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Organoleptic characteristics of *Chutney* prepared from leaves of Desi and Kabuli varieties of chickpea (*Cicer arietinum* L.)

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Abstract
This study had been conducted in the Department of Food and Nutrition, CCS HAU, Hisar. Product namely *chutney* was prepared from the fresh leaves of both the desi as well as Kabuli chickpeas varieties. Supplementation levels of 10, 15 and 20 per cent i.e. fresh leaves of both the varieties were used. The data regarding colour, appearance, aroma, texture, taste and overall acceptability of *chutney* is presented. Four products were prepared from the leaves (10, 15 and 20% supplementation levels) of desi and Kabuli chickpea varieties at 30, 45 and 60 days after sowing. *Chutney* was prepared with 10, 15 and 20 per cent supplementation levels of fresh leaves of desi and Kabuli chickpea varieties. All four products were evaluated for overall acceptability and maximum mean scores of overall acceptability were recorded of all four products. *Chutney* having 15 per cent fresh leaves of desi chickpea variety HC-1 got the highest overall acceptability scores (8) followed by those having HK-1 (7.5), HK-2 (7.4) and C-235 (7.3) at 45 days after sowing.

Keywords: *Chutney***,** chickpea, aroma, texture

Introduction
Chickpea is grown in tropical, sub-tropical and temperate regions. Kabuli type is grown in temperate regions while the desi type chickpea is grown in the semi-arid tropics (Muehlbauer and Singh, 1987; Malhotra *et al*., 1987) [5, 4]. In habitual Indian diets, being based predominantly on unrefined cereals and plant foods, this level of dietary fibre intake is easily achieved (Joshi *et al.,* 1991) [1].

In fact the consumption of green leafy vegetables in Indian population is limited to 5-10 gram per day as against the recommendation of 100 gram per day. They can supplement the traditional food products. These leaves can be used fresh as well as processed and then utilized in value addition of traditional Indian recipes. The basic idea is to find novel methods by which consumption of greens can be increased. Green leafy vegetables are seasonal, highly perishable, having abundant supply during the peak season results but are spoilt in large quantities. By employing suitable preservation techniques that are user friendly and sustainable at the household level can augment the utilization and avoid the wastage. Dehydrated vegetables can be easily converted into fresh like form by rehydration and can be used throughout the year (Karva *et al.,* 2010) [2].

It is a general perception that the leaves of the desi chickpea can only be used for various products like *chutney, sag* etc. among the rural population. In Haryana, the area under pulses decreased due to availability of irrigation facilities. In the present scenario, the importance of leaves along with grain yield has been increased due to their nutritional value. Limited work has been done on this aspect. Desi and Kabuli chickpea varieties are explored due to their prominent characteristics which cover whole Haryana. Many varieties of chickpea have been developed for irrigated, rainfed, early and late sowing conditions and disease resistance. The varieties under the present study are medium tall (C-235) and dwarf (HC-1 and HK-1), branched (HK-1). The desi chickpea variety C-235 is recommended for the irrigated condition, which is medium in height and maturity, tolerant to blight disease prone to wilt with yield potential of 8.00 quintal per acre. The other desi chickpea variety HC-1 is recommended for rainfed, irrigated and for late sown conditions. It can also be sown in the areas where cotton and paddy is grown i.e. in whole Haryana. This is a dwarf variety and its leaves are thin and light green in colour.

This variety is early maturing and the attack of pod borer is less and tolerant to wilt. Its yield potential is 8 to 10 quintal per acre. The Kabuli chickpea variety HK-1 is recommended for whole Haryana except rainfed areas. It has higher number of branches with more leaves. It is medium in maturity. Wilt is less in this variety as compared to all other Kabuli chickpea varieties. The yield potential is 8 to 10 quintal per acre. The other Kabuli chickpea variety HK-2 which is also recommended for the whole Haryana except for the rainfed areas. The leaves are light green in colour. This variety is resistant to all the main disease of chickpea. The yield potential of the variety is 7 to 8 quintal per acre. All the four varieties are taken for the present study for their leaves for nutritional evaluation and their products with their storability. The study will impact the farmers of Haryana, where these varieties are grown on large scale and they can be benefitted with the information generated for the use of leaves by making different products additionally.

Material and Methods

Chickpea varieties two desi (C-235, HC-I) and two Kabuli (HK-I, HK-2) newly released by the Pulses Section, Department of Genetics and Plant Breeding of CCS HAU, Hisar were selected for the present study.

Standardization and development of products

Chutney from fresh leaves

Thirty six types of *chutneys* using fresh chickpea leaves of both desi and Kabuli chickpea varieties at 10, 15 and 20 per cent levels picked up at 30, 45 and 60 days after sowing were standardized and developed as per method given below:

Table A: Ingredients used for making *chutney*s

Ingredients	Amounts		
	I	II	III
Fresh chickpea leaves (g) collected at each 30, 45 and 60 days after sowing	10	15	20
Onion (g)	55	50	45
Tomato (g)	30	30	30
Green chilli (g)	5	5	5
Salt (g)	2	2	2

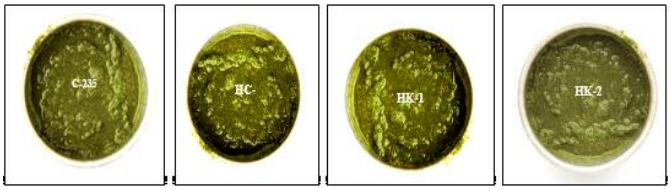

Plate A: *Chutneys* supplemented with leaves of desi and Kabuli chickpea varieties

Method

1. Washed chickpea leaves.
2. Chopped onion, tomato and green chilli.
3. Mixed chickpea leaves, onion, tomato and greed chilli and ground well.
4. Added salt and served.

Development of products, their sensory and nutritional evaluation

Fresh leaves

Chutney

Two products namely *chutney* and *sag* were prepared from the fresh leaves of both the desi as well as Kabuli chickpeas varieties. Supplementation levels of 10, 15 and 20 per cent i.e. fresh leaves of both the varieties were used. The data regarding colour, appearance, aroma, texture, taste and overall acceptability of *chutney* is presented in Tables 1 and 2.

Organoleptic evaluation of *chutney*

Colour

In desi chickpea varieties i.e. HC-1 and C-235, none of the supplementation levels produce significant ($p \leq 0.05$) differences in colour at 30 days after sowing. However, the highest mean scores (7.9 and 7.5) were found at 15 per cent supplementation of fresh leaves of HC-1 and C-235 varieties of desi chickpea in *chutney* (Table 1). Similarly, there were no significant differences in mean scores for colour when leaves of Kabuli chickpea varieties collected at 30 days after sowing when incorporated at 10, 15 and 20 per cent level of supplementation in the *chutney.* Higher values of mean scores i.e. 7.4 and 7.3 for colour were observed at 15 per cent supplementation levels of the leaves of HK-1 and HK-2 varieties in *chutney*, respectively.

Similar results for mean scores of colour of *chutney* with different supplementation levels of fresh leaves collected at 45 days after sowing of desi chickpea varieties were obtained. The level of supplementation did not make any significant difference in the mean scores of colour when fresh leaves of HC-1 and C-235 varieties were incorporated in the product. The highest scores (8.0 and 7.7) for colour were observed at 15 per cent supplementation level of leaves collected at 45 days after sowing in both the varieties. Likewise, the highest mean scores (7.5 and 7.5) for colour were observed with the 15 per cent supplementation level of leaves of HK-1 and HK-2 varieties of Kabuli chickpea collected at 45 days after sowing in the *chutney*. The differences were statistically non-significant (Table 2).

The mean scores of colour of *chutney* incorporating fresh leaves collected at 60 days after sowing were analyzed. The data revealed that in case of variety HC-1 of desi chickpea, higher mean scores (6.8) for colour were found in *chutney* having 10 per cent supplementation with fresh leaves at 60 days after sowing and the mean scores differed significantly ($p \leq 0.05$) from mean scores of colour of *chutney* supplemented with 20 per cent fresh leaves. Similar results were observed in variety C-235 of desi chickpea. Likewise, mean scores of colour of *chutney* incorporating different per centage of supplementation of fresh leaves of Kabuli varieties HK-1 and HK-2 were analyzed. In case of both the Kabuli chickpea varieties, fresh chickpea leaves (60 days after sowing) incorporated at 10 per cent level in *chutney* had 6.8 (HK-1) and 6.7 (HK-2) mean scores for colour which decreased but were within the acceptable range (Table 2).

Irrespective of the supplementation level, in leaves collected up to 45 days in both desi and Kabuli chickpea varieties, mean scores for colour were in the category of 'likely moderately' and they fell in the category of 'liked slightly' when supplementation was done at various levels with fresh leaves of 60 days after sowing in *chutney* (Tables 1 and 2).

Appearance

The mean scores for appearance of *chutney* having fresh leaves at 30, 45 and 60 days after sowing were statistically non-significant and were not affected by any of the supplementation levels. All the mean scores of appearance of *chutney* from the fresh leaves at 30, 45, 60 days after sowing with different supplementation levels in Kabuli chickpea varieties were found to be almost similar.

At 30 days after sowing, fresh leaves of both the desi and

Kabuli chickpea varieties when supplemented at 10, 15 and 20 per cent levels, the mean scores for appearance ranged from 7.0 to 7.6 and 6.9 to 7.4, respectively. They fell in the category of 'liked moderately'. Up to 45 days after sowing, fresh leaves incorporated at various levels in both desi and Kabuli chickpea varieties resulted in 'liked moderately' scores for appearance. As the days of sowing increased from 45 to 60 days, mean scores for appearance at all the levels of supplementation decreased to 'liked slightly' categories.

Aroma

All the mean scores for aroma of *chutney* having fresh leaves at 30 and 45 days after sowing in case of both desi chickpea varieties were statistically similar but were significantly ($p \leq 0.05$) different from that of *chutney* prepared from fresh leaves collected at 60 days after sowing at 10, 15 and 20 per cent supplementation (Table 1). In both the varieties of Kabuli chickpea (HK-1 and HK-2), mean scores of aroma of *chutney* having fresh leaves collected at 30, 45 and 60 days after sowing were almost similar irrespective of the supplementation level. Up to 20 per cent supplementation level, mean scores ranged from 'liked slightly' to 'liked moderately' (Table 2).

Texture

Mean scores for texture of *chutney* containing 10 and 15 per cent fresh leaves (30 and 45 DAS) of variety HC-1 and C-235 were found to be significantly ($p \leq 0.05$) higher than those containing 20 per cent leaves except 20 per cent supplementation of C-235 leaves (30 and 45 DAS) (Table 1). The mean scores of texture of the *chutney* having 10 and 15 per cent fresh leaves were found to be better in both the varieties of desi chickpea than those having fresh leaves 60 days after sowing. The mean scores of texture of *chutney* having varying supplementation levels of fresh leaves collected at 30, 45 and 60 days after sowing were statistically similar in case of HK-1 and HK-2 of Kabuli chickpea varieties (Table 2).

In both the desi and Kabuli chickpea varieties, mean scores for texture varied from 'liked moderately' to 'liked slightly'. As the growth period of leaves and their supplementation level increased, the mean scores for texture decreased.

Taste

The highest mean scores for taste of *chutney* were noticed when 10 and 15 per cent fresh leaves of 30 days after sowing (varieties HC-1 and C-235) were compared to mean scores for taste of *chutney* having 20 per cent level of fresh leaves (Table 1). The mean scores for taste of *chutney* having 10 and 15 per cent level of leaves (45 days after sowing) were significantly ($P \leq 0.05$)higher (7.3 and 7.8 in HC-1 and 7.2 and 7.5 in C-235, respectively) than those of having 20 per cent supplementation level in both the varieties. The taste of *chutney* was found to be better from the leaves collected at 30 and 45 days than 60 days after sowing and with 10 and 15 per cent supplementation level as compared to 20 per cent supplementation in HC-1 of desi chickpea. In case of variety C-235, the mean scores of taste of *chutney* were almost same at 10, 15 and 20 per cent supplementation of leaves at 30, 45 and 60 days after sowing. Taste remained better when leaves of both the chickpea varieties up to their 45 days of growth and their 15 per cent supplementation level were incorporated in the *chutney*.

With increasing period of growth of leaves and their increase in supplementation level, mean scores for taste declined; however, they remained in the acceptable range.

The mean scores for taste of *chutney* having the 10, 15 and 20 per cent level of leaves (at 30 days after sowing) of Kabuli chickpea varieties were found to be non-significant but when the leaves were taken from the crop at 45 days after sowing, the taste was found to be significantly ($p \leq 0.05$) better at 15 per cent (7.5 score) rather than leaves than at 20 per cent supplementation (6.7 score) in variety HK-1. Similar results were found in case of variety HK-2. The mean scores of tastes of the *chutney* having 15 per cent fresh leaves collected at 45 days after sowing were found to be significantly better (7.5 and 7.6) than that containing leaves collected at 60 days after sowing with those of 20 per cent supplementation in both the varieties i.e. HK-1 and HK-2 of Kabuli chickpea (Table 2). However, in both the varieties, mean scores for taste remained in the 'acceptable' range in *chutney* irrespective of the supplementation level than growth period in both desi and Kabuli chickpea varieties.

Overall acceptability

The overall acceptability of the *chutney* was found to be significantly ($P \leq 0.05$) better when 10 and 15 per cent fresh leaves collected at 45 days after sowing of both the desi and Kabuli chickpea varieties were used. Leaves collected at 60 days after sowing and incorporated in *chutney* were acceptable but not up to the extent as that containing 10 and 15 per cent of leaves collected at 30 and 45 days after sowing (Tables 1 and 2).

Table 1: Mean scores of organoleptic characteristics of *chutney* prepared from desi chickpea leaves:

Days after sowing	Supplementation level of HC-1 variety			Supplementation level of C-235 variety		
	10%	15%	20%	10%	15%	20%
Colour						
30	$7.7^{abA} \pm 0.21$	$7.9^{aA} \pm 0.23$	$7.3^{abA} \pm 0.15$	$7.3^{abA} \pm 0.15$	$7.5^{abA} \pm 0.22$	$7.1^{bA} \pm 0.18$
45	$7.9^{aA} \pm 0.10$	$8.0^{aA} \pm 0.00$	$7.6^{abA} \pm 0.16$	$7.4^{bcA} \pm 0.16$	$7.7^{abA} \pm 0.15$	$7.2^{cA} \pm 0.13$
60	$6.8^{aB} \pm 0.20$	$6.6^{abcB} \pm 0.16$	$6.1^{cB} \pm 0.10$	$6.7^{abB} \pm 0.15$	$6.4^{abcB} \pm 0.16$	$6.2^{bcB} \pm 0.25$
Appearance						
30	$7.4^{aA} \pm 0.22$	$7.6^{aA} \pm 0.22$	$7.2^{aA} \pm 0.20$	$7.3^{aA} \pm 0.21$	$7.5^{aA} \pm 0.22$	$7.0^{aA} \pm 0.21$
45	$7.7^{abA} \pm 0.15$	$7.9^{aA} \pm 0.18$	$7.4^{abA} \pm 0.22$	$7.4^{abA} \pm 0.16$	$7.6^{abA} \pm 0.16$	$7.3^{bA} \pm 0.15$
60	$7.1^{aA} \pm 0.28$	$6.8^{abB} \pm 0.25$	$6.4^{bB} \pm 0.16$	$6.9^{abA} \pm 0.18$	$6.6^{abB} \pm 0.16$	$6.3^{bB} \pm 0.21$
Aroma						
30	$7.1^{aA} \pm 0.18$	$7.5^{aA} \pm 0.17$	$7.6^{aA} \pm 0.22$	$7.2^{aA} \pm 0.25$	$7.3^{aA} \pm 0.21$	$7.6^{aA} \pm 0.22$
45	$7.4^{aA} \pm 0.16$	$7.7^{aA} \pm 0.15$	$7.5^{aA} \pm 0.17$	$7.3^{aA} \pm 0.21$	$7.6^{aA} \pm 0.16$	$7.5^{aA} \pm 0.17$
60	$6.0^{aB} \pm 0.26$	$6.4^{aB} \pm 0.16$	$6.5^{aB} \pm 0.17$	$6.1^{aB} \pm 0.18$	$6.3^{aB} \pm 0.15$	$6.5^{aB} \pm 0.17$
Texture						
30	$7.1^{abAB} \pm 0.18$	$7.6^{aA} \pm 0.22$	$6.2^{cA} \pm 0.20$	$7.2^{aA} \pm 0.20$	$7.4^{aA} \pm 0.22$	$6.5^{bcA} \pm 0.27$
45	$7.4^{aA} \pm 0.16$	$7.8^{aA} \pm 0.2$	$6.7^{bA} \pm 0.21$	$7.3^{aA} \pm 0.21$	$7.6^{aA} \pm 0.16$	$6.6^{bA} \pm 0.16$

60	6.7 ^{aB} ± 0.26	6.4 ^{aB} ± 0.27	6.1 ^{aA} ±0.23	6.5 ^{aB} ± 0.17	6.3 ^{aB} ± 0.15	6.0 ^{aA} ±0.21
Taste						
30	7.2 ^{abA} ± 0.20	7.6 ^{aA} ± 0.27	6.5 ^{cAB} ±0.22	7.0 ^{abcA} ± 0.26	7.4 ^{aA} ± 0.16	6.7 ^{bcAB} ±0.21
45	7.3 ^{bcA} ± 0.15	7.8 ^{aA} ± 0.13	6.8 ^{dA} ±0.20	7.2 ^{bcdA} ± 0.13	7.5 ^{abA} ± 0.17	6.9 ^{cdA} ±0.10
60	6.5 ^{aB} ± 0.17	6.1 ^{aB} ± 0.23	5.9 ^{aB} ±0.23	6.4 ^{aA} ± 0.43	6.2 ^{aB} ± 0.25	6.1 ^{aB} ±0.28
Overall acceptability						
30	7.4 ^{abA} ± 0.22	7.8 ^{aA} ± 0.25	6.8 ^{bA} ±0.13	7.0 ^{bA} ± 0.15	7.2 ^{abA} ± 0.20	6.9 ^{bA} ±0.23
45	7.5 ^{abA} ± 0.17	8.0 ^{aA} ± 0.29	6.8 ^{cdA} ±0.13	7.1 ^{bcA} ± 0.10	7.3 ^{bcA} ± 0.15	6.4 ^{dAB} ±0.22
60	6.6 ^{aB} ± 0.22	6.4 ^{aB} ± 0.16	6.1 ^{aB} ±0.28	6.4 ^{aA} ± 0.40	6.3 ^{aB} ± 0.26	6.1 ^{aB} ±0.28

Values are mean ± SE of three independent determinations.
The mean values in same row with different superscripts differ significantly ($p \leq 0.05$).

Organoleptic scores in the table like 9 represent the rating 'like extremely', 8 -'like very much', 7 - 'like moderately' and 6- 'like slightly'.

Table 2: Mean scores of organoleptic characteristics of *chutney* prepared from Kabuli chickpea leaves:

Days after sowing	Supplementation level of HK-1 variety			Supplementation level of HK-2 variety		
	10%	15%	20%	10%	15%	20%
Colour						
30	7.2 ^{abcA} ± 0.13	7.4 ^{aA} ± 0.16	7.0 ^{abcA} ± 0.15	6.9 ^{bcA} ± 0.18	7.3 ^{abA} ± 0.15	6.8 ^{CA} ± 0.13
45	7.3 ^{aA} ± 0.30	7.5 ^{aA} ± 0.17	7.0 ^{aA} ± 0.30	7.2 ^{aA} ± 0.20	7.5 ^{aA} ± 0.22	6.8 ^{aA} ± 0.20
60	6.8 ^{aA} ± 0.20	6.6 ^{aB} ± 0.16	6.3 ^{aB} ± 0.15	6.7 ^{aA} ± 0.15	6.5 ^{aB} ± 0.17	6.3 ^{aA} ± 0.21
Appearance						
30	7.1 ^{aAB} ± 0.18	7.4 ^{aAB} ± 0.16	7.0 ^{aA} ± 0.15	6.9 ^{aA} ± 0.23	7.2 ^{aAB} ± 0.20	7.1 ^{aA} ± 0.23
45	7.5 ^{abA} ± 0.22	7.7 ^{aA} ± 0.15	7.1 ^{abA} ± 0.28	7.2 ^{abA} ± 0.20	7.6 ^{aA} ± 0.16	6.9 ^{bA} ± 0.23
60	6.7 ^{aB} ± 0.21	6.9 ^{aB} ± 0.23	6.6 ^{aA} ± 0.27	6.8 ^{aA} ± 0.20	6.9 ^{aB} ± 0.18	6.7 ^{aA} ± 0.26
Aroma						
30	6.9 ^{aA} ± 0.10	7.2 ^{aA} ± 0.13	7.3 ^{aA} ± 0.15	6.8 ^{aA} ± 0.25	7.0 ^{aA} ± 0.21	7.1 ^{aA} ± 0.23
45	7.2 ^{aA} ± 0.20	7.4 ^{aA} ± 0.22	7.5 ^{aA} ± 0.17	7.1 ^{aA} ± 0.23	7.2 ^{aA} ± 0.25	7.0 ^{aA} ± 0.26
60	6.7 ^{aA} ± 0.21	6.9 ^{aA} ± 0.23	7.0 ^{aA} ± 0.21	6.6 ^{aA} ± 0.34	6.8 ^{aA} ± 0.29	7.0 ^{aA} ± 0.26
Texture						
30	6.8 ^{aA} ± 0.25	6.9 ^{aA} ± 0.10	6.7 ^{aA} ± 0.15	6.7 ^{aA} ± 0.26	6.8 ^{aA} ± 0.15	6.6 ^{aA} ± 0.27
45	7.2 ^{aA} ± 0.20	7.4 ^{aA} ± 0.31	6.8 ^{aA} ± 0.20	7.1 ^{aA} ± 0.28	7.3 ^{aA} ± 0.15	6.7 ^{aA} ± 0.15
60	6.9 ^{aA} ± 0.28	6.7 ^{aA} ± 0.37	6.4 ^{aA} ± 0.16	6.7 ^{aA} ± 0.21	6.8 ^{aA} ± 0.29	6.6 ^{aA} ± 0.40
Taste						
30	6.9 ^{aA} ± 0.28	7.0 ^{aAB} ± 0.00	6.8 ^{aA} ± 0.25	6.8 ^{aA} ± 0.25	7.1 ^{aAB} ± 0.28	6.9 ^{aA} ± 0.23
45	7.1 ^{abA} ± 0.18	7.5 ^{aA} ± 0.17	6.7 ^{bA} ± 0.21	7.2 ^{abA} ± 0.13	7.6 ^{aA} ± 0.16	6.8 ^{bA} ± 0.13
60	6.6 ^{aA} ± 0.16	6.8 ^{aB} ± 0.36	6.4 ^{aA} ± 0.40	6.4 ^{aA} ± 0.43	6.6 ^{aB} ± 0.22	6.3 ^{aA} ± 0.21
Overall acceptability						
30	6.9 ^{aA} ± 0.18	7.1 ^{aAB} ± 0.10	6.8 ^{aA} ± 0.13	6.7 ^{aA} ± 0.21	6.9 ^{aA} ± 0.23	6.8 ^{aA} ± 0.25
45	7.2 ^{abA} ± 0.20	7.5 ^{aA} ± 0.27	6.7 ^{bA} ± 0.15	7.2 ^{abA} ± 0.13	7.4 ^{aA} ± 0.16	6.8 ^{bA} ± 0.20
60	6.7 ^{aA} ± 0.26	6.8 ^{aB} ± 0.25	6.5 ^{aA} ± 0.40	6.6 ^{aA} ± 0.34	6.7 ^{aA} ± 0.30	6.4 ^{aA} ± 0.37

Values are mean ± SE of three independent determinations.
The mean values in same row with different superscripts differ significantly ($p \leq 0.05$).

Organoleptic scores in the table like 9 represent the rating 'like extremely', 8 -'like very much', 7 - 'like moderately' and 6- 'like slightly'.

Discussion

Organoleptic evaluation of developed products

Four products were prepared from the leaves (10, 15 and 20% supplementation levels) of desi and Kabuli chickpea varieties at 30, 45 and 60 days after sowing. *Chutney* was prepared with 10, 15 and 20 per cent supplementation levels of fresh leaves of desi and Kabuli chickpea varieties. All four products were evaluated for overall acceptability and maximum mean scores of overall acceptability were recorded of all four products. *Chutney* having 15 per cent fresh leaves of desi chickpea variety HC-1 got the highest overall acceptability scores (8) followed by those having HK-1 (7.5), HK-2 (7.4) and C-235 (7.3) at 45 days after sowing. Kaur and Kochar (2005) carried out a study on organoleptic evaluation of preparations using underexploited greens (greens of cauliflower, radish, turnip and carrot).

Chutney product was developed from the leaves of chickpea desi and Kabuli varieties i.e., HC-1 and C-235 and HK-1 and HK-2, respectively. *Chutney* was prepared from fresh leaves with 10, 15 and 20 per cent supplementation levels of leaves collected at 30, 45 and 60 days after sowing. The organoleptic test was done and product was selected on the basis of maximum mean scores gained for overall acceptability and further tested for nutritional evaluation.

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