



Conformity of Fruit Nectar Samples to Libyan Specification Standards

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ABSTRACT

The aim of this study is to evaluate the quality characteristics of physical, chemical and microbiological of some fruit nectar samples produced from some local and imported companies and sold in the city of Tripoli, and to determine their conformity with Libyan specification standards. In this study, 40 samples of different fruit nectars (grape, pineapple, guava, orange, apple, and mixed fruits) were collected from different local supermarket, five imported companies and 4 domestic which were available at the time of study. The Samples were classified based on their type of fruit nectars and also marked as (A, B, C, D) and (E, F, L, M, N) for different domestic or imported and imported companies respectively. The results showed that all the samples were free from artificial colours added. Local and imported samples were conform with the Libyan specification standards (990-2014) for fruit nectars. Five local and four imported samples were unconfirmed with the standards. In terms of acidity, some local and imported samples were conform to the Libyan specification standards, except one local sample and 5 imported samples. However, 35.3% of local samples and 43.5% of the imported samples unconfirmed to the Libyan standard specifications. Microbiological results showed that all local and imported samples were free from total bacterial count, yeasts and molds and coliform bacteria. Heavy metals (cadmium, lead, arsenic, copper, zinc, iron) of local and imported samples were conform to the Libyan specification standard, except 3 samples of imported products were had higher arsenic concentration. Based on the results of this study which indicated the importance of quality control programs for such products not only during production but also during storage and sales due to possibility of contamination and spoilage.

Introduction

Nectars, juices and drinks produced from fruits are the most common industries, which are prevalent in most parts of the world, global demand for such products has increased over recent decades. These industries are depend on some raw materials such as fruits concentrate, sugar and additives (natural flavors and sweeteners) which are permitted for use. The most important factors that determine the type of product (juice, nectar or drink) are the ratio of natural juice or natural concentrate used for production, generally, the proportion of natural juice in the juice product should be more than 50% and nectars should be between 25-50% and drinks should be between 10-24% depending on the type of fruit (Codex Alimentarius, 2005).

Fruit nectar is the unfermented but fermentable product obtained by adding water with or without the addition of sugars, honey and/or syrups, and/or permitted food additive sweeteners to products or to a mixture of those products. Aromatic substances, volatile flavor components, pulp and cells all of which must be recovered from the same kind of fruit and be obtained by suitable physical means may be added, that product moreover must meet the requirements defined for fruit

nectars standard, a mixed fruit nectar is obtained from two or more different kinds of fruits (NCSM, 2014).

Nectars and juices contain some good nutrients such as natural sugars and certain vitamins and minerals, they are also of refreshing products and desired by the consumer, especially children. Consumption of these products depends on food pattern, and economic terms of the individual and family (ASSABAH, 2014). Some producers when producing such products may be used some additives which are not generally recognized as safe (GRAS) additives such as some pigments or colors and preservatives which may be carcinogenic, so legislative and specifications bodies approved several technical and health requirements, therefore, quality control programs and testing for such products is important in order to prevent consumer health and safety.

Some researchers in Romanian (2013) conducted a study, and the aim of this study was to analyze changes for physicochemical properties (pH values, acidity, vitamin C, and total soluble solids) of fresh and refrigerated stored of fruit juices for a week. Fruit juices (orange, kiwi, apple and mixed of different fruits) were prepared and study their physicochemical characterization. Results showed that kiwi juice and

mixed kiwi and orange 30:70% contained a high amount of vitamin C, (83.6 and 96 0.8mg/100g) respectively. As it turns out that the reduction in the amount of vitamin C per 100g of the product to be clear in orange juice and mixed juice after the storage process, also there were no significant differences in the other physicochemical properties for fresh and stored juices (Leahu et al., 2013). A study in Zimbabwe (2013) was conducted to identify adulteration of fruit juices where 6 different varieties of fruit juices assembled, and the samples were analyzed and determining the quantity of heavy metals, acidity, total soluble solids (TSS %) and inverted sugars. Results showed significant differences in the proportion of natural juice and added water in some samples, natural juice ratio were low (20.65%), which refers to addition of high quantity of water, as well as the results showed that the proportion of TSS% were low in 19.5% of the samples. The study also pointed out that the addition of sucrose was high in some samples which contrary to specification standards (Maireva et al., 2013).

A microbiological study of vendor and packed fruit juices locally available in Dhaka city Bangladesh was conducted in 2013. Twenty six different fruit juice samples handy or manually filled and fifteen factory processed fruit juices samples sold in the local market were analyzed. Results were revealed that, total bacterial count ranged between 10^2 - 10^7 (cfu/ml), Staphylococci bacteria present in thirty samples, the number of coliform bacteria ranged between 10^2 - 10^6 (cfu/ml), coliform bacteria was present in four samples of manually filled samples (10^2 cfu/ml), while the processed samples were showed absence of coliform bacteria. The study concluded that both types (manually filled and factory processed) fruit juices were low quality. Regulatory and authorities administrations must take quick action towards fruit juices factories and production units, regards health aspects in order to prevent safety and health of the consumers (Rashed et al., 2013).

A study was conducted (2004) in Brazil to determine copper and zinc concentration in fruit juice for 12 different sample. Results showed variation in the quantity of copper ranged between 85-384 mg/kg and the quantity of zinc ranging from the 68-1097 mg/kg. The results indicated that all the samples were in permissible limits of standards for those two elements (Nascentes et al., 2004). A group of researchers in (2013) conducted a study to determine the concentration of some heavy metals in fruit juices and soft drinks available in the market of Accra city in Ghana. Twenty samples were bought from the market and the concentration of some heavy metals determined by atomic absorption spectrometer. Results showed that the average concentrations in fruit juice and soft drink samples were 0.83, 9.07, 1.59, 3.33 mg/kg for copper, iron, lead and zinc respectively, also it showed that the concentration of heavy metals in some samples of fruit juices and soft drinks were higher than the permissible limits indicated by the World Health Organization (WHO) (Ofori et al., 2013).

As a result of different trade names, brands and varieties of locally produced and imported fruit nectars

available in Libyan market, in addition to that, growing demand for consumption of different fruit juices and nectars by consumers, that highlighted the importance of conducting this study in order to evaluate physical, chemical and microbiological quality properties for different fruit nectar trade names, locally produced and imported and to evaluate their extent of compliance with the Libyan specification standard.

Materials and Methods

Samples

Forty samples were collected from local markets of the city of Tripoli area, which represent four local companies or producers and five foreign companies and 6 species varieties of different fruit nectars (pineapple, orange, guava, apple, grapes and mixed fruits).

Questionnaire included a series of questions was promoted in order to determine the per capita consumption of juices and nectars rate annually to compared with some other countries, also to know the most consumed brands and to determine the percentage of consumption of these products. More than 100 hard copy questionnaires were distributed to consumers in different areas of Libya, Also, e-questionnaire (electronic copy) was posted in the internet for Libyan consumers and 197 responses were obtained and then statistically and graphically analyzed.

Methods of Analysis

Physical and chemical methods: Water capacity test was conducted by measuring the volume of nectar in packages, then each package was filled with water to measures complete volume and water capacity was calculated according to the following equation:

$$\text{Water capacity\%} = \text{nectar volume/water volume} \times 100$$

Total volume of nectar juices in the packages were also measured and compared with the volume written on the label of each package. Total titratable acidity was determined on the basis of malic acid for apple nectars, on the basis of tartaric acid for grape nectars and on the basis of citric acid for other nectar fruits according to (ISO, 1998b) method no. 750. Value of pH was measured accordance to (ISO, 1991) method no. 1842 by pH-meter. Total soluble solids (TSS %) was determined according to (ISO, 1998a) method no. 2173, by refractometer (ATAGO-PR2011). Artificial colors test was conducted according to (IFU, 2005) method no. 24. Heavy metals were determined by (AOAC, 1984) method no. 25.061, using atomic absorption spectrophotometer.

Microbiological methods: Total bacterial count test was conducted by (IFU, 1996a) method no. 2 using a nutrient medium (Plant Count Agar) and incubated at (37°C) for a period of 24-48 hours. Coliform bacteria conducted by (ISO, 2006) methods no. 4832-1&2 using nutrient medium (Hicrome ECC Selective Agar Base) and incubated at (37°C) for 24-48 hours. Yeasts and molds were conducted in accordance to (IFU, 1996b) methods

no.3&4 using nutrient medium (Chloramphenicol Yeast Glucose Agar) and incubated at (25°C) for 3-5 days.

Readings and results of all the tests (physical, chemical and microbiological) were conducted in three replicates, and the results were subjected to statistical analysis using a computer with Minitab, ver. 14 program.

Results

Water Capacity

Water capacity value of the different local and imported fruit nectar containers were ranged from (89.90-95.23%), which indicated that all the samples matching the Libyan specification standard no. (990-2014) for fruit nectars, as shown in tables (2 & 3).

Artificial Colors

Tables (1 and 2) illustrated that all local and imported fruit nectars samples did not contain artificial colors added, so consequently all samples conform with the Libyan specification standard which mentioned above.

pH

Table 1 showed that local fruit nectar samples conform with the Libyan specification standard except the samples no. (4 pineapple, 5 pineapple, 8 mixed, 11 guava&16 apple) for the subsidiaries (a, b, a, b, c) respectively. Table 2 showed that imported fruit nectar samples were also within Libyan specification standard, except 4 samples, namely as, (2 grape, 9 mixed, 14 guava, 17 orange) produced by (l, f. n. l), because their pH values were higher than the limit of pH (3-4) which indicated in the Libyan specification standard (990-2014).

Acidity

Titrateable acidity for all local fruit nectar samples were matching the Libyan specification standard (990-2014) for fruit nectars, except one sample no. 9 (mixed) produced by the company (c) was higher than the limit, the highest acidity value for local samples was (0.66%) for mixed fruit nectars no. 9, and the lowest value was (0.22%) for grape sample no. 3, as showed in Table 1. However, five samples of imported fruit nectar were not conformed to the specifications, namely, (1 grape, 3 pineapple, 4 pineapple, 5 pineapple, 21 apple), produced by (e, e, f, l, f), companies respectively, the highest acidity value for imported samples was (0.98%) for orange nectars no. 18 and the lowest value was (0.12%) for orange sample no. 19 as indicated in Table 2, according to Libyan specification standard (990-2014), the acidity must not exceed 0.5% of different fruit nectars, except for orange nectars should be not more than (1.0%).

Total Soluble Solids (TSS%)

Table 1 indicated that TSS% for some of the local fruit nectar samples (2 grape, 6 pineapple, 7 pineapple, 8 mixed, 9 mixed and 16 apple) were less than the limit in the Libyan specification standard, the highest TSS% was (16.1%) for both grape sample no. 3 and apple sample no. 17, and the lowest TSS% were 5.5% for mixed sample 9. At the meantime, Table 2 showed that TSS% for some of imported samples numbered as (3 pineapple, 4 pineapple, 5 pineapple, 9 mixed, 10 mixed, 15 orange, 16 orange, 17 orange, 20 apple and 21 apple) were, also less than the limits showed in the Libyan specification standard for fruit nectars, and the highest TSS% for was 15.2% for apple sample no.22, and the lowest TSS% was 4.4% for mixed sample no. 10.

Table 1 Physicochemical characteristics of local produced fruit nectars

Sample No.	Product	Company Name	Volume of Nectars	Water Capacity %	pH Value	Acidity %	TSS %	Artificial Colors
1	Grape	B	1000±10	92.67±2.21	3.68±0.11	0.49±0.08	15.5±0.5	-ve
2	Grape	C	1000±10	93.10±3.11	3.51±0.13	0.32±0.06	7.8±0.2	-ve
3	Grape	D	980±10	91.16±1.34	3.28±0.12	0.22±0.05	16.1±0.3	-ve
4	Pineapple	A	980±5	89.90±1.23	4.19±0.10	0.49±0.06	13.4±0.3	-ve
5	Pineapple	B	1000±15	92.67±1.56	4.89±0.25	0.50±0.08	15.1±0.3	-ve
6	Pineapple	C	1000±10	93.10±2.21	3.96±0.12	0.45±0.06	11.5±0.2	-ve
7	Pineapple	D	980±10	91.16±1.15	4.08±0.14	0.33±0.05	11.9±0.4	-ve
8	Mixed	A	980±10	89.90±1.30	4.13±0.10	0.35±0.04	13.0±0.3	-ve
9	Mixed	C	1000±12	93.10±2.31	4.01±0.09	0.66±0.05	5.5±0.2	-ve
10	Guava	A	980±10	89.90±1.23	4.00±0.08	0.26±0.04	12.8±0.4	-ve
11	Guava	B	1000±8	92.67±1.97	4.85±0.13	0.51±0.08	13.9±0.5	-ve
12	Guava	C	1000±10	93.10±2.20	4.04±0.08	0.33±0.04	12.6±0.3	-ve
13	Orange	A	980±10	89.90±1.12	4.00±0.11	0.59±0.05	12.6±0.4	-ve
14	Orange	B	1000±10	92.67±1.75	4.05±0.09	0.65±0.07	12.5±0.5	-ve
15	Apple	A	980±10	89.90±1.31	3.64±0.08	0.38±0.08	13.0±0.3	-ve
16	Apple	C	1000±20	93.10±2.25	4.99±0.13	0.40±0.05	10.7±0.2	-ve
17	Apple	D	980±10	91.16±1.25	3.89±0.09	0.33±0.06	16.1±0.5	-ve

Table 2 Physicochemical characteristics of imported fruit nectars

Sample No.	Product	Company Name	Volume of Nectars	Water Capacity %	pH Value	Acidity %	TSS %	Artificial Colors
1	Grape	E	990±10	92.09 ± 1.25	3.93±0.12	0.68±0.03	14.8±0.5	-ve
2	Grape	L	980±10	91.16±1.33	4.91±0.10	0.36±0.02	14.4±0.6	-ve
3	Pineapple	E	990±10	92.09±2.26	4.01±0.08	0.54±0.02	6.9±0.2	-ve
4	Pineapple	F	980±7	91.24±1.15	3.90±0.13	0.69±0.04	6.6±0.2	-ve
5	Pineapple	L	980±8	91.16±1.30	4.00±0.15	0.59±0.05	9.9±0.3	-ve
6	Pineapple	M	980±10	94.23±2.45	3.69±0.20	0.16±0.04	13.5±0.4	-ve
7	Pineapple	N	980±8	95.14±2.50	3.48±0.10	0.34±0.05	13.6±0.5	-ve
8	Mixed	E	990±10	92.09±2.33	4.04±0.12	0.48±0.04	12.5±0.4	-ve
9	Mixed	F	980±10	91.24±1.65	4.97±0.10	0.45±0.05	6.4±0.3	-ve
10	Mixed	L	980±10	91.16±1.44	3.77±0.08	0.37±0.06	4.4±0.2	-ve
11	Mixed	M	980±10	95.23±3.59	3.90±0.10	0.16±0.03	14.2±0.5	-ve
12	Mixed	N	980±10	95.14±2.81	3.59±0.09	0.13±0.04	14.4±0.5	-ve
13	Guava	M	980±10	95.23±2.90	4.04±0.10	0.20±0.05	14.0±0.3	-ve
14	Guava	N	980±12	95.14±4.75	4.09±0.12	0.41±0.07	13.4±0.3	-ve
15	Orange	E	990±10	92.09±2.82	4.02±0.09	0.69±0.05	5.6±0.2	-ve
16	Orange	F	980±8	91.24±1.66	4.01±0.10	0.77±0.06	6.5±0.2	-ve
17	Orange	L	980±5	91.16±1.90	4.61±0.15	0.55±0.04	9.9±0.3	-ve
18	Orange	M	980±7	95.23±3.77	3.80±0.08	0.98±0.06	15.7±0.5	-ve
19	Orange	N	980±10	95.14±4.80	3.27±0.09	0.12±0.02	14.5±0.4	-ve
20	Apple	E	990±10	92.09±1.75	3.73±0.10	0.41±0.05	6.0±0.2	-ve
21	Apple	F	980±10	91.24±1.95	3.86±0.12	0.53±0.04	5.9±0.2	-ve
22	Apple	M	980±12	95.23±3.89	3.56±0.08	0.28±0.03	15.2±0.4	-ve
23	Apple	N	980±10	95.14±3.71	3.75±0.10	0.39±0.05	14.0±0.5	-ve

Table 3 Heavy metals (mg/kg) of local produced fruit nectars

Sample No.	Product	Company Name	Fe mg/kg	Zn mg/kg	Cu mg/kg	Ar mg/kg	Pb mg/kg	Cd mg/kg
1	Grape	B	5.75±1.23	2.23±0.35	3.02±0.50	0.04±0.01	0.008±0.001	0.006±0.002
2	Grape	C	5.90±0.89	3.22±0.55	2.73±0.47	0.06±0.02	0.005±0.002	0.003±0.001
3	Grape	D	7.30±1.23	1.87±0.23	1.66±0.75	0.02±0.005	0.003±0.001	0.005±0.002
4	Pineapple	A	4.45±0.98	2.61±0.19	2.85±0.92	0.04±0.01	0.005±0.002	0.002±0.001
5	Pineapple	B	6.15±0.45	2.50±0.37	1.99±0.89	0.02±0.006	0.006±0.003	0.007±0.003
6	Pineapple	C	5.87±0.95	3.52±0.61	2.81±0.48	0.02±0.008	0.006±0.002	0.005±0.002
7	Pineapple	D	6.32±0.85	2.75±0.39	1.56±0.76	0.03±0.01	0.002±0.001	0.008±0.004
8	Mixed	A	6.34±1.05	3.04±0.22	1.76±0.73	0.05±0.003	0.002±0.001	0.008±0.003
9	Mixed	C	6.76±0.87	2.18±0.41	2.97±0.91	0.04±0.01	0.006±0.002	0.003±0.001
10	Guava	A	5.90±0.75	2.71±0.33	2.28±0.85	0.07±0.01	0.003±0.001	0.004±0.002
11	Guava	B	7.10±1.09	3.02±0.65	2.08±0.75	0.03±0.007	0.006±0.002	0.008±0.005
12	Guava	C	5.76±0.83	3.06±0.47	1.86±0.25	0.03±0.005	0.005±0.002	0.006±0.002
13	Orange	A	7.23±0.95	2.90±0.18	3.23±0.54	0.02±0.008	0.007±0.003	0.006±0.003
14	Orange	B	6.89±0.72	4.01±0.68	2.45±0.51	0.05±0.009	0.003±0.001	0.004±0.001
15	Apple	A	6.79±0.91	2.76±0.34	3.20±0.63	0.06±0.01	0.004±0.001	0.006±0.002
16	Apple	C	7.22±1.03	2.90±0.29	3.05±0.42	0.05±0.01	0.003±0.001	0.004±0.001
17	Apple	D	4.45±0.76	1.77±0.37	2.31±0.22	0.04±0.008	0.004±0.002	0.006±0.003

Heavy Metals

The quantity of heavy metals for all local fruit nectar samples were within the permissible level of the Libyan specification standard (990-2014) for fruit nectars, which stated that heavy metals (iron, zinc, copper, arsenic, lead, cadmium) should be no more than (15, 5, 5, 0.1, 0.01, 0.01) mg/kg, respectively, the concentration of Fe was ranged between (7.30-4.45), Zn (4.01-1.77), Cu (3.23-1.56), Ar (0.07-0.02), Pb (0.008-0.002) and Cd (0.008-0.002) mg/kg (Table 3).

However, arsenic contents in some of the imported fruit nectars samples (6 pineapple, 12 mixed, 13 guava) were (0.18, 0.15, 0.16) mg/kg which produced by (m, n, m) companies respectively were unconfirmed with the Libyan specification standard for fruit nectars which indicated that arsenic should be not more than (0.1 mg/kg), the concentration of Fe was ranged between (9.02-3.56), Zn (4.05-1.85), Cu (4.54-1.75), Ar (0.18-0.01), Pb (0.006-0.002) and Cd (0.008-0.002) mg/kg (Table 4).

Table 4 Heavy metals (mg/kg) of imported fruit nectars

Sample No.	Product	Company Name	Fe mg/kg	Zn mg/kg	Cu mg/kg	Ar mg/kg	Pb mg/kg	Cd mg/kg
1	Grape	E	8.08±1.08	1.87±0.55	3.98±0.64	0.02±0.001	0.005±0.002	0.003±0.001
2	Grape	L	5.02±0.93	4.03±0.46	1.75±0.81	0.05±0.004	0.002±0.001	0.003±0.002
3	Pineapple	E	5.59±0.65	4.05±0.73	2.65±0.69	0.06±0.003	0.002±0.001	0.005±0.002
4	Pineapple	F	7.54±0.72	2.74±0.53	3.34±0.28	0.03±0.007	0.005±0.002	0.008±0.004
5	Pineapple	L	6.91±0.81	2.77±0.46	2.53±0.73	0.01±0.005	0.004±0.002	0.007±0.003
6	Pineapple	M	4.16±0.74	3.65±0.61	2.54±0.43	0.18±0.04	0.002±0.001	0.002±0.001
7	Pineapple	N	5.91±0.84	4.02±0.38	2.94±0.62	0.08±0.009	0.006±0.002	0.008±0.004
8	Mixed	E	4.45±0.55	3.34±0.29	2.76±0.51	0.04±0.005	0.003±0.001	0.002±0.001
9	Mixed	F	6.19±0.36	2.98±0.32	4.54±0.33	0.10±0.03	0.004±0.001	0.006±0.003
10	Mixed	L	5.15±0.54	2.81±0.15	1.88±0.49	0.06±0.004	0.003±0.001	0.002±0.001
11	Mixed	M	8.30±1.03	3.42±0.18	2.51±0.23	0.05±0.003	0.006±0.001	0.008±0.005
12	Mixed	N	3.56±0.78	2.34±0.23	1.99±0.28	0.15±0.06	0.005±0.001	0.006±0.003
13	Guava	M	9.02±1.05	2.75±0.32	1.76±0.19	0.16±0.03	0.003±0.001	0.002±0.001
14	Guava	N	7.02±0.48	3.55±0.19	2.65±0.45	0.05±0.007	0.003±0.001	0.004±0.002
15	Orange	E	6.85±0.59	3.08±0.20	2.19±0.30	0.04±0.005	0.004±0.001	0.005±0.003
16	Orange	F	5.41±0.62	3.56±0.48	1.76±0.29	0.06±0.008	0.002±0.001	0.007±0.002
17	Orange	L	6.82±0.49	3.45±0.62	2.27±0.61	0.03±0.007	0.005±0.002	0.003±0.001
18	Orange	M	4.74±0.28	1.85±0.16	2.82±0.48	0.07±0.005	0.004±0.001	0.006±0.002
19	Orange	N	6.80±0.75	2.88±0.45	3.71±0.29	0.04±0.003	0.004±0.001	0.007±0.003
20	Apple	E	7.24±0.92	2.16±0.29	3.05±0.42	0.07±0.008	0.006±0.002	0.003±0.001
21	Apple	F	6.10±0.84	2.31±0.28	2.56±0.30	0.04±0.007	0.003±0.001	0.005±0.002
22	Apple	M	6.70±0.66	1.90±0.17	3.17±0.46	0.06±0.005	0.003±0.001	0.004±0.002
23	Apple	N	6.84±0.51	2.72±0.35	4.12±0.72	0.06±0.004	0.002±0.001	0.005±0.001

Table 5 Microbiological results of local produced fruit nectars

Sample No.	Product	Company Name	Total Bacterial Count (cfu/ml)	Yeasts & Molds (cfu/ml)	Coliform Bacteria (cfu/ml)
1	Grape	B	-ve	-ve	-ve
2	Grape	C	-ve	-ve	-ve
3	Grape	D	-ve	-ve	-ve
4	Pineapple	A	-ve	-ve	-ve
5	Pineapple	B	-ve	-ve	-ve
6	Pineapple	C	-ve	-ve	-ve
7	Pineapple	D	-ve	-ve	-ve
8	Mixed	A	-ve	-ve	-ve
9	Mixed	C	-ve	-ve	-ve
10	Guava	A	-ve	-ve	-ve
11	Guava	B	-ve	-ve	-ve
12	Guava	C	-ve	-ve	-ve
13	Orange	A	-ve	-ve	-ve
14	Orange	B	-ve	-ve	-ve
15	Apple	A	-ve	-ve	-ve
16	Apple	C	-ve	-ve	-ve
17	Apple	D	-ve	-ve	-ve

Microbiological Analysis

Microbiological analysis results in table (5&6) indicated that the local and imported fruit nectars samples were free from total coliform bacteria, bacterial count, yeasts and molds which matching the Libyan specification standard (990-2014).

Questionnaire Results

Throughout the questionnaire prepared as a part of this study indicated after graphically and statistically analyzing, that the average consumption of the individual Libyan consumer was about 36.5 liters/year/capita, also the questionnaire indicated that 25% of the consumers usually consume 1 cup a day of fruit nectars or juices,

35% of consumers may consume 2 cups/day and only 10% consume more than 3 cup/day (Figure 1). The more brands consumed by different age groups of consumers were the imported brands (50%), and local brands

accounted as(33%) and both of them together were (17%) (Figure 2). Also the results showed that 83% of Libyan consumers most of the time consume fruit juices and nectars and 13% did not consumed them.

Table 6 Microbiological results of imported fruit nectars

Sample No.	Product	Company Name	Total Bacterial Count (cfu/ml)	Yeasts & Molds (cfu/ml)	Coliform Bacteria (cfu/ml)
1	Grape	E	-ve	-ve	-ve
2	Grape	L	-ve	-ve	-ve
3	Pineapple	E	-ve	-ve	-ve
4	Pineapple	F	-ve	-ve	-ve
5	Pineapple	L	-ve	-ve	-ve
6	Pineapple	M	-ve	-ve	-ve
7	Pineapple	N	-ve	-ve	-ve
8	Mixed	E	-ve	-ve	-ve
9	Mixed	F	-ve	-ve	-ve
10	Mixed	L	-ve	-ve	-ve
11	Mixed	M	-ve	-ve	-ve
12	Mixed	N	-ve	-ve	-ve
13	Guava	M	-ve	-ve	-ve
14	Guava	N	-ve	-ve	-ve
15	Orange	E	-ve	-ve	-ve
16	Orange	F	-ve	-ve	-ve
17	Orange	L	-ve	-ve	-ve
18	Orange	M	-ve	-ve	-ve
19	Orange	N	-ve	-ve	-ve
20	Apple	E	-ve	-ve	-ve
21	Apple	F	-ve	-ve	-ve
22	Apple	M	-ve	-ve	-ve
23	Apple	N	-ve	-ve	-ve

■ 1-cup ■ 2-cups ■ 3-cups ■ more:than-3-cups

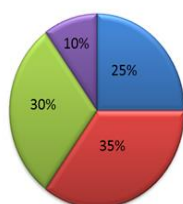


Figure 1 Daily rate consumption of fruit juices and nectars (cup/daily/capita)

■ Local ■ Imported ■ Both

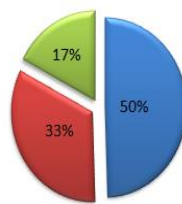


Figure 2 Local and imported trademarks of fruit nectars preferred by consumer

■ No ■ Yes

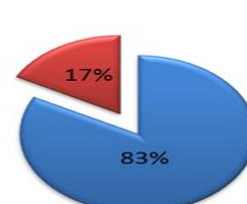


Figure 3 The proportion of consumers of fruit juices and nectars

Discussion

Finding results of this study indicated that some local and imported fruit nectar samples were unconfirmed with the Libyan specification standard, such as titratable acidity were high in some samples which could be as a result of immaturity of the fruits used in the processing of nectars. All samples were indicated that free of artificial colors which could be added to fruit nectars or juices, addition of artificial colors to fruit nectars and juices contrary to Libyan and international legislation and specification standards, as a result of the seriousness of

these artificial colors on the health and consumer safety. With regard to the percentage of TSS, the results of this study were consistent with a study of (Maireva et al., 2013), where found decrease in the percentage of TSS in (19.5%) of different fruit nectars samples which were below the limits of the specification standard.

Finding results were consistent with the study conducted by (Nascentes et al., 2004) in Brazil for determination of copper and zinc in fruit juices, they found variation in the concentration of copper and zinc

but within the limits of the approved specifications (Nascentes et al., 2004). The results of this study were incompatible with the research conducted by (Rashed et al., 2013) for microbiological analyzes of some fruit juice samples sold in Bangladesh local markets which indicated that total bacteria count was between 10^2 - 10^7 (cfu/ml) and number of coliform bacteria ranged between 10^2 - 10^6 (cfu/ml), thus these samples were unconfirmed with the standard specifications of the juices approved in Bangladesh (Rashed et al., 2013).

The questionnaire results illustrated that average consumption of the Libyan consumer was about 36.5 liters/year/capita which was compatible with some of other Arabic countries, such as Saudi Arabia, UAE and Kuwait (Free Palestine Agency, 2014).

Conclusion

Through the results of this study which conducted physical, chemical, microbiological and heavy metals tests for local and imported fruit nectar samples, indicated that some samples does not meet the Libyan specification standard of fruit nectars as follows:

- High pH values for 5 local produced samples and 4 imported samples.
- High acidity of one local produced sample and 5 imported samples.
- Low total soluble solids in 6 local produced samples and 10 imported samples were accounted 35.3% and 43.5 % of the total number of local produced and imported sample respectively.
- All locally produced and imported samples were free of coliform bacteria, total bacterial count, yeasts and molds.
- High quantity of arsenic for 3 imported samples.
- Based on these results we recommend the following:
- Emphasis on the importance of conducting analyzes and tests for various locally and imported produced foods, including fruits nectar not only during production but also during handling operations, storage and marketing by the regulatory authorities.
- Conducting studies and scientific technical research for the quality control of different fruit nectars as well as other food products for the sake of health and safety of the consumer.
- Emphasize the role of the National Center for specifications and standards to renewing and the development of Libyan specification standard for fruit juices and other food standards.

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