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Nutritional and storage study of upvas special (fasting) value added ready-to-eat thalipeeth

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ABSTRACT

Fasting is a moral and spiritual practice which involves a restriction of food or drink intake for specific time period. *Thalipeeth* is one of the traditional product whose preparation is quiet lengthy. In the present investigation the attempts were made to formulate and optimize the instant *upvas thalipeeth mix* by adding flours of proso millet, amaranth, sabudana and sweet potato in four different combinations (T_1, T_2, T_3 and T_4). The *thalipeeth* of each was presented for sensory attributes with market *upvas bhajani thalipeeth* (control). Among these combinations T_4 was significantly superior which was then analyzed nutritionally with control. The selected fresh *thalipeeth* packed in laminated aluminium zip pouch was further evaluated for storage quality at 30±2℃ and 4±2°C temperature for 12 days. The nutritional analysis revealed that T_4 *thalipeeth* was higher in crude protein (20.11 g/100g), crude fibre (8.34g/100g), carbohydrate (48.15g/100g), calcium (102.51 mg/100g) and iron (7.05 mg/100g) than control. Storage study revealed that the sensory and microbial quality of Ready-To-Eat *thalipeeth* at refrigeration condition was acceptable up to 12 days of storage. Thus prepared *upvas* special Ready-To-Eat *thalipeeth* could be helpful to satisfy nutritional, mineral and convenience food demand of the population.

Keywords: Amaranth, *bhajani*, refrigeration, traditional food..

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INTRODUCTION

Fasting is one of the religious practice known as *upvas*. It is a crucial component of worship. Fasting is a moral and spiritual practice that purifies the body and mind which helps to acquire divine blessings. When fasting, one must forgo a set amount of time the consumption of certain foods and fluids from their diet. It provides benefits for physical, mental, and spiritual health (Dhongdi et al., 2021). According to many religions, *upvas* have a variety of justifications as fasting on specific day of the week which dedicated to a particular deity, fasting during holy days like *Navaratri*, during month of *Sravaṇa*, fast on certain days of the month like on *Purnima* and *Ekadasi*, fasting during any specific religious occasion like on the day of marriage couples normally fast for a day. According to Ayurveda, fasting is essential for the effectiveness of *Panchakarma* treatments (Gaikwad

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et al., 2017). General protocols for *upvas,* allows consumption of fresh fruits, fruit juices, coconut water, dry fruits and nuts, milk and milk products, roots and tubers, some cereals and millet. However, the method and strictness of fasting is varied depending on individual beliefs or practices. In market various *upvas* products are available like different types of chikki, laddu, papad, snacks.

Millet is one of the group of small sized food grains grown widely all over the world having good source of protein, minerals, and phytochemicals (Saleh et al., 2013). Besides having better nutritive value still millet consumption is comparatively lower. The Food and Agriculture Organization and United Nations have designated 2023 as the International Year of Millets in an effort to raise awareness of the nutritional and health advantages of millets. Proso millet *(Panicum miliaceum)* is commonly cultivated small millet in India, known by the name as *barri/vari*. Because of its golden colour also called as 'Golden millet'. It is rich source of minerals like calcium, iron, phosphorus, potassium, sodium, magnesium, manganese, magnesium and zinc (Sandhvi and Singh 2022). Proso millet has a similar quantity of fibre in dehulled grains to oat (0.8-1.2%), and it has about 9.6% of fibre in caryopsis (Kalinova 2007). It is used as animal, bird and human food. In the United States, dehulled proso millet is recommended for use as a replacement for up to 30% of the wheat flour in some baked goods and other home dishes, as well as in the form of puffed or cooked morning cereals (Farheentaj et al., 2017).

Amaranth (*Amaranthus cruentus*) grain known as *Rajgira or Ramdana* is a pseudo-cereal having superior nutritional profile and is gluten-free like proso millet. It is one of India's oldest and most widely grown crop which preferred for *upvas* (Raghuvanshi and Bhati 2019). Amaranth grain has 14.7g of protein, having a superior amino acid profile and is comparable to milk and eggs (Zapotoczny et al., 2006). Sabudana or sago is one of the starchy food item made from the milk of palm, cycad and cassava. In India sabudana is made from milk of tapioca root and is widely used in preparation of *upvas* food item due to high in starch content. It is a great fasting or post-fasting food since it gives much of energy and prevents tiredness, migraines, and spinning (Andi et al., 2015). Sweet potato *(Ipomoea batatas* L.*)* is one of the significant, popular root crop. They are a good source of carbohydrates, dietary fibre, B-carotene, ascorbic acid, folic acid, and minerals. As a result, sweet potatoes are now often used in human diets all over the world. Kamal et al. (2013) reported that sweet potato flour contain 9.73% protein, 79.4% carbohydrates, 0.85% fat, 4.40% ash and 2.44 mg/100g of vitamin C. Thus by considering nutritional aspects of all those ingredients they were preferred to incorporate.

Thalipeeth is one of the traditional cereal based food item which getting consumers attention recently. It is made by mixing various cereals, millet, pulses and bean flours along with spices. The process of making *thalipeeth* is hectic, needs skill and time. While due to fast lifestyle current population does not have enough time for food preparation. As it is made with blends of different grain flours its nutritive value might be higher. According to survey only few data regarding *thalipeeth* was reported, like storage study of *thalipeeth* by Kokani and Ranganathan (2016), about ingredient optimization, process standardization, and nutritional evaluation by Gaikwad and Arya (2015), flour optimization with dried greens of 'moringa', 'keerae' and 'shepu' by Gangakhedkar et al., (2021) and Gupta and Prakash (2011). In present era public demand for simple, convenient, nutritious, healthy, Ready-To-Eat, Ready-To-Cook food is rising. Also under *upvas* food category only limited processed foods are available in market, however, there was fewer information reported on the either *upvas thalipeeth mix* or Ready-To-Eat *upvas thalipeeth*. Hence, current study has been undertaken to formulate and standardize instant *upvas thalipeeth mix* using flours of proso millet, amaranth, sabudana and sweet potato and to study storage quality of Ready-To-Eat *thalipeeth* at different storage conditions.

MATERIALS AND METHODS

Raw material

Raw materials like proso millet, amaranth grains, sabudana, red chilli powder, cumin seeds and sendha namak were procured from the local market. Freshly harvested sweet potato of variety Kishan (white fleshed) were purchased from the local Karad vegetable market. The analytical grade chemicals were used from the Department of Food Chemistry and Nutrition, DMCFT, Rajmachi.

Flours preparation

Proso millet grains was first cleaned, soaked in lukewarm water for 6 hours and then dried in cabinet drier at 60°C for 7 to 8 hours. After drying they were roasted at 120 to 150℃ for 5 to 10 min till whitish colour and pleasant flavour released. On cooling grains were grinded to make fine flour. The cleaned amaranth grains were puffed on to a hot pan of about 200-220ºC for 10-15 seconds or until they popped out. Those puffed grains were then grinded to make fine flour. Sabudana granules were cleaned, roasted and grinded to make fine flour.

Freshly harvested good quality sweet potatoes were cleaned to remove dirt, mud and other field affected part. Then with knife they were cut into small piece and dried at 65℃ for about 15 hours using cabinet dryer. The dried sweet potatoes were grinded into flour. All these flours were sieved after grinding and packed in polyethylene bag until further use.

Optimization and standardization of instant *upvas thalipeeth mix*

Four different combinations of *bhajani flours* T_1, T_2, T_3 and T_4 were tried as given in Table 1 in order to optimize and standardize combination of different flours like proso millet, amaranth, sabudana and sweet potato. After weighing of flours they were mixed with spices and sendha namak. The prepared *instant upvas thalipeeth mix* was stored in air tight condition until *thalipeeth* preparation. The prepared *thalipeeth* of each combination were analysed for sensory attributes.

Table 1: Different combinations of instant *upvas thalipeeth* mix

Ingredients	Different combinations of instant upvas thalipeeth mixes (g)			
	T_1	T_2	T_3	T_4
Proso millet flour	30	40	50	**60**
Amaranth flour	5	10	15	**20**
Sabudana flour	50	45	25	**10**
Sweet potato flour	15	05	10	**10**
Cumin seeds	2	2	2	**2**
Red chilli powder	5	5	5	**5**
Sendha namak	3	3	3	**3**
Potassium sorbate	0.2	0.2	0.2	**0.2**

Calcium propionate	0.1	0.1	0.1	**0.1**

Preparation of *upvas thalipeeth*

Upvas special Ready-To-Eat *thalipeeth* was prepared using formulated instant *upvas thalipeeth mix* as per method described by Jamdar and Patil (2023) with slight modification. First the smooth sticky dough was prepared by adding 50 ml of water, 15g of curd and 2 ml of vinegar into 100g of instant *upvas thalipeeth mix* flour which was kept a side for 5-10 minutes to obtain desired texture of product. On a moist piece of fabric, a dough ball of 40g was manually flattened into a spherical form by pressing with the fingers to a diameter of 15-20 cm and a thickness of 2- 3 mm. The rolled sheet was then transferred to hot pan, fabric piece was removed slowly with application of water, some holes were made to let steam to escape out and then baked for 50-60 seconds in covered condition. After that, flip it over and bake for an additional 35 to 40 seconds.

Sensory evaluation of *upvas thalipeeth*

The prepared *upvas thalipeeth* of each combination were subjected to sensory evaluation for acceptability in comparison with control market sample *upvas bhajani flour thalipeeth*. This was conducted by a panel of ten semi-trained judges including faculty and students from the institute using 9 point hedonic scale for different parameters such as appearance and colour, flavour, taste, texture and overall acceptability where 1 describes poor and 9 describes excellent Ranganna (2009).

Nutritional analysis of *upvas thalipeeth*

Both control and selected combination (T_4) *upvas thalipeeth* were analysed for nutritional parameters like moisture, crude protein, crude fat, crude fibre, ash and total carbohydrates using standard procedures. The moisture content was determined using hot air oven method, crude protein content estimated by using Micro-Kjeldhal technique, crude fat estimated by using soxtron fat extraction system, ash content was determined by muffle furnace, while total carbohydrate was estimated by difference method as by summing the values of moisture, crude protein, crude fat, crude fibre and ash and subtracting the sum from 100 Nielsen (2002). Calcium and iron content were measured using flame photometer and colorimetry method respectively. Crude fibre was determined using the standard method mentioned in Ranganna (2009). All the estimations were done in triplicates.

Storage study of Ready-To-Eat *upvas thalipeeth*

Freshly prepared *upvas thalipeeth* of both control and best selected combination packed in laminated aluminium zip pouch (200 gauge) were kept at ambient temperature (30±2℃) and refrigeration temperature (4 ± 2°C) for a period of 12 days. The stored *upvas thalipeeth* were analysed for their sensory quality during storage period, at the interval of 0, 3, 6, 9 and 12 days. At same interval microbial growth was determined in terms of Total Plate Count (TPC) and yeast and mould count as per procedure given by Andrews (1997).

Statistical analysis

The nutritional analysis and sensory scores were analysed using descriptive statistics of Web Based Agricultural Statistics Software Package (2.0). The values are expressed as Mean ± SE (Standard error).

RESULTS AND DISCUSSION

Sensory evaluation

In current experiment sensory qualities scores were used to optimize the product formulation. The mean sensory scores of the fresh Ready-To-Eat *thalipeeth* for appearance and colour, flavour, taste, texture and overall acceptability are shown in Table 2. Among the varying proportion of different flours T_4 combination *upvas thalipeeth* (60% proso millet + 20% amaranth + 10% sabudana + 10% sweet potato flours) was found the most acceptable (8.19±0.13) followed by T_3 (7.81±0.06), T_2 (7.51±0.12), T_1 (7.33±0.27) than control (7.11±0.11). This higher sensory score of T_4 combination was might be due to increased level of soaked, roasted proso millet flour and puffed amaranth grain flour. Since it piques the taste buds, more salivary amylase is produced, which aids in the breakdown of starchy meals. Same finding have been reported by Sandhvi and Singh (2021) where they developed value added fresh products of proso millet like *'chapati'* and *'kitchari'*. Another supportive finding for the better overall acceptability of T_4 combination was reported by Chungkham and Singh (2021) where they used popped amaranth grain flour in making products like *'besan burfi and cashewnut burfi'*.

Table 2: Sensory scores of fresh Ready-To-Eat upvas thalipeeth

Sample code	Sensory attribute				
	Appearance and Colour	Flavour	Taste	Texture	OA
T_0 (Control)	7.00±0.15	6.89±0.08	6.99±0.27	7.01±0.20	7.11±0.11
T_1	7.46±0.05	7.40±0.01	7.52±0.22	7.58±0.02	7.33±0.27
T_2	7.51±0.12	7.59±0.20	7.56±0.14	7.58±0.07	7.51±0.12
T_3	7.80±0.03	7.71±0.11	7.86±0.00	7.88±0.01	7.81±0.06
T_4	8.11±0.11	7.91±0.01	8.19±0.06	8.21±0.17	8.19±0.13

Values are mean ± SE of responses from a panel of ten semi-trained judges

Nutritional analysis

The nutritional composition of fresh *upvas thalipeeth* are given in Table 3. Three *thalipeeth* of each were analysed and averaged. It was found that crude protein, crude fibre and mineral content (calcium and iron) (20.11 g/100g, 8.34 g/100g, 102.51 mg/100g and 7.05 mg/100g) of developed *upvas thalipeeth* were increased significantly. This increase might be due higher proportion of proso millet (60%) and added amaranth flour (20%) as Hymavathi et al., (2020) stated higher contribution of said nutrients in proso millet and Gebreil et al., (2020) recorded with increased level of addition of amaranth flour in bakery products like crackers and tortilla had increased significantly the crude protein and crude fibre content. Thus developed T_4 *upvas thalipeeth* was nutritionally rich as compared with T_0 control market sample.

Table 3: Nutritional composition of control and developed fresh upvas thalipeeth per 100 g

Parameters	Control *thalipeeth*	Developed *thalipeeth* (T_4)
Moisture (%)	18.89±0.13	16.37±0.10
Crude protein (%)	12.17±0.08	20.11±0.19
Crude fat (%)	4.53±0.17	4.49±0.011
Ash (%)	1.80±0.56	2.54±0.31

Crude fibre (%)	3.10±0.43	8.34±0.09
Total carbohydrate (%)	59.51±0.19	48.15±0.29
Calcium (mg)	81.34±0.04	102.51±0.54
Iron (mg)	5.99±0.09	7.05±0.16

Values are expressed as Mean ± SE (Standard Error) of three determinations

Sensory quality of control and selected formulation *upvas thalipeeth* during storage

The control and T_4 combination *thalipeeth* samples were analysed for the different sensory attributes after 3 days interval during ambient temperature (30±2℃) and refrigeration temperature (4 ± 2°C) storage up to 12 days. The results are shown in Table 4. The control sample stored at ambient was discarded before 3rd day and that was stored at refrigeration temperature had shelf life only of 3 days. The average overall acceptability score of T_4 was reduced below neither like nor dislike score after 3rd day and was good enough up to 6th day at ambient temperature. The selected combination of *upvas thalipeeth* stored at refrigeration temperature had maximum overall acceptability (6.07±0.11) at storage period of 12th day. Overall sensory results showed that use of preservatives did not affect the sensory quality throughout storage. However, all sensory scores were declined gradually with increasing storage time. Same finding was reported by Unhale et al., (2012) in case of sorghum roti.

Table 4: Sensory analysis of control and selected formulation upvas thalipeeth *at ambient and refrigeration temperature during storage*

Days	Ambient temperature		Refrigeration temperature	
	Control *thalipeeth*	**Selected formulation *thalipeeth***	**Control *thalipeeth***	**Selected formulation *thalipeeth***
		Appearance and colour		
0	7.00±0.15	8.11±0.11	7.00±0.15	8.11±0.11
3	Discarded	5.73±0.01	5.17±0.29	7.92±0.10
6	Discarded	4.82±0.14	Discarded	7.11±0.09
9	Discarded	Discarded	Discarded	6.82±0.01
12	Discarded	Discarded	Discarded	6.03±0.21
		Flavour		
0	6.89±0.08	7.91±0.01	6.89±0.08	7.91±0.01
3	Discarded	5.68±0.20	5.05±0.11	7.91±0.16
6	Discarded	4.50±0.06	Discarded	7.17±0.19
9	Discarded	Discarded	Discarded	6.78±0.21
12	Discarded	Discarded	Discarded	6.09±0.08
		Taste		
0	6.99±0.27	8.19±0.06	6.99±0.27	8.19±0.06
3	Discarded	5.74±0.11	5.12±0.02	7.90±0.04
6	Discarded	4.28±0.07	Discarded	7.39±0.12
9	Discarded	Discarded	Discarded	6.72±0.18
12	Discarded	Discarded	Discarded	6.10±0.05

		Texture		
0	7.01±0.20	8.21±0.17	7.01±0.20	8.21±0.17
3	Discarded	5.55±0.13	5.01±0.23	7.83±0.07
6	Discarded	4.11±0.04	Discarded	7.24±0.10
9	Discarded	Discarded	Discarded	6.53±0.07
12	Discarded	Discarded	Discarded	5.89±0.15
		Overall acceptability		
0	7.11±0.11	8.19±0.07	7.11±0.11	8.19±0.01
3	Discarded	5.63±0.13	5.00±0.08	7.72±0.12
6	Discarded	4.31±0.19	Discarded	7.21±0.13
9	Discarded	Discarded	Discarded	6.67±0.01
12	Discarded	Discarded	Discarded	6.07±0.11

Values are mean ± SE (Standard Error) of responses from a panel of ten semi-trained judges

Microbial analysis of *upvas thalipeeth* during storage

The stored *upvas thalipeeth* samples at ambient and refrigeration temperature were subjected to microbial analysis for the parameters like total plate counts and yeast, mould count. The evaluation was done at interval of 0, 3, 6, 9 and 12th days. The results were given in terms of colony forming unit per gram (CFU/g) of sample. The data obtained are presented in Table 5. It was found that the bacterial and fungal growth was increased with increase in storage period at both storage conditions. Clearly visible surface growth of bacteria, yeast and mould were observed in control sample stored at ambient and refrigeration temperature on 3rd and 6th day respectively. The selected T_4 *upvas thalipeeth* stored at ambient temperature shows limited and acceptable growth as per WHO (1994) up to 9th day of storage however its sensory score on 6th day was below 5.0. The maximum shelf of 12 days was found in T_4 combination at refrigeration storage.

Table 5: Microbial quality of upvas thalipeeth during storage at ambient and refrigeration temperature

Days	Ambient temperature		Refrigeration temperature	
	Control *thalipeeth*	**Selected formulation *thalipeeth***	**Control *thalipeeth***	**Selected formulation *thalipeeth***
		Standard plate count (CFU/g)		
0	3×10^1	1×10^1	2×10^1	1×10^1
3	43×10^5 and Visual surface growth	121×10^2	104×10^3	69×10^2
6	Discarded	96×10^3	11×10^5 and Visual surface growth	360×10^2

9	Discarded	25×10^4 and Visual surface growth	Discarded	64×10^3
12	Discarded	Discarded	Discarded	87×10^3
		Yeast and mould (CFU/g)		
0	1×10^1	Nil	Nil	Nil
3	12×10^3 and Visual surface growth	2.3×10^3	37×10^2	8×10^2
6	Discarded	6.1×10^3	9×10^3 and Visual surface growth	12×10^2
9	Discarded	27×10^3 and Visual surface growth	Discarded	43×10^2
12	Discarded	Discarded	Discarded	68×10^2

Values are mean of three determinations

CONCLUSION

From the results presented in this work, it is concluded that Ready-To-Eat *upvas special thalipeeth* made with proportion of proso millet, amaranth, sabudana and sweet potato flour (60:20:10:10) could be highly preferred by the consumers. Apart from giving sensory satisfaction the prepared *upvas thalipeeth* satisfy consumer's nutritional, mineral and convenience food demand during fasting period. The *upvas thalipeeth* packed in laminated aluminium zip pouch stored at refrigeration storage can remain satisfactory for consumption up to 12 days. This will be helpful to create awareness and increase consumption of millets among the population.

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