Intl. J. Food. Ferment. Technol. 6(2): 241-250, December, 2016

DOI: 10.5958/2277-9396.2016.00047.7

RESEARCH PAPER

Development of Ready to Eat Mint Coriander Sauce

Poorva Kashyap*[1], Poonam Aggarwal[2] and Hradesh Rajput[3]

[1,2]Department of Food Science and Technolog, Punjab Agricultural University, Ludhiana, Punjab, India
[3]Sam Higginbottom University of Agriculture Technology and Science, Allahabad, UP, India

*Corresponding author: kashyap.poorva@gmail.com

Paper No.: 133 Received: 19 June 2016 Accepted: 7 Dec. 2016

ABSTRACT

'Development of ready to eat mint coriander sauce' with objectives to standardize the method of preparation, preservation and shelf-life of the sauce is reported here. Mint, coriander, other ingredients and the prepared sauce were analyzed for their physicochemical, phytochemical and sensory characteristics. It was observed that solids were separated, so guar gum and CMC were added in the combination of 0.3%+0.3% and homogenization was carried out at 7400 RPM for 7-8 minutes at 20°C to improve the consistency. The samples were stored in five batches i.e. control, preserved with KMS, preserved with sodium benzoate, preserved with combination of KMS+ sodium benzoate and thermal processed sauce for a storage interval of four months. The results observed that the control sample retained shelf life of 30 days while the samples preserved with sodium benzoate remaining for acceptable quality for four months.

Keywords: Mint, coriander, sauce, physicochemical, phytochemical, sensory

Sauce, a liquid or semi-liquid edible dressing or condiment served as an accompaniment to an ingredient; is one of the most versatile side dishes that can be used in many different ways (Anonymous 1, 2008). It is popular as it offers a refreshing taste to both ready to eat foods and meals, and is also believed to be nutritious (Ghosh *et al.*, 2004). It is also served with many appetizers and is suited as a spread for sandwiches, rolls or as side dishes like *Biryani* and other rice dishes. But it is best used as a condiment with grilled or fried food, though could be used as a spread or dip too (Anonymous 2, 2008).

Mint coriander sauce, also called as green sauce, can be commonly used as an accompaniment in many Indian meals. The sauce is appreciated for its unique flavor and convenience due to its various health benefits. This contributes significantly in maintaining the nutritional status of the population. The present investigation was undertaken with the objectives to standardize the method of preparation and preservation of ready to eat mint coriander sauce and to ascertain its shelf stability at room temperature.

MATERIALS AND METHODS

The study was carried out in the Department of Food Science and Technology, Punjab Agricultural University, Ludhiana.

Mint, coriander and other ingredients

Mint, coriander, onion, garlic, green chili, good quality crystal sugar, salt and spices and condiments such as black pepper powder, cumin powder, cloves powder, cinnamon powder and cardamom powder were procured from the local market for the preparation of ready to eat mint sauce. Synthetic vinegar (4% acetic acid) was added as a class II preservative for sauce preparation

Optimization of levels of ingredients

The sauce was made with different concentrations of salt, sugar, spices and condiments. Salt was tried from 10.2-5 g, sugar from 8-18 g, onion from 40-25 g, garlic from 4.4-1 g, green chili from 4.2-1 g, cumin from 2.55 to 0.25 g, cloves from 1.0 to 0.04 g, cinnamon from 2.0 to 0.025g, cardamom from 1.0 to 0.05 g, black pepper from 2.0 to 0.05 g and synthetic vinegar from 0.4 to 1.08%.

Optimization of levels of hydrocolloid and treatment of homogenization

Different concentrations of guar gum and CMC i.e. 0.1% to 0.5% were used and combination of guar gum + CMC in 0.3%+0.3% was selected on the basis of sensory evaluation. Homogenization was tried at 2400, 3600, 4800, 6000, 7200, 7400 and 7600 RPM for 2, 4, 6 and 8 minutes.

The samples with guar gum and CMC in combination of 0.3%+0.3% and homogenized at 7400RPM for 7-8 minutes were selected for storage.

Optimization of levels of sodium benzoate and KMS for final storage

The sauce was prepared and stored in batches of control, preserved with KMS, preserved with sodium benzoate, preserved with KMS+ sodium benzoate and thermally processed. The KMS 100 ppm and sodium benzoate 250 ppm were added in the final products.

Storage studies

Sauce was packed in glass bottles and glass jars and stored at room temperature (16-32°C) for about four months. The effect of storage on physicochemical, phytochemical and organoleptic characteristics was analyzed at fixed interval of one month.

Physico-chemicals analysis

Moisture content was estimated by following the method of AOAC (2005). Total soluble solids content of raw material as well as the product was determined by using a hand refractometer (Erma, Japan) with scale ranging from 0 to 32°B for mint leaves, coriander leaves as well as mint coriander sauce and readings were obtained. The observations were corrected to 20°C and the values were expressed as total soluble solids (AOAC 2005). The titrable acidity was determined following the method of (Ranganna, 1997) by titrating a known quantity of sample solution against standard 0.1 N NaOH solution to a faint pink color in the presence of phenolphthalein indicator. The % acidity was expressed as per the source of acid used. Viscosity of sauce was determined at 20°C by using Brookfield viscometer (model LVT) using spindle number 3.

Phyto-chemicals analysis

Total phenols were determined by colorimetric method described by Swain and Hills (1959). The Folin- Ciocalteau reagent was used then kept for 5 min, and saturated solution of sodium carbonate was mixed. Absorbance of the developed color after 60 minutes was measured at 765 nm using spectronic-20 spectrophotometer. A standard curve was plotted by taking known amount of Gallic acid as reference standard. Ascorbic acid was extracted from the sample with 0.4 per cent oxalic acid and determined by titrimetric method using 2, 6-dichlorophenol indophenol dye solution (0.04 per cent) which was standardized against standard L-ascorbic acid (0.1 mg/ml of 0.4 per cent oxalic acid). The results were expressed as ascorbic acid mg % of sample (Ranganna 1997).

Total chlorophyll

Total chlorophyll of the fresh leaves as well as final product was determined following the method given by Nagata and Yamashita (1992). All the pigments were extracted with acetone: hexane 4:6 at once and then, the optical density of the supernatant was checked at 663 and 645 nm and the values of chlorophyll a, Chlorophyll b and Total Chlorophyll were estimated as:

Chlorophyll a = $0.999\ A_{663} - 0.0989\ A_{645}$

Chlorophyll b = $0.328\ A_{663} + 1.77\ A_{645}$

Total Chlorophyll = Chlorophyll a + Chlorophyll b

Antioxidant activity

Free radical scavenging activity was determined by DPPH (2, 2- di phenyl L picrylhydrazyl) method. A method according to Shimada *et al.* (1992) was followed with some modifications. Five gram of mint leaves and coriander leaves and mint coriander sauce were taken and refluxed with 80% methanol for two hours in a round bottom flask and residue was then, further refluxed for one hour. After filtration of the extract volume was made to 100 ml with 80% methanol. To 1ml of methanolic extract of sample, 2ml of 1mM freshly prepared DPPH and 1ml of 50 mM tris buffer was added and absorbance was determined at 517 nm (blank as 80 per cent methanol and tris buffer) after 30 minutes. The free radical scavenging activity was evaluated by comparing the absorbance of the sample solution with control solution to which distilled water was added instead of sample, 2ml of 1mM DPPH and 1ml of 50 mM tris buffer. DPPH was taken as standard.

$$\text{Radical scavenging activity (\%)} = \frac{\text{Control OD (0 min)} - \text{Sample OD (30 min)}}{\text{Control OD (0 min)}} \times 100$$

Organoleptic evaluation

The organoleptic evaluation of the samples was conducted by a panel of eight semi-trained panellists for appearance, consistency, mouthfeel, flavor and overall acceptability using the 9- point Hedonic Rating Scale (Larmond, 1970) as scores 9, 8, 7, 6, 5, 4, 3, 2 and 1 represented liked extremely, liked very much, liked moderately, liked slightly, neither liked nor disliked, disliked slightly, disliked moderately, disliked very much and disliked extremely respectively.

Statistical Analysis

Results were analyzed statistically for their interpretation using completely randomized design experiment as discussed by Singh *et al* (1991). Each value presented is a mean of three observations.

RESULTS AND DISCUSSION

Physicochemical and phytochemical characteristics of raw material.

Total solids, total soluble solids, acidity, viscosity, total phenols, ascorbic acid, total chlorophyll and antioxidant activity were analyzed among the physicochemical and phytochemical characteristics of mint and coriander leaves. The mint and coriander leaves had 13.27 and 22.44% total solids respectively. The ascorbic acid content was slightly higher in coriander leaves i.e. 10.13mg/100g than mint leaves i.e. 8.01mg/100g. Moisture content was found to be higher in mint leaves as 88.2% than in coriander leaves i.e. 86.9% which corresponds to lower total solids i.e. 11.8 % and 13.1 % in mint and coriander leaves respectively. Similar results were obtained by Singh *et al.* (2001) while studying the nutritional composition of certain green leafy vegetables. Mint and coriander had 207.97mg/100g and 255.82 mg/100g total phenols and 16.22% and 15.99% antioxidant activity. Wong and Kitts (2006) also determined similar results while studying radical scavenging activity in cilantro stem. The total chlorophyll content was 0.98 and 0.97 mg/g in coriander. Kizhedath and Suneetha (2011) obtained 6.17mg/g total chlorophyll while estimating the chlorophyll content in mint leaves.

Physicochemical and phytochemical characteristics of spices and condiments

Onion, garlic, green chili, cumin, cloves, cinnamon, cardamom and black pepper were analyzed for their acidity, ascorbic acid content, total phenols and antioxidant activity. Cumins had the highest acidity content of 2.22% and onion and garlic had the lowest i.e. 0.04%. Highest ascorbic acid content was found in green chilies. The ascorbic acid content in green chilies was 45.62 mg/100g and in garlic was 9.11mg/100g. All the spices were rich in total phenols and antioxidant activity. The phenolic content was found to be highest in cinnamon that is 6.81g/100g and lowest in black pepper that is 0.77g/100g. Cloves had the highest

antioxidant activity of 92.44% which was found to be least in green chili that is 0.34%. Shobhana and Naidu (2000) also found similar results while studying the antioxidant activity of selected Indian spices. Nutila *et al.* (2002) also found similar trends while analyzing antioxidant activities of onion and garlic extracts (Table 1).

Table 1: Physicochemical and phytochemical characteristics of spices and condiments

Spices and condiments	Acidity (%)	Ascorbic acid (mg/100g)	Total phenol (g/100g)	Antioxidant activity (%)
Onion	0.04	13.12	1.15	3.18
Garlic	0.04	9.11	1.25	2.88
Green chili	1.85	45.62	1.32	0.34
Cumin	2.22	9.93	1.40	22.95
Cloves	2.18	38.72	1.91	92.44
Cinnamon	0.21	10.15	6.81	31.86
Cardamom	0.45	15.25	1.38	23.85
Black pepper	0.62	12.47	0.77	13.58

Physicochemical and phytochemical analysis of control sample

During zero-day analysis of control sample, physicochemical characteristics tested were total solids, total soluble solids, acidity and viscosity Total solids were found to be 24.44%, Total soluble solids 23.2°B, Acidity 0.98% and viscosity 745 P. Total phenols, antioxidant activity, ascorbic acid and total chlorophyll were tested amongst the phytochemical characteristics and their values were found to be 350.5mg/100g, 20.52%, 5.56 mg/100g and 46.28mg/100g respectively. The control samples were found to shelf-stable for around 30 days at room temperature after which, the taste became unacceptable (Table 2).

Table 2: Physicochemical, phytochemical and microbial analysis of control sample at room temperature for one month and refrigeration for two months

Parameters	Mint chutney	Mint coriander chutney	Coriander chutney
Total solids (%)	23.89	24.44	24.72
Acidity (%)	0.98	0.98	0.98
Ascorbic acid (mg/100g)	5.41	5.56	5.69
Color			
L	37.28	37.56	37.81
a	-0.61	-0.65	-0.70
b	0.04	0.07	0.08
Total phenol (mg/100g)	344.25	350.50	356.82
Antioxidant activity (%)	18.95	20.52	21.50
Total chlorophyll (mg/100g)	46.06	46.28	46.35
Viscosity (poise)	750	745	750
Total plate count (log cfu/g)	3.36	3.45	3.41
Total yeast/mold count (log cfu/g)	Not detected	Not detected	Not detected
Shelf stability (days)	27	30	30

Effect of storage and method of preservation on physicochemical characteristics of ready to eat mint coriander sauce

Under physicochemical characteristics, total solids, total soluble solids, acidity and viscosity were analyzed out of which, total solids, total soluble solids and acidity were found to be non significant during storage. The results were in agreement with Ahmed *et al.* (2003) who also found non-significant change in total solids while studying the storage characters of coriander leaf puree. Similar results were found in green chili puree by Ahmed *et al.* (2002). Ahmed and Shivhare (2001) found non-significant change

in total soluble solids while studying the storage characteristics of garlic puree/paste. Jasim Ahmed (2004) also found similar results while studying the storage characteristics of ginger paste.

Storage and method of preservation had a significant ($p<0.05$) effect on viscosity of ready to eat mint coriander sauce. The samples preserved with sodium benzoate were found to be most viscous, as, sodium benzoate, being compatible with guar gum, has an interesting property of increasing the viscosity of the sample (R.J. Chudzikowski, 1971). These were followed by samples preserved with KMS+ sodium benzoate, KMS and thermally processed samples. The viscosity decreased significantly with storage time in all the samples. The decrease in viscosity with increase in storage time was also observed by Ahmed *et al.* (2004) while studying the rheology of coriander leaf puree and Jasim Ahmed (2004) while studying the rheological behavior and color changes of ginger puree. Decrease in viscosity or consistency of the puree can be attributed to softening of tissues as a result of alteration in the structure of macromolecular polymeric substances forming the cell walls (Rudra *et al.*, 2008).

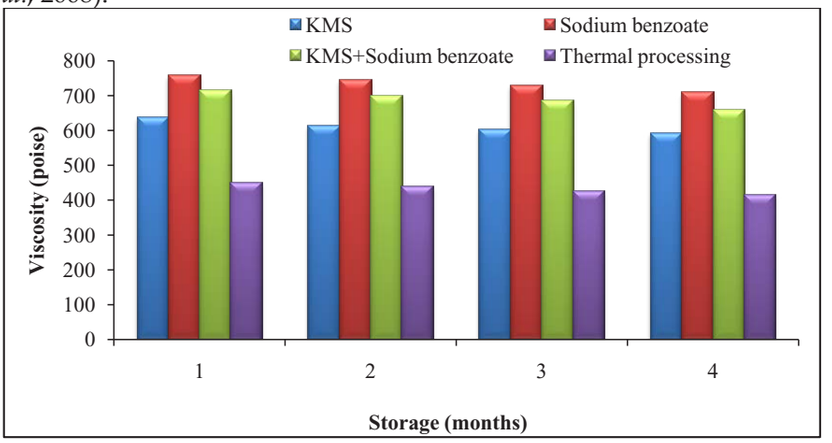

Fig 1: Effect of storage and method of preservation on viscosity (P) of ready to eat mint coriander sauce

Effect of storage and method of preservation on phytochemical characteristics of ready to eat mint coriander sauce

Under phytochemical characteristics, total phenols, ascorbic acid, total chlorophyll and antioxidant activity were analyzed which were found to reduce significantly ($p<0.05$) during storage interval. Out of the four samples stored, maximum loss of phytochemical characteristics was observed in thermally processed samples which could be due to degradation of components by heat and light. Similar results were observed by Burdurlu *et al.* (2006) in citrus juice concentrates. Loss of chlorophyll in thermally processed samples is due to the fact that green vegetables contain chlorophyll, which breaks down on exposure to heat during thermal processing. (Gupte *et al.*, 1964. Buckle and Edwards, 1970). Shin and Bhowmik, (1995) also analyzed similar reasons for chlorophyll while studying the thermal kinetics of color changes in pea puree. Maximum decrease was found in the thermally processed samples which could be mainly due to its degradation with heat and light (Conesa *et al.*, 2009.) Decrease in antioxidant activity in all the samples during storage could be due to decrease in bioactive compounds such as ascorbic acid, total chlorophyll and total phenols as a result of thermal degradation. Anese *et al.* (1999) also found decrease in antioxidant activity of preheated tomato juice for short heat treatments.

Highest phenolic content was found in the samples containing sodium benzoate as sodium benzoate combines with ascorbic acid to form benzene, which directly contributes in increasing the number of total phenols (Gardner and Lawrence 1993). The results were agreement with Conesa *et al.*, 2009 while studying the changes in bioactive compounds and antioxidant activity during homogenization and thermal processing of tomato puree. Similar results were also obtained by Jacobo *et al.*, 2011 while studying the influence of ultra-high pressure homogenization on antioxidant capacity, polyphenol and vitamin content of clear apple juice (Table 3,4,5 and Fig. 2).

Table 3: Effect of storage and method of preservation on total phenols (mg/100g) of homogenized ready to eat mint coriander sauce at room temperature

Storage months	KMS	Sodium benzoate	KMS+ Sodium benzoate	Thermal processing	Mean
1	280.12	342.25	315.5	276.5	303.59
2	266.75	325.5	298.82	256.62	286.92
3	255.36	300.06	285.61	240.48	270.38
4	246.06	290.21	270.28	225.25	257.95
Mean	262.07	314.51	292.55	249.71	
CD (p≤0.05)					
Storage	(A)	10.6	AXB	NS	
Treatments	(B)	10.6			

Table 4: Effect of storage and method of preservation on ascorbic acid (mg/100g) of homogenized ready to eat mint coriander sauce at room temperature

Storage months	KMS	Sodium benzoate	KMS+ Sodium benzoate	Thermal processing	Mean
1	4.99	4.93	4.8	4.03	4.69
2	4.78	4.7	4.51	3.84	4.46
3	4.39	4.29	4.15	3.69	4.13
4	3.94	3.94	3.97	3.45	3.83
Mean	4.53	4.47	4.36	3.75	
CD (p≤0.05)					
Storage	(A)	0.08	AXB	0.01	
Treatments	(B)	0.08			

Table 5: Effect of storage and method of preservation on total chlorophyll (mg/100g) content of homogenized ready to eat mint coriander sauce at room temperature

Storage months	KMS	Sodium benzoate	KMS+ Sodium benzoate	Thermal processing	Mean
1	45.76	45.74	45.62	44.94	45.52
2	45.66	45.45	45.35	44.73	45.30
3	45.15	44.94	44.98	44.65	44.93
4	44.82	44.76	44.88	44.5	44.74
Mean	45.35	45.22	45.21	44.71	
CD (p≤0.05)					
Storage	(A)	0.04	AXB	0.08	
Treatments	(B)	0.04			

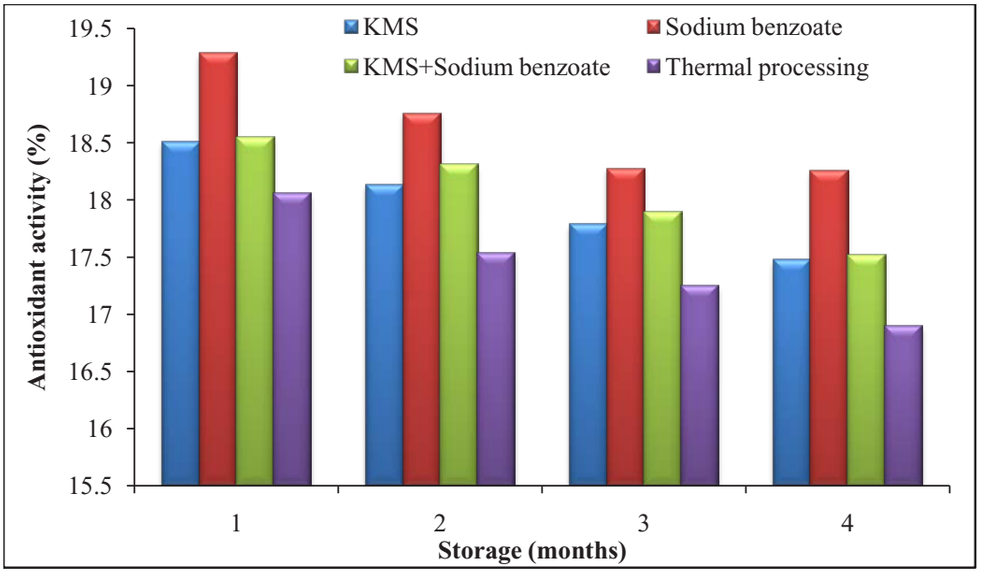

Fig. 2: Effect of storage and method of preservation on antioxidant activity (%) of ready to eat mint coriander sauce.

Effect of storage and method of preservation on organoleptic evaluation of ready to eat mint coriander sauce

Effect of storage on organoleptic evaluation of ready to eat shelf stable mint coriander sauce is depicted in table 6. Appearance, consistency, mouth-feel, flavor and overall acceptability were the major parameters which were considered on which, effect of storage was found to be non significant. Similar results were obtained by Sallam *et al.* (2007) while studying chemical quality and sensory attributes of marinated Pacific saury (*Cololabissaira*) during vacuum-packaged storage at 4 °C. Kezban Candogan (2002) also found similar results while studying the effect of tomato paste on some quality characteristics of beef patties during refrigerated storage.

However, method of preservation showed a significant ($p<0.05$) effect on consistency, mouthfeel and overall acceptability of mint coriander sauce. The sauce preserved with sodium benzoate scored highest in terms of consistency, mouthfeel and overall acceptability followed by the sauce preserved with KMS+ sodium benzoate, followed by KMS and least scores were obtained by thermally processed samples.

Sauce samples preserved with sodium benzoate were most liked by the panelists in terms of overall acceptability followed by the samples preserved with KMS+ sodium benzoate, KMS and thermally processed samples. However, all the sauces were found to be under acceptable limits by the semi trained panelists. Celik *et al.* (2006) observed consistent decrease in overall acceptability while analyzing the physicochemical and organoleptic properties of Yogurt with Cornelian Cherry past.

Table 6: Effect of storage and method of preservation on organoleptic quality (9 point hedonic scale) of ready to eat mint coriander sauce

Treatments	Storages (months)			
	1	2	3	4
Appearance				
KMS	8.75	8.63	8.75	8.75
Sodium Benzoate	8.88	8.75	8.88	8.88
KMS+ Sodium Benzoate	8.63	8.56	8.50	8.56

Thermal Processing	8.69	8.63	8.56	8.56
Consistency				
KMS	8.50	8.44	8.38	8.38
Sodium Benzoate	8.88	8.75	8.75	8.81
KMS+ Sodium Benzoate	8.63	8.56	8.56	8.50
Thermal Processing	8.38	8.31	8.25	8.31
Mouthfeel				
KMS	8.44	8.25	8.31	8.31
Sodium Benzoate	8.75	8.63	8.63	8.75
KMS+ Sodium Benzoate	8.63	8.56	8.63	8.56
Thermal Processing	8.13	8.06	8.06	8.00
Flavor				
KMS	8.88	8.88	8.81	8.88
Sodium Benzoate	9.00	8.94	8.88	8.94
KMS+ Sodium Benzoate	8.94	8.88	8.88	8.88
Thermal Processing	8.81	8.75	8.75	8.69
Overall Acceptability				
KMS	8.61	8.53	8.50	8.53
Sodium Benzoate	8.88	8.77	8.78	8.84
KMS+ Sodium Benzoate	8.73	8.66	8.70	8.67
Thermal Processing	8.50	8.44	8.41	8.39

ANOVA

MSS

CD	Appearance	Consistency	Mouth-feel	Flavor	**Overall Acceptability**
Treatment (T)	NS	0.238	0.231	NS	0.155
Storage (S)	NS	NS	NS	NS	NS
T X S	NS	NS	NS	NS	NS

CONCLUSION

The present study was carried out with the objectives to standardize the method of preparation and preservation of ready to eat mint coriander sauce and to ascertain its shelf life stability at room temperature. Mint and coriander were taken to formulate the recipe. The problem of separation of solids was observed in the final product, to overcome which, and to give the product a smooth texture and consistency, guar gum and CMC were added in combination of 0.3%+0.3% and samples were homogenized at 7400 RPM for 7-8 minutes at 20°C. The sauce was prepared in five batches i.e. control, samples preserved with KMS, sodium benzoate, KMS+ sodium benzoate and thermal processing. The control sample could retain shelf life of around 30 days after which it became organoleptically unacceptable. Amongst the other samples, physicochemical characteristics studied

were total solids, total soluble solids, acidity and viscosity. Non significant change was observed in total solids, total soluble solids and acidity of mint coriander sauce but a significant reduction was seen in viscosity during storage. Also, a significant ($p<0.05$) decrease was observed in the phytochemical characteristics i.e. total phenols, antioxidant activity, total chlorophyll and ascorbic acid.

REFERENCES

Ahmed, J. 2004. Rheological behaviour and color changes of ginger paste during storage. *Int J Food Sci Technol.,* **39**(3): 325-30.

Ahmed, J. and Shivhare, U.S. 2001. Thermal kinetics of color change, rheology and storage characteristics of garlic puree/paste. *J Food Sci.,* **66**(5): 754-57.

Ahmed, J., Shivhare, U.S. and Debnath, S. 2002. Color degradation and rheology of green chilli puree during thermal processing. *Int J Food Sci Tech.,* **37**: 57-63.

Ahmed, J., Shivhare, U.S. and Singh, P. 2003. Color kinetics and rheology of coriander leaf puree and storage characteristics of the paste. *Food Chem.,* **84**(4): 605-11.

Anese, M., Manzocco, L., Nicoli, M.C. and Lerici, C.R. 1999. Antioxidant properties of tomato juice as affected by heating. *J Sci Food Agric.,* **79**: 750–54.

Anonymous 1 2008. "Sauce" http://www.urbandictionary.com/define.php?term=Sauce

Anonymous 2 2008. "Mint & Coriander *Sauce*- Green *Sauce*" www.ecurry.com

AOAC 2005. *Official Methods of Analysis of AOAC International* (18th ed). Offficial Association of Analytical Chemists, Washington, DC.

Buckle, A.K. and Edwards, R.A. 1970. Chlorophyll degradation and lipid oxidation in frozen unblanched peas. *J Sci Food Agric.,* **31**(6): 307-12.

Burdurlu, H.S., Koca, N. and Karadeniz, F. 2006. Degradation of vitamin C in citrus juice concentrates during storage. *J Food Eng.,* **74**(2): 211–16.

Candogan, K. 2002. The effect of tomato paste on some quality characteristics of beef patties during refrigerated storage. *Eur Food Res Technol.,* **215**(4): 305-09.

Celik, S., Bakirci, I. and Şat, I.G. 2006. Physicochemical and organoleptic properties of Yogurt with Cornelian Cherry paste. *Int J Food Prop.,* **9**(3): 401-08.

Chudzikowski, R.J. 1971. Guar gum and its application. *J Soc Cosmet Chem.,* **22**: 43-60.

Conesa, D.P., Alonso, J.G., Valverde, V.G., Iniesta, M.D., Jacob, K., Siles, L.M.D., Ros, G. and Periago, M.J. 2009. Changes in bioactive compounds and antioxidant activity during homogenization and thermal processing of tomato puree. *Innovat Food Sci Emer Technol.,* **10**(2): 179–88.

Gardner, L.K. and Lawrence, G.D. 1993. Benzene production from decarboxylation of benzoic acid in the presence of ascorbic acid and a transition-metal catalyst. *J Agric Food Chem.,* **41**(5): 693-95.

Ghosh, M., Bansal, S. and Ganguli, A. 2004. Prevalence and survival of *S. aureus* in street vended Indian green *sauces*. *J Food Technol.,* **2(2):** 67-70.

Gupte, S.M., EL-Bisi, H.M. and Francis, F.J. 1964. Kinetics of Thermal Degradation of Chlorophyll in Spinach Puree. *J Food Sci.,* **29**(4): 379-82.

Jacobo, A.S., Rüfer, C.E., Gervilla, R., Guamis, B., Roig-Sagués, A.X. and Saldo, J. 2011. Influence of ultra-high pressure homogenisation on antioxidant capacity, polyphenol and vitamin content of clear apple juice. *Food Chem.,* **127**(2)**:** 447–54.

Kizhedath, A. and Suneetha, V. 2011. Estimation of chlorophyll content in common household medicinal leaves and their utilization to avail health benefits of chlorophyll. *J Pharm Res.,* **4**(5): 1412–13.

Larmond, E. 1970. Method of Sensory evaluation of food. *Can Deptt Agric Pubs.,* 1284.

Nagata, M. and Yamashita, I. 1992. Simple method for determination of chlorophyll and carotenoids in tomato fruit. *J Japan Soc Food Sci Technol.,* **39**(10): 925-28.

Nuutila, A.M., Pimia, R.P., Aarni, M. and Oksman Callentey, K.M. 2002. Comparison of antioxidant activities of onion and garlic extracts by inhibition of lipid peroxidation and radical scavenging activity. *Food Chem.,* **81**: 485-93.

Rudra, S.G., Sarkar B.C., Shivhare U.S. and Basu S. 2008. Rheological properties of coriander and mint leaf puree. *J Food Proc Engg.,* **31**(1): 91-104.

Ranganna, S. 1997. *Handbook of Analysis and Quality Control for Fruit and Vegetable Products*. Tata Mc Graw Hill Pub Co. Ltd. New Delhi, India.

Sallam, K.I., Ahmed, A.M., Elgazzar, M.M. and Eldaly, E.A. 2007. Chemical quality and sensory attributes of marinated Pacific saury (*Cololabis saira*) during vacuum-packaged storage at 4 °C. *Food Chem.,* **102**(4): 1061–70.

Shimada, K., Fujikawa, K., Yahara, K. and Nakamura, T. 1992. Antioxidative properties of xanthin on autoxidation of soybean oil in cyclodextrin emulsion. *J Agric Food Chem.,* **40**: 945-48.

Shin, S. and Bhowmik, S.R. 1995. Thermal kinetics of color changes in pea puree. *J Food Eng.,* **24**(1): 77-86.

Shobana, S. and Naidu, K.A. 2000. Antioxidant activity of selected Indian spices. *Prostag Leukotr Ess.,* **62**(2): 107-10.

Singh, G., Kawatra, A. and Sehgal, S. 2001. Nutritional composition of selected green leafy vegetables, herbs, carrots. *Pt Food Hum Nutr.,* **56**: 359-64.

Singh, S., Singh, T., Bansal, M.L. and Kumar, R. 1991. *Statistical methods for research workers*. Kalyani publishers, New Delhi.

Swain, T. and Hillis, W.E. 1959. The phenolic constituents of *Prunus domestica* I. The quantitative analysis of phenolic constituents. *J Sci Food Agric.*, **10**: 63-68.

Wong, P.Y.Y. and Kitts, D.D. 2006. Studies on the dual antioxidant and antibacterial properties of parsley (*Petroselinum crispum*) and cilantro (*Coriandrum sativum*) extracts. *Food Chem.*, **97**(3): 505-15.