

Organoleptic and Consumer Evaluation Studies of Microgreens Enriched Instant Chutney Mixes/Powders

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ABSTRACT

Microgreens have gained attention as therapeutic functional foods with the potential to boost human health through dietary augmentation. Considering this the present study was planned to develop the instant chutney powders by using mustard, spinach,

amaranth and safflower microgreens. The chutney powders were prepared by incorporating 5%, 10%, 15%, 20% and 25% of different microgreens. All the developed chutney powders were analyzed for their organoleptic qualities to check their acceptance rate over the regular chutney powders. The sensory analysis results showed that all the prepared chutney powders were approved by the semi-trained panel members. Instant chutney powders containing 5% microgreens were highly accepted by the panelists and were selected as final formulations for further studies. The final selected formulations from each microgreen were subjected to consumer evaluation. The results showed a positive attitude of the consumers towards the developed chutney powders. All the chutney powders were preferred almost equally by most of the consumers. Most of the consumers (94%) preferred instant chutney powders were more nutritious than the regular chutney powders. Consumers appreciated the development of such type of food products as these are abundant in vitamins, minerals, antioxidants and phytonutrients and also have other functional benefits.

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INTRODUCTION

Microgreens are a new class of salad crops which are gaining popularity as a new culinary ingredient.

Growing microgreens can be versatile practice to fulfill the requirements of diverse and renewed dietary pattern as well as amassing the higher level of satisfaction and bioactive perspective to the vegetarian diet especially. Consumption of microgreens also has been increased because of higher concentrations of bioactive compounds especially vitamins, minerals, antioxidants and phytonutrient content are available in microgreens compared to mature greens, which are beneficial for human health (Kyriacou *et al.* 2017).

Microgreens consist a variety of flavors, colors, appearance and textures, which are allowing their utilization in various food adjunct like soups, salads and sandwiches and also to garnishes a variety of other dishes (Treadwell *et al.* 2010, Xiao *et al.* 2012). Microgreens have a short production cycle, which is usually 1–3 weeks from seed germination to edible stage (Sun *et al.* 2013). Recently, these innovative class of vegetables has been gained the tag of ‘functional foods’ because they have health-promoting and disease preventing abilities.

Microgreens are fresh, flavory and also nutrient-rich delish which can be easily grown indoors throughout the year (Kyriacou *et al.* 2017). The nutritional composition of the microgreens also varied from the sprouts and also their mature parts. It was reported that red cabbage microgreen (11.5 mg/100 g) showed almost 260-fold high β -carotene content than the mature red cabbage (0.044 mg/100 g) (Singh *et al.* 2006 and Xiao *et al.* 2012) and obtained more than 200 times (24.1 mg/100 g FW) α -tocopherol concentration compared to its mature part (0.111 mg/100 g FW) (Podsdek *et al.* 2006 and Xiao *et al.* 2012). It was observed by Kyriacou *et al.* (2018) that microgreens belonging to Brassica family were found to have the highest lipophilic as well as hydrophilic antioxidant activities.

The microgreens could be effective and also useful in mitigating the challenges of nutritional gap as well as consumer familiarization along with sensory attributes, which is making them the next generation “superfoods” (Kamal *et al.* 2020, Paradiso *et al.* 2020

and Pinto *et al.* 2015).

Furthermore, the main drawback of microgreens is that they deteriorate very rapidly after harvesting because of their perishable nature which will become unfit for consumption. Therefore, one way to preserve these greens is to dehydrate them because it is a low cost technology which can be used to preserve microgreens for longer time and nutrients can be attained in concentrated forms later these dehydrated greens can be utilized in the preparation of various food products.

In the present study an attempt has been made to prepare ready to eat instant chutney powders with the incorporation of dehydrated microgreens. As a result of this, it is necessary to know the perception of common people in order to decide the success rate of any product. Therefore, qualitative evaluation techniques such as sensory evaluation and consumer acceptance studies, are conducted which can provide the base to accept or reject any food adjuncts.

MATERIALS AND METHODS

The present study was conducted at Department of Foods and Nutrition, Post Graduate and Research Center (PGRC), Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad (India).

Preparation of raw materials: Good quality seeds (70–99% germination) of mustard, spinach and amaranth were directly purchased from authorized seed shop (M/s Srinivasa seeds and fertilizers, Shamshabad, Hyderabad), whereas safflower seed has been procured from Indian Institute of oil seeds Research, Hyderabad. Vermicompost was procured from college farm, PJTSAU, Rajendranagar, Hyderabad. All the microgreens namely mustard, spinach, amaranth and safflower have been grown in the horticulture garden of PJTSAU, Rajendranagar, Hyderabad. All other required ingredients were purchased from local market of Hyderabad to prepare instant chutney powders.

Sample growth and preparations: All the microgreens namely mustard, spinach, amaranth and

safflower were grown in trays using vermicompost enriched soil under ambient conditions. All the seeds were soaked in potable water separately except amaranth. Pre-soaking leads to quicker germination and more even growth of microgreens. After that, the seeds were sown in trays with even depth. The trays were covered for first 3 days for good germination. After that, these trays were exposed to light and water was sprinkled two times in a day. All microgreens were harvested after 10-12 days when their cotyledon leaves were fully open and true leaf was about to come. The roots were removed and leaves were cleaned.

Blanching and drying of microgreens: All the microgreens were subjected to blanching prior to drying to deactivate the enzyme activity as well as to retain more color. After that all blanched microgreens were placed in tray drier at $52\pm 2^\circ\text{C}$ for 5-6 hrs. After completion of drying, microgreens were cooled, powdered and packed in high-density polyethylene (HDPE) re-sealable bags for further use.

Development of instant chutney powders: Five formulations of instant chutney powders were prepared from each microgreens with the incorporation of 5%, 10%, 15%, 20% and 25% dried microgreens. Control chutney powder (CCP) and instant chutney powders from each microgreens (mustard, spinach, amaranth and safflower) with different formulations were prepared using ingredients given in Table 1. All the ingredients weighed separately. One formulation from each microgreen was selected by sensory analysis for further studies. For the development of instant chutney powders, the steps followed are mentioned in Fig. 1.

Sensory analysis: Sensory profile is the most

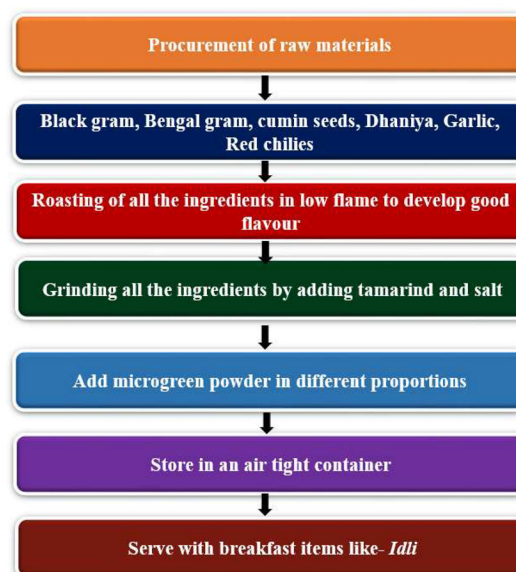


Fig. 1. Flow chart for the preparation of microgreens incorporated instant chutney powder.

important parameter in determining the products overall quality. A nine-point hedonic scale (where 1= extremely dislike and 9= extremely like) was used to determine the sensory acceptability of chutney powders for appearance, color, flavor, taste, texture and overall acceptability. 15 semi-trained panelists were asked to evaluate each attribute by applying nine point hedonic scale (Meilgaard *et al.* 1999). They compared all the formulated instant chutney powder and given scores according to their perception. Statistical analysis (One-way Anova) was performed for the obtained responses and one best formulation was selected from each microgreen for further studies.

Consumer evaluation studies: The final best selected formulation from each microgreen was subjected to consumer evaluation studies. A structured ques-

Table 1. Ingredients used for preparation of microgreens incorporated instant chutney powders.

Ingredients	CCP	F1 (MCP1, SCP1, SACP1 and ACP1)	F2 (MCP2, SCP2, SACP2 and ACP2)	F3 (MCP3, SCP3, SACP3 and ACP3)	F4 (MCP4, SCP4, SACP4 and ACP4)	F5 (MCP5, SCP5, SACP5 and ACP5)
Microgreen powder	0.0	5.0	10.0	15.0	20.0	25.0
Black gram dhal	6.5	6.5	6.5	6.5	6.5	6.5
Bengal gram dhal	5.0	5.0	5.0	5.0	5.0	5.0
Cumin powder	3.5	3.5	3.5	3.5	3.5	3.5
Coriander seeds	6.5	6.5	6.5	6.5	6.5	6.5

Table 1. Continued.

Ingredients	CCP	F1 (MCP1, SCP1, SACP1 and ACP1)	F2 (MCP2, SCP2, SACP2 and ACP2)	F3 (MCP3, SCP3, SACP3 and ACP3)	F4 (MCP4, SCP4, SACP4 and ACP4)	F5 (MCP5, SCP5, SACP5 and ACP5)
Garlic	5.5	5.5	5.5	5.5	5.5	5.5
Tamarind powder	7.0	7.0	7.0	7.0	7.0	7.0
Chili powder	10.0	10.0	10.0	10.0	10.0	10.0
Common salt	6.0	6.0	6.0	6.0	6.0	6.0

Note: All ingredients were measured in grams. CCP: Control instant chutney powder.

MCP1: 5% mustard microgreen incorporated instant chutney powder

MCP2: 10% mustard microgreen incorporated instant chutney powder

MCP3: 15% mustard microgreen incorporated instant chutney powder

MCP4: 20% mustard microgreen incorporated instant chutney powder

MCP5: 25% mustard microgreen incorporated instant chutney powder

SCP1: 5% spinach microgreen incorporated instant chutney powder

SCP2: 10% spinach microgreen incorporated instant chutney powder

SCP3: 15% spinach microgreen incorporated instant chutney powder

SCP4: 20% spinach microgreen incorporated instant chutney powder

SCP5: 25% spinach microgreen incorporated instant chutney powder

SACP1: 5% safflower microgreen incorporated instant chutney powder

SACP2: 10% safflower microgreen incorporated instant chutney powder

SACP3: 15% safflower microgreen incorporated instant chutney powder

SACP4: 20% safflower microgreen incorporated instant chutney powder

SACP5: 25% safflower microgreen incorporated instant chutney powder

ACP1: 5% amaranth microgreen incorporated instant chutney powder

ACP2: 10% amaranth microgreen incorporated instant chutney powder

ACP3: 15% amaranth microgreen incorporated instant chutney powder

ACP4: 20% amaranth microgreen incorporated instant chutney powder

ACP5: 25% amaranth microgreen incorporated instant chutney powder

tionnaire was formulated with the objective towards finding the consumer's perceptions and attitude towards microgreens incorporated chutney powders. The questionnaire was distributed to 100 respondents randomly (Chambers 1994).

RESULTS AND DISCUSSION

Sensory analysis of microgreens incorporated chutney powders:

Sensory evaluation is carried out to measure, analyze and interpret reactions to those characteristics of the food and other materials as they are perceived by the senses of sight, smell, taste, touch and hearing (Sharif *et al.* 2017 and Loncarevic *et al.* 2018). Sensory evaluation provides important quantitative and qualitative data that aids in product development with respect to appearance, color, flavor, taste, texture and overall acceptability.

The control instant chutney powder (CCP) obtained the highest sensory scores amongst all the formulated chutney powders. As the incorporation of microgreens increased, the mean sensory score for each attribute decreased. MCP1, SCP1, SACP1 and ACP1 obtained the highest scores in all the parameters among mustard, spinach, amaranth and safflower incorporated chutney powders, respectively. In most

of the attributes, MCP1, SCP1, SACP1 and ACP1 formulations did not differ significantly ($p \leq 0.05$) with respect to their control because they were found similar to control, whereas other formulations differed significantly. The least accepted formulations were MCP5, SCP5, SACP5 and ACP5.

Acceptability index of the tested samples was calculated from the obtained scores and it was observed that control instant chutney powder revealed highest acceptability index (99.61%) followed by 5% (MCP1, SCP1, SACP1 and ACP1), 10% (MCP2, SCP2, SACP2 and ACP2), 15% (MCP3, SCP3, SACP3 and ACP3), 20% (MCP4, SCP4, SACP4 and ACP4) and 25% (MCP5, SCP5, SACP5 and ACP5) microgreens incorporated chutney powders (Fig. 2).

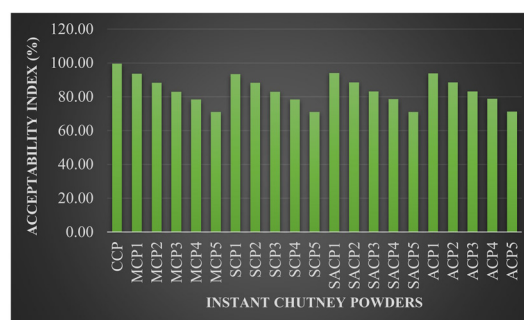


Fig. 2. Acceptability index (%) microgreens incorporated instant chutney powders.

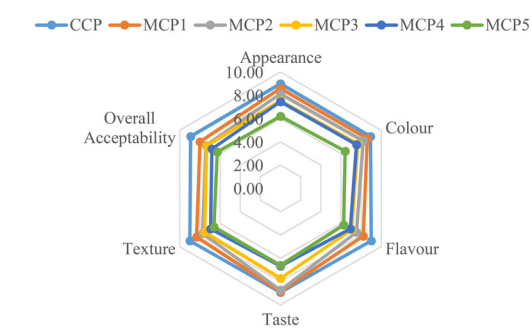


Fig. 3. Mean sensory scores of mustard microgreen incorporated instant chutney powders.

Nivedha and Lakshmy (2018) compared microgreens and mature greens chutney powder, microgreens incorporated chutney powder was more preferred compared to mature greens incorporated chutney powder. Priya and Haripriya (2021) developed ready-to-cook instant soup mix of microgreens at three different levels of incorporations i.e., 10%, 20% and 30%. The sensory attributes were evaluated by semi-trained panelist using a 9-point hedonic scale. It was found that the mustard microgreen (10%) incorporated soup mix was found to be highest in respect to taste, appearance, flavor and overall acceptability. Kaveri *et al.* (2004) prepared papads with two types of green leafy vegetables i.e., shepu (*Peucedanum graveolens*) and kilkeerae (*Amaranthus tricolor*) at two different levels in fresh (15 and 20%) and dehydrated forms (5 and 10%). Papads developed with 15–20% fresh greens and 5% dehydrated greens scored above 6 on a scale of 10 indicating acceptability of papads incorporated with greens.

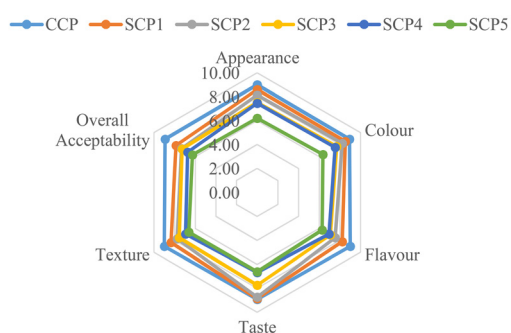


Fig. 4. Mean sensory scores of spinach microgreen incorporated instant chutney powders.

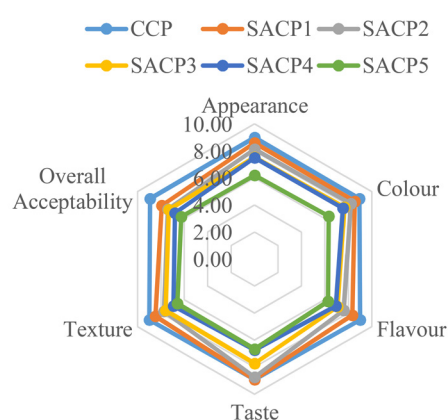


Fig. 5. Mean sensory scores of safflower microgreen incorporated instant chutney powders.

Being good in appearance, color, flavor, taste, texture and overall acceptability, obtaining higher scores in sensory evaluation and taking the health point into consideration, the final selected instant chutney powders were MCP1, SCP1, SACP1 and ACP1. Consumer evaluation studies were conducted for these formulations so as to find out the success rate of these food adjuncts among the mass populations. The differences among the control and microgreens incorporated chutney powders are depicted in Fig. 3 – 6.

Consumer acceptability of microgreens incorporated chutney powders: Consumer evaluation is necessary to know the attitude and perception of the people about any food product. It helps to ascertain whether a product will be approved in the market or

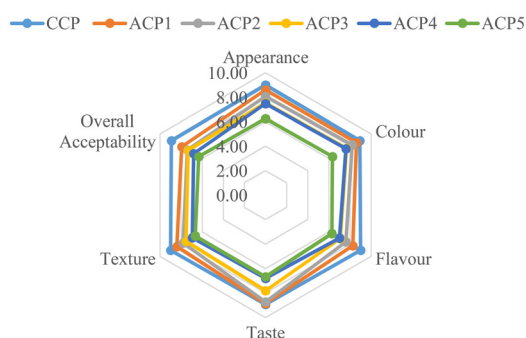


Fig. 6. Mean sensory scores of amaranth microgreen incorporated instant chutney powders.

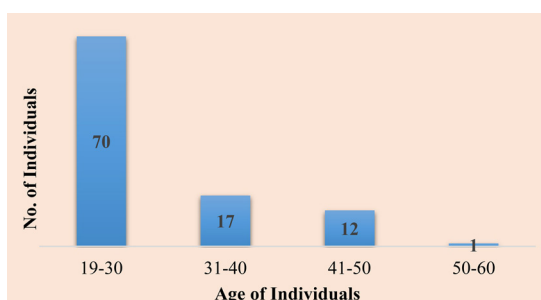


Fig. 7. Age groups of respondents (in years).

not. The consumer acceptance study for the selected formulations of microgreens incorporated chutney powders was done including 100 participants, out of which 72% were females and the rest 28% were males, belonging to various age groups as mentioned in Fig. 7.

The participants tasted the products and rated them using a 5-point hedonic scale (5= like very much to 1= dislike very much) for various parameters including appearance, color, flavor, taste, texture and overall acceptability. All types of microgreens incorporated chutney powders received good scores for all the parameters. The average of the sensory scores for MCP1, SCP1, SACP1 and ACP1 is presented in Fig. 8. A very slight difference was observed among all type of chutney powders, almost similar results were reported for all types of chutney powders. Overall the highest preference was given to MCP1 (mustard

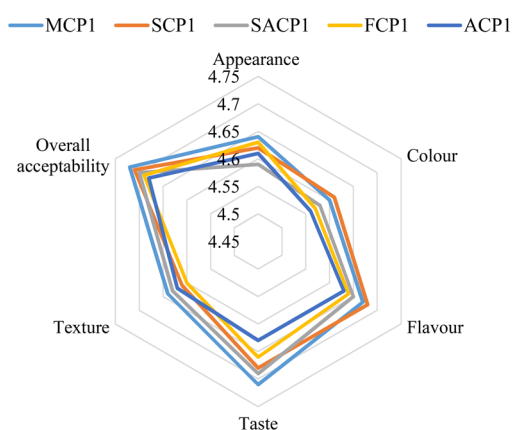


Fig. 8. Mean sensory scores given by the consumers for the final formulations of microgreens incorporated chutney powders.

microgreen incorporated chutney powder) and least was found to ACP1 (amaranth microgreens incorporated chutney powder).

Consumer's perception about likeness, cost, acceptance and benefits of microgreens incorporated instant chutney powders:

Among the respondents, 94% respondents stated microgreens incorporated instant chutney powders were more nutritious than the regular chutney powders and most of the respondents (93%) preferred better than regular chutney powders. Out of 100, 95% respondents showed willingness to consume microgreens incorporated instant chutney powders due to its nutritional and health benefits and also were willing to buy these chutney powders if available commercially, while 5% of respondents did not prefer to consume these chutney powders (Table 2). According to the willingness to buy 50g of microgreens incorporated chutney powders, it was found that 41% of the respondents were willing to pay Rs40, 51% respondents like to pay Rs45, 5% like to pay Rs50, 2% like to pay Rs55 and 1% like to pay Rs60. It was revealed that 12% of the respondents were willing to consume microgreens incorporated chutney powders daily, while 21% were interested in consuming these chutney powders thrice a week, 45% twice a week, 10% once a week, 8% monthly and 4% preferred to consume rarely. The satisfaction level varied among the participants from satisfied (33%) to highly satisfied (64%) for given products. All the respondents agreed that these products are a healthy initiative and can be recommended to their friends and family members.

Many factors influence customer acceptance of food products, including the qualities of the product, social conditions and consumer characteristics. Consumer acceptance of a food product is influenced by factors such as price, convenience, taste, appearance and health-promoting characteristics. Furthermore, consumer factors such as attitude toward innovation, preferences for specific food groups, or nutritional neophobia influence food acceptability to a great extent (Cichonska and Ziarno 2020).

From the present study it can be concluded that all formulations of microgreens incorporated chutney powders were in the acceptable range and fell in

Table 2. Consumer's responses towards likeness, cost, acceptance and benefits of microgreens incorporated instant chutney powders (n=100).

Sl. No.	Particulars	Percentage (%)	
		Yes	No
1	Perceptions towards microgreens incorporated instant chutney powders that they are more nutritious than regular chutney powders	94%	6%
2	Preferences of microgreens incorporated instant chutney powders	93%	7%
3	Willingness to buy microgreens incorporated chutney powder based on its nutritional contents and health claims	95%	5%
4	Recommendation of microgreens incorporated chutney powder to your family and friends	100%	Nil
5	Making such products is an healthy initiative	100%	Nil
6	Consent for price (Rupees) to pay for 50g of microgreens incorporated chutney powders	Rs 40	41%
		Rs 45	51%
		Rs 50	5%
		Rs 55	2%
		Rs 60	1%
7	Willingness to purchase the given microgreens incorporated chutney powders	Daily	12%
		Thrice a week	21%
		Twice a week	45%
		Once a week	10%
		Monthly	8%
8	Satisfaction level of consumers towards microgreens incorporated chutney powders	Rarely	4%
		Extremely satisfied	33%
		Satisfied	64%
		Nearly satisfied	3%
		Not satisfied	Nil

the category of “like slightly” to “like extremely”. As concentration of microgreens was increased, the sensory scores was decreased significantly. Because of the high acceptability of the developed ready-to-eat microgreens incorporated chutney powders, the outcome of this study can be useful in formulation of such type of more microgreens based food products and value addition of these type of food products with dehydrated microgreens can be recommended as a feasible food-based approach to combat micronutrient malnutrition.

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