Minufiya J. Agric. Res. Vol.39 No. 5: 1591 - 1602 (2014) "http://www.mujar.net"

PREPARATION OF HEALTHY POMEGRANATE DRINK CONTAINING BARLEY B- GLUCAN

Gamila Y. Attia
Food Tech. Res. Inst., A R C, Giza, Egypt

(Received: Jun., 21, 2014)

ABSTRACT: *A functional healthy drink of combined pomegranate aril juice and extracts of barely Beta-glucan was prepared. Pomegranate juice had several effects on reducing cardio and cerebrovascular disease in addition B-glucan delays glucose absorption and regulates level of blood glucose. It was found that the B-glucan which extracted from Shakira barley (wort) and added to pomegranate juice (1:1) contained 0.22% B-glucan. However the pomegranate juice with the addition of B- glucan extracted from Shakira barley at 0.4 % was superior to the latter juice since it contained 0.4 % B-glucan more over contained the same quantaties of anthocyanin phenolic componends and oxidation percent inhibition as in Manfaloti juice. B-glucan level should not exceed 0.4% otherwise it would affect negatively the organoleptic properties. Functional juices which were prepared and packed in glass bottles and pasteurized at 90°C for 10 min. were sealed with crown cover and stored for six months at ambient temperature (25 ±2°C).The packed juice were tested for their organoleptic properties and their microbial counts directly after preparation and at the end of storage period. Also the organoleptic scores were slightly decreased. However the microbial counts had an obvious decreasing trend after six months of storage. Chemical composition of functional juice changed slightly for T.S.S, pH, dietary fiber, ash, and soluble protein. However an obvious decrease was found in ascorbic acid content.*

***Key word**: Pomegranate juice, barley, B- glucan, functional juice.*

INTRODUCTION

Pomegranate aril juice provides about 16% of an adults daily vitamin C requirement per 100 ml serving, and is a good source of vitamin B5(pantothenic acid), potassium and polyphenols, such as tannins and flavonoids *Schubert et al., (1999*). Dietary supplementation with nutrients rich in antioxidation is the associated with inhibition of atherogenic modifcations to LDL, macrophage foam cell formation, and atherosclerosis. Pomegranate is a source of polyphenols and other antioxidant. *Aviram et al., (2007).*

The most abundant in pomegranate juice are the hydrolysable tannins called ellagitannins formed when ellagic acid binds with a carbohydrate. Punicalagins are tannins with free- redical scavenging Properties *Kulkarni et al., (2007*). Other phytochemicals include catechins, gallocatechins, and anthocyanins such as prodelphinidins delphinidin, cyaniding, and pelargonidin are also found *Plumb et al., (2002).*

Juice of the pomegranate may be effective in reducing heart disease risk factors, including LDL oxidation, macrophage oxidative status, and foam cell formation *Aviram et al., (2004) and Esmaillzadeh et al., (2004)*. Consumption of pomegranate juice reduce systolic blood pressure by inhibiting serum angiotenisn-converting enzyme *Aviram and Dornfeld, (2001*).

Consumption of pomegranates and pomegranate juice appear to correlate with preventing such following diseases prostate cancer prostatic hyperplasia, diabetes, lymphoma, atherosclerosis coronary at (NIH-Listed human clinic trials on pomegranate 2010) and The Many Amazing Health Benefits of pomegranate 2011). On the other hand in recent years the research has been oriented to cereals because of their potential to enable the development of functional foods. Cereal have a 60% share in the world production of foods providing fiber, proteins, energy, minerals, and

vitamins required for the human health. As a food cereals are relatively cheap and at the same time they are also an important source of B- glucan *Jadhav et al.,(1998)*.

Barley (*Hordeum distychum)* contains many natural compounds beneficial to health. These include tocopherols and phytosterols as a unique soluble fiber, is the most recognized health promoting compound of the common cereals (wheat ,rye, oats and barley). The largest (seed) amount of B-glucan are found in barley (3-11%) and oats (3-7%) Wood and Beer, (1998). The chemical analysis constitute as much as 75%of the endosperm cell wall *Lambo et al.,(2005)*. The cell wall of barley and oat contains B-glucan, a non-starch polysaccharide composed of B- (1-4) linked glucose units separated every two to three units by a single B-(1-3) –linked glucose and referred to as a mixed linkage B-glucan Carpita, (1996).

B-glucan is characterised by a reduce absorbation in the intestine, which leads to increased viscosity and to the subsequent slowing down of the gastric evacuation Malkki and Virtanen, (2001). B-glucan delays glucose absorption and regulates the level of blood glucose*Wood et al., (1994)*.

These results have the importance for the reduction of LDL, cholesterol and subsequently lead to a decreased glucose leveling blood after meals, as well as to the adequate response of insulin. A linear decrease in glycaemic index for increasing B-glucan content was found *Cavallero et al., (2002).*

Cereal grains contain B-glucan, which influences digestion *White et al., (1981*) and cholesterol level in blood and liver tissue *Fadel et al., (1987)* and *Newman et al., (1989)*.

Diets that include grains with a high B-glucan content may decrease the risk of heart attack. Kalra and Jood, (2002) showed that barley B-glucan lowered the levels of total cholesterol,LDL cholesterol and triglycerides in rats. Edwards and parrett, (1996) suggested several possible mechanisms for lowering cholesterol levels. These include inhibition of fat digestion and absorption, increased loss of bile acids and cholesterol, inhibition of cholesterol synthesis in the liver by propionate or other bacterial product and the action of viscous non-starch polysaccharides (NSP) on insulin and other hormone secretions.

The barley contains substantially higher amount of functional ingredient B-glucan. The use of B- glucan extracted from barley as human food due to its positive role in human health has received a growing attention.

Functional foods including functional beverages are important for their role in health promotion and disease prevention. The barley grains can be used to enhance the flavor, texture, appearance and nutritional composition in a variety of functional food, including hot cereals, cookies, crackers, breads, tortillas, granola bars, fruit-filled cereal bars, extruded snacks and pastes and development of different beverages Amdt (2006).These beverages may enrich diet and improve human health, because of its ease of consumption along with a usual meal. Barley B-glucan assume to be well suited for such functional application, being capable of imparting a smooth mouth feel to beverage products and providing an excellent source of soluble dietary fiber. A barley B-glucan gum with similar functional properties, could potentially serve as an alternative to traditional beverage thickeners such as alginates, pectin, xanthan and carboxymethyl cellulose Giese (1992).

The aim of this investigation was to prepare a healthy drink of a combined pomegranate aril juice and extracts of barely beta glucan with good sensory and chemical properties.

MATERIALS AND METHODS

Two cultivars of pomegranate fruits are available in Egypt Manfaloti variety in upper Egypt with red aril color and Delta variety which is common in lower Egypt with aril color (ranging from white to faint pink). Both varieties are varied of hardness of seed

maturities, juice content and its acidity, sweetness and astringency.

Methods of analysis:

Pomegranate varieties were brought from local market El Abour, Manfaloti and Delta varieties were used in this experiment. The weighed milled aril samples were extracted three times 50 ml of ethyl acetate at temperature of 55°C for 20 min. under magnet stirring. The residue was treated twice with 50 ml n- propanal under the same extraction condition as with combined ethyl acetate. The extracts were evaporated at 40°C under vacuum to dryness and the residue was dissolute with 5 ml of methanol and filtered and put at a refrigerator until photometric determination of total phenols and antioxidant activity performed. Total phenol contents (TPC) of samples was determined spectrophotometrically by a spectrophotometer (Jenway 6405 UV/visible) using the Folin and Ciocalteu assay described by *Vinson et al.,(1995)*. One gm of sample was mixed with 1 ml of 6 M HCl and 5 ml of 75% methanol / water solution in a screw-capped tube. The tube was vortexed and placed in a 90ºC water bath and shaken for 2 h. Then, the tube was allowed to cool to room temperature and diluted to a 10 ml volume with distilled water. One milliliter of this solution was mixed with 5 ml of previously tenfold diluted Folin & Ciocalteau reagent. Fifteen milliliters of Na_2CO3 (7 g/100 ml) were added to this mixture to produce basic conditions. The mixture was diluted to 100 ml with distilled water. The absorbance versus prepared blank was read at 760 nm until it reached steady state. The same procedure was applied for six standard solutions of gallic acid (50–300 mg/100 ml). Final results were expressed as mg gallic equivalent per 100 ml of juice. Antioxidant activity were determined in methanolic extracts with 0.06 mM DPPH at 515 nm according to photometric method of *Bandoniene et al., (2002)* and expressed as %inhibition. Antioxidant activity values were calculated by means of the formula :

% Inhibition = (ΔA / Ao) x 100 with ΔA= Ao –A fin

Whereby is the absorbance at 515 nm. Ao is the initial absorbance of the control used (0.06 Mm DPPH in methanol without antioxidant) at t = 0 .

A fin is the absorbance of the reaction solution at the end of the reaction

Ether extract of samples were determined according to AOAC (1995). Also the Kjeldahl method was followed to determine the crude protein content according to the procedure described in the AOAC (1995). Total carbohydrates were determined according to *Dubois et al., (1956*) total dietary fiber was determined according to the methods described by *Prosky et al., (1984*) whereas vit. C was estimated according to the reduction of 2,6 dichlorophenol indophenol AOAC (1995).

The total anthocyanin was determined as reported by *Mondello et al.,(2000).* Ten gm of sample were filtered through glass wool, and the pulp washed with 90 ml of ethanol : HCl mixture previously prepared mixing 79.7 ml of anhydrous ethyl alcohol with 20.3 ml of HCl (37%). The volume was made up to 100 ml by solvent. The absorbance has been measured at 535 nm, by spectrophotometer (Jenway 6405 UV/visible), using 1 cm cells. The quantification was done with respect to standard curve of cyaniding-3-glucoside. The results were expressed as cyaniding-3-glucoside equivalent (mg per 100 ml of sample).

Ca, Fe, K, Zn, in pomegranate juice were determined according to *Galvao et al.,(1976*) using atomic absorption spectrophotometer F.M.D, Zesis.

Preparation of barley:

The barley variety Shakira was brought from AL Ahram company and the wort was prepared as follows:

The barley grains usually has moisture content between 10-12%. The grains were cleaned through screeners to remove stones, foreign bodies dust, and straw.

Thereafter, the grains was steeped for 24 hours and left to germinate for 96 hours. The germinated barely (malt) is heated to stop further germination and improve its flavor. The malt is then crached by portable stirrer and the resulting grits is then mixed with hot water and left to stand for two hours so that starch can be converted naturally to sugars. The resulting malt is sprayed with hot water filtered to produced a sugary liquid called (wort). The T.S.S in wort was 14.5% and the pH 5.83% Wort was cooled.

Extraction and purification of B-glucan:

B-glucan was extracted from barley flour by following the method of *Wood et al.,(1978)* with some modification. The barley flour (50) g was suspended in 500 ml water the pH was adjusted to 10 with Na_2CO3 (20% v/w) and stirred vigorously for 30 min at temperature of 45°C. The mixture was centrifuged at 15000x g at 4 °C for 15 min. The supernatant was adjusted to pH 4.5 with 2M HCL and centrifuged again (20 min at 21000xg at 4°C) to separate precipitated protein, which was discarded. The B-glucan was precipitated by adding of an equal volume of ethanol (99.9%) to the supernatant with slow stirring .The precipitate was recovered by centrifugation at 3300x g for 10 min allowed to settle overnight at 4°C and dried in a vacuum drier. The B- glucan extracts were kept in polyethylene bags for further studies on storage stabilities at 7°C.

The extracted of juices and the functional ones were packed in glass bottles (250 ml capacity) and sealed after pasteurization by crown covers were pasteurized at 90 °C for 10 min in water path after cooling the packed juices were stored for six months at ambient temperature. The different stored juice were tested for sensory properties and bacterial, yeast and mold counts.

Microbiological assay:

Fifty grams samples were placed into sterilized flasks and 450 ml of sterile phosphate buffer solution was added. The mixture was mechanically shaken for 30 min at steady speed. Serial dilutions were prepared in sterile saline solution for the following tests.

Total viable count:

Duplicate plates were inoculated with 1 ml for each dilution and thoroughly mixed with 10 to 15 portion of nutrient agar Difco Manual, (1985). The plates of the suitable dilution were recorded after the incubation period at 30°C for 72 hrs. The counts/gm food materials were calculated.

Yeast and mold count :

Duplicate plates were inoculated with 1 ml for each dilution and thoroughly with 10-15 ml portion of potato dextrose agar pH 5-6. The solidified plates were incubated for 48 hrs at 30°C. The plate counts of the suitable dilution were recorded after incubation period. The counts /gm food materials were calculated.

Sensory evaluation:

Sensory evaluation was carried out (color, appearance, flavor and total acceptability) by ten panelists of pomegranate juice samples at zero time of storage and after storage period using the methods described by (Ritmier and Nonnecks, 1991).

Statistical methods

Data were statistically analyzed to facilitate comparing the least significant differences (L.S.D) between means of different values according to (Senedecor and Cochran, 1973) .

RESULTS AND DISCUSSION

Chemical and nutritional data of both pomegranate varities:

The nutritional value of pomegranate juice from 100gm arials juice differ slightly between the two varieties available in Egypt namely (The Manfaloti and the Delta). According to results in the (Table 1).

Table (1): Nutritional values for 100g juice arils.

Chemical content	Varieties	
	Manfaloti	Delta
Moisture%	81.2	80.3
Carbohydrate %	16.2	15.5
T.S.S %	15.8	12.3
pH %	4. 23	3.5
Sugars %	15.6	12.8
Dietary fiber %	9.2	9.9
Fat %	0.6	0.4
Protein %	0.9	0.7
Ascorbic acid mg /100g	16.0	12.0
Calcium mg /100g	15.0	9.0
Fe mg /100g	0.42	0.31
Potassium mg /100g	246	202
Zin mg /100g	0.41	0.36
*Anthocyanin mg/100g	165	96
**Total phenol compounds mg/ kg	1672	1082
Antioxidant (% inhibtion)	72.4	66.4

* mg cyaniding-3 glincoside equivalents CGE/L.
** mg gallic acid equivalent GAE/ L.

Pomegranate juice is rich in polyphenolic compounds, results in (Table1) reveal that both pomegranate varieties contained total phenolic compounds of 1672 ppm for Manfaloti variety and 1082 ppm for Delta variety. Beside, these varieties contained anthocyanin of 165 mg for the first variety and 96 mg for the latters of cyanidin3-glucoside equivelant (CGE/L). These compounds act as antioxidants which protect against free radicals. Free radicals cause damage to celluler biomolecules such as nucleac acids, enzymes, proteins, lipids,and carbohydrates consequently they adversely affect their functions .The antioxidant (inhibition %) was 72.4% for the juice of Manfaloti variety and 66.4 for Delta variety. Other constituents include vitamin C was in the range of 12-16 mg/100g which covered 16% of an adult daily vitamin C requirement. Dietary fiber reached 9.2% and 9.9% for Manfaloti and Delta respectively. Other constituents were 15, 0.42, 246, and 0.41 for Ca, Fe, K and Z respectively for Manfaloti variety the corresponding values for Delta variety were 9.0, 0.31, 202 and 0.36. These results are in a greement with results obtained by *ELkar et al., (2011).*

Chemical composition of barley variety Shakira.

Results in (Table 2) reveal that barley variety Shakira used in the manufacture of Non alcoholic beverage has moisture content of 11.2%crude protein 12.6% ,ether extract 2.39% dietary fiber 19.55 % ,sugar 2.71 %,starch 60.2% and ash 2.26 % whereas B-glucan percentage was 4.1 %. These results are in agreement with results obtained by (Biel and Jacyno, 2013).

Table (2): Chemical composition of barley variety Shakira.

Components	Shakira
Moisture content %	11.2
Starch %	60.2
Sugar%	2.71
Dietary fiber %	19.55
Ash %	2.26
Crude protein(NX6.25) %	12.6
Ether extract %	2.39
B-Glucan %	4.1

Physicochemical properties of nonalcoholic beverage (wort):

Results in (Table 3) indicate that the nonalcoholic beverage extracted from barely variety Shakira after being adjusted to pH 5.83% had the chemical constitutes of water 86.20 % soluble protein 3.53 %, ether extract 0.23 %, dietary fiber 1.9 % ,beta glucan 0.22% , and pH 5.83% and T.S.S. 14.5 % .Also the B-glucan content of wort was lowered to (0.22%) due to the dilution during the preparation of wort from barley.

Effect of B- glucan on the organoleptic properties:

To study the effect of the B-glucan on the organoleptic properties.The different concentration of pomegranate juices were prepared which contained different concentrations of B-glucan ranged from 0 to 0.8%. (Table 4) these results reveal that organoleptic properties had decreasing score rate upon increasing %of B-glucan of juice. Accordingly 0.4% Beta glucan was the moderate concentration which had better scores the Manfaloti juice containing 0.6%and 0.8% was significantly different in color, taste, viscosity and overall acceptability when compared to 0.0% B-glucan Manfaloti juice (Table 4). These results are in a greement with results obtained by *Din et al.,(2009).* for functional beverages contain B-glucan.

Results in (Table 5) reveal that the functional pomegranate juice prepared by adding B-glucan at 0.40% was superior to the other juice prepared by mixing 1:1 pomegranate juice to barley wort the latter had less B-glucan of 0.11 % and dietary fiber 5.5% (Table 5). Also other components like Anthocyanine, total phenolic components were decreased.

Effect of ambient storage on chemical composition of functional juices:

The chemical constituents of functional juice after being storage six months are presented in (Table 6) a slight decreasing trend was observed for T.S.S, pH, dietary fiber, ash, and soluble protein. However an obvious decrease was found in ascorbic acid content. Also Anthocyanine, phenolic components and antioxidant inhibition were also decreased slightly due to storage period for six months. However B-glucan percent was almost always the same during storage.

Table (3): Analysis of nonalcoholic beverage (wort)*.

Content	Water%	T.S.S%	pH%	Dietary fiber%	Ash %	Soluble Protein %	Ether extract %	B-glucan %
Nonalcoholic	86.20	14.5	5.83	1.9	0.2	3.53	0.23	0.22

*Wort extracted from barely shakira.

Table (4): Effect of B-glucan incorporation on organoleptic properties of functional pomegranate juice of Manfaloti variety.

Treatment	Color	Taste	Viscosity	Overall acceptability
Manfaloti juice 0.0 % B-glucan	8.4	9.2	7.1	8.7
Manafaloti juice 0. 4 % B-glucan	8.1	7.2	8.3	8.6
Manfaloti juice 0. 6 % B-glucan	6.3	6.2	8.9	8.1
Manfaloti juice 0.8 % B-glucan	5.0	6.0	9.4	7.0
L.S.D :0.05	1.10	0.96	0.90	0.87

Table (5): Functional juice of pomegranate and B-glucan.

Component	* (1)	**(2)
Moisture content %	86.5	81.2
T.S.S%	17.4	15.8
pH%	4.31	4.23
Dietary fiber %	5.5	9.2
Ash %	0.3	0.6
Ascorbic acid mg/100gm	7.9	15.8
Anthocyanin mg/100gm	84	165
Total phenol mg/kg	83.6	1672
Antioxidant inhibition %	30.2	72.6
Soluble protein(NX6.25) %	3.35	1.9
Ether extract %	0.15	1.4
B-Glucan %	0.11	0.40

* (1) : Barley wort and Manfaloti juice 1:1.
** (2) : Manfaloti juice and extracted B-glucan at 0.40%.

Table (6): Chemical composition of functional juices after being stored for six months.

Content	Storage period months							
	0		2		4		6	
	*(1)	** (2)	* (1)	** (2)	* (1)	** (2)	*(1)	** (2)
T.S.S %	15.16	15.8	15.0	15.8	14.9	15.7	14.6	15.6
pH%	4.31	4.23	4.31	4.23	4.3	4.22	4.29	4.13
Dietary fiber%	5.5	9.2	5.4	9.1	5.4	9.0	5.3	9.0
Ascorbic acid mg/ 100gm	7.9	15.8	7.1	15.6	7	15.3	6.2	14.2
Ash%	0.3	0.6	0.3	0.6	0.31	0.6	0.29	0.59
Soluble protein %	3.35	1.9	3.32	1.8	3.2	1.79	3.1	1.7
Ether extract %	0.15	1.4	0.15	1.3	0.16	1.3	0.16	0.13
Anthocyanin mg/100gm	84	165	79	158	74	153	79	143
Total phenol compounds mg/kg	83.6	1672	82.1	1593	81.1	1512	79.0	1508
Antioxidant inhibition %	30.2	72.6	30.1	70.9	28.5	69.7	28.1	62.4
B-glucan %	0.11	0.4	0.11	0.4	0.11	0.4	0.11	0.39

* (1) : Barley wort and Manfaloti juice 1:1.
** (2) : Manfaloti juice and extracted B-glucan 0.4%.

Microbial exanimation of total bacterial, yeast and mold counts of pomegranate juice samples:

Total bacterial, yeast and mold counts of pomegranate juice samples were determined before storage and subsequently every two months along with six months of storage at ambient temperature. The obtained data are presented in (Table 7). It could be observed that both bacterial as well as yeast and mold counts decreased gradually with increasing the storage period .

Effect of storage of pomegranate juice and pomegranate juice enriched with B- glucan sensory evaluation:

Results in (Table 8) represent the organoleptic scores of different pomegranate juices and the functional pomegranate juice prepared by adding the B-glucan extract to the juice in 0.4% concentration . The best scores were given to the pomegranate juice variety Manfaloti with the adding 0.4% extracted B-glucan. However after storage for six months at ambient temperature the organoleptic scores slightly decreased. It could be observed that there were significant differences between color appearance flavor and total acceptability for Manfaloti juice and wort1:1 and Manfaloti juice alone.

Table (7): Change in total bacterial , yeast and molds counts for pomegranate juice and functional juice after being stored for six months at ambient temperature (25± 2°C).

Samples	Total bacterial counts (X 10^4/gm)					Yeast and molds counts (X 10^2 / gm)				
	Storage period (months)				Change %	Storage period (months)				Change %
	0	2	4	6		0	2	4	6	
Manfaloti juice	2.1	1.9	0.63	0.42	80	4.2	2.3	1.9	0.92	78.09
Manfaloti juice and wort 1:1	2.1	1.8	0.42	0.32	84.76	4.1	2.6	1.6	0.81	80.24
Manfaloti juice and 0.4 % B-glucan	3.2	1.9	1.8	0.93	70.93	4.2	2.1	1.9	0.79	81.19

Table (8): Sensory evaluation of pomegranate juice and pomegranate juice enriched with B-glucan extracted from barely at zero time and after storage period of six months at ambient temperature (25 ±2°C) .

Samples	Sensory attributes directly after preparation				Sensory attributes directly after six months storage			
	Color	Appearance	Flavor	Total acceptability	Color	Appearance	Flavor	Total acceptability
Manfaloti juice	8.9	9.2	9.1	8.8	8.3	9.1	9.04	8.1
Manfaloti juice and wort 1:1	7.3	8.1	6.9	7.3	7.1	8.0	6.3	7.2
Manfaloti juice and 0.4% B-glucan	8.5	7.5	9.3	8.6	8.3	7.2	9.1	7.9
L.S.D:0.05	1.63	1.01	0.97	0.84	0.99	1.39	1.17	1.1

REFERENCES

A.O.A.C: (1995). Official Methods of Analysis of the Association of official Analyttical chemists . 16th Ed , published by the Association of official Analytical chemists. Arington Virginia, 2220 USA.

Amdt., E. A. (2006). Whole grain barley for todays health and wellness needs Con/Agro Foods, Inc. Omaha, NE., 51:20-22.

Aviram, M., M. Rsenblat and D. Gaitini (2004). Pomegranate juice consumption for 3 years by patients with carotid artery stenosis reduces common carotid intima-media thickness, blood pressure and LDL oxidation . CLin Nutr, 23(3) : 423-433.

Aviram, M. and L. Dornfeld (2001). Pomegranate juice consumption inhibits serum angiotensin converting enzyme activity and reduces systolic blood pressure. ELsevier, Atherosclerosis 158 (1) :195-198.

Aviram, M., L. Dornfeld, M. Rosenblat, N. Volkova, M. Kapan, R. Coleman, T. Hayek, D. Presser and Bianca Fuhrman (2007). Pomegranate juice consumption reduces oxidative stress, atherogenic modifications to LDL,and platelet aggregation: studies in humans and in atherosclerotic apolipoprotein E-deficient mice The American Journal of Clinical Nutrition. 71 :1062-1076

Bandoniene, D., M. Murcovic, W. Pfannhauser, P. R. Venskutonis and D. Gruzdiene (2002). Detaction and activity evaluation of radical scavenging compounds by using DPPH free radical and on-line HPLC- method. Eur. Food Res. Technol., 214,143-147.

Biel, W. and E. Jacyno (2013). Chemical composition and nutritive value of spring hulled Barley varieties. Bulgarian journal of Agriculture science, 19,(4), 721-727.

Carpita, N.C. (1996). Structure and biogenesis of cell walls of grasses ANUL. Rev. Plant Physiol. Plant Mol. Biol., 47: 445-476.

Cavallero, A., S. Empilli, F. Brighenti and AM. Stanca (2002). High (1-3,1-4) B-glucan barley fractions in bread making and their effects on human glycemic response. J .Cereal Sci. 36:59-66.

Difco Manual, (1985). Dehydrated culture Media and reagent for Microbiology. Tenth Edition (1985). Difico Laboratories, Detroit, Michign, U.S.A.

Din, A.F. M. Anjume T. Zahoor and H. Nawaz(2009). Extraction and utilization of barley B-glucan for the preparation of functional beverage. Int, J. Agric. Biol,11: 37-740.

Dubois, M., K.A. Gilles, J. Hamilton, P.A. Rebers and F. Smith (1956). Colorimetric method for determination of related substances Anal. Chem..,28: 250-352.

Edwards, C.A. and A.M. Parrett (1996). Plant cell wall polysaccharides, gums and hydrocolloids : Nutritional Aspects .In Carbohydrates in food. Eliasson A-C(ed.), Marcel Dekker, New York, p319-345.

ELKar, C., A. Ferchichi, F. Attia and J. Bouajila (2011). Pomegranate *(Punica granatum)* Juices: Chemical composition , micronutrient Cations, and Antioxidant Capacity. J . Food Sci , 76, 5, 707-713.

Esmaillzadeh, A., F. Tahbaz, I. Gaieni, H. Alavi-MAJD and L. Azadbakht (2004). Concentrated pomegranate juice improves lipid profiles in diabetic patients with hyperlipidemia J. Med Food 7 (3): 305-308.

Fadel, J.G., R.K. Newman, C.W. Newman and A.E. Barnes (1987). Hypocholestrolemic effects of beta-glucan in different barley diets fed to broiler chicks. Nutr. Rep Int. 35: 1049.

Jadhav, S.J., S.E. Lutz, V.M. Ghorpade and D.K. Salunkhe (1998). Barley chemistry and value added processing .Critical Reviews in Food Science and Nutrition. 38:123-171

Galvao, L. C. A., A. Lopsz and H. Williams (1976). Essential mineral elements in peanuts and peanuts butter J.Food Sci., 41: 1305-1309.

Giese, J.H. (1992). Hitting the spot :Bevarages and beverage technology Food Technol., 46: 70-72.

Kalra, S. and S. Jood (2002). Effect of dietary B-glucan on cholesterol and lipoprotein fractions in rats . J Cereal Sci 31: 141-145.

Kulkarni, A.P., H.S. Mahal, S. Kapoor and S.M. Aradhya (2007). In vitro studies on

the binding, antioxidant and cytotoxic actions of punicalagin J. Agric Food Chem, 55(4) : 1491-1500.

Lambo, A.M., R. Oste and M.E.G. Nyman (2005). Dietary fiber in fermented oat and barley B-glucan rich concentrates .Food Chemistry ,89:283-293.

Malkki, Y. and E. Virtanen (2001). Gastrointestinal effect of oat and oat gum : a review . Lebensmittel –Wissenschaft und Technologie ,34: 337-347.

Mondello, L., A. Cotroneo, G. Errante, G. Dugo and P. Dugo (2000). Determination of anthocyanins in blood orange juice by HPLC. J. Pharmaceutical and Biomedical Analysis, 23:191-195.

Newman, R.K., C.W. Newman and H. graham (1989). The hypocholesterolemic function of barley B-glucan .Cereal Foods Worled,34:883.

NIH- Listed human clinical trials on pomegranate, July (2010).

The Many Amazing Health Benefits of Pomegranates .Exotic Fruit for Health. 22 August 2001.

Plumb, G.W., De Pascual- Teresa S. Santos- Buelga C, Rivas-Gonzalo JC, and Williamson G. (2002). Antioxidant properties of gallocatechin and prodelphinidins from pomegranate peel Redox Rep. Methods of Analysis of functional Food and Nutraceuticals. 7:41

Prosky, L., N. Aso, I. Furda, J.W. Devries, S chweizer ,T.F. and B.F. Hardland (1984). Determination of total dietary fiber in Food, Food products and total diets, J.A.O.A.C, 67: 1044-1052.

Ritmier, C.A. and G.R. Nonnecks (1991). Objective and Sensory evaluation of fresh fruit of day natural strawberry cultivars. J.Hort.Sci.,26: 843-845.

Schubert, S.Y., E.P. Lansky and I. Neeman (1999). Antioxidant and eicosanoid enzyme inhibition properties of pomegranate seed oil and fermented juice flavonoids Jethnopharmacol 66 (1): 11-17.

Senedecor, G. W and W. G. Cochran (1973). Statistical Methods Iowa State Univ., Press Ames, Iowa, pp.593 – 610.

Vinson, J. A., Y. A. Dabbagh, M. S. Mamdouh and J. Jang (1995). Plant flavonoids, especially tea flavonols are powerful antioxidants using an in vitro oxidation model for heart disease. J. Agric. and Food Chem. 43: 2800-2802.

White, W.B., H.R. Bird, M.L. Sunde, N. Prentice, W.C. Burger and J.A. Marlett (1981). The viscosity interaction of barley beta glucan with *Trichoderma viride* cellulase in the chick instestine .Poult. Sci. 60: 1043.

Wood, P.J., J.T. Braaten, F.W. Scott, K.D. Riedel, M.S. Wolynetz and M.W. Collins (1994). Effect of dose and modification of viscous properties of oat gum on plasma glucose and insulin following an oral glucose load. British J. Nutri., 72: 731-743.

Wood, P.J. and M.U. Beer (1998). In Functional Foods Biochemical and Processing Aspects Mazza, G. (Ed) Technomic Publication Company .Inc Lancaster, PA, PP1-37 .

Wood, P.J., I.R. Siddiqui and D. Paton (1978). Extraction of High-Viscosity Gums from Oats. Sereal Chem.,55:1038-1049.

اعداد مشروب رمان صحي محتوي علي بيتا جلوكان الشعير

جميلة يوسف عطية

معهد بحوث تكنولوجيا الأغذية – مركز البحوث الزراعية – الجيزة – مصر

الملخص العربي

تم تحضير مشروب صحي وظيفي من عصير الرمان ومن البيتا جلوكان المستخلص من الشعير وعصير الرمان له تأثيرات عديدة لخفض الإصابة بأوعية القلب الدموية بالإضافة فإن البيتاجلوكان يؤخر امتصاص السكر وينظم مستوي الجلوكوز في الدم ولقد وجد ان البيتاجلوكان المستخلص من الشعير صنف شاكيرا (ورت) والمضاف الي عصير الرمان بنسبة1 :1 يحتوي علي 0.22% بيتا جلوكان لذلك تم إضافة مستخلص بيتا جلوكان بنسبة 0.4% الي عصير الرمان المنفلوطي ولقد وجد أن البيتاجلوكان يجب ألايزيد نسبته عن 0.4% حتى لا يؤثر بالسالب علي الصفات الحسية.

والعصير الوظيفي تم تحضيره وتعبأته في زجاجات ثم بسترته علي 90مْ لمد ة عشرة دقائق وتم غلق الزجاجات بواسطة كبسولة تاجية وخزنت لمدة ستة اشهر علي درجة حرارة الغرفة (25±2 مْ)

والعصير المعبأ تم اختباره للصفات الحسيه والميكروبيه بعد تحضيره مباشرة وبعد تخزينه لمدة سته اشهر.

أيضا وجد أن العصير الوظيفي المخزن قد انخفضت مكوناته الكيماويه انخفاضاً بسيطاً بالنسبه للمواد الذائبة الكلية والpH والألياف الغذائيه والرماد والبروتين الذائب.

ألا أن الإنخفاض كان واضح بالنسبه لحامض الاسكوربيك لذلك فإن الأنثوسيانين والفينولات الكلية ومضادات الاكسدة انخفضت انخفاضاً ملحوظ أثناء التخزين لمدة ستة اشهر.

كذلك وجد أن الدرجات الحسية إنخفضت إنخفاضاً بسيط في حين أن الأعداد الميكروبية للفطر والخميره وكذلك البكتريا كان انخفاضها واضح بعد سته اشهر.