



Studies on Development of Orange Peel Pickle and its Preservation with Health Benefits

Patil K.^{1*}, Patil S.², Deshmukh N.³

DOI: 10.5281/zenodo.4732444


^{1*} Ketaki Patil, R & D Manager, , Food Tech Formulator, Satara, Maharashtra, India.

² Sulekha Patil, QC executive, , Food Tech Formulator, Satara, Maharashtra, India.

³ Nikita Deshmukh, R & D executive, , Food Tech Formulator, Satara, Maharashtra, India.

A number of Agro-industrial by-products or wastes like citrus pulp, citrus meals, citrus seed meal, citrus molasses, and citrus peels are generated from fresh citrus after the main products of interest have been removed or extracted during processing or peeled for direct human consumption as in the case of developing countries. The waste utilization of orange peel is the most important aspect of this study. The Present Study was undertaken to prepare orange peel pickle by using different preservatives and to assess its shelf life and overall acceptability of pickle in sensory evaluation. The study was conducted to note down the efficacy of preservatives on the shelf life of pickles. Sensory evaluation was done in order to see the acceptability of the product for parameters color, flavor, aroma, texture, and overall appearance. In the first treatment, the pickle was prepared with sugar. In the second treatment, pickle was prepared with jaggery. Both combinations were observed majorly for taste and shelf life. Treatment 1 (T1) showed the best result in terms of shelf life and Treatment 2 (T2) showed the best result in terms of sensory.

Keywords: Orange Peel, Preservation, Health effective, Waste utilization.

Corresponding Author	How to Cite this Article	To Browse
Ketaki Patil, R & D Manager, , Food Tech Formulator, Satara, Maharashtra, India. Email: ketu8939@gmail.com	Ketaki Patil, Sulekha Patil, Nikita Deshmukh, Studies on Development of Orange Peel Pickle and its Preservation with Health Benefits. FASJ. 2021;02(02):71-. Available From https://fasj.org/index.php/fasj/article/view/69	

Manuscript Received 2021-03-02	Review Round 1 2021-03-18	Review Round 2 2021-03-24	Review Round 3 2021-03-29	Accepted 2021-04-29
Conflict of Interest NA	Funding Nil	Ethical Approval Yes	Plagiarism Turnitin 16%	Note



OBJECTIVES

01. To develop nutritional pickles and enhancement of shelf life.
02. To utilize waste of orange for benefits of nutrition.

INTRODUCTION

The orange peel is considered as having certain vital nutrients and having certain properties which make the gastrointestinal tract function well and it is excellent for the diabetic and heart patient as well(1). The citrus peels are divided into epicarp or flavedo and mesocarp or albedo. The flavedo is colored and is the outermost surface of the peel whereas the albedo is the white, soft inner layer of the peel.

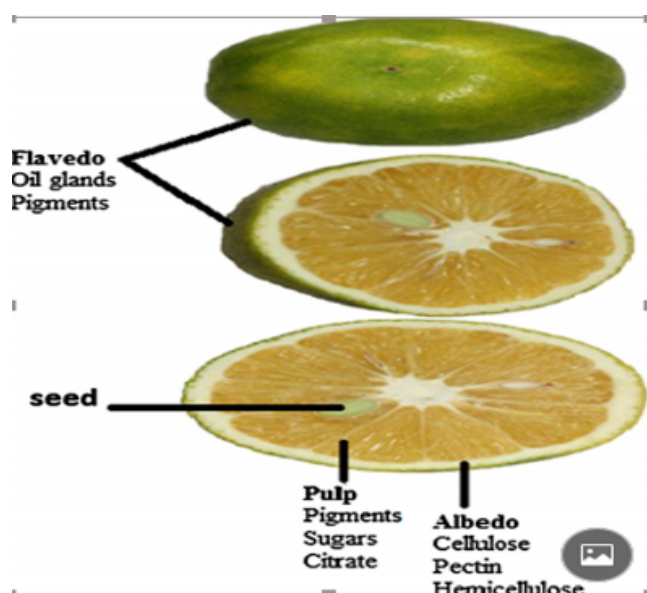


Fig. 1

Juice, flavedo and albedo account for about 50, 10 and 25% (w/w) respectively of the whole fruit. Fruit peel or fruit skin is the outermost covering or the skin of the fruit(2). Peels of citrus fruits comprise two layers, red outer layer as flavedo and inner white layer as albedo.

The genus *Citrus* belongs to the family Rutaceae and is native to tropical and subtropical areas in Southeast Asia(3). The citrus plants are grown worldwide and rank top in world production and trade among fruit trees. Citrus fruits are richer sources of bioactive compounds having a beneficial effects on human health such as vitamin C, carotenoids, flavonoids, limonoids,

Essential oils, acridone alkaloids, minerals, and vitamin B complex.

Pickle is widely acceptable and usable food items all over India. The popular common pickle prepared by the women or manufacturers are mango, lemon, chilli, mixed vegetable, turmeric, garlic, fish, and Chicken. Pickles are usually made from a mixture of vegetables and fruit(4). They are eaten as savory, spicy accompaniments to a meal. Pickles are preserved by a combination of increased acidity (reduced pH), added salt, reduced moisture and added spices.

Pickles can be prepared using one of the two main methods:- lactic acid fermentation of vegetables, either with or without the addition of salt, and preservation of vegetables in acetic acid (vinegar). Vegetables pickled in acetic acid (vinegar) have salt and sugar added. They are not fermented and therefore have a different texture and flavor(5).

Usually, large amount of peel is discarded every day of citrus fruits in different parts of the country, only a few parts of it is being used by very few people or organizations(6). The objective of the present study was to determine the utilization of orange peel for health benefits hence developing such a product which is a byproduct and nice in nutrients also.

MATERIALS AND METHODS

Collection of Citrus Fruits

Fresh, ripe, and free from damage and infestation oranges were purchased from two locations of Satara city. Oranges were peeled to obtain rinds. Collected peel was cut into small-medium size square pieces (size can vary according to individual) as shown in Fig.2 and Fig.3. Few fruits were subjected to juice extraction.

Development of Orange Peel Pickle



Fig. 2



Fig. 4

The experiment was conducted for 1 month. Observations were recorded at weekly intervals in order to see any change in color, flavor, texture, and appearance of fungus. Different treatments and their details were shown in Table 1. Statistical analysis of the data was carried out using SPSS version 20.

Treatment	Details of Treatment
T1	Orange Peel + Spices + 15 % Vinegar + 6 % Sugar
T2	Orange Peel + Spices + 15 % Vinegar + 6 % Jaggery

Table 1. Different treatments and their details.

Method of preparation of green chili pickle.

The recipe for orange peel pickle is given in Table 2. Selected fresh, ripe oranges were taken and washed thoroughly with tap water to remove dust and dirt. Then removed peel and cut into small pieces and juice was extracted from fruits. Then Whole spices like cinnamon, clove, and black pepper were roasted on a heated pan and then ground for making powder. Peel and chopped garlic was steamed for 15 min as shown in Fig.5 and kept aside.



Fig. 3

Collection of other Spices and Condiments

Sugar, Salt, Jaggery, Garlic, Asafoetida, Turmeric, Fenugreek Seeds, Black Pepper, Clove, Cinnamon, Red chili powder and Vinegar were procured from local market as shown in Fig.4

Development of Orange Peel Pickle



Fig. 5

For treatment 1 (T1) Sugar syrup and orange juice were boiled together and other spices and condiments like Asafoetida, turmeric, red chili powder, and salt were added to it. Steamed peel and garlic were added to the same and cooked for 5 min. Once the mixture gets cooked it removed from the flame and kept for cooling at ambient temperature. Once the mixture achieved normal temperature then vinegar was added, then the mixture was filled into a sterilized glass bottle and sealed airtight, and kept at ambient temperature. For treatment 2 (T2) Jaggery and orange juice were boiled together and followed by other steps same like treatment 1.



Fig. 6

The flow chart for the preparation of orange peel pickle was shown in Fig.7

Sr.No	Ingredients	T1 (%)	Ingredients	T2 (%)
1.	Orange Peel	38.28	Orange Peel	38.28
2.	Orange Juice	31.90	Orange Juice	31.90
3.	Vinegar	15.95	Vinegar	15.95
4.	Sugar	6.38	Jaggery	6.38
5.	Garlic	3.19	Garlic	3.19
6.	Salt	1.91	Salt	1.91
7.	Fenugreek Seeds	1.27	Fenugreek Seeds	1.27
8.	Turmeric	0.31	Turmeric	0.31
9.	Red Chilli powder	0.31	Red Chilli powder	0.31
10.	Black pepper powder	0.19	Black pepper powder	0.19
11.	Cinnamon	0.06	Cinnamon	0.06
12.	Clove	0.095	Clove	0.095
13.	Asafoetida	0.095	Asafoetida	0.095

Table 2. Recipe of orange peel pickle treatments

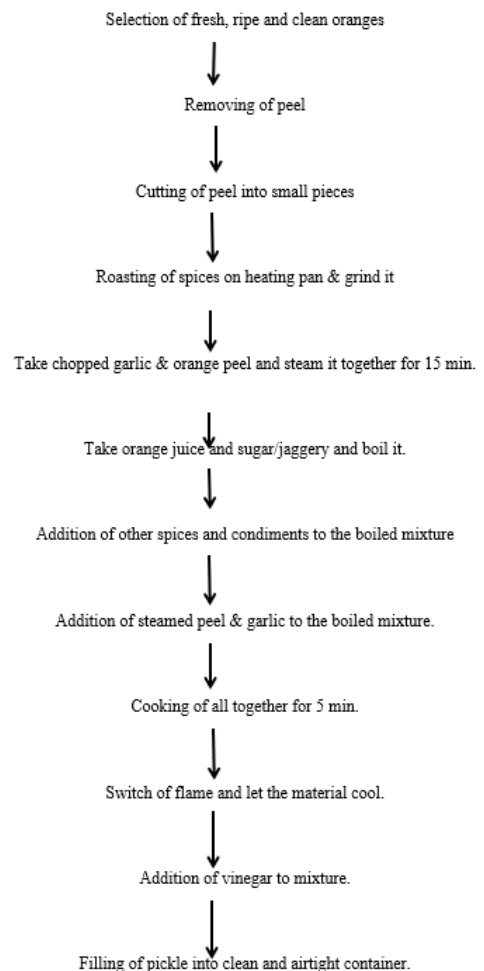


Fig.7 Flow chart for the preparation of orange peel pickle.

Nutritional Analysis

Development of Orange Peel Pickle

Nutritional analysis of samples is done on the basis of calculation using the reference of Department of Health's Dietary Reference Values for Food Energy and Nutrients for the United Kingdom (7)

Microbiological Analysis

Microbiological parameter i.e. fungal growth observed through visual inspection.

Sensory Evaluation

The consumer's acceptability was evaluated by a taste testing panel. The hedonic scale used to determine the result.

Statistical analysis

The data were expressed as the mean ± SD. The data were statistically analyzed by an independent sample T-test using SPSS program version 20.0 to express the significance of difference ($P < 0.05$) between mean

RESULT AND DISCUSSION

The experiments were conducted for "Development of orange peel pickle and its effect on quality during its preservation with health benefits of it. The shelf life studies were conducted at the interval of 1 to 30 days. The results of the study are being presented and discussed in following section.

Physico-Chemical Analysis of orange peel

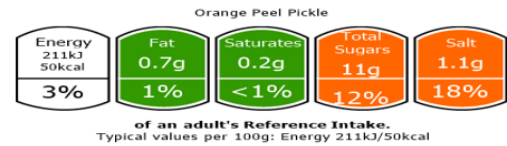
Following is the nutritional information of raw orange peel as per reference of food data central mentioned in Table 3

Energy	97 Kcal
Protein	1.5 g
Total lipids (fat)	0.2 g
Ash	0.8 g
Carbohydrates	25 g
Fiber	10.6 g
Calcium	161 mg
Iron	0.8 mg
Magnesium	25 mg
Phosphorus	21 mg
Potassium	212 mg
Sodium	3 mg
Zinc	0.25 mg
Vitamin C	136 mg
Mono saturated fat	0.036 g
Poly unsaturated fat	0.04 g
Cholesterol	0 mg

Table 3. Nutritional Information of Raw Citrus Peel (Per 100 g)

Nutritional Analysis of Orange peel pickle

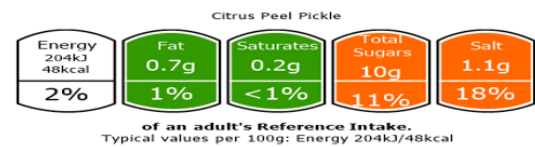
Following is the nutritional information (calculated) of orange peel pickle treated with sugar i.e. Treatment 1 as per reference of food data central mentioned in(8) Fig.8



Nutrition Information Typical Values		
	Per 100g	Per portion (100g)
Energy (kJ)	211	211
Energy (kcal)	50	50
Fat (g)	0.7	0.7
Saturates (g)	0.2	0.2
Carbohydrate (g)	11	11
Total Sugars (g)	11	11
Fibre (g)	0.6	0.6
Protein (g)	1.7	1.7
Salt (g)	1.1	1.1

Figure 8. Nutritional Analysis of Treatment 1 (T1)

Following is the nutritional information (calculated) of orange peel pickle treated with Jaggery i.e. Treatment 2 as per reference of food data central mentioned in Fig.9



Nutrition Information Typical Values		
	Per 100g	Per portion (100g)
Energy (kJ)	204	204
Energy (kcal)	48	48
Fat (g)	0.7	0.7
Saturates (g)	0.2	0.2
Carbohydrate (g)	11	11
Total Sugars (g)	10	10
Fibre (g)	0.6	0.6
Protein (g)	1.7	1.7
Salt (g)	1.1	1.1

Figure 9. Nutritional Analysis of Treatment 2 (T2)

The result shows a significant difference ($P < 0.05$) in Nutritional analysis due to changes in ingredients.

Visual observation of fungus growth developed in Orange Peel pickle

The fungal growth developed in Orange peel pickle at different storage periods was examined through visual observation. Details of the observation were given in Table 4. Up to 4 weeks of storage, no fungal growth was observed. Little

Development of Orange Peel Pickle

Growth was observed after the 4th week in T2. Fungal growth was observed in T2 due to jaggery as it absorbs moisture easily. Whitish fungal growth was observed on the surface of the pickle which may come from spices or due to Jaggery in the T2 sample. In the case of Sugar treated sample no fungal appearance on the surface of the pickle like T2. Proper concentration of vinegar helped to maintain the proper pH of the pickle.

Storage Period (Week)	Treatment	Fungal Growth
1	T1	No Growth
	T2	
2	T1	No Growth
	T2	
3	T1	No Growth
	T2	
4	T1	No Growth
	T2	Slightly Growth

The result shows a significant difference ($P < 0.05$) in the shelf-life study of both the samples due to the role of sugar & jaggery in the preservation process.

Storage Studies of Orange Peel Pickle

Orange Peel pickles were stored at room temperature. The deterioration of the product was observed at a regular interval of one month. The change in color, flavour and texture were observed for a period of 1Month. Two different treatments of orange peel pickle were used for storage studies at room temperature of 27°C – 33 °C from 1week to 4 week. The effect of storage time on physical properties such as colour, flavour and texture of the pickles were studied. The processed orange peel pickles were in good condition up to 4 week. in case of T1 no growth was observed and in case of T2 whitish mold growth was observed. For T1 change in color, flavour and texture started from 4th week onwards which was shown in Table 5. For T2 change in color, flavour and texture started from 3rd week onwards which was shown in Table 5. This may be due to lack of proper concentration of preservatives like vinegar and Jaggery.

Shelf Life (week)	Treatment	Color	Flavour	Texture	Remark
1	T1	No change	No off flavour	Firm	Acceptable
	T2	No change	No off flavour	Firm	Acceptable
2					

T1	No change	No off flavour	Firm	Acceptable	
T2	No change	No off flavour	Firm	Acceptable	
3	T1	No change	No off flavour	Little soft	Acceptable
	T2	No change	No off flavour	Little soft	Acceptable
4	T1	No change	No off flavour	Little soft	Acceptable
	T2	Slight Change	Slight Acidic Flavour	Little soft	Not Acceptable

Table 5. Storage Life of Orange Peel Pickle

Sensory Evaluation of Orange Peel Pickle

The consumer's acceptability of processed orange peel pickle was evaluated by a taste testing panel. The hedonic rating test was used to determine the acceptability of pickle.

Panelists were asked to give scores for characteristic color, flavour, texture and overall acceptability of the processed orange peel pickle. The scale was arranged such that 9 = like extremely, 8 = like very much, 7 = like moderately, 6 = like slightly,

5 = neither like or dislike, 4 = Dislike slightly, 3 = Dislike moderately, 2 = Dislike very much, 1 =Dislike extremely. The mean score of performance of orange peel pickles was presented in Table 6 it was seen that T2 secured the highest score 8 for colour, 8.5 for flavour, 8 for texture and 8.1 for overall acceptability and was ranked as like very much. It also showed that T1 got the lowest value than the other sample. So, this indicated that color, texture are same but flavour of T2 is more acceptable than other.

The result shows the significant difference ($P < 0.05$) in Sensory Analysis due to change in ingredients.

Treatment	Sensory Attributes			
Color	Flavor	Texture	Overall Acceptability	
T1	8	7	8	7.6
T2	8	8.5	8	8.1

Table 6. Mean Score for the performance of color, flavor, texture, and overall acceptability of various treatment of orange peel pickle

CONCLUSION

Orange peel pickle is perishable. So, proper preservatives like sugar, jaggery, salt, vinegar should be used in proper concentration to extend the shelf life of the pickle. From this study, it was found that fungal growth was a great

Problem for pickles. If we add a proper concentration of preservatives, the fungal growth becomes very low. The panelists also tested the product and gave the score for color, flavor, texture, and overall acceptability. The score of the panel test indicated that among the two treatments, the pickle which was prepared with Jaggery (T2) was the most acceptable in sensory. In the case of shelf life, T1 has better shelf life than other treatments. It was proved that T1 was the best method for extending the shelf life and also for improving the quality of the pickle. This study gave a good prospect on the processing orange peel. This technology may be adopted on large scale by women entrepreneurs and farm women or workers in order to generate income and occupy a space in the market.

Reference

01. Turner T, Burri BJ. Potential nutritional benefits of current citrus consumption. *Agriculture (Switzerland)*. 2013;3(1):170–87. [Crossref] [PubMed] [Google Scholar]
02. Singh PK, Sah AK, Singh AK, Li Y-R. The Association of Sugarcane Technologists of India EXECUTIVE COUNCIL [Internet]. [cited 2021 May 2]. Available from: www.iisr.nic.in; [Crossref] [PubMed] [Google Scholar]
03. Divya PJ, Jamuna P, Jyothi LA. Antioxidant properties of fresh and processed Citrus aurantium fruit. Yildiz F, editor. *Cogent Food & Agriculture* [Internet]. 2016 May 19 [cited 2021 May 2];2(1):1184119. Available from: [Article] [Crossref] [PubMed] [Google Scholar]
04. Milind P, Dev C. ORANGE: RANGE OF BENEFITS [Internet]. Vol. 2012, IRJP. [cited 2021 May 2]. Available from: www.irjponline.com [Crossref] [PubMed] [Google Scholar]
05. Fundamentals Of Foods And Nutrition - Sumati R Mudambi - Google Books [Internet]. [cited 2021 May 2]. Available from: <https://books.google.co.in/books?id=rIOYafijhNoC&printsec=frontcover&dq=Fundamentals+of+Foods+and+Nutrition&hl=en&sa=X&ved=0ahUKEwiFi66Ii5zVAhWLOY8KH3CAwsQ6AEIIzAA#v=onepage&q=Fundamentals%20of%20Foods%20and%20Nutrition&f=false> [Crossref] [PubMed] [Google Scholar]
06. Oluremi OIA, Ojighen VO, Ejembi EH. The nutritive potentials of sweet orange (*Citrus sinensis*) rind in broiler production. *International Journal of Poultry Science*. 2006;5(7):613–7. [Crossref] [PubMed] [Google Scholar]
07. Zahra N, Kalim I, Khalid Saeed M, Ahmad I, Hina S. Nutritional Evaluation and Antioxidant Activity of Zest obtained from Orange (*Citrus sinensis*) Peels. [cited 2021 May 2]; Available from: www.researchtrend.net [Crossref] [PubMed] [Google Scholar]
08. Citrus Science and Technology: Fruit production, processing practices. . . - Google Books [Internet]. [cited 2021 May 2]. Available from: [Article] [Crossref] [PubMed] [Google Scholar]