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PJ Jadhav
Post Graduate Student, Department of Food Science and Technology, Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahmednagar, Maharashtra, India

PM Kotecha
Sr. Cereal Food Technologist, Sorghum Improvement Project, Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahmednagar, Maharashtra, India

AC Patil
Post Graduate Student, Department of Food Science and Technology, Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahmednagar, Maharashtra, India

UD Chavan
Head Department of Food Science and Technology, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahmednagar, Maharashtra, India

AA Pawar
Post Graduate Student, Department of Food Science and Technology, Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahmednagar, Maharashtra, India

Corresponding Author:
PJ Jadhav
Post Graduate Student, Department of Food Science and Technology, Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahmednagar, Maharashtra, India

Studies on utilization of papaya pulp powder in cookies

PJ Jadhav, PM Kotecha, AC Patil, UD Chavan and AA Pawar

Abstract
The present investigation on "Studies on utilization of papaya pulp powder in cookies" was undertaken to explore the underutilized or neglected but highly nutrient rich papaya pulp powder in bakery products. Papaya pulp powder is a rich source of crude fibre, Potassium, β-carotene and can be utilized in bakery products such as cookies. The prepared cookies were analyzed for nutritional composition. The changes occurred during storage of cookies were also studied. Preliminary experiments were conducted to find out optimum level of papaya pulp powder for preparation of quality cookies. The quality cookies were prepared from 15 g papaya pulp powder and 85 g maida. Chemical composition of papaya pulp powder showed that the moisture content was 4.4%, carbohydrates 51.00%, protein 4.06%, fat 1.30% and crude fiber 8.40%, Potassium 77.44 mg/100 g and β-carotene 582.40 µg/100 g. The physical properties of papaya pulp powder has yellow colour, bulk density 0.47 kg/cm3. The fresh cookies had 4.18% moisture, 12.80% protein, 24.25% fat, 2.10 mg/100 g crude fibre, 58.15% carbohydrates, 410.25 µg/100 g β-carotene and 163.51 mg/100 g Potassium. The sensory evaluation of cookies was carried out regularly at a interval of one month. The mean score for colour and appearance was 8.28, texture 8.33, flavour 8.31, taste 8.03 and overall acceptability was 8.24 on 9 point hedonic scales. Storage study of cookies showed that the cookies prepared by incorporation of 15 g papaya pulp powder and 85 g maida packed in polypropelyene (PP), low density polyethylene (LDPE) and aluminium foil can be stored up to 3 months in good condition with minimum losses in sensory, nutritional and textural characteristics.

Keywords: Utilization, papaya, preparation, cookies

Introduction
Papaya (*Carica papaya*) is recognized for nutritional and medicinal properties all over the world. From the times immemorial, all parts of papaya plant including its leaves, unripened and ripened fruits, seeds, pulp and their juice is utilized as traditional medicine. Today, papaya fruit is considered as nutraceutical fruit due to its multifaceted medicinal properties. Papaya has anti- fertility, diuretic, ureteric, antihypertensive, hypolipidemic, anti-helmintic, wound healing, antifungal, antibacterial and anticancer characteristics as well as free radical scavenging properties. Enzymes (papain), carotenoids, alkaloids, monoterpenoids, flavonoids, minerals and vitamins are all present in the whole plant (Mahendra and Amnerkar, 2016) [8].
Papaya (*Carica papaya*) is known all over the world for its nutritional and therapeutic benefits. All parts of the papaya plant, including the leaves, unripened and ripened fruits, seeds, pulp, and juice, have been used as traditional medicine since time immemorial. Because of its numerous medical characteristics, papaya fruit is now regarded a nutraceutical fruit. Antifertility, diuretic, ureteric, antihypertensive, hypolipidemic, anti-helmintic, wound healing, antifungal, antibacterial, and anticancer properties, as well as free radical scavenging qualities, are all attributes of papaya. The entire plant contains enzymes (papain), carotenoids, alkaloids, monoterpenoids, flavonoids, minerals, and vitamins (Mahendra and Amnerkar, 2016) [8].
Papaya pulp is made from the tropical fruit papaya. It may be used as a concentrate for juice, jams, baby food, addition to desserts and ice cream or just eaten as is. Commercial preparations of papaya pulp are available but it can be made easily at home from fresh papayas. When making papaya pulp it is important to use ripe papayas. When they are ripe it should be possible to make a mark if pressing the skin. The papaya is then pulped and cut in half. All seeds should be scooped out and then the papaya roughly chopped into pieces.
In India one of the most important segments of the food processing business is baking. People in society likes bakery product because they are readily available, convenient to eat as well as has a long shelf life (Vijayakumar *et al*., 2013) [11]. Since the earlier times, bakery products have become more popular in India. Cookies are the most popular of all bakery items. Cookies were invented very early. Because their moisture content is so low, they can be stored for a long period. Cookies are a chemically leavened baked product with a higher amount of fat as

well as sugar content (Navy, 1980) [9]. The market of cereals and bakery products is worth $1 billion in India and is increasing day by day (Bhise and Kaur, 2013) [4].
Cookies are the popular bakery product and this is consumed nearly by all levels of society. This is mainly due to its ready-to-eat nature, good nutritional quality and availability in different variety and affordable cost. Most of bakery products are utilized as a source for incorporation of different nutritionally rich ingredients for their diversification.

Materials and Methods

The experiment was conducted in the laboratory of Department of Food Science and Technology, Post Graduate Institute at Mahatma Phule Krishi Vidyapeeth, Rahuri during the year 2021-2022. Papaya pulp powder was prepared inlaboratory.

Packaging material

The packaging materials like low density polyethylene (LDPE), polypropylene (PP) and aluminium foil were purchased from the local market.

Ingredients

The major ingredients for the preparation of cookies such as maida, sugar and Vanaspati ghee were purchased from local market.

Method

Procedure for preparation of cookies by incorporating papaya pulp powder

The procedure for preparation of cookies by incorporating papaya pulp powder is shown in Fig. 1.

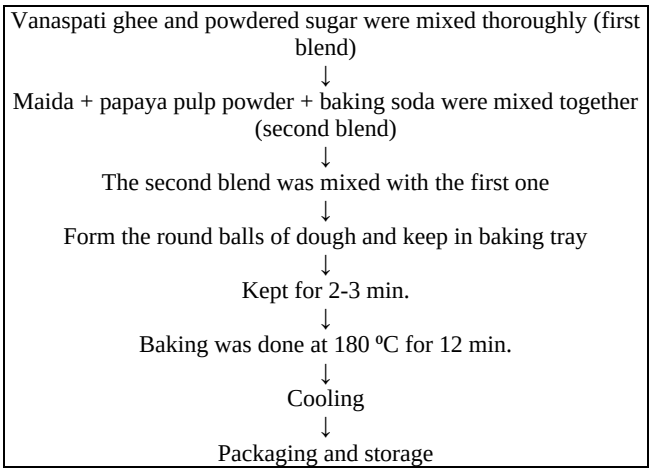

Fig 1: Flow sheet for preparation of cookies

Table 1: Treatment details

Treatments	Maida (g)	Papaya pulp powder (g)
T0 (Control)	100	00
T1	95	05
T2	90	10
T3	85	15
T4	80	20
T5	75	25

Physico-chemical analysis of raw material and cookies

The method described in A.A.C.C. (2000) [1] for determining moisture was used. The protein content of cookies was estimated by determining total nitrogen content using standard Micro- Kjeldhal method and fat conetnt of the cookies estimated by the soxhlet method A.A.C.C (2000) [2]. The crude fiber content in the product was estimated by A.A.A.C. (2000) [2]. The carbohydrate content in the selected cookies were obtained by subtracting from 100, the sum of values of moisture, protein, fat and ash content per 100 g of the sample (Raghuramulu, *et al.*, 1993) [12]. ß-carotene content of the selected samples was determined by the method of A.O.A.C. (1980) [3]. Potassium is estimated by flame photometer.

Packaging and storage of cookies

The selected treatment (T3) i.e. 15 g papaya pulp powder and 85 g maida blended cookies was packed in low density polyethylene (LDPE), polypropylene (PP) and aluminium foil and stored for 90 days. The cookies were drawn at an interval of 30 days and evaluated for chemical and sensory quality.

Sensory evaluation of cookies prepared by incorporation of papaya pulp powder

Sensory evaluation of cookies prepared by incorporation of papaya pulp powder was carried on by 9 point hedonic scale. The average scores of the ten judges for different quality characteristics *viz.* Colour and appearance, flavour, texture, taste and overall acceptability were recorded.

Statistical analysis

All experiments were carried out by using Completely Randomized Design (CRD) and Factorial Completely Randomized Design (FCRD). The data obtained in the present investigation were analyzed for the statistical significance according to the procedure given by Rangaswamy (2010) [10].

Results and Discussion

Table 2: Physico-chemical composition of raw materials used in the preparation of cookies

Sr. No.	Physical and Chemical constituents	Mean value (Papaya pulp powder)	Mean value (Maida)
1.	Color	Yellow	White
2.	Bulk density (g⁄cm3)	0.50	0.49
3.	Moisture (%)	4.4	13.17
4.	Protein (%)	4.6	11.90
5.	Fat (%)	1.30	0.78
6.	Crude fiber (%)	8.40	0.42
7.	Carbohydrates (%)	51.00	74.10
8.	β-carotene (µg/100 g)	582.40	380.15
9.	Potassium (mg⁄100 g)	77.44	148.00

Each value represents the average of three determinations

Table 3: Sensory evaluations of fresh cookies prepared by incorporation of papaya pulp powder

Treatments	Colour and appearance	Texture	Flavour	Taste	Overall acceptability
T0	8.3	8.4	8.1	8.0	8.20
T1	8.3	8.4	8.3	8.1	8.27
T2	8.4	8.5	8.3	8.3	8.37
T3	8.5	9.0	9.0	8.5	8.75
T4	8.1	8.2	8.3	8.0	8.15
T5	8.1	7.5	7.9	7.3	7.7
Mean	8.28	8.33	8.31	8.03	8.24
SE±	0.04	0.12	0.09	0.10	0.08
CD@5%	0.12	0.36	0.27	0.30	0.26

Maximum score out of 9

Whereas;
T0 = Cookies with 100 g miada and 00 g papaya pulp powder
T1 = Cookies with 95 g miada and 05 g papaya pulp powder
T2 = Cookies with 90 g miada and 10 g papaya pulp powder
T3 = Cookies with 85 g miada and 15 g papaya pulp powder
T4 = Cookies with 80 g miada and 20 g papaya pulp powder
T5 = Cookies with 75 g miada and 25 g papaya pulp powder

The organoleptic evaluation of cookies prepared by different combination of papaya pulp powder and maida were carried out. The cookies were prepared and presented to panel of ten judge for assessing the quality and acceptability of product. Organoleptic evaluation of cookies was carried out using a 9 point hedonic scale of sensory characteristics such as colour, texture, taste and overall acceptability.
Treatment T3 i.e. 15 g papaya pulp powder and 85 g maida was selected and kept for 3 months for storage study. Chemical analysis and sensory evaluation was done at interval of 30 days.

Changes in chemical parameters of papaya pulp powder and maida blended cookies during storage

Table 4: Chemical analysis of papaya pulp powder and maida blended cookies during storage

Parameter	Moisture (%)	Protein (%)	Fat (%)	Crude fibre (%)	Carbohydrate (%)	β- carotene (µg/ 100 g)	Potassium (mg/ 100 g)
Initial							
T1P1	4.19	11.85	24.00	1.65	57.25	374.88	162.15
T1P2	4.17	11.86	24.01	1,64	57.26	374.89	162.16
T1P3	4.17	11.87	24.02	1.65	57.27	374.91	162.18
T2P1	4.24	12.75	24.15	2.07	58.10	410.27	162.43
T2P2	4.22	12.76	24.16	2.08	58.11	410.18	163.44
T2P3	4.21	12.77	24.17	2.10	58.12	410.20	163.20
Final							
T1P1	4.26	11.77	23.84	1.61	57.17	374.64	162.01
T1P2	4.27	11.80	23.86	1.60	57.20	374.76	162.03
T1P3	4.22	11.83	23.89	1.61	57.23	374.79	162.06
T2P1	4.34	12.67	24.00	2.02	58.02	410.05	163.21
T2P2	4.32	12.70	24.01	2.04	58.05	410.08	163.34
T2P3	4.29	12.73	24.04	2.05	58.08	410.14	163.14

Whereas;
T1 - 100 g maida (Control treatment)
T2 - 85 g maida and 15 g papaya pulp powder P1 – Low density polyethylene (LDPE)
P2 - Polypropylene bag (PP) P3 – Aluminium foil

The data in Table 4 shows that protein and β-carotene contents decreased in T2 with increasing papaya pulp powder concentration, this is due to replacing the maida which is major source of the protein and fat. On the otherside, moisture, crude fibre and pottasium increased in T2 by increasing the level of papaya pulp powder, as from the proximate composition of the papaya pulp powder it is clear that pulp powder is a major source of the crude fibre, potassium and fat. Except moisture all other parameters found decreased in final analysis as compared to initial analysis. Cookies stored in aluminium foil shows better quality than LDPE and polypropylene (PP).

Changes in sensory parameters of papaya pulp powder and maida blended cookies during storage

Table 5: Sensory evaluation of papaya pulp powder and maida blended cookies during storage

Treatment	Colour and appearance	Texture	Flavour	Taste	Overall acceptability
Initial					
T1P1	8.24	8.34	8.04	7.96	8.14
T1P2	8.25	8.35	8,05	7.97	8.15
T1P3	8.25	8.35	8.05	7.97	8.15
T2P1	8.45	8.95	8,96	8.47	8.70
T2P2	8.45	8.96	8.95	8.48	8.71
T2P3	8.46	8.96	8.96	8.48	8.71
Final					
T1P1	7.78	7.88	7.58	7.61	7.71
T1P2	7.75	7.95	7.65	7.67	7.78
T1P3	7.91	8.01	7.71	7.71	7.83
T2P1	8.05	8.55	8.56	8.17	8.33
T2P2	8.07	8.54	8.57	8.20	8.34
T2P3	8.14	8,65	8.64	8.23	8.41

Maximum score out of 9

Whereas;
T1 - 100 g maida (Control treatment)
T2 - 85 g maida and 15 g papaya pulp powder P1 – Low density polyethylene (LDPE)
P2 - Polypropylene bag (PP) P3 – Aluminum foil

The data in table 5 show that papaya pulp powder and maida blended cookies (15 g papaya pulp powder and 85 g maida) remained in good condition at ambient temperature during theentire storage period of 3 months. The cookies stored in aluminium foil bags showed good quality than polypropylene

(PP) and LDPE during 3 months of storage. The overall acceptability score of papaya pulp powder and maida blended cookies was decreased from 8.70 to 8.33 in LDPE, 8.71 to 8.34 in PP and 8.71 to 8.41 in aluminium foil.

Conclusion

Papaya pulp powder and maida blended cookies prepared with combination of 15 g papaya pulp powder and 85 g maida was best and it was fairly stable to storage period for chemical composition. The cookies remained in good condition during storage period of 3 month. The cookies stored in aluminium foil showed good quality than polypropylene (PP) and LDPE during 3 month storage.

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