final product. Pea shell substitution, in addition to enhancing its utilization, also improves the nutritional value of the end product. Owing to their high nutritive value and cost affectivity, they can prove beneficial in the commercial sector and might help with the goals of sustainable development through food waste management.It also needed further study to determine the performance of substituted products in other conventional foods, such as supplementary food in powder form, analysis of harmful metals, and clinical trials.

Practical application and limitation

Due to a change in lifestyles, the demand for ready-to-eat food and junk food has increased in the Indian diet.They contain a very high amount of starch, fat, energy, but depleted amounts of fiber and minerals. Therefore, modification of traditional recipes into nutritionally rich recipes by incorporating underutilized but nutritionally adequate products could help in preventing lifestyle disorders. They could adopt pea shells in fresh and powder formin food industries as a better substitute at a cost-effective rate. Pea processing industries could use the newer formulations and processing technologies to develop products by utilizing their by-products, which are still underutilization and ongoing research projects.

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