STUDIES ON THE DEVELOPMENT AND STORAGE STABILITY OF CUCUMBER-MELON FUNCTIONAL DRINK

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ABSTRACT

A blend of drinks from cucumber (*Cucumis sativus*) and muskmelon (*Cucumis melo*) was formulated and evaluated for its storage stability in Food Technology Section, Post Harvest Research Centre, Ayub Agricultural Research Institute, Faisalabad, Pakistan during the year 2010-11. Addition of muskmelon to cucumber juice increases the nutritional value of the drink and also provides various health benefits to consumers. These ready-to-use functional drinks were prepared by blending different ratios of cucumber and muskmelon (100:0, 90:10, 80:20, 70:30, and 60:40). The physico-chemical parameters and sensory characteristics of blended drinks were evaluated for four months at 15 days of storage interval. It was observed that TSS mean values increased (15.49-16.09%) during storage. Increase in acidity (0.41-0.51%) and decrease in pH (4.89-4.82) was also observed. Reducing sugars increased from 1.9 to 2.48 percent while non-reducing sugars decreased from 9.36 to 8.70 percent. Regarding sensory attributes, maximum scores (7.51) for overall acceptability was observed in cucumber and muskmelon ratio of 90:10 followed by ratio of 100:0 (7.33) Drink prepared at 90:10 was also found as The most acceptable in maintaining the physico-chemical and organoleptic characteristics as compared to other treatments.

KEYWORDS: ***Cucumis sativas; Cucumis melo;*** **fruit juices; mixing; chemicophysical properties; Pakistan.**

INTRODUCTION

The functional beverages can play an important role in health promotion and disease prevention. These reduce increasing burden on health care system by a continuous preventive mechanism (30). Beverages are considered to be an excellent medium for the supplementation of nutraceutical components for enrichment (17) such as soluble fibre or herbal extract (33). The functional beverages not only provide taste and refreshment satisfaction, but can also

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provide necessary nutrients to prevent nutrition-related diseases (24). There is huge number of food products taken as beverages such as iced teas, coffees, sports drinks, herbal teas, frozen carbonated beverages, mint blends, vegetable juices and smoothies (12).

Cucumber contains calcium (20 mg /100 g), iron (0.7 mg/100 g), thiamin (0.3 mg /100g), niacin (0.2 mg/100g) and riboflavin (0.01 mg/100g) (6). Large quantity of cucumber gets spoiled due to excessive production in peak season. Spoilage of cucumber during harvesting can be minimized by long term preservation of cucumber in drink form.

Melon belongs to Cucurbitaceae family with fibrous and shallow root system. Melon is the 4th important fruit in the world fresh fruit market with several varieties and serves as major food sources (20). It is a delicious fruit of common man. Its flesh and seeds both have high nutritive value Muskmelon is a rich source of vitamin C, ß-carotene, vitamin A, carbohydrates, sugars, protein and also traces of vitamin B6, vitamin K, niacin, vitamin B2 and vitamin B1 (1). Its seeds contain 40-44 percent oil and used as a substitute of almond and pistachio. The fruit pulp and juice is used in refreshing drinks. Fruit pulp contains 94 percent water, 5 percent carbohydrates, 1 percent protein, 3420 IU of vitamin A and 33mg vitamin C (26).

Blending could lead to the production of delightful and delicious beverages with improve organoleptic quality and high nutritive value. Blending increases taste and flavour of fruit juices. Sistrunk and Morris (27) reported that the blend of apple and grape juices were highly acceptable in quality and retained acceptable flavour and colour during storage at 24^{o}C for 12 months. Other workers (3, 8, 9, 10, 28, 29) reported that two or more fruits juice/pulp may be blended in various proportions for the preparation of nectar, RTS beverages, etc. The blending of juice may also improve aroma, taste and nutrients of the beverages.

Cucumber-melon drink is not available commercially and research has not been carried out on preservation of such blended drink. Research on preservation and storage studies were mostly confined to carrot, pumpkin, tomato, spinach and beetroot juice (4, 14, 7, 5, 32). In present study cucumber-melon blended functional drinks were developed and evaluated for storage statistically to provide more nutritive drinks to the consumers.

MATERIALS AND METHODS

This study was conducted in Food Technology Section, Post Harvest Research Centre, Ayub Agricultural Research Institute, Faisalabad, Pakistan during the year 2010-11. Fresh and sound fruits of cucumber *(Cucumis*

sativus) and muskmelon *(Cucumis melo* L.*)* were purchased from local market and were washed with clean water to remove dust, dirt and outer material. Fruits were cut into desired pieces for further processing. Pulp of cucumber and melon was obtained through fine pulper. The drink was prepared by adding hot water, sugar, carboxy methyl cellulose (CMC) and sodium citrate. All the ingredients were dissolved through homogenizer. Drinks were prepared by blending cucumber and muskmelon at different ratios (T_1 = 100:0, T_2 = 90:10, T_3 = 80:20, T_4 = 70:30 and T_5 = 60:40). Drinks were heated below boiling point for a few minutes and sodium benzoate was added into it. The drinks were filled in glass bottles at 85^{o}C, sealed and stored at ambient temperature of 28$\pm$ 5^{o}C.

The prepared drinks were analyzed for total soluble solids (TSS) by Refractometer (Abbe Refractometer Model 2WAJ) for four months storage at 15 days intervals. A few drops of well homogenized sample were taken on prism of refractometer and direct reading was taken by reading the scale in meter as described in AOAC (2). The pH of each sample was determined with digital pH meter (InoLab 720, Germany). A sufficient quantity (50mL) of cucumber-melon drink was taken in 100mL beaker and pH meter was used to record pH according to method explained in AOAC (2). The acidity in each sample was determined according to standard procedure given in AOAC (2). 10mL of cucumber melon drink alongwith 100mL water was taken and then titrated with 0.1 N NaOH using phenolphthalein as an indicator (1-2 drops) till light pink colour was achieved. Reducing and non-reducing sugars were determined as described in AOAC (2) using Lane and Eynon method.

Sensory evaluation was made through panel of 10 semi-trained judges. The panel evaluated the acceptance level of drinks for colour, flavour, taste and overall acceptability. A 9-point hedonic scale was used for this purpose (9).

The data obtained were subjected to statistical analysis using analysis of variance technique and comparison of means by LSD test (31).

RESULTS AND DISCUSSION

Total soluble solids(%)

The mean values of TSS (Table 1) revealed significant difference (15.39-16.24%) among treatments and significant increase (15.49-16.09%) during storage period. The TSS increased gradually which might be due to hydrolysis of polysaccharides into monosaccharide and oligosaccharides. At zero day storage TSS of all drinks was in the range of 15.16-15.83 percent

Table 1. Effect of treatments and storage on TSS of cucumber- melon drinks.

Treat-ments	Storage period (Days)									Means
	0	15	30	45	60	75	90	105	120	
T_1	15.16	15.16	15.23	15.33	15.40	15.40	15.50	15.63	15.70	15.39e
T_2	15.30	15.33	15.40	15.40	15.46	15.53	15.60	15.60	15.66	15.47d
T_3	15.50	15.50	15.60	15.66	15.73	15.86	15.90	16.00	16.03	15.75c
T_4	15.66	15.66	15.83	15.70	16.00	16.13	16.26	16.26	16.40	15.99b
T_5	15.83	16.00	16.00	16.13	16.30	16.40	16.40	16.50	16.66	16.24a
Means	15.49g	15.53fg	15.61ef	15.64e	15.78d	15.86cd	15.93bc	16.00ab	16.09a	

The values in column and row followed by different letters are significantly different (P<0.05).

which started increasing gradually as the storage period proceeded. A significant change was observed after 15 days of storage in these drinks. Maximum TSS was recorded in T_5 (16.24%) followed by T_4 (15.99%) against minimum in T_1 (15.39%) and T_2 (15.47%). Hussain *et al.* (15) found an increasing trend in total soluble solids from 8.90 to 9.46 percent during storage of apple and apricot blended juice preserved with potassium sorbate at low temperature. Similar results were found by Majumdar *et al.* (23) for this parameter (11.32-11.50%) during six months storage of gourd-basil leaves juice.

Titeratable acidity (%)

Titeratable acidity is directly proportional and is a measure of shelf life of the product and guard against the attack of micro-organisms. It also helps to ensure some chemical changes during preparation (33) and storage (18). The statistical analysis of data (Table 2) showed that acidity varied significantly due to substitution of melon in cucumber. There was significant

Table 2. Effect of treatments and storage on acidity(%) of cucumber- melon drinks

Treat-ments	Storage period (Days)									Means
	0	15	30	45	60	75	90	105	120	
T_1	0.48	0.48	0.49	0.50	0.52	0.52	0.53	0.54	0.54	0.51a
T_2	0.47	0.47	0.49	0.50	0.50	0.51	0.52	0.53	0.53	0.50a
T_3	0.45	0.45	0.47	0.48	0.49	0.49	0.50	0.51	0.53	0.46b
T_4	0.43	0.43	0.44	0.45	0.47	0.47	0.49	0.49	0.50	0.46b
T_5	0.40	0.40	0.42	0.44	0.44	0.44	0.45	0.46	0.46	0.43c
Means	0.44d	0.44d	0.46cd	0.47bcd	0.48abc	0.48abc	0.49ab	0.50a	0.51a	

The values in column and row followed by different letters are significantly different (P<0.05).

decrease in acidity among treatments and significant increase during storage period. It is evident that on zero day the acidity was in the range of 0.48-0.40 percent and almost no significant change was observed in these drinks till 15 days of storage. Afterwards a significant increase in acidity was observed in all the treatments during storage. Dhaliwal and Hira (10) reported that there was minor changes in acidity i.e. from 0.39 to 0.42 percent in carrot-spinach

and carrot-pineapple juices during storage. Similarly, Majumdar *et al*. (22) reported that acidity increased from 0.25-0.36g/100ml during storage of cucumber-basil juice. Krishnaveni *et al.* (16) also reported marginal changes in acidity in jack fruit RTS beverage (0.25-0.27%). The decrease in pH and increase in acidity during storage might be due to degradation of carbohydrates present in cucumber melon drink by the action of micro-organisms which cause production of acids in drink.

pH

pH is inversely proportional to the acidity of any medium. The results of present study also showed significant effect of storage period and treatments on pH of all drink samples with the increase in acidity and decrease in pH. Mean values (Table 3) ranged from 4.59-5.16. It revealed significant increase in pH among treatments and significant decrease (4.89-4.82) during storage period of four months. Maximum mean values were recorded in T_5 (5.16), and minimum in T_1 (4.59) followed by T_2 (4.66). These finding are almost similar to earlier study (10) where pH of fruit juices decreases (from 3.9 to 3.6) with corresponding increase in acidity during storage. Majumdar *et al*. (21) also reported that pH values decreased from 4.0-3.93 in ash gourd-mint leaves juice during six months storage. High acid and low pH may be due to production of acetic acid and lactic acid during storage.

Table 3. Effect of treatments and storage on pH of cucumber- melon drinks

Treat-ments	Storage period (Days)									Means
	0	15	30	45	60	75	90	105	120	
T_1	4.64	4.64	4.63	4.61	4.60	4.59	4.58	4.57	4.56	4.59e
T_2	4.70	4.70	4.68	4.67	4.67	4.66	4.64	4.62	4.62	4.66d
T_3	4.90	4.89	4.89	4.87	4.85	4.83	4.83	4.82	4.81	4.82c
T_4	5.10	5.10	5.08	5.07	5.05	5.03	5.02	5.00	5.00	5.05b
T_5	5.22	5.21	5.18	5.16	5.15	5.15	5.15	5.13	5.11	5.16a
Means	4.89ab	4.90a	4.89abc	4.87abc	4.86abcd	4.85bcd	4.84cd	4.77e	4.82de	

The values in column and row followed by different letters are significantly different (P<0.05).

Sugars

The results indicated that different treatments and storage period had significant effect on reducing sugars of drinks. The data (Table 4) revealed significant decrease (2.34 to 2.06%) among treatments and significant increase (1.92 to 2.48%) during storage of 120 days. Maximum mean score was recorded in T_1 (2.34%) followed by T_2 (2.24%) while minimum score was recorded in T_5 (2.06). These changes may be attributed to the inversion of sucrose under acidic environment. Similar results were found earlier (23) where reducing sugars increase from 2.13 to 70 percent during six months storage of bottle gourd-basil leaves juice.

Table 4. Effect of treatments and storage on reducing sugars (%) of cucumber- melon drinks.

Treat-ments	Storage period (Days)									Means
	0	15	30	45	60	75	90	105	120	
T_1	2.09	2.14	2.21	2.30	2.38	2.38	2.50	2.50	2.58	2.34a
T_2	2.01	2.01	2.10	2.18	2.26	2.35	2.35	2.42	2.50	2.24b
T_3	1.95	1.95	2.05	2.13	2.13	2.25	2.38	2.38	2.49	2.19c
T_4	1.81	1.81	1.90	2.02	2.10	2.10	2.22	2.34	2.45	2.08d
T_5	1.76	1.76	1.87	1.98	2.08	2.20	2.20	2.31	2.40	2.06e
Means	1.92h	1.93h	2.02g	2.12f	2.19e	2.25d	2.33c	2.39b	2.48a	

The values in column and row followed by different letters are significantly different (P<0.05).

The non-reducing sugars decreased during storage. The mean values ranged from 8.94-9.08 percent (Table 5). The highest value was observed in T_3 (9.11%) and lowest in T_1 (8.94%) followed by and T_4 (9.06). These findings are similr to those of Hussain *et al.* (15) where non-reducing sugars decreased from 2.56 to 1.88 percent in apple-apricot blended juice. Majumdar *et al.* (23) also reported decreasing trend in non-reducing sugars from 8.27-7.59 percent in bottle gourd-basil juice during storage of six months.

Table 5. Effect of treatments and storage on non-reducing sugars (%) of cucumber-melon drinks.

Treat-ments	Storage period (Days)									Means
	0	15	30	45	60	75	90	105	120	
T_1	9.11	9.11	9.05	9.00	9.00	8.92	8.85	8.78	8.69	8.94d
T_2	9.25	9.25	9.18	9.10	9.10	9.03	8.95	8.90	8.90	9.07b
T_3	9.38	9.38	9.30	9.20	9.10	9.03	8.92	8.92	8.78	9.11a
T_4	9.50	9.50	9.30	9.12	9.00	9.00	8.85	8.72	8.60	9.06c
T_5	9.60	9.60	9.38	9.21	9.03	8.92	8.80	8.68	8.55	9.08b
Means	9.36a	9.36a	9.24b	9.12c	9.04d	8.98e	8.87f	8.80g	8.70h	

The values in column and row followed by different letters are significantly different (P<0.05).

Sensory evaluation

Colour: The data (Table 6) showed that colour score decreased with an increase in muskmelon substitution in drinks. T_2 (90:10) gained maximum score (7.53) followed by T_1 (100.:0) (7.35) while minimum score was recorded for T_4 (70:30) (6.64) followed by T_5 (60:40) (6.46). Four week interval of storage showed stability in colour while at the end of 120 days there was gradual decrease in colour. The change in colour parameter may be due to maillard reaction between sugars and amino acids (13).

Table 6. Effect of treatments and storage on colour of cucumber- melon drinks

Treat-ments	Storage period (Days)									Means
	0	15	30	45	60	75	90	105	120	
T_1	7.8	7.8	7.6	7.4	7.4	7.2	7.0	7.2	6.8	7.35a
T_2	8.0	7.8	7.8	7.6	7.8	7.4	7.2	7.2	7.0	7.53a
T_3	7.6	7.6	7.4	7.2	7.0	6.6	6.8	6.8	6.6	7.06b
T_4	7.2	7.2	6.8	6.8	6.6	6.4	6.4	6.2	6.2	6.64c
T_5	7.0	7.0	6.6	6.6	6.4	6.4	6.2	6.0	6.0	6.46c
Means	7.52a	7.50a	7.24ab	7.12b	7.04bc	6.80cd	6.72d	6.68d	6.52e	

The values in column and row followed by different letters are significantly different (P<0.05).

Flavour: The mean values of flavour decreased from 7.68 to 6.68 (Table 7). Maximum mean score was recorded for T_2 (7.68) followed by T_1 (7.48) while minimum score was recorded in T_5 (6.68) followed by T_4 (6.84). The results indicated that during storage there was gradual decrease in flavour of drinks. A decrease in flavor score may be attributed to the increase in acidity of drinks. A gradual decrease in flavour during storage may also be due to heat treatment applied during processing as reported by Pruthi *et al.* (25).

Table 7. Effect of treatments and storage on flavour of cucumber-melon drinks.

Treat-ments	Storage period (Days)									Means
	0	15	30	45	60	75	90	105	120	
T_1	8.0	8.0	7.8	7.6	7.4	7.4	7.2	7.0	7.0	7.48a
T_2	8.2	8.2	8.0	7.8	7.6	7.6	7.4	7.2	7.2	7.68a
T_3	7.6	7.6	7.4	7.2	7.2	7.0	6.8	6.8	6.6	7.13b
T_4	7.4	7.4	7.2	7.0	6.8	6.6	6.4	6.4	6.4	6.84c
T_5	7.2	7.2	7.0	6.8	6.6	6.6	6.4	6.2	6.2	6.68c
Means	7.68a	7.68a	7.48ab	7.28bc	7.12cd	7.04cd	6.84de	6.72e	6.68e	

The values in column and row followed by different letters are significantly different (P<0.05).

Taste: The data (Table 8) revealed that T_2 (90:10) ranked first (7:51) on the basis of taste while T_5 (60:40) gained the lowest score judges (6.31). It also revealed a gradual decrease in taste of drinks during storage. The results showed a loss of flavour and taste which may be due to the degradation of ascorbic acid and furfural production.

Table 8. Effect of treatments and storage on taste of cucumber-melon drinks.

Treat-ments	Storage period (Days)									Means
	0	15	30	45	60	75	90	105	120	
T_1	7.8	7.8	7.6	7.4	7.4	7.2	7.0	6.8	6.8	7.31a
T_2	8.0	8.0	7.8	7.6	7.6	7.4	7.2	7.2	6.8	7.51a
T_3	7.4	7.4	7.2	7.0	7.0	6.8	6.8	6.6	6.6	6.97b
T_4	7.0	7.0	6.8	7.0	6.6	6.4	6.4	6.2	6.2	6.62c
T_5	6.8	6.8	6.6	6.4	6.2	6.2	6.0	6.0	5.8	6.31d
Means	7.40a	7.40a	7.20ab	7.08bc	6.96bcd	6.80cde	6.68def	6.56ef	6.44f	

The values in column and row followed by different letters are significantly different (P<0.05).

Overall acceptability: The statistical analysis of sensory scores showed significant difference for overall acceptability of drinks during the storage of four months. Maximum mean score was attained by T_2 (7.51) followed by T_1 (7.33) while minimum score was recorded in T_4 (6.73) followed by T_5 (6.31) (Table 10). The judges concluded that increase in level of substitution of muskmelon juice decreases the overall acceptability for the drinks. Din *et al.* (11) also reported a decrease in overall acceptability of beverages prepared from different ratios of bitter gourd during storage.

Table 9. Effect of treatments and storage on overall acceptability of cucumber-melon drinks.

Treat-ments	Storage period (Days)									Means
	0	15	30	45	60	75	90	105	120	
T_1	7.8	7.8	7.6	7.4	7.4	7.2	7.0	7.0	6.8	7.33ab
T_2	8.0	8.0	7.8	7.6	7.4	7.4	7.2	7.2	7.0	7.51a
T_3	7.6	7.6	7.4	7.2	7.2	7.0	7.2	6.8	6.6	7.17b
T_4	7.2	7.2	7.0	6.8	6.8	6.6	6.4	6.4	6.2	6.73c
T_5	6.8	6.8	6.6	6.4	6.4	6.2	5.8	6.0	5.8	6.31d
Means	7.48a	7.48a	7.28ab	7.08bc	7.04bc	6.88cd	6.72de	6.68de	6.48e	

The values in column and row followed by different letters are significantly different (P<0.05).

CONCLUSION

The study concludes that cucumber-melon pulp functional drink prepared at 90:10 was the most acceptable for minimum changes in TSS, acidity, pH, reducing and non-reducing sugar. Sensory evaluation score was also higher for this drink followed by ratio of 100:0. The data further revealed that all blended drinks remained acceptable during the storage period of 120 days.

REFERENCES

1. Anon. 2002. Cantaloupe melon nutritional value. USDA Nutrient Database.
2. Anon. 2006. Official Methods of Analysis. Association of Official Analytical Chemists International. 18th Ed. Horwitz, W. (ed.), AOAC Press, Arlington, VA, USA.
3. Attri, B.L., B.B. Lal and V.K. Joshi. 1998. Physico-chemical characteristics, sensory quality and storage behavior of sand pear juice blended with temperate fruit juices/pulp. Ind. Food Packer. 52(6):36-42.
4. Ayranci, G. and A. Tuetuencueler.1993. Preparation and storage stability of juices from different carrot species. Nahrung. 37(5):433-439.
5. Bong, Y.O. and H. Bock. 1998. Changes in physico-chemical components of stewed pumpkin juice with ingredients during storage. J. Food Sci. Nutr. 27(6):1027-1033.

6. Bose, T.K. 1985. Fruits of India, Tropical and Sub-Tropical. 1st Edition. Naya Prokash Publication, Kolkata, India.
7. Chen, H.E., H.Y. Peng and B.H. Chen. 1996. Stability of carotenoids and vitamin A during storage of carrot juice. Food Chem. 57(4):497-503.
8. Deka, B.C. 2000. Preparation and Storage of Mixed Fruit Juice Spiced Beverage. Ph.D. Thesis, IARI, New Delhi.
9. Deka, B.C. and V. Sethi. 2001. Preparation of mixed fruit juice spiced RTS beverages. Ind. Food. Packer. 42(3):58-61.
10. Dhaliwal, M. and C.K. Hira. 2004. Effect of storage on physico-chemical and nutritional characteristics of carrot-spinach and carrot-pineapple juices. J. Food Sci. Technol. 41: 613-617.
11. Din, A., S.A.H. Bukhari, A. Salam and B. Ishfaq. 2011. Development of functional and dietetic beverage from bitter gourd. Internet. J. Food Safety. 13:355-360.
12. Giese, J.H. 1992. Hitting the spot: Beverages and beverage technology. Food Technol. 46:70-80.
13. Gonzalez, E.R. and S. Leeson. 2000. An investigation on the preservation of kunun-zaki, an African fermented cereal based food drink. Acta Alimentaria. 29:385-392.
14. Hsin, Y.W. and W.J. Swi-Bea. 1996. pH adjustment and high temperature sterilization of spinach juice. Food Sci. Taiwan. 23(5):662-670.
15. Hussain, I., A. Zaib and M. Ayub. 2010. Quality attributes of apple and apricot blend juice preserved with potassium sorbate during storage at low temperature. Internet. J. Food Sci. 12:80-86.
16. Karishnaveni, A., G.M. Megalai and R. Saravanikumar. 2001. Storage stability of Jackfruit (*Artocarpus heterophyllus*) RTS beverage. J. Food Sci. Technol. 38:601-602.
17. Kuhn, M. E. 1998. Functional food overdose. Food Proc. Mag. 59(5):21–48.
18. Langthasa, S. 1999. Processing and Preservation of Apple Pulp. Ph. D. Thesis, IARI, New Delhi.
19. Lee, J.Y., H.J. Park, C.Y. Lee and W.Y. Choi. 2003. Extending shelf-life of minimally processed apples with edible coatings and antibrowning agents. Lebensm.-Wiss. U.-Technol. 36(3):323-329.
20. Mabalaha, M.B., Y.C. Mitei and S.O. Yoboah. 2007. A comparative study of the properties of selected melon seeds oil as potential candidates for development of commercial edible vegetable oil. J. Amer. Oil Chem. Soc. 84:31-34.
21. Majumdar, T.K., C.R. Vasudish, K.s. Premavalli and A.S. Bawa. 2008. Studies on processing and storage stability of ashgourd-mint leave juice. J. Food Proc. and Preserv. 34:549-556.

22. Majumdar, T.K., D.D. Wadikar and A.S. Bawa. 2010. Development, stability and sensory acceptability of cucumber-basil juice blend. Afri. J. Food. Agric. Nutr and Dev. 10:4093-4104.
23. Majumdar, T.K., D.D. Wadikar, C.R. Vasudish, K.S. Premavalli and A.S. Bawa. 2011. Effect of storage on physico-chemical, microbiological and sensory quality of bottlegourd-basil leaves juice. Amer J. Food Technol. 6(3):226-234.
24. Menrad, M., B. Husing, K. Menrad, T. Reib, S. Beer-Borst and C.A. Zenger. 2000. Functional Food. TA 37/2000. Bern: Schweizerischer Wissenschafts und-Technologierat.
25. Pruthi, J.S., J.K. Manna, M.S. Tectia, S.G. Radhakriahna, W.E. Eipeson, S. Saroja and A.Chikkappaji. 1984. Studies on the utilization of kinnow and malta orange. J. Food Sci and Technol. 21(3):121-127.
26. Rashid, A. and K. Mahmood. 2004. Melon production in Pakistan. *In:* Vegetable Crops. Saeed, A. (ed). Horti. Foundation Pak.
27. Sistrunk, W.A. and J.R. Morris. 1985. Quality acceptable of two cultivars of muscadine grapes mixed with other juices. J. Amer. Soc. Hort. Sci. 110 (3):328-332.
28. Sandhu, K.S. and J.S. Sindhu. 1992. Studies on the development of multi fruits ready-to-serve beverage. J. Plant Sci. Res. 8:87-88.
29. Saxena, A.K., M.S. Teotia and S.K. Berry. 1996. Studies on the development of grape-mango and grape-pineapple beverage blends. Ind. Food. Packer. 50:26-29.
30. Shahidi, F. 2004. Functional foods: Their role in health promotion and disease prevention. J. Food Sci. 69(5):146-149.
31. Steel, R.G.D., J.H. Torrie and D.A. Dickey. 1997. Principles and Procedures of Statistics - A Biometrical Approach (3rd Ed.). McGraw Hill Book Co. Inc., New York, USA.
32. Su-Yeun, K., Y. Young-Bean and C. Eon-Ho. 2000. Change in quality of mixed juice of fruits and vegetables by aseptic treatment and packing with nitrogen gas during storage. Korean J. Food Sci. Technol. 32(6):1271-1277.
33. Swientek, B. 1998. Toasts of the town. Prep. Foods. Pp :21-26.