



P-ISSN: 2349-8528

E-ISSN: 2321-4902

IJCS 2017; 5(6): 2016-2018

© 2017 IJCS

Received: 04-09-2017

Accepted: 05-10-2017

Fiza Nazir

Division of Food Science and Technology, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu and Kashmir, India

Rehana Salim

Division of Food Science and Technology, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu and Kashmir, India

HR Naik

Division of Food Science and Technology, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu and Kashmir, India

Syed Zameer Hussain

Division of Food Science and Technology, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu and Kashmir, India

Studies on storage stability of apricot and date incorporated rice based extruded snack

Fiza Nazir, Rehana Salim, HR Naik and Syed Zameer Hussain

Abstract

Storage studies are an important parameter to analyse the quality characteristics and product behaviour during storage. A study was conducted at the *Division of Food Science and Technology, SKUAST- K, Shalimar* to investigate the effect of storage on quality characteristics of apricot + date incorporated rice based extruded product. The extrudate using broken rice flour + apricot powder: date powder in the proportion of 90:10 respectively was developed under optimized conditions of 15% moisture content, 450 rpm screw speed and 170°C barrel temperature and stored in high density polyethylene for three months at ambient temperature. Moisture content, water activity, free fatty acids, hardness, total plate count and sensory properties of extrudate were evaluated at an interval of one month for three months.

Keywords: Apricot powder, Broken rice flour, Date powder, Extrudate, Storage.

1. Introduction

Extrusion cooking is an important and popular food processing technique classified as a high temperature/short time process to produce fiber-rich products (Gaosong and Vasanthan, 2000; Vasanthan, *et al.*, 2002) [1, 2]. In the extruder, the food mix is thermo mechanically cooked to high temperature, pressure and shear stress which are generated in the screw-barrel assembly. The thermo mechanical action during extrusion brings about gelatinization of starch, denaturation of protein and inactivation of enzymes, microbes and many anti-nutritional factors; all this occurs in a shear environment, resulting in a plasticized continuous mass (Bhattacharya and Prakash, 1994) [3]. Nowadays, there is focus on foods with functional properties. The consumer's interest has been toward foods with more natural antioxidants, dietary fibers, natural colorants, minerals, vitamins and synthetic additives free.

Cereal grains are generally used as major raw material for development of extruded snack foods due to their good expansion characteristics because of high starch content. The broken rice is a byproduct of modern rice milling process. The rice portion can have varying percentages (5- 7%) of broken kernels which contain nutritive value similar to whole rice and are available readily at relatively lower cost. Rice flour has become an attractive ingredient in the extrusion industry due to its bland taste, attractive white color, hypoallergenicity and ease of digestion (Kadan *et al.*, 2003) [4]. Apricot (*Prunus armeniaca*) is the most important fruit crop in Ladakh division of Jammu and Kashmir. Nutritionally, it is a rich source of sugars, fibers, minerals, bioactive phytochemicals and vitamins like A, C, thiamine, riboflavin, niacin and pantothenic acid (Leccese *et al.*, 2007) [5]. Dates are one of the most popular fruits packed with essential nutrients, vitamins and minerals that are required for normal growth, development and overall well-being. Since antiquity, both fruits and pits of dates have been of use in various traditional and folk systems of medicines where date palms are found to be growing (Duke, 1992; Khare, 2007) [6, 7]. The chemical composition of the date shows that the flesh is an important source of sugar (81-88%, mainly fructose, glucose and sucrose), dietary fibre (5-8.5%) and small amounts of protein, fat, ash and polyphenol (Al-Farsi *et al.*, 2007; Al-hooti *et al.*, 1995; Al-Shahib and Marshall 2002) [8, 9, 10]. Thus, dates provide a good source of rapid energy (sugars) and a good nutritional value, based on their dietary fibre (DF) contents. DF has important therapeutic implications (e.g. for diabetes, obesity) and exhibits a protective effect (Goni, *et al.*, 2000; Guillon and Champ, 2000; Hill, 1998; Roehrig, 1988) [11, 12, 13, 14].

The loss of nutrients in fruits and vegetables depends on the type of food, processing time, processing temperature, and storage conditions. Some preservation methods are also believed to be responsible for depleting the naturally occurring antioxidants in the foods, with a subsequent decrease in their health-protecting capacity

Correspondence**Fiza Nazir**

Division of Food Science and Technology, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu and Kashmir, India

(Kalt, 2005; Puupponen-Pimia *et al.*, 2003) ^[15, 16]. Extrusion being a high temperature short time process retains most of the bioactive components of raw materials.

Nowadays, consumers are increasingly demanding high food quality, and they have corresponding expectations that the quality of their food will be maintained at a high level during the period between purchase and consumption. Shelf life is an important attribute of all foods, including raw materials, ingredients, and manufactured products. It is defined as the time during which the food product will (1) remain safe; (2) be certain to retain desired sensory, chemical, physical, and microbiological characteristics; (3) comply with any label declaration of nutritional data; and (4) be acceptable to the consumer (Earle and Earle, 2008) ^[17].

2. Materials and Methods

Paddy was milled in Division of Food Science and Technology using Rubber roller based rice mill. Rice brokens were ground in a lab mill (model 3303 perten, Sweden) to a fineness that passes through 200 μ m sieve. Dried apricot and date were ground into powder using grinder (Black and Decker FG 550). The blend of rice + apricot: date was extruded at pre-optimized conditions i.e. 90% rice + apricot: 10% date, 15% moisture, 450 rpm screw speed and 170°C barrel temperature and stored in HDPE for three months. Extruded snacks were studied at an interval of one month for moisture, water activity, hardness, free fatty acids, total plate count and sensory quality.

Moisture was studied as per AOAC 1995 method. Water activity was measured using water activity meter (AQUA LAB, SN: PRE-000197). Hardness was estimated using Texture analyser. Standard AOAC procedure was followed with slight modification for free fatty acid determination.

Sensory evaluation of snacks was done by a panel of semi-trained judges using 5- point scale. Total plate count was studied by standard serial dilution plate count method using nutrient agar (Anonymous, 1957) ^[19], Martin's lose Bengal agar (Martin and James, 1995) ^[20]

2.1 Extrusion processing

The extrusion was performed using a co-rotating intermeshing twin screw extruder model BC 21 (Cleextral, Firminy, France). The barrel consisted of four zones heated electrically. The temperature distribution inside barrel varied from low at the zone next to the feeding to high at zone next to die. Temperature of the 1st, 2nd, and 3rd was maintained at 20, 30 and 40°C, respectively, throughout the study; while the temperature in last zone (compression and die section) was varied. The extruder was equipped with torque indicator which showed percent of torque in proportion the current drawn by drive motor. The raw material was fed into the extruder with a single-screw volumetric feeder. A cutter with bladed knives and a die made of stainless steel were used for shaping the extrudates.

3. Results and discussion

The rice + apricot: date extrudate was extruded at pre-optimized condition (Composition – 90% rice + apricot: 10% date powder, moisture content – 15%, screw speed – 450 rpm and Barrel temperature – 170°C). The extrudate was stored in high density polyethylene for three months under ambient conditions and analysed at one month's interval for moisture, hardness, free fatty acids, water activity and overall acceptability.

Table 1: Effect of storage period on moisture content, free fatty acids, water activity, breaking strength, total plate count and overall acceptability

Storage period (month)	Moisture content (%)	Free fatty acids (%)	Breaking strength (N)	Water activity	Total plate count (CFU/g)	Overall acceptability
0	4.31	0.007	85.02	0.42	0.00	4.50
1	4.43	0.007	81.57	0.45	0.00	4.16
2	4.73	0.008	78.00	0.46	6.00	4.03
3	5.07	0.010	75.95	0.50	9.00	3.83
CD (p \leq 0.05)	0.015	0.001	0.248	0.012	0.591	0.162

3.1 Moisture content

The moisture content of extruded snacks increased during storage period of 90 days. The moisture content of product ranged from 4.31-5.07 per cent. Increase in moisture content of extrudates was due to absorption of moisture from the storage environment owing to their hygroscopic nature. Similar results for extruded snacks were reported by Kocherla *et al.* (2012) ^[21]. Sumathi *et al.* (2007) ^[22] also reported that increase in the moisture content was considerable for pearl millet based extruded samples packed in HDPE. Results obtained in the present investigation are well in agreement with the above-mentioned researchers. Charunuch *et al.* (2008) ^[23] reported an increase in moisture content in Thai rice extruded snack supplemented with mulberry during storage of 4 months.

3.2 Free fatty acids

During the storage period of three months the free fatty acids increased. The free fatty acids of product ranged between 0.007-0.010 per cent. The increase in free fatty acids was within permissible limits. The increase in free fatty acids

during storage might be due to the breakdown of long fatty acid chain into individual fatty acid moieties and increased lipid hydrolysis at elevated temperature (Khan *et al.*, 2011) ^[24]. Similar results were also reported by Bindu and Srinivas (2007) ^[25]; Aubourg and Medina (1997) ^[26].

3.3 Breaking strength

The hardness of the extrudates showed a decreasing trend during a storage period of three months. The hardness of the product decreased from 85.02-75.95 N. The decrease in hardness might be related to gain in moisture of extrudates and thereby increased starch bonding (Dar *et al.*, 2014) ^[27]. These results are in alignment with those of Hussain *et al.* (2015) ^[28].

3.4 Water activity

The water activity of extruded products increased during storage from 0.42-0.50. Water activity is an indicator of quality and stability of extruded food products. The increase in water activity of extrudates might be attributed to the

humid environmental conditions. These results are in alignment with those of Hussain *et al.* (2015) [28].

3.5 Total plate count

The microbiological change as measured by TPC in the extruded snacks stored at ambient temperature condition was within permissible limits. This indicates the extrudates were microbiologically safe during the storage period. Similar findings were reported by Hussain *et al.* (2015) [28].

3.6 Overall acceptability

The extrudates were organoleptic evaluation every month during storage period of three months. Overall acceptability score showed a slight decrease during the storage period of 90 days. The evaluated organoleptic parameters were within acceptable range during storage period of three months.

4. Conclusion

Storage studies revealed that rice + apricot: date extruded products showed no significant changes in quality and overall acceptability during three months of storage. All the quality parameters were within acceptable limits. There was a slight decrease in acceptability owing to the texture degradation due to moisture absorption by extrudates. It can be concluded that rice based apricot and date powder incorporated extruded products are fit for consumption when stored in high density polyethylene for three months of storage.

5. References

1. Gaosong J, Vasanthan T. The effect of extrusion cooking on the primary structure and water solubility of b-glucans from regular and waxy barley. *Cereal Chemistry*. 2000; 77:396-400.
2. Vasanthan T, Gaosong J, Yeung J, Li J. Dietary fiber profile of barley flour as affected by extrusion cooking. *Food Chemistry*. 2002; 77:35-40.
3. Bhattacharya S, Prakash M. Extrusion of blends of rice and chick pea flours: A response surface analysis. *Journal of Food Engineering*. 1994; 21:315-330.
4. Kadan RS, Bryant RJ, Pepperman AB. Functional properties of extruded rice flours. *Journal of Food Science*. 2003; 68:1669-1672.
5. Leccese A, Bartolini S, Viti R. Total antioxidant capacity and phenolics content in apricot fruits. *International Journal of Fruit Science*. 2007; 7(2):3-16.
6. Duke JA. *Handbook of phytochemicals of GRAS herbs and other economic plants*. USA: CRC Press, 1992.
7. Khare CP. *Indian medicinal plants: An illustrated dictionary*. New York: Springer Verlag, 2007.
8. Al-Farsi M, Alasalvar C, Al-Abid M, Al-Shoaily K, Al-Amry M, Al-Rawahy F. Compositional characteristics of dates, syrups and their by-products. *Food Chemistry*. 2007; 104:943-947.
9. Al-Hooti S, Sidhu JS, Qabazard H. Studies on the physiochemical characteristics of date fruits of five UAE cultivars at different stages of maturity. *Arab Gulf Journal of Scientific Research*. 1995; 13(3):553-569.
10. Al-Shahib W, Marshall RJ. Dietary fibre content of dates from 13 varieties of date palm *Phoenix dactylifera* L. *International Journal of Food Science and Technology*. 2002; 37:719-721.
11. Goni I, Valdivieso L, Garcia-Alonso A. Nori seaweed consumption modifies glycemic response in healthy volunteers. *Nutrition Research*. 2000; 20:1367-1375.
12. Guillon F, Champ M. Structural and physical properties of dietary fiber and consequence of processing on human physiology. *Food Research International*. 2000; 33:233-245.
13. Hill JM. Cereal, dietary fiber and cancer. *Nutrition Research*. 1998; 18:653-659.
14. Roehrig KL. The physiological effects of dietary fiber-A review. *Food Hydrocolloids*. 1988; 2(1):1-18.
15. Kalt W. Effects of production and processing factors on major fruit and vegetable antioxidants. *Journal of Food Science*. 2005; 70:11-19.
16. Puupponen-Pimiä R, Häkkinen ST, Aarni M, Suortti T, Lampi AM, Euro M *et al.* Blanching and long-term freezing affect various bioactive compounds of vegetables in different ways. *Journal of the Science of Food and Agriculture*. 2003; 83(14):1389-1402.
17. Earle M, Earle R. *Case Studies in Food Product Development*. CRC Press, Boca Raton, 2008.
18. AOAC, 1995. *Official methods of analysis*. 16th Edition. Association of Official Analytical Chemists, Washington, D. C.
19. Anonymous. *Manual of Microbiological Methods*. McGraw Hill Book Co. Inc. New York, 1957, 127.
20. Martin, James P. Use of acid, rose bengal, and streptomycin in the plate method for estimating soil fungi. *Soil science*. 1995; 69:215-232.
21. Kocherla P, Aparna K, Lakshmi DN. Development and evaluation of RTE (Ready To Eat) extruded snack using egg albumin powder and cheese powder. *Agricultural Engineering International: CIGR Journal*. 2012; 14(4):179-187.
22. Sumathi A, Ushakumari R, Malleshi NG. Physicochemical characteristics, nutritional quality and shelf-life of pearl millet based extrusion cooked supplementary foods. *International Journal of Food and Nutrition*. 2007; 58:350-362.
23. Charunuch C, Tangkanakul P, Rungchang S. Application of mulberry (*Morus alba* L.) for supplementing antioxidant activity in extruded Thai rice snack. *Acta Horticulture*. 2008; 42:79-87.
24. Khan MA, Semwal AD, Sharma GK, Chitrashekarchar M, Nataraj S, Srihari KA, Bawa AS. Development and evaluation of long shelf-life ambient stable chapatis without the use of chemical preservatives. *Journal of Food Process Technology*. 2011; 2:27-32.
25. Bindu, R. and Srinivas. Shelf life evaluation of ready to eat black calm, product in indigenous retort pouches. *Journal of Food Engineering*. 2007; 78:995-1000.
26. Aubourg, Gallardo and Medina. A comparison during different sterilization conditions in canning of aibore in oil. *International Food Science and Technology*. 1997; 32:427-431.
27. Dar AH, Sharma HK, Kumar N. Effect of extrusion temperature on microstructure, textural and functional attributes of carrot pomace-based extrudates. *Journal of Food Process Preservation*. 2014; 38:212-222.
28. Et al SZ, Bibi A, Rather AH. Preparation and Storage Studies of Walnut Kernel Incorporated Rice Based Snacks. *International Journal of Basic and Applied Biology*. 2015; 2(6):449-451.