DEVELOPMENT AND QUALITY ANALYSIS OF INSTANT MULTIGRAIN SPINACH THALIPEETH MIX

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ABSTRACT

At present the demand for healthy, nutritious, simple, fast and convenient food is growing worldwide. *Thalipeeth* is a product which becoming popular in Maharashtra, however its preparation is time consuming which requires a high skill of cooking. Right now, *bhajani* flour is available in some food stores with different grain flour combination, while only few reports are available on nutritional content and composition of *thalipeeth*. Keeping in view the above facts the aim of present work was to develop instant multigrain thalipeeth mix supplemented with dried green spinach leaves. Four different samples of *bhajani* flour P_1, P_2, P_3 and P_4 were formulated in order to standardize composition of different flours like wheat, soya, rice, pearl millet, ragi, sorghum and bengal gram along with different spices. The organoleptically selected sample (P_3) was further fortified with blanched, dried spinach leaves in different proportions as 1%, 1.5 %, 2% and 2.5% levels. The prepared *thalipeeth* were evaluated for sensory quality in comparison to control that is P_4 (without spinach leaves). Final organoleptically selected sample was analyzed for nutritional and shelf life study. The nutritional analysis of the selected mix showed a significant increase in the proximate composition especially crude protein which was (19.30 %), total carbohydrates (60.84 %) and crude fiber (9.03 %). Sensory evaluation revealed that *thalipeeth* incorporated with 1.5% dried spinach were near about to control in all quality attributes. Storage studies showed that *thalipeeth* prepared from selected formulation after 6 months storage in PP pouch were acceptable. Microbial studies revealed that coliform, yeast, mould and standard plate count of instant thalipeeth mix was within the limit up to 6 months storage. It may be concluded that healthy, nutritious instant thalipeeth mix could be prepared using multi grains along with dried spinach leaves who can be stored in good condition up to 6 months at room temperature.

Keywords: *Thalipeeth*, convenient food, millet, standardization, storage

I. INTRODUCTION

Today's consumers are becoming health conscious and as a result there desire for new foods with innovative, healthful components is rising. Along with this, there are a number of other factors that contribute to the population's changing eating habits, including growing industrialization, preference for nuclear families, increases in per capita income, and an increase in the proportion of working women. Given that the majority of women are employed, they face the difficult issue of juggling all of the required home duties within a time. As a result, there is a growing desire for quick, easy, convenient, and Ready-To-Cook foods. Instant mixes are those foods which requires less time and efforts while preparing. According to reports in India, consumption of Ready-To-Eat (RTE) and Ready-To-Cook food has been significantly increasing amongst the age group of 25-40 years [11].

The savoury unleavened pancake known as a *thalipeeth* is a Maharashtrian tradition that originated in India. The word *thali* indicates its shape while *peeth* is a Marathi word meaning flour. All age groups, including children's, enjoy it and typically eat it as a healthy breakfast. *Thalipeeth* is made using a mixture of roasted cereal, pulse, and bean flours called as *bhajani* flour. Making *thalipeeth* is a laborious procedure that takes time and expertise [4]. When making the dough, the first step is to combine the flour and the spices. The dough is then rolled out on a damp muslin cloth and transferred to a hot pan for roasting on both sides using oil. While preparation first dough is prepared by mixing flours and spices which then rolled on wet muslin cloth and transferred to hot pan for roasting on both sides with application of oil. Use of instant thalipeeth mix eliminates the need to gather all the flours, spices, and additional ingredients, if any. The mixing of different cereals, legumes, pulses, millet flours in different combinations along with various dried leafy vegetables might enhances nutritional value. Only a small number of studies have been published so far on the formulation of

thalipeeth flour blends supplemented with vegetables or green leaves, as well as on the storage of RTE *thalipeeth*, but there have been no publications on the preservation of instant thalipeeth mixes.

Till now only few studies were reported on *thalipeeth* flour blends formulation supplemented with vegetables/green leaves and storage study of RTE thalipeeth but there were no any report on storage study of instant thalipeeth mix. Reference [11] was undertaken research on the storage of *thalipeeth* prepared with various combinations of cereal malt flour. Research on *thalipeeth* ingredient optimization, process standardization, and nutritional evaluation were done by [4]. According to reference [6] *thalipeeth* made from a variety of flours including sorghum, soybean, green gram, horse gram, and moth beans, along with moringa leaves, were a good source of nutrients. Reference [5] was examined effect of additives on rheological, morphological, textural and sensory properties of thalipeeth. Reference [9] was formulated micronutrient rich *thalipeeth* and m*athri* by incorporating dehydrated greens of 'keerae' (*Amaranthus paniculatus*) and 'shepu' (*Peucedanum graveolens*). Thus by considering current growing customers demand of the nutritional, healthy and instant food present study was carried out to formulate instant thalipeeth mix using flours of wheat, soya, rice, pearl millet, ragi, sorghum and bengal gram in supplementation with dried spinach leaves. The nutritional value of *thalipeeth* could be improved by adding pearl millet, ragi, soya, bengal gram, and dried spinach leaves to wheat, rice, and sorghum flour, which would satisfy consumer demand for a quick and healthful meal, particularly among working women.

II. MATERIALS AND METHODS

A. Procurement and processing of ingredients

Raw ingredients like whole wheat, soybean, rice, pearl millet, ragi, sorghum and bengal gram flour were purchased from the local market of Karad. Spices like cumin seed, ajwain, onion powder, turmeric powder and salt were purchased from the local spice retail shop in Karad. Fresh ingredients like spinach green vegetable, green chili, curry leaves were purchased from the local Karad vegetable market. The chemicals used in this investigation were of analytical grade and were obtained from Department of Food Process Technology, DMCFT, Rajmachi.

B. Processing of soybean, cereal and millet grains

Raw whole wheat, soybean, rice, pearl millet, ragi and sorghum were first cleaned, soaked in lukewarm water for 6 hrs separately and then dried in cabinet drier at 60°C for 7 hrs. After drying they were roasted at 120℃ to 200℃ for 5 to 10 min till brown colour and pleasant flavor developed. The roasted grains were then ground into fine flour separately.

C. Processing of spinach, curry leaves and green chili

Freshly harvested green spinach (*Spinacia oleracea*) and curry (*Murraya koenigii*) leaves were washed and cleaned. They were then chopped, blanched and dried in the oven at 80°C for 6 hours which was then powdered. Clean, fresh, healthy green chilies were cut into pieces and dried in same way. All ingredients were packed in polyethylene bag until further use.

D. Standardization of proportion of *bhajani* flour in mixture for making *thalipeeth*

Four different samples of *bhajani* flour P_1, P_2, P_3 and P_4 were formulated as given in Table 1 in order to standardize composition of different flours like wheat, soya, rice, pearl millet, ragi, sorghum and bengal gram. The *thalipeeth* prepared using each formulation along with spices as per standard recipe were evaluated for sensory parameters.

Table 1: Standardization of proportion of *bhajani* flour in mixture

Sr. No.	Ingredients	Different formulations of *bhajani* flour			
		P1	**P2**	**P3**	**P4**
1	Wheat flour 'g'	10	15	**30**	25
2	Rice flour 'g'	15	20	**15**	25
3	Pearl millet flour 'g'	25	20	**15**	15
4	Sorghum flour 'g'	20	15	**10**	5
5	Ragi flour 'g'	10	5	**15**	10
6	Soya flour 'g'	15	20	**10**	15
7	Bengal gram flour 'g'	5	5	**5**	5

E. Standardization of instant thalipeeth mix with dried spinach leaves

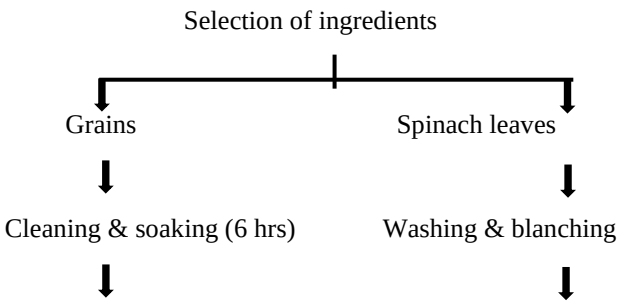
The organoleptically selected formulation (P_3) was further incorporated with blanched, dried green powder formed spinach leaves in different proportions as given in Table 2. The most acceptable formulation of first standardization were then taken as the control for the second standardization with dried spinach leaves.

Table 2: Standardization of instant thalipeeth mix with dried spinach leaves

Sr. No.	Sample code	*Bhajani* flour 'g'	Dried spinach leaves %
1	T_0 (Control)	100	---
2	T_1	100	1.0
3	**T_2**	**100**	**1.5**
4	T_3	100	2.0
5	T_4	100	2.5

F*. Preparation of instant thalipeeth mix and *thalipeeth

The instant thalipeeth mix was formulated as per procedure given below in Figure 1. Then *thalipeeth* of this instant thalipeeth mix was prepared as per standard traditional method given in Figure 2. The standardized recipe of thalipeeth was mentioned in Table 3. The first step of *thalipeeth* making includes dough preparation. The dough was prepared by adding 45 ml of water into 100g of instant mix flour. It was kneaded properly manually and kept a side for 5 minutes to enhance texture of final product. 35g dough ball was then rolled round shaped with hand into thickness of 1.5-2mm and diameter 15-20cm on a wet cloth. The prepared dough sheet was then transferred on hot iron pan for baking as mentioned in flow sheet.



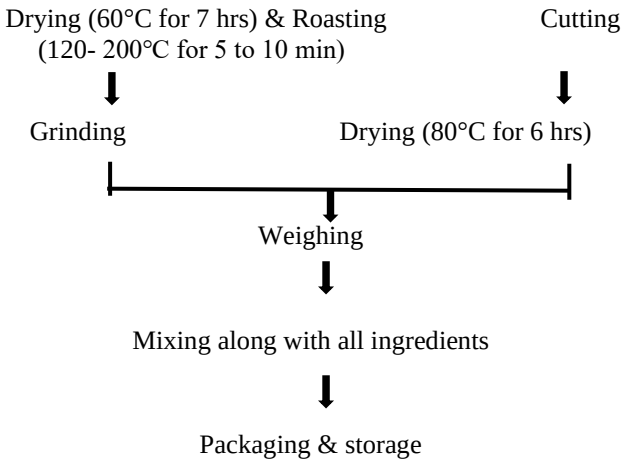


Figure 1: Process flow chart for instant thalipeeth mix

Table 3: Standard recipe for the preparation instant thalipeeth mix

Ingredients	**Weight 'g'**
Wheat flour	30
Rice flour	15
Pearl millet flour	15
Sorghum flour	10
Ragi flour	15
Soya flour	10
Bengal gram flour	5.0
Spinach leaves powder	1.5
Curry leaves powder	0.5
Dried chili pieces	3.0
Cumin seed	3.0
Ajwain	1.5
Onion powder	2.6
Turmeric powder	1.0
Salt	2.5

Preparation of *bhajani* flour

⬇

Mixing of ingredients

⬇

Dough formation

⬇

Dough divided into small balls of 35g

⬇

Flattened by rolling into round shape of about 15-20 cm diameter

⬇

Dough sheet transferred on hot pan (140˚C)

Seamer with oil & cover with dish

Baked for 50-60 sec.

Turned to other side and bake for 35 to 40 sec.

Serve hot with curd or chutney

Figure 2: Process flow chart for *thalipeeth* preparation

G. Organoleptic evaluation of the prepared *thalipeeth*

The index of overall acceptability of foodstuffs is provided by organoleptic evaluation, which depends on its colour, flavor, taste, texture and overall acceptability. In order to check acceptability of developed *thalipeeth's* of first *bhajani* flour standardization (P_3) and second with dried spinach leaves standardization (T_2) were then subjected to organoleptic evaluation. Organoleptic evaluation was carried out by panel of 10 semi trained members using 9 point hedonic scale as per procedure given by [15].

H. Nutritional analysis of final selected *thalipeeth* mix made with incorporation of dried spinach leaves

Proximate composition like moisture, crude protein, crude fat, crude fiber, ash and total carbohydrates of the selected *thalipeeth* mix sample (T_2) were assessed using standard procedures. The moisture content was determined using hot air oven method, crude protein content was by using micro-kjeldahl method, crude fat was estimated using soxtron fat extraction system, ash content was by muffle furnace while total carbohydrate was by difference. Calcium and iron content were determined using the standard method mentioned in [14].

I. Storage study of developed instant thalipeeth mix

Any product's shelf life depends on how it is stored throughout a specific time period. The best instant thalipeeth mix formulation was packed in Polypropylene (PP) pouch (200 gauge) and kept for storage life study at room temperature (28±2°C). The thalipeeth prepared from stored formulation was evaluated organoleptically at one month interval up to 180 days of storage. The instant mix was also microbiologically examined during storage to determine the number of yeast and mould, standard plate counts and coliforms on initial day, 90th day and 180th day. According to the procedure outlined by Andrews (1997), standard plate count, yeast and mould count and coliforms were estimated.

III. RESULT AND DISCUSSION

A. Organoleptic evaluation

During present investigation the prepared product formulations were standardized on the basis of organoleptic properties. Organoleptic evaluation of the *thalipeeth* was done by 10 semi trained panel members using 9 point hedonic scale where they evaluated product on the basis of its parameters like colour, flavour, texture, taste and overall acceptability. The scores for the organoleptic evaluation of *thalipeeth* made from different formulations of *bhajani* flour were shown in Table 4. Among four different formulations sample P_3 was found highest in taste score (7.71) which might be due to lower proportion of soya flour. Formulations P_1 and P_2 received the lowest score in texture (6.13 & 7.17) which might be due to higher proportion of pearl millet flour, as the texture of pearl millet grain is somewhat coarse, compact and rough texture. Same results 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* [8]. Also we got same result in case of instant appam mix made with flours of rice, pearl millet, black gram and soya [19]. The developed instant mix and prepared *thalipeeth* are revealed in Figure 3.

Table 4: Scores for organoleptic evaluation of *thalipeeth* made from different formulations of *bhajani* flour

Formulations	Colour	Flavour	Taste	Texture	OA
P_1	7.27	6.80	6.47	6.13	6.61
P_2	7.33	6.91	6.23	7.17	6.91
P_3	**7.73**	**7.12**	**7.71**	**7.89**	**7.61**
P_4	7.60	7.07	7.23	7.30	7.33

The result of the organoleptic evaluation of *thalipeeth* incorporated with blanched, dried green spinach leaves was recorded in Table 5. Among all samples T_2 was found better near about to control, thus 1.5 % addition of dried spinach leaves in instant thalipeeth mix was found superior in terms of colour, flavour, taste, texture and overall acceptability. However with increasing concentration of dried spinach leaves overall acceptability score was reduced. Similar observations have been reported by Gupta & Prakash (2011) who incorporated other dehydrated vegetables like *Amaranthus paniculatus* and *Peucedanum graveolens* greens in *thalipeeth* [9].

Table 5: Scores for organoleptic evaluation of *thalipeeth* made with incorporation of dried spinach leaves

Sample code	Colour	Flavour	Taste	Texture	OA
T_0 (Control)	7.73	7.12	7.71	7.89	7.61
T_1	7.81	7.00	7.62	7.83	7.57
T_2	**7.81**	**7.12**	**7.64**	**7.90**	**7.62**
T_3	7.00	6.36	6.86	7.88	7.01
T_4	6.54	6.15	5.78	7.51	6.50

Fig.3 Instant thalipeeth mix stored in PP Pouch

Fig. 4 Prepared RTE *thalipeeth*

B. **Nutritional analysis of prepared instant *thalipeeth* mix**

The Table 6 unfolds the data of nutritional contents of developed thalipeeth mix. Nutritional analysis of selected mix showed a significant increase in the proximate composition especially crude protein which was (19.30%), total carbohydrates (64.36%) and crude fibre (3.28%). With the incorporation of protein rich ingredients pearl millet, ragi, soya flour and dried spinach leaves protein content of prepared product was increased [1, 12, 7, 3, & 18]. Soaking treatment applied to grains helped to increase the protein digestibility and removal of antinutritional factors as reported by [16]. The mix of cereals, millet and legumes in prepared thalipeeth mix was proven to be an excellent source of carbohydrates. As grains with a large amount of fibre content, formulated thalipeeth mix was also discovered to be a good source of crude fibre (3.28%). The high amount of calcium and iron content 119.76 and 6.83 mg per 100g of product respectively was due to calcium and iron rich ingredient particularly ragi, pearl millet [13].

Table 6: Nutritional composition of developed instant thalipeeth mix per 100g

Parameter	Contribution
Moisture %	14.10
Crude protein %	19.30
Crude fat %	4.01
Ash %	1.75
Crude fibre %	9.03
Total carbohydrate %	60.84
Calcium 'mg'	119.76
Iron 'mg'	6.83

C. Storage study of developed instant thalipeeth mix

Organoleptic evaluation of *thalipeeth* made from stored instant thalipeeth mix

The findings of the organoleptic evaluation of *thalipeeth* made from stored thalipeeth mix in polypropylene pouch at room temperature (28±2°C) were given in the Table 7. The product was analysed at one month interval up to 180 days of storage. It was found that all of the scores for organoleptic features were declined as storage duration increased. Up to 180 days of storage, the overall acceptability score was reduced from 7.62 to 7.02. Similar results were reported by Vijayalaxmi et al., 2020 in case of instant dosa mix during storage up to 180 days [17].

Table 7: Organoleptic evaluation of *thalipeeth* during storage

Duration 'Days'	Organoleptic attribute				
	Colour	Flavour	Taste	Texture	OA
0	7.81	7.12	7.64	7.90	7.62
30	7.74	7.05	7.59	7.82	7.55
60	7.63	6.92	7.45	7.68	7.42
90	7.53	6.80	7.34	7.59	7.32
120	7.46	6.72	7.29	7.46	7.23
150	7.31	6.67	7.10	7.33	7.10
180	7.23	6.56	7.03	7.24	7.02

Microbial examination of stored instant thalipeeth mix during storage

The storage life of prepared instant thalipeeth mix was checked by examining product for microbial parameters like standard plate counts, yeast and mould and coliforms count at one month interval up to 6 months of storage. The data on microbial analysis of the product was reported in Table 8. It was found that there was no growth of any kind of microorganism up to the 60^{th} day of storage. However, from the 90th day onward, bacteria and fungi began to multiply. The standard plate count of thalipeeth mix was on 0^{th} day was zero, while on 90^{th} day it was 0.90×10^2 cfu/g and on 180^{th} day was about 10×10^2. Similarly, yeast and mould count was zero up to 60^{th} days storage, while on 90^{th} days was 1×10^1cfu/g and up to 180^{th} day it was about 3×10^1 cfu/g. However, coliforms was not detected throughout storage period. The permissible limits for SPC, yeast, and moulds should be less than 10^6 and 10^4 cfu/g, respectively [10]. As a result, up to the end of storage, increased SPC and yeast and mould count were within the safe range.

Table 8: Microbial examination of instant thalipeeth mix during storage at RT

Microbial parameter	Storage period (Days)						
	0	**30**	**60**	**90**	**120**	**150**	**180**
Standard plate count (cfu/g)	Nil	Nil	Nil	0.90×10^2	2.25×10^2	5.3×10^2	10×10^2
Yeast and mould (cfu/g)	Nil	Nil	Nil	1×10^1	1×10^1	2×10^1	3×10^1
Coliform (cfu/g)	Nil	Nil	Nil	Nil	Nil	Nil	Nil

IV. CONCLUSION

From the above observations, it can be concluded that instant thalipeeth mix could be successfully formulated using multiple grains including wheat, rice, pearl millet, ragi, soya, begal gram dhal and dried spinach leaves. The combination of all grains improves the nutritional profile of the product in terms of protein, fibre, calcium and iron. Moreover, this instant mix could be stored at room temperature up to 180 days with optimum organoleptic, microbial quality. Thus, the current growing demand of the consumer for healthy, nutritious, instant, and tasty food can be successfully fulfilled by this instant thalipeeth mix.

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