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ORGANOLEPTIC AND NUTRITIONAL EVALUATION OF ALOE VERA (*Aloe Barbadensis Miller*) PRODUCTS

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ABSTRACT

The study was aimed for development and organoleptic evaluation of products using Aloe vera leaves (AVL) and to estimate nutritional composition of products. Five products viz *Dalia*, *Dal*, Mix vegetable, *Chutney* using Aloe vera leaves at 10-30 % and Shake at 5-15% level were developed. Products like *Dalia*, *Dal*, Mix vegetable, *Chutney* were acceptable at 20% level of supplementation of Aloe vera leaves with an overall acceptability score of 7.4 for *Dalia*, *Dal* (7.8), Mix vegetable (7.72) and *Chutney* (7.7). Shake was most acceptable at 5% level of Aloe vera leaves with an acceptability score of 7.68. With increase in level of supplementation of AVL organoleptic scores decreased due to bitter taste, fibrous and slimy texture. Nutritional analysis revealed that products supplemented with AVL had more moisture, fibre and total ash content as compared to control. The highest vitamin C content was present in vegetable (62.43 mg/100g) and lowest in shake (7.75 mg/100g). A significant ($p \leq 0.01$) increase in vitamin C content of products was observed after supplementation with AVL. *Chutney* showed the maximum β carotene content of 3126 $\mu\text{g}/100\text{g}$ followed by *Dal* (114 $\mu\text{g}/100\text{g}$) and Mix vegetable (99 $\mu\text{g}/100\text{g}$). Aloe vera leaves could be incorporated in daily diets to enhance fibre and vitamin C content of diets for improving the nutritional and health status of individuals.

Keywords: Aloe vera leaves, β -carotene, Organoleptic evaluation, Vitamin C.

INTRODUCTION

Aloe vera has marvellous medicinal properties. Scientists have discovered over 150 nutritional ingredients in Aloe vera. There seems to be no single magic ingredient. They all work together in a synergetic way to create healing and health giving benefits. The ten main areas of chemical constituents of Aloe vera include: amino acids, anthraquinones, enzymes, minerals, vitamins, lignins, monosaccharide, salicylic acid, Saponins and phytosterols (Surjushe *et al*, 2008). According to UNESCO (1998) report around 80.00 per cent of the world's total population still relies on traditional system of medicine. Aloe vera (*Aloe barbadensis*) is among the 28 medicinal plants which have been selectively given in monograph by WHO (1999) to promote international harmonization in quality control and use of herbal medicine. Aloe vera has been referred to as a safer and healthier plant. Aloe vera has very good nutritional composition. It contains 20 of the 22 Amino acids required for good nutrition. Aloe has shown to contain 13 of the 17 minerals required in the body, namely, calcium, potassium, phosphorus, sodium, chlorine, aluminium, magnesium, manganese, selenium, silicon, zinc and cobalt. Other than these minerals, vitamins like vit. B1, B2, B3, choline, folic acid, vit. C and carotene are also present in Aloe (Shelton, 1991). It contains different polysaccharides (Hart *et al*, 1989).

To ease the intake of Aloe vera, it can be incorporated into food products, as it's slimy and gel like consistency makes it slightly undesirable to be consumed in the raw state. Since it is not convenient to obtain fresh Aloe vera at times of need it can be incorporated in many food products which can be used when required. With the use of such products the nutritional and therapeutic benefits of Aloe vera can be added to the diet of an individual Aloe vera could be considered as an excellent novel source of natural health promoting compounds which include antioxidants (vitamin C, E, β -carotene) for the functional food market.

MATERIALS AND METHOD

SAMPLE SELECTION

Samples of Aloe vera (*Aloe barbadensis miller*) plant (free from blemishes and damage) were procured from Department of Agronomy, Punjab Agricultural University Ludhiana. For standardization of food products developed by using Aloe vera, commonly consumed food items i.e. bengal gram *dal*, vegetables, milk, banana, coriander leaves and mint leaves were procured from the local market along with other ingredients like oil, spices, sugar and salt.

METHODS

Aloe vera leaves were incorporated in *Dalia*, *Dal*, Mix vegetables, *Chutney* at 10,20,30 % levels and Shake was developed at 5, 10, 15% levels. The developed products were organoleptically evaluated by a trained panel of 10 judges from department of Food and Nutrition, College of Home Science, Punjab Agricultural University, Ludhiana. Each product was prepared and tested twice. The judges were served each preparation with one control and three test samples. The samples were coded as S1, S2, S3 and C to avoid any bias. Judges were asked to score the samples for color, flavour, texture, taste and overall acceptability by using a score card of 9 point hedonic rating scale.

PROXIMATE ANALYSIS

Ground samples of raw and cooked samples were analyzed for their proximate contents using AOAC (2000) method. The moisture content was determined by air-oven drying at 105° C for 8 hrs and the crude protein contents by microkjeldhal method. The fat content was determined using petroleum ether (bp. 60-80°C) in a soxhlet extraction apparatus and crude fibre content by dilute acid and alkali hydrolysis. Carbohydrate content was calculated by difference of total contents from 100.

DETERMINATION OF VITAMIN C

The Aloe vera samples were estimated for their ascorbic acid content by the association of vitamin chemists (AOVC, 1996) method. The blue color produced by the reduction of 2,6-dichlorophenyl indophenols dye by ascorbic acid is estimated colorimetrically.

DETERMINATION OF β-CAROTENE

Estimation of β-carotene was also done by using Rao (1967) method. The individual carotenoids are separated on a column of calcium hydroxide of alumina and determined spectrophotometrically.

STATISTICALLY ANALYSIS

All the determinations were carried out in duplicate and the results are expressed as mean ± standard error. One way analysis of variance (ANOVA), turkey's test, paired t-test and their significance difference ($p \leq 0.05$) was ascertained to determine the comparison between control and products supplemented with Aloe vera leaves at different levels.

RESULTS AND DISCUSSION

ORGANOLEPTIC EVALUATION OF THE ALOE VERA DEVELOPED PRODUCTS

Data regarding organoleptic evaluation of products in Table 1 revealed that *Dalia*, *Dal*, Mix vegetable and *chutney* were acceptable at 20% (S2) level of Aloe vera supplementation and Shake was acceptable at 5%(S1) level. Mean scores for color, appearance, flavor, texture and taste obtained by S2 sample of *Dalia* were ranging from 7.3 to 7.45 with an overall acceptability score of 7.4 and was liked moderately. A significant difference was observed between control and S2 sample. The mean scores for overall acceptability was lowest for S3 i.e. 6.98. Arora (2007) developed and standardized *Aloe vera* based

products i.e. sweet and salty biscuits and *vadi*. The maximum acceptability was for products developed using fresh gel (15g) followed by fresh whole (15g) and Aloe powder (5g).

Table 1: Organoleptic evaluation of Aloe vera developed products

| Products | Color | Appearance | Flavor | Texture | Taste | Overall Acceptability |
|----------------------|--------------------------|-------------------------|-------------------------|--------------------------|--------------------------|--------------------------|
| Dalia | | | | | | |
| C | 8.1 ^a ±0.12 | 8.05 ^a ±0.14 | 7.95 ^a ±0.13 | 7.9 ^a ±0.12 | 7.95 ^a ±0.14 | 7.99 ^a ±0.12 |
| S1 | 7.75 ^{ab} ±0.23 | 7.7 ^{ab} ±0.16 | 7.5 ^{ab} ±0.14 | 7.55 ^{ab} ±0.11 | 7.55 ^{ab} ±0.13 | 7.61 ^{ab} ±0.11 |
| S2 | 7.4 ^b ±0.13 | 7.45 ^b ±0.14 | 7.3 ^b ±0.11 | 7.4 ^{bc} ±0.11 | 7.45 ^{bc} ±0.11 | 7.4 ^{bc} ±0.10 |
| S3 | 7.4 ^b ±0.13 | 7.2 ^b ±0.17 | 6.65 ^c ±0.19 | 6.95 ^c ±0.17 | 6.7 ^c ±0.15 | 6.98 ^c ±0.14 |
| F ratio | 6.287 | 5.669 | 13.55 | 8.89 | 15.30 | 12.15 |
| Dal | | | | | | |
| C | 8.25 ^a ±0.10 | 8.2 ^a ±0.10 | 8.2 ^a ±0.10 | 8.15 ^a ±0.81 | 8.2 ^a ±0.10 | 8.2 ^a ±0.08 |
| S1 | 8.1 ^a ±0.16 | 8.05 ^a ±0.15 | 8.25 ^a ±0.14 | 7.95 ^{ab} ±0.11 | 8.05 ^{ab} ±0.15 | 8.07 ^{ab} ±0.13 |
| S2 | 8.0 ^a ±0.07 | 8.0 ^a ±0.07 | 7.65 ^b ±0.11 | 7.65 ^b ±0.11 | 7.6 ^b ±0.11 | 7.8 ^a ±0.07 |
| S3 | 7.15 ^b ±0.2 | 7.25 ^b ±0.18 | 7.0 ^b ±0.18 | 7.15 ^b ±0.20 | 6.8 ^b ±0.18 | 7.1 ^b ±0.016 |
| F ratio | 9.424 | 10.613 | 18.84 | 10.81 | 19.94 | 18.107 |
| Mix vegetable | | | | | | |
| C | 8.3 ^a ±0.21 | 8.3 ^a ±0.21 | 8.3 ^a ±0.21 | 8.2 ^a ±0.2 | 8.4 ^a ±0.22 | 8.3 ^a ±0.18 |
| S1 | 8.1 ^a ±0.18 | 8.0 ^a ±0.21 | 7.7 ^a ±0.21 | 7.9 ^{ab} ±0.18 | 7.8 ^a ±0.2 | 7.9 ^{ab} ±0.18 |
| S2 | 8.3 ^a ±0.21 | 7.8 ^a ±0.13 | 7.5 ^a ±0.22 | 7.6 ^{ab} ±0.16 | 7.4 ^{ab} ±0.22 | 7.72 ^{ab} ±0.14 |
| S3 | 7.7 ^a ±0.33 | 7.5 ^a ±0.31 | 7.4 ^a ±0.31 | 7.2 ^b ±0.25 | 6.76 ^b ±0.45 | 7.44 ^a ±0.17 |
| F ratio | 1.769 | 2.242 | 2.77 | 4.76 | 6.66 | 4.58 |
| Chutney | | | | | | |
| C | 8.1 ^a ±0.18 | 8.1 ^a ±0.18 | 8.3 ^a ±0.15 | 8.3 ^a ±0.15 | 8.3 ^a ±0.15 | 8.22 ^a ±0.12 |
| S1 | 8.1 ^a ±0.18 | 8.0 ^{ab} ±0.15 | 7.7 ^{ab} ±0.21 | 7.8 ^{ab} ±0.24 | 7.7 ^{ab} ±0.25 | 7.86 ^a ±0.17 |
| S2 | 8.1 ^a ±0.23 | 8.0 ^{ab} ±0.15 | 7.5 ^b ±0.17 | 7.5 ^b ±0.17 | 7.4 ^b ±0.16 | 7.7 ^a ±0.14 |
| S3 | 7.4 ^b ±0.37 | 7.2 ^b ±0.33 | 6.7 ^b ±0.26 | 6.6 ^b ±0.31 | 6.3 ^b ±0.3 | 6.84 ^a ±0.28 |
| F ratio | 1.91 | 3.84 | 10.6 | 9.87 | 1.35 | 9.42 |
| Shake | | | | | | |
| C | 7.8 ^a ±0.2 | 7.8 ^a ±0.8 | 8.2 ^a ±0.2 | 8.1 ^a ±0.18 | 8.2 ^a ±0.2 | 8.02 ^a ±0.18 |
| S1 | 7.7 ^a ±0.33 | 7.7 ^a ±0.33 | 7.7 ^{ab} ±0.26 | 7.8 ^{ab} ±0.29 | 7.5 ^{ab} ±0.22 | 7.68 ^a ±0.27 |
| S2 | 7.2 ^a ±0.47 | 7.2 ^a ±0.47 | 6.9 ^{ab} ±0.38 | 6.9 ^{ab} ±0.38 | 6.7 ^b ±0.42 | 6.98 ^{ab} ±0.40 |
| S3 | 7.2 ^a ±0.42 | 7.2 ^a ±0.47 | 5.9 ^b ±0.40 | 6.0 ^b ±0.42 | 5.7 ^b ±0.40 | 6.38 ^a ±0.36 |
| F ratio | 0.755 | 0.921 | 9.688 | 8.223 | 10.864 | 5.471 |

The mean values with different notations indicate a significant difference at 5 % level of significance.

C-Broken wheat/ Bengal gram *dal*/ Vegetables/Mint leaves + coriander leaves

S1-Control +10 % Aloe vera leaves

S2-Control + 20 % Aloe vera leaves

S3-Control +30 % Aloe vera leaves

** Significant at 5% level

Note: Shake was supplemented at 5, 10 and 15% level

Overall acceptability scores of S2 sample of *Dal* was 7.8 which were liked very much. A non significant ($p \leq 0.05$) difference was found in color, appearance and overall acceptability between control and S2 sample. The mean scores for overall acceptability was lowest for S3 i.e. 7.1 being liked moderately. Bhumra (2005) reported that *Aloe vera* powder can be incorporated in bengal gram flour at 5, 10 and 15% level and was acceptable.

Mean scores obtained by S2 sample of Mix vegetable were ranging from 7.4 to 8.3 with an overall acceptability score of 7.72 which was also liked very much. A non significant difference was found in color, appearance, flavour and overall acceptability of S2 sample when compared with S1 sample. With 20% (S2) supplementation of Aloe vera leaves in *Chutney* mean scores were ranging from 7.4 to 8.1 with overall acceptability score of 7.7, similar scores of color was obtained in control and S2 sample. Bhumra (2005) revealed that the 20% aloe tomato chutney obtained scores in the range 7.70-7.90 for all of organoleptic characteristics on the 9-point hedonic scale.

Overall acceptability scores of S1 (5%) shake was 7.5 which was liked moderately and no significant difference was observed in color and appearance for S2 and control samples. The mean scores for overall acceptability was lowest for S3 (15%) i.e. 6.38 and was highest for control i.e. 8.02. Neall (2004) reported the role of *Aloe vera* extracts in functional foods, particularly in the beverage and dairy section. However, with increase in the levels of supplementation of Aloe vera leaves in all the products, a significant ($p < 0.05$) decrease in the overall acceptability was observed due to its dark green color, pungent taste, slimy and fibrous texture.

PROXIMATE COMPOSITION

Nutritional analysis among control and Aloe vera supplemented products is shown in Table 2. Maximum protein content was found in bengal gram *dal* as 19.42% followed by broken wheat as 10.3%. Crude fibre content was found to be in the range of 0.8% for milk and maximum 7.6 %for Aloe vera leaves. The total ash content ranged from 1.0 to 3.96 % being maximum for banana and minimum for cauliflower followed by Aloe vera leaves i.e. 3.1 per cent. The developed products supplemented with Aloe vera leaves had more moisture content in *Chutney* (9.34%) followed by *Dal* (6.14%) as compared to control samples. Gautam and Awasthi (2007) reported that Aloe vera contained 97.20 per cent moisture. Addition of 20% Aloe vera leaves significantly ($p \leq 0.01$) improve crude fibre content of Aloe vera supplemented (S2) samples as

compared to control samples. Mix vegetable contain highest crude fibre among all products i.e. 6.7% followed by *dalia* (6.7%). Arora (2007) studied that the crude fibre content was 13.75 g/100g in the bitter variety and 11.84 g/100g in the sweet variety. Addition of 20% Aloe vera leaves Significantly ($p \leq 0.01$) improve the ash content of S2 sample of Mix vegetable (7.34%) and *Dal* (6.67 %) as compared to control i.e. 4.25 and 5.63 per cent. The Aloe vera gel contains minerals like sodium, potassium, calcium, magnesium, manganese, copper, zinc, chromium and iron (Paul 2003). The carbohydrate and energy content was found as inversely related to moisture content of samples. The same findings were reported by Nazni *et.al.*, 2010.

Table 2-proximate composition of developed products using aloe vera leaves (on dry weight basis)

| Products | Moisture % | Curde protein % | Crude fat % | Crude Fibre % | Total Ash % | CHO % | Energy (kcal) |
|-----------------------|-------------------|--------------------|--------------------|--------------------|--------------------|-------|---------------|
| Dalia | | | | | | | |
| C | 6.56 | 9.34 | 9.23 | 3.5 | 6.56 | 64.81 | 424 |
| S2 | 5.74 | 8.53 | 9.85 | 6.7 | 5.89 | 63.29 | 389 |
| t value | 3.27* | 7.84* | 5.07* | 28.38* | 3.24* | | |
| Dal | | | | | | | |
| C | 5.98 | 15.13 | 7.72 | 2.3 | 5.63 | 63.24 | 388 |
| S2 | 6.14 | 14.7 | 8.25 | 2.7 | 6.67 | 61.54 | 390 |
| t value | 1.5 ^{NS} | 2.88 ^{NS} | 3.84* | 2.34 ^{NS} | 7.61** | | |
| Mix vegetables | | | | | | | |
| C | 4.66 | 10.5 | 12.9 | 7.33 | 4.25 | 60.36 | 414 |
| S2 | 4.3 | 9.62 | 13.77 | 7.6 | 7.34 | 57.37 | 407 |
| t value | 17.04** | 6.82** | 6.14** | 2.06 ^{NS} | 39.51** | | |
| Chutney | | | | | | | |
| C | 7.9 | 8.75 | 0.60 | 5.68 | 15.95 | 61.12 | 296 |
| S2 | 9.34 | 7.0 | 0.82 | 4.27 | 14.43 | 64.14 | 302 |
| t value | 15.58** | 21.74** | 2.31 ^{NS} | 30.89** | 58.18** | | |
| Shake | | | | | | | |
| C | 7.58 | 11.2 | 13.56 | 2.71 | 2.56 | 62.39 | 422 |
| S2 | 5.96 | 10.67 | 13.85 | 2.9 | 2.69 | 69.93 | 429 |
| t value | 8.23** | 4.53* | 2.72 ^{NS} | 1.39 ^{NS} | 1.21 ^{NS} | | |

DETERMINATION OF VITAMIN C

The vitamin content of control and Aloe vera supplemented products is shown in Table 3 and Table 4. The highest vitamin C content among raw ingredients was present in coriander leaves i.e. 132 mg/100g followed by Aloe vera leaves (44.54 mg/100g). Arora (2007) reported the ascorbic acid content in bitter and sweet variety of Aloe vera was observed to be 53.24 mg/100g and 52.82 mg/100g, respectively. Bhumra (2005) reported 53.28 mg of vitamin C content in Aloe vera. Among all the products except *Chutney* vitamin C content of S2 (20%) supplementation of Aloe vera leaves were significantly ($p \leq 0.01$) higher then control sample. Figure 1 showed that among all the developed products vitamin C content was highest in Mix vegetable (62.43 mg/100g) followed by *Dalia* (11.84 mg) and lowest in Shake (7.75 mg/100g). The 20 % level of supplementation of Aloe vera leaves significantly ($p \leq 0.01$) increased the ascorbic content of products by 1 to 4 fold. Among S2 samples maximum increase in ascorbic acid content was observed in *dal* (4 folds) followed by *dalia* (3 folds) and minimum in shake

(1 fold) with supplementation of 5% level of Aloe vera leaves. Singhi (2007) reported an ascorbic acid content of 11.14 mg/100g in *kabuli channa* with cauliflower leaf supplementation. The same findings were reported by Nazni *et.al.*, 2014.

Table 3 - content of raw ingredients on fresh weight basis

| Ingredients | Vitamin C mg/100 | B carotene µg/100g |
|------------------|------------------|--------------------|
| Coriander leaves | 132 | 5532 |
| Aloe vera | 44.54 | 19.08 |
| Mint leaves | 26.4 | 1587.8 |
| Milk | 1.21 | 50.88 |
| Broken wheat | 0.29 | 37.14 |
| Banana | 6.37 | 75.41 |
| Beans | 27.14 | 124.8 |
| Potato | 17.95 | 22.91 |
| Cauliflower | 49.03 | 31.39 |

| | | |
|-----------------|-----|--------|
| Bengal gram dal | 0.8 | 123.05 |
|-----------------|-----|--------|

Values are mean

Table 4 – vitamin C content of the of developed products using aloe vera leaves (on dry weight basis)

| Products | Vitamin C mg/100 | B carotene µg/100g |
|-----------------------|------------------|--------------------|
| Dal | | |
| C | 2.55 | 120.69 |
| S2 | 31.35 | 113.56 |
| t value | 91.17** | 41.92** |
| Dalia | | |
| C | | |
| S2 | 3.82 | 70.4 |
| t value | 11.84 | 67.73 |
| Mix vegetables | | |
| C | 55.45** | 19.88** |
| S2 | 25.25 | 102.17 |
| S2 | 62.43 | 99.33 |
| t value | 254.65** | 75.90** |
| Chutney | | |
| C | 74.57 | 3403.8 |
| S2 | 68.21 | 3125.95 |
| t value | 45.19** | 8314.73** |
| Shake | | |
| C | 4.25 | 40.32 |
| S2 | 7.75 | 33.28 |
| t value | 60.47** | 232.52 |

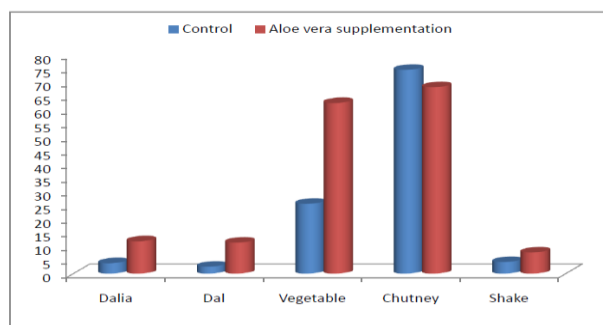


Fig. 6: Vitamin C content of developed product using Aloe vera leaves

DETERMINATION OF β-CAROTENE

β-carotene was found to be highest in coriander leaves as 5532µg/100g where as Aloe vera leaves contain 19.08 µg/100g. Gautam and Awasthi (2007) analysed the β-carotene in *Aloe vera* leaf powder and fresh leaf. In the powder β-carotene levels reported was 335.80 µg/100 where as in the fresh leaf was 10.80 µg/100g. A significant (p≤0.01) decrease in β-carotene was observed in all the developed products after supplementation with Aloe vera due to lower content of β-carotene in Aloe vera leaves. *Chutney* showed the maximum β-carotene content of 3126 µg/100g followed by *Dal* (114 µg/100g) and *Vegetable* (99µg/100g).

CONCLUSION

From above it results that *Dalia*, *Dal*, *Chutney* and *Mix vegetable* were found to be acceptable at 20% level, where as *Shake* at 5% level of supplementation of Aloe vera leaves. Products with increased in the level of supplementation of Aloe vera leaves had decreased acceptability scores due to bitter taste, slimy and fibrous

texture. Supplementation with Aloe vera leaves significantly improved the crude fibre, total ash, moisture and vitamin C content of the products.

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