

## Nutritional Composition, Sensory Evaluation and Quality Assessment of Different Brands of Commercial Tetra Pack Apple Juices Available in Local Market of Peshawar Pakistan

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**Abstract:** The present study was conducted to investigate the comparative nutritional composition, sensory evaluation and quality assessment of different brands of commercial tetra pack apple juices available in the local market of Peshawar (Khyber Pakhtunkhwa). The study was carried out in Food Biochemistry/Analytical Section of Food Technology Center, PCSIR Laboratories Complex Peshawar. Six samples were chemically analyzed for their nutritional composition and sensory evaluation. Four samples were found to contain total soluble solids less than the standard limits as prescribed by pure Pakistan Food Laws and regulation 1965. Sensory evaluation for all these samples was found in the acceptable range.

**Key words:** Apple juice • Nutritional composition • Quality assessment

### INTRODUCTION

Apple is an important fruit of temperate climate and is very popular the world over. It was cultivated in Greece around 600 BC or earlier. During the time a number of wild varieties were known. Those varieties were perhaps spread by animals into Europe before much cultivation was practiced [1]. The Apple is the promaceous fruit of the apple, species *Malus domestica* in the rose family Rosaceae and is perennial [2]. It is one of the most widely cultivated tree fruits and the most widely known of the many members of genus *Malus* that are used by human. The tree originated in Central Asia where its wild ancestor is still found today. There are more than 7500 known cultivar of apples, resulting in a range of desired characteristics. Cultivars vary in their yield and the ultimate size of the tree even when grown on the same root stock [3].

At least, 55 million tons apples were grown world wide in 2005, with a value \$10 billion, china about 35% of this total, USA is second leading producer with more than 7.5% of the world production, Iran is 3<sup>rd</sup>, followed by Turkey, Russia, Italy and India. Pakistan is at No 11 [4].

In Pakistan, apples have been grown as commercial fruit plant in Khyber Pakhtunkhwa and in British Balochistan since long because of its attractive income; apple plantation was taken up by the grower in Swat, Dir, Abbotabad, Mansehra, Chitral, Gilgit Baltistan, North and South Waziristan. District Swat covers an area of approximately 4000 sq. miles within Malakand Division. This area is mainly a river valley surrounded by mountains which also have fertile land. District Swat is the most important of all the apple producing districts of Khyber Pakhtunkhwa. Next come the district of Mansehra, Dir, Abbotabad, Chitral and Gilgit Baltistan district of Hunza. Pakistan produce 600,000 metric ton of apples during the year 1999-2000 and shares of Balochistan is about 60 % and Khyber Pukhtunkhwa is 25% of the total produce. The remaining is produced by Punjab and Sindh [5].

Apple is mostly consumed as fresh fruit but in order to make the availability of the fruit during the off-season. It is processed to make juices, jams, concentrates, squashes, toffees and canned apple slices etc. Apple is one of the cherished fruit not only for taste but also for nutritional value. Apples can be canned or juiced. They are milled to produce apple cider (non alcoholic) and

filtered for apple juice. Various alcoholic beverages can be produced, such as applejack, calvados and apple wine through distillation. Pectin apple seed oil may also be produced.

Apples are an important ingredient in many desserts, such as apple pie, apple crumble, apple crisps and apple cake. Apples are also made in apple butter and apple jelly. They are used (cooked) in meat dishes. Sliced apple turns brown with exposure to air due to conversion of natural phenolic substances, into melanin. Different cultivars vary in their propensity to brown after slicing. Sliced fruit can be treated with acidulated water to prevent this effect. It is highly nutritive fruit containing essential food elements such as sugar 11%, fat 0.4%, protein 0.3%, carbohydrates 14.9% and vitamin C, A and B in a balanced form. In Europe and America, it is considered as a bottle of vitamins. It ranks 3<sup>rd</sup> in consumption after citrus and banana and is almost available throughout the year. Compared to many other fruits and vegetables, apples contain relatively low amount of vitamin C, but are rich source of other antioxidant compounds [6].

The fiber contents help to regulate bowel movement and may thus reduce the risk of colon cancer, they may also help with heart diseases, weight loss and controlling cholesterol by preventing reabsorption and are bulky for their caloric content like most fruits and vegetables [7, 8]. This evidence that apples also possess phenolic compounds which may be cancer protective and antioxidant activity. The phenolic compounds in apple are quercetin, epicatechin and procyanidin (B<sub>2</sub>) [9]. It is also a good source of energy, vitamin-A, calcium, phosphorus and iron etc [10]. Apple juice concentrate has been found to increase production of neuron transmitter acetylcholine providing a potential mechanism for the prevention of decline in cognitive performance that accompanies dietary, genetic deficiencies and aging [11].

A large number of new brands of fruit juice based beverages have sold in the market, in glass, plastic and Tetra Pack containers. Although, food laws exist for the production of quality food products [12], but most of the manufacturers do not strictly comply with them. Food adulteration can prove very dangerous for the development of healthy society. It can lead to a number of diseases such as paralysis, hypertension, mental retardation and cancer. Therefore, it is essential to take necessary steps to check food adulteration and contamination in edibles, especially in beverages, bottled water, cooking oil/ghee, sweetener, spices, tea, bakery products, milk and milk products, fruits and vegetables products which are a constant threat to health of common

man. The most important measure in this regard is to create awareness among the public regarding the level of hygiene i.e. to maintain and control the impurities that are found in food items sold in the market. This can only be done through advertisement and media. Keeping in view these facts, the present study was therefore, conducted to evaluate the quality and nutritional composition of different brands of commercial tetra pack apple juices, available in the market of Peshawar KPK Pakistan.

## MATERIALS AND METHODS

Six different brands of commercial tetra pack apple juices were purchased from the local market of Peshawar and labeled with the laboratory code Nos. I, II, III, IV, V and VI. These samples were then chemically analyzed for their nutritional composition and sensory evaluation in Food Technology Center, PCSIR Laboratories Complex, Peshawar.

**Nutritional Composition:** Moisture and ash determined by direct heating method as reported in AACC [13]. Acidity was estimated by titrating diluted samples against 0.1% NaOH according to the method as described in AOAC [14]. The pH was recorded in the pH meter (HANNA Model HI-8520). The total soluble solids were directly recorded by digital Refractometer (Atago Rx-1000) and results expressed as soluble solids (brix) as described by AOAC [14]. Total and reducing sugars were investigated by the modified standard method of Ruck [15]. Protein content was estimated by using the Kjeldhal method, as described in AACC [13]. Pectin was determined by the method as described in Pearson's chemical analysis of food [16]. Vitamin-C (ascorbic acid) content of the samples was estimated by indophenols titrimetric method as described by AOAC [14].

**Sensory Evaluation:** These samples were also evaluated by a panel of six judges for their sensory characteristics like color, flavor, taste, texture and overall acceptability at room temperature as described by Larmond [17].

## RESULTS AND DISCUSSION

The results of the nutritional composition are given in Table 1. It is evident that moisture content was found maximum in samples III, IV, V, and VI i.e. (95.45, 96.0, 94.50 and 96.02%) and minimum in sample I and II i.e. (84.66 and 85.15%). Samples IV and VI were found to have the same moisture content i.e. (96.0%) followed by sample III (95.45%) and V (94.50%). Higher moisture content is very

Table 1: Nutritional composition of different brands of commercial tetra packs apple juices.

Parameters	Sample I	Sample II	Sample III	Sample IV	Sample V	Sample VI
Moisture (%)	84.66	85.15	95.45	96.08	94.50	96.02
Ash (%)	0.17	0.04	0.07	0.05	0.09	0.08
pH	3.11	2.59	2.75	2.90	2.81	2.82
Acidity (%)	0.04	0.18	0.25	0.15	0.23	0.18
Total soluble solids (%)	12.0	10.5	4.0	4.40	3.60	5.0
Crude protein (%)	0.16	0.17	0.15	0.12	0.10	0.13
Ascorbic acid (mg/100g)	11.40	10.91	9.50	11.62	10.91	8.0
Pectin (%)	2.62	0.004	0.05	2.62	2.63	2.94
Total sugars (%)	11.5	9.6	3.7	4.0	3.2	4.75
Reducing sugars (%)	5.6	4.20	1.5	2.6	2.1	2.9
Crude fiber (%)	0.10	0.37	0.14	0.52	0.36	0.40

Table 2: Sensory evaluation of different brands of commercial tetra packs apple juices.

Parameter	Sample I	Sample II	Sample III	Sample IV	Sample V	Sample VI
Color	7.0	6.50	5.50	8.0	7.50	6.0
Taste	8.50	6.0	7.0	5.0	6.50	8.0
Flavor	7.50	6.5	7.0	5.50	8.0	6.0
Texture	6.0	8.0	4.0	6.0	7.0	8.0
Overall acceptability	8.0	7.0	7.0	7.5	8.0	7.0

1= Extremely dislike, 2= Strong dislike, 3= Moderate dislike, 4= Slight dislike

5= Neutral, 6=Slight like, 7=Moderate like, 8=strong like, 9= Extremely like.

important factor affecting the flavor of juices. The products having high moisture content have minimum shelf stability.

Ash content shows the different minerals present in the food products. The ash content of given apple juice samples was ranged from (0.045-0.17%). Maximum ash content was found in sample I i.e (0.17%) and minimum was found in sample II (0.04%). The variation in ash content of these samples may be due to the different formulation of each manufacturer. The lower ash content also indicates that the less quantity of apple fruit content used in the preparation of these juices. Long storage on different temperature also affects the quality parameters of the juices [18].

pH was recorded in the range of (2.59-3.11) and was higher in sample I (3.11), followed by sample IV (2.90). The higher pH value may be due to the loss of acidity. Sivakov [19] also observed rise in pH of the fruit juices during storage. Acidity also plays an important role in the flavor of different food products [20]. According to the results acidity was higher in sample II (0.25%) and lower in sample I (0.04%). Akubor [21] has also analyzed acidity for different fruit juices and reported that acidity increased with long storage period for different juices.

TSS of sample I (12.0%) was higher followed by sample II (10.5%) whereas sample III (4.0%), IV (4.4%), V (3.60%) and VI (5.0%) was found lower TSS. Akubor [21]

has also found minimum TSS up to 4.2% in different juices. Mahajan [22] has also reported increase in TSS of juices during long storage. Protein is the most important component of all foods. The results show that apple juices are very poor source of protein. High value of protein content was recorded in sample II i.e., (0.17%) and low value for sample V (0.10%), whereas sample I, III, IV and VI was found in the range from (0.12 to 0.16%). These results were also agreed with the values reported by Akubor [21].

Vitamin C (ascorbic acid) is also an important constituent of the fruits. Its deficiency produces a disease called scurvy. The preservation of this vitamin is very difficult during blanching and dehydration. Sample IV has maximum level of ascorbic acid (11.62mg/100g) whereas sample VI shows minimum ascorbic level i.e., (8.0 mg/100g). Pectin was found in the same range for sample I, IV, V and VI (2.6%) but very low in sample II and III. i.e., (0.004%) and (0.05%). Jones [23] also determined that degradation of pectin during long storage of juices; forming the free uronic acid resulted in an increase in acidity.

Sugar plays an important role in the fermentation process; therefore fermentation depends on sugar concentration in a given sample. Total sugars of these samples were found in the range of (11.5 to 3.2%). Sample I shows the highest total sugar i.e (11.5%) but the sample

II and V show the lowest total sugar (3.7 % and 3.2%). The study [21] also reported (3.6%) total sugar in mango juices. The fiber contents are also very important component of the fruit juices; they help to regulate bowel movements and may thus reduce the risk of colon cancer as reported by (SCC) [7]. The fiber contents were found in the range from (0.10 to 0.52%). Samples IV, VI, II and V contained higher level of fiber i.e., (0.52, 0.40, 0.37, and 0.36%) whereas sample I and III contain lower level of fiber contents i.e., (0.10, and 0.14%).

**Sensory Evaluation:** The results of sensory evaluation are tabulated in Table 2. the variation in the sensory characteristics of different brands of commercial tetra pack apple juice for color, taste, flavor and texture might be depends on the quality of raw material, ingredients and recipes during processing/manufacturing. Organoleptical acceptability decreases with increases in storage period of juices [24, 25].

Sensory evaluation of the samples was carried out by a panel of judges to assess the acceptability of the products by the consumers. Table 2 contains the results of sensory evaluation of different brands of commercial tetra pack juices. Color of the juice is very important parameter. The score assigned to color of these tetra pack apple juices is ranged from (8.0-5.5). Samples IV, V and I contain maximum score of color; i.e., 8.0, 7.5 and 7.0 followed by samples II, VI and III (6.5, 6.0 and 5.5). Samples I, VI and III found higher test score i.e., 8.5, 8.5 and 7.0 whereas samples V, II and IV were found lower taste score (6.5, 6.0 and 5.0). Flavor score was found higher in samples V, I and III (8.0, 7.5 and 7.0) whereas lower in samples II, VI and IV i.e., 6.5, 6.0 and 5.5. Texture and over acceptability were almost found in the same range for all the samples i.e., from 7.0-8.0.

## CONCLUSIONS

The comparison of the international market with that of Pakistan reveals that there is great potential for export growth of fruit and vegetables juices/preserves, provided some special concessions are allowed to this industry to flourish. For example, two major inputs i.e. sugar and packing material be made available to the processing units of special concessional prices as compare to the existing high rates. Besides, packing material for the export of fruit juices and pulp with addition of any preservative may be made available free of duty and taxes. It is only then the export can be substantially increased and a good amount of foreign exchange can be earned.

## REFERENCES

1. Origin, "History of cultivation" University of Georgia, Retrieved 2008.
2. Potter, D.I., T. Esikson, R.C. Evans, J.E.E. Smedwork, D.R.M. Kerr, K.R. Robertson, M.P. Arsenault, T.A. Dikson and C.S.T. Compbell, 2007. Phylogeny and classification of rosaceae plant systematic and evaluation. 266 (1-2): 5-43.
3. Apple, *Malus domestica*" natural England, 2008.
4. Dedicated to successful Global Apple Marketing. Apple Industry, Key facts, 2008.
5. Pakistan and Gulf Economist, 36: 2010.
6. Boyer, J.I.L. and R.H. Ruilin. 2004. Apple phytochemicals and their health benefits. Deptt. Of Food Science and Institute of comparative and environmental toxicology, USA. Nutritional Journal, 3: 5.
7. Stanford Cancer Center (SSC). "Nutrition to Reduce Cancer Risk, 2008.
8. Washington State Apple Advertising Commission, Apple keep your family healthy.
9. Lee, K.W., Y.J. Kim, D.O. Kim, H.J. Lee and H.J. K.W. Lee 2003. Major phenolics in apple and their contribution to teh total antioxidant capacity. J. Agri. Food. Chem., 51(22): 6516-6520.
10. Malik, M.A, A. Salam, M. Saleem and A. Saeed, 1994. Brochure of the Hort. Foundation. Pak Islamabad.
11. Chan, A., V.S.T. Graves, 2006. Apple juice concentrate maintains acetylcholine levels following dietary comprises. "Alzheimer's disease. Am. J. Med., 9(3): 287-291.
12. Awan IM. Food Laws manual, Mansoor Book House, Lahore, 1985.
13. AACC (American Association of Cereals Chemists) Approved Method of American Association of Cereal Chemists, St. Pauls Minnesota, USA 2000.
14. AOAC (Association of Official methods for analytical chemists) official method of analysis 17<sup>th</sup> Ed. USA 2002.
15. Ruck, J.A. Chemical methods for analysis of fruit and vegetable products, Deptt. Of Agri. Canada, pp: 1963.
16. Pearson's chemical analysis of food, 8<sup>th</sup> ed. 1981.
17. Larmond, E. Laboratory method of sensory evaluation of food. Deptt. Of Agri Ottawa Canada, 1977. Publication no, pp: 1637.
18. Ayub, M.A., J. Zab, M.A.K. Khattak, 2005. Effect of various sweeteners of chemical composition of guava slices. Sarhad J. Agric, 21(1): 131-134.

19. Sivakov, L., V. Petervouba, D.V. Gergeiv and N. Vesa, 1990. Changes in the chemical composition and transpiration of persimmons during storage. *Godison Zbornik Fakulet na Univerazitot*, V.O. Skopzje, 37: 103-111.
20. Hussain, S., K.I. Siddique, N. Perveen and N.Z. Perwaz, 1993. Effect of packing on the quality of fruit juice based drinks." *JAPS*, 3(1-2): 15-18.
21. Akubor, P.I., 1996. Deptt. Of Food tech. federal Polytechnic, PMB. Nijeria, J. Plt. Fruit for human nutria. 49(30): 213-219.
22. Mahajan, V.V.C., 1994. Biochemical and Enzymetic change in apple during cold storge. *J. Food Sci. tech. Mysore*, 31(92): 142-144.
23. Jons, J.K.N., 1961. Studying on the storage stability of guava fruit juice. *Pak. J. Sci. Ind. Res.*, 3(4): 179-183.
24. Awan, M.S. and R.A. Riaz. 1993. Comparative studies of changes during storage n uncarbonated lime fruit juice beverage. *Modern Agri.*, 4(1): 19-22.
25. Siddique, F.A., B.A. Salahuddin and F.H. Mehmood, Shah, 1987. Copper, Lead, Tin and Zinc contents in canned and bottled fruit products. *Pak. J. Sci. Ind. Res.*, 30(4): 505.