

## Evaluation of tomato, spinach and carrot based vegetable Soy Soup

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Received : October, 2011 / Accepted : July, 2012

Soup and beverages are generally consumed by large number of people for its being tasty and nutritious. The use of pure vegetable soup or fruit juice as breakfast drink has grown dramatically in recent year. Tomato (*Solanum lycopersicum*) contains lycopene (the red pigment in tomato), vitamin A, C, potassium and iron and nicotinic acid. Consumption of tomato everyday helps in improving skin texture, colour and various types of cancers, protects the liver from cirrhosis, dissolve gallstones, natural antiseptic, prevent heart diseases and good blood purifier (Nutrition and recipes, 2008). Spinach (Chenopodiaceae) is an excellent source of Vitamin A, B<sub>2</sub>, B<sub>6</sub>, C, K, E, manganese, foliate, magnesium, iron, calcium, potassium, dietary fiber, copper, protein, phosphorus and zinc. In addition it also has Omega-3 fatty acids, niacin and selenium. Spinach (Palak) contains lutein which is protective against eye diseases. Spinach is said to be good for those with heart disease, arthritis, anemia, tumors, constipation, insomnia, obesity, neuritis, high blood pressure, bronchitis, colon cancer, prostate cancer, breast cancer, osteoporosis, dyspepsia and diseases of kidneys, bladder and liver, (Anamika, 2008a). The carrot (*Daucus carota*) are rich in vitamins B<sub>1</sub>, B<sub>2</sub>, B<sub>6</sub>, C, D, E, potassium, magnesium, iron, copper, phosphorus and sulphur, dietary fiber and minerals and can be consumed as raw, juiced or cooked. Carrots are an excellent source for carotene, which is converted to vitamin A in the human body (Fageria, 2003). One hundred grams of carrot comprises of 7.6g carbohydrate, 0.6g protein, 0.3g fat, 30mg calcium and 0.6 mg iron. (Anamika, 2008b). Soybean (*Glycine max*) is globally known as a good source of vegetable protein and oil, used as health food. It contain higher amount of calcium than milk, more lecithin than egg, many more vitamins

and biologically active components than most of the grain. Soybean is a cheaper, conventional, convenient and richest source of protein for the fast growing human population. In the current scenario, it suits the modern life style of the people of all the ages (Singh et al., 2010).

The above vegetable are easily available at lower cost is the market during the season. Looking to the popularity of soups, the present investigation was carried out to Sensory attributes of soup prepared with different ratio of vegetables.

Fresh good quality edible selected vegetables (tomato, spinach, and carrot), soybean cake, salt, black pepper, butter and corn flour were procured from the local market of the Varanasi city. Preparation of soup was completed in two phases. In Phase I, the fresh vegetables (tomato, spinach and carrot) were washed and diced into small pieces and mixed with different ratio 1:1:1 (group a), 1:1:2 (group b), 1:2:1 (group c), 1:2:2 (group d), 2:1:1 (group e), 2:1:2 (group f) and 2:2:1 (group g) on weight basis. From each group, 250 gm sample was taken into pressure cooker and butter mixer containing butter (3gm) cumin powder (2gm), salt (6gm) and corn flour (15gm) were added and mixed it properly. Then, 750 ml fresh and clean water was added. The above mixture was steamed boiled in a pressure cooker for 15 minutes. Pressure cooker lid was open and sprinkle black pepper (1gm) into it and puree it in a mixer. The puree was squeezed out so as to remove the solid particles and increases its palatability for human taste. Finally, it was served hot for judging.

In Phase II, first we prepared soy cake soup. Similar to phase I, butter mixer was prepared and added to the soy cake (100gm) along with 900ml of water. Then, the whole content was steamed boiled in a pressure cooker for 15 minutes. Lid was open and sprinkle black pepper (1gm) into it and thoroughly mix it. It was then squeezed out so as to remove the solid particles and served hot. Then, the selected best combination of vegetable soup from phase I (through sensory evaluation) was mixed with soy cake soup in different ratios *i.e.* 0:100

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(group h), 25: 75 (group i), 50:50 (group j), 75:25 (group k) and 100:0 (group l). The samples were evaluated using 9- point Hedonic scale for their sensory characteristics *i.e.* flavour, colour and appearance, consistency, taste and overall acceptability by the panel of 6 experienced judges. The results were analyzed using RBD (Randomized Block Design) to test the statistical significance as per method described by Snedecor and Cochran (1994).

### **Phase- I: Effect of sensory attributes of soup prepared with different ratio of vegetables**

The flavour score of vegetable soup prepared with tomato, spinach and carrot in the ratio of 1:2:2 showed significantly ( $P < 0.01$ ) highest score in group d ( $8.12 \pm 0.09$ ) than the rest of the groups (Table 1). The flavour score of groups b ( $7.15 \pm 0.46$ ) and c ( $7.34 \pm 0.28$ ) were also very high ( $P < 0.01$ ) than the groups a ( $4.42 \pm 0.27$ ), e ( $3.49 \pm 0.21$ ), f ( $5.71 \pm 0.21$ ) and g ( $4.55 \pm 0.20$ ). The difference in the values between the groups b and c was not significant. Group d got maximum score for flavor. The colour and appearance score of vegetable soup increased ( $P < 0.01$ ) as the levels of carrot and spinach increased, but decreased ( $P < 0.01$ ) with increased level of tomato in the soup. The score was significantly highest ( $P < 0.01$ ) in group d ( $7.69 \pm 0.28$ ) followed by group c ( $7.00 \pm 0.12$ ) than rest of the groups. The colour and appearance was very

low in group a ( $4.62 \pm 0.25$ ) and group e ( $4.85 \pm 0.06$ ). Similar findings have also been reported by Alam *et al.* (2002) when tomato whey soup was prepared. The consistency score of vegetable soup was significantly ( $P < 0.01$ ) increased as the levels of spinach and carrot increased in the samples. The average consistency score was significantly ( $P < 0.01$ ) higher in group d ( $7.68 \pm 0.09$ ) as compared to rest of the groups. The consistency was at par in groups a ( $6.70 \pm 0.10$ ) and g ( $6.42 \pm 0.07$ ) which was significantly higher ( $P < 0.01$ ) than the values obtained in groups b ( $5.71 \pm 0.29$ ), c ( $5.20 \pm 0.14$ ), e ( $5.45 \pm 0.23$ ) and f ( $5.27 \pm 0.28$ ).

Like other sensory attributes the taste score of the soup prepared with the vegetables-tomato, spinach and carrot in the ratio of 1:2:2 was ranked first ( $P < 0.01$ ) than the values found in rest of the groups. This might be due to increased in the level of sweetness of carrot in the soup. The values of the groups b ( $7.12 \pm 0.13$ ) and c ( $7.38 \pm 0.08$ ) were also very high ( $P < 0.01$ ) than the score found in groups a ( $5.17 \pm 0.19$ ), e ( $5.33 \pm 0.23$ ), f ( $6.03 \pm 0.21$ ) and g ( $5.73 \pm 0.08$ ). The overall acceptability score was also the highest ( $P < 0.01$ ) in group d ( $7.99 \pm 0.19$ ) when tomato, spinach and carrot was added in the ratio of 1:2:2 than the rest of the groups (Table 1). The next higher score was found in group b ( $6.52 \pm 0.36$ ) and c ( $6.73 \pm 0.52$ ). The acceptability of other groups like a ( $5.23 \pm 0.52$ ), e ( $4.78 \pm 0.45$ ), f ( $5.75 \pm 0.18$ ) and g ( $5.68 \pm 0.40$ ) did not show any significant differences between the groups.

**Table 1.** Sensory attributes of soup prepared with different ratio of vegetables (Tomato:Spinach:Carrot)

Treatment	Average Score				
Groups	Flavour	Colour & Appearance	Consistency	Taste	Overall Acceptability
Group a (1:1:1)	4.42 <sup>b**c**d**e**f**</sup> ±0.27	4.62 <sup>b**c**d**f**g**</sup> ±0.25	6.7 <sup>b**c**d**e**f**</sup> ±0.10	5.17 <sup>b**c**d**f**</sup> ±0.19	5.23 <sup>b*c*d**</sup> ±0.52
Group b (1:1:2)	7.15 <sup>d**e**f**g**</sup> ±0.46	6.11 <sup>c**d**e**</sup> ±0.18	5.71 <sup>d**g**</sup> ±0.29	7.12 <sup>d**e**f**g**</sup> ±0.13	6.52 <sup>d*e**</sup> ±0.36
Group c (1:2:1)	7.34 <sup>d**e**f**g**</sup> ±0.28	7.00 <sup>d**e**f**g**</sup> ±0.12	5.20 <sup>d**g**</sup> ±0.14	7.38 <sup>d**e**f**g**</sup> ±0.08	6.73 <sup>d*e**</sup> ±0.52
Group d (1:2:2)	8.12 <sup>e**f**g**</sup> ±0.09	7.69 <sup>e**f**g**</sup> ±0.28	7.68 <sup>e**f**g**</sup> ±0.09	8.46 <sup>e**f**g**</sup> ±0.21	7.99 <sup>e**f**g**</sup> ±0.19
Group e (2:1:1)	3.49 <sup>f**g**</sup> ±0.21	4.85 <sup>f**g**</sup> ±0.06	5.45 <sup>g**</sup> ±0.23	5.33 <sup>f*</sup> ±0.23	4.78 ±0.45
Group f (2:1:2)	5.71 <sup>g**</sup> ±0.21	5.99 ±0.10	5.27 <sup>g**</sup> ±0.28	6.03 ±0.21	5.75 ±0.18
Group g (2:2:1)	4.55 ±0.20	6.02 ±0.10	6.42 ±0.07	5.73 ±0.08	5.68 ±0.40
CD 0.05	0.715	0.495	0.505	0.561	1.196
CD 0.01	1.002	0.693	0.708	0.786	1.639

Values are means ± SEM, n=6. \*\* Significant ( $P < 0.01$ ) and \* Significant ( $P < 0.05$ ).

**Table 2.** Sensory attributes of soup prepared with different ratio of vegetable soup containing Tomato, Spinach and Carrot (1:2:2): Soya cake soup

Treatment	Average Score				
Groups	Flavour	Colour & Appearance	Consistency	Taste	Overall Acceptability
Group h (0:100)	4.32 <sup>i**j**k**l**</sup> ±0.27	4.56 <sup>i**j**k**l**</sup> ±0.34	5.70 <sup>j**k**l**</sup> ±0.23	4.16 <sup>i**j**k**l**</sup> ±0.21	4.69 <sup>i**j**k**l**</sup> ±0.35
Group i (25:75)	5.56 <sup>j**k**l**</sup> ±0.23	5.89 <sup>j**k**l**</sup> ±0.28	6.10 <sup>j**k**l*</sup> ±0.14	5.92 <sup>j**k**l**</sup> ±0.09	5.87 <sup>j**k**l**</sup> ±0.11
Group j (50:50)	8.28 <sup>k**l**</sup> ±0.20	8.12 <sup>l*</sup> ±0.12	7.32 <sup>l**</sup> ±0.19	8.25 <sup>l**</sup> ±0.10	7.99 <sup>l*</sup> ±0.23
Group k (75:25)	7.58 ±0.23	7.67 ±0.20	7.04 ±0.09	7.89 <sup>l**</sup> ±0.14	7.55 ±0.18
Group l (100:0)	7.07 ±0.07	7.20 ±0.44	6.62 ±0.17	7.02 ±0.15	6.98 ±0.13
CD 0.05	0.649	0.787	0.479	0.507	0.736
CD 0.01	0.945	1.146	0.697	0.738	1.032

Values are means ± SEM, n=4. \*\* Significant (P<0.01) and \* Significant (P<0.05).

### **Phase- II: Effect of sensory attributes of soup prepared with different ratio of vegetables soup and soy soup**

The average flavour score varied from 4.32 to 8.28 (Table 2). The flavour score of group j (8.28±0.20) was very high (P<0.01) than the values found in groups h (4.32±0.25), i (5.56±0.23), k (7.58±0.23) and l (7.07±0.07). The differences between the groups k and l was not significant. The flavour score increased significantly (P<0.01) when the soy soup was added up to 50% level in vegetable soup but decreased with further increased in the levels of soy soup in the samples. This might be due to increase in soy level in soup, which may increased off flavour (due to toxin saponins) and soy flavour present in the sample (Manay and Shadaksharaswamy, 2008). The score of colour and appearance was significantly (P<0.01) higher in groups j (8.12±0.12) and k (7.67±0.20) than the score of other groups. The value of soup increased as the level of soy cake soup into vegetable soup increased (up to 50% level) and then decreased in group h and i with further increase of soy cake soup. The colour and appearance score decreases for groups l (7.20±.044), i (5.89±0.28) and h (4.56±0.34) than the groups j and k. This might be due to increase in soy bean level in soup causing increased glycosides (saponin) which possess the property of producing lather or foam when shaken resulting in reduction of colour and appearance (Manay and Shadaksharaswamy, 2008). The minimum consistency score was observed in group h (5.70±0.23) while the maximum score was observed in group j

(7.32±0.19). The average consistency was at par in groups j (7.32±0.19) and k (7.04±0.09) which was significantly higher (P<0.01) than the values obtained in groups l (6.62±0.17), i (6.10±0.14) and h (5.70±0.23). The best consistency score was observed in the soup prepared with 50% vegetable soup made from tomato, spinach, carrot (1:2:2) and 50% soy cake soup.

Like other sensory attributes the taste score of the soup prepared with 50% vegetables soup prepared with tomato, spinach and carrot in the ratio 1:2:2 and 50% soy cake soup was ranked first (P<0.01) than the values recorded in groups h, i and l (Table 2). The taste score was at par in groups j (8.25±0.10) and k (7.89±0.14) which was significantly higher (P<0.01) than the values obtained in groups l (7.02±0.15), i (5.92±0.09) and h (4.16±0.21). The score for taste increased with the increased level of soy in the soup up to 50% then it decreased with further increased in the level of soy in the sample. This might be due to the increased soy flavour and glycosides (saponin) in the soup of the group h and i.

The levels of soy soup into vegetable soup made from tomato, spinach and carrot in the ratio of (1:2:2) significantly (P<0.01) affected the overall acceptability score of vegetable soy soup. The minimum score was observed for the group h (4.69±0.35) and maximum for the group j (7.99±0.23). However, the value of groups j (7.99±0.23) and k (7.55±0.18) was at par. Its value decreased in groups l (6.98±0.13), i (5.87±0.11) and h (4.69±0.35). The overall acceptability score

increased significantly ( $P < 0.01$ ) when the ratio of soy soup was added up to 50% level, but decreased when the level of soy soup further increased in the samples.

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