

Studies on Storage Stability of Corn Based Honey Powder Incorporated Breakfast Snacks

Jasia Nissar, Tehmeena Ahad, H.R. Naik and S.Z. Hussain

Division of Post Harvest Technology, Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir

Abstract—Shelf life studies of food products are important, keeping in view the consumers awareness towards the quality and safety of food products. Experiments were conducted to assess the storage studies of corn based honey powder incorporated breakfast snacks extruded at pre-optimized conditions (10% honey powder, 15% moisture, 450 rpm screw speed and 170°C barrel temperature). The developed snacks were packed in high density polyethylene (HDPE) bags and kept under ambient conditions for the period of three months. The stored samples were evaluated for moisture content (MC), water activity (WA), free fatty acids (FFA), breaking strength (BS), total plate count (TPC) and sensory evaluation at regular intervals for three months. Gradual increase in moisture content and gradual decrease in breaking strength was observed during three months of storage. Storage had non-significant effects on breaking strength and TPC. In the present study it was observed that corn based honey powder incorporated snacks did not develop any potential health risk and can be stored up to three months when packed in HDPE bags.

Keywords: corn, honey, storage, breakfast snacks, extruded, HDPE.

1. INTRODUCTION

Recent awareness and interest in health and wellness has shifted focus on healthy eating and lifestyle. People are gradually realizing the importance and benefits of functional breakfast snacks. Health conscious people are replacing traditional breakfasts with the bowl of functional breakfast snack in order to maintain good health. The need for convenience foods, busy life schedules and increased per capita income in developing countries is giving the breakfast snack industry a new dimension to look for. During the recent years, quite a number of technologies in food processing have emerged and made an impact on the availability and variety of food products. Food extrusion is one of these latest multidimensional food processing techniques. Extrusion cooking, a versatile food processing technique being the high temperature short time process has become the method of choice for the development of snacks owing to nutrient retention and favorable economics of the process [9]. Cereals are the main raw materials used for the development of extruded snacks [10]. Corn, one of the major cereal grains of India, is an attractive ingredient for extrusion process because of its superior characteristics attributed to its starch content, typical corn flavor and appealing yellow color. The market of

confectionary, which is using sweeteners instead of sucrose, is growing as the nutritional awareness among the people increases. This trend can be explained due to the adverse health effects of sugar. Natural honey is one of the most widely sought products due to its unique nutritional and medicinal properties. It is packed with B-vitamins, rich in minerals, having antioxidant activity. It also contains 80-85% carbohydrate (mainly glucose and fructose), 15-17% water, 0.1-0.4% protein, 0.2% ash and minor quantities of amino acids, enzymes and vitamins as well as phenolic antioxidants [8]. Honey has a long history in human consumption and people prefer having it in their breakfast, thus incorporation of honey in breakfast snacks could be a convenient way for its proper consumption.

2. MATERIAL AND METHODS

2.1 Preparation of raw material

The present investigation was carried out in the Division of Post Harvest Technology, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir (SKUAST-Kashmir), Shalimar, Kashmir. The corn (C-6) variety obtained from division of plant breeding and genetics, SKUAST-K was milled in lab mill 3030 (Perten, Sweden) to fineness that passes through 200µm sieve. Honey powder was procured from a renowned company (Kanegrade Flavours). The blends of corn flour and honey powder were extruded at pre-optimized conditions i.e. 10% honey powder, 15% moisture, 250 rpm screw speed and 170°C barrel temperature and were stored in HDPE for three months. Extruded snacks were studied at an interval of 30 days for moisture content, water activity, free fatty acids, breaking strength, total plate count and sensory evaluation.

2.2 Extruder cooking.

The extrusion was performed on co-rotating intermeshing twin screw extruder model BC 21 (Clextral, Firminy, France). The barrel diameter and its length to diameter ratio (L/D) were 2.5 mm and 16:1, respectively. The extruder had four barrel zones, temperature of the 1st, 2nd, and 3rd was maintained at 20, 30 and 40°C, respectively, throughout the study period; while the temperature in last zone (compression and die section) was

varied according to experimental design. The extruder was equipped with torque indicator which showed percent of torque in proportion the current drawn by drive motor. Raw material was metered into extruder with a single screw volumetric feeder.

2.3 Quality parameters

Physico-chemical characteristics i.e. Moisture was studied using AOAC 2000 methods. Water activity was estimated using water activity meter (Rotronic, UK). Standard AOAC procedure was followed with slight modification for free fatty acid determination. Break strength was estimated using Texture analyzer and total plate count was studied by standard serial dilution plate count method using nutrient agar [2].

2.4 Sensory analysis

Sensory quality of extrudates sample was determined with the help of 10 semi trained panelist using a 5-point Hedonic scale (5-excellent to 1-poor). The aspects considered were color, appearance, texture, flavor, mouth feel and *overall acceptability*. overall acceptability was evaluated as an average of color, appearance, texture, flavor and mouth feel. The average scores of all the 10 panelists were computed for different characteristics.

3. RESULTS AND DISCUSSION

3.1 Storage stability of snacks

The blends of honey + corn were extruded at pre-optimised conditions i.e. 10% honey powder, 15% moisture content, 450 rpm screw speed and 70°C barrel temperature. The extrudates were packed in high density polyethylene bags and kept for three months under ambient conditions for storage studies (25±2°C, RH=60-62%). The product was analysed for following parameters at an interval of one month.

3.2 Moisture content

With the advancement of storage period, Gradual increase in moisture content was observed during 3 months of storage. The moisture content of the product ranged from 3.53 to 5.32 per cent during 3 months of storage. Gradual increase in moisture content was observed during 3 months of storage. The increase in moisture content during storage was due to the hygroscopic nature of snacks. Cheng *et al.* (2011) observed non-significant increase of moisture content in mung bean snacks during storage. Butt *et al.* (2004) observed an increase in moisture content in breakfast cereals during a storage period of six months

3.3 Water activity

During the storage period of three months, the water activity of snacks increased slightly. The mean water activity at zero months of extrude was 0.47 which increased to 0.57 (table 1) after three months of storage. The slightly increase of water

activity in extrudates was possibly due to the change in humidity of the surrounding environment.

3.4 Free –fatty acids

Storage had significant effect on the development of FFA over the period of three months. The FFA content increased only slightly from 0.062 to 0.079 per cent (table 1) in three months. The FFA increased during the storage time of three months. The increase in FFA was presumably due to the enzyme activity of lipase upon fats, which leads to generation of free fatty acids in presence of a catalyst like moisture, light or heat [5]. The similar increase in FFA was observed by [12]

3.5 Total plate count

Storage had a non-significant effect on the total plate count. TPC was too few to count (TFTC <25 colonies /plate) upto three months of storage. The reason for low total plate count of extruded snacks might be due to low moisture content of product [7]

3.6 Breaking – strength

The effect of storage period had significant effect on the breaking strength of extrudates. During the three months of storage period, a decrease in the break strength of extrudates was observed. Change in break strength was observed from maximum of 52.8 to minimum of 48.3 (table 1) over the period of three months. The decrease in breaking strength might be related to gain in moisture of extrudates. Charunuch *et al.* (2008) also reported decrease in hardness of iron fortified extruded Thai rice snacks stored for 4 months.

3.7 Sensory analysis

Storage period had non-significant effect on the organoleptic properties of the snacks. During the entire period of three months of storage, overall acceptability of snacks was within acceptable range. The overall score decreased from 4.6 to 3.9 on a 5 point scale (table 1) Butt *et al.* (2004) observed that sensory properties were almost same throughout six months storage and there was a non-significant difference in various treatments. Pathania (2013) reported that the extruded instant mixes developed from combination of cereal: pulses: groundnuts were in acceptable range after six months of storage.

Table 1: Effect of Storage Period on Moisture, water activity, Free Fatty Acids, breaking strength, Total Plate Count and sensory analysis

Storage period (3 months)	Moisture content (%)	Water activity	Free fatty acids (%)	Breaking strength (N)	Total plate count (CFU/g)	Overall acceptability
0	3.53	0.47	0.062	52.8	0.00	4.6

1	3.64	0.49	0.06 9	51.7	0.00	4.6
2	4.71	0.53	0.07 4	50.4	5.00	4.2
3	5.32	0.57	0.07 9	48.3	8.00	3.9
CD (p≤0.05)	0.127	0.02	0.00 2	NS	0.93	0.199

4. CONCLUSION

It can be concluded from the present study that the product was acceptable after three months of storage. Product retained most of its nutritional and sensory attributes under three months of storage. However the snacks turned soft with the passage of storage time, therefore there is scope to conduct further studies regarding the efficiency of packing material and packaging methods.

5. LITERATURE CITED

- [1] AOAC, 2000. Official Methods of Analysis. Vol II, 15th Edition. Association of Official Analytical Chemists, Inc., Arlington, Virginia 1298.
- [2] Anonymous. *Manual of Microbiological Methods*. McGraw Hill Book Co. Inc. New York, 1957, pp 127.
- [3] Butt M S, Nasir M, Akhtar S and Sharif K 2004. Effect of moisture and packaging on the shelf life of wheat flour. *Int J Food Saf* 4:1-6.
- [4] Camire, M. E., Dougherty, M. P. and Briggs, J. L. 2007. Functionality of fruit powders in extruded corn breakfast cereals. *Food Chemistry* 101(2): 765-770
- [5] Charunuch C, Tangkanakul P and Rungchang S 2008. Application of mulberry (*Morus alba* L.) for supplementing antioxidant activity in extruded Thai rice snack. *Acta Hort* 42: 79-87.
- [6] Cheng, Y. S., Lin, P. C. and Lin, J. 2011. Effects of extrusion processing conditions on the physico-chemical properties of mung bean extrudates. The 12th ASEAN Food Conference, BITEC Bangna, Bangkok, Thailand pp. 524-526.
- [7] Frazier and Westhof 1988. Food Microbiology. Tata McGraw Hill Publications, New Delhi pp. 410.
- [8] James, F., Faller, H. and Heyman 2009. Sensory and physical properties of extruded Potato puffs. *Journal of Sensory Studies* 11(3): 227-245.
- [9] Onyango C, Henle T, Hoffmann T and Bley T 2004. Production of high energy density fermented uji using a commercial alpha-amylase or by single-screw extrusion. *Lebensm.-Wiss u.-Technol* 37: 401-07.
- [10] Pathania, S. 2013. Development of grain based instant mixes using extrusion technology. Ph. D Thesis. Punjab Agricultural University, Ludhiana, India.
- [11] Pradeep P M, Dharmaraj U, Rao B V S, Senthil A, Vijayalakshmi N S, Malleshi N G and Singh V 2013. Formulation and nutritional evaluation of multigrain ready-to-eat snack mix from minor cereals. *J Food Sci Technol* DOI: 10.1007/s13197-013-0949-3.
- [12] Uma, T., Mary, G., Jagmohan, R., Alagursundaram and Tiwari, B. K. 2011. Quality characteristics and shelf-life studies of deep fried snack prepared from rice brokers and legume by products. *Food Process Technology* 4: 1172-1178.