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Process standardization of instant rice based meal

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Abstract

The present study has been undertaken to develop a ready to eat instant rice based meal from commonly consumed ingredients like joha rice (*Oryza sativa* L.), lentil (*Lens culinaris*), green gram dhal (*Vigna radiata*), sweet corn (*Zea mays*), carrot (*Daucus carota* L.), french beans (*Phaseolus vulgaris*), tomato (*Solanum lycopersicum*), broccoli (*Brassica oleracea* var. *italica*), cabbage (*Brassica oleracea* var. *capitata*), green pea (*Pisum sativum*), rice bran oil, spices and condiments. The ingredients were processed and mixed in varying proportions to prepare one base meal and other three formulations. *Joha* rice and rice bran oil were taken as 35g and 5ml respectively for the base meal and for each of three different formulations but the proportions and the other ingredients were adjusted and mixed in different proportions. Among all the formulations, Formulation III made with 35% rice, 12% lentil dhal, 14% green gram dhal was much preferred by the panellist during sensory evaluation and was subjected to further analysis. Henceforth, it is concluded that instant rice based meal prepared using Formulation III can be successfully utilized which is easy and fast to prepare besides being hygienic and convenient to eat.

Keywords: Instant foods, standardization, processing, sensory

Introduction

Majority of food consumption in India is still at home. Nevertheless, out-of-home food consumption is increasing due to rise in urbanization, increasing rural income, change in rural life style, breaking up of the traditional joint family system, need for quality time, increasing number of working women, rise in per capita income, and increasing level of affluence in the middle income group had brought about changes in food system.

With the help of advanced technology, people found that "Instant food" and "Readymade food" were more convenient for the last twenty years worldwide and it is mostly popular among working peoples. The term 'instant foods' means simple, fast and convenient food, which is simple and fast to prepare besides being hygienic and convenient to eat (Shanmugapriya & Srivarshini, 2018) [15]. These foods are gaining popularity in Indian homes, since such foods are either ready to consume as such or which require very little preparation. However, the kind of food to be developed into convenience food has to be capable of providing energy and meet basic nutritional requirement, easy to prepare and familiar to consumers to enhance wide acceptability of the meal (Idowu *et al.*, 2010) [5]. In the cereal-pulse food categories, ready-made mixes are now available for *idli*, *dosa*, *vada*, etc. Capitalizing this situation, business houses ranging from small manufacturers to multinational corporations have started innovating and commercializing "easy to cook food items" like noodle, vermicelli, instant *gulabjamun*, *idli*, *vada*, *dosa* mix, etc. and therefore the ready to cook category has been one of the rising stars of the food industry (Siddiqui, 2014). Hence, instant food products came into light, which originated in Japan with instant noodles. These foods had its beginning in India in 80's and are found today in the kitchen shelves of every Indian household (Kumar and Padmavati, 2015) [7].

Modern dietary expectations are emerging as a reflection of changing lifestyles, and nowadays consumers increasingly tend to seek out nutritious and functional foods (Triyannanto and Lee, 2015) [17]. *Khichdi* which is a popular cereal pulse mixture is consumed all over India.

It is a balanced product which is traditionally prepared by cooking rice, dhal, adding edible oil and salt. There is a rise in the demand for foods on traditional Indian recipes across different

states in India and abroad. Researches being continually carried out in different parts of the country by several workers to develop instant foods through food based approach by using cereal, pulses, vegetables, etc., for nutrient density as well as consumer demand (Amal *et al.*, 2014) [2]. There are documented research works on instant meal from other parts of the country, but no such investigation on instant meal standardization have been documented from North eastern states.

In this study an attempt has been made to standardize the processing of instant rice based meal using locally available ingredients by different processing techniques like open pan blanching, pressure cooking, microwave blanching /cooking.

Materials and methods

The present investigation on standardization of instant rice based meal was carried out in the Department of Food Science & Nutrition, College of Community Science, Assam Agricultural University, Jorhat, Assam and Department of Plant pathology, Assam Agricultural University Jorhat, Assam during the month of January to May, 2018.

1. Collection of raw materials

The raw materials were collected from the local market of Jorhat district of Assam. The raw materials that used for the preparation of Instant rice based meal are as follows: Joha rice, lentil dhal, green gram dhal, sweet corn, carrot, french

beans, cabbage, broccoli, peas, tomato, ginger, garlic, onion, black pepper, roasted cumin powder, roasted coriander powder, turmeric and rice bran oil.

2. Processing of raw ingredients

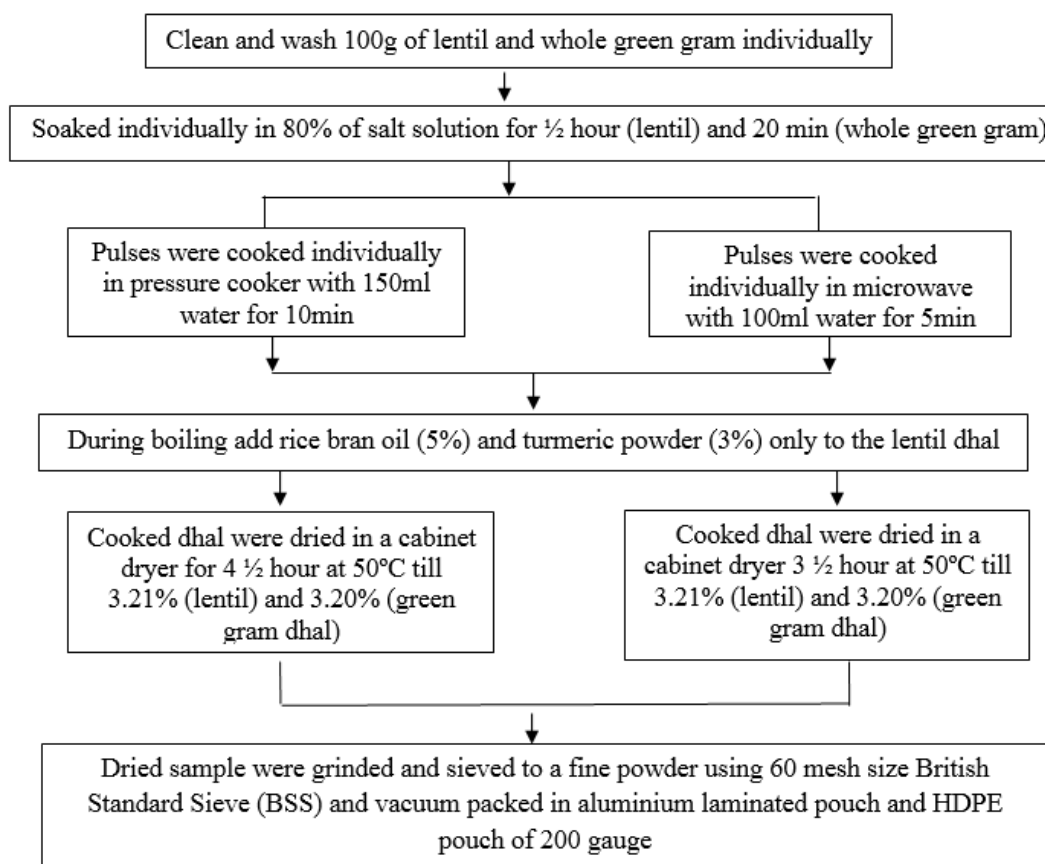
2.1. Processing of instant rice

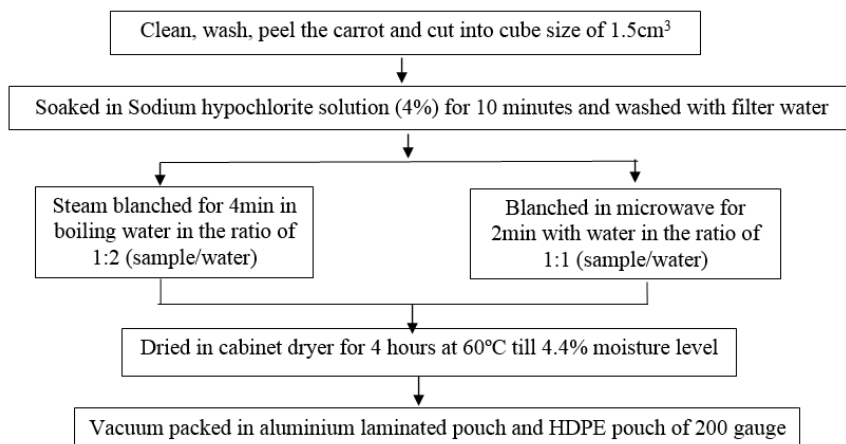
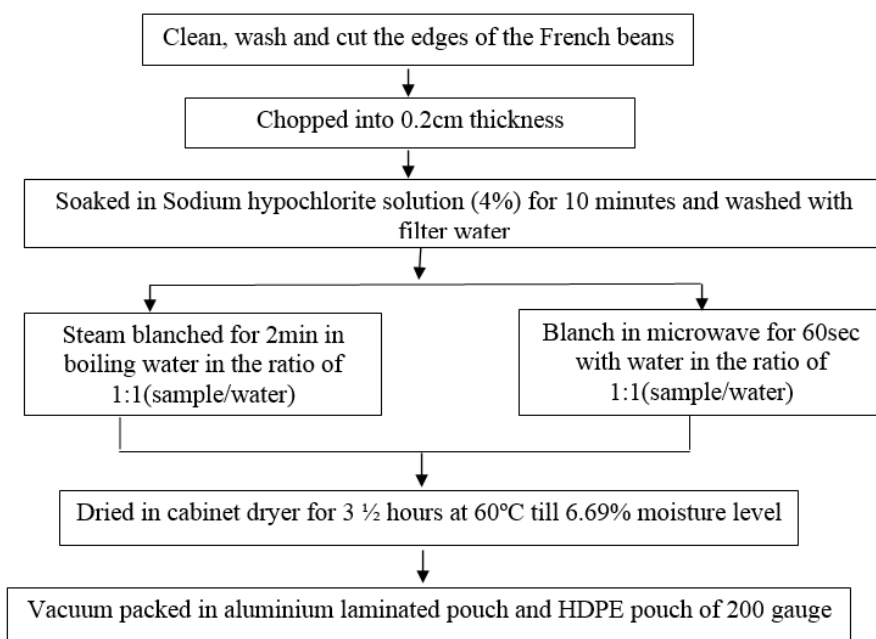
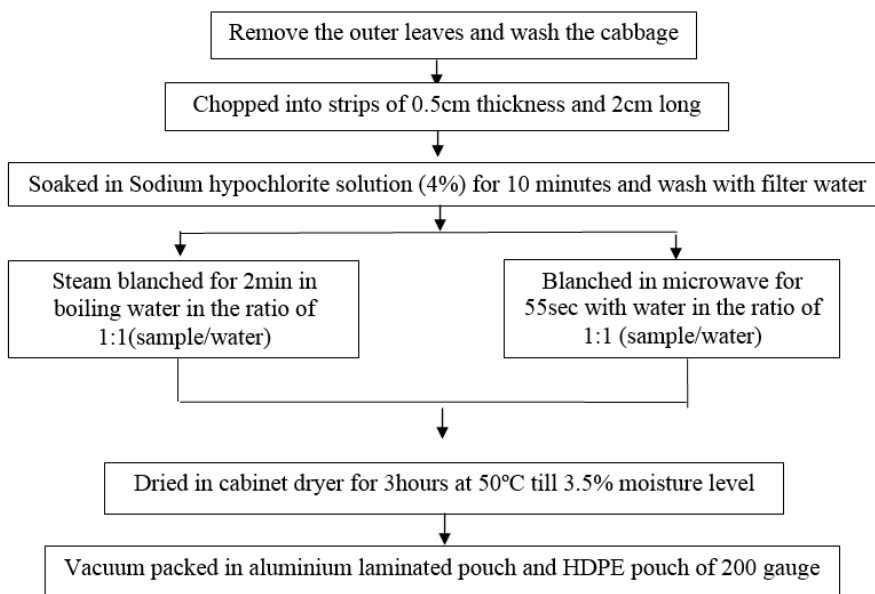
The cooked rice was prepared by conducting different processing techniques including pressure cooking and microwave cooking. Joha rice was cleaned to remove the foreign particles. Five hundred gram of rice was soaked in water for 30 minutes. Two fifty gram of rice with 100ml water was pressure cooked for 5minutes (till one whistle) and another 250g of rice with 150ml rice was cooked in microwave for 20minutes. Then the cooked rice samples were spread in a tray and dried in a cabinet dryer for 6 hour initially at 70°C and finally at 60°C till its final moisture content reached to 8%. The samples were immediately vacuum packed in aluminium laminated pouch and HDPE pouch of 200 gauge thickness.

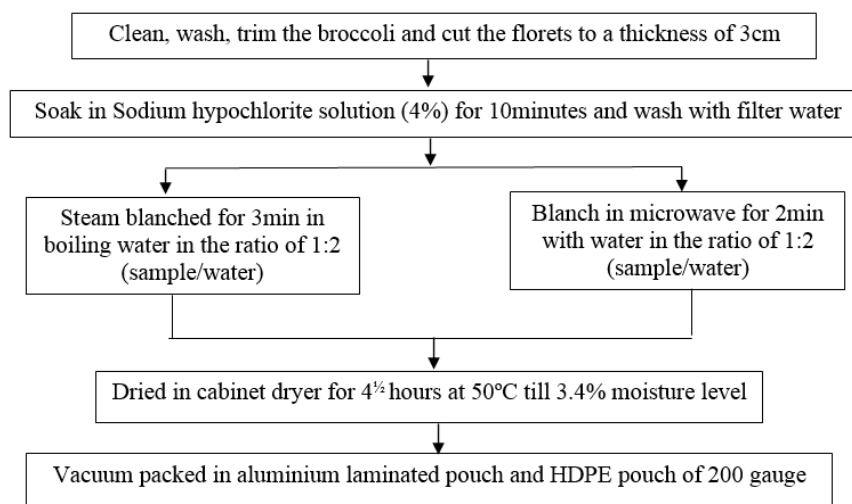
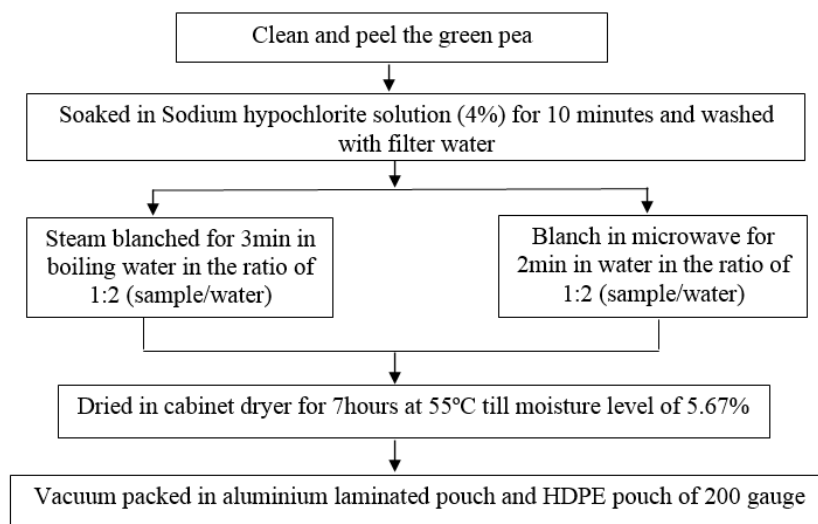
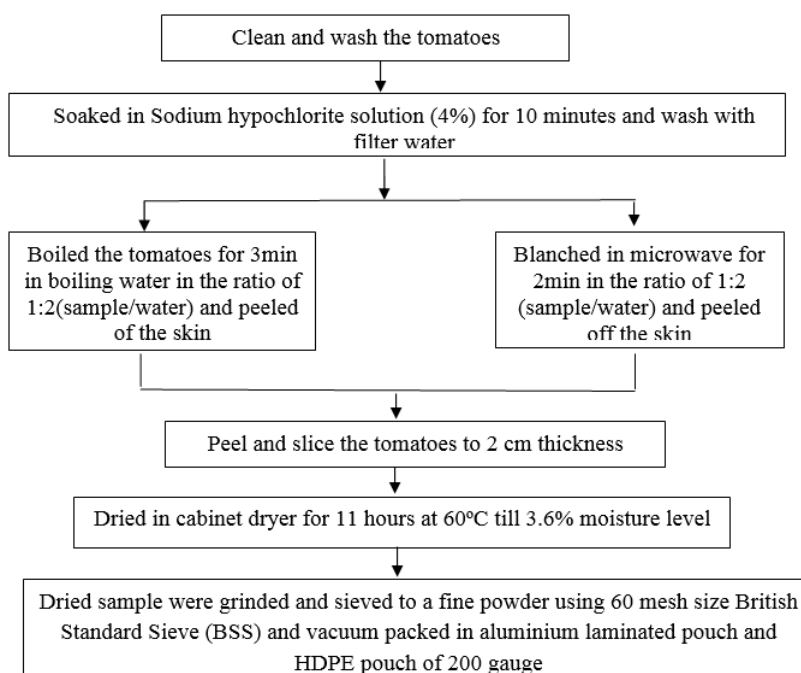
2.2.1. Processing of pulses (whole green gram and lentil dhal)

For the instant rice based meal, whole green gram and lentil dhal was used and was prepared by conducting different processing techniques including pressure cooking and microwave cooking.

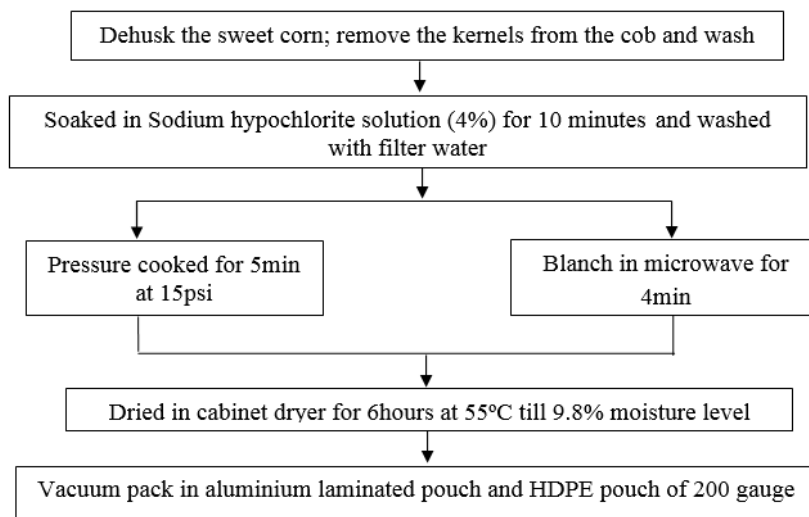
2.2.2. Processing of vegetables



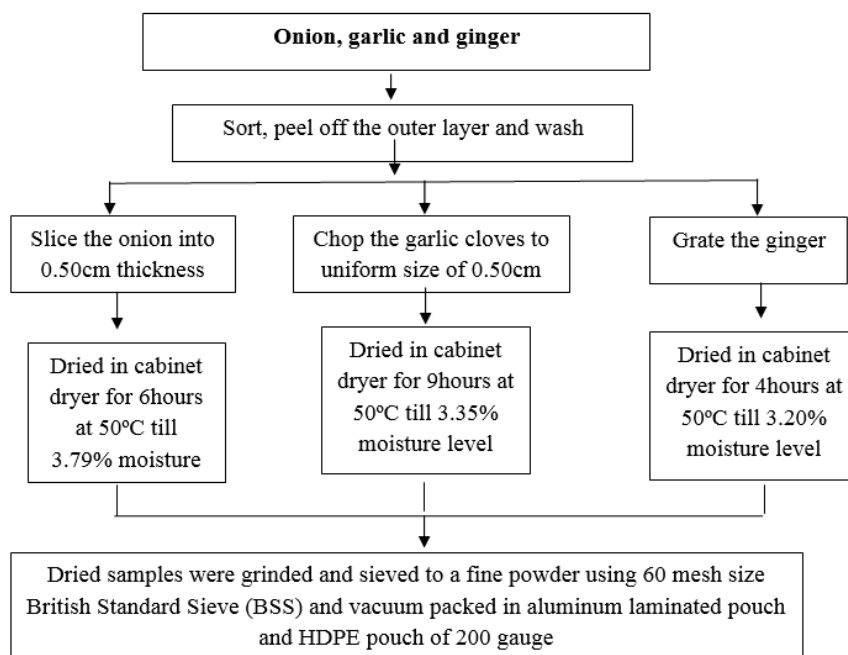
a) Carrot**b) French beans****c) Cabbage**

d) Broccoli**e) Green pea****f) Tomato**

2.2.3. Processing of sweet corn



2.2.4. Processing of condiments



3. Standardization

Standardization of a recipe is a formula specific of a quality of each ingredient required to produce a specific quality and quantity of a particular food. The basic recipe for preparation of instant rice based meal was standardized by using ingredients such as Rice, lentil, green gram dhal, sweet corn, carrot, French beans, tomato, broccoli, cabbage, green pea, oil spices and condiments. The best selected meal formulation by Malick, 2016^[8], was taken as the base meal and the other three formulations were tried by varying the proportions of the ingredients.

3.1. Formulation of Instant rice based meal

The base meal comprised of 35% joha rice, 13% lentil dhal, 12% whole green gram, 2% green peas, 6% carrot, 3% french beans, 5% tomato, 2% cabbage, 2% broccoli, 5% rice bran oil, 3% salt, 12% spices and condiments. Further, Formulation I, Formulation II and Formulation III were formulated by

changing the proportion of ingredients used in Base meal along with addition of few new ingredients and the total quantity of the mix however was made to hundred by varying proportions of the ingredients (Table 1).

3.2. Procedure for the preparation of instant rice based meal

All the precooked dehydrated ingredients such as *joha* rice, lentil dhal, whole green gram, sweet corn, carrot, french beans, tomato, cabbage, broccoli, peas, onion, garlic, ginger, and spice mix were weighed and blended in suitable proportions. Product was filled in HDPE pouch and aluminium laminated pouch (thickness= 200 gauge) followed vacuum sealing and then stored at ambient temperature.

3.3. Rehydration ratio (RR) of the modified formulations

Rehydration ratio of the modified formulations were determined based on the available standard properties

(Abeysinghe and Illeperuma, 2006; Amal *et al.*, 2014) ^[1, 2]. A known amount (100g) of processed meal formulations were rehydrated in 366ml hot water (60°C) was required for reconstitution. The samples were taken from the bowl after 20 minutes and were weighed after blotted with tissue paper in order to remove the excess water (Amal *et al.*, 2014) ^[2].

$$\text{Rehydration ration (RR)} = \frac{\text{Weight of the rehydrated sample}}{\text{Weight of dehydrated sample}}$$

Table 1: Development and standardization for preparation of instant rice based meal

Ingredients	Base meal (gm or ml)	Formulation I (gm or ml)	Formulation II (gm or ml)	Formulation III (gm or ml)
Joha rice	35	35	35	35
Lentil dhal	13	12	13	12
Whole green gram	12	12	11	14
Sweet corn	-	3	2	-
Carrot	5	4	3	5
French beans	3	3	4	2
Tomato	5	6	5	5
Cabbage	4	4	4	2
Broccoli	3	3	3	4
Green pea	2	-	2	3
RBO*	5	5	5	5
Salt	3	3	3	3
Spices & Condiments 1.5% garlic, 2% ginger, 1.5% onion, 0.5% black pepper, 0.5% cumin, 0.5% cardamon, 0.5% cinnamon, 3% turmeric powder)	10	10	10	10

4. Acceptability trials of the formulated instant rice based meal

Sensory evaluation has been defined as a scientific discipline used to evoke, measure, analyze and interpret those responses to products as perceived through the senses of sight, smell, touch, taste and hearing (Sidel and Stone, 1993) ^[16]. Acceptability of the formulations was evaluated by sensory evaluation using 9 point Hedonic scale (Rangana, 2004) ^[11]. The acceptability trial was done in the Food Science Laboratory, Department of Food Science and Nutrition in the following manner. The formulation having the significantly best score was selected among the other formulations for further experiment.

Results and discussion

Formulation of the Instant rice-based meal

The instant rice-based meal was formulated by incorporation of macronutrient and micronutrient rich foods such as *joha* rice, lentil, whole green gram, carrot, broccoli, cabbage, peas, French beans, tomato, sweet corn, spices and condiments. *Joha* rice is significantly known for its aroma, superfine kernel, good cooking qualities and excellent palatability which provides 27.37g/100g of carbohydrate, 2.38g/100g of protein and 0.17g/100g of fat. Pulses are important sources of protein for the human diet. The pulses used are lentil and whole green gram. The nutritional composition of legumes can provide a high proportion of proteins, fats, carbohydrates, dietary fibers, β -group vitamins (thiamin, riboflavin, niacin) and minerals. Carrot is rich in carotene which provides 189 μ g/100g. Vegetables are excellent sources of several phytochemicals with proposed health-related benefits (Moreno *et al.*, 2006) ^[10]. Vegetables as broccoli are rich in vitamins, minerals, flavonoids, polyphenols, anthocyanin with high antioxidant activity and powerful phytochemicals

(glucosinates and isothiocyanates) (Monero *et al.*, 2010) ^[9]. Cabbage, a leafy green leafy vegetable, contains a variety of vitamin C, manganese and vitamin E. Starch is the major constituent of available carbohydrates of peas and beans. They are very poor sources of fat soluble vitamins and rich sources of water soluble vitamins; as well as excellent sources of minerals: calcium, phosphorus, potassium, sodium, manganese, iron, magnesium, copper, cobalt, sulfur, zinc and fluorine. Tomatoes are rich source of lycopene (0.85mg/100g), vitamin C (1.55 mg/100g) and carotene (9.60 μ g/100g) (Gopalan *et al.*, 2007) ^[4]. Spices and condiments possess a number of beneficial properties such as antioxidigenic, antibacterial, anti-inflammatory, flavouring as well as health and medical properties (Sharma, 2015) ^[14]. This makes spices and condiments a very important food component. For several beneficial facts, turmeric, cumin, black pepper, onion, garlic, ginger has been used in the formulations. Rice bran oil is the only oil which besides having PUFA and linoleic acid/alpha linoleic acid also contains antioxidants such as tocopherols, tocotrienols and oryzanol. Keeping in view about the above nutritional facts these food ingredients have been selected for the development of instant rice based meal.

The instant meal has been formulated using the precooked and dehydrated ingredients based on the traditional cereal, pulse, vegetable combination dish. The base meal comprised of 35% *joha* rice, 13% lentil dhal, 12% green gram dhal, 2% green peas, 6% carrot, 3% french beans, 5% tomato, 2% cabbage, 2% broccoli, 5% rice bran oil, 3% salt, 12% spices and condiments. Further, three variations, *viz.*, Formulation I, Formulation II and Formulation III were formulated (Table 2) by changing the proportion of ingredients used in Base meal and by incorporating other new ingredients and the total quantity was made to hundred by varying proportions of the ingredients.

Table 2: Composition of the formulated instant rice based meal

Formulations	Ingredients
Base meal	35% rice, 13% lentil dhal, 12% green gram dhal, 5% carrot, 3% beans, 5% tomato, 4% cabbage, 3% broccoli, 2% green pea, 5% RBO*, 3% salt, 10% spice and condiments
Formulation I	35% rice, 12% lentil dhal, 12% green gram dhal, 3% sweet corn, 4% carrot, 3% beans, 6% tomato, 4% cabbage, 3% broccoli, 5% RBO*, 3% salt, 10% spice and condiments
Formulation II	35% rice, 13% lentil dhal, 11% green gram dhal, 2% sweet corn, 3% carrot, 4% beans, 5% tomato, 4% cabbage, 3% broccoli, 2% green pea, 5% RBO*, 3% salt, 10% spice and condiments
Formulation III	35% rice, 12% lentil dhal, 14% green gram dhal, 5% carrot, 2% beans, 5% tomato, 2% cabbage, 4% broccoli, 3% green pea, 5% RBO*, 3% salt, 10% spice and condiments

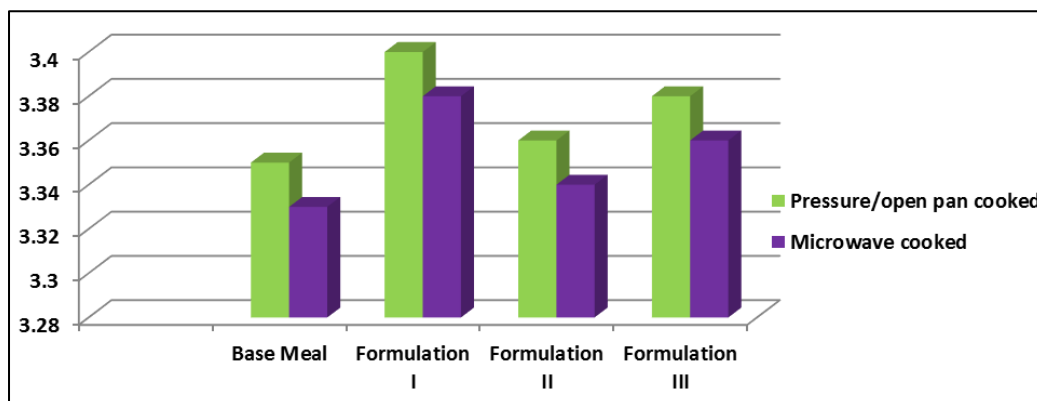
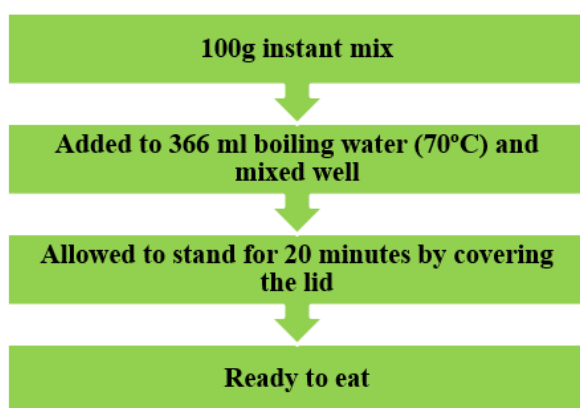
*RBO = Rice Bran Oil

Rehydration ratio of the developed formulations

In the present investigation the rehydration ratio was done using hot water (70°C) which did not show any significant differences among the formulations. From the Fig. 1, it can be revealed that the rehydration ratio of the instant mix prepared from pressure cooked/open pan processed ingredients and microwave processed ingredients were found to be almost same in the range of 3.35 to 3.40 and 3.33 to 3.38 respectively. The rehydration ratio of the formulations was found to be maximum in Formulation I *i.e.*, 3.40 followed by Formulation III (3.38), Formulation II (3.36) and Base meal (3.35) and was found to be non-significant at $p > 0.05$ level.

For the ingredients cooked in microwave, the range of rehydration ratio were found to be between (3.33 to 3.38) with the maximum in Formulation I *i.e.*, 3.38 followed by Formulation III (3.36), Formulation II (3.34) and Base meal (3.33) and was found to be non-significant at $p > 0.05$ level.

The results of the present study are almost similar with the study conducted by Jokie *et al.*, (2009) [6] who found that the products with a high rehydration capacity are tastier and retain their fresh appearance. Hence, the ratio of 3.35 to 3.33 in hot water was found to be acceptable as the reconstituted meal formulation possessed a desirable overall quality attributes.

**Fig 1:** Rehydration ratio of the instant rice based meal**Fig 2:** Flow chart for reconstitution procedure of instant rice based meal (per 100g)

Acceptability trial of the formulated instant rice based meal

Acceptability trial is very important for screening best formulation among the other formulations. During the study, all the three formulations and the base meal were reconstituted and were subjected to sensory evaluation to find out acceptability of the best formulation.

The acceptability scores for the instant mix prepared from pressure cooked/open pan blanched ingredients and microwave processed ingredients were almost similar and the details are presented in Table 3 and 4. From the Table 3, it can be seen that all the formulation prepared by pressure cooked/open pan blanching had almost a similar value. In terms of appearance, Base meal (8.00 ± 0.52) and Formulation III (8.00 ± 0.51) scored the highest followed by Formulation I (8.10 ± 0.66) and Formulation II (8.10 ± 0.63). Statistical analysis revealed that there was no significant difference ($p > 0.05$).

According to the acceptability score, it was found that Formulation III had scored the highest score in terms of Flavour (8.14 ± 0.82), taste (8.20 ± 0.38), texture (8.40 ± 0.36) and overall acceptability (8.37 ± 0.56) followed by the base meal *i.e.*, 8.01 ± 0.63 , 8.00 ± 0.31 , 8.20 ± 0.40 and 8.25 ± 0.39 for flavour, taste, texture and overall acceptability respectively. Formulation I was judged with lowest score in overall acceptability (7.98 ± 0.75) followed by Formulation II (8.00 ± 0.58). However, Formulation I and Formulation II scored 7.86 ± 0.65 and 7.90 ± 0.50 for flavour, 7.83 ± 0.40 and 7.90 ± 0.62 for taste, 7.70 ± 0.44 and 7.80 ± 0.48 for texture respectively. All the cooked varieties were liked slightly, moderately and very much by the panel judges.

Table 3: Mean acceptability scores of instant mix prepared from pressure cooked / open pan blanched ingredients

Name of the product	Appearance	Flavour	Taste	Texture	Overall acceptability
Base Meal	8.00±0.52	8.01 ± 0.63	8.00 ± 0.31	8.20 ± 0.40	8.25 ± 0.39
Formulation I	7.93±0.66	7.86 ± 0.65	7.83 ±0.40	7.70 ± 0.44	7.98 ± 0.75
Formulation II	7.96 ± 0.62	7.90 ± 0.50	7.90 ± 0.62	7.80 ± 0.48	8.00 ± 0.58
Formulation III	8.00 ±0.51	8.14 ± 0.82	8.20 ± 0.38	8.40 ± 0.36	8.37 ± 0.56

Values are expressed in Mean ± Standard Deviation

Among the microwave processed formulations, Formulation III was judged best with the highest overall acceptability score of 8.30 ± 0.32 , followed by Base meal i.e., 8.20 ± 0.39 , Formulation II (8.00 ± 0.58) and Formulation I (7.96 ± 0.72). Individual sensory parameters showed that appearance wise almost similar scores were recorded in Formulation I (7.94 ± 0.66) and Formulation II (7.96 ± 0.62). The score for taste ranged from 7.82 ± 0.40 in Formulation I to 8.18 ± 0.40 in Formulation III. Similarly, the score for texture ranged from 7.72 ± 0.44 in Formulation I to 8.42 ± 0.34 in Formulation III. Highest score for flavour was observed in

Formulation III (8.00 ± 0.87) followed by Base meal (8.00 ± 0.49), Formulation II (7.96 ± 0.62) and Formulation I (7.96 ± 0.62). The results showed that highest acceptability was in Formulation III, whereas lowest acceptability was recorded in Formulation II.

The sensory data on instant rice based meal indicated that microwave cooked rice varieties were equally preferred and in some attributes proved to be better than pressure cooked ones. Sensory attributes, though different for microwave and pressure cooked samples were not adversely affected due to the method of cooking.

Table 4: Mean acceptability scores of instant mix prepared from microwave processed ingredients

Name of the product	Appearance	Flavour	Taste	Texture	Overall acceptability
Base Meal	8.00±0.49	7.94 ± 0.62	8.00 ± 0.35	8.21 ± 0.38	8.20 ± 0.39
Formulation I	7.94±0.66	7.81 ± 0.69	7.82 ±0.40	7.72± 0.44	7.96 ± 0.72
Formulation II	7.96 ± 0.62	7.86 ± 0.54	7.90 ± 0.61	7.80 ± 0.45	8.00 ± 0.58
Formulation III	8.00 ±0.45	8.00 ± 0.87	8.18 ± 0.40	8.42 ± 0.34	8.30 ± 0.32

Values are expressed in Mean ± Standard Deviation

The results of the present study was found to be lower as compared to the study conducted by Sharma *et al.*, 2009^[12] who prepared an instant mix using flours of roasted barley, roasted local peas, dried *churphey* and dried spinach. The results of overall acceptability scores of the product after reconstitution were found to be in the range of 7.35 to 7.60. An attempt was made to develop ready to cook (RTC) *Bisibelebath* mix using little millet and other ingredients. The optimization of RTC little millet *Bisibelebath* mix was achieved using little millet, red gram dhal and spice mixture as ingredient variables and sensory attributes were selected as responses. For 15 different combinations, sensory scores ranged from 6.29-8.00 for appearance, 6.56-8.01 for colour, 6.54-8.12 for consistency, 6.63-8.05 for flavour, 5.89-8.11 for taste and 6.36-7.95 for overall acceptability (Brundha *et al.*, 2019)^[3] which was lower than the present study.

Conclusion

It may be concluded from the study that, the instant rice based meal is a convenient product made with 35% rice, 12% lentil dhal, 14% green gram dhal i.e., Formulation III was found to be highly acceptable. This instant rice based meal is convenient and nutritious food which is easy and fast to prepare besides being hygienic and convenient to eat.

Acknowledgments

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Conflicts of interest: The authors declare no conflict of interest.

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