

A Study on Chemical Properties and Sensory Evaluation of Pomegranate Juices from Sulaimani Shelf Markets Compared to Local Natural Juice

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Abstract

This study was carried out in 2020, at the Sulaimani Polytechnic University, Kurdistan-Region, Iraq, about sensory and chemical characteristics of two local organic pomegranate juice (Salakhany) with comparison between four samples of shelf markets. Then, one of the sample was freshly consumed, and another was pasteurized juices at 63 °C for 30 minutes. The other samples of pomegranate juices were presented commercially on the market and labeled such as (OC, OS, IR, IT, IS). The fresh pomegranate juices (fresh1 and fresh2) and two commercial pomegranate juice (OC and IS) have higher pH value (4.027, 4.633, 4.037 and 4.097), respectively. Total anthocyanin contents were higher in the IR juice compared to fresh1, fresh2, OC, OS, IT and IS juices. Also, the highest values of Gallic acid (28.100 mg/100 ml) was in OS, and the lowest rate of Caffeic acid was in Fresh2 (0.030 mg/100ml), and the glucose is the highest for (IT) sample (0.120 mg/100 ml), while glucose is the lowest level in sample (OC), which is (0.004 mg/100ml). The treatment (Fresh1) had a higher score when it was compared to the other treatments. Thus, this work will assist consumers in choosing a better pomegranate juice, and also, it will help them to know which one has a better compound.

Keyword: Pomegranate juice, *Punica granatum* L, Sensor evaluation, Anthocyanin, Gallic acid, Glucose, Caffeic acid, and phenolic compound.

Introduction:

Pomegranate fruits (*Punica granatum* L.) is historically the most ancient fruit that is extensively cultivated and consumed by human over the world [1], and pomegranate juice is an exactly clear liquid extracted from the pomegranate using various techniques with different processes [2]. Consequently, pomegranate juice contains various vitamins and minerals, high antioxidant, polyphenols, and anthocyanins. For that reasons, it has an important role for human health [3,4]. [5] stated that the pomegranate juice impacted on some human's diseases, such as cancer, diabetes, inflammations, bacterial infections, and antibiotic resistance.

The edible parts of pomegranate fruits are arils, and it can be eaten freshly, used for juice production, and canned beverages, such as alcoholic beverages, jellies, and jams, beside that is applied for the flavoring and coloring of drinks [6, 7]. Also, it can be found in amounts of different vital nutrients such as, sugars, vitamins, acids, polysaccharides, and polyphenols [8].

The amount of ascorbic acid in pomegranate juice is about (8.00 mg/100 ml) of juices, and it contains Vitamin B5, some minerals like Na, K, Fe, and Cr, and different polyphenols (tannins and flavonoids) [9]. However, pomegranate juice is a source of carbohydrate, crude fiber, vitamin C and some phenolic compounds such as, anthocyanins, ellagic acid, punicalagin and galloannings [10]. In the pomegranate juice, there are 6 anthocyanins, that are 3-glucosides and 3,5-diglucosides of cyanidin, delphinidin, and pelargonidin affecting the juice colour of pomegranate [5]. [2]

stated that the phenolic installation in the pomegranate juice had a huge impact on polyphenols content and the antioxidant capacity. The antioxidant contents in pomegranate juice are higher than that in the most of the fruit juice [11].

There are some factors directly affecting the composition of pomegranate juice, like pomegranate variety, postharvest, ecological and processing methods [2]. In addition, organoleptic and Physical-chemical properties are varying depending on the extraction methods [12]. Thus, the aim of the study is to compare the sensory characteristic and physio-chemical properties of the pomegranate local variety (Sallakhani) fresh juice with four types of shelf markets juice.

Material and Methods

Collecting and Prepared the Samples

This study was carried out in 2020, at Halabja Technical College of Applied Sciences, Sulaimani Polytechnic University, Kurdistan-Region Iraq. Organic pomegranate fruits (*Punica granatum* L.) (Salakhany), local variety, were obtained from Halabja Technical College of Applied Sciences farm, during 2020 seasons. the real time for harvesting of pomegranate in Halabja region is starts from October to the end of November. Then, from the local variety of pomegranate fruit, two samples of the treatments prepared by hands in the food Sciences lab and labeled (Fresh 1 and Fresh 2), and other pomegranate juice samples were obtained from the local stores and brought to the laboratory of the department of Food Sciences and

Quality Control. Then, four samples were prepared and labeled (Ukraine (CAOUOK) (OK), Ukraine (SANDORA) (OS), Kirkuk Rich (IR), Tazj Kirkuk (IT), and Sunej Iranian (IS). Thus, one sample was freshly consumed and others were pasteurized in juice at 63 °C for 30 minutes. The samples were prepared to analyze according to [13].

Determination of Physiochemical Properties

The Digital pH-meter (720, WTW) were used to determination of the pH, and then, each time, they were calibrated with distilled water. Hence, the hand refractometer was applied to find the total soluble solids (TSS), one drop from each sample was put at 25 °C and recorded, then calibrated with distilled water. Consequently, the calculation of the titratable acidity (TA) based on the classification made by [14, 15].

Extraction of Phenolic Compound by High Performance Liquid Chromatography (HPLC)

The Phenolic compound in the fresh pomegranate juices was extracted by HPLC relaying on [16], using different standard phenolic compound such as, Caffeic acid, Ellagic acid, Gallic Acid, Choestine acid, and Para Hydroxibezaoic acid. Then, the HPLC condition put in lab temperature; the analytical column: C18,0 base C18, 0 base (250 x 4.6 mm), particle size = Sum, mobile phase Acetonitrile + Acetic acid 1% (40: 60 V/V) Flow rate: 1 ml/min Detection wavelength: 280 nm.

Total Sugar Content

The total sugar content were determined by spectrophotometer according to [17]. About 1 mL of pomegranate juice was

mixed with 1 mL of 5% aqueous solution of phenol, and then 18 ml of distilling water and shaken added. After that 5mL of concentrated sulfuric acid 97% was added. It was placed in 60 °C water bath for 30 minutes, filtered by filter, and then 1 ml of solution was measured by UV-visible spectrophotometer at 490 nm. Readings were tabulated, and a calibration curve was prepared.

Determined Total Phenol Using Spectrophotometer

Spectrophotometer was used for determination of total phenol in the pomegranate juice samples. Hence, for the sample preparation, 5 ml of juice samples were taken and then dissolved in 25 ml of 95% ethyl alcohol and HCl (1.5 N) percentage 15:85 and then waited for 24 hours in 4 °C. After that, the sample was filtered by Watman. Also, the determination of total phenol solution was measured by UV-visible spectrophotometer at 280 nm. Readings data were tabulated and a calibration curve, It was prepared according to [18].

Drying Procedure

Moisture content of pomegranate juice samples was determined at 70 °C for 24 to 72 hours until the samples were stabled in the oven dryer (Model memmert), so the samples were weighed by digital balance white balance, then they were put into the oven after they were calculated [19].

Determined of Sensor Evaluation

Sensory evaluation in this study was evaluated by a trained panel, and it contained a minimum information about the nature of the evaluation.

Pomegranate juices were assessed as attributes appearance, color, texture, flavor, and taste. The rating of each characteristic was based on a 9-point scale (1 extremely dislike, 2 strong dislike, 3 moderate dislike, 4 slight dislike, 5 neutrals, 6 slight like, 7 moderate like 8 strong like, and 9 extremely like). Thus, during the evaluation, water is rinsed between each sample, and the test started at 10:30 am at room temperature [20].

Statistical Analysis

All data were analyzed using (XLSTAT-pro) program for window, version 7.5.2. The date was obtained from the analysis samples displayed as mean ± standard deviation, and analyses of Variance (ANOVA) Duncan’s multiple range tests at $P < 0.05$.

Result and Discussion

Physiochemical Properties of Pomegranate juice

Physiochemical characteristics (total solid %, total soluble solid %, water content %, pH, and total acidity %) of the fresh and marketable pomegranate juices are shown in Table (1). In this experiment, the total soluble solid (TSS) results showed the significant different between treatments, (TSS) from the fresh organic pomegranate juices are shown higher (fresh1 16.167% and fresh2 17.1%), respectively, compared to other treatments, and the lowest result was taken from OC (11.167). That results obtained from the experiments compared to other studied applied [14] were recorded (12,36% - 16.32%). According to [15] the variety could be attributed to the technique of juice production, the variety, the growing region, the growing year, and the fruit's maturity level.

Table 1: Chemical properties in fresh and commercially packaged juices

pomegranate juice	TSS(°Brix)	T.A (%)	pH	T.S (%)	Moisture (%)
Fresh1	16.167 ^b	1.054 ^c	4.027 ^c	16.904 ^b	83.096 ^f
Fresh2	17.1 ^a	1.304 ^b	4.633 ^a	18.196 ^a	81.804 ^g
OC	11.167 ^f	1.550 ^a	4.037 ^c	11.822 ^g	88.178 ^a
OS	13.1 ^d	1.663 ^a	3.610 ^d	13.583 ^e	86.417 ^c
IR	12.1 ^e	1.598 ^a	3.627 ^d	12.784 ^f	87..216 ^b
IT	14.1 ^c	1.538 ^a	3.517 ^e	15.017 ^c	84.983 ^e
IS	13.9 ^c	1.239 ^b	4.097 ^b	14.551 ^d	85.449 ^d

The pH values obtained from that study are ranged between (4.633 – 3.517). The highest was taken from the (fresh2), and the lowest was obtained from treatment (IT), and the contrast showed no significant different between treatments. That results are agree with [21], who mentioned that the pH of pomegranate juice was (3.57) at full ripeness and

rinsed with maturity, and also, that results in agreement with [22] who reported that the higher and lowest of pH in both fresh and commercial pomegranate juice were (4.17 – 2.22).

The lower percentage of total titratable acidity (TA) was found from fresh1 pomegranate juice (1.054%). That

results compared to other treatments showed the low content, and reversion to the pH value may be high in fresh pomegranate juice [22]. In addition, [21], who concluded that the percentage of total titratable acidity were lower during pomegranate fruit ripening, and [13] stated that the TA was inversely correlated with pH, and also, it was affected by preservation. Mechanical pressing and the temperature were used for pasteurization and methods of storage, and [23] also agrees with the statements. Thus, the results concluded that the treatment OS recorded the highest TA (1.663%) compared to other brands.

The highest percentage levels of total solid (TS) was found in Fresh2 (18.196 %), while the lowest TS was found in OC (11.822%). There were significant differences between all pomegranate juice brands. Despite of that the maximum percentage of moisture content was observed from OC sample (88.178 %), the lowest moisture content was found in treatment fresh2 (81.804%). Those moisture values were similar to the values observed by [23].

Phenolic Compound

In this experiment, five phenolic compounds were found in fresh and commercial marketable pomegranate juices such as, Caffeic, Choestine acid, Gallic acid, Ellagic acid and Para Hydroxibezaoic acid, and the ratio (mg/100 ml) of phenolic compound were illustrated from **Table (2)**. The highest ratio of Caffeic acid was found in parameter labeled IT (14.1 mg/100 mL), Also, the maximum ratio of Choestine acid was found in treatment (0.023 mg/100ml). In addition, the samples prepared to determine some phenolic compound are not produced the results, such as (fresh 2, OC, IT and IS for Ellagic acid. Furthermore, IR for Choestine acid, Ellagic acid and Para Hydroxibezaoic acid are not indicated in that samples, with IT for Para Hydroxibezaoic and IS for Caffeic acid. Thus, the highest ratio of Gallic acid was found in sample OS (28.100 gm/100 ml). These results taken from all parameters are in agreement with my previous studies on the pomegranate juice [24].

Table 2: Phenolic compounds in fresh and commercially packaged juices

pomegranate juice	Caffeic acid (mg/100ml)	Choestine acid (mg/100ml)	Gallic acid (mg/100ml)	Ellagic acid (mg/100ml)	Para Hydroxibezaoic acid (mg/100ml)
Fresh1	0.072 ^c	0.023 ^a	24.600 ^b	0.020 ^a	0.021 ^a
Fresh2	0.030 ^e	0.020 ^a	22.100 ^d	N.D	0.013 ^a
OC	0.270 ^a	0.013 ^{ab}	21.400 ^e	N.D	0.021 ^a
OS	0.040 ^d	0.020 ^a	28.100 ^a	0.013 ^a	0.013 ^a
IR	0.140 ^b	N.D	21.100 ^f	N.D	N.D
IT	14.1 ^c	0.013 ^{ab}	0.200 ^g	N.D	N.D
IS	N.D	0.013 ^{ab}	24.300 ^c	N.D	0.014 ^a

Total Anthocyanin, Total Phenol and Ascorbic acid

The Data in (Table 3) shows the total anthocyanin, total phenol and ascorbic acid content in different samples of the pomegranate juice. In the study, the total anthocyanins were ranged from (1.043 - 2.898 mg/100 ml) for the IT and IR juice, respectively. Total anthocyanin contents were higher in the IR juice compared to other pomegranate juices, whilst in the fresh 1 and fresh 2 juices, there is no significant difference between them (2.305 – 2.898 mg/100 ml). The total phenolic content ranged from (12.005 - 24.337 mg/100 ml) respectively. Fresh1 juice had a higher total phenol content (24.337 mg/100 ml) than the fresh2 juice (20.352 mg/100 ml). The highest total phenols were found in OS commercial pomegranate juice (18.707 mg/100 ml). The fresh1 juice had a higher content of Ascorbic acid (52.000 mg/100 ml) than the other pomegranate juice (fresh 2 and the

commercial juices). The commercial pomegranate juices did not have a significant difference with the fresh2 juice, ranged from (21.000 - 31.000 mg/100 ml), respectively. The lowest ascorbic acid was found in the IR juice (21.000 mg/100 ml). The quality of pomegranate seed and juice is red pigmentation, which is one of the most important characteristics of pomegranate [25]. Consequently, the major compound accountable for purple-red colors are Anthocyanins (glycosylated anthocyanidins) [5].

However, the chemical compound in fresh pomegranate juices were affected by variety, climate condition, species and processing methods [3, 24]. Thus, the processing methods of extraction have a significant impact on anthocyanin compounds, phenolic and ascorbic acid in fresh fruit juice [26]. Therefore, the total phenolic compounds obtained from the seed alone were higher than the juices taken from holly fruit [2].

Table 3: Total anthocyanin, total phenol, and ascorbic acid in fresh and commercially packaged juices

pomegranate juice	Total Anthocyanin (mg/100ml)	Total Phenol (mg/100ml)	Ascorbic acid (mg/100ml)
Fresh1	2.305 ^a	24.337 ^a	52.000 ^a
Fresh2	2.898 ^a	20.352 ^b	31.000 ^b
OC	1.428 ^b	19.722 ^b	27.000 ^c
OS	1.920 ^{ab}	18.707 ^b	22.000 ^{de}
IR	1.328 ^b	12.005 ^c	21.000 ^c
IT	1.043 ^{bc}	12.102 ^c	23.000 ^d
IS	1.214 ^b	13.378 ^c	26.000 ^c

Sensory Evaluation

Table (4) illustrated the sensory evaluation between samples taken from the local variety pomegranate juice and shelf markets juice. Likewise, some characteristics (flavor, color, taste, and texture) were used to evaluate the juices taken from the pomegranate. The date found from the sensory evaluation after analysis, and compared between treatments showed that there were no significant variation in the color of the treatment (Fresh1) and the sample (Fresh2), and the treatments (Fresh1)

and (Fresh2) (7.00) had the best color and sensory attributes. In term of visual color, both Fresh1 and Fresh2 showed red color, which was related to anthocyanin pigments [13]. In addition, the (OC) treatment shows the lowest color score, in addition to that results obtained from the treatments. [27] mentioned that the processing and storage conditions affected the color of pomegranate. Furthermore, [28] stated that the anthocyanins were not stable resulting from color changes during process and storage.

Table 4: Sensory evaluation for all types of commercial and homemade organic juice

pomegranate juice	color	taste	Flavors	texture
Fresh1	7.000 ^a	7.600 ^a	6.900 ^a	7.400 ^a
Fresh2	7.000 ^a	6.300 ^{ab}	6.600 ^a	7.200 ^a
OC	3.000 ^c	3.800 ^{cd}	4.000 ^b	4.100 ^{bc}
OS	3.700 ^{bc}	3.200 ^d	3.800 ^b	3.900 ^c
IR	5.300 ^{ab}	5.444 ^{bc}	5.300 ^{ab}	5.600 ^b
IT	5.000 ^b	4.700 ^{abd}	4.300 ^b	5.100 ^{bc}
IS	3.900 ^{bc}	3.778 ^{cd}	3.800 ^b	3.800 ^c

Taste assessment is an admirable characteristic for the consumer, and the experiment carried out to compared the fresh and commercial pomegranate juice demonstrates that the treatment (Fresh1) had a higher score (7.600) compared to the other treatments. Therefore, in relation to taste, there were insignificant differences between the treatments (Fresh1 and Fresh2) compared to the majority of commercials (OC, OS, IR, IT, IS). It might relate to different preparation processes [27]. For the

flavor characteristics, the findings of table (4) revealed a significant difference between the treatments (Fresh1) and (OG, OS, IT, IS), but no significant difference between the treatments (Fresh1) and (Fresh2, IR). Furthermore, the treatment (Fresh1) had a much greater Flavor value, which indicated (6.900), and the (OS and IS) treatments had the lowest flavor values of (3.800)/. The different raw materials and processes might be reasons for these different tastes, and the results agree

with [3]. The texture characteristic results showed that the treatments (Fresh1, Fresh2) had a higher texture score, and there was no significant difference between them. Furthermore, the sample (Fresh1) had a higher score compared to (IS) treatment, which obtained the lower score.

Type of Sugar (Fructose, Glucose and Sucrose)

In our analysis, we found out the ratios of different types of sugar (fructose, glucose, and sucrose) illustrated from the **Table (5)**, and they played an important role in pomegranate juice quality [4]. In this study, sample (OS) was given the

highest level in fructose (0.140 mg/100 ml), which is due to the additional amount of sucrose added to the product. As the table shows, equal value between sample (fresh1) and (OS) is (0.080 mg/100 ml). Another sample shows that glucose is the highest for sample (IT) (0.120 mg/100 ml), while glucose is the lowest level in sample (OC), which is (0.004 mg/100 ml), as already reported by [22]. The values for fructose were almost in the same range. For the samples (fresh2), (OG), and (IS), it is (0.130 mg/100 ml), as in a previous study on pomegranate juice, we reported the similar results [24].

Table 5: Illustrated the fructose, glucose and sucrose for all types of commercial and homemade organic pomegranate juice.

pomegranate juice	Fructose (mg/100ml)	Glucose (mg/100ml)	Sucrose (mg/100ml)
Fresh1	0.120 ^{ab}	0.016 ^d	0.080 ^a
Fresh2	0.130 ^a	0.005 ^d	0.030 ^{cd}
OC	0.130 ^a	0.004 ^d	0.040 ^{bc}
OS	0.140 ^a	0.090 ^{bc}	0.080 ^a
IR	0.050 ^b	0.100 ^b	0.020 ^d
IT	0.070 ^{ab}	0.120 ^a	0.040 ^{bc}
IS	0.130 ^a	0.085 ^c	0.050 ^b

Conclusion

The sensory evaluation with nutritional content in this study was studied. Fresh pomegranate juices prepared by hands contained more total soluble solid (brix), total solid, and pH and lower moisture and total acidity. Marketable pomegranate juices compared to other samples had a lower phenol compound, Ascorbic acid and total Anthocyanin than handmade samples of pomegranate juices. This is due to that vitamin C

breakdown can occur during industrial processes like pasteurization and storage packaged pomegranate juice. Sensory characteristics carried out in this experimental considerably varies between homemade and marketable pomegranate juices, depending on the sugar content, organic acid, the phenol component, and anthocyanin compound in pomegranate juices. Thus, this experiment illustrated that the home made pomegranate juices can be

beneficial than the marketable pomegranate juices. Hence, we recommend to the researchers to study more on this topic to be find the new records of most benefits of pomegranate juices.

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