Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; 7(6): 2497-2500
Received: 25-09-2018
Accepted: 27-10-2018

SD Katke
Dept. of Food Engineering, College of Food Technology, VNMKV, Parbhani, Maharashtra, India

VS Pawar
Dept. of Food Chemistry & Nutrition, College of Food Technology, VNMKV, Parbhani, Maharashtra, India

Mohammed Abdur Rahman
Dept. of Food Technology, Sam Higginbottom University of Agriculture, Technology & Sciences, Allahabad, Uttar Pradesh, India

Correspondence
SD Katke
Dept. of Food Engineering, College of Food Technology, VNMKV, Parbhani, Maharashtra, India

Studies on process standardization & quality evaluation of ready to eat (RTE) extruded product by using composite flour

SD Katke, VS Pawar and Mohammed Abdur Rahman

Abstract
The present investigation focuses on standardizing the process for composite flour (Chickpea, Water Chestnut and Rice flour) RTE extruded product. Composite flour in the ratio of (40:25:35) was found to be more acceptable with respect to nutritional & quality parameters for preparation of RTE extruded product. The assessed techno-economic feasibility of prepared RTE extruded snack food shows more profits with better consumer acceptability & will open an avenue for health-conscious consumer market.

Keywords: Composite flour, extruded products, water chestnut flour, ready to eat products

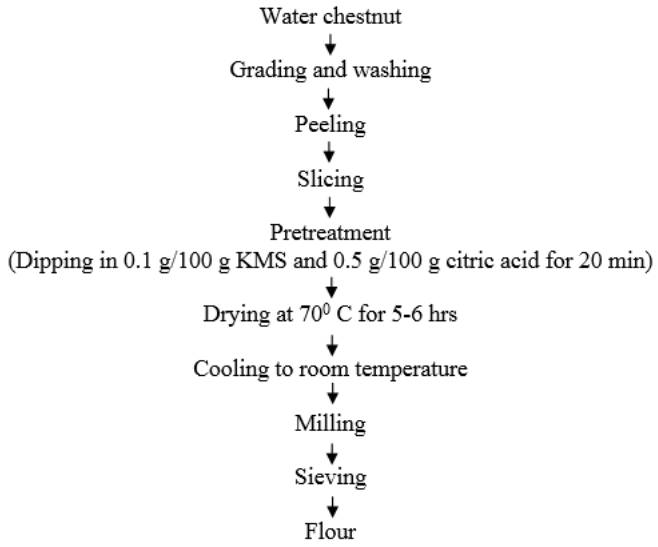
Introduction
In India many extruded foods are prepared either at home or by skilled artisans from rice or rice and legume flours and served as snacks. These are mostly prepared by cooking the rice flour with water and extruding the gelatinized mass through a hand operated press in the form of noodles, chords or ribbons and drying them in sun dried product remain stable for months and just before serving, these are fried in oil resulting in many fold expansion and a soft and crisp texture. Alternatively, extruded foods are also prepared by making dough of rice and legume (black gram, Bengal gram, green gram.) and extruding in hand operated press into different shapes and directly frying in oil. Extrusion cooking, particularly for snack production, is a complex process that differs from the conventional process as it involves high shear and high temperatures (above 150 °C) during a short period of time (seconds) (Athar *et al*., 2006) [3]. The thermal energy generated by vapor dissipation during extrusion, combined with the effect of shear, rapidly cooks and modifies the properties of the ingredients. Many thermo-mechanical processes are involved, including the Maillard reaction, protein de-naturation, hydrolysis and expansion (Thymi, 2005) [17]. Extrusion cooking technology being used increasingly in the food industries for the development of new products, such as cereal-based snacks including dietary fiber, baby foods, breakfast cereals and modified starch from cereals (Sebio and Chang, 2000) [13]. It is becoming more and more popular in the production of snack foods due to their technological advantages over the traditional food processing techniques (White, 1994) [18]. Singhara was extensively grown in Uttar Pradesh, Madhya Pradesh, Bihar, and Orissa, where high rainfall was conducive to successful cultivation (Mazumdar 1985) [7]. Water chestnut is valued for its nutritional and medicinal properties in modern India. Dried water chestnuts were ground into flour and used to make various foodstuffs (Mazumdar 1985) [7]. Water chestnut fruits are either used boiled or roasted or can be dried and ground into flour, which is sometimes used as a substitute for arrowroot flour. The fruits are a good source of nutrition with 16% starch and 2% protein. The kernel are good source of mineral, vitamin, carbohydrate, calcium, phosphate, iron, copper, manganese, magnesium, sodium, and potassium. (Bhatiwal *et al*. 2012) [4]. Chickpea (*Cicer arietinum L*.) is legume, grown in tropical and subtropical areas, that presents high potential as a functional ingredient for the food industry. The chickpeas contain moderately high protein (17–22%), low fat (6.48%), high available carbohydrate (50%) and crude fiber contents of 3.82% dry basis (Saleh and Tarek, 2006) [12]. Rice (*Oryza sativa*) is a staple food crop for a large part of the world's human population, making it the second most consumed cereal grain. Rice provides more than one fifth of the calories consumed worldwide by humans. Rice contains approximately 7.37% protein, 2.2% fat, 64.3% available carbohydrate, 0.8% fiber and 1.4%ash content (Zhoul *et al.,* 2002) [19]. The texture of extruded foods is one of the key parameter driving consumer preference. Among the texture attributes of food products the crispiness is one of the most important and desirable textural attribute in quality evaluation of extruded products.

Extrusion processing is an important technology used for producing a variety of expanded snacks and breakfast cereals (Agbisit *et al*., 2007) [2].

Materials and Methods

The ingredients like water chestnut flour (*Trapa natans*) Chick Pea Flour (*Cicer arietinum L.*), Rice flour (*Oryza sativa L.*), edible oil and other minor ingredients like salt, spices, etc. were purchased from local market.

Flow chart for The Preparation of water chestnut flour



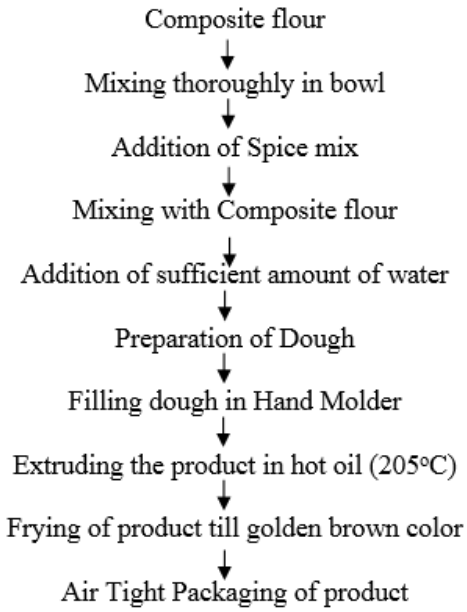
Flow Sheet 1: Process for preparation of Water chestnut flour

Composite flour formulation for preparation of extruded snack

Table 1: Standardization of Formulation for Composite Flour

S. No.	Flour	Composition of Composite Flour (%)			
		Control	C_1	C_2	C_3
1	Chickpea flour	50	45	40	40
2	Rice flour	50	40	40	35
3	Water chestnut flour	---	15	20	25

Preparation of RTE Extruded product



Flow Sheet 2: Process for preparation of RTE Extruded Product.

Evaluation of physico-chemical & sensory properties

Physical properties (MFR, TD, BD, WAI, WSI, WHC, OHC & Expansion Ratio) & chemical properties (Moisture, Fat, Protein, Crude Fibres, Total Carbohydrates & Ash) were determined by AOAC method 925.10 (AOAC, 2005) [1]. The sensory assessments were conducted by using nine-point hedonic scale (1 = dislike extremely to 9 = like extremely). The analysis of variance of the data obtained was done by using Completely Randomized Design (CRD) for different treatments as per the methods given by (Panse and Sukhatme 1985) [10].

Results and Discussion

Physical Properties of RTE Extruded Snacks

The physical properties of the Extruded snack food reflect the effectiveness of the process and suitability of selected ingredients. The physical properties of extruded prepared from three different composite flours with control sample are presented in Table 1.

Table 2: Physical properties of RTE Extruded Snacks

Parameter	Control	C_1	C_2	C_3	SE ±	CD at 5%
Mass Flow Rate (MFR)	3.15	3.20	3.24	3.30	0.0052	0.0157
Tap Density (TD)	0.20	0.25	0.30	0.35	0.0018	0.0053
Bulk Density (BD)	0.15	0.20	0.22	0.30	0.0047	0.0142
Water Holding Capacity (WHC)	405	425	450	465	0.667	2.0069
Oil Absorption Capacity (OAC)	4.25	4.60	4.98	5.25	0.0042	0.0127
Expansion Ratio (ER)	1.70	1.60	1.62	1.65	0.0024	0.0071

The results during present investigation revealed that rate of increase in water chestnut flour concentration linearly increased the Mass flow rate (MFR). Control sample was found to have MFR of 3.15g/s while highest MFR was observed in Sample C_3 (i.e. 3.30g/s). Similar types of results were also reported by Singh *et al.,* (2006) [15]. Tap density of the product was found to be linearly increasing with increasing concentration of water chestnut flour. This may be due to the highest density of flours and the lower rate of expansion. Bulk density also showed increasing values with increasing concentrations of water chestnut flour. Similar types of results were observed by Singh *et al.,* (1996) [16] & Onwuka, G. I. (2015) [9]. It can be clearly observed from above table that water holding capacity is decreasing with increasing the incorporation of water chestnut flour in extruded snacks. This could be due to higher level of starch and crude fiber in the composite flour. Similar results were observed by Shirani and Ganeshranee (2009) [14]. Oil absorption capacity of product is found to be increasing with increasing concentration water chestnut flour. However, higher absorption of oil may be attributed to presence of less fat and more crude fiber in case of extrudate sample prepared

from water chestnut flour reported by (Deshpande and Poshadri, 2011) [5]. Expansion ratio decreases with increase in concentration of water chestnut flour. This may be due to decrease in protein content and more starch content of product. Protein affects expansion through their ability to effect water distribution in the matrix and through their macro molecular structure.

Chemical Properties of RTE Extruded Snacks

The chemical properties of the RTE Extruded snack food prepared from three different composite flours with control sample are presented in Table-3.

Table 3: Chemical properties of RTE Extruded Snacks

Parameter (%)	Control	C_1	C_2	C_3	SE ±	CD at 5%
Moisture	6.65	6.15	5.90	5.60	0.0018	0.0053
Protein	9.60	8.65	8.20	7.50	0.2112	0.6357
Fat	7.15	6.90	6.75	5.50	0.2107	0.6343
Ash	1.38	1.45	1.55	1.65	0.0158	0.0476
Crude Fibre	1.05	1.30	1.50	1.65	0.0024	0.0071
Carbohydrate	73.35	75.45	75.25	77.60	0.5922	1.7828

The moisture content of extruded snacks was decreased as compared to control sample. The reduction in moisture content may be due to addition water chestnut flour as it is having less moisture content than rice flour. The protein content was found to be decreasing as compare to control it may be because the water chestnut flour has low protein content. The fat content of control extruded snacks was 7.15 per cent which was gradually decreasing with addition of water chestnut flour as it contain low amount of fat. The ash content of prepared extruded snacks found to be increasing with the addition of water chestnut flour, it may be due to the high mineral content in the water chestnut flour. The crude fiber content was found to be increasing by addition of water chestnut flour it may be because water chestnut flour contains more amount crude fiber than chick pea and rice flour. It can be observed that carbohydrate content was increased with addition of water chestnut flour as it contain more amount of starch hence carbohydrate content was increased by addition water chestnut flour.

Sensory evaluation of RTE extruded snacks

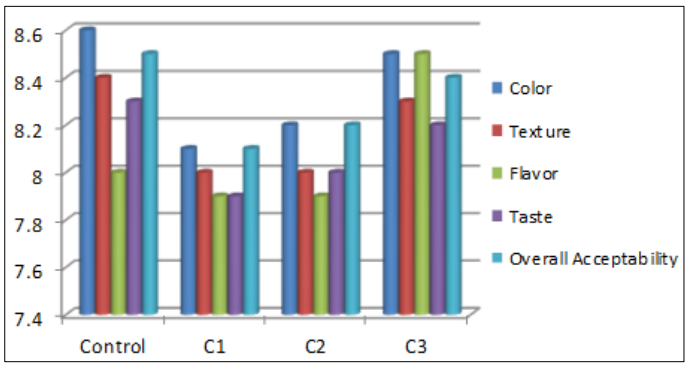
The panel of semi-trained judges consisting of 10 members was given the extruded snack food samples for evaluation of organoleptic characteristics viz. colour, taste, flavour, texture and overall acceptability. It was served to judges on the day of preparation. The average score recorded by judges was considered presented and discussed (Table 4) under suitable quality attributes.

Table 4: Sensory Evaluation of RTE Extruded Snacks

Sample	Color	Texture	Flavor	Taste	Overall Acceptability
Control	8.6	8.4	8.0	8.3	8.5
C_1	8.1	8.0	7.9	7.9	8.1
C_2	8.2	8.0	7.9	8.0	8.2
C_3	8.5	8.3	8.5	8.2	8.4
SE ±	0.0703	0.0176	0.0444	0.0351	0.0527
CD at 5%	0.2115	0.0529	0.1338	0.1058	0.1587

Color is one of the most important sensory attribute that affect directly the consumer preference of any product. The color value goes on decreasing with increasing the incorporation of water chestnut flour because the color of water chestnut flour lesser bright than rice flour hence as the quantity of water chestnut flour increases color value found to be decreasing. Nefisa A. Hegazy *et al.* (2014) [8]. The score value for the texture found decreasing with increasing incorporation of water chestnut flour in extruded snacks because the hardness was increasing with incorporation of water chestnut flour, this may be due to more crude fiber content in water chestnut flour. Similar reports were noted by Jehangeer Bhat *et al.*, (2015) [6].

The flavor character was more acceptable for sample C_3 (8.5) followed by control (8.0). The best taste was observed in case of control sample (8.3) followed by sample C_3 (8.2). The overall acceptability expresses how the consumers or panelists accept the product by considering all the other parameters of sensory evaluation & it is higher for sample C_3 (8.4).



Graph 1: Sensory evaluation of RTE Extruded snacks.

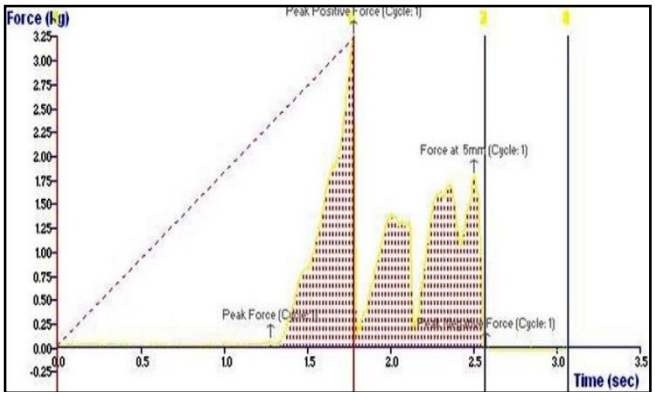
Textural parameters of RTE Extruded Snacks

Extrudates with lower expansion ratio had higher hardness and lower fracturability. The hardness increased with increase in amount of chestnut flour, High amount of sucrose in chestnut flour that inhibited the starch gelatinization could be the reason.

Table 5: Textural parameters of RTE Extruded Snacks

Sample	Hardness (Kg)
Control	1.580
C_1	2.045
C_2	2.340
C_3	2.940

Hardness of extruded product increased linearly with increase in concentration of water chestnut flour. High value of hardness indicates more crispiness and vice versa. Increase in hardness may be due more amount of fibre content which result in increased density and hardness reported by Sajad Ahmad Wani (2015) [11].



Graph 2: Texture (Hardness) profile analysis of sample C_3.

Conclusion

The composite flours were prepared by blending of flours of chick pea, water chestnut and Rice flour in different proportions on dry weight basis. The blends were standardized according to preliminary extrusion trails, by considering the ease in process for extruder and acceptability of products in terms of physical characteristics as well as sensory attributes. Thus in the light of the scientific data of the present investigation, it may be concluded that composite flour in the ratio of (40:25:35) was found to be more acceptable with respect to nutritional & quality parameters for preparation of RTE extruded product. The assessed techno-economic feasibility of prepared RTE extruded snack food shows more profits with better consumer acceptability & will open an avenue for health-conscious consumer market.

References

1. AOAC. Official Method of Analysis Edn. 15th Association of Official Analytical Chemists Washington DC, 2005.
2. Agbisit R, Alavi S, Cheng E, Herald T, Trater A. Relationship between microstructure and mechanical properties of cellular corn starch extrudates. J Texture Studies. 2007; 38:199-219.
3. Athar N. Vitamin retention in extruded food products. Journal of Food Composition and Analysis. 2006; 19(4):379-383.
4. Bhatiwal S, Jain A, Chaudhary J. Trapa Natans (Water Chestnut): An overview. International research journal of pharmacy. ISSN 2230-8407, 2012.
5. Deshpande HW, Poshadri A. Physical and sensory characteristics of extruded snacks prepared from Foxtail millet based composite flours. International Food Research Journal. 2011; 18:751-756.
6. Jehangeer Bhat. Textural and Sensory Characteristics of Bread Made from Wheat Flour Supplemented with Water Chestnut. American Journal of Food Science and Nutrition Research. 2015; 2(3):94-97.
7. Mazumdar BC. Water chestnut-the aquatic fruit. Agriculture International Series. 1985; 32(2):42-44.
8. Nefisa Hegazy A. chemical and technological properties of improved biscuit by chestnut flour. International journal of food and nutritional science. Official Chemists, Washington. 2014; 3:6.
9. Onwuka GI. Comparative Evaluation of Proximate Composition and Functional Properties of Two Varieties of Cooking Banana. IOSR Journal of Environmental Science, Toxicology and Food Technology. 2015; 9:01-04.
10. Panse VG, Sukhatme PV. Statistical Methods for Agricultural Workers, Edn. 2, ICAR, New Delhi, 1985.
11. Sajad Ahmad Wani. Extruded product based on oat and fenugreek and their storage stability. Current Nutrion and Food Science. 2015; (11):78-84.
12. Saleh Alajaji A, Tarek A. Nutritional composition of chickpea (Cicer arietinum L.) as affected by microwave cooking and other traditional cooking methods. Journal of Food Composition and Analysis. 2006.
13. Sebio L, Chang YK. Effects of selected process parameters in extrusion of yam flour (Dioscorea rotundata) on physicochemical properties of extrudates. Nahrung. 2000; 44:96-101.
14. Shirani G, Ganesharanee R. Extruded products with fenugreek (*Trigonellagraecium*) Chick pea and Rice: physical properties, sensory acceptability and glycemic index. Journal of food Engineering. 2009; 90:45-52.
15. Singh DS, Garg SK, Singh M, Goyal N. Optimization of processing parameters of extrudate prepared from Bengal gram broken and sorghum blends by using Wenger X - 5 extruder. J Food Sci Technol. 2006; 43:301-304.
16. Singh N, Singh B, Sandhu KS, Bawa AS, Sekhon KS. Extrusion behaviour of wheat, rice and potato blends. Journal of Food Science and Technology. 1996; 33(4):291-294.
17. Thymi S. Structural properties of extruded corn starch. Journal of Food Engineering. 2005; 68(4):519-526.
18. White G. Defining the true meaning of snacks. Food Technology International Europe. 1994; 2:115-117.
19. Zhoul Z, Robards K, Helliwell S, Blanchard C. Aging of stored rice: Changes in chemical and physical attributes. Journal of Cereal Science. 2002; 35(1):65-78.