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Optimization and evaluation of frozen Puranpoli

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Abstract
Puranpoli is an Indian sweet flatbread made from whole wheat flour, Bengal gram and jaggery with added spices. *Puran* was optimized on the basis of different combinations Bengal gram and jaggery after that it was analyzed for sensory, colour and texture. Dough was optimized on the basis of proving time. Prepared *puranpoli* was packed in LDPE, zip lock pouch and laminated aluminium zip pouch which stored at frozen storage (-18ºC) for 28 days. The physico-chemical, microbial and sensory stability of the *Puranpoli* was evaluated during storage at the interval of 7th, 14th, 21st and 28th day. pH was slightly decreased for sample which was kept in LDPE pouch and Zip lock pouch. The sample which was stored in laminated aluminium zip pouch does not show any change. Microbiologically *Puranpoli* was found to be safe which was stored in laminated aluminium zip pouch during entire period of storage. *Puranpoli* stored in laminated aluminium zip pouch remains stable and acceptable for 28 days of storage studies at frozen temperature conditions (-18°C).

Keywords: *puranpoli*, unleavened, flat bread, sensory, colour, texture

1. Introduction
Puranpoli is a marathi cuisine, considered as a nutritionally rich food and traditionally made only during auspicious occasions and during important Indian festivals. *Puranpoli* is the most popular dessert of Maharashtra state and it is made in each and every house during the festivals. *Puranpoli* is called by different names in different languages like Poli in Tamil, Lanchipoli in Malayalam, Bobbatlu in Andhra Pradesh and Vermi/wermi in Gujrati, Bakshalu in Telugu. In Karnataka the outer covering of a *Puranpoli* is called the 'Kanaka', the filling is called the 'Hoorna' and *Puranpoli* is called as Holige. The Kanaka should be thin and able to just hold the hoorna together. The general appearance of *Puranpoli* is like chapatti. The shelf-life of freshly baked chapatti is 24-36 hrs and becomes unfit for consumption due to development of mold growth, ropiness and texture deterioration depending upon storage conditions [1].
Wheat (genus *Triticum*) is a member of the grass family (*Poaceae*).It is the most important stable food crop for more than one third of the world population and contributes more calories and proteins to the world diet than any other cereal crops. It is nutritious, easy to store and transport and can be processed into various types of food. Wheat is considered a good source of protein, minerals, B-group vitamins and dietary fiber although the environmental conditions can affect nutritional composition of wheat grains with its essential coating of bran, vitamins and minerals. It is an excellent health-building food. Most of the wheat is consumed in the form of flour [2]. Glycerol monostearate, commonly known as GMS, is an organic molecule used as an emulsifier. GMS is a white, odorless, and sweet-tasting flaky powder that is hygroscopic. It is a glycerol ester of stearic acid. It occurs naturally in the body as a by-product of the breakdown of fats, and is also found in fatty foods. GMS is a food additive used as a thickening, emulsifying, flavor enhancer, anti-caking, and preservative agent [3]. Chickpea (*Cicer arietinum*), also called garbanzo bean or Bengal gram. There is a growing demand for chickpea due to its nutritional value. Chickpea is a good source of carbohydrates and protein, dietary fiber, vitamins and minerals [4]. Jaggery is sugarcane based natural sweetener made by the concentration of sugarcane juice without any use of chemicals. It is available in the form of solid blocks and in semi-liquid form. Jaggery is consumed mostly by the rural population in India which is a natural mixture of sugar and molasses [5].

2. Materials and methods
2.1 Materials
The ingredients such as Wheat (Lokwan), Bengal gram Dal (56 Bhag), Jaggery, Cardamom and Nutmeg were procured from local market of Aurangabad, India.

2.2 Packaging materials
LDPE (350 gauge), LLDPE Zip lock pouch (45 micron), Laminated Aluminium zip pouch (42 micron) were used to study storage stability and keeping quality of *puranpoli*. Packaging material procured from local market of Aurangabad.

2.3 Methods
2.3.1 Optimization the process of stuff (*puran*) making
In the process of *puran* optimization five different combinations of Bengal gram dal and Jaggery was used i.e. 60:40, 55:45, 50:50, 45:55 and 40:60. Among these samples one sample was selected by sensory evaluation and by analysis of texture and colour. Further the selected sample was kept for storage study.

2.3.2 Method of preparation of *Puran*

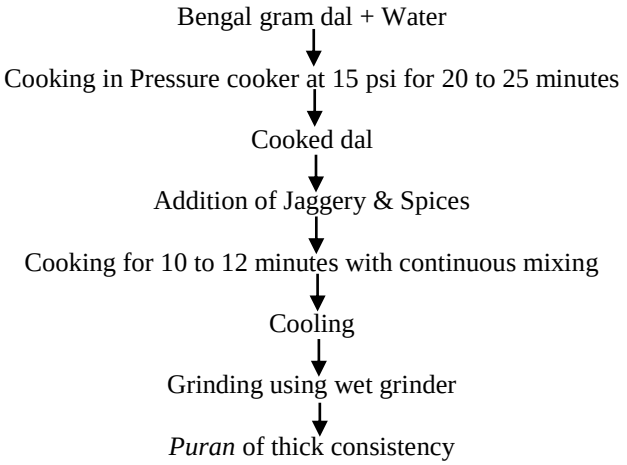

Fig 1: Flow chart for preparation of *Puran* traditionally [1]

2.3.3 Analysis of *Puran*

Colour of *puran*

Colour of the *puran* was evaluated by using Colour Scanning Machine (Premier Colourscan, Thane, MPKV, Rahuri). The colorimeter was calibrated with a standard white plate. The colour of a samples were recorded in terms of *L** (Lightness), *a** (green,-a to red, +a) and *b** (blue, -b to yellow, +b).

Texture Analysis of *Puran*

Texture of the *puran* was analysed by using texture analyzer. Prepared *puran* were analyzed for its Tensile and compression using Texture analyzer (Shimadzu Japan, Model AG-X, MPKV, Rahuri). Tensile and compression of the *puran* were measured by using the stickiness (plate) and penetration (rod) technique. Compression test speed 10 mm/min; tensile test speed 5mm/min.

Sensory evaluation of *Puran*

The prepared samples of *puran* were evaluated for sensory parameters such as color, flavor texture, taste and overall acceptability using 9 point hedonic scale by the panel of 10 semi trained judges. Samples ware coded with numbers and presented together to panel members in day light. Water was provided for rinsing mouth after each sample.

2.4 Optimize the process of Dough making

The dough was optimized on the basis of extensibility with different resting time i.e. 30 min, 60 min and 90 min. From these three resting time one resting time was selected for preparation of dough.

2.4.1 Method of preparation of whole wheat flour dough

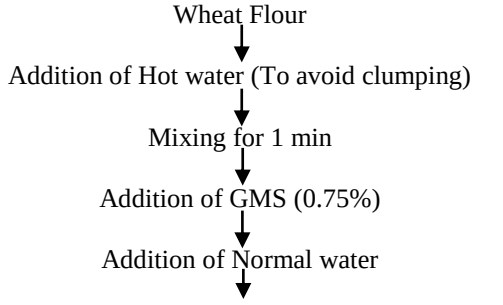

Fig 2: Flow chart for preparation of dough from whole wheat flour [1]

2.5 To study the shelf life and eating quality of frozen *Puranpoli*

To study the shelf life of *puranpoli* different packaging materials like LDPE (350 gauge), LLDPE Zip lock pouch and Laminated Aluminium zip pouch were used. The samples was kept for storage at -18^{o}C.

2.5.1 Method of preparation of *puranpoli*

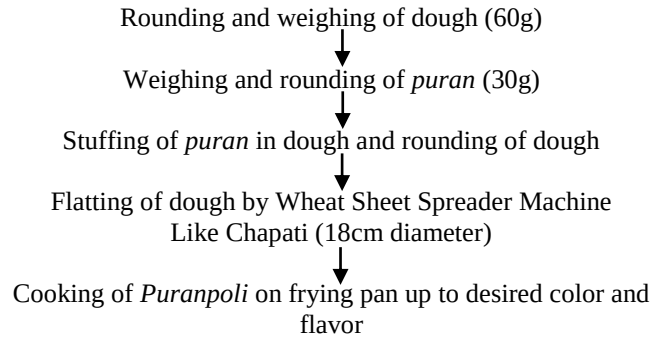

Fig 3: Flow chart for preparation of *Puranpoli* [1]

2.5.2 Microbial Analysis of *puranpoli*

Total Plate Count (TPC)

Total plate count, and yeast and mould count were estimated by using nutrient agar and potato dextrose agar respectively with the help of pour plate technique The dilutions was made up to 10^{-5} and the 1 ml of aliquot was used for the isolation. All processes were carried out in a sterile condition with the help of Laminar Air Flow. Plates were incubated at 37° C for 48 hrs and results noted in CFU/ml. Total Plate Count (TPC) of *puranpoli* were examined. The microbial count was taken up to 28 days at the interval of seven days after preparation [6].

2.5.3 pH of *Puranpoli*

The pH is instantly determined by using the pH meter. *Puranpoli* sample was taken in a beaker and adjusted according to room temperature in which electrodes of pH meter ware dipped and reading is recorded after standardizing the instrument with buffer solution of pH 4 and 7 and reading was directly recorded. pH of *puranpoli* was measured during 1st day, 7th day, 14th day, 21th day, 28th and the measurements were made in triplicate for each *puranpoli* sample to avoid errors.

2.5.4 Textural analysis of *Puranpoli*

Texture of *puranpoli* was carried out initially and a regular interval of 7 days using food texture analyzer. (FTC/USA/TMS-Pro, UDCT, Babasaheb Ambedkar Matarhwada University, Aurangabad).

A *puranpoli* was held at the centre of the two clamps. The penetration probe was used to rupture *puranpoli*. The peak force (N) that is the force required to puncture the *puranpoli*. Penetration test was very similar to compression test with one key difference: the probe is typically much smaller than the sample being tested, such that the surface is pierced, or punctured. Three measurements per replication were taken for all the textural analysis.

2.5.5 Sensory Evaluation
The prepared samples of *puranpoli* were evaluated for sensory parameters such as color, flavor, texture, taste and overall acceptability using 9 point hedonic scale by a panel of 10 semi trained judges at initially and a regular interval of 7 days. Samples ware coded with numbers and presented together to panel members in day light. Water was provided for rinsing mouth after each sample.

2.5.6 Parameters Analyzed for *puranpoli*
In this study different parameters of *puranpoli* were analyzed during *puranpoli* preparation and those are weight of dough, weight of *puran*, baking time, diameter of *puranpoli*, Thickness of *puranpoli*, weight of *puranpoli* before cooking, weight of *puranpoli* after cooking, thawing time etc.

3. Results and Discussion

3.1 Analysis of *Puran*
The *puran* was optimized on the basis of sensory analysis, Colour analysis and by analyzing Texture of *puran*. For the *puran* optimization different combinations of Bengal gram with Jaggery was taken and that were 60:40, 55:45, 50:50, 45:55 and 40:60.

3.1.1 Results of *puran* optimization
The prepared samples of *puran* were evaluated for sensory parameters such as Color, Aroma, Taste, Texture and Overall acceptability using 9 point hedonic scale by a panel of 10 semi trained judges. The Sensory analysis of *puran* showed that T3 sample got highest score comparative to other samples.

3.1.2 Colour of *puran*
The colour of puran was analyzed by using colour scanning machine. The sample of *puran* was compared with standard white. Colour results indicated that T5 samples had the darkest colour, followed by T4, T3, T2 and T1. The Lightness value of *puran* increases from sample T1 to T5, it may be due to increasing the concentration of jaggery. In many food products colour, appearance or eye appeal is the first indicator of quality and may contribute significantly to the decision of the consumer to accept or reject the product. The colour of T3 sample was neither too bright nor too light, on this basis sample T3 was selected.

3.1.3 Texture of *puran*
One of the most important sensorial attributes for *puranpoli* is texture. Texture is one of the responsible factors for consumer liking or disliking. Texture of the *puran* was analyzed by using texture analyzer. Prepared *puran* were analyzed for its tensile and compression using Texture analyzer (Shimadzu Japan, Model AG-X). Tensile and compression of the *puran* were measured by using the stickiness (plate) and penetration (rod) technique. The changes were observed in texture of *puran* due to changes in concentration of Jaggery. As the proportion of jaggery decreases the puran finds dry in texture and as the proportion of jaggery increase the texture become too sticky. The texture of *puran* was depending on the amount of jaggery used in preparation of puran. Findings of stickiness Table 1 shows that sample T1 required 93.5N force after that as the concentration of jaggery was decreases in sample the required force is also decreases up to 41.24 for sample T5. Findings of penetration test shows that T1 sample required max force for penetration i.e.0.67N and it was decreases up to 0.067N for sample T5.

3.2 Dough optimization
The rheological characteristics of dough are important, as they affect both the mechanical inability of the dough and the quality of the end product. The rheological properties of dough depend on the chemical composition of flour and nature of other ingredients added. Among the rheological characteristics, farinograph dough stability, extensograph ratio and area, mixograph peak height, compressive stress, dough hardness and cohesiveness are affected by the nature of the flour. However, dough should meet certain rheological requirements in order to produce high quality flat bread with prolonged shelf-life. The rheological properties of dough change significantly during baking operation, mainly as the result of the temperature [7]. The dough was optimized on the basis of extensibility with different proving periods 30min, 60min and 90 min.

3.2.1 Physico-Chemical Analysis of Wheat Flour
The whole wheat flour was analyzed for parameters such as moisture, ash, water holding capacity and alcoholic acidity. Physico-chemical analysis report of wheat flour shows that the wheat flour contains 14% moisture content with 1.3% ash. The water holding capacity of flour is 85% with 9.24% gluten content, 0.06% alcoholic acidity. The results are comparable with those reported by [1].

3.2.2 Farinograph
Water absorption of whole wheat flour was measured in Barbender Farinograph. The higher water absorption can also be due to higher protein content. It is well known that besides starch, proteins also influence water absorption of flour along with pentosans. The Final reading for whole wheat flour was taken from the average of three readings.

3.2.3 Extensibility
The extensibility of whole wheat flour samples was measured in farinograph. A 300 gram flour sample on a 14% moisture basis is combined with a salt solution and mixed in the farinograph to form dough. After the dough is rested for 5 minutes, it is mixed to maximum consistency (peak time). Then prepared dough samples were used for extensibility measurement. A 150 gram sample of prepared dough is placed on the extensograph rounder and shaped into a ball. From Table 2 three resting time were used to optimize the dough i.e.30min, 60 min and 90 min. From these three resting periods 30 min resting time was selected for preparation of dough. The Extensibility, Energy and Tolerance of dough was decrease up to 60 min after the 60 min the tolerance, Energy and Extensibility of dough is again increases for 90 min of proving time.

3.3 Shelf life and eating quality of frozen *Puranpoli*
To study the shelf life of *puranpoli* different packaging materials like LDPE (350 gauge), LLDPE Zip lock pouch and Laminated Aluminium zip pouch were used. The samples were kept for storage at different temperature -18^{o}C and ambient temperature.

3.3.1 Physico-Chemical Analysis of *Puranpoli*
The physic- chemical analysis of *puranpoli* revealed that its Moisture content 25.6%, Ash 1.95%, Fat content 9.1%, Protein content 23.3% and total Carbohydrates 39%. The results are well

comparable with [1] and [2]. These slight variations in results may be due to amount of ingredients used and varietal differences from place to place.

3.3.2 Textural analysis of *Puranpoli*

One of the most important sensorial attributes for *puranpoli* is texture. Apparent body and texture of *puranpoli* is responsible factor for consumer liking or disliking. Many of the factors were found to be responsible for the texture and microstructure of *puranpoli*, responsible factors such as fat content, addition of emulsifier, storage time, temperature and manufacturing process were found notable. Texture of *puranpoli* was carried out initially and a regular interval of 7 days using food texture analyzer. Parameter firmness was studied and the data has been presented in Table 4. The data revealed an increase in firmness and softness in *puranpoli* during storage, which may be because most of the starch molecules in freshly baked *puranpoli* hydrated randomized form and most of the glucose moieties have inter–molecular hydrogen bonding with water resulting in a soft and pliable texture. However the starch molecules on storage tend to realign to attain more organized structure having hydrogen bonding between hydroxyl groups of adjacent glucose units. This change is associated with increase in crystalline and loss in solubility of starch gel leading to brittle texture.

The energy required to puncture a sample S1 decreased significantly from 0.62 N to 0.46 N, S2 sample decreased from 0.62 to 0.39 after that sample S1 and S2 were unfit for consumption due to microbial growth. The firmness of S3 sample was decreased from 0.62 to 0.43 in *puranpoli* during storage up to 1 month under freezing temperature (-18^{o} C) conditions [8].

3.3.3 Microbial Analysis

Total Plate Count (TPC)

The total plate count of *puranpoli* was determined by using total plate count method, in which Nutrient Agar was used for total bacterial count and Potato Dextrose Agar was used for total yeast and mold count.

Microbial analysis was done to study the microbial quality of *puranpoli* by using Pour Plate Technique. The analysis was done at the interval of seven days after the preparation of *puranpoli* with packed in different packaging material.

The obtained results are presented in Table 4. The control sample showed surface growth on 7th day whereas S1 and S2 showed surface growth on 21st and 28th day respectively for yeast and mould count. There is no bacterial growth on sample S3 up to 28th day. Sample S3 was in good condition up to 28th day of storage.

As per the WHO (1994) guideline the total plate count and yeast and mould count should be less than 2 x 10^5 and 1 x 10^4 per gram respectively [6].

3.3.4 pH of *Puranpoli*

The results regarding pH of *puranpoli* are summarized in the Table 4 Negative logarithm of the hydrogen ion concentration is called pH. It is more authentic means of measurement than titratable acidity. The titratable acidity provides a measurement of the quantity of acid present whereas pH gives the measurement of the potency of that acid. *Puranpoli* is a perishable food and due to acidity production pH of the perishable foods decreased by increasing storage time. Results show that pH of the *puranpoli* samples significantly affected due to storage. The pH values of *puranpoli* samples reduced with the advancement of storage time. The decrease in pH from 1st to 28th day of storage was 6.28 to 5.97, 6.28 to 6.13 and 6.28 to 6.16 for samples S1, S2 and S3 respectively. Results revealed that the *puranpoli* having packed in aluminum laminated pouches had the least decreased in pH compared to rest of the samples with other packaging materials. These results are in line with findings of [9].

3.3.5 Sensory Evaluation

The sensory analysis was done at the interval of seven days after the preparation of *puranpoli* with packed in different packaging material. Samples S1 and S2 showed good score for colour and taste but less score in aroma and texture due to change in packaging material.S1 and S2 showed surface growth on 21st and 28th day respectively for yeast and mould count. There for sample S1 and S2 were failed for further storage study. There is no bacterial growth on samples up to 28th day. There is not any difference in the sweetness of the product. Sample S3 was in good condition up to 28th day of storage and it also got good score in sensory evaluation.

3.4 Parameters checked for *puranpoli*

The study was done on packaging material during storage of packed product for period of 1 month with different packaging material ((LDPE 350 gauge, aluminum foil and zip pouch) at 7 days interval.

- Puran taken for each *puranpoli* = 40gm
- Dough taken for each *puranpoli* = 35 gm
- Diameter of *puranpoli* = 12 cm±1
- Thickness of *puranpoli* =2.46 mm
- Baking Time 1.One side = 45 sec
- 2. Other side = 15 sec
- Weight of *puranpoli* before cooking = 75.9 gm
- Weight of *puranpoli* after cooking = 73.16 gm
- Thawing Time = 20 min

3.5 Results of storage study

Puranpoli was kept in deep freezer at -18^{o}C for one month in packaging material like LDPE pouch, LLDPE Zip lock pouch and Laminated Aluminum pouch. Different parameters were analyzed like microbial analysis, texture analysis, pH analysis and sensory analysis in the interval of seven days.

The results of Microbial analysis revealed that the control sample showed surface growth on 7th day whereas S1 and S2 showed surface growth on 21st and 28th day respectively for yeast and mould count. There is no bacterial growth on sample S3 up to 28th day. Sample S3 was in good condition up to 28th day of storage. During the storage period of *puranpoli* the texture was slightly affected, the firmness of *puranpoli* was increase. The pH values of *puranpoli* samples reduced with the advancement of storage time. S1 and S2 showed good score for colour and Taste but less score in Aroma and Texture due to change in packaging material. Sample S1 and S2 were failed for further storage study as it showed surface growth of yeast and mould on 21st and 28th day. Sample S3 was in good condition up to 28th day of storage and it also got good score in sensory evaluation.

Table 1: Colour and Texture analysis of *Puran*

		Standard-White	T1	T2	T3	T4	T5
Colour	L	95.588	95.332±0.04	95.524±0.03	95.674±0.03	95.965±0.05	96.129±0.32
	a*	0.575	0.567±0.04	0.649±0.01	0.56±0.02	0.488±0.02	0.411±0.03
	b*	2.115	2.276±0.05	2.276±0.06	2.799±0.05	3.811±0.01	4.305±0.01
Texture	Tensile Test (Stickiness) Max Force(N)		93.05	88.03	75.22	62.96	41.24
	Compression Test (penetration) Max Force(N)		0.67	0.63	0.29	0.24	0.06

Table 2: Extensibility of dough

Sample	Proving Time (min)	Energy (cm^2)	Resistance to Extension(BU)	Extensibility (mm)
Whole Wheat Flour	30	41	315	85
	60	28	208	67
	90	32	253	72

Table 3: Proximate analysis of *puranpoli*

Parameters	Results (%)
Moisture	25.5 ± 0.41± **0.41**
Ash	1.95 ± 0.44
Fat	9.1 ± 0.25
Protein	23.3 ± 0.32
Carbohydrate	39 ± 0.24

Table 4: Storage study of *puranpoli*

Storage Period (Days)	Texture(N)			Microbial Analysis						pH Analysis		
				Total Bacterial Count(CFU/ml)			Total Yeast and Mould Count(CFU/m)			Samples		
	S1	S2	S3	S1	S2	S3	S1	S2	S3	S1	S2	S3
0	0.6±0.01	0.62±0.01	0.62±0.01	ND	ND	ND	ND	ND	ND	6.28±0.01	6.28±0.01	6.28±0.01
7	0.5±0.005	0.53±0.15	0.53±0.03	ND	ND	ND	ND	ND	ND	6.13±0.005	6.20±0.15	6.27±0.03
14	0.4±0.03	0.47±0.25	0.50±0.001	ND	ND	ND	ND	ND	ND	6.00±0.04	6.20±0.12	6.21±0.002
21	NL	0.39±0.001	0.47±0.02	13×10^1	ND	ND	8×10^1	ND	ND	5.97±0.13	6.15±0.02	6.18±0.12
28	NL	NL	0.43±0.13	NL	11×10^1	ND	NL	9×10^1	ND	NL	6.13±0.12	6.16±0.004

4. Conclusion

The conclusions of the studies from all results are, The whole wheat flour dough with 30 min proving time showed good water absorption, tolerance and extensibility so 30 min proving time is good for preparation of *puranpoli*. Puran prepared from taking 50:50 combination of Bengal gram and Jaggery results in puran giving good aroma, taste and colour. *Puranpoli* apart from giving taste contributes to calorie and nutrition in diet. Frozen storage can be an appropriate method to preserve the quality of *puranpoli* for longer duration. The *puranpoli*, packed in laminated aluminium pouch and stored at -18°C can remain satisfactory for consumption of minimum 30 days.

5. References

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