EJ Publications
International Journal Research in Applied Engineering, Science and Technology (IJRAEST)
An International Peer-Reviewed Journal Vol-1, Issue-1, 2019
www.ijraest.com ISSN: 2582-029X

# "STUDIES ON EFFECT OF PHYSICOCHEMICAL PROPERTIES ON QUALITY EVALUATION OFMULTICEREALS ENRICHED EXTRUDED SNACKS"

**Jarupla Surendar[1]*, Srinivas.D[2],**
S.K Sadawarte College of Food Technology
Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani (MH), India

Abstract:

Extrusion is a kind of procedure by which has a set of clubbed components are vigour in the course of an opening in a pierced coat or die with a device precise to the food, and is then cut to an individual mass by blades. The composite flours for the preparation of extruded snacks were prepared by blending of Barley, Maize, Sorghum and mixed flour in different proportions on dry weight basis *i.e.* A (50:10:10:30), B (50:15:15:20) and C (50:20:20:10). The moisture content of all the flours remained more or less similar with the values ranging from 9.75 to 11.39 per cent. Crude fibre contented of chickpea, maize, sorghum and rice flour was set up to subsist 3.91, 3.57, 3.25 and 0.34 per cent correspondingly. The physicochemical distinctiveness of extruded cookies was unwavering by a fixed process. The price of an outcome of extruded cookies food 1kg was found to be Rs. 108.25.

Keywords: Extruded snacks, barley, maize, sorghum, rice etc

## Introduction:

According to the Food and Agricultural Organization (FAO), India is the world's largest producer of millets and second-largest producer of wheat, rice and pulses**.** The basmati rice is cultivated traditionally grown in Punjab, Haryana, and western Uttar Pradesh. With the prologue of lofty-springy PUSA-1121 variety, India's long-grain basmati rice production has been improving, and its cultivation has spread to other parts of Uttar Pradesh and Madhya Pradesh.The advantages especially two of this kind of progression over other industrialized process are its capacity to fashion very multipart cross-sections and to work stuff that is delicate since the stuff only come upon compressive and shear stresses. It also forms parts with a brilliant surface finish.[1]

Drawing is a parallel development, which utilizes the tensile strength of the material to pull it through the die. Extrusion can sometimes be fixed (supposedly fabricate for the foreseeable future long material) or incompletely-unremitting (producing many pieces). The extrusion process can be done with the textile can be hot or cold. Especially, sometimes the commonly extruded stuff contain metals, polymers, ceramics, and concrete, play dough, and foodstuffs. The contrived supplies of extrusion are by and large called "extrudates".

EJ Publications
International Journal Research in Applied Engineering, Science and Technology (IJRAEST)
An International Peer-Reviewed Journal Vol-1, Issue-1, 2019
www.ijraest.com ISSN: 2582-029X

Unfilled voided within extruded material cannot be fashioned by means of a simple flat extrusion die, because there will be no other way to prop up the centre barrier of the die. As a surrogate, the die presumes the contour of a wedge with reserve simple underpinning first with a contour shadow that prop ups the centre section. The shape of the die obviously has changed along with its span into the final shape, with the perched centre pieces sustained from the back of the die. The stuff floods roughly the bring and fuses together to create the yearning closed shape. The extrusion string in metals may also widen the force of the stuff.

Spices the term 'spice' is used to refer to all of the edible parts of a plant used for flavouring foods, including roots, stems, seeds, rhizomes and the leafy plant parts usually referred to as herbs. A food developer needs technical knowledge, creative talent, and an understanding of the cultural aspects of the consumer in order to develop successful products (Susheela, 2003).

Methodology:

Preparation of blend and mixing:

Composite of products was prepared by mixing barley flour, maize flour sorghum flour and rice flour in the different ratios shown in Table 1. The unify illustrations were adapted to 21% - 22% wetness by spraying with an analyzed amount of water and mixing endlessly at the medium rate in a blender. The models were put in containers and store up at 4˚C overnight.

Table 1: Formulation of different composite flour

| **Sr. No.** | **Flour** | **The composition of Composite flour** | | | |
|---|---|---|---|---|---|
| | | **Control** | **A** | **B** | **C** |
| 1 | maize flour | 50 | 50 | 50 | 50 |
| 2 | Maize flour | --- | 10 | 15 | 20 |
| 3 | Sorghum flour | --- | 10 | 15 | 20 |
| 4 | Rice flour | 50 | 30 | 20 | 10 |

Method for preparation of Extruded product:

The production of extruded snacks was started by dry mixing the composite flour in a bowl. Then the spice mix and other dry ingredients were added and mixed thoroughly. The mixture was kneaded in the bowl and dough was formed with using enough water added. Then, the

dough was placed into hand mould before pressing it into hot oil and deep frying it at 180°C to 200°C until the product turns a golden brown colour. After frying, the products were kept in an airtight container to prevent it from deteriorating by moisture or other elements that may cause unacceptable taste and reduce crispiness.

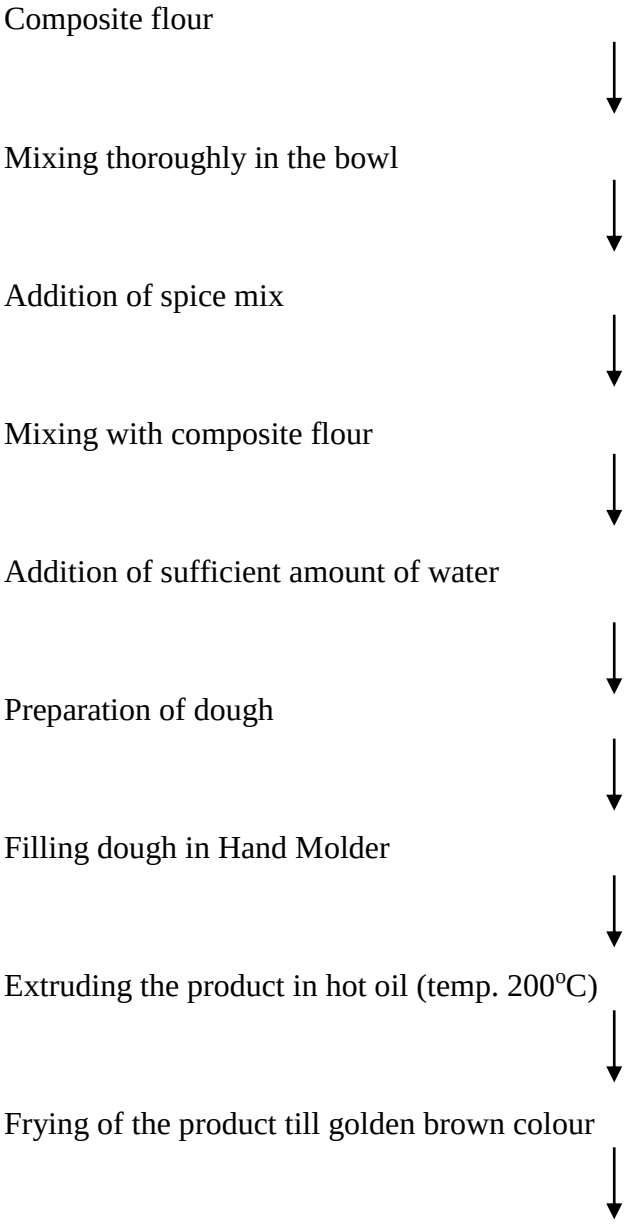


Fig 1: Preparation of extruded snacks

EJ Publications
International Journal Research in Applied Engineering, Science and Technology (IJRAEST)
An International Peer-Reviewed Journal Vol-1, Issue-1, 2019
www.ijraest.com ISSN: 2582-029X

Chemical Composition:

Moisture, ash, fat, carbohydrate, protein and measured by using standard methods described by (AOAC, 2002: AOAC, 2005)

Functional Properties:

The dried samples were analyzed for the density of extrudates (including tap density, true density and bulk density, water absorption index and water solubility index).

Organoleptic Evaluation

The product was evaluated for its acceptability based on sensory parameters like flavour, texture, colour and overall acceptability using nine-point hedonic scale (1 = dislike extremely to 9 = like extremely).

Results:

Proximate composition of Rice flour, Maize flour, Sorghum flour and chickpea flour:Chemical composition different namely moisture content, macronutrients contents (such as protein, fat and carbohydrates), ash and crude fibre of different flour are presented in Table 2.

It could be observed from the table that moisture content of all the flours remained more or less similar with the values ranging from 9.75 to 11.39 per cent. Amongst all the ingredients, sorghum flour was found to contain the highest amount of fat (i.e. 19.75%) while the lowest fat content was observed in rice flour (1.21 per cent). With respect to protein, the protein content of sorghum flour, chickpea flour, maize flour and rice flour was found to be 40.73, 17.25, 13.70 and 7.53 per cent respectively.

Table 2: Proximate composition of rice flour, maize flour, sorghum flour and rice flour

| Flour | Moisture (%) | Crude Fat (%) | Crude Protein (%) | Ash (%) | Crude Fiber (%) | Carbohydrate (%) |
|---|---|---|---|---|---|---|
| Rice flour | 11.39 | 1.21 | 7.53 | 1.01 | 0.34 | 77.2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Maize flour | 10.70 | 7.50 | 13.70 | 1.75 | 3.57 | 62.73 |
| Sorghum flour | 9.75 | 19.75 | 40.73 | 4.19 | 3.25 | 22.51 |
| Chickpea Flour | 9.81 | 5.38 | 17.25 | 1.65 | 3.91 | 60.56 |

The results with respect to the composition of sorghum flour are comparable with the earlier reported values (Pollock and Geddes, 1960). Nearly similar values for rice (Ding *et al.*, 2005), chickpea (Gopalan *et al.*, 2006) and maize flour (Hahn *et al.*, 1990) were reported earlier.

Functional properties of extruded cookies:The functional properties of extruded cookies are presented in Table 3.

The mass flow rate gives an indication of soundness of ingredient to pass through the dies in preparation of the extruded product. The results during the present investigation revealed that the rate of increase in sorghum flour and maize flour concentration linearly increased the Mass flow rate (MFR). The mass flow rate was found to be higher in sample C (3.30) and lowest in the control sample (3.22).

Tap density and bulk density of control, sample A, B and C were observed as 0.34, 0.33, 0.31, 0.30 and 0.14, 0.13, 0.11, 0.10 respectively. The tap density of the product was found to be linearly decreasing with increasing concentration of soy and maize flour. This may be due to the highest density of flours and the lower rate of expansion which resulted in such values

The finding showed that WSI of sample C (0.36) was higher followed by B (0.35 %), A (0.31 %) and control (0.28 %). Similar trends were reported by Anderson *et al.* (1969). Analysis of data showed that WHC in extruded snacks sample C was higher (440) while lowest in sample A (396). Water holding capacity is a function of protein content. The increase in protein content results into higher entrapment of moisture in the protein matrix resulting in increased WHC of product. Similar results were reported by Shirani and Ganeshranee (2009). The moisture retention and expansion ratio of extruded snacks for control, sample A, B and C were found to be 25.73, 25.71, 25.69, 25.68 and 1.61, 1.68, 1.83 and 1.91 respectively. Moisture retention capacity also found to slightly increase with an increase in the concentration of sorghum and maize flour which is found to be insignificant. The consumer acceptability of the product could also be correlated with the expansion ratio.

EJ Publications
International Journal Research in Applied Engineering, Science and Technology (IJRAEST)
An International Peer-Reviewed Journal Vol-1, Issue-1, 2019
www.ijraest.com ISSN: 2582-029X

Table 3: Functional properties of extruded snacks

| Parameters | Samples | | | | S.E± | C.D at 5% level |
|---|---|---|---|---|---|---|
| | Control | A | B | C | | |
| Mass flow rate (g/s) | 3.22 | 3.25 | 3.27 | 3.30 | 0.014 | 0.04 |
| Tap density | 0.34 | 0.33 | 0.31 | 0.30 | 0.008 | 0.02 |
| Bulk density | 0.14 | 0.13 | 0.11 | 0.10 | 0.008 | 0.02 |
| Water Solubility Index (%) | 0.28 | 0.31 | 0.35 | 0.36 | 0.015 | 0.04 |
| Water Holding Capacity | 432 | 396 | 410 | 440 | 13.22 | 0.39 |
| Moisture Retention | 25.73 | 25.71 | 25.69 | 25.68 | 0.008 | 0.02 |
| Expansion Ratio | 1.61 | 1.68 | 1.83 | 1.91 | 0.068 | 0.206 |
| Oil Absorption Capacity (%) | 4.28 | 5.17 | 5.32 | 5.49 | 0.094 | 0.282 |

*Each value was an average of three determinations

In the present investigation, it was revealed that expansion ratio increases with an increase in the concentration of sorghum and maize flour. This may be due to increase protein content and lowered starch content of the product. Similar findings were reported by Sing *et al.* (1996).

The oil Absorption Capacity of cookies 4.28%, 5.17%, 5.32% and 5.49% were observed. The oil absorption capacity of the product is found to increase with increasing concentration of sorghum and maize flour. The oil absorption capacity is the function of the crude fibre content of the product, which could be successfully correlated with the results obtained by Deshpande and Seshadri, 2011.

Nutritional composition of extruded snacks:

In the present investigation, the efforts were made to enhance the nutritional quality of extruded snacks food by using sorghum and maize flour in replacement of rice flour. The nutritional composition of all the samples with control was analyzed and the results are reported in Table 4.

EJ Publications
International Journal Research in Applied Engineering, Science and Technology (IJRAEST)
An International Peer-Reviewed Journal Vol-1, Issue-1, 2019
www.ijraest.com ISSN: 2582-029X

The results revealed that moisture content of control was found lowest while the increase in the concentration of soy and maize flour linearly increased the moisture content of the product. The carbohydrate content was drastically reduced from 72.12 per cent for control to 54.51 per cent for Sample C. With respect to protein content, it could be clearly observed that the protein content of the sample increase from 12.91 per cent to 20.49 per cent which is significantly high justifying the suitability of sorghum and maize flour incorporation in the product. The values of crude fibre content almost tripled from control to sample C. Fat content of sample also increased from 6.1 to 11.29 per cent.

Table 4: Nutritional composition of extruded snacks

| **Nutrient Parameters** | **Composition of Sample** | | | |
|---|---|---|---|---|
| | **Control** | **Sample-A** | **Sample-B** | **Sample-C** |
| Moisture (%) | 6.51 | 6.57 | 6.61 | 6.69 |
| Carbohydrate (%) | 72.13 | 64.01 | 59.33 | 54.11 |
| Crude Protein (%) | 12.91 | 16.3 | 18.15 | 20.49 |
| Crude fat (%) | 6.1 | 8.01 | 10.16 | 11.29 |
| Calorific value kcal/100 g | 395.06 | 413.82 | 437.36 | 400.01 |
| Crude Fiber (%) | 1.18 | 2.59 | 3.02 | 3.31 |
| Ash (%) | 1.02 | 1.57 | 1.72 | 2.09 |

However, it could be concluded that incorporation of soy and maize flour in extruded product resulted in an increase in moisture, protein, fat, crude fibre and ash content while decreased the total carbohydrate content. Similar trends were reported by Guria, (2006).

Sensory evaluation of extruded products:

The panel of semi-trained judges consisting of 10 members was given the extruded snacks food samples for evaluation of organoleptic characteristics *viz*. colour, taste, flavour, texture and overall acceptability.

Table 5: Organoleptic evaluation of extruded snacks food

EJ Publications
International Journal Research in Applied Engineering, Science and Technology (IJRAEST)
An International Peer-Reviewed Journal Vol-1, Issue-1, 2019
www.ijraest.com ISSN: 2582-029X

| Sample | Colour | Flavour | Taste | Texture | Overall acceptability |
|---|---|---|---|---|---|
| Control | 9.00 | 8.50 | 8.0 | 8.50 | 8.50 |
| A | 8.30 | 8.40 | 8.30 | 8.30 | 8.30 |
| B | 8.00 | 8.20 | 8.00 | 8.00 | 8.00 |
| C | 7.50 | 7.00 | 7.50 | 7.00 | 7.50 |

*Each value is average of ten determinations

The average score recorded by judges was considered presented and discussed (Table 5) under suitable quality attributes.

It may be visualized from Table 5, that the colour of the control sample was more acceptable (9.00) followed by samples A (8.50), B (8.00) and C (7.50). The flavour character was more acceptable for sample A (8.40) as compared with Sample B (8.20). Further Control (8.50) sample was rated superior to sample C (7.00) as well as sample A (8.40). The best taste was observed in the case of sample A (8.30), whereas Control sample and sample B scored same *i.e.* 8.00. It is important to note from the findings, Sample A was found better taste characteristics among other three samples. It can be observed that the flours combinations in composite flour exhibited wide differences with regard to texture character of final product ranging from 7.00 to 8.50. The best texture was found for Control sample followed by sample A, B and C. The overall acceptability of extruded snacks food could be attributed to the different characters of colour, taste, flavour and texture of the final product. The highest score of overall acceptability was found for control while lowest for sample C.

Conclusion:

From the present investigation, it could be concluded that the extruded sample –A (Chickpea; Maize; Sorghum; Rice; in the ratios of 50:10:10:30) was found to be having better sensorial quality than sample B and C. The chemical composition of extruded sample A revealed that it contains more protein (16.3g/100g), crude fibre (2.59g/100g) than that of commercial extruded products. This may be attributed to the large quantity of Chickpea and Maize flour in the composite flour sample.

References:

- Anderson R.A. (1982). Water absorption and solubility and amyl graph characteristics of roll-cooked small grain products. Cereal Chemistry, 59, 265-269.

- AOAC (2002). Official Methods of Analysis of the AOAC International, 16th ed., 5th rev. Method 930.15. The Association, Gaithersburg, MD.
- AOAC (2005). Official Methods of Analysis of the AOAC International, 18th ed. Association of Official Analytical Chemists, Gaithersburg, MD.
- Colonna P., Tayeb J. and Mercier C. (1989). Extrusion cooking of starch and starchy products. In: Mercier, C., Linko, C.P. and Harper, J.M., Eds., Extrusion Cooking, American Association of Cereal Chemists, Inc., St. Paul, 247-319.
- Deshpande H. and Poshadri A. (2011). Physical and sensory characteristics of extruded cookies prepared from Foxtail millet based composite flours International Food Research Journal, 18, 751-756.
- Ding Q., Ainsworth B., Plonkell A., Tucker G. and Marson H. (2005). The effect of extrusion conditions on the physicochemical properties and sensory characteristics of rice-based expanded cookies. Journal of Food Engineering, 66, 283-289.
- Gopalan C.R., Sastri B.V. and Subramanian B. (2006). Nutritive value of Indian foods, published by National Institute of Nutrition, ICMR, Hyderabad. 47- 69.
- Guria P. (2006). Physico-chemical properties, nutritional quality and value addition to quality protein maize (*Zea mays*). Department of Food Science and Nutrition, College of Rural Home Science, University of Agricultural Sciences, Dharwad.
- Hahn J.D., Chung T.K. and Baker D.H. (1990). Nutritive value of maize flour and maize bran. J Anim Sci. 68, 4253-4260.
- Kadan R.S., Bryant R.J. and Pepperman A.B. (2003). Functional properties of extruded rice flours. Journal of Food Science, 68, 1669-1672.
- Li S., Zhang H.Q., Jin Z.T. and Hsieh F. (2005). Textural modification of soya bean/corn extrudates as affected by moisture content, screw speed and soya bean concentration. International Journal of Food Science and Technology, 40, 731-741.
- Mahungu S.M., Diaz-Mercado S., Li J., Schwenk M., Singletary K. and Faller J. (1999). Stability of isoflavones during extrusion processing of corn/soy mixture. Journal of Agriculture and Food Chemistry, 47, 279-284.
- Panse V.G. and Sukhatme P.V. (1985). Statistical methods for agricultural workers ICAR pub. Edn. New Delhi.
- Pollock J.M. and Geddes W.F. (1960). Soya flour as white ingredients, paper no.4180 scientific journal series, Minnesota agricultural experiment station the Procter and gamble co., Cincinnati, Ohio.
- Riaz M.N. (1999). Sorghum as a functional food. Cereal Food World., 44(2), 88-92.
- Shirani G. and Ravindran G. (2009). Extruded products with fenugreek (*Trigonella-graecium*) barley and rice: physical properties, sensory acceptability and glycemic index, Journal of Food Engg., 90, 45-52.

- Singh N., Singh B., Sandhu K.S., Bawa A.S. and Sekhon K.S. (1996). Extrusion behaviour of wheat, rice and potato blends, J Food Sci Technol, 33(4), 291-294.
- Singh S., Gamlath S. and Wakeling L. (2007). Nutritional aspects of food extrusion: A Review. International Journal of Food Science and Technology, 42, 916-929.
- Zhou1 Z., Robards K., Helliwell S. and Blanchard C. (2002). Composition and functional properties of rice. International Journal of Food Science and Technology, 37, 849–868.