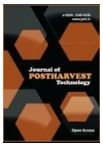

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RESEARCH ARTICLE

Development of instant appam mix supplemented with millet and legume flour

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ABSTRACT

One of the most consumed fermented morning foods in South India and Sri Lanka is *appam*. Commercially produced dry ingredient mixtures known as "instant mixes" that are quick and simple to manufacture. By considering present population increasing demand for a healthy, simple and convenient foods, the present investigations was carried out to formulate pearl millet, soybean supplemented instant appam mix in four different proportions. Sample A, B, C and D were formulated which contain rice flour, black gram flour along with pearl millet flour, and soya flour in different levels. It was found that organoleptic evaluation of sample C formulation had scored highest in texture (7.9), overall acceptability (8.3) and taste (8.1). The most acceptable instant appam mix sample was further analyzed for their nutritional composition and shelf life study. Nutritional properties showed that sample C formulation had protein (15.3 %), carbohydrates (66.7%) and crude fiber (5.52 %). Storage studies have showed that *appam* prepared from sample C stored for 5 months were found acceptable up to 150 days of storage. It may be concluded that instant appam mix could be stored up to 5 months successfully without any significant change in their sensory attributes.

Keywords: Instant mix, morning food, pearl millet, shelf life, soybean

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INTRODUCTION

At present the lifestyle of population has been changing fastly across the world. Today's consumer becomes health conscious, busier in fast and competitive life style. Even most of the women's who are home makers are engaged in job, career and business hence, they don't have enough time to make food. As a result of all current populations demand for healthy, nutritious, simple, fast and convenient food is growing Vijayalaxmi et al. (2020), Sharma et al. (2009). Foods that are ready to eat and ready to cook are popular in the twenty-first century. Instant food mixes comes under ready to cook category. The term "instant food mix" refers to straightforward, practical, and quick-to-prepare food items, which contain pre-mixed ingredients that make its preparation simple and accessible thus, instant foods help to save both the time and energy Dhiman et al. (2017). The current generation needs instant foods that are of high quality and nutritional value. For many types of people among the population, such instant mixes are convenient foods. They are easy to prepare and helps to reduce the

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effort of gathering and processing of various ingredients Vijayalaxmi et al. (2020). They are produced with various combinations of processed pulses, cereals, spices, condiments or other foods. To make and standardize various ready-to-cook (RTC) mixes of traditional, favourite Indian meals, a number of technologies have been developed. These include instant khichadi mix Patki et al. (2002), instant rava idli mix Madhura et al. (1998), proso millet instant idli mix Farheentaj et al. (2017), instant vegetable pulav mix Semwal et al. (2001), instant spread mix Saha & Dunkwal (2009), instant sooji upma mix Premavalli et al. 1987) and instant dhokla mix Ravi et al. (2010), instant kodo dosa mix Vijayalaxmi et al. (2020). Due to their high dietary fibre content and other health advantages, instant mixes have the potential to serve as a source of healthy meals Dhiman et al. (2017). In present study we further tried to improve nutritive value of instant appam mix using millet and legume flour.

The term "millets" refers to a variety of small-seeded annual grasses Bafna et al. (2020). These are hardy plants that can grow where the majority of other cereal grains can't. Millets are typically grown in regions with little rainfall, inadequate irrigation systems, and poor soil fertility Gupta & Paul (2012). Millets having high nutritive value which possesses various health benefits Vijayalaxmi et al. (2020). The most common millet in India is bajra (Pearl millet), which is a staple diet for rural residents in the country's drier regions. After rice, wheat, and sorghum, pearl millet is the fourth-most significant staple crop in India Singh et al. (2006). The high calcium, iron, zinc, fat, and high-quality protein content of pearl millet makes it an important source of nourishment for people Kumari (2018). Additionally, it has a lot of fat, dietary fibre, and minerals like iron and zinc Phalphale et al. (2021). Major component of pearl millet grains are carbohydrates. The protein and fat content of pearl millet is often higher than that of sorghum or the other millets. Its protein composition is not only high but also of good grade, with the exception of lysine deficiency Gill (1991). Varieties of pearl millet range in protein content from 12.25 to 13.09%, fat content from 4.32 to 5.11%, and protein digestibility from 47.30 to 61.17%, while carbs range from 71.82 to 81.02%. Gill (1991), Dudhate et al. (2017). Several research suggested that bajra flour could be used in formulation of a variety of food products for human consumption. Bajra is becoming more and more popular among consumers who are health conscious, due to its complex carbohydrate content and reduced glycemic reaction even if its gray colour causes negative impact on colour of produced items Gupta & Paul (2012).

Among the legume one of the most significant oil and protein crops in the world is the self-pollinated soybean *(Glycine max L.)*. The soybean is well known for its nutritional value especially protein content. The protein found in soybeans is referred to as a complete protein because it contains an adequate quantity of all the different types of amino acids needed for tissue growth and repair Suradkar et al. (2014), Katiyar & Katiyar (2018). Several essential nutrients, including vitamins and minerals, are abundant in soybeans. Soybean seeds contains 43.2% protein, 19.5% fat, 20.9% carbohydrate, and 3.7% crude fibre as well as high concentration of additional minerals like calcium, phosphorus, iron, and vitamins Gopalan et al. (1971). Additionally, isoflavones, a type of phytoestrogen found in soybeans, are thought to be helpful in preventing cancer by many nutritionists and medical professionals Rahman & Uddin (2008). Another ingredient used was black gram dhal. One of India's most highly prized pulses is black gram. Whole, split, and dehusked split black gram are the commonly used forms of black gram Kanth et al. (2021). Black gram is a valuable element in the making of *appam* as it contains mucilaginous substance. Pulses are excellent providers of iron, soluble fibre, protein, and a number of vitamins and minerals Roopa et al. (2017).

A well-known traditional fermented snack from India called an *appam* is made from rice flour, white sugar, and coconut milk. It is a popular dish in Kerala which mostly preferred as a healthy breakfast Sabu et al. (2017). At Indian kitchen many varieties of appam’s are available Manickavasagan et al. (2014). The way of preparation of *appam* get varied from region to region. Each variation has got unique taste. In Maharashtra *appam* is prepared mainly from fermented coarsely grounded rice flour and

black gram flour. At some places pulses like bengal gram, green gram are added to make it more tasty and nutritious whereas traditionally *appam* is also prepared using sorghum and rava. Presently, *appam* batter is available in a few food stores with different grain flour combination. However, no research reports are available on the ingredients and process standardization of *appam* yet. As the dried instant mixes saves preparation time and have better shelf life the present investigation was carried out to develop and standardize instant appam mix by adding pearl millet flour, soya flour in different proportions along with rice and black gram flour.

MATERIALS AND METHODS

Procurement of raw materials and chemicals

Whole rice, pearl millet, soybean, black gram dhal, baking soda (sodium bicarbonate), citric acid and salt were procured from local market, Karad. Analytical grade chemicals were used from Department of Food Process Technology, Dadasaheb Mokashi College of Food Technology, Rajmachi, Karad, Dist- Satara.

Preparation of raw materials

Rice, pearl millet, soybean and black gram dhal were sorted for removal of stones, any foreign materials and then washed with a tap water for several times to remove adhered dirt, dust particles. After cleaning, rice, pearl millet, soybean and black gram dhal were soaked in water separately at room temperature for 6 hours. The soaked grains were then either sun dried for three days or dried in a hot air oven for 24 hours at 65^0C, coarsely ground and stored in clean airtight containers for further use.

Preparation of instant appam mix

Four formulations of instant appam mix coded as Sample A, B, C and D were prepared by incorporating pearl millet and soya flour at different level with rice and black gram flour as given in Table 1. To standardize, ideal ratio mixes were prepared with different combination of flours along with 1.5% of citric acid, 1.2% sodium bicarbonate and 3% of salt. The detailed procedure of making instant appam mix was mentioned in Figure 1.

Table 1: Different blends of instant appam mix (100g)

Ingredients	Sample A	Sample B	Sample C	Sample D
Rice flour ‘g’	50	50	50	50
Pearl millet flour ‘g’	35	30	25	20
Black gram flour ‘g’	10	10	10	10
Soya flour ‘g’	5	10	15	20

Preparation of batter and appam from instant appam mix

Uniform batter of instant appam mix was made by mixing 100g of dried instant mix with 130 ml of water and 10g of curd. This was then kept aside for 15 min for rising and appam samples were prepared as per procedure given in Figure 2.

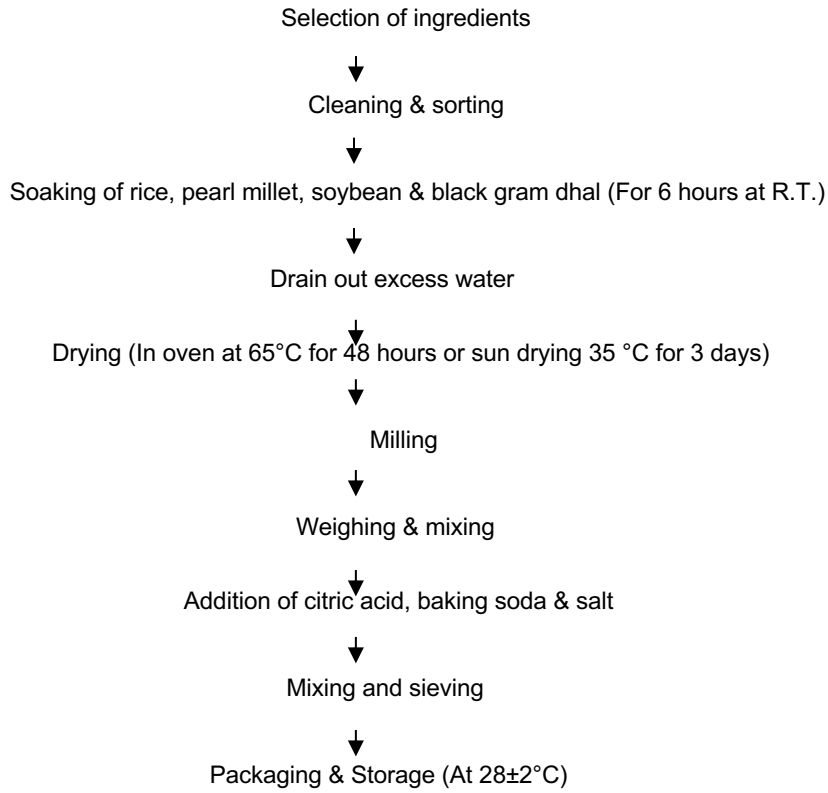

Figure 1: Process flow chart for instant appam mix preparation

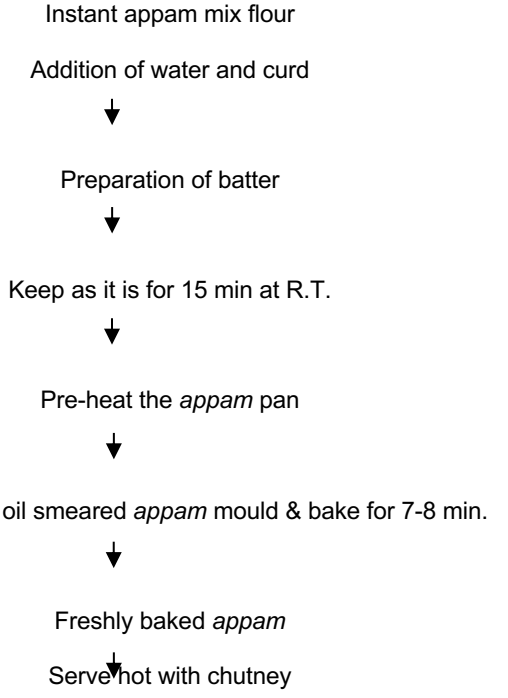

Figure 2: Process flow chart for *appam* preparation

Nutritional analysis of developed millet and legume flour supplemented instant appam mix

On the basis of sensory evaluation result selected Sample C formulation was analyzed for nutritional parameters such as moisture, crude protein, crude fat, ash, carbohydrate's and crude fibre, content using different procedures. Among minerals calcium, phosphorus and iron content were determined. The moisture content was determined at 105°C using hot air oven method, crude protein content was by using micro-kjeldahl method, crude fat content was by soxtron fat extraction system and ash content was by using muffle furnace while carbohydrate was by difference means by subtracting the measured protein, fat, ash and moisture from 100 Pearson (1976). The crude fibre content, iron, calcium and phosphorus content were determined using the standard method mentioned in Ranganna (2009).

Sensory evaluation of millet and legume supplemented appam

Prepared appam samples were subjected to sensory evaluation with respect to colour, flavour, taste, texture, and overall acceptability by a panel of 10 semi trained judges, using 9 point hedonic scale where score ranges from 9- Like extremely to 1- Dislike extremely.

Shelf-life study of developed instant appam mix

The best accepted instant appam mix formulation from sensory evaluation were packed in Aluminium Laminated Foil Pouches (200 gauge) and stored for shelf life studies under ambient condition (28±2°C). The stored formulation was evaluated for sensory parameters at one month interval up to 150 days of storage. During storage period the product was also evaluated microbiologically for standard plate count and yeast and mold count. Standard plate count and yeast and mold count was estimated as per procedure given by Andrews (1997).

RESULTS AND DISCUSSION

Nutritional analysis of developed millet and legume flour supplemented instant appam mix

Nutritional analysis of selected Sample C formulation showed the following results as per Table 2. The moisture content of appam mix was 12.26 %, the crude protein content was 15.3 %, crude fat was 3.91 %, the ash content was 1.83 %, and carbohydrate content was about 66.7 %. The crude fibre content was 5.52%. Among the minerals iron, calcium and phosphorus content was about 5.13mg per 100g, 57.07mg per 100g and 233.7mg per 100 g of product respectively. The results shown that supplementation of rice and black gram *appam* with pearl millet and soya flour 25 g and 15 g respectively resulted in increase of protein, crude fiber, iron, calcium and phosphorus content as both are amazing sources of protein having higher biological value and also minerals particularly iron, calcium and phosphorus as reported by Phalphale et al. 2021 in cookies formulation, Rafat et al. 2015 in papad formulation. According to Rani et al. 2017 the nutrient profile especially the protein and mineral contents of gluten-free products like biscuits, noodle, fried snacks and macaroni has improved by the addition of soy flour, rice flour, and dehulled black gram flour.

Sensory evaluation of millet and legume supplemented appam at 0 day

The findings of the sensory assessment of four distinct instant appam mix formulations were shown in Table 3. Among four different formulation, Sample C was found to be best accepted. The result of colour parameter shown that Sample D

formulation scored higher (8.2) which might be due to lower proportion of pearl millet flour because as the proportion of pearl millet flour increases, its undesirable grey colour becomes more dominant which makes the colour and appearance of product less acceptable. The flavour and taste score got highest for Sample C formulation (8.5 & 8.3 respectively) that contained 25% pearl millet flour and 15% soya flour while the average score decreased in Sample A formulation (6.8 & 6.7 respectively) at 35 % level of incorporation of pearl millet flour because as the proportion of pearl millet flour increases, its distinct bitter taste gradually becomes more dominant which makes the product less acceptable. On the other side even if the Sample D formulation was having lower proportion of pearl millet flour its flavour and taste scores were lower than Sample C because of highest proportion of soya flour (20%) which again add bitter taste. The average texture score got lowest for Sample A formulation that having higher proportion of pearl millet flour which might be due to coarse, compact and rough texture of pearl millet grain. Similar findings were reported by Gupta and Paul, 2012 in utilization of coarse grains like bajra flour, soya flour and whole wheat flour for formulation of value added snacks like *Laddo, Gatta* and *Thalipeeth*.

Table 2: Nutritional composition of developed instant appam mix per 100g

Sr. No.	Parameters	Amount %
1	Moisture (g)	12.26
2	Crude protein (g)	15.3
3	Crude fat (g)	3.91
4	Ash (g)	1.83
5	Crude fiber (g)	5.52
6	Carbohydrate (g)	66.7
8	Calcium (mg)	57.07
9	Phosphorus (mg)	233.6
10	Iron (mg)	5.13

Table 3: Sensory evaluation of different formulations of instant appam mix at 0 day

Formulation	Colour	Flavour	Taste	Texture	Overall acceptability
Sample A	6.9	6.8	6.7	6.7	6.8
Sample B	7.5	7.5	7.8	7.7	7.6
Sample C	8.1	8.5	8.3	8.1	8.3
Sample D	8.2	7.8	7.6	7.8	7.9

Shelf-life study of selected instant appam mix formulation

Sensory evaluation of stored instant appam mix formulation

The results of sensory evaluation of instant appam mix sample packed in aluminium laminated foil pouch, stored under ambient condition (28±2°C) at interval of one month were given in the Table 4. As the storage time increases all the scores for sensory characteristics slightly decreases. There were non-significant decline in colour, flavour, taste, texture and overall

acceptability up to 150 days storage period. Similar findings were reported by Bishnoi et al. 2015 in rice and chicken meat powder (CMP) incorporated idlies during storage up to 90th days.

Table 4: Mean sensory scores of appam prepared from stored instant appam mix

Sensory parameters	Storage period (Days)					
	0	30	60	90	120	150
Colour	8.10	8.10	8.04	8.00	7.95	7.90
Flavour	8.50	8.50	8.44	8.41	8.37	8.35
Taste	8.30	8.26	8.23	8.16	8.15	8.10
Texture	8.10	8.08	8.03	8.01	8.00	7.92
Overall acceptability	8.30	8.23	8.19	8.15	8.12	8.07

Microbial analysis of stored instant appam mix

The results of microbial analysis of selected Sample C formulation during storage period up to 150 days for the standard plate count (SPC) and yeast and mold parameters were mentioned in Table 5. The standard plate count was 6.3×10^2 cfu/g on Day 0 and it increased up to 5.3×10^3 cfu/g on Day 150 whereas yeast and mold count was 1.1×10^1 cfu/g on Day 0 which was increased up to 3.0×10^1 cfu/g on Day 150. As per FDA, 2013 acceptable limit of SPC and yeast and molds for cereal grains should be within less than 10^6 cfu/g and 10^4 cfu/g respectively. Thus, increased SPC and yeast and mold count were within the safety limits up to the end of storage.

Table 5: Standard plate count and yeast and mold count (cfu/g) of instant appam mix stored at 28±2°C

Microbial parameter	Storage period (Days)					
	0	30	60	90	120	150
SPC (cfu/g)	6.3×10^2	8.5×10^2	2.3×10^3	3.9×10^3	5.5×10^3	5.3×10^3
Y& M count (cfu/g)	1.1×10^1	1.3×10^1	1.5×10^1	1.7×10^1	2.3×10^1	3.0×10^1

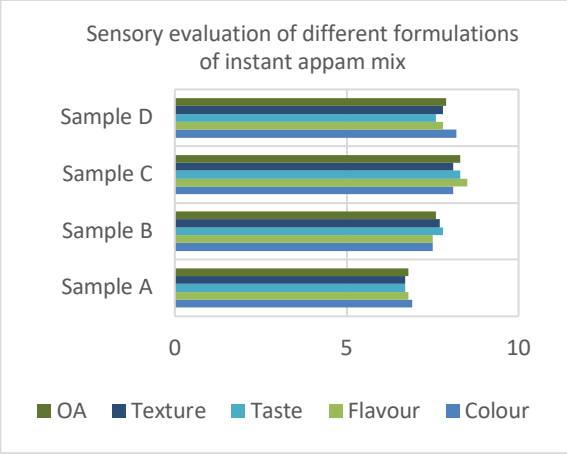

Fig. 3: Sensory evaluation of appam mix

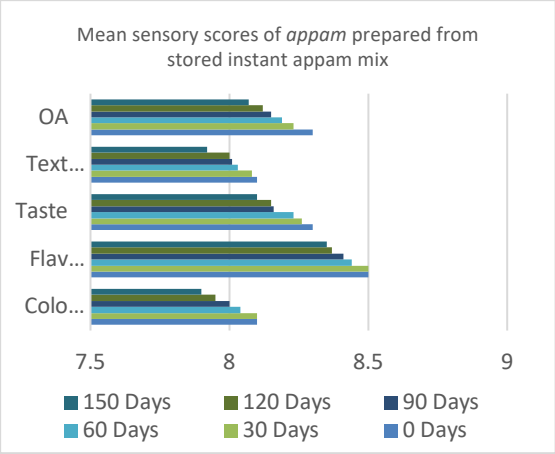

Fig. 4: Mean sensory scores of appam mix

Fig 5. Prepared baked *appam*

Fig.6: Instant appam mix stored in Aluminium Laminated Foil Pouch

CONCLUSION

From this research it may be concluded that highly acceptable instant appam mix can be prepared from rice flour, pearl millet flour, soya flour and black gram flour as 50%, 25%, 15% and 10% respectively. The pearl millet and soya flour supplementation in appam mix will helps to improve nutritive profile in terms of crude proteins, crude fibers, minerals like iron, calcium and phosphorus hence it might be preferred as healthy and convenient breakfast. Developed instant appam mix could be stored up to 150 days at room temperature, with acceptable sensory attributes and without any significant deterioration in microbiological quality.

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