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REVIEW ARTICLE

Convenience foods: Foods of the future

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ABSTRACT

Convenience foods are a class of foods which impart convenience to the consumers by way of little or no requirements of major processing or cooking before their consumption. The potential of growth in development of convenience foods is vastly untapped. Convenience foods are gaining popularity in the global market, food processing industries, also among the food scientists and researchers. It is remarkable that despite the urgent need of convenience food, research on development, nutritional composition analysis and shelf life evaluation of convenience food is still in its infancy. In the present study aspects related to standardization and development, nutritional analysis and shelf life of convenience foods has been reviewed.

Keywords: Convenience foods, standardization, development, Nutritional composition, shelf life

INTRODUCTION

Convenience foods are a class of foods which require minimum handling, such as mild heating/warming for ready-to-eat products or rehydration in hot/cold water for dehydrated foods. However, the complexity of convenience foods lies in their composition, shape, size and method of processing. Viewing this heterogenecity, transformation of the product into a simpler form with minimum handling prior to consumption speaks of the skill of the technologists. However, the major thrust is to provide convenience by way of saving the cooking time and labour in the kitchen. In addition, convenience for long shelf-life, reduction in weight, good quality, easy commercial availability are of prime concern (Arya, 1992). Several technologies, methods and products have been developed to standardize and commercialize ready-to-eat (RTE) or easy-to-reconstitute (ETR) mixes of traditional or popular Indian foods.

Extrusion cooking has unique and distinctive features as compared to other heat processes with capability of breaking covalent bonds in biopolymers along with facilitating reactions otherwise limited by diffusion of reactants and products (Iwe *et al.*, 2001). Extrusion processing alters the nature of several food constituents, like starches and proteins, by changing their physical, chemical and nutritional properties. Application of extrusion technology for millet processing so as to improve purpose of improving its shelf life and value addition of product by making it a convenient food item is a novel approcach (Filli and Nkama, 2007).

Most of the convenient foods are made up of refined flour which are devoid of many of nutrients especially minerals and fibre. Over the past several years, convenience foods have been popular and such foods may emerge as promising products in the market (Singh and Sehgal, 2008). The requirement of people for high quality, ready-to-eat foods of traditional nature with modem technological application has become a necessity; both from the economy point of view and to reduce the losses of seasonal agricultural produce. Preservation of traditional food either in ready-to-eat form or by canning of the products has achieved considerable success (Ghosh *et al.*, 2001)

The technological advancement, urbanization, mechanization, migration, increased women employment away from homes and several other factors have a profound influence on habitual food preparation and also special occasion's foods. The traditional foods and food habits are being replaced by modern food culture. With rise of global village idea, where the entire world is considered as being closely connected by modern

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telecommunication and as being interdependent socially, economically and politically the foods are becoming global. The traditional foods requiring tedious processing protocols are substituted with modern ready to use/ready to eat foods. Such foods have entered both rural and urban kitchens. Economic empowerment, affordability, easy access and availability of processed foods in the market have influenced the type of foods consumed by the population. A large number of women now are spending at least one third of the day on job and find less time in long cooking regimes.

The objective of the present study is to review the research work done towards development and standardisation, nutritional composition and shelf life of convenience foods.

Standardization and development of convenience foods

Several technologies have been developed to standardize and commercialize ready-to-eat (RTE) or easy-to-reconstitute (ETR) mixes of traditional or popular Indian foods. These products have been found microbiologically safe and organoleptically acceptable for periods ranging from 3 months to 1 year. Dry mixes of several traditional Indian foods have gained worldwide popularity. Some major factors for their popularity include rapid urbanization, industrialization and consequent changes in eating habits of people (Prasad *et al*., 2000). *Jowar* crunch, a snack food with a light crunchy texture, prepared by deep-fat frying of dried kernels (pellets) of alkaline-cooked whole sorghum was developed (Suhendro *et al.*, 1998). A chemically leavened cereal legume based instant *dhokla* mix with different proportions of ingredients and leavening agents was also developed by Mahajan and Chattopadhyay (2000). Seth and Rajamanickam (2012) developed convenience mixes, suitable for five different types of baby foods, based on millet. Malting and popping were used as processing techniques. Malted convenience mix was further used as multipurpose flour for development of different baby foods, namely sweet gruel, salty gruel, *halwa, laddoo* and biscuits.

Noodles and pasta products also known as convenience foods prepared through cold extrusion system which become hard and brittle after drying. Noodles, puff, cookies, a parboiled rice-like product and snack foods have been successfully produced from sorghum and pearl millet (Schober *et al*., 2005). Pasta was extracted in dolly pasta machine. The cooking of these noodles is very convenient and requires few minutes. Noodles in different combinations have been developed such as noodles made of exclusively finger millet, finger millet blended with wheat and soy flour in the ratio of 5:4:1 and finger millet and wheat in the ratio of 1:1. Pasta can be prepared with finger millet, refined wheat and soy flour/whey protein concentrate composite flour formulated in the ratio of 50, 40 and 10 per cent (Devaraju *et al.*, 2006).

Sood *et al.* (2010) prepared ready to use mixes by using cereals, pulses, vegetables/fruits and nuts with soy-whey. Different products like *idli, dhokla, halwa, sattu* and *upma* were prepared.

According to Arya (1990) the traditional Indian instant mixes of *idli* and *dosai* based on cereal-legume combinations were now being manufactured by blending various ingredients in required proportions along with chemical leavening agents. Instant *idli* and *dosai* mixes have been prepared, based on the black gram and rice flours in suitable proportions along with yeast or chemical leavening agents, thereby eliminating the need for soaking, wet grinding and fermentation.

Srivastava *et al*. (2003) developed popped grains based on barnyard, little millet and foxtail millet with common salt as heating medium in an open iron pan containing sample and salt in the ratio of 1:20 at a temperature of 240-260 ^{o}C for 15-25seconds. Two types of *laddoos* first one using only popped millet grains along with jaggery and second type by using millets, roasted groundnut and coconut powder were developed.

Millet based extruded snack foods were prepared using twin-screw extruder from kodo millet-chickpea flour blend in the ratio of 70:30 by Geetha *et al*. (2012) or ragi, sorghum, soy and rice in proportion of 42.03,14.95,12.97 and 30% flour blend by Seth and Rajamanickam, (2012).

Jha et al. (2013) standardized *kheer* mix, with pearl millet and milk as major ingredients. During the investigation, effect of different levels of dairy whitener, pearl millet and temperature was studied by employing a three factor central composite rotatable design version 7.1.6. The best formulation with 18.49per cent dairy whitener and 6.0per cent pearl millet and a process temperature of 87.5 °C yielded 46.76 per cent of the product on the basis of the dairy whitener used.

Itagi *et al*. (2013) prepared multigrain *halwa* mixes (four types) from cereals, millets, legumes, nuts and condiments. These mixes had around 4% initial moisture content (IMC), during storage studies they had 23 to 32% as equilibrium relative humidity (ERH); 5 to 8% as the critical moisture content (CMC) and critical relative humidity (CRH) for these mixes was 60%. Balasubramanian *et al.* (2014) developed *Upma* mix, a popular breakfast of southern India, traditionally made from wheat, were prepared using pearl millet semolina (PMS). Pearl millet grains were hydro-thermally treated to reduce anti-nutritional factors and inactivate lipase activity. Hydrothermal treatments reduced the anti-nutritional factors significantly. No lipase activity was detected after steaming.

Nutritional composition of convenience foods

Srivastava *et al.* (2001) developed malted and popped convenience mixes based on proso millet, soybean and peanut flours. Popped mix contained significantly higher amounts of fat (5.43g/100g), protein (15.98g/100g) and energy (336 Kcal/100g) compared to malted mix (5.0g, 14.35g, and 328 Kcal/100 g respectively).

Eight composite mixes were formulated using popped cereals (40% wheat, finger millet, pearl millet or sorghum), legumes (20 or 10% defatted soy flour or 10 % bengal gram dhal), jaggery (30 %) and vegetable fat (5%). The mixes, fortified with vitamins and minerals were analysed for proximate composition and dietary fibre. Results indicated that mixes contained 10.4 to 12.5g protein, 4.2 to 5.9g fat, 10.0 to 13.0 g dietary fibre, 1.8 to 3.6g ash, 64 to 67g carbohydrates and 340 to 398 Kcal of energy. The mixes were well within PAG recommendations of protein and could meet 1/3rd RDA for children (Baskaran *et al.*, 2001).

Thathola and Srivastava (2002) formulated millet based weaning food, using malted flours of foxtail millet (30%), pearl millet (30%), roasted soy flour (25%) and skim milk powder (15%). Weaning mix contained 18.37, 4.0, 9.0, 0.41 and 60.89 percent of protein, total ash, crude fat, crude fibre and carbohydrates, respectively. Further weaning mix was fortified with multivitamin-mineral mixture to meet PFA standards.

Banakar *et al*. (2005) developed supplementary foods using roasted or malted sorghum, finger millet, green gram and roasted rice, soybean and peanuts. To enhance the micro-nutrients powdered amaranth leaves were added. When analysed for nutritional quality, roasted food contained significantly higher amount of protein (16.88%), fat (4.27%) and ash (2.97%) compared to malted (15.96, 3.89 and 2.86%, respectively) while, malted food contained significantly higher amounts of moisture (5.93%), crude fibre (2.52%) and total carbohydrates (68.84%) compared to that of roasted (5.89, 2.43 and 67.56%, respectively).The energy value of roasted and malted foods was 376 and 374 Kcal, respectively. Every 100 gram of malted mix had comparatively higher amounts of calcium (430.50 mg), iron (11.18mg), zinc (4.5mg) and copper (3.48 mg) than roasted (4.27, 10.97, 4.28 and 3.39mg, respectively).

Fasasi (2009) showed increase in protein content (14.0-15.7%), fat (2.4-7.2%), ash (1.9-2.7%) and reduction in carbohydrates (76.3-72.6%) and crude fiber (2.0-1.8%) due to popping. Sood *et al.* (2010) prepared different mixes like *idli, dhokla, halwa*, *sattu* and *upma* and analysed for mineral and other nutritional parameters. The calcium content was found highest in *sattu* i.e. 213.33 mg/100g. Moisture content was highest in *sattu*, whereas crude protein was highest in *upma,* crude fat was highest in *dhokla* and crude fibre was highest in *sattu* are 8.87 per cent, 12.75, 7.66 and 3.57 per cent, respectively. Soy-whey based products are nutritious as they are good sources of proteins and minerals.

Pushparaj *et al*. (2011) analyzed the effects of commonly used traditional methods on dietary fiber, tannin content and %IVPD of two locally available pearl millet varieties (Kalukombu and Maharashtra Rabi Bajra). The millet was subjected to various processing methods like milling (whole flour, semi refined flour and bran rich fraction) roasting, boiling and pressure cooking respectively. Processing had little effect on the total dietary fiber (TDF) content in both varieties; however the bran rich fraction showed highest TDF content of around 29% polyphenols effectively lowered upon boiling and pressure cooking. Although the per cent IVPD of the millet (45.5 – 49.3 g/100g) was low, it significantly increased upon milling (bran rich fraction) and roasting.

Itagi *et al.* (2013) prepared multigrain *halwa* mixes (four types). *Halwa* prepared from these mixes had 26 to 31% moisture with protein, fat, carbohydrates and ash content being 5.7 to 6.3%, 7.9 to 8.7%, 54 to 58%, 1.6 to 3.3%, respectively. Energy derived from these ranged from 1,318 to 1,380 kJ/100 g. Pearl millet based multigrain *halwa* was harder and chewy in texture; while wheat based multigrain *halwa* was softer.

Extrusion is being used increasingly for making ready-to-eat foods. In extrusion processes, cereals are cooked at high temperature for a short time. Starch is gelatinized and protein is denatured, which improves their digestibility. Anti-nutritional

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factors that are present may be inactivated. Pearl millet flour and grits can be utilized in preparation of ready-to-eat (RTE) products. Such products will have crunchy texture and can be coated with traditional ingredients to develop sweet or savoury snacks. Alternatively, the grits could be mixed with spices and condiments prior to extrusion to obtain RTE snacks of desirable taste. The acid-treated pearl millet produces food products of better organoleptic acceptability as compared to decorticated pearl millet based food products. Pearl millet on blending with soy, protein-rich ingredients like groundnut or legumes, on extrusion can provide nutritionally balanced supplementary foods (Sumathi *et al.*, 2007). Extrusion-cooking positively enhances the *in vitro* protein digestibility of foods (Malleshi *et al.*, 1996).

Yadav *et al*. (2014) developed non-wheat pasta from pearl millet supplemented with 10–30 % barley flour, 5–15 % whey protein concentrate. The developed pasta had protein 16.47 g, calcium 98.53 mg, iron 5.43 mg, phosphorus 315.5 mg and β-glucan 0.33 g 100 g^{-1} of pasta on dry matter.

Le lestienne *et al*. (2005) reported that the simulations of gastro-intestinal digestion, used to estimate *in vitro* iron and zinc availability, when performed on two kinds of samples: (i) samples with decreased phytate contents from whole pearl millet flour and (ii) non-dephytinized or dephytinized samples from two pearl millet grain fractions, a decorticated fraction with low fiber and tannin contents and a bran fraction with high fiber and tannin contents. Iron and zinc *in vitro* availabilities of pearl millet flour improved significantly by phytate degradation. Total dephytinization of decorticated fraction led to a marked rise in iron and zinc *in vitro* availabilities. In whole Pearl millet flour, phytate and iron binding phenolic compound contents were both around 0.60 g/100 g DM.

Krishnamoorthy *et al*. (2013) formulated ready-to-make millet *Idli* mix. The millet-based *Idli* contained high proportions of protein (15–18%), fat (5.0–6.2%) and carbohydrate (72–74%) compared to the rice-based *Idli*. The ash content was in the range of 1–2% and crude fibre (3.0–4.9%).

Bunker *et al*. (2014) developed instant *kheer* mix from pearl millet using dairy whitener, and powdered sugar. Responses were recorded by employing the 3-factor Central Composite Rotatable Design. The formulation of instant *kheer* mix with sugar (15 g), dairy whitener (30 g) and pearl millet (20 g) was found suitable. The analysis was based on scores of consistency, viscosity, cohesiveness and overall acceptability. The reconstituted product from the formulated *kheer* mix had an overall acceptability score of 7.66 with desirability index of 0.7663. The values for moisture, fat, protein, carbohydrate and ash contents of the dry mix were 2.8, 4.38, 5.84, 85.88 and 1.1 per cent, respectively.

A ready-to-eat nutritious snack mix was made by blending the flour from popped Pearl millet and legumes with sugar and several other ingredients in the optimized proportion of 30:20:27:23. The nutrient composition, sensory qualities, functional properties and storage characteristics of the product were evaluated. The product contained protein 14.02 g, fat 14.50g, carbohydrates 59.00 g and dietary fiber 6.30 g per 100 g of mix. The sensory evaluation of the product revealed that color, taste, texture, aroma, appearance and overall quality were in acceptable range with mean score of 6.8. Shelf life of the product was about 90 days under normal conditions when stored in low density polypropylene pouches (Pradeep, 2013).

Shelf-life of convenience foods

Balasubramanian *et al*. (2014) developed *upma* mix which was monitored for peroxide value, free fatty acids and thiobarbituric acid value as well as sensory quality during storage and was found stable for 6 months at ambient conditions (20–35 °C) in poly ethylene pouches (75 μ).

A ready to serve instant *halwa* powder was developed by Dev raj *et al.* (2007), with potato flour (39.6g), ghee (9.9g), sugar powder (43.6g), cardamom, fennel, coconut and cashew nut as condiments. It was recorded that the product remained stable when packed in polyethylene bags and stored for 6 months at room temperature.

Prasad *et al.* (2000) standardized and commercialized ready-to-eat (RTE) and easy-to-reconstitute (ETR) mixes of traditional or popular Indian foods. Dry mixes of several traditional Indian foods gained worldwide popularity. These products were found to be microbiologically safe and organoleptically acceptable for periods ranging from 3 months to 1 year.

Khan *et al.* (2012) optimized coconut meal incorporated instant wheat semolina *halwa* mix which had better nutritional profile. Central composite rotatable design with two independent variables and four responses (lightness, redness, taste and overall acceptability) were used for the optimization. Coconut meal incorporated instant *halwa* mix prepared using optimized levels of ingredients contained moisture 0.95, fat 26.2, protein 7.65, total ash 0.86, fibre 1.02 per cent and received overall acceptability score of 8.5 on a 9 point hedonic scale providing 523.86 Kcal/100g. The changes in quality of stored VCM incorporated instant *halwa* mix packed in polypropylene were monitored in order to analyze the shelf-life. Instant *halwa* mix remained stable and acceptable for one year under ambient temperature conditions (15–34°C). However, Fatty acid composition of coconut meal incorporated instant *halwa* mix remained practically unchanged during storage.

Singh *et al. (*2013) prepared instant multigrain *dalia* mix based on sorghum, pearl millet and maize. Physicochemical changes in the *dalia* mix stored at 10, 25, 37 and 45^{o}C for 180 days were monitored. Hydroxy methyl furfural (HMF), free fatty acids (FFA) and thiobarbituric acid (TBA) value for the product increased significantly with increase in temperature and progression of storage period. The potential acceptable shelf life of developed instant multigrain *dalia* mix was 71 weeks at 10 ^{o}C.

CONCLUSION

The challenge for future researchers is to understand the consumer's preferences of convenience foods and work in this direction. Popularizing low cost food grains like pearl millet in form of RTE snacks or health mixes can be further worked on. These convenience foods can be marketed and taken up for commercialization to make them reach more people and become more popular and also give economic and health benefits to people.

REFERENCE

1. Arya, S. S. and Thakur, B. R. 1990. Instant *Halwa* (Kesari Bath) Mix-Storage Stability and Packaging Requirements. *Indian Food Industry*, **5**: 119-121.
2. Arya, S.S.1992. Convenience foods - emerging scenario.*Indian Food Ind*. **11**(4):31-41.
3. Balasubramanian, S., Yadav, D. N., Kaur, J. and Anand. 2014. Development and shelf-life evaluation of pearl millet based upma dry mix. *J. Food Sci. Technol* .**51**(6) :1110-1117.
4. Devaraju, B., Begum, M., Begum, S. and Vidya, K. 2006. Effect of temperature on physical properties of pasta from finger millet composite flour. . *J. Food Sci. Technol*. **43**: 341-343.
5. Filli, K.B. and Nkama, I. 2007. Hydration properties of extruded fura from millet and legumes. *Br. Food J.* **109**(1): 68-80.
6. Ghosh, K.G., Krishnappa, K.G., Srivatsava, A.N., Eapen, K.C. and Vijayaraghavan, P.K. 2001. Inpack processing of ready-to-eat foods in indigenous flexible packaging materials, Part III :Studies on newer packaging materials capable of withstanding the processing temperatures. *J. Food Sci. Techol*. **16**: 198-201.
7. Itagi, H. N., Singh, V., Indiramma, A.R. and Prakash, M. 2013. Shelf stable multigrain *halwa* mixes :preparation of *halwa*, their textural and sensory studies. *J. Food Sci. Technol*.**50** (5) :879-889.
8. Iwe, M.O., Van Zauilichem, D.J., Ngoody, P.O. and Ariahu, C.C. 2001. Residence time distribution in a single- screw extruder processing soy- sweet potato mixtures. *Lwt*. **34** (7).
9. Mahajan, P.V. and Chattopadhyay, P.K. 2000. Development of chemically leavened cereal legume based instant mix (*Dhokla)*. *J. Food Sci. Technol*. **37**(5): 459-464.
10. Prasad, N., Narayan, M., Siddalingaswamy, P.M., Parameswariah, K., Radhakrishna, R.V., Rao, K.R. and Viswanathan. 2000 .Proximate and mineral composition of some processed traditional and popular Indian dishes, Food Chem. 68 : 87-94.
11. Schober, T.J., Messerschmidt, M., Bean, S.R., Park, S.H. and Arendt, E.K. 2005. Gluten-free bread from sorghum: quality differences among hybrids. *Cereal Chem*. **82**:394-404.
12. Seth, D. and Rajamanickam, G. 2012. Development of extruded snacks using soy, sorghum, millet and riceblend – A response surface methodology approach. *International J. Food Sci. Technol*, **47**(7): 1526-1531.
13. Singh, G. and Sehgal, S. 2008. Nutritional evaluation of *laddoo* prepared from popped pearl millet. *J. Nutr. Food Sci.* **38** : 310-315.
14. Sood, S., Minhas, S., Kalia, M. and Modgil, R. 2010. Studies on Formulation of Ready-To-Use Weaning

Foods Mixes with Soywhey. Journal of Dairying, Foods and Home Sciences 29(1) : 42-46.

15. Srivastava, S., Dhyani, M. and Singh, G. 2003. Popping characteristics of barnyard and foxtail millet and their use in preparation of sweet. Recent Trends in Millet Processing and Utilization. pp. 38-40.
16. Suhendro, E.L., McDonough, C.M., Rooney, L.W., Waniska, R.D. and Yetneberk, S. 1998. Effects of processing conditions and sorghum cultivar on alkaline processed snacks. *Cereal Chemistry*, **75**: 187-193.

