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The Effectiveness of Some Heat Treatments on the Specifications of Local and Imported Pomegranate Juice

Ziad Tariq Samir

Department of Food Sciences, College of Agriculture, Tikrit University

Abstract: This study was conducted to find out the physical and chemical properties of some local and imported juices. It studied the concentration of (Total dissolved solids, total sugars, reducing sugars, total acidity, pH, ascorbic acid). The results of the study showed that there was no effect of heat treatment on the juice content of Total dissolved solids, total sugars, acidity and PH value, while a significant decrease in the amount of ascorbic acid was observed after heat treatment, which reached 2.24 mg/100 ml in the Egyptian variety, 1.68 mg/100 ml. In the Iraqi variety, using the first pressing method M1. As for the samples heat-treated using the second pressing method M2, the amount of ascorbic acid was 2.03 mg / 100 ml in the Egyptian variety, and 1.65 mg / 100 ml in the juice of the Iraqi variety. As for the samples heat-treated using the third pressing method M3, the amount of ascorbic acid was 2.07 mg / 100 ml in Egyptian variety and 1.77 mg/100 ml in Iraqi variety juice. The anthocyanins, total phenolic substances, and antioxidant activity were also measured, and when conducting heat treatment, a decrease in the Quantity of total anthocyanins was noted, and there was also a difference in phenols and oxidative activity.

Keywords: pomegranate juice, heat treatments, chemical composition.

1. INTRODUCTION

The juice industry has witnessed a clear development in recent years in terms of the techniques used in manufacturing as well as the quantity of production compared to the past few years, where the industrial processes witnessed the production and preparation of innovative types of juice products, as well as in the context of competition between manufacturers (Ashoush., 2012; et al.,2010 Robert). The consumption of juices increases or decreases depending on multiple conditions, the most important of which is the weather in a region, as the high temperature causes an increase in fluid consumption so that the body can perform its vital functions in an ideal manner and avoid the negative effects of high temperatures. In addition, juices are considered an important source of vitamins, minerals, fiber and carbohydrates that are of vital benefit to the body (Altan and maskanm., 2005; Saenz et al., 2010). Fruit juices, especially unpasteurized or unsterilized juices, have been reported to be a source of many bacteria, such as E.coli 0157, Salmonella (Adams et al., 2006). Fresh fruit juices were also considered among the prominent causes of food-borne diseases (Arjmand., 2011; Sumner et al., 2005). It is also known that there are types of microorganisms such as yeasts, spores and fungi on the outer surface of fruits as a result of direct contact of these fruits with soil, insects and animals during Its growth, harvesting, transportation and storage processes (Ashoush., 2012; Seeram et al., 2008).

2. MATERIALS AND METHODS OF WORK

Manufacture of pomegranate juice: Sorting the fruits that are free from mechanical, insect and other diseases, and that do not conform to specifications. The fruits were washed with clean water to remove impurities and dirt, and the outer peel was dried with a clean, dry cloth. The juice was obtained according to the following two methods (Debasis et al., 2000):

The first method M1: The fruits were cut into varieties and the juice was extracted through a manual pressing machine by pressing the halves of the fruits, and receiving the juice directly through a clean container (Still., 2006).

The second method M2: The pomegranate kernels were separated manually and the thin films that separated the kernels were removed from each other, and then the kernels were mashed through an electric mixer to obtain the juice (Singh et al., 2007).

Juice filtering: the juice was filtered using stainless steel strainers with micro-holes to get rid of pomace residues and suspended solids (Shulman et al., 1984).

Juice filling: The juice was packaged in sterile and dry glass bottles of 330 ml capacity, and aseptic and dry tubes of 20 ml capacity (Tezcan et al., 2009).

juice condensation

The first method: Concentration according to the traditional method and symbolized by C1: the pomegranate juice was concentrated by heating it in a container made of stainless steel at regular atmospheric pressure and at a temperature of 90 °C with continuous stirring until reaching the final concentration of 70 Brix, then keeping the concentrate in sterilized, dry, airtight glass containers with a capacity 330 ml (Dafny-Yalin, 2010).

The second method: Concentration under vacuum and symbolized by C2: The pomegranate condensation was concentrated using a temperature-controlled vacuum concentration unit and LTE level, at a temperature of 50-55 °C, and a pressure of 350 mm Hg/cm2, until reaching the final concentration of 70 Brix. Then the concentrated juice was kept in sterile, dry, airtight glass containers with a capacity of 330 ml (Dhumal, 2015).

The third method: Concentrate using the microwave and symbolized by C3: using a microwave until the final concentration is reached 70 Brix, then save the concentrated juice in sterile, airtight glass containers with a capacity of 330 ml (Fellow, 2000; Van et al., 2004; Wrolstad et al., 2005).

The tests

Measurement of total dissolved solids: Total solids in pomegranate juice were measured using an Atago RX5000 digital refractometer (Atago Co,Ltd,Japan) at a temperature of 20°C, and the results were expressed as Brix.

Determination of total acidity: by titration with 0.1 NaOH solution, measured on the basis of citric acid (AOAC 2000).

Estimation of PH: Using a device (Germany and Inolab 730), which automatically adjusts the temperature at a temperature of 20 °C, after calibrating it with a standard solution at PH 7.0 and PH4.0.

Determination of the quantity of reducing sugars: Reducing sugars were determined by using Eynon & Lane method by titration with Fehling's solution after the process of clarification of the juice with lead acetate and potassium oxalate. Determination of the amount of vitamin C. In the form of 2,6-Diclorophenol indophenol (Jackson & Linshens 1995).
Determination of total phenolic content TPC: Total phenols were measured using Folin-Siocaltio (AOAC 2000).
Estimation of the antioxidant activity AA: using the DPPH method (Picrylhydrazyl 2,2 dipheny1-1), which is based on measuring the ability to inhibit free radicals in the sample (AOAC 2000).
Determination of anthocyanins: The amount of anthocyanins present in pomegranate juice was estimated using the pH method according to Rasisarada, Fallico, 1220, & Maccarone, 1994 and measured at a wavelength of 700 nm (AOAC 2000).
Viscosity determination: The viscosity of pomegranate juice was determined using a Spanish-made HAAKE Visco Tester 6R viscometer (AOAC 2000).
Determination of metallic elements: using atomic absorption spectrometry analyzer produced by Blotech company phoenix model and using flame technique with high purity acetylene gas as leaching gas and air as oxidizing gas (AOAC 2000).

3. RESULTS AND DISCUSSION

Effect of pressing methods on the chemical composition of pomegranate juice: The percentage of juice reached 50.60% in the Egyptian variety and 50% in the Iraqi variety when using the first pressing method, with a percentage of M1, and 65%-55% when using the second method M2. The percentage of juice reached 68%-58% when using the third method M3. The percentage of total dissolved solids was 14.90 Brix and 13.18 Brix at the first pressing method M1, and 14.80 Brix and 13.30 Brix at the second press M2, and 14.79 Brix and 13.28 Brix at the third pressing method M3 in all the two varieties, respectively. This difference in the total dissolved solid matter is due to the difference in the variety, cultivation methods and the used pressing method.
The total acidity percentage was 1.51% -1.49% when using the first method M1, while the value was 1.72%-1.43% when using the second method M2, and it reached 1.75%-1.40% when using the third method for both types, respectively, and this is consistent with what was found to it by (Heshi et al., 2001). As for the PH value, it reached 3.33-3.86 in the pressing resulting from the first method M1, 3.40-2.83 in the resulting from the second method, 3.32-2.82 in the resulting from the third method in both varieties, respectively.

Table (1) Effect of pressing methods on some components of the chemical composition of pomegranate juice

Iraqi variety			Egyptian variety			variety
M3	M2	M1	M3	M2	M1	the components
13.28	13.30	13.18	14.79	14.80	14.90	Total dissolved solids
12.28	12.30	12.36	15.38	15.45	15.12	Total sugars %
10.40	10.42	10.48	14.38	14.23	14.74	Reducing sugars
1.75	1.72	1.51	1.40	1.43	1.49	Total acidity

2.82	2.83	2.86	3.32	3.40	3.35	The PH
4.81	4.60	4.62	7.50	7.46	7.40	Ascorbic acid mg/100ml

Ascorbic acid reached 7.40 mg / 100 ml when using the M1 pressing method, 7.46 mg / 100 ml when using the M2 pressing method, and 7.50 mg / 100 ml when using the M3 pressing method. While the amount of ascorbic acid was 4.62 mg / 100 ml in the M1 pressing method, 4.60 mg / 100 ml when using the second pressing method M2, and 4.81 mg / 100 ml when using the third method M3 in both varieties, respectively, and this is consistent with what was reached by (Holland et al., 2008).

The pomegranate juice produced by the Egyptian variety also outperformed in the percentage of total dissolved solids and total sugars over the juice produced from the Iraqi variety, which was positively reflected on the harmonious taste of the juice of the Egyptian variety, while the acidity percentage increased in the Iraqi variety, so we suggest a directive to use in the manufacture of concentrates. (Holland et al., 2009).

Effect of pressing and heat treatment methods on the chemical composition of pomegranate juice: From Table No. (2) we note that there is no effect of heat treatment on the juice content of total dissolved solid, total sugars, acidity and PH number, in that a significant decrease in the amount of ascorbic acid was observed after the treatment Thermal temperature reached 2.24 mg / 100 ml in the Egyptian variety, 1.68 mg / 100 ml in the Iraqi variety, using the first pressing method M1.

As for the heat-treated samples using the second pressing method M2, the amount of ascorbic acid was 2.03 mg/100 ml in the Egyptian variety, and 1.65 mg/100 ml in the juice of the Iraqi variety. As for the samples heat-treated using the third pressing method M3, the amount of ascorbic acid was 2.07 mg/100 ml. in the Egyptian variety and 1.77 mg/100 ml in the juice of the Iraqi variety, and this is consistent with what was reached by (Saad et al., 2012; Gil et al., 2000).

Table (2) Effect of pressing methods on some components of the chemical composition of pomegranate juice

Iraqi variety						Egyptian variety						variety
Heat treated juice			fresh juice			Heat treated juice			fresh juice			
M3	M2	M1	M3	M2	M1	M3	M2	M1	M3	M2	M1	the components
13.17	13.20	13.07	13.28	13.30	13.18	14.20	14.24	14.56	14.79	14.80	14.90	Total dissolved solids
12.14	12.17	12.31	12.28	12.30	12.36	15.29	15.20	15.08	15.38	15.45	15.12	Total sugars %
10.31	10.34	10.36	10.40	10.42	10.48	14.07	14.00	14.20	14.38	14.23	14.74	Reducing sugars
1.63	1.62	1.41	1.75	1.72	1.51	1.41	1.40	1.45	1.40	1.43	1.49	Total acidity

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2.76	2.76	2.80	2.82	2.83	2.86	3.28	3.35	3.30	3.32	3.40	3.35	The PH
1.77	1.65	1.68	4.81	4.60	4.62	2.07	2.03	2.24	7.50	7.46	7.40	Ascorbic acid mg/100ml

Effect of pressing and heat treatment methods on the antioxidants of pomegranate juice: From Table (3) it is clear that the total amount of anthocyanins reached 735.3 mg/L in the fresh Egyptian variety, where the Egyptian variety outperformed the Iraqi variety in this criterion, and this was reflected positively in the color of the resulting juice, which appeared more Clarity and concentration, and this is due to the difference in the variety and type of cultivation, such as irrigation, fertilization and others. Also, there were no significant differences for the effect of the pressing method on the total content of total anthocyanins (Incedagi et al., 2010). When conducting heat treatment, a decrease in the total amount of anthocyanins was observed from (735.3 mg/l) to (637.2 mg/l) in the Egyptian variety, and from (372.3 mg/l) to (315.4 mg/l) in the Iraqi variety, i.e. by 13%. When using the M1 first pressing method.

When using the second method M2, a decrease in the total amount of anthocyanins was observed from (727.1 mg/l) to (506.6 mg/l) in the Egyptian variety, from (375.6 mg/l) to (332.7 mg/l) in the Iraqi variety, i.e. by 8%. On the use of the second pressing method M2. And from (757.1 mg/l) to (558.7 mg/l) in the Egyptian variety, and from (374.9 mg/l) to (330.9 mg/l) in the Iraqi variety, i.e. 6% when using the M3 three-press method (Kaplan et al. , 2001).

Table (3) Effect of the methods of pressing and heat treatment on antimicrobials

antioxidant activity %	Total phenolic substances mg/100 ml	Total anthocyanins mg/L	the treatment	variety
75.67	1143.32	735.3	M1	Egyptian (fresh) Iraqi (fresh)
65.72	134.43	727.1	M2	
75.24	1137.77	757.1	M3	
67.27	1024.01	657.2	M1	Egyptian (heat treated)
60.38	121.23	506.6	M2	
68.81	1026.37	558.7	M3	
89.49	1123.83	372.3	M1	Iraqi (fresh)
86.26	242.39	375.6	M2	
87.39	1314.96	374.9	M3	
86.19	1052.39	315.4	M1	Iraqi (heat treated)
81.56	205.46	332.7	M2	
83.12	1123.86	330.9	M3	

The total amount of phenols was (1143.32 mg/100ml) in fresh Egyptian pomegranate juice and (1123.83 mg/100ml) in fresh Iraqi juice using the M1 first pressing method. When using the second pressing method M2, the amount of total phenols was less (134.43 mg/100 ml) in the Egyptian cultivar and (242.39 mg/100 ml) in the Iraqi cultivar. Therefore, we note from the previous table that there are significant differences in the amount of total phenols resulting from the different methods of the pressing (Mirdehghan et al., 2006), These differences are attributed to the effect of the outer shell and the inner shell separating the pomegranate grains, which leads to the transfer of a large amount of phenolic compounds in the peel to the juice resulting from pressing, This indicates that there are significant differences in the effect of the pressing method used on the juice content of total phenolic substances (Maskan, 2006).

When conducting heat treatment, a decrease in the total phenols amount was observed from (1143.32 mg/100 ml) to (1024.01 mg/100 ml) in the Egyptian variety, and from (1123.32 mg/100 ml) to (1052.39 mg/100 ml) in the Iraqi variety when following the first pressing method. M1. And from (134.43 mg/100 ml) to (121.23 mg/100 ml) in the Egyptian variety, and from (242.39 mg/100 ml) to (205.46 mg/100 ml) in the Iraqi variety, when using the second M2 method. And from (1137.77 mg/100 ml) to (1024.01 mg/100 ml) in the Egyptian variety and from (1314.96 mg/100 ml) to (1123.86 mg/100 ml) in the Iraqi variety when following the third pressing method M3. From the above, we note that there are no significant differences for the effect of heat treatment on the total content of total phenols of pomegranate juice in both varieties and according to the different pressing methods used (Manuel Valero et al., 2014).

The values of oxidative activity (inhibiting free radicals) ranged between 75.67% in the Egyptian variety and 89.49 in the Iraqi variety, when using the first pressing method M1. Using the second pressing method M2, where the value of the oxidation activity in the Egyptian variety was 65.72% and 86.26 in the Iraqi variety, and by using the third pressing method, the value of the oxidation activity in the Egyptian variety reached 75.24% and 87.39% in the Iraqi variety. Which indicates a relationship of total phenols and antioxidant activity, as the value of antioxidant activity increased due to the increase in the amount of total phenols produced (Monica et al., 2013; Miguel et al., 2004).

the pomegranate juice extracted by the first method M1, was superior to the pomegranate juice extracted from the granules by the second method M2 and the third M3, in its inhibition of various oxidation factors, and this is due to the presence of additional phenolic compounds in the juice produced when using the pressing method, compared with the juice produced when using the second method M2 The third is M3 (Poyrazoglu et al., 2002). (Gil et al., 2000) indicates the presence of compounds such as punicalagins and ellagic acid derivatives in commercial pomegranate juice extracted from the whole fruit compared with laboratory pomegranate juice extracted from grains and returns, to extract phenolic compounds in addition to the peel, under the influence of pressure and their transfer to the juice. Also (Singh et al., 2002) concluded that the extract of pomegranate peels possesses a higher antioxidant activity than the extract of the granules, which is due to the presence of very effective phenolic compounds in the peels other than those in the granules. When using heat treatment, the value of the antioxidant activity reached 75.67% in the Egyptian variety and 89.49% in the Iraqi variety using the first pressing method M1. Where this value reached 65.72% in the Egyptian variety, 86.26 in the Iraqi variety using the second pressing method M2, and reached 75.24% in the Egyptian variety and 87.39% in the Iraqi variety when using the third pressing method M3. This indicates that there were no significant differences for the effect of heat treatment on the antioxidant activity of the extracted juice (Poyrazogln et al., 2002; Perez et al 2002).

Effect of pressing and heat treatment methods on the mineral elements of pomegranate juice: The study showed that the juice's mineral content was superior to the Egyptian juice in its content of mineral elements, the most important of which are calcium and iron, while the Iraqi pomegranate juice outperformed it in its zinc content. And there was no significant effect of the difference of pressing methods in the content of mineral elements (Rosenblat and Aviram, 2006).

Table (4) Effect of pressing and heat treatment methods on metallic elements

Iraqi variety			Egyptian variety			metallic elements
M3	M2	M1	M3	M2	M1	
11.23	11.19	11.01	18.89	18.72	18.59	Ca mg/L
4.31	4.25	4.35	12.30	12.21	12.00	Fa mg/l
1.81	1.92	1.92	0.191	0.195	0.210	Zn mg/l

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