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PHYSICOCHEMICAL AND SENSORY EVALUATION OF THE TYPES OF POMEGRANATE MOLASSES AVAILABLE IN LOCAL MARKETS AND ITS CONFORMITY WITH THE IRAQI STANDARD

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ABSTRACT
Pomegranate molasses (PM) are used as a condiment and believed to have an important effect for blood pressure, cholesterol levels and cancer prevention due to the antioxidant potential of pomegranate fruit itself. Although data about the importance of pomegranates in human nutrition has increased extensively nowadays, the physical and chemical characteristics of some different kind of PM that locally processed and that's imported from different origin to Iraq have not been investigated in detail yet. Therefore, the evaluation of physicochemical characteristics of PM was the aim of the present study. It was found that the nutrition information and general requirements of the Iraqi samples did not follow the Iraqi Quality Standard (IQS) compared to the Turkish samples which were following the IQS. Also, it was found the physical analyses of PM samples were found as: pH significantly varied from 2.17 to 2.70, lumps content was found a lot in Iraqi and Lebanon samples, while there were no lumps in all Turkish samples. While the chemical composition of PM samples were found as: the water soluble dry matter varied from 74 to 76%, total acidity (as citric acid %) varied from 7.0 to 7.4, viscosity from 1140 to 1800 mPas, and total soluble solid varied significantly from 69.8 to 79.5. It was found the total polyphenols content, of PM varied from 254.6 to 290.5 mg of gallic acid equivalent per gram of PM. Also, It was found that Iraqi brands Al-Taff was significantly contaminated with Copper and Lead 0.4553 and 0.2847mg/kg respectively.

KEYWORDS: Pomegranate molasses -physicochemical analysis-polyphenols- minerals and microbial contamination.

INTRODUCTION

The pomegranate fruit (*Punica granatum* L.), one of the oldest edible fruits that widely grows in many tropical and subtropical countries has been considering as a food [Akpinar *et al*., 2016; Rinaldi *et al*., 2013]. They are widely cultivated in Asia, the Mediterranean border and USA as well as in most near and far east countries [Schubert *et al*., 1999]. Turkey, India, Iran, Egypt, Tunisia, Spain, and Morocco are the most of leading producers of pomegranate [Anonymous, 1986; Ercisli *et al*., 2011]. The popularity of pomegranate is mainly due to a protective role in prevention of lipoprotein oxidation, blood pressure, inflammation, atherosclerosis, prostate cancer, heart disease (Johanningsmeier & Harris, 2011). These beneficial effects have been attributed due to the presence of diverse 'phenolic compounds', including (Gallic acid, protocatechinunic acid, chlorogenic acid, caffeic acidferulic acid, coumaric acid), and anthocyanins (Kulkarni & Aradya, 2005; Viuda-Martos *et al*., 2010).

Pomegranate is consumed both as fresh fruit and fruit juice. It is also being used in the production of jam, wine, liqueur, food coloring agent and flavor enhancer. The kernels are also used as a garnish for desserts and salads (Al-Maiman and Ahmad, 2002). Pomegranate molasses, a concentrated pomegranate juice is a traditional Middle Eastern ingredient made from cooked down pomegranate juice [Yadav *et al*., 2006; Chalfoun-Mounayar *et al*., 2012]. Thick and syrupy in texture, pomegranate molasses provide sour, tangy flavor and is dark in colour. Its sweetness comes from the concentration of the fruits natural sugars [Yadav *et al*., 2006]. Traditional methods are still being used to produce pomegranate molasses. It is concentrated simply by boiling, without any or addition of further sugar or other additives (Tekeli, 1965; Gökçen *et al*., 1982). (Marti *et al*., 2001; Poyrazoğlu *et al*., 2002; Altan and Maskan, 2005; Maskan, 2006). A typical processing requires cleaning, crushing, extraction, filtration, clarification and evaporation in open vessel or under vacuum. Clarification step is generally omitted since consumers prefer bitterness and sourness caused by phenolic substances and acidity (Kaya and Sözer, 2005), though different type of fruits requires different production methods (Vardin and Abbasoğlu, 2004). Pomegranate molasses is a highly nutritive product since it is processed as concentrate. Especially the presence of high mineral contents of the fruit are in higher concentration of the molasses, makes it an exceptional nutritional properties and it was found that to have a good antioxidant activity an important aspect important for human health (Bige *et al*., 2010). It is typically used to flavor chutneys, curries and salad dressings to glaze or tenderize meat products (Dhinesh and Ramasamy, 2016). The general characteristics of pomegranate molasses according to Iraqi standard of pomegranate molasses (TSE 12720) were shown in Tables, 1, 2, and 3 respectively Iraqi markets is one of the leading importers of too many surplus goods, one of that is pomegranate molasses. Pomegranate molasses (PM) is a large compound of the different Iraqi diets, which is commonly used in salads, Sauce, sour desserts and many dishes. Till now, no research has been

performed on this product. So that, the purpose of this present review to measure the physicochemical measurements of the different market brands imported pomegranate molasses and local products for their composition and the components that are of importance for nutrition and health, and if that products is identical to the Iraqi standards requirements of their heavy metal contamination, microbial content, physicochemical properties and nutrition facts.

MATERIALS & METHODS

In this study, six different market brands of pomegranate molasses were analyzed. The samples were analyzed as triplicate at room temperature. Water soluble dry matter, viscosity, the presence of glucose syrup, total acidity, pH, and some heavy metals (Cadmium, mercury, manganese, cobalt, arsenic and boron) of the samples were determined. The water soluble dry matter content (brix) of the samples was expressed as g/100g by using an Abbe Refractometer (Cemeroğlu, 1992). Presence of glucose syrup was verified qualitatively 10 g of sample was diluted with 10mL distilled water then filtered. 1-2 drops of 10% ammonium oxalate solution were added. After heating for a short time, activated carbon included and again it was heated. Solution was filtered and 2mL of the filtrate was mixed with 2 drops of 37.5 % HCl and 20 mL 96 % ethyl alcohol. If the solution contained glucose syrup, solution become blurred the color changed to white (Cemeroğlu, 1992). Viscosity was measured in mPa.s using a (Rotational spindle viscometer, MYr, Shanghai Precision & Scientific Inst. Co. Ltd.) as shown in page 11. Total acidity was determined as citric acid, by titrating samples against NaOH solution of known normality (AOAC, 2005). pH was measured potentiometrically by a Nel-pH 890 model pH meter. Titratable acidity (TA) was determined by titration to pH 8.1 with 0.1 M NaOH solution and expressed as g of citric acid per 100 g of juice (Anon, 1984). The pH measurements were performed using a digital pH meter (Metrohm model 601) at 21°C. Total soluble solids (TSS) were determined with a digital refractometer (Erma, Tokyo, calibrated using distilled water). The results were reported as Brix at 21°C. Minerals that are present in significant amounts were determined according to the wet ashing method in the TS 4887-05/1986 by using Shimadzu AA 6701 F atomic absorption spectrometer and expressed as mg/100g (Anonymous, 1986).

Measurement of polyphenols

Total phenolic contents of six brands pomegranate molasses were measured, according to Singelton *et al*. (1999) using Folin-Ciocalteu reagent and gallic acid as standard. Briefly, 0.1 ml distilled water and 1 ml of Folin-Ciocalteu reagents was added and the flask was shaken thoroughly. After 3 min, 3 ml of 2% Na_2CO_3 solution was added and the mixture was allowed to stand for 2 h with intermittent shaking. Absorbance was measured at 760.

Microbial tests

Different market brands of pomegranate molasses were examined for total viable count, total coliform count, Staphylococcus, yeast and mold count. For total viable count of bacteria, colony count method was used according to Laboratory Methods in Dairy Products Company (IQS, 11987). The total number of viable bacteria per gram of pomegranate molasses was obtained by multiplying the number of colony forming units (CFU) on the plate with respective dilution factor and then was converted into logarithmic form. Total coliform (MPNg-1) Yeast and mold were determined according to the Standard Methods for Examination of Dairy Products by Iraqi Standard (IQS).

Statistical Analysis

The Statistical Analysis System- SAS (2012) program was used to effect of difference factors in study parameters. Least significant difference –LSD test was used to significant compare between means in this study.

RESULTS & DISCUSSION

This study showed the packaging information's of PM that's available in local market in the capital city of Baghdad especially that's locally processing did not follow the IQS of PM product as was shown clearly in table 1. Also, it was found that type of packaging is soft and does not locked good. In addition of that there were no batch number, E-mail and the contents, so that not follow the IQS order. So that, its mean the absence of the Health Monitoring of all the goods that's available in all Iraqi markets that has a big effect on human health.

TABLE 1: shows the general requirements of the different market brands pomegranate molasses available in local markets recording to IQS*

Samples	Country's Origin	Package Type	identification card	Production and expiring date	Batch number	Email	Contents
Al-Taff	Iraq-Karbala-	Plastic	+	+	-	+	-
Rawa	Iraq-Zakho-	Plastic	+	+	-	+	+
Yamama	Labonan	Vitreous Glases	+	+	+	-	+
Bill-Back	Turkya	Plastic Hard	+	+	+	+	+
Syra	Turkya	Vitreous	+	+	+	+	+
Altonsa	(Turkya)	Vitreous	+	+	+	+	+
The minimum level accepted as IQS*	+	+	+	+	+	+	+

+= means menshoned, _=means not menshoned, IQS*=Iraqi quality standard

Altaff (Karbaka)-Iraq, 2=Rawa (Zakho-Kurdistan)-Iraq, 3= Yamama (Labanon), 4= Bill Back (Turkey), 5=Sera (Turkya), Altonsa (Turkya) and ICS= Iraqi Codex Standard. + means it's mentioned and – means it's not mentioned.

Table 2, shows the physicochemical composition of PM samples were found as: pH of the samples ranged from 2.17 to 2.70 which significantly difference (P<0.05). While there were no significant differences in titration acidity and total solid % (P>0.05). It was found clearly there were a lot of lumps in Iraqi brands only and significantly difference (P<0.05), that's refers to the bad processing and the absence of healthy monitoring organization and not follow the regulation of Iraqi quality standards compared with foreigner brands. Viscosity, presence of glucose syrup, and total soluble solid were highly significant differences (P<0.05) through all samples.

TABLE 2: shows the physical examination of the different market brands pomegranate molasses

Samples	PH	Titration acidity (as citric acid) %	Total solid %	Lumps	Viscosity (mPas)	Presence of glucose syrup	Refractometer (TSS-total soulable solid)
Al-Taff	2.50 ab	7.2 a	74 a	Few lumps	1500 b	+	79.0 a
Rawa	2.70 a	7.0 a	76 a	Nil	1360 c	+	79.5 a
Yamama	2.17 b	7.4 a	75 a	Many lumps	1800 a	+	69.8 b
Bill-Back	2.50 ab	7.2 a	75 a	Nil	1150 d	-	74.7 ab
Syra	2.40 ab	7.3 a	74 a	Nil	1140 d	-	73.1 ab
Altonsa	2.40 ab	7.2 a	75 a	Nil	1142 d	-	74.0 ab
The minimum level accepted as IQS (mg/kg)	-	≥7.5	≥64	No lumps	-	-	-
LSD value	0.502 *	0.744 NS	6.296 NS	--	146.63 *	-	6.259 *

Altaff (Karbaka)-Iraq, 2=Rawa (Zakho-Kurdistan)-Iraq, 3= Yamama (Labanon), 4= Bill Back (Turkya), 5=Sera (Turkya), Altonsa (Turkya) and Iraqi quality Standard (IQS) * (P<0.05).
Means having with the different letters in same column differed significantly.

Total phenolic content of pomegranate molasses were shown in Table 3. It was shown clearly the dosage of total polyphenols in Iraqi brands Al-Taff and Rawa are higher than imported brands from Lebanon and Turkey. Since pomegranate molasses is a concentrated product, It was expected to have high phenolic content. However, due to thermal processing conditions (simply boiling) and inclusion of saccharides syrup to give a caramelized flavor with artificial pomegranate flavor phenolic contents were low (A. Akpinar-Bayizit, et al. 2016).

TABLE 3: Analysis of total polyphenols in six different samples of different brands pomegranate molasses as (GA: Gallic acid).

Molasses brands	Total Polyphenols (mg GA equivalent/L)
Al-Taff (Iraqi)	289.5
Rawa (Iraqi)	290.5
Yamama (Lebanon)	268.6
Bill-Back (Turkish)	252.3 ± 33.67
Syra (Turkish)	255.5
Altonsa (Turkish)	254.6

Altaff (Karbaka)-Iraq, 2=Rawa (Zakho-Kurdistan)-Iraq, 3= Yamama (Labanon), 4= Bill Back (Turkya), 5=Sera (Turkya) and Altonsa (Turkya).

TABLE 4: shows the proportion of metal contaminants (PPM) of different market brands pomegranate molasses in Local Iraqi markets

Samples	Fe mg/kg	Mg mg/kg	Mn mg/kg	Copper mg/kg	Zinc mg/kg	Cr mg/kg	Cd mg/kg	Arsenic mg/kg	Lead mg/kg
Al-Taff	0.9253 a	0.4772 a	0.3297 ab	0.4553 a	0.1068 a	1.1204 a	0.8917 a	0.0901 a	0.2847 b
Rawa	0.7822 ab	0.5034 a	0.4560 a	0.0109 b	0.1424 a	1.1560 a	0.9320 a	0.0092 a	0.4449 a
Yamama	0.5653 b	0.5521 a	0.2789 b	0.1750 b	0.0890 ab	0.9532 ab	0.7504 a	0.0089 a	0.3559 ab
Bill-Back	0.5560 b	0.4925 a	0.3400 ab	0.0109 b	0.0350 b	0.8562 b	08022 a	0.0077 ab	0.2847 b
Syra	0.7230 ab	0.6033 a	0.3521 ab	0.0073 b	0.0335 b	0.8523 b	0.7985 a	0.0056 b	0.3381 ab
Altonsa	0.5662 b	0.5283 a	0.3422 ab	0.0060 b	0.0422 b	0.7653 b	0.7254 a	0.0055 b	0.3352 ab
The minimum level accepted as IQS	-	-	-	0.21	0.1	-	-	0.1	0.1
LSD value	0.266 *	0.281 NS	0.179 *	0.106 *	0.077 *	0.257 *	0.296 NS	0.033 *	0.161 *

* (P<0.05). Means having with the different letters in same column differed significantly.

Minerals contents

Table 4 shows the contents of edible minerals and heavy metals of PM samples. Iron contents are high and significantly different (P<0.05) among the brands, it ranged from 0.9253 to 0.5560. Also, the zinc content were high in Iraqi brands compared with Turkish brands and its significantly differences (P<0.05) and within the range of IQS. It was shown that, Iraqi brands Al-Taff was contaminated with Copper and Lead 0.4553 and 0.2847 mg/kg respectively, and does not follow the IQS as shown

in the table below. In addition of that all PM brands contaminated with Lead significantly ($P<0.05$) and does not follow the IQS, due to the violation of the imports-exports regulations in term of quality control system , absence of health monitoring system, as the financial and administration deteriorations dominating the issue.

Microbial contamination

It was found that, there were no contamination with any of the microbes, total count, coliform, staphylococcus, yeast and mold as shown in table 5. The obtained date revealed that pomegranate molasses has a great antifungal and antibacterial activity, due to their contents of phenolic compounds, pigments, and citric acid (Nanis, et al. 2014).

TABLE 5: shows the microbial contamination of different market brands pomegranate molasses

Samples	Total Count	Coliform	Staphylococcus	Yeast & Mold
Al-Taff	-	-	-	-
Rawa	-	-	-	-
Yamama	-	-	-	-
Bill-Back	-	-	-	-
Syra	-	-	-	-
Altonsa	-	-	-	-
The minimum level accepted as IQS	1×10^4	1×10^2	-	1×10^3
LSD value	0.00 NS	0.00 NS	0.00 NS	0.00 NS

NS: Non-significant.

CONCLUSION

Pomegranate molasses has recognized its utility as a base ingredient in various value added food products to flavor chutneys, curries and salad dressings to glaze or tenderize meat products. Therefore, the present investigation was undertaken to evaluate some components as (general requierments), physicochemical properties and the minerals and microbial contamination were within the limit of the Iraqi Quality Standard. From the results of the analysis, it was found that some components were within the limits of the IQS, while others (PH, total acid%, lumps, viscosity, and the presence of glucose syrup) were significantly different. Based on the results of this study, the presence of mineral content of the molasses, gives it an exceptional nutritional characteristic. The results showed that pomegranate molasses are also rich in phenolic content with high health and nutritional values. So that, it's very important to monitor all local and imported products of all goods, especially dietary products which is effecting the human health for developing fruit processing industry and selection of superior desirable pomegranate molasses to meet market demand.

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