International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(4): 1019-1023

Received: 26-05-2018
Accepted: 29-06-2018

Sadal KB
Department of Agricultural Engineering, Maharashtra Institute of Technology, Aurangabad, Maharashtra, India

Dabhade SB
Department of Agricultural Engineering, Maharashtra Institute of Technology, Aurangabad, Maharashtra, India

Bornare DT
Department of Agricultural Engineering, Maharashtra Institute of Technology, Aurangabad, Maharashtra, India

Correspondence
Sadal KB
Department of Agricultural Engineering, Maharashtra Institute of Technology, Aurangabad, Maharashtra, India

Development and quality evaluation of Pineapple Pomace Powder fortified biscuits

Sadal KB, Dabhade SB and Bornare DT

Abstract
The present investigation was carried out to study the preparation of pineapple pomace powder biscuit as a valuable healthful food. Many by-products of fruits could be profitably used for development of value added products. The pineapple pomace was obtained during extraction of pineapple juice which is used as rich source of dietary fibre. Fibre rich biscuits were prepared by substituting whole wheat flour with pineapple pomace powder at 5%, 10%, and 15% respectively and evaluated for its physical properties, chemical composition, textural properties and sensory characteristics. Results obtained showed that weight and thickness of the Biscuits increased whereas the diameter and spread ratio decreased with the increase in Pineapple pomace powder in flour blend. The moisture, crude fibre and ash content increased whereas the protein and carbohydrate content decreased with the increase in Pineapple Pomace Powder in flour blend. The fat content of the biscuits showed no pronounced variation. The hardness of the biscuits increased with increase in the level of incorporation of Pineapple pomace powder in the flour blends. The Addition of PPP had adverse effect on colour of biscuit; however the texture score decreased with the increase in the level of PPP. Finally it was concluded that biscuits with 10% PPP were found to be most acceptable due to attractive appearance; and better taste and flavour.

Keywords: Whole wheat flour, Pineapple Pomace Powder (PPP), biscuits, fibre, texture

Introduction
Pineapple world production reached 21.8 million of tons in 2011 (FAO, 2013), and most of its production is used for processing as fruits salads, juices, concentrates, and jams. During processing, large amounts of byproducts, consisting mainly of peel and pomace are generated, representing about 25–35% of the fruit weight. Since most of these byproducts have no specific destination, they may be inappropriately disposed causing environmental issues. Consequently, it is of vital importance to reuse industrial byproducts in order to improve the process economics and its sustainability. It is well-known that dietary fibre plays an important role in human health, promoting several physiological and metabolic positive effects. The insoluble dietary fibre acts as a bulking agent, normalising intestinal motility, preventing constipation while soluble fibre is associated to decreasing the intestinal absorption of cholesterol and glucose. Due to all of these benefits of dietary fibre intake, a tendency in the development of products enriched with fibre or with specific fibre claims has already been observed for some time. According to the Food and Drug Administration (FDA) (2013), to have a product with a ‘‘high source of fibre’’ and ‘‘good source of fibre’’ claim, it must contain, respectively, 20% or more fibre and 10–19% of fibre of the recommended daily value for dietary fibre in a serving size. (Selani *et al*., 2014) [5].

Wheat (*Triticum aestivum*) is grown throughout the world. Wheat is nutritious, easy to store and transport and can be processed into various types of food. Wheat is considered a good source of protein, minerals, B-group vitamins and dietary fibre. Wheat flour is used to prepare bread, produce biscuits, confectionary products, noodles and vital wheat gluten or seitan. Wheat germ and wheat bran can be a good source of dietary fibre helping in the prevention and treatment of some digestive disorders. (Lourembam *et al*., 2016) [3].

Baked products have been widely used for incorporating healthy compounds and different plant fibre products are added to various baked food products in order to increase their fibre content. Among bakery products cookies are ideal for supplementation due to palatability, compactness, convenience and long shelf life of the product (Wade, 1988); and being liked by all the segments of the consumers. Thus, it is good carrier for providing a fibre rich product. (Sahni *et al*., 2016) [9].

Biscuits, which are leavened baked products, are one of the most delicious foods preferred by most people. Biscuits represent the largest category of snack item among bakery products (Pratima and Yadav, 2000) [7]. They are stable foods and have advantages such as ready-to-eat form, wide consumption, long shelf life and eating quality. Biscuits are widely accepted and consumed by almost all profiles of consumers in many countries and therefore offer a valuable supplementation vehicle for nutritional improvement. Currently, cookies are prepared from composite flour or fortified with some other good sources of nutrients. Modifications of basic recipes and incorporation of new ingredients such as fibers, fat replacers, cereals other than wheat, *etc*. have led to novel biscuit formulations with improved functionality and nutritive value. (Thivani *et al*., 2016) [4].

The present study was carried out to find out the effect of addition of different proportion of pineapple pomace powder on physical properties, chemical properties, texture and sensory characteristics of fibre rich biscuits.

Materials and Methods

Preparation of Pineapple Pomace Powder (PPP)

Pineapple were washed, de-headed and peeled and subjected to juice extraction. After juice extraction pomace was spread on aluminium trays keeping bed thickness of 0.5 cm and was dried at 60°C for 5 hours in cabinet drier. Dry pomace was pulverized using domestic grinder and sifted through sieve of 250 um particle size and packed in HDPE and stored in cool and dry place. Flow chart for the preparation of Pineapple pomace powder is presented in figure1.

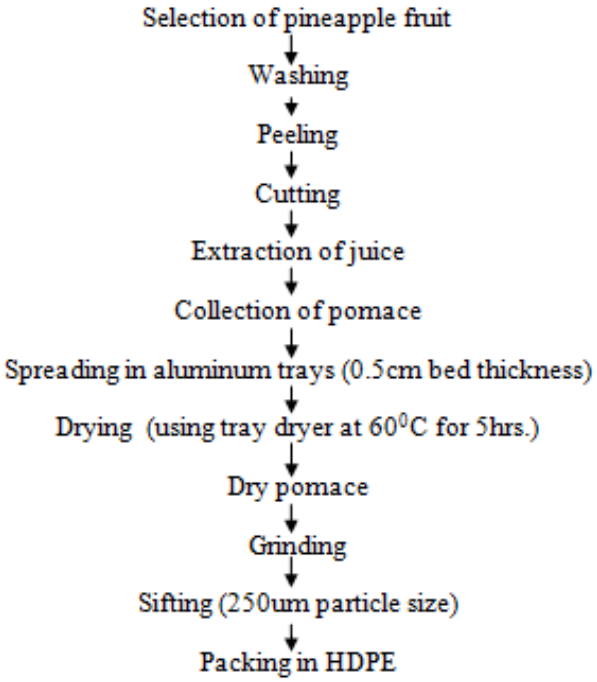


Fig 1: flow chart of pineapple pomace powder

Preparation of flour blends: Substitution of Whole wheat flour with pineapple pomace powder was done at different levels *viz.* 5%, 10% and 15%,

Preparation of Biscuits

Biscuits were prepared using creamery method for making biscuit dough. The ingredients (g) used in preparation of biscuits were flour blends 100, fat 20, sugar 40, SMP 10 (g) baking powder 1.5, ammonium bicarbonate 1.5 and water as per requirement for making dough. Dough was rolled in sheet of 0.5 cm thickness and cut into circular shape with dye. The pieces were placed in the baking tray smeared with fat and baked at 160°C for 20 min. The biscuits were allowed to cool, packed and stored at ambient temperature.

Physical Properties

The weight, diameter, thickness, spread ratio and spread factor of biscuits were calculated as per AACC methods (AACC, 1976) [1]. Top grain was visually assessed as a function of number of cracks formed over the surface of the biscuits.

Chemical Composition

Moisture, crude fat, protein, ash and crude fibre content of different samples of biscuits were determined as per standard methods (AACC, 2000) [2]. Total carbohydrate was obtained by difference.

Textural Properties

Stable Micro System *TAXT2 plus* Texture Analyzer was used for texture profile analysis (TPA) of biscuits. The test was configured so that the hardness calculated at the time of the test by determining the load and displacement at predetermined points on the TPA curve. S-5 probe with 20 mm/sec. of pre-test and post-test speeds; and 75% compression were selected for TPA analysis. The maximum force required to break the biscuits was noted as hardness.

Sensory Characteristics

The sensory characteristics of biscuits were evaluated for its different sensory attributes using ten semi trained panellists. Panellists were given control sample and the treatments at the time of evaluation. Sensory attributes like colour and appearance, texture, taste, flavour and overall acceptability were evaluated using 9 point hedonic rating (Ranganna, 2011) [8].

Statistical Analysis

Completely Randomized Design (CRD) was used to test the significance of results (Panse and Sukhatme, 1984) [6].

Results and Discussion

Physical properties of biscuits

Effect of incorporation of Pineapple pomace powder at various levels on physical properties of the biscuts is presented in Table 1. Weight of the biscuits increased progressively from 9.58 g to 9.81 g with increase in the level of Proportion of PPP. Increase in the weight could be due to water binding capacity of PPP. The increase in Proportion of PPP in flour blend resulted in poor spreading of biscuits and progressive decrease in diameter, spread ratio and spread factor and increase in the thickness of biscuits poor spreading resulted from high viscosity of dough due to absorption of water of PPP.

Table 1: Physical properties of biscuits incorporated with pineapple pomace powder

Sample	Wt of biscuits (gm)	Diameter of biscuits (mm)	Thickness of biscuits (mm)	Spread ratio of biscuits
T0	1. 9.58±0.01	2. 48.25±0.01	3. 3.53±0.05	4. 13.65±0.2
T1	5. 9.65±0.01	6. 48.23±0.015	7. 3.56±0.015	8. 13.53±0.04
T2	9. 9.74±0.01	10. 48.22±0.01	11. 3.73±0.01	12. 12.80±0.03
T3	13. 9.81±0.01	14. 48.18±0.01	15. 3.86±0.05	16. 12.45±0.01
SE±	17. 0.00204	18. 0.0096	19. 0.00118	20. 0.0091
CD at 5%	21. 0.00599	22. 0.02815	23. 0.00346	24. 0.0267

* Each value is average of three determinations

T_0- Control, T_1- 5% pineapple pomace powder, T_2- 10% pineapple pomace powder, T_3- 15% pineapple pomace powder.

Chemical properties of biscuits

The effect of incorporation of pineapple pomace powder at various levels on chemical properties of the biscuits is presented in Table 4. The moisture content of biscuits increased linearly with increased level of replacement of PPP in flour blend. The increase in moisture content was due to water holding capacity of PPP. The fat content of the biscuits showed no pronounced variation due to low fat content of whole wheat wheat flour and PPP. Crude fibre and ash content of the biscuits increased linearly with the increase in the PPP content in the biscuits. The crude fibre content increased at different levels of replacement (0% to 15 %) ranging from 1.36 % -3.13 %. Marked increase in fibre and ash content was due to high crude fibre and ash content of PPP. Protein and carbohydrate content of the biscuits decreased linearly with the increase in PPP in the biscuits. Since whole wheat flour was having higher protein than PPP, replacement of whole wheat flour by PPP resulted in low protein content in the biscuits.

Table 2: Chemical composition of biscuits incorporated with pineapple pomace powder

Sample	Moisture (%)	Fat (%)	Crude Fibre (%)	Ash (%)	Protein (%)	Carbohydrate (%)
T0	25. 2.26±0.01	17.55±0.09	1.36±0.01	1.26±0.02	7.63±0.45	69.8±0.23
T1	26. 2.34±0.01	17.46±0.05	2.16±0.02	1.40±0.05	7.46±0.5	68.96±0.04
T2	27. 2.35±0.02	17.68±0.06	2.55±0.17	1.51±0.01	7.36±0.2	68.53±0.15
T3	28. 2.42±0.01	17.77±0.01	3.13±0.03	1.62±0.01	7.23±0.01	29. 67.78±0.1
SE±	30. 0.01763	0.01025	0.00782	0.00825	0.00842	31. 0.00312
CD at 5%	32. 0.0517	0.03007	0.02293	0.0242	0.02469	33. 0.00915

* Each value is average of three determinations

T_0- Control, T_1- 5% pineapple pomace powder, T_2- 10% pineapple pomace powder, T_3- 15% pineapple pomace powder

Sensory evaluation of biscuits incorporated with pineapple pomace powder

Sensory scores of the biscuits incorporated with pineapple pomace powder are presented in Table 2. Sensory scores for colour and appearance decreased with the increase in the level of PPP in flour blend. Texture score of the biscuits gradually decreased with the increase in the levels of PPP. Addition of PPP improved the taste of biscuits by imparting it typical pineapple taste. Biscuits maintained acceptable taste even up to 10 % addition. PPP improved the flavour of biscuits due to development of peculiar pineapple flavour. Overall acceptability scores of the biscuits increased upto 10% addition of PPP followed by decrease in the score. In comparison to biscuits with 15 % PPP showed markedly decreased sensory scores.

Table 3: Sensory evaluation of biscuits incorporated with pineapple pomace powder

Variation	Color	Texture	Taste	Flavor	Overall acceptability
T_0	8.3	8.4	7.9	7.8	8.1
T_1	8.1	8.2	8.1	8.1	8.1
T_2	7.9	8.1	8.7	8.5	8.3
T_3	6.9	7.7	7.6	7.2	7.3
SE±	0.06040	0.1748	0.09884	0.12056	0.04564
CD at 5%	0.17738	0.5271	0.28989	0.3536	0.13388

* Each value is average of 10 determinations

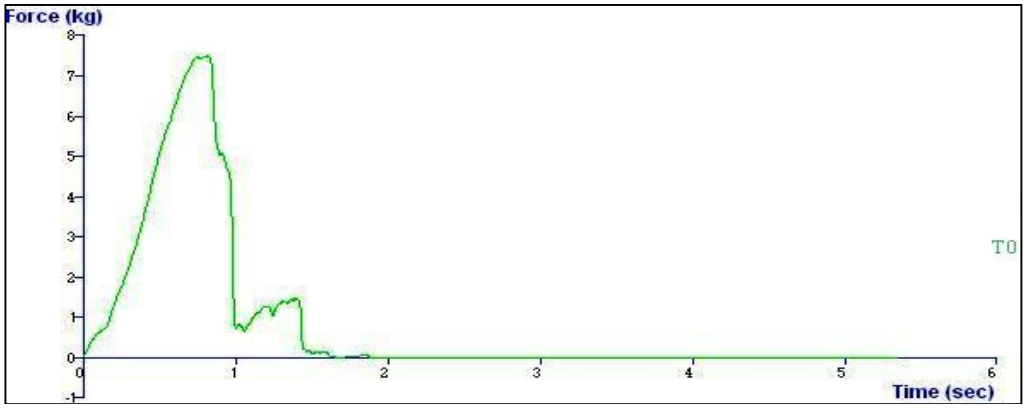
T_0- Control, T_1- 5% pineapple pomace powder, T_2- 10% pineapple pomace powder, T_3- 15% pineapple pomace powder.

Table 4: Texture Profile Analysis of cookies incorporated with beetroot pomace powder

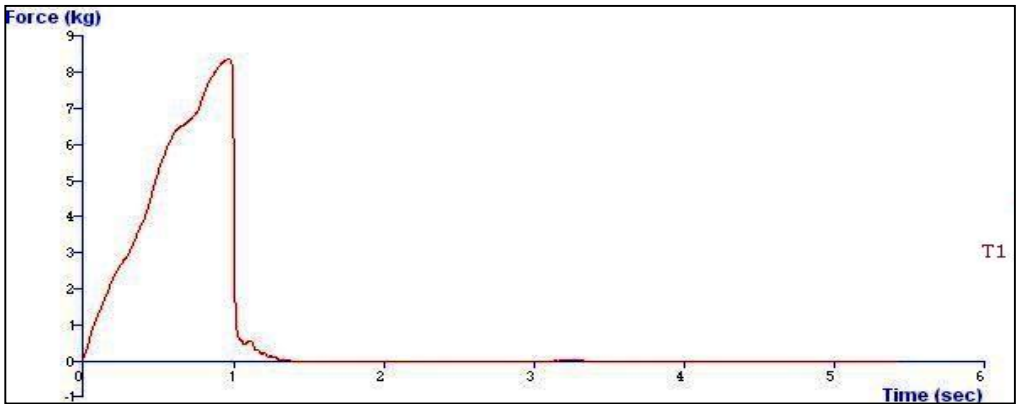
Sample	Hardness (Kg)
T_0	7.51
T_1	8.41
T_2	8.89
T_3	10.02

T_0- Control, T_1- 5% pineapple pomace powder, T_2- 10% pineapple pomace powder, T_3- 15% pineapple pomace powder

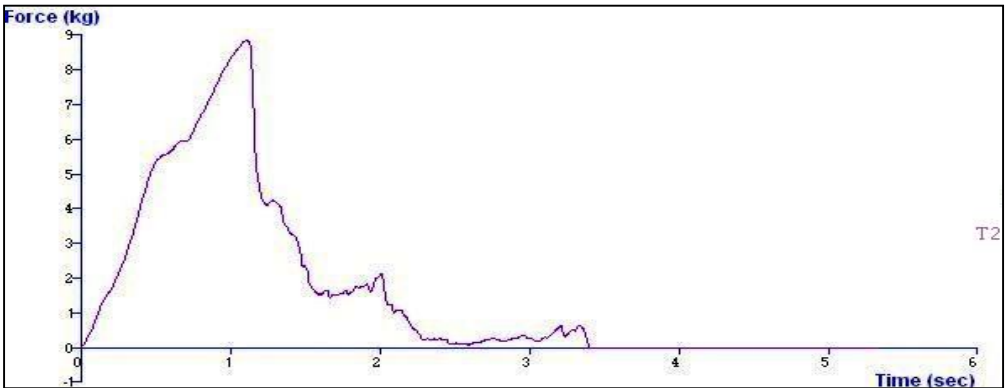
It can be observed from the above table that the hardness value of the biscuit increased with respect to level of incorporation of PPP. The hardness of biscuit was reported to be increased from 7.51 to 10.02 kg. The maximum hardness was noted in case of sample T3 i.e. 10.02 kg containing 15% PPP.



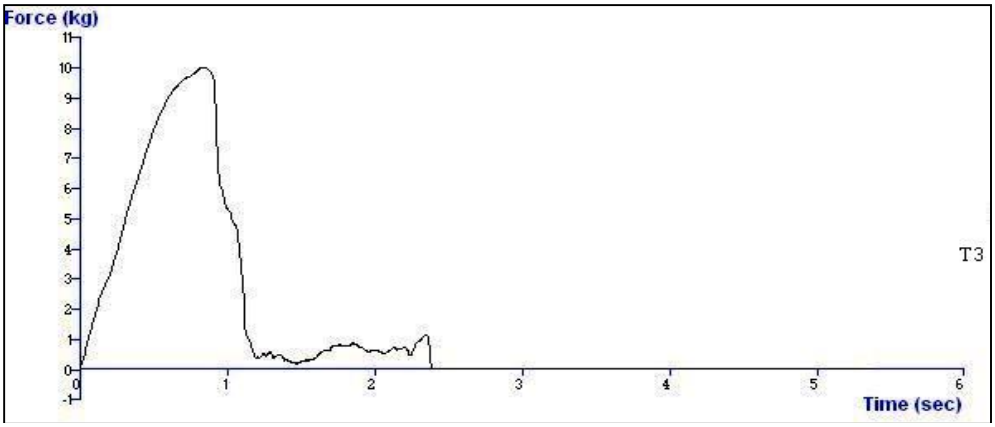
1.1: Representative TPA graph of Control Sample (0 % Incorporation)



1.2: Representative TPA graph of Control Sample (5 % PPP)



1.3: Representative TPA graph of Control Sample (10 % PPP)



1.4: Representative TPA graph of Control Sample (15 % PPP)

Fig 2: Representative graphs of Texture Profile Analysis (TPA) of Biscuits.

It is evident from graphs that there was increase of peak positive force with the increase in the level of incorporation of pineapple pomace powder representing decrease in the crunchiness of the biscuit.

Conclusion

Pineapple pomace is an underutilized by-product which is rich source of dietary fibre and can be utilized for developing fibre rich bakery products. Incorporation of PPP decreased the spread ratio of biscuits. The biscuits with 10 % level of incorporation of PPP were found to be most acceptable level due to improved taste and flavour. However, it was found that incorporation at high level adversely affected the colour and appearance, and texture of the biscuits thus, reducing overall acceptability of the biscuits. Hardness of the biscuits increased with the increase in level of incorporation PPP. Incorporation of PPP resulted in increase in the fibre content of biscuits. Thus, Pineapple pomace powder can be a used as source of fiber for enrichment of the biscuits.

References

1. AACC. American Association of Cereal Chemists 7th Ed, 1976.
2. AACC. Approved Methods of the American Association of Cereal Chemists, 10th Ed, 2000.
3. Lourembam Kamala Devi, Sachin Karoulia, Neha Chaudhary. Preparation of High Dietary Fibre Cookies from Pineapple (*Ananas comosus*) Pomace. International Journal of Science and Research. 2016; 5:2319-7064.
4. Thivani M, Mahendran1 T, Kanimoly M. Study on the physico-chemical properties, sensory attributes and shelf life of pineapple powder incorporated biscuits. Ruhuna journal of science. 2016; 7:32-42.
5. Miriam Mabel Selani, Solange Guidolin Canniatti Brazaca, Carlos Tadeu dos Santos Dias, Wajira Ratnayake S, Rolando Flores A *et al*. Characterisation and potential application of pineapple pomace in an extruded product for fibre enhancement. Food Chemistry. 2014; (163):23-30.
6. Panse VS, Sukhatme PV. Statistical Methods for Agricultural Workers, I.C.A.R., New Delhi, 1984, 70-72.
7. Pratima A, Yadave MC. Effect of incorporation of liquid dairy by-product chemical characteristic of soy fortified biscuits during storage. Journal Food Science and Technology. 2000; 37:158-161.
8. Ranganna S. Handbook of Analysis and Quality Control for Fruit and Vegetable Products, 2nd Edition, Tata Mcgraw Hill, 2011.
9. Sahni P, Shere DM. Physico-chemical and Sensory Characteristics of Carrot Pomace Powder Incorporated Fibre Rich Cookies. Asian J Dairy & Food Res. 2016; 36(4):327-331.
10. Wade P. Biscuit, Cookies and Crackers: The Principles of the Craft. Elsevier Applied Science, London, 1988, 1.