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Nutritional and Microbial Evaluation of Commercial Apple Juices Available in Market of Peshawar City

By Sana Irshad Khan, Zafar Iqbal, Ubairah, Arsalan Khan, Falak Naz Shah & Abid Shah Shinwari

University of Agriculture

Abstract- The present study was aimed to carry out quality assessment of different commercial apple juices available in the market of Peshawar city. Physiochemical characteristics like moisture, total soluble solids (Brix°), pH, acidity (%), Vit-C (%), total dissolved solids (ppt), reducing sugars (%), non-reducing sugars (%) and SO2 residue concentration (g/Kg) and microbial analysis of six juice samples were carried out. % moisture contents of sample VI was found higher (88.25±1.88) and lowe of sample III having % moisture content (82.67±1.71). Of all the samples, sample III has highest TSS (13.1±0.82), in contrast lowest TSS was found for sample VI (1.17±0.15). pH was found in the range of 3.39±0.05 to 3.08±0.01. Higher pH was observed for sample VI and lower for sample II. Total acidity (%) was observed maximum for sample I (0.83±0.05) and was found minimum for sample VI (0.11±0.03). Sample III has maximum Vit-C concentration (%) of 26.01±0.05 and sample VI has minimum Vit-C content (%) i.e. 14.00±0.10. Total dissolve solids (TDS) of the commercial apple juice samples (I-VI) were recorded in the range of 0.84 to 0.23. Highest TDS was found for sample I and lowest for sample II. Maximum % reducing and non-reducing sugars were observed for sample I i.e. (21.45±0.93) and (2.1±0.74) respectively, while in sample V and VI no content of (0.00) of % reducing and non-reducing sugars were found. Of all the selected juice samples, only samples I and III showed SO2 residues concentration within WHO standard (<0.03 g/Kg) and were found suitable for human consumption. Highest TPC were found in sample VI (30 cfu/mL). TCB was found in normal range (<1.1) and E.Coli were absent in all selected juice samples.

Keywords: apple juices, quality assessment, SO2, physico-chemical analysis, WHO standard.

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NUTRITIONALANDMICROBIALEVALUATIONOFCOMMERCIALAPPLEJUICESAVAILABLEINMARKETOFPESHAWARCITY

Strictly as per the compliance and regulations of:

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Sana Irshad Khan [α], Zafar Iqbal [σ], Ubairah [ρ], Arsalan Khan [Ѡ], Falak Naz Shah [Ѡ] & Abid Shah Shinwari [Ѡ]

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I. Introduction

Apples, a highly nutritious fruit, found abundant of essential food elements including fats (11%), carbohydrates (14.9%), sugars (11%), proteins (0.4%) and balanced level of pectin, dietary fibers and potassium, vitamins (A, B and C) and different types of phenolics (1). Apple can be used raw or processed into juices, jellies, jams, cidar and wine etc. (2). Apple juices act as nutritious beverages and are becoming an important part of the modern diet in many communities, essentially available in the same form almost anywhere in the world (3). Several epidemiological studies suggested the antioxidant and detoxification effect of apple juices in the human body and thus playing role to reduce the risk of chronic degenerative diseases (4,5, 6).

Quality of fruit juices is strictly maintained in developed countries under some law and regulation but in many developing and under developed countries the manufacturer is not concerned about the microbiological safety, hygiene and nutritional importance of fruit juices because of unawareness and lack of legislation (3). Thus the transmission of some human diseases through juice and other drinks are considered a serious problem in these countries today (7).

From our local market survey, it was revealed that although a large number of fruit juices brands (bottles and tetra packs) are available. Some of these juice brands have been found nutritionally low in quality and synthetic. According FDA (2001) reports fruit juices contain water, sugar and natural fruit pulp that could support microbial growth. Several factors encourage, prevent or limit the growth of microorganisms in juices; the most important are pH, hygienic practice storage temperature and concentration of preservatives and water. Industries apply chemical preservatives (including Sulphur Dioxide (SO2) and benzoate) that can inhibit all types of microbial growth (8). However these preservatives can significantly damage the vegetative cells also. In order to develop awareness among the people about commercial fruit juices nutritional quality and health hazard due to microbial contamination, this study was attempted to measure nutritional and microbiological quality and SO_2 level of industrially processed apple juices available in the local market of Peshawar city.

II. Materials and Methods

a) Sample Collection

Different commercially available apple juice samples (Two multinational and four national) were

Author α: Research Officer, Soil and water Testing Laboratory, Charsadda, Directorate of Soil plant Nutrition, ARI Tarnab, Peshawar.
e-mail: sanairshad@aup.edu.pk
Author σ: Department of Agricultural Chemistry, Faculty of Nutrition Sciences, The University of Agriculture, Peshawar-Pakistan.
Author ρ: Soil Chemistry, Directorate of Soil plant Nutrition, ARI Tarnab, Peshawar.
Author Ѡ: Food Science and Technology, ARI Tarnab, Peshawar.

collected from the local market of Peshawar city and were labeled with laboratory code Nos. i.e. I (multinational), II (national), III (national), IV (multinational), V (national) & VI \(national) respectively. RTS apple juices were analyzed for the following parameters.

b) Physico-Chemical Analysis

Moisture contents of the commercial apple juice samples were determined by direct heating method (9). Total soluble solids of the commercial apple juice samples were recorded by digital Refractometer (Atago Rx-1000) and results were expressed as soluble solids in °Brix (10). Acidity was estimated by titrating diluted samples (1%) against 0.1% NaOH according to the method as described in AOAC (2012) method no. 94.15 (11). The pH was recorded by pH meter (HANNA, HI 2211, pH/ORP meter) by using standard method of AOAC (2012) method no. 2005.02 (12). Reducing and non-reducing sugar (%) were investigated by Lyan and Eynon methods as reported in AOAC (2012) method no. 920.183 & method no. 920.184 respectively (13). Ascorbic acid content (%) of the commercial juice samples was calculated by indophenols titrimetric method as described in AOAC (2012) (9). Total dissolve salts (TDS) in parts per trillion (ppt) of the juice samples was analyzed by digital TDS meter (HANNA, Dist 2 Hi98302) using standard method of AOAC (2012).

c) Sulfur dioxide (SO_2) Residue Determination (g/Kg)

Sulfur dioxide (SO_2) concentration (g/Kg) in apple juices was determined as described by Laboratory manual of agricultural Chemistry, The University of Agriculture, Peshawar (14).

d) Microbial Analysis (cfu/mL)

For microbial evaluation of commercial juice samples Total Viable Count was used, by pour plate method (7). Sample (1 mL) was taken from the three dilutions (10^{-1}, 10^{-2} and 10^{-3}) and was added to Petri dish. Then Plate Count Agar ((PCA) media was added to each Petri dish. After incubation at 35 °C for 48 hours, colonies were counted by colony counter and results were expressed as cfu/mL.

e) Statistical Analysis

Statistical analysis of results was carried out using CR design. Means of triplicate reading will be represented as mean ± Std.

III. Result and Discussion

a) Physico-chemical Analysis

Physico-chemical properties of different commercial apple juices available in the market of Peshawar city were shown in Table 1. Maximum % moisture contents was observed in sample VI (88.25±1.88) and minimum % moisture content (82.67±1.71) was observed in sample III of commercial apple juice. Sample I, II, IV and V have moisture content (%) of 84.2±1.13, 86.01±2.01, 83.91±2.17 and 86.12±2.20 respectively. Moisture content affect shelf stability of food samples significantly. Apple juice sample having higher moisture content (%) have low storage life. Of all the samples, sample III has highest TSS 13.1±0.82 followed by sample I (12.23±0.27). In contrast lowest TSS was found for sample VI (1.17±0.15) followed by sample V (2.26±0.05). TSS for samples II and IV are 8.86±0.06 and 10.03±0.20 respectively. TSS for samples III and I fall within acceptable limit of ready to serve drinks (15). PH values for juice samples I to VI were 3.32±0.08, 3.08±0.01, 3.22±0.11, 3.31±0.10, 3.30±0.05 and 3.39±0.05. From pH of juices samples it was clear that sample VI has highest value of 3.39±0.05 and sample II has lowest pH value of 3.08±0.01. Total acidity (%) of the commercial apple juice samples was found in the range of 0.11-0.83. maximum acidity (%) was found for sample I (0.83±0.05) followed by sample III, II and IV (0.68±0.05), (0.24±0.07) and (0.23±0.03) and minimum acidity (%) was found for sample VI (0.11±0.03) followed by sample V (0.14±0.01) respectively. Vit-C contents of the commercial juice samples were ranged from 14% to 26%. Sample III has maximum Vit-C concentration (%) of 26.01±0.05 followed by samples I, II, IV, V and VI having % Vit-C concentration of 23.50±1.83, 22.00±1.02, 20.20±0.33, 20.00±0.02 and 14.00±0.10. Total dissolve solids (TDS) of the commercial apple juice samples (I-VI) were recorded in the range of 0.84 to 0.23. highest TDS was found for sample I (0.84±0.03) and lowest for sample II 0.23±0.01. Recorded TDS for samples III to VI was 0.67±0.11, 0.48±0.08, 0.56±0.10 and 0.48±0.22. Reducing sugar (%) was found highest in sample I (21.45±0.93) followed by sample III (20.20±0.51), IV (18.3±0.43) and II (8.46±0.55). in contrast, in juice samples V and VI no content of reducing sugar was found. Like reducing sugar (%), non-reducing sugar (%) contents were also found 0.00 in sample V and VI. Sample I contained highest concentration (2.1±0.74) of non-reducing sugar followed by sample III (1.81±0.15). While sample II and IV has 0.26±0.06% and 0.93±0.20 % of non reducing sugars.

b) Sulfer Dioxixe (SO_2) residue determination (g/Kg)

Sulfer dioxide concentration of juice samples (I to VI) were 0.01±0.02, 0.10±0.00, 0.01±0.01, 0.05±0.00, 0.10±0.02 and 0.17±0.09. According to WHO standard, MRL (maximum Residual Limit) for SO_2 in juices is 0.03 g/Kg. Of all the selected juice samples, only samples I (multinational) and III (national) showed SO_2 residues concentration less than 0.03 g/Kg (i.e. 0.01±0.02 and 0.01±0.00 respectively) and were found suitable for human consumption. All other samples were proven toxic and need to neglect its consumption (Table 1). Consumption of SO_2 above standard limits

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(0.03g/Kg) damage vegetative cell, cause stomach upsetting and various types of allergies (FAO/ WHO, 1999).

Table 1: Physico-chemical and SO_2 residue analysis of commercial juice samples available in the market of Peshawar City

Parameters	Sample I	Sample II	SampleIII	Sample IV	Sample V	Sample VI
Moisture %	84.2±1.13	86.01±2.01	82.67±1.71	83.91±2.17	86.12±2.20	88.25±1.88
TSS Brix°	12.23±0.27	8.86±0.06	13.1±0.82	10.03±0.20	2.26±0.05	1.17±0.15
pH 32.4 °C	3.32±0.08	3.08±0.01	3.22±0.11	3.31±0.10	3.30±0.05	3.39±0.05
Acidity %	0.83±0.05	0.24±0.07	0.68±0.05	0.23±0.03	0.14±0.01	0.11±0.03
Vit-C %	23.50±1.83	22.00±1.02	26.01±0.05	20.20±0.33	20.00±0.02	14.00±0.10
TDS ppt	0.84±0.03	0.23±0.01	0.67±0.11	0.48±0.08	0.56±0.10	0.48±0.22
Red.sugar%	21.45±0.93	8.46±0.55	20.20±0.51	18.3±0.43	0.00±0.00	0.00±0.00
Non-reducing sugar %	2.1±0.74	0.26±0.06	1.81±0.15	0.93±0.20	0.00±0.00	0.00±0.00
SO_2 (g/Kg)	0.01±0.02	0.10±0.00	0.01±0.01	0.05±0.00	0.10±0.02	0.17±0.09

c) *Microbial Analysis*

Total viable count (CFU/mL) concentration was 30, 21, 15, 6, 4 and 2 for sample VI, V, II, III, IV and I. Coliform bacteria population was less than 1.1 for all samples. No evidence of E.coli was found in all selected juice samples (Table 2). According to WHO standard of drinking water (total viable count = < 100, coliform bacteria < 1.1 and E.coli 0157:H7 = nil), commercial apple juices present in the local market of Peshawar City are suitable for human consumption, from microbial point of view.

Table 2: Microbial analysis of commercial juice samples available in the market of Peshawar City

Parameters	Sample I	Sample II	Sample III	Sample IV	Sample V	Sample VI
Total viable count (cfu/mL)	2	15	6	14	21	30
Coliform bacteria (MPN/100mL)	< 1.1	< 1.1	< 1.1	< 1.1	< 1.1	< 1.1
E.coli	Nil	Nil	Nil	Nil	Nil	Nil

IV. Conclusion

From this study it was observed that sample III (national) followed by sample I (multinational) of the selected apple juices is more suitable for human consumption. In contrast, human usage of samples VI and V is not good physic-chemically. Similarly all samples were found acceptable for human's consumption from microbial point of view and fall in the range of WHO standards.

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