

Preparation of Ready-To-Serve Chutney Powder using Various Dried Microgreens, Its Organoleptic, Experimental and Shelf Life Analysis

Research Article

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Abstract

Formulation of new product involves modification of an existing product or formulation of entirely new product. This present study is focused on formulation of Ready-To-Serve microgreen chutney powder with an intention of preserving microgreens for longer duration and to get increased shelf-life. For this, various microgreens were grown and RTS microgreen chutney powder was developed and chosen based on organoleptic evaluation and highest yield microgreens. For the preparation of RTS microgreen chutney powder, microgreens were dried in a low temperature of 50°C for 3-4 hours and powdered. After organoleptic evaluation, green gram RTS microgreen chutney powder was rated the best with overall acceptability mean score of 4.36. The antioxidant level has been retained at 3664 mg/100 g and is rich in calcium which is 350 mg/100 g.

Keywords: Analysis; Chutney powder; Formulation; Microgreens; Organoleptic; Shelf life

Introduction

“The creation of products with new and different characteristics which provides new and extra benefits to customers termed as Product Development. The life cycle of Product Development consists of Idea Generation, Idea Screening, Concept Development, Concept Testing and Business Analysis [1].

The departments of manufacturing, engineering, research & development, marketing, finance and purchasing should coordinate to make the “New Development Product” effective [2].

A new product can be created from already existing chutney powder by adding microgreens to enhance its nutritional value and characteristics. The chutney powder is a staple food commonly consumed among the Indians as a ready to eat food without refrigerated storage for maximum up to twelve days. Literature review reveals that various food ingredients are used in the development of

chutney powder based on their seasonal availability of those products [3].

Rohini N, Sathiyamurthy VA, Arumugam T (2016), has defined “Microgreens as a tiny vegetable green that is used both as a visual and flavour component or ingredient primarily in fine dining restaurants [4].

“Microgreens” is a marketing term used to describe young and tender edible seedlings harvested when the cotyledonary leaves have fully developed and the first true leaves emerge [5].

Microgreens are new emerging food products having two fully developed cotyledons with the first pair of true leaves emerging or partially expanded and is used to enhance salads or as edible garnishes and its consumption has been increased due to the presence of bioactive components such as vitamins, minerals and antioxidants in higher amounts.

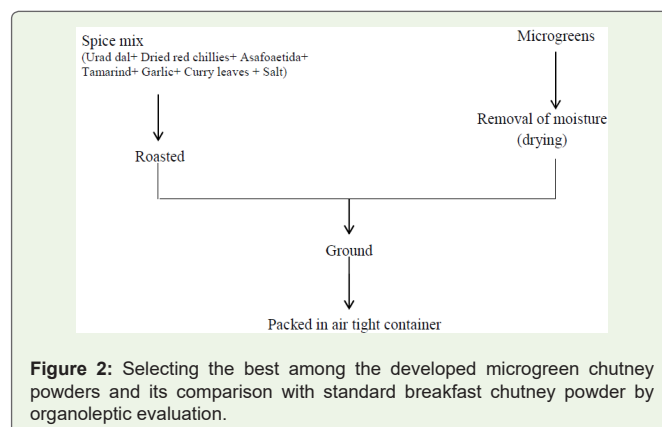
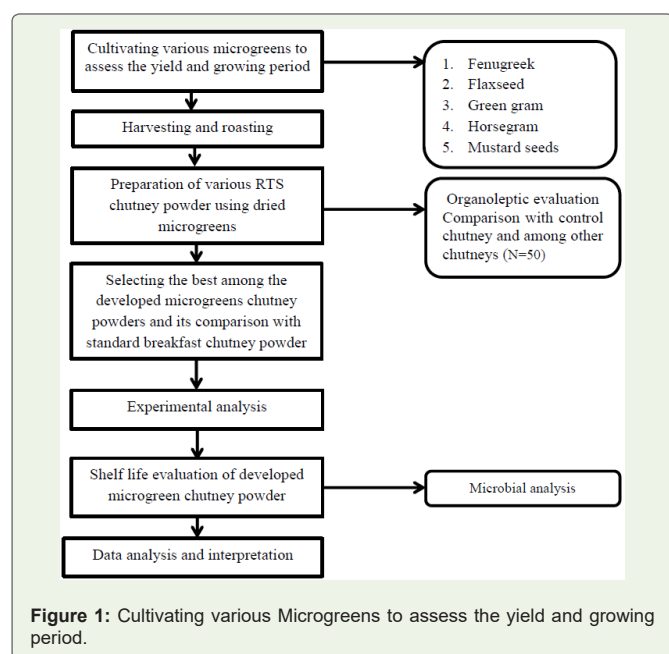
They typically have a short shelf life due to rapid product

deterioration. Microgreens are usually 1-3 inches in height, harvested at 7-14 days after germination, depending on the species, and sold with the stem and attached cotyledons (seed leaves). They provide a large array of intense flavours, vivid colours and tender textures [6].

Commonly found microgreens are amaranth, beet, lettuce, radish, mustard, sunflower and peas. Regarding the cultivating conditions, microgreens are a versatile product. They may be grown in greenhouse or indoor, with natural or artificial light sources and in soil or in soilless systems. One way to preserve such plant products is to dry them in order to preserve their desirable qualities, reduce storage volume and to extend shelf-life. In addition, it is also important to retain the biological activity of important phyto constituents, including antioxidants and nutrients as well as avoid undesirable chemical or physical changes like browning and loss of colour [6].

Growing microgreens is relatively a simple process, even if microgreens life cycle is very short and hence certain measures are applied for improving seeds germination. They are done to determine a more rapid stabilization and to promote vigorous seedlings. Also, it is done to shorten the greenhouse production and thus the production cost [7].

Based on the above mentioned facts, the present study was done to assess the yield of various microgreens by cultivating them and to find out the best harvesting period from the 10 microgreens grown (Figure 1). To develop RTS microgreens chutney powders from different type of microgreens and to find out the best among them based on organoleptic evaluation and highest yield microgreens. To compare the organoleptic quality of newly developed microgreens chutney powder with a standard breakfast chutney powder. To analyse nutritional components present in RTS microgreens chutney powder by various experimental analysis, to assess the shelf life by microbial analysis and organoleptic evaluation (Figure 2).



Materials & Methods

Cultivating Various Microgreens to Assess the Yield and Growing Period

As a trial, more than 10 variants of microgreens were sown and cultivated. Seeds such as chia seeds, cumin seeds, mustard seeds, wheat, fenugreek, garden cress, flaxseed, red cowpeas, green gram and horse gram were chosen randomly and purchased from the local market. Different mediums such as soil, coirpits and tissue papers were tried out to find out the best means of cultivation.

Selecting the Best Five Variants Based on its Yield

Based on yield and growing period, 5 variants were selected, since it has shown better yield with short period of time. Fenugreek, flaxseed, green gram, horsegram and mustard seeds were chosen to prepare the RTS microgreen chutney powder.

Preparation of Various RTS Chutney Powder Using Dried Microgreens

After harvesting, the microgreens were dried in a hot air oven at 50°C for 3-4 hours and powdered. Ready-to-serve chutney powders were formulated using the selected microgreens.

Selecting the Best among the Developed Microgreen Chutney Powders and its Comparison with Standard Breakfast Chutney Powder by Organoleptic Evaluation

Five varieties of microgreen RTS chutney powder have undergone sensory evaluation. The best variant was selected on the basis of sensory score and high yielding variant. A comparison was also done with a control sample chutney powder and among other developed chutneys. The control sample chutney powder was developed by self, similar to breakfast chutney powder available in market.

A) Organoleptic Evaluation

Sensory evaluation was done by comparing with the control sample chutney powder and among other chutney powders. A composite score card was developed and was assessed based on sensory attributes.

Experimental Analysis: Experimental analysis such as proximate composition and nutrient analysis were determined for developed RTS

microgreen chutney powder and dried microgreens respectively. Total anti-oxidant activity was also done for microgreen chutney powder. The estimation of nutritional component of dried microgreens was done for iron and calcium components. The proximate composition of developed RTS microgreen chutney powder were analysed and the estimated components were energy, moisture, fat, ash, carbohydrate and protein. Anti-oxidants are the major bioactive compounds present in the microgreens. So to determine it, anti-oxidant assay has been conducted using the method IFL C/QSP G/078 for the developed RTS microgreen chutney powder.

Shelf Life Evaluation of Developed Microgreens Chutney Powder

A shelf life study was conducted among the developed microgreen chutney powder. The evaluation was done by placing 4 jars in room temperature and 2 packs in refrigerators. The jars were autoclaved and hygienically packed with headspace. Equal quantity of microgreen chutney powder was put into the jars and zip lock covers and labelled individually. Shelf life evaluation was done for 60 days. Each one of the jars was taken after every 10 days for organoleptic evaluation to assess the quality of the product.

a) Shelf Life Assessment by Microbial Analysis

Shelf life assessment by microbial analysis of RTS microgreen chutney powder done were total plate count, yeast and mold analysis of the product were assessed on 45th day due to COVID pandemic situation.

b) Shelf Life Assessment by Organoleptic Evaluation

Shelf life assesment by organoleptic evaluation was done by self due to COVID pandemic situation on day 10, day 20, day 40 and day 60. Attributes such as appearance, colour, aroma, taste and texture was assessed and rated as excellent, good, fair, poor, very poor.

Data Analysis and Interpretation: The data analysed and its interpretation is given under results and discussions.

Results

Determination of Growing period and harvesting yield of various microgreens (Table 1).

Organoleptic Evaluation Score of Various Microgreen Chutney Powder (Table 2).

Table 1: Growing Period and Harvesting Yield of Microgreens (n=10).

S.No.	SEED TYPE	GROWING PERIOD	HARVESTING YIELD
1.	Chia seeds	Didn't sprout	-
2.	Cumin seeds	Didn't sprout	-
3.	Fenugreek	5 to 10 days	50 g
4.	Flaxseed	6 to 8 days	60 g
5.	Garden cress	10 to 15 days	90 g
6.	Green gram	7 to 14 days	180 g
7.	Horse gram	7 to 10 days	200 g
8.	Mustard seeds	15 to 20 days	80 g
9.	Red cowpeas	10 to 14 days	110 g
10.	Wheat	5 to 15 days	50 g

Experimental Analysis

Nutrient Analysis of Dried Microgreens (Table 3).

Proximate Composition of RTS Microgreen Chutney Powder (Table 4).

Antioxidant Activity of RTS Microgreen Chutney Powder (Table 5).

Shelf Life Evaluation of Developed Microgreens Chutney Powder (Table 6).

Shelf Life Assessment by Organoleptic Evaluation (Table 7).

Discussion

Determination of Growing period and harvesting yield of various microgreens

10 seeds, each of 100g were sown and observed to assess the growing period and harvesting yield of microgreens. It is also noted that green gram and horsegram had maximum harvesting yield i.e., 180g and 200g respectively and growing periods was 7 to 14 days for green gram and 7 to 10 days for horsegram. Fenugreek seeds took around 5-10 days and wheat grains took 5 to 15 days for growing and yield of microgreens obtained was only about 50g. Flaxseed took 6 to 8 days for growing and yielded 60 g of microgreens. Growing period of garden cress seeds and red cowpeas were similar i.e., 10 to 15 days and 10 to 14 days respectively which yielded 90 g of garden cress microgreens and 110g red cowpeas microgreens. Chia seeds and cumin seeds didn't grow at all.

Organoleptic Evaluation Score of Various Microgreen Chutney Powder

A) Mean Score of Green Gram Microgreen Chutney Powder

The mean score for appearance is 4.4, for colour 4.34, for texture 4.12, for flavor 4.32 and taste 4.32 and the overall acceptability of the sample is 4.36.

B) Mean Score of Horse Gram Microgreen Chutney Powder

The mean score for appearance is 4.26, for colour 4.36, for texture 3.94, for flavor 3.72, for taste 3.8 and the overall acceptability of the sample is 3.9.

C) Mean Score of Mustard Microgreen Chutney Powder

The mean score for appearance is 4.16, for colour 4.22, for texture 3.8, for flavor 3.34, for taste 3.3 and the overall acceptability of the sample is 3.34.

D) Mean Score of Fenugreek Microgreen Chutney Powder

The mean score for appearance is 3.8, for colour 3.92, for texture 3.32, for flavor 3.06, for taste 3.14 and the overall acceptability of the sample is 3.3.

D) Mean Score of Flaxseed Microgreen Chutney Powder

The mean score for appearance is 3.92, for colour 4.02, for texture 3.38, for flavor 2.52, for taste 2.48 and the overall acceptability of the sample is 2.8.

Table 2: Organoleptic Evaluation Score of Various Microgreen Chutney Powder (n=50).

S.No.	Criteria	Score	Green Gram Microgreen Chutney Powder	Horse Gram Microgreen Chutney Powder	Mustard Microgreen Chutney Powder	Fenugreek Microgreen Chutney Powder	Flaxseed Microgreen Chutney Powder
MEAN \pm SD							
1.	Appearance	5	4.4 \pm 0.3	4.26 \pm 0.37	4.16 \pm 0.42	3.8 \pm 0.6	3.92 \pm 0.54
2.	Colour	5	4.34 \pm 0.33	4.36 \pm 0.32	4.22 \pm 0.39	3.92 \pm 0.54	4.02 \pm 0.49
3.	Texture	5	4.12 \pm 0.44	3.94 \pm 0.53	3.8 \pm 0.6	3.32 \pm 0.84	3.38 \pm 0.81
4.	Flavor	5	4.32 \pm 0.34	3.72 \pm 0.64	3.34 \pm 0.83	3.06 \pm 0.97	2.52 \pm 0.19
5.	Taste	5	4.32 \pm 0.34	3.8 \pm 0.6	3.3 \pm 0.85	3.14 \pm 0.93	2.48 \pm 0.23
6.	Overall acceptability	5	4.36 \pm 0.32	3.9 \pm 0.55	3.34 \pm 0.83	3.3 \pm 0.85	2.8 \pm 0.25

Table 3: Nutrient Analysis.

Parameter Analysed	Result
Calcium	350 mg/ 100 g
Iron	7.18 mg/kg

Table 4: Proximate Composition.

Parameter Analysed	Result
Energy	393 kcal/100 g
Protein	24.5 g/ 100 g
Fat	6.42 g/100 g
Carbohydrate	59.3 g/100 g
Moisture	4.88 g/100 g
Ash	4.95 g/ 100 g

Table 5: Antioxidant Activity of RTS Microgreen Chutney Powder.

Parameter Analysed	Result
Total anti-oxidant activity (as ascorbic acid)	3664 mg/100 g

Table 6: Shelf Life Assessment by Microbial Analysis.

Parameter Analysed	Result
Total Plate Count (30°C for 72 hours)	10*105 CFU/g
Yeast and mold (25°C for 5 days)	10*105 CFU/g

Table 7: Shelf Life Assessment by Organoleptic Evaluation.

Days	Sensory parameter	Inference
10 th day	Appearance	Excellent Excellent Excellent Excellent Excellent
	Colour	
	Aroma	
	Taste	
	Texture	
20 th day	Appearance	Excellent Excellent Excellent Excellent Excellent
	Colour	
	Aroma	
	Taste	
	Texture	
40 th day	Appearance	Excellent Excellent Good Good Excellent
	Colour	
	Aroma	
	Taste	
	Texture	
60 th day	Appearance	Excellent Excellent Good Good Excellent
	Colour	
	Aroma	
	Taste	
	Texture	

E) Overall Acceptability Mean Score of Microgreens Chutney Powder

The overall acceptability score of green gram is 4.36, horse gram is 3.9, mustard seeds is 3.34, fenugreek is 3.3 and that of flaxseed is 2.8.

According to Nivedha (2018), the mean score of appearance is 7.9 \pm 0.22, for colour 7.8 \pm 0.22, for flavor 8.6 \pm 0.54 and taste 8.6 \pm 0.54 and overall acceptability of amaranth microgreen chutney powder is 8.2 \pm 0.44.

According to Nivedha (2018), the mean score of flavor 8.1 \pm 0.84 and taste 7.8 \pm 0.83 of beet microgreen chutney powder is 8.2 \pm 0.44.

Experimental Analysis

The nutrient analysis of dried microgreens contains 350 mg Ca in 100 g and 7.18 mg of iron per kilogram.

While considering a normal breakfast chutney powder, Ca content is very low. But in this microgreen chutney powder Ca content is much higher i.e. 350 mg/100 g.

According to Fuente (2019), among 30 varieties of rassicacea microgreens grown in peat moss substrate evaluated by Xiao et al. calcium content was found to be in range of 41 to 88 mg/100g FW and iron was found between 0.47 to 0.72 mg/100 g FW. Also level of Ca and Fe in broccoli microgreens was found to be 59-202 mg/100 g FW and 0.59-1.2 mg/100 g. According to Xiao (2016), Brassiacaeae microgreens contained 28 to 66 mg/ 100 g FW of calcium and 0.47 to 0.84 mg/ 100 g FW of iron [8].

According to Nivedha (2018), iron content of mustard leaves and sunflower leaves microgreen chutney powder ranges between 5.53mg and 16.48mg respectively. Calcium content of mix of amaranth, beet and lettuce microgreen chutney powder ranged from 15.66 mg [6].

Proximate Composition of RTS Microgreen Chutney Powder

The proximate composition present in RTS microgreen chutney powder. Energy was found to be 393 kcal/100 g, protein content was 24.5 g/ 100g, fat content 6.42 g/100 g, carbohydrate content 59.3 g/100 g, moisture content 4.88 g/ 100g and ash content was found to be 4.95 g/ 100g.

According to Nivedha (2018), moisture content in beet leaves microgreen chutney powder was found to be 6.17 g and in mustard leaves microgreen chutney powder was 14.53g. Protein content of mustard leaves microgreen chutney powder was 20.59 g and 44.23

g in beet leaves microgreen chutney powder. Ash content of radish leaves microgreen chutney powder was 4.65 g and mustard leaves contained 6.63 g.

Antioxidant Activity of RTS Microgreen Chutney Powder

The total antioxidant activity of RTS microgreen chutney powder was found to be 3664 mg/100 g. The recommended daily intake of antioxidants is a minimum of 400 g/day of fruits and vegetables, but the developed microgreen contains 3664 mg/100 g.

According to Fuente (2019), amount of Vitamin C in fresh microgreens were found as 31-56 mg/100 g FW, which would provide between 38 and 70% of recommended daily intake for vitamin C.

According to Polash (2018), the experiment revealed that after 1st day of harvest the microgreens of four tested varieties (mustard, leaf mustard, radish and cabbage) showed vitamin C (16.23, 13.17, 8.57 and 8.03mg/100g, respectively) and the activity of DPPH (0.75, 1.20, 2.90 and 3.57µg/ml respectively) whereas these substances deteriorated significantly on 3rd or 5th day of harvest.

Shelf Life Evaluation of Developed Microgreens Chutney Powder

Shelf Life Assessment by Microbial Analysis

The results of shelf life assessment done for RTS microgreen chutney powder by microbial analysis on 45th day. Total plate count was found to be CFU/g and yeast and mold was found to be CFU/g. It indicates that the results obtained are little higher value than normal range but is still acceptable to consume since it was acceptable with its appearance, color, aroma, taste and texture on 60th day.

Shelf Life Assessment by Organoleptic Evaluation

The result of shelf life assesment by organoleptic evaluation on day 10, day 20, day 40 and day 60. Attributes such as appearance, colour and texture was excellent till day 60th. Aroma and taste of the product was rated as good on 40th and 60th day and on all other days it was rated as excellent.

Conclusion

On the basis of findings, it can be concluded that microgreens can be grown easily at home and can be included in the diet as it has many nutritional benefits. The microgreens can be harvested within 5-14 days after sown. RTS microgreen chutney powder was developed with an intention of preserving microgreens for longer duration and to prove increased shelf- life. It was also developed considering a variety from breakfast chutney powders available in the market. For the preparation of RTS microgreen chutney powder, microgreens were dried in a low temperature of 50°C for 3-4 hours and powdered. The antioxidant level has been retained at 3664 mg/100g and is rich in calcium which is 350 mg/100g. Organoleptic evaluation was also conducted for developed microgreen chutney powder and it was found to be acceptable.

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