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STUDIES ON PRODUCT DEVELOPMENT CHARACTERISTICS OF ONION PEEL POWDERS AND ASSESSMENT OF ACCEPTABILITY TESTS

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Abstract

Onion skin is a waste produced during onion bulb processing. Recent studies have reported that it contains large amounts of bioaccessible and bioavailable compounds thus it can be used to design of novel food products. The objective of the study was an attempt to utilize onion peel waste in an effective way by preparing dehydrated onion peel powder and analyze its nutritive and phytochemical parameters. And different food preparations were done by incorporating onion peel powder and conducted acceptability tests. The results of nutritive analysis showed that onion peels are rich in both nutrients and phytochemicals, and appreciable sensory scores were obtained significantly for all onion peel incorporated food preparations. These results indicating that onion peels can be effectively used both domestical and commercial food preparations either in fresh or dehydrated form or in value added products.

Key words: onions peels, onion by-products, onion waste, phytochemicals, value added onion products

Introduction

Onion production: Onions (Allium cepa L.) are bulbous vegetables from the Liliaceae family, important in terms of domestic consumption and export. Onions are grown mainly as food materials. They are highly valued for their flavor and for their nutritional value. Onion bulb which may be red, white or yellow in color, is consumed in its tender state, raw, ripe, pickled or in form of powder. The bulbs are boiled and used in soups and stews, fried or eaten raw. They are also preserved in the form of pickles. Onion leaves are also used in salads and soups. According to the Food and Agriculture Organization (FAO) of the United Nations, onions are grown in at least 175 countries. Of those countries, two of the leading producers are China, which harvested 2.2 million acres of onions in 2005, and India, which harvested 1.3 million acres (Onions, Vegetables, NASS, USDA, and April 2008).

Onion by-products: More than 450000 tons of onion wastes are produced annually in Europe, mainly in the United Kingdom, Holland, and Spain. There is considerable industrial pressure to come up with a way to convert the waste into useful products (Otles, S., et al 2015) This attempt would reduce the environmental impact of onion waste disposal by converting waste streams into useful products resulting in low-waste food production (Waldron, 2001). By-products are promising sources of compounds which may be used because of their favorable technological or nutritional properties (Schieber et al., 2001).

Purpose of the study

In recent years, demand for processed onions has increased, which has led to an increase in the amount of waste production (more than 500 000 tons each year). The main onion by-prod-ucts are: dry skins, two outer fleshy scales and roots (generated during industrial peeling) etc. A possible way of utilizing at least the onion skin may be to transform it into a biologically high-value functional ingredient. It seems appropriate, because this part of onion contains a number of bioavailable compounds with a documented high nutritional value. In particular: dietary fibre (DF), FOS, quercetin aglycones, minerals and small quantities of alk(en)yl cystein sulfoxides (ACSOs) Wiczkowski W et al, (2003).

Economics of the onion wastage: Reducing storage wastage is another way to check extreme price fluctuations, traders said. Storage losses in onions in India are 35% to 40%. Simple techniques like keeping a neck of about three inches while harvesting onions reduces possibility of bacterial infection of the bulb, India produces a little over 20 per cent of global onion produce; Sharma, K et al (2016). Onion is not only nutritionally rich but it is a unique source of dietary flavonoids (Slimestad, R et al (2007). In order to reduce the onion peel waste, the researcher would like to bring a value addition to onion peels by analyzing the constituents in onion peels and evaluating simple domestic food preparations with onion peels with following objectives;

Objectives of the Study

1. Selection and pre-processing of onion peels
2. Processing of onion peels by drying and powdering and storage
3. Analysis of onion peel powders
4. Standardization of different food preparations based on the onion peel powder
5. Sensory evaluation of the onion peel powder food preparations

Materials and methods

Selection of the sample

The selection of the sample includes onion peel layers which are by products of onions were selected for the present study.

Sample Collection

The samples were collected from university hostels, where large scale preparations takes place every day, and the samples collected were stored in a cloth bag at room temperature for further study.

Processing of the collected onion peel layer samples

Pre-cleaning and sorting The collected samples were takeout for pre-processing. A mat was spread on a floor and dumped all onion waste on the mat and sorted out onion crowns and removed spoiled onion peel layers and selected only healthy onion peel layers for the study.

Cleaning of the selected samples The selected onion peel layers were initially washed in the fresh water for two to three times thoroughly.

Blanching after cleaning proceeded for the blanching process. The cleaned onion peel layers were dipped in hot water for 5-7min in a stainless steel vessel. After blanching is over, the water was drained off and the blanched onion peel layers were collected.

Drying of the samples the blanched samples were kept for shaded drying in the laboratory by spreading the onion peel layers on a muslin cloth for 2-3 days.

Processing of the samples After complete drying of all onion peel layers the samples were grinded in a mixer grinder and collected the onion peel powdered (OPP) samples.

Storage and labeling The powdered samples are stored in the double layer polyethylene sachets and labeled it and stored the samples in refrigerator for further analysis.

Analysis of the onion peel powdered samples

a. Nutrient analysis

b. Phytochemical analysis

the major and minor nutrients like Protein, Vitamin A, Dietary fiber Iron, Riboflavin, Phosphorus were analyzed in the pre-prepared onion peel powdered samples as per the procedures A.O.A.C, 1985; and phytochemical analysis like total phenols, total tannins and total flavonoids was carried out according to (Mark A Carine; et al 2004).

Standardization of different food preparations based on the onion peel powder (OPP)

Standardization of beverage based food preparations with OPP

Standardization of Tea preparations with OPP;

TABLE-1

Type of beverage	Amount of OPP /g	Amount of milk or water/ml	Amount of flavoring substance/g/ml	Made up to 1 cup (100-150ml
Made up to 1 cup (100-150ml	40	200	-	150
OPP Green Tea	20	200	Green Tea Leave 20gm	150
OPP Tea with Honey	30	200	Honey–10gm	150
OPP Tea with lime juice	30	200	Lime – 10ml	150
OPP Tea with Salt	30	200	Salt – 5gm	150

Method of preparation of Tea beverages with OPP

Method of preparation OPP plain Tea

Ingredients: OPP-20gms; Green tea leaves-20gms; Water-200ml

1. Boil water at medium heat.

2. Mix 40gms of onion peel powder in the boiling water for about 1 hour.

3. Pour into a cup

Method of preparation OPP Green tea

Ingredients: OPP-20gms; Green tea leaves-20gms; Water-200ml

1. Boil water at medium heat.
2. Mix 20gms of OPP and 20gms of green tea leaves in the boiling water for about 1hour.
3. And strain the boiling water through sieve.
4. Pour into a cup.

Method of preparation OPP Honey tea

Ingredients: OPP-30gms; Honey-20gms; Water-200ml

1. Boil water at medium heat.
2. Mix 30gms of OOL & 20gms of Honey of in the boiling water for about 1hour
3. Pour into a cup.

Method of preparation OPP Lemon tea

Ingredients: OPP-30gms; Lemon-15ml; Water-200ml

1. Boil water at medium heat.
2. Mix 30gms of OPP and 15ml of lemon juice in the boiling water for about 1hour
3. Pour into a cup.

Method of preparation OPP Salt tea

Ingredients: OPP-30gms; Lemon-2gm; Water-200ml

1. Boil water at medium heat.
2. Mix 20gms of OPP and 2gms of Salt in the boiling water for about 1hour.
3. And strain the boiling water through sieve

Standardization of soup preparations with OPP

Table-2

Type of soup	Amount of OPP /g	Amount of milk or water/ml	Amount of flavoring substance/g/ml	Amount of vegetables/g/ml	Made up to 1 cup (100-150) ml of beverage/ ml
Plain OPP soup	40	200	Cornflour-15gms	-	150
OPP + Carrot Soup	20	200	Cornflour-15gms	Carrot scrape-20gms	150
OPP + mixed vegetables soup	30	200	Cornflour-15gms	Cabbage scrape-20gms Beans-10gms Capsicum-5gms	150

Method of preparation of soup preparations with OPP

Method of preparation of plain OPP soup:

Ingredients: OPP-30gms; Butter-10gms; Pepper-1/2tsp; Salt-1/2tsp; Garlic-5gms; Cornflour-15gms; Water-200ml

1. Heat the butter in a saucepan at gentle heat.
2. Add onion peels, pepper, salt, garlic pieces in the butter until it turns to golden color.
3. Add water in that and mix the corn flour stir well.
4. Heat for a 15-20 min and serve it in a soup bowl.

Method of preparation of OPP Carrot soup:

Ingredients: OPP-30gms; Carrot scrape-20gms; Butter-10gms; Pepper-1/2tsp; Salt-1/2tsp; Garlic-5gms; Cornflour-15gms; Water-200ml

1. Heat the butter in a sauce pan at gentle heat.
2. Add onion peels, carrot scrape, pepper, salt, garlic pieces in the butter until it turns to golden color.
3. Add water in that and mix the corn flour stir well.
4. Heat for a 15-20 min
5. Serve it in a soup bowl.

Method of preparation of OPP Mixed Vegetable soup

Ingredients: OPP-30gms; Cabbage scrape-20gms; Beans-10gms; Capsicum-5gms; Butter-10gms; Pepper-1/2tsp; Salt-1/2tsp; Garlic-5gms; Cornflour-15gms; Water-200ml

1. Heat the butter in a sauce pan at gentle heat.
2. Add onion outer layer peels, cabbage scrape, beans, capsicum pieces pepper, salt, garlic pieces in the butter until it turns to golden colour.
3. Add water in that and mix the corn flour stir well.
4. Heat for a 15-20 min
5. Serve it in a soup bowl.

Standardization of Spice Mix preparations with OPP

Table-3

Type of spice mix	Amount of OPP /g	Amount of flavoring material/g/ml	Amount of other spice ingredients/g	Amount of total spice mix/g
Plain OPP spice mix	50	-	Red chilies – 20gms Garlic – 5gms Coriander seeds – 10gms	80
OPP + Curry leaves	50	Curry leaves – 50gms	Red chilies – 20gms Garlic – 5gms Coriander seeds – 10gms	130
OPP + Mint leaves mix	50	Mint leaves – 50gms	Red chilies – 20gms Garlic – 5gms Coriander seeds – 10gms	130
OPP + Coriander leaves mix	50	Coriander leaves – 50gms	Red chilies – 20gms Garlic – 5gms Coriander	130
OPP + roasted gram dhal	50	Roasted gram – 50gms	20gms Garlic – 5gms Coriander seeds – 10gms Red chilies – 20gms	130
OPP + roasted Groundnuts	50	Groundnuts – 50gms	Garlic – 5gms Coriander seeds – 10gms	130

Method of preparation of Spice Mix preparations with OPP

Method of preparation of OPP Spice Mix

Ingredients: OPP-50gms; Red chilies – 20gms; Garlic – 5gms; Corriander seeds – 10gms; Salt – 1tbsp

1. Take a pan and heat all the ingredients for a few minutes.
2. After that keep a side for a ten minute.
3. And grind it in mixer until it turns to fine powder.
4. Store it in a glass kettle.

Method of preparation of OPP Curry leaves Spice Mix:

Ingredients: OPP-50gms; Curry leaves – 50gms; Red chilies – 20gms; Garlic – 5gms; Corriander seeds – 10gms; Salt – 1tbsp

1. Take a pan and heat all the ingredients for a few minutes
2. After that keep a side for a ten minute.
3. And grind it in mixer until it turns to fine powder.
4. Store it in a glass kettle

Method of preparation of OPP Mint Spice Mix

Ingredients: OPP-50gms; Mint leaves – 50gms; Red chilies – 20gms; Garlic – 5gms; Corriander seeds – 10gms; Salt – 1tbsp

1. Take a pan and heat all the ingredients for a few minutes
2. After that keep a side for a ten minute.
3. And grind it in mixer until it turns to fine powder.
4. Store it in a glass kettle

Method of preparation of OPP Coriander leaves Spice Mix

Ingredients: OPP-50gms; Corriander leaves – 50gms; Red chilies – 20gms; Garlic – 5gms; Salt – 1tbsp

1. Take a pan and heat all the ingredients for a few minutes
2. After that keep a side for a ten minute.
3. And grind it in mixer until it turns to fine powder.
4. Store it in a glass kettle

Method of preparation of OPP Roasted gram dhal Spice Mix

Ingredients: OPP-50; Roasted gram – 50gms; Red chilies – 20gms; Gallic – 5gms; Corriander seeds – 10gms; Salt – 1tbsp

1. Take a pan and heat all the ingredients for a few minutes
2. After that keep a side for a ten minute.
3. And grind it in mixer until it turns to fine powder.
4. Store it in a glass kettle

Method of preparation of OPP Roasted Groundnut Spice Mix

Ingredients: OPP-50gms; Groundnuts – 50gms; Red chilies – 20gms; Garlic – 5gms; Corriander seeds – 10gms; Salt – 1tbsp

1. Take a pan and heat all the ingredients for a few minutes
2. After that keep a side for ten minutes.
3. And grind it in mixer until it turns to fine powder.
4. Store it in a glass kettle.

Sensory evaluation of the OPP food preparations

The selection of particular test method will depend on the defined objective of the test, accuracy desired and personnel available for conducting the evaluation and development of score cards using appropriate attributes suitable to each of the products Mian k sharif et al (2017), (De Bouillé, AG; Beeren, CJM; (2016).

Hedonic rating test was conducted for all OPP based food preparations done with the help of seven trained panel member who can discriminate the products well and the panel members given scores on 13 point hedonic scale according to their choices. (Kemp, S.E et al (2009) and the sensory scores were subjected to statistical analysis.

Statistical Analysis

The data is subjected to statistical analysis, mean, standard deviation; Analysis of variance (ANOVA) tests was carried out, percentages of sensory evaluation on OPP Products.

Results and discussion

Onion Outer layers consists of Phytochemicals, Onion outer layer has major and minor nutrients it should be analyzed according to laboratory methods. Onions for dehydration are generally white or yellow varieties have a high solids content (18–20% and above) and strong pungency. After preliminary cleaning, peeling, and slicing/chopping, onions are dehydrated at 75–60 °C, the temperature being reduced as the moisture content decreases. The final moisture content of 4% is achieved through warm air circulation.

Analysis of the onion peel powdered samples

Nutrient analysis onion peel powdered samples

Table – 4 Nutrient analysis onion peel powdered samples

Sl.No	Nutrients	Results	
1.	Protiens	4.23g	
2.	Carbohydrates	2.00g	
3.	Fibre	3.12g	
4.	Vitamin c	1.02mg	
5.	Phosphorus	0.10mg	
6.	Iron	0.67mg	
7.	Calcium	1.27	
8.	Fat	0.12g	

The nutritive analysis shows that the protein 4.23gms, carbohydrates 2.13, dietary fibre 3.12mg was in higher leves in OPP ,vitamin c 1.02mg, phosphorus 0.12mg, calcium1.27mg, iron 0.67mg, fat 0.12g contents was resulted while analysis path.

Phytochemical analysis onion peel powdered samples

Table-5 Phytochemical analysis onion peel powdered samples

Sl.no	Test Parameters	Results
1	Total Phenolic content	30.05mg
2	Flavonoids	51.49mg
3	Tannic Acid	168.54mg

Phytochemical analysis confirms that the OPP provide an exceptionally rich source of plant compounds called total phenolics-30.05mg, total flavonoids-51.49mg, and tannic acid-168.54

Sensory scores of onion peel powder based food preparations

Sensory scores of OPP Plain Tea

Table-6 Sensory scores of OPP Plain Tea

Groups	N	Mean	Std. Dev.	Std. Error
Appearance	7	7.1429	0.378	0.1429
Colour	7	7	0	0
Flavour	7	9.2857	1.1127	0.4206
Consistency	7	11.7143	0.488	0.1844
Acceptability	7	8.2857	0.7559	0.2857

ANOVA Summary

Source	Degrees of Freedom DF	Sum of Squares SS	Mean Square MS	F-Stat	P-Value
Between Groups	4	104.3996	26.0999	59.5749	0
Within Groups	30	13.1431	0.4381		
Total:	34	117.5427			

F-statistic value = 59.57485

The above table denoted that the mean scores and F-value of sensory evaluation of OPP Plain tea with different attributes.

The mean score obtained for the attribute ‘appearance’ was 7.14 ±0.34. The mean score obtained for the attribute ‘colour’ was7±0. The mean score obtained for the attribute ‘flavor strength’ was 9.28±1.11 The mean score obtained for attribute ‘consistency’ was 11.71±0.34. The mean obtained for attribute ‘Eating properties’ was 10.1±1.34. The mean obtained for attribute after taste was 9.71±1.86. The mean obtained for attribute ‘acceptability of the product’ was 8.28±0.75

Sensory scores of OPP Green Tea

Table-7 Sensory scores of OPP Green Tea

Data Summary				
Groups	**N**	**Mean**	**Std. Dev.**	**Std. Error**
Appearance	7	12.5714	0.5345	0.202
Colour	7	11.2857	0.9512	0.3595
Flavor	7	11.7143	0.7559	0.2857
Consistency	7	12	0.8165	0.3086
Acceptability	7	12.5714	0.5345	0.202

ANOVA Summary					
Source	**Degrees of Freedom DF**	**Sum of Squares SS**	**Mean Square MS**	**F-Stat**	**P-Value**
Between Groups	4	8.6854	2.1713	3.9999	0.0102
Within Groups	30	16.2853	0.5428		
Total:	34	24.9707			

F -statistic value = 3.99994

P-value = 0.01021

The above table denoted that the mean scores and F-value of sensory evaluation of OPP Green tea with different attributes.

The mean score obtained for the attribute ‘appearance’ was7.14 ±0.38. The mean score obtained for the attribute ‘colour’ was7±0. The mean score obtained for the attribute ‘flavor strength’ was 9.28±1.11 The mean score obtained for attribute ‘consistency’ was 11.71±0].34. The mean obtained for attribute ‘Eating properties’ was 10.1±1.34. The mean obtained for attribute after taste was 9.71±1.86. The mean obtained for attribute ‘acceptability of the product’ was 8.28±0.75

Sensory scores of OPP honey tea

Table-8 Sensory scores of OPP honey tea

Data Summary				
Groups	**N**	**Mean**	**Std. Dev.**	**Std. Error**
Appearance	7	11.2857	1.1127	0.4206
Colour	7	9.5714	0.9759	0.3689
Flavour	7	10.8571	0.8997	0.3401
Consistency	7	11.7143	0.7559	0.2857
Acceptability	7	11.7143	0.9512	0.3595

ANOVA Summary					
Source	**Degrees of Freedom DF**	**Sum of Squares SS**	**Mean Square MS**	**F-Stat**	**P-Value**
Between Groups	4	22.1152	5.5288	6.1759	0.0009
Within Groups	30	26.8567	0.8952		
Total:	34	48.9718			

F-statistic value = 6.1759

P-value = 0.00095

The above table denoted that the mean scores and F-value of sensory evaluation of OPP Honey tea with different attributes.

The mean score obtained for the attribute ‘appearance’ was 11.28. The mean score obtained for the attribute ‘colour’ was 1.11. The mean score obtained for the attribute ‘flavor strength’ was 9.28±1.11 The mean score obtained for attribute ‘consistency’ was 10.87±0.84. The mean obtained for attribute was 10.1±1.34. The mean obtained for attribute after taste was 11.71±0.75. The mean obtained for attribute ‘acceptability of the product’ was 11.71±0.95

Sensory scores of OPP Lime tea

Table-9 Sensory scores of OPP Lime tea

Data Summary				
Groups	**N**	**Mean**	**Std. Dev.**	**Std. Error**
Appearance	7	8.5714	1.3973	0.5281
Colour	7	7	1	0.378
Flavour	7	11.5714	0.7868	0.2974
Consistency	7	11.7143	0.7559	0.2857
Acceptability	7	11.1429	0.378	0.1429

ANOVA Summary					
Source	**Degrees of Freedom DF**	**Sum of Squares SS**	**Mean Square MS**	**F-Stat**	**P-Value**
Between Groups	4	124.2867	31.0717	36.2498	0
Within Groups	30	25.7146	0.8572		
Total:	34	150.0013			

F-statistic value = 36.24981

The above table denoted that the mean scores and F-value of sensory evaluation of OPP Lime tea with different attributes.

The mean score obtained for the attribute ‘appearance’ was 8.57 ±1.39. The mean score obtained for the attribute ‘colour’ was7±1. The mean score obtained for the attribute ‘flavor strength’ was 11.5±0.7 The mean score obtained for attribute ‘consistency’ was 11.7±0.7. The mean obtained for attribute was 10.1±1.34. The mean obtained for attribute after taste was 10.71±1.86. The mean obtained for attribute ‘acceptability of the product’ was 11.14±0.37

Sensory scores of OPP Salt tea

Table-10 Sensory scores of OPP Salt tea

Data Summary				
Groups	**N**	**Mean**	**Std. Dev.**	**Std. Error**
Appearance	7	7	0.5774	0.2182
Colour	7	6.8571	0.378	0.1429
Flavour	7	8	0.8165	0.3086
Consistency	7	9.1429	0.8997	0.3401
Acceptability	7	7.7143	1.496	0.5654

ANOVA Summary					
Source	**Degrees of Freedom DF**	**Sum of Squares SS**	**Mean Square MS**	**F-Stat**	**P-Value**
Between Groups	4	23.5442	5.8861	7.0232	0.0004
Within Groups	30	25.1425	0.8381		
Total:	34	48.6868			

F-statistic value = 7.02322 P-value = 0.00041

The above table denoted that the mean scores and F-value of sensory evaluation of OPP Salt tea with different attributes.

The mean score obtained for the attribute ‘appearance’ was7.14 ±0.38. The mean score obtained for the attribute ‘colour’ was7±0. The mean score obtained for the attribute ‘flavor strength’ was 9.28±1.11 The mean score obtained for attribute ‘consistency’ was 11.71±0].34. The mean obtained for attribute ‘Eating properties’ was 10.1±1.34. The mean obtained for attribute after taste was 9.71±1.86. The mean obtained for attribute ‘acceptability of the product’ was 8.28±0.75

Sensory scores of OPP plain soup

Table-11 Sensory scores of OPP plain soup

Data Summary				
Groups	**N**	**Mean**	**Std. Dev.**	**Std. Error**
Colour	7	16.1429	1.3452	0.5084
Consistency	7	15.8571	0.378	0.1429
Flavor	7	36.5714	1.8127	0.6851
Absence of defects	7	10	0	0

ANOVA Summary					
Source	**Degrees of Freedom DF**	**Sum of Squares SS**	**Mean Square MS**	**F-Stat**	**P-Value**
Between Groups	3	2842.9934	947.6645	723.6388	0
Within Groups	24	31.43	1.3096		
Total:	27	2874.4234			

F-statistic value = 723.63885

The above table denoted that the mean scores and F-value of sensory evaluation of OPP Plain soup with different attributes.

The mean score obtained for the attribute ‘colour’ was 16.14 ±1.34. The mean score obtained for the attribute ‘colour’ was7±0. The mean score obtained for the attribute ‘flavor strength’ was 9.28±1.11 The mean score obtained for attribute ‘consistency’ was 11.71±0].34. The mean obtained for attribute ‘ was 10.1±1.34. The mean obtained for attribute after taste was 9.71±1.86. The mean obtained for attribute ‘acceptability of the product’ was 8.28±0.75

Sensory scores of OPP Carrot Soup

Table-12 Sensory scores of OPP Carrot Soup

Data Summary				
Groups	**N**	**Mean**	**Std. Dev.**	**Std. Error**
Colour	7	18.1429	0.378	0.1429
Consistency	7	18.4286	0.7868	0.2974
Flavor	7	40	0	0
Absence of defects	7	5	0	0

ANOVA Summary					
Source	**Degrees of Freedom DF**	**Sum of Squares SS**	**Mean Square MS**	**F-Stat**	**P-Value**
Between Groups	3	4412.105	1470.7017	7720.8445	0
Within Groups	24	4.5716	0.1905		
Total:	27	4416.6766			

F-statistic value = 7720.84451

The above table denoted that the mean scores and F-value of sensory evaluation of OPP Carrot Soup with different attributes.

The mean score obtained for the attribute ‘colour’ was7±0. The mean score obtained for the attribute ‘flavor strength’ was 9.28±1.11 The mean score obtained for attribute ‘consistency’ was 11.71±0].34. The mean obtained for attribute was 10.1±1.34. The mean obtained for attribute after taste was 9.71±1.86. The mean obtained for attribute ‘absence of defects of the product’ was 2±0.

Sensory scores of OPP mixed vegetable soup

Table-13 Sensory scores of OPP mixed vegetable soup

Data Summary				
Groups	**N**	**Mean**	**Std. Dev.**	**Std. Error**
Colour	7	19.8571	0.378	0.1429
Consistency	7	19.5714	0.5345	0.202
Flavor	7	40	0	0
Absence of defects	7	2	0	0

ANOVA Summary					
Source	**Degrees of Freedom DF**	**Sum of Squares SS**	**Mean Square MS**	**F-Stat**	**P-Value**
Between Groups	3	5065.8578	1688.6193	15760.3426	0
Within Groups	24	2.5714	0.1071		
Total:	27	5068.4292			

F-statistic value = 15760.3426

The above table denoted that the mean scores and F-value of sensory evaluation of OPP Mix Veg Soup with different attributes.

The mean score obtained for the attribute ‘colour’ was7±0. The mean score obtained for the attribute ‘flavor strength’ was 9.28±1.11 The mean score obtained for attribute ‘consistency’ was 11.71±0].34. The mean obtained for attribute was 10.1±1.34. The mean obtained for attribute after taste was 9.71±1.86. The mean obtained for attribute ‘absence of defects of the product’ was 2±0.

Sensory scores of OPP Spice Mix

Table-14 Sensory scores of OPP Spice Mix

Data Summary				
Groups	**N**	**Mean**	**Std. Dev.**	**Std. Error**
Appearance	7	12	0.8165	0.3086
Colour	7	10	0	0
Flavor	7	9.5714	0.7868	0.2974
Consistency	7	12.7143	0.488	0.1844
Acceptability	7	12.2857	0.7559	0.2857

ANOVA Summary					
Source	**Degrees of Freedom DF**	**Sum of Squares SS**	**Mean Square MS**	**F-Stat**	**P-Value**
Between Groups	4	56.9722	14.2431	33.9888	0
Within Groups	30	12.5715	0.4191		
Total:	34	69.5437			

F-statistic value = 33.98882

The above table denoted that the mean scores and F-value of sensory evaluation of OPP Plain tea with different attributes.

The mean score obtained for the attribute ‘appearance’ was7.14 ±0.38. The mean score obtained for the attribute ‘colour’ was7±0. The mean score obtained for the attribute ‘flavor strength’ was 9.28±1.11 The mean score obtained for attribute ‘consistency’ was 11.71±0].34. The mean obtained for attribute ‘Eating properties’ was 10.1±1.34. The mean obtained for attribute after taste was 9.71±1.86. The mean obtained for attribute ‘acceptability of the product’ was 8.28±0.75

Sensory scores of OPP Curry leave Mix

Table-14 Sensory scores of OPP Curry leave Mix

Data Summary				
Groups	**N**	**Mean**	**Std. Dev.**	**Std. Error**
Appearance	7	13.4286	0.7868	0.2974
Colour	7	11.2857	1.1127	0.4206
Flavor	7	11.7143	0.7559	0.2857
Consistency	7	12.4286	0.5345	0.202
Acceptability	7	12.1429	0.8997	0.3401

ANOVA Summary					
Source	**Degrees of Freedom DF**	**Sum of Squares SS**	**Mean Square MS**	**F-Stat**	**P-Value**
Between Groups	4	18.4578	4.6144	6.5477	0.0007
Within Groups	30	21.1421	0.7047		
Total:	34	39.5999			

F-statistic value = 6.54774 P-value = 0.00065

The above table denoted that the mean scores and F-value of sensory evaluation of OPP Plain tea with different attributes.

The mean score obtained for the attribute ‘appearance’ was7.14 ±0.38. The mean score obtained for the attribute ‘colour’ was7±0. The mean score obtained for the attribute ‘flavor strength’ was 9.28±1.11 The mean score obtained for attribute ‘consistency’ was 11.71±0].34. The mean obtained for attribute ‘Eating properties’ was 10.1±1.34. The mean obtained for attribute after taste was 9.71±1.86. The mean obtained for attribute ‘acceptability of the product’ was 8.28±0.75

Sensory scores of OPP Mint Mix

Table-15 Sensory scores of OPP Mint Mix

Data Summary				
Groups	**N**	**Mean**	**Std. Dev.**	**Std. Error**
Appearance	7	11.4286	1.1339	0.4286
Colour	7	11	1.1547	0.4364
Flavor	7	12	0.5774	0.2182
Consistency	7	10.7143	0.7559	0.2857
Acceptability	7	11	0.8165	0.3086

ANOVA Summary					
Source	**Degrees of Freedom DF**	**Sum of Squares SS**	**Mean Square MS**	**F-Stat**	**P-Value**
Between Groups	4	7.0285	1.7571	2.0966	0.106
Within Groups	30	25.1431	0.8381		
Total:	34	32.1716			

F-statistic value = 2.09657 P-value = 0.106

The above table denoted that the mean scores and F-value of sensory evaluation of OPP Plain tea with different attributes.

The mean score obtained for the attribute ‘appearance’ was11.42±1.38. The mean score obtained for the attribute ‘colour’ was11±1.15. The mean score obtained for the attribute ‘flavor strength’ was 12±0.11 The mean score obtained for attribute ‘consistency’ was 10.71±0.75. The mean obtained for attribute was 10.1±1.34. The mean obtained for attribute after taste was 9.71±1.86. The mean obtained for attribute ‘acceptability of the product’ was 8.28±0.75

Sensory scores of OPP Coriander leave Spice Mix

Table-16 Sensory scores of OPP Coriander leave Spice Mix

Data Summary				
Groups	**N**	**Mean**	**Std. Dev.**	**Std. Error**
Appearence	7	11.7143	0.7559	0.2857
Colour	7	10.7143	0.7559	0.2857
Flavor	7	12.1429	0.378	0.1429
Consistency	7	12.2857	0.488	0.1844
Acceptability	7	12.5714	0.5345	0.202

ANOVA Summary					
Source	**Degrees of Freedom DF**	**Sum of Squares SS**	**Mean Square MS**	**F-Stat**	**P-Value**
Between Groups	4	14.6852	3.6713	10.1446	0
Within Groups	30	10.8569	0.3619		
Total:	34	25.5422			

F-statistic vvaluF value = 10.14461 P-value = 0.00003

The above table denoted that the mean scores and F-value of sensory evaluation of OPP Coriander leaves Spice Mix with different attributes.

The mean score obtained for the attribute ‘appearance’ was11.14 ±0.38. The mean score obtained for the attribute ‘colour’ was10±0. The mean score obtained for the attribute ‘flavor strength’ was 12.28±1.11 The mean score obtained for attribute ‘consistency’ was 12.71±0.34. The mean obtained for attribute was 12.1±1.34. The mean obtained for attribute after taste was 12.71±1.86. The mean obtained for attribute ‘acceptability of the product’ was 12.28±0.75

Sensory scores of OPP Roasted gram dhal Spice Mix

Table-18 Sensory scores of OPP Roasted gram dhal Spice Mix

Data Summary				
Groups	**N**	**Mean**	**Std. Dev.**	**Std. Error**
Appearance	7	12.5714	0.5345	0.202
Colour	7	12.7143	0.488	0.1844
Flavor	7	12.1429	0.378	0.1429
Consistency	7	12.7143	0.488	0.1844
Acceptability	7	12.8571	0.378	0.1429

ANOVA Summary					
Source	**Degrees of Freedom DF**	**Sum of Squares SS**	**Mean Square MS**	**F-Stat**	**P-Value**
Between Groups	4	2.1139	0.5285	2.522	0.0617
Within Groups	30	6.2865	0.2095		
Total:	34	8.4004			

F-statistic value = 2.52198 P-value = 0.06174

The above table denoted that the mean scores and F-value of sensory evaluation of OPP Roasted gram dal Spice Mix with different attributes.

The mean score obtained for the attribute ‘appearance’ was12.57 ±0.53. The mean score obtained for the attribute ‘colour’ was12.71±0.48 The mean score obtained for the attribute ‘flavor strength’ was 12.14±0.37 The mean score obtained for attribute ‘consistency’ was 12.71±0.48. The mean obtained for attribute ‘Eating properties’ was 10.1±1.34. The mean obtained for attribute after taste was 9.71±1.86. The mean obtained for attribute ‘acceptability of the product’ was 12.85±0.37

Sensory scores of OPP Roasted Groundnut Spice Mix

Table-19 Sensory scores of OPP Roasted Groundnut Spice Mix

Data Summary				
Groups	**N**	**Mean**	**Std. Dev.**	**Std. Error**
Appearance	7	12.2857	0.488	0.1844
Colour	7	12.8571	0.378	0.1429
Flavor	7	12.5714	0.5345	0.202
Consistency	7	12.8571	0.378	0.1429
Acceptability	7	13	0	0

ANOVA Summary					
Source	**Degrees of Freedom DF**	**Sum of Squares SS**	**Mean Square MS**	**F-Stat**	**P-Value**
Between Groups	4	2.2857	0.5714	3.529	0.0178
Within Groups	30	4.8576	0.1619		
Total:	34	7.1433			

F-statistic value = 3.52903 P-value = 0.01783

The above table denoted that the mean scores and F-value of sensory evaluation OPP Roasted Groundnuts Spice Mix with different attributes.

The mean score obtained for the attribute ‘appearance’ was 12.28 ±0.48. The mean score obtained for the attribute ‘colour’ was12.85±0.37 The mean score obtained for the attribute ‘flavor strength’ was 12.57±0.53 The mean score obtained for attribute ‘consistency’ was 12.85±0.37. The mean obtained for attribute was 10.1±1.34. The mean obtained for attribute after taste was 9.71±1.86. The mean obtained for attribute ‘acceptability of the product’ was 13±0.

Conclusions

The outer skins of onions are an excellent source of Protein, Vitamin A, Dietary fiber Iron, Riboflavin, Phosphorus and phytochemicals like total phenols, total tannins and total flavonoids which are a potent antioxidant and anti-inflammatory. One of the easiest ways to add onion peels to our diet is via steeping. Add some to soups or curries and discard the peel before serving. We can also try making an infusion by adding onion skin to green or herbal teas. Onion peel-infused water may provide its anti-inflammatory properties and may also take care of the lingering muscle cramps. By processing and

stabilizing onion wastes (residues and surpluses of onion) could represent both advantages: a solution for the environmental problem derived from the great onion wastes disposal and the obtaining of stabilized onion by-products as natural antioxidant food ingredients and food products.

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