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Preparation and Standardization of Mixed Vegetable Sauce

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Abstract

The aim of the present work was to utilize the surplus vegetables for the preparation of sauce. For this, a sum of nine treatments combining different vegetables was used to prepare the sauce following the standard method. The vegetable used were potato, carrot, bottle gourd, palak, coriander, green chilli, pumpkin, beetroot, cabbage, cauliflower, and bean. The TSS, total solids, and acidity were increased irrespective of the combination whereas the sensory attributes were tended to decrease during the storage. The combination 5 [pumpkin (28%), beetroot (28%), cabbage (17%), palak (17%), coriander (5%), and green chili (2%)] has been found the best among the all combination and treatments. Considering the organoleptic attributes, the cost benefit ratio of the C_5 was 1:2. The results suggest that the unmarketable vegetables could be used for value addition especially during glut to have better remuneration.

INTRODUCTION

Fruits and vegetables are known for promoting health benefits being rich in vitamins especially water soluble vitamins and micro nutrients. Scientific substantiations show that consumption of fruit and vegetable lowers the risk of several disease and disorders (Siddiqui et al., 2015).

India is the second largest producer of vegetables in the world producing 146.55 million tonnes (NHB-2012), however, being perishable in nature the postharvest losses are very high ranging from 30-35% of total production (Siddiqui et al., 2014a). The loss becomes worst during the glut. There are several products prepared from vegetables such as mixed pickle, sauce, salsa, soup, etc. Several vegetables are grown in India with appreciable quality. However, during peak period of production, the price remains very low due to glut. The farmers have to suffer from economic losses due to low income as well as high perishability of vegetables. The conversion of different vegetables in to value added products such as sauce could be an option to curtail the losses and entrepreneurship can be started at home and cottage scales (Siddiqui et al., 2011).

Considering the facts mentioned above, the current investigation was designed and conducted with different objectives such as utilization of surplus vegetables for preparation of sauce, value addition of culled unmarketable vegetables, and popularization of home and cottage scale vegetable based processing industries.

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MATERIALS AND METHODS

The research was conducted in the laboratory of Department of Food Science and Technology, Bihar Agricultural University, Sabour, Bihar, India. The experiment was laid out in complete randomized design with nine treatments using different vegetables. Known percent of vegetables (Table- 1) were mixed to prepare vegetable sauce following bagging method. Different biochemical quality analyses (Titratable acidity, total solids) were carried out by standard AOAC method (1990) and Total soluble solid was measured by hand refractometer. Sensory evaluation (color, smell, taste, texture, and overall acceptability) of sauce was performed by 5 point Hedonic scale where, 1 = dislike very much, 3 = like moderately, and 5 = like extremely and Cost: benefit ratio is observed during storage at certain time intervals.

Table 1: Different combinations of vegetables

Vegetables	C 1	%	C 2	%	C 3	%
Potato	1.00Kg	18.69	1.5Kg	28.04	2.00Kg	37.38
Carrot	2.00Kg	37.38	1.5Kg	28.04	0.50Kg	9.35
Bottle Gourd	1.00Kg	18.69	1.00Kg	18.69	1.5Kg	28.04
Palak	1.00Kg	18.69	1.00Kg	18.69	1.00Kg	18.69
Corriender (G. L.)	0.25Kg	4.67	0.25Kg	4.67	0.25Kg	4.67
Green Chilly	100gm	1.86	100gm	1.86	100gm	1.86

Vegetables	C 4	%	C 5	%	C 6	%
Pumpkin	1.00Kg	18.69	1.5Kg	28.04	2.00Kg	37.38
Beet Root	2.00Kg	37.38	1.5Kg	28.04	0.50Kg	9.35
Cabbage	1.00Kg	18.69	1.00Kg	18.69	1.5Kg	28.04
Palak	1.00Kg	18.69	1.00Kg	18.69	1.00Kg	18.69
Corriender (G. L.)	0.25Kg	4.67	0.25Kg	4.67	0.25Kg	4.67
Green Chilly	100gm	1.86	100gm	1.86	100gm	1.86

Vegetables	C 7	%	C 8	%	C 9	%
Cauliflower	2.00Kg	37.38	1.00Kg	18.69	1.5Kg	28.04
Been	1.00Kg	18.69	2.00Kg	37.38	1.5Kg	28.04
Palak	1.00Kg	18.69	1.00Kg	18.69	1.00Kg	18.69
Corriender (G. L.)	0.25Kg	4.67	0.25Kg	4.67	0.25Kg	4.67
Green Chilly	100gm	1.86	100gm	1.86	100gm	1.86

Table 2: Changes in TSS (° B) content in vegetable sauce during storage

	C1	C2	C3	C4	C5	C6	C7	C8	C9	Mean			
D1	14.7	14.2	14.8	14.0	14.9	14.4	14.6	14.3	15.1	14.5	**SE diff. mean for**		**CD**
D2	15.1	14.8	15.4	15.2	15.8	15.2	14.7	14.2	14.5	14.9	**D**	**0.07**	**0.14**
D3	15.4	15.2	15.6	15.3	16.1	15.4	14.2	15.1	15.1	15.2	**C**	**0.22**	**0.51**
D4	15.7	15.5	15.9	15.6	16.3	15.5	15.8	15.3	15.5	15.6	**DC**	**0.21**	**0.42**
Mean	15.2	14.9	15.4	15.0	15.7	15.1	14.8	14.7	15.0	15.0			

Table 3: Changes in acidity (° B) content in vegetable sauce during storage

	C1	C2	C3	C4	C5	C6	C7	C8	C9	Mean			
D1	1.1	1.2	1.1	1.1	1.2	1.1	1.2	1.2	1.1	1.1	**SE diff. mean for**		**CD**
D2	1.4	1.6	1.6	1.3	1.5	1.6	1.5	1.4	1.5	1.5	D	0.02	0.05
D3	1.5	1.7	1.7	1.4	1.6	1.6	1.7	1.5	1.6	1.6	C	0.11	NS
D4	1.6	1.8	1.9	1.5	1.7	1.9	1.8	1.7	1.9	1.7	DC	0.03	0.07
Mean	1.4	1.6	1.6	1.3	1.5	1.5	1.5	1.5	1.5	1.5			

RESULTS AND DISCUSSION

The experiment was carried out to determine the preparation and standardization of vegetable sauces from mixed vegetables. The acceptability and shelf life of sauce were evaluated at different day interval through chemical analyses and sensory evaluation.

Total Soluble Solids

Changes in the TSS of mixed sauces over the storage time are shown in Table 2. Maximum TSS content 15.7 °B was recorded in C_5 (Pumpkin -28%, Beet Root - 28%, Cabbage-19%, Palak-19%, Coriander-5%, Green Chilly-2%) where as the minimum value was found in C_8 combination. TSS content continuously increased with increasing the storage period from 0 to 60 days. The increase in TSS content of sauce is in complete agreement with the findings of Chakraborty et al. (2007) in case of tomato puree.

Acidity

Acidity is very important because they influences the thermal processing conditions required for producing safe products (Siddiqui et al., 2014). In case of acidity, it was observed that minimum acidity (1.3%) was found C_4 sample, which tended to increase during storage (Table 3). Increase in titratable acidity content was found in C1 (1.1-1.6), C2 (1.2-1.8), C3 (1.1-1.9), C4 (1.1-1.5), C5 (1.2-1.7), C6 (1.1-1.9), C7 (1.2-1.8), C8 (1.2-1.7) and C9 (1.1-1.9). Acidity content of sauce gradually increased with along with the storage period. Earlier, Gould (1992) suggested that titratable acidity content after storage of tomato products increases may be due to acids produced by *Bacilus coagulans*, *Clostridium butyricum* and because of phenolic compounds produced by *Bacillus coagulans.* Increase in acidity may also be due to conversion of some amount of sugar to acids (Siddiqui et al., 2014b). Increase in titratable acidity was also reported in hot pepper paste (Bozkurt and Erkmen, 2004).

Table 4: Changes in the sensory attributes in vegetable sauce during strage

		C1	C2	C3	C4	C5	C6	C7	C8	C9
Color	D1	1.89	1.73	1.68	5.00	5.00	5.00	4.00	3.80	4.00
	D2	1.66	1.52	1.58	4.50	4.70	4.00	3.50	2.80	3.00
	D3	1.50	1.25	1.32	4.35	4.50	4.00	3.00	2.30	2.65
	D4	1.50	1.25	1.23	4.23	4.60	3.90	2.10	2.00	2.00
	Mean	**1.64**	**1.44**	**1.45**	**4.52**	**4.70**	**4.23**	**3.15**	**2.73**	**2.91**
Smell	D1	1.71	1.48	1.46	4.50	4.30	4.80	4.00	3.80	4.50
	D2	1.67	1.41	1.37	3.50	4.00	3.80	2.60	2.20	3.00
	D3	1.65	1.50	1.52	3.50	4.10	3.50	1.60	1.90	2.20
	D4	1.50	1.30	1.30	3.30	3.80	3.00	1.30	1.30	2.00
	Mean	**1.63**	**1.42**	**1.41**	**3.70**	**4.05**	**3.78**	**2.38**	**2.30**	**2.93**
Taste	D1	2.78	3.10	2.81	5.00	5.00	5.00	4.50	5.00	4.00
	D2	2.51	2.57	2.43	4.50	4.70	5.00	2.10	2.60	3.20
	D3	2.60	2.50	2.50	4.50	4.40	4.80	1.60	1.90	2.50
	D4	2.25	2.31	2.10	4.25	4.25	4.50	1.25	1.30	2.00
	Mean	**2.54**	**2.62**	**2.46**	**4.56**	**4.59**	**4.83**	**2.36**	**2.70**	**2.93**
Texture	D1	1.72	1.81	1.67	5.00	4.80	5.00	3.50	4.00	3.20
	D2	1.50	1.59	1.61	4.00	4.30	4.50	1.90	2.20	2.90
	D3	1.45	1.40	1.50	3.90	4.00	4.25	1.40	1.90	1.70
	D4	1.30	1.25	1.36	3.75	3.65	4.25	1.20	1.50	1.20
	Mean	**1.49**	**1.51**	**1.54**	**4.16**	**4.19**	**4.50**	**2.00**	**2.40**	**2.25**
Overall	**Acceptability**	**1.82**	**1.75**	**1.72**	**4.24**	**4.38**	**4.33**	**2.47**	**2.53**	**2.75**

Sensory evaluation

The vegetable sauces was evaluated for its color, smell, taste, texture and overall acceptability through a taste testing panel consists of 10 untrained panellists. The panellists were briefed about the sample and then asked to score the sample in ascending order of 1-9 points showing their degree of preference in respect of color, flavor, texture and overall acceptability of the sauce sample. The responses were tabulated in Table 4. It was observed that overall consumer acceptability was the best in sample C_5 throughout the storage. The average score of all the sensory parameter was 4.38.

Cost-benefit ratio

The cost benefit ratio of all the combinations has been calculated (Table 5). The cost benefit ration of C_5 (1:2) was a bit lower than others but that was not significantly different. Considering the overall data in terms of biochemical and sensory quality the sauce of C_5 was the best.

Table 5: Cost benefit ratio of the sauce

	Veg	Spices	Misc.	Cost (rs.)	Recovery	Benefit	C:B Ratio
C1	48	30	21	99	180	81	1:2.2
C2	47	30	21	98	180	82	1:2.2
C3	40	30	21	91	180	89	1:2.0
C4	49	30	21	100	200	100	1:2.0
C5	49	30	21	100	200	100	1:2.0
C6	46	30	21	97	200	103	1:1.9
C7	30	30	21	81	150	69	1:2.1
C8	34	30	21	85	150	65	1:2.3
C9	33	30	21	84	150	66	1:2.2

CONCLUSION

Sauce was prepared using different vegetables and it was found that surplus produce can be used for value addition during peak season of availability when price remains negligible. The combination 5 [pumpkin (28%), beetroot (28%), cabbage (17%), palak (17%), coriander (5%), and green chili (2%)] has been found the best among the all combination and treatments. The postharvest loss can be reduced by valorizing the vegetables and entrepreneurship can be started at home and cottage scales.

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