ISSN 1110-0419

Annals Of Agric. Sc., Moshtohor,
Vol. 45(2): 671-684, (2007).

BIOCHEMICAL EVALUATION OF YOUNG GREEN BARLEY LEAVES POWDER AND ITS APPLICATION IN PREPARING SOME FRESH JUICES

BY

Foda, F.F.A.* and Mohamed, M.H.**
* Agric. Chemistry Dept. and ** Food Sci. Dept., Fac. of Agric., Benha Univ., Egypt

ABSTRACT

Young green barley leaves, freeze-dried barley leaves juice and green magma powders were analyzed for chemical composition, some bioactive components and minerals content. As well as, the effect of addition of barley leaves juice and green magma powder on chemical and organoleptic properties of some manufacturing fresh juices such as grapefruit, balady orange and cantaloupe were also evaluated.

The obtained results indicated that total protein was higher in green magma (38.61%) than that in freeze-dried barley leaves juice powder (23.52%) and barley leaves powder (23.69%). However, available carbohydrate were found to be 37.74, 39.34 and 36.65% for barley leaves, freeze dried barley leaves juice and green magma powders, respectively. Also, crude fiber conten were (16.59, 14.57 and 10.25%) and ash (19.26, 19.82 and 11.59%) while ether extract content was (2.72, 2.75 and 2.90%) for barley leaves powder, freeze-dried barley leaves juice and green magma, respectively. The chlorophyll (a, b), β-carotenoids and ascorbic acid contents were found to be (1494, 1435 and 1327 mg/kg), (226, 211 and 214 mg/kg) and (317, 221 and 273 mg/kg) for barley leaves, freeze-dried barley leaves juice and green magma powders, respectively. However, minerals content i.e. Na, K, P, Fe, Mn, Zn, Ca, Mg, Ni and Cu in the raw materials under investigation were determined. The obtained results showed that the above-mentioned materials had high amounts of K, Ca, Na, P minerals.

The chemical characteristics and organoleptic properties of prepared fresh juices for grapefruit, balady orange and cantaloupe fortified with different levels (1, 2, 3, 4 and 5% v/v) of juice from young green barley leaves and different concentrations (0.05, 0.10, 0.15, 0.20 and 0.25 g/100 ml juice) of green magma powder were evaluated. The sensory evaluation of juices prepared under above-mentioned conditions showed insignificant differences in colour with cantaloupe and grapefruit juices and lower significant difference with orange juice when compared with controls.

From the obtained results, it could be concluded that young green barley leaves powder had natural sources of antioxidants, minerals and other phytochemicals that neutralize free radicals and other unfriendly chemicals.

INTRODUCTION

Recently, natural plants have received much attention as sources of biologically active substances including antioxidants; antimutagens and anticarcinogens (Cress *et al.*, 1997).

Young green barley grass is an extremely potent detoxifier. Barley extract contains abundant chlorophyll, antioxidants, enzymes and other phytochemicals that neutralize free radicals and other unfriendly chemicals, including pesticides and food preservatives. Also, can makes a number of whole food nutritional supplements made with barley grass juice, including green magma, veggie magma and magma plus (Osawa *et al.*, 1992; Hartland, 1994; Marschner, 1995; Hagiwara, 1996 and Cremer *et al.*, 1998).

Kitta *et al.* (1992) determined the antioxidative activity of an isoflavonoid, 2"-O-glucosylisovitexin (2"-O-GIV) isolated from green barley leaves using lipid peroxidation systems. They found that 2"-O-GIV (100 µM) decreased malonaldehyde formation from ethyl linoleate (10 µl) to 59 and 10% at pH 3.5 and 7.4, respectively.

Economides and Gregoriou (1993) and Wallrauch (1995) reported that the grapefruit juice contained 10% total soluble solids; 2% acidity; 3.47 pH; 9.2 mg/100 ml Mg; 9 mg/100 ml Ca; 129.8 mg/100 ml K and 170.3 mg/100 ml Na.

Nakajima *et al.* (1998) studied the effect of the antioxidant, 2"-O-glycosylisovitexin from young green barley leaves on acetaldehyde formation in beer stored at 50°C for 90 days. They found that the concentration of acetaldehyde in beer samples increased by 873% after 90 days of storage. When a beer sample was stored at 50°C for 10 days with 1 mµg/ml of 2"-O-glycosylisovitexin and butylated hydroxytoluene (BHT), the acetaldehyde content was reduced by 60 and 15%, respectiveiy.

Durham *et al.* (1999) studied the degradation of the organophosphorus pesticides malathion, chlorpyrifos, guthion, diazinon, methidathion and parathion in an aqueous extract of young green barley leaves (*Hordeum vulgare* L.). They found that the above six pesticides 10 mg/L each was incubated in a 15% (150 g/L) solution of young green barley leaves for 3 h at 37°C and pH 7.4, malathion and chlorpyrifos degraded 100% whereas parathion (75%), diazinon (54%), guthion (41%) and methidathion (23%).

Arimoto *et al.* (2000) studied the effect of natural antioxidant, 2"-O-glycosylisovitexin(2"-O-GIV) isolated from green barley leaves on superoxide and hydroxyl radical generation. They found that the 2"-O-GIV inhibited superoxide formation by 97% at a level of 25 mM and inhibited hydroxyl radical formation by 91% at a level of 500 u.

Moustafa (2002) reported that the fresh grapefruit and cantaloupe juices contained 90.23 and 91.49% moisture, 9.5 and 8.5% total soluble solids, 1.51 and

0.35% total acidity, 4.84 and 4.92% reducing sugars, 2.33 and 2.76% non-reducing sugars, 7.17 and 7.68% total sugars, 0.27 and 0.27% ash and 33.89 and 37.00 mg/100 g ascorbic acid, respectively. Also, the fresh grapefruit and cantaloupe juices contained 20.01 and 14.00 mg/100 g calcium, 11.07 and 9.87 mg/100 g magnesium, 18.20 and 16.00 mg/100g phosphorus, 3.80 and 12.65 mg/100 g sodium, 176.50 and 227.00 mg/100g potassium and 0.35 and 0.40 mg/100g iron (fresh basis), respectively.

The aim of this investigation is to study the biochemical evaluation of juice powder from young green barley leaves and its application in manufacturing of some fresh juices including grapefruit, balady orange and cantaloupe fortified with barley leaves juice and the produced green magma as standard. Therefore, the importance of natural antioxidants has increased greatly, safe, economic and to replace the synthetic chemicals.

MATERIALS AND METHODS

Materials:

Growth condition and plant material:

- Barley (*Hordeum vulgare*) Giza 126 cultivar was selected seeds of barley that were germinated on moist filter paper for three days in an incubator at 25°C. After germination, the seeds were planted into plastic pots containing the organic matters as nutrient sources.
- Green barley leaves were harvested 3 weeks after germinat on. The juice from barley leaves was freeze dried and subsequently ground with a mesh size 2-mm sieve to form a fine and uniform powder for used.
- The grapefruit fruits (*Citrus paradise*) and balady orange(*Citrus sinensis*) have been obtained from Moshtohor Faculty of Agric. Farm, Benha Univ.
- The cantaloupe fruits (*Cucumis melon*) have been obtained from local market, Tukh, Qaliubia, Egypt.

Extraction of juices:

The grapefruit and balady orange fruits were washed, halved and the juice was extracted by pressing in a laboratory hand juicer. However, the cantaloupe fruits were washed, peeled, the seeds were removed, and the flesh was sliced. The juice was extracted by multipress compact juicer. The extracted juices were separated through two layers of cheesecloth and the juices were obtained to be analyzed and processed.

Chemical composition of materials under investigation:

Moisture, crude protein, ether extract, fiber and ash contents were determined according to the methods described in A.O.A.C. (2000). Also, The total soluble solids content were determined by an Abbe' refractometer at 20°C according to the method described in the A.O.A.C (2000). The total acidity was determined by titration with 0.1N sodium hydroxide solution using phenolphthalein as indicator according to A.O.A.C. (2000). Results were expressed as citric acid. pH value of juices samples was measured using digital pH-meter model SA 210. Ascorbic acid content was determined using 2, 6

dichlorophenol indophenol titration method, according to the method described by A.O.A.C. (2000). The results were expressed as mg ascorbic acid per 100 g sample. The total and reducing sugars were determined by Shaffer-Somogy micro-method, according to A.O.A.C. (2000).

Determination of minerals salts concentration in materials under investigation:

Minerals salts concentration in the above-mentioned materials i.e. sodium (Na) and potassium (K) were measured by flame-photo metrically and phosphorus (P) was determined colorimetrically according to the methods described in A.O.A.C. (2000). However, other metals like Fe, Mn, Zn, Ca, Mg, Ni and Cu were determined by atomic absorption according to the methods described in A.O.A.C. (2000).

Determination of chlorophyll and total carotenoids:

The chlorophyll A, B and total carotenoids were determined by method according to Wettestein (1957).

Sensory evaluation of prepared fresh juices:

The samples were evaluated for colour, odour, taste, appearance and overall acceptability. The score sheet was designed as mentioned by Ibrahim (1985).

Statistical analysis:

Statistical analysis was carried out that was followed by multiple comparisons using Least significant difference (L.S.D.) at 0.05 level of significance (Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

Chemical composition of raw materials:

The proximate chemical composition of whole barley leaves, freeze-dried barley leaves juice and green magma powders are presented in Table (1). The obtained results indicate that crude protein content was significantly ($p<0.05$) higher in green magma (38.61%) than that in freeze dried juice barley leaves powder (23.52%) and barley leaves powder (23.69%). However, total carbohydrate in freeze-dried juice barley leaves was significantly ($p<0.05$) higher (39.34%) than that whole barley leaves powder and green magma, 38.74 and 36.65%, respectively. The results show that crude fiber content was 16.59, 14.57 and 10.25% for the above-mentioned materials under investigation.

Also, raw materials under investigation had low moisture content ranged from 8.12 to 8.65%, which makes it resistant to microorganisms attacks and storage longtime at room temperature. This point is very important for technology fields. On the other hand, ash and ether extract content were found to be (19.26, 19.82 and 11.59%) and (2.72, 2.75, 2.90%) in barley leaves powder, dried barley leaves juice and green magma powder, respectively (on dry weight basis). From the obtained results, it could be concluded that young green barley leaves powder

has quality plant found in nature because the main components, carbohydrate, crude protein, fiber and ash are balance with each other for the human body. These results were different with those reported by Hagiwara (1996) and Durham *et al.* (1999). These may be due to different growth conditions, plant material and nutrient sources of organic matters.

Table (1): Chemical composition of barley leaves, freeze-dried barley leaves juice and green magma powders (g/100 g, on dry weight basis) (mean±SE).

Components (%)	Barley leaves powder	Freeze-dried barley juice powder	Green magma powder	L.S.D. at 0.05
Moisture	8.32±0.06^{b}	8.65±0.01^{a}	8.12±0.01^{c}	0.11
Crude protein	23.69±0.16^{c}	23.52±0.09^{b}	38.61±0.02^{a}	0.55
Ether extract	2.72±0.04^{b}	2.75±0.03^{b}	2.90±0.01^{a}	0.06
Ash	19.26±0.04^{b}	19.82±0.02^{a}	11.59±0.02^{c}	0.27
Crude fiber	16.59±0.05^{a}	14.57±0.02^{b}	10.25±0.02^{c}	0.56
Available carbohydrate	37.74±0.07^{b}	39.34±0.05^{a}	36.65±0.03^{c}	0.87

a, b & c: There is no significant difference between any two means, with the same attribute, have the same letter ($P > 0.05$).

Also, barley leaves have bioactive components which increased nutritional value. The obtained data are presented in Table (2). The results show that chlorophyll (a) and chlorophyll (b) contents were (761, 748 and 669 mg/kg) and (733, 687 and 658 mg/kg) for barley leaves, freeze-dried barley leaves juice and green magma powders, respectively. However, β-carotenoids content were found to be (226, 211, 214 mg/kg) for the above-mentioned materials. But, ascorbic acid content was significantly ($p<0.05$)higher in barley leaves powder (317 mg/kg) than that freeze dried barely leaves juice powder (221 mg/kg) and green magma (273 mg/kg). Generally, the obtained values were in line with those reported by Hagiwara (1996). Kitta *et al.* (1992) and Osawa *et al.* (1992) reported that flavonoids, certain food-derived substances, such as ascorbic acid and carotenoids have been shown to diminish the adverse effects of oxidation in organisms. Their antioxidative activity is due to their ability to chelate metal ions by means of the 3-hydroxyl 4-keto grouping and their ability to scavenge free radicals derived from the phenolic moiety of the structure. Therefore, barley leaves or juice barley leaves may be usable as an antioxidative agent in certain foods or beverage.

Minerals content in materials under investigation:

Generally, minerals content are considered as important in the growth of human, animals and plants. Calcium is essential element for metabolic processes in all living microorganisms. Also, magnesium is important element for activities enzymatic reaction. However, sodium and potassium are considered as important elements for the growth of animals and plants (Lester and Birkett, 1999). Mineral content in whole barley leaves, freeze-dried barley leaves juice and green magma

powders were estimated and the results are presented in Table (3). From the obtained results, it could be concluded that calcium, potassium and sodium are the most abundant major cations. The mean values of calcium were 982.50, 1058.33 and 1048.33 mg/100 g for barley leaves, freeze-dried barley leaves juice and green magma powders, respectively. While, potassium content was significantly ($p<0.05$)higher in green magma (3899 mg/100 g) than that in barley leaves (3125 mg/100 g) and freeze-dried barley leaves juice powders (3253 mg/100 g). However, sodium content was found to be significantly ($p<0.05$) higher in green magma (628.33 mg/100 g) when compared with barley leaves (114.33 mg/100 g) and freeze-dried barley leaves juice powders (125.00 mg/100g). These differentiations may be due to different growth conditions and nutrient sources of organic matters. While, the mean values of magnesium were found to be 13.67, 15.17 and 18.67 mg/100 g for barley leaves, freeze-dried barley leaves juice and green magma powders, respectively. But, the mean values of phosphorus content in materials under investigation were found to be 496.33, 502.0 and 533.0 mg/100 g for barley leaves, dried barley leaves juice and green magma powders, respectively.

Table (2): Chlorophyll, β-carotenoids and ascorbic acid content of barley leaves, freeze-dried barley leaves juice and green magma powders (mg/kg, on dry basis) (mean±SE).

Components (mg/100 g)	Barley leaves powder	Freeze-dried barley juice powder	Green magma powder	L.S.D. at 0.05
Chlorophyll (a)	761±4.88[a]	748±3.46[a]	669±2.02[b]	16.70
Chlorophyll (b)	733±4.72[a]	687±8.33[b]	658±4.41[c]	19.86
β-carotenoids	226±0.88[a]	211±2.08[b]	214±1.53[b]	5.14
Ascorbic acid	317±4.41[a]	221±2.08[c]	273±371[b]	11.54

a, b & c: There is no significant difference between any two means, with the same attribute, have the same letter ($P > 0.05$).

On the other hand, iron and manganese are essential elements in physiological metalo-enzymes systems. But, zinc is very important to the living system, however, copper is an essential component of numerous oxidation reduction enzymes (Beveridge and McAndrew, 2000). Data in Table (3) show that iron content was found to be 14.97, 13.95 and 16.53 mg/100 g of barley leaves, freeze-dried barley leaves juice and green magma powders, respectively. The mean values of zinc were 16.5, 33.33 and 26.17 mg/100 g for the above-mentioned materials under investigation, respectively. While, the mean values of manganese and copper were (6.60 and 16.87), (9.15 and 21.07) and (7.33 and 21.78 mg /100 g) for barley leaves, freeze-dried barley leaves juice and green magma powders, respectively. These results were different with those reported by Hagiwara (1996) who found that Na, K, Ca, Mg, Fe, Cu, P, Mn and Zn were 775, 8880, 1108, 225, 16,1.36, 594, 5.6 and 733 mg/100 g, respectively (on dry weight basis) in green juice from young barley leaves.

Table (3): Minerals content of barley leaves, freeze-dried juice barley leaves and green magma powders (mg/100 g on dry weight basis).

Materials	Ca	K	Na	Mg	P	Fe	Zn	Mn	Cu
Fresh whole powder	982.50± 23.87^{b}	3125± 27.02^{b}	114.33± 3.48^{b}	13.67± 1.26^{b}	496.33± 4.96^{b}	14.97± 0.78^{b}	16.50± 0.76^{c}	6.60± 0.57^{b}	16.87± 0.79^{b}
Freeze-dried juice barley leaves powder	1058.33± 13.76^{a}	3253± 40.55^{b}	125.00± 2.89^{b}	15.17± 1.25^{ab}	502.00± 4.66^{b}	13.95± 0.12^{b}	33.33± 2.58^{a}	9.15± 0.71^{a}	21.07± 0.93^{a}
Green magma powder	1048.33± 20.72^{a}	3899± 47.96^{a}	628.33± 20.19^{a}	18.67± 1.33^{a}	533.00± 2.58^{a}	16.53± 0.19^{a}	26.17± 1.49^{b}	7.33± 0.74a^{b}	21.78± 0.86^{a}
LSD	59.39	128.74	38.95	3.82	12.55	1.40	5.30	2.03	2.57

a & b: There is no significant difference between any two means, with the same attribute, have the same letter (P > 0.05).

Chemical composition of fresh grapefruit, balady orange and cantaloupe juices:

Chemical components and minerals content of fresh grapefruit, balady orange and cantaloupe juices were determined and the data are presented in Table (4). The obtained results showed that the fresh grapefruit juice contained 90.22% moisture, 9.72% total soluble solids, 0.31% ash, 0.74% crude protein, 7.18% total sugars, 45 mg/100 g ascorbic acid, pH value 3.3 and 2.16% total acidity (as citric acid). Also, the fresh grapefruit juice contained 151.50 mg/100 g potassium, 1.97 mg/100 g sodium, 17.22 mg/100 g phosphorus, 16.37 mg/100 g calcium, 10.42 mg/100 g magnesium and 0.27 mg/100 g iron (fresh basis). However, the chemical components of balady orange juice were found to be 87.92, 12.03, 0.43, 0.65 and 9.86% of moisture, total soluble solids, ash, crude protein and total sugars, respectively. Also, the juice contained 42 mg/100 g ascorbic acid, pH value 4.09 and 1.88% total acidity (as citric acid). But, minerals content were found to be 193.67, 1[illegible]5. 17.18, 12.50, 10.50 and 0.21 mg/100 g for potassium, sodium, phosphorus, calcium, magnesium and iron, respectively (on wet weight basis). On the other hand, fresh cantaloupe juice contained 90.39% moisture, 9.69% total soluble solids, 0.55% ash, 0.80% crude protein, 8.10% total sugars, 35 mg/100 g ascorbic acid, pH value 6.37 and 0.25% total acidity (as citric acid). Also, it has the mean values 237.33, 12.62, 16.08, 14.05, 9.92 and 0.44 mg/100 g of K, Na, P, Ca, Mg and Fe, respectively. From the above-mentioned results, it could be concluded that the different juices under investigation had lower levels of crude protein, ash and iron when compared with juice from barley leaves powder (Tables, 1 and 2). These results are agreement with those reported by Wallrauch (1995) and Moustafa (2002).

Table (4): Chemical components of fresh grapefruit, balady orange and cantaloupe juices (mean±SE).

Components	Grapefruit juice	Balady orange juice	Cantaloupe juice
Moisture %	90.22±0.17	87.92±0.14	90.39±0.04
Total soluble solids %	9.72±0.04	12.03±0.04	9.69±0.2
Ash %	0.31±0.02	0.43±0.04	0.55±0.03
Crude protein %	0.74±0.01	0.65±0.04	0.80±0.04
Reducing sugars %	4.88±0.08	6.74±0.14	5.15±0.12
Non-reducing sugars %	2.30±0.04	3.12±0.08	2.95±0.08
Total sugars %	7.18±0.06	9.86±0.11	8.10±0.10
Ascorbic acid (mg/100 g)	45±1.64	42±1.78	35±1.18
pH	3.30	4.09	6.37
Total acidity (as citric acid) %	2.16±0.04	1.88±0.02	0.25±0.02
Potassium (mg/100 g)	151.50±13.54	193.67±4.10	237.33±6.74
Sodium (mg/100 g)	1.97±0.43	1.05±0.05	12.62±0.07
Phosphorus (mg/100 g)	17.22±0.81	17.18±0.19	16.08±0.13
Calcium (mg/100 g)	16.37±2.34	12.50±0.43	14.05±0.10
Magnesium (mg/100 g)	10.42±0.37	10.50±0.25	9.92±0.04
Iron (mg/100 g)	0.27±0.05	0.21±0.03	0.44±0.02

Chemical composition of preparing fresh juices fortified with fresh barley leaves juice or green magma powder:

Data in Table (5) represent the chemical composition of preparing grapefruit, balady orange and cantaloupe juices supplemented with fresh barley leaves juice or green magma powder at different levels. The obtained results showed that the fresh grapefruit juices fortified by fresh barley leaves juice at different concentration (1, 2, 3, 4 and 5% v/v) had slightly more or less in most components when compared with control sample. Ascorbic acid content was increased while, total soluble solids (T.S.S.), total sugars and total acidity content were decreased. But, fresh juices preparing from grapefruit, balady orange, cantaloupe fortified with green magma powder at different levels (0.05, 0.1, 0.15, 0.20 and 0.25% w/v), total soluble solids content only were increased, while other components were decreased when compared with control sample.

Data in the same table indicated that balady orange and cantaloupe juices prepared with the same method, moisture and ascorbic acid content were slightly increased with increasing fortified of fresh barley leaves juice, while other components were decreased with increasing level of the same additives compared with control. On the other hand, the juices prepared with green magma powder were decreased in moisture and acidity content with increasing levels of green magma powder, but was increased in other attributes with increasing levels of the same additives.

Organoleptic evaluation of some prepared juices supplemented with different levels of fresh barley juice and green magma powder:

The data in Table (6) presented the mean values of the organoleptic evaluation (colour, odour, taste, appearance and overall acceptability) of some prepared juices i.e. grapefruit, balady orange and cantaloupe fortified by fresh barley

Table (5): Chemical components of preparing juices fortified with fresh barley juice and green magma powder.

Juice	Properties	Control	Treatments									
			T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
Grapefruit	Moisture %	90.22	90.22	90.23	90.24	90.25	90.26	90.18	90.15	90.09	90.05	90.00
	Total soluble solids (T.S.S.) %	9.72	9.72	9.70	9.68	9.66	9.66	9.77	9.80	9.84	9.90	9.95
	Ash %	0.31	0.32	0.32	0.32	0.33	0.33	0.31	0.32	0.32	0.33	0.34
	Reducing sugars %	4.88	4.88	4.88	4.87	4.86	4.86	4.86	4.86	4.85	4.84	4.82
	Non-reducing sugars %	2.30	2.30	2.28	2.28	2.26	2.26	2.30	2.30	2.29	2.28	2.28
	Total sugars %	7.18	7.18	7.16	7.15	7.12	7.12	7.16	7.16	7.14	7.12	7.10
	Ascorbic acid (mg/100 g)	45	45	45	46	46	46	45	45	45	46	46
	pH	3.30	3.34	3.40	3.41	3.42	3.43	3.32	3.37	3.41	3.53	3.61
	Total acidity (as citric acid) %	2.16	2.14	2.14	2.12	2.10	2.08	2.12	2.10	2.08	2.06	2.04
Balady orange	Moisture %	87.92	87.93	87.95	87.96	87.97	87.99	87.88	87.83	87.78	87.74	87.69
	Total soluble solids (T.S.S.) %	12.03	12.01	11.99	11.98	11.95	11.93	12.07	12.11	12.16	12.20	12.24
	Ash %	0.43	0.43	0.43	0.44	0.44	0.44	0.43	0.44	0.45	0.45	0.46
	Reducing sugars %	6.74	6.72	6.70	6.67	6.65	6.64	6.74	6.73	6.70	7.68	6.66
	Non-reducing sugars %	3.12	3.11	3.10	3.10	3.08	3.06	3.12	3.11	3.10	3.08	3.07
	Total sugars %	9.86	9.83	9.80	9.77	9.73	9.70	9.86	9.84	9.80	9.76	9.73
	Ascorbic acid (mg/100 g)	42	42	42	43	43	44	43	43	44	44	45
	pH	4.09	4.09	4.10	4.11	4.13	4.14	4.23	4.23	4.25	4.26	4.27
	Total acidity (as citric acid) %	1.88	1.84	1.80	1.77	1.72	1.70	1.85	1.80	1.78	1.75	1.70
Cantaloupe	Moisture %	90.39	90.42	90.42	90.44	90.48	90.51	90.34	90.30	90.25	90.21	90.17
	Total soluble solids (T.S.S.) %	9.60	9.57	9.54	9.51	9.50	9.48	9.64	9.68	9.72	9.76	9.81
	Ash %	0.55	0.55	0.55	0.55	0.56	0.56	0.55	0.56	0.56	0.57	0.57
	Reducing sugars %	5.15	5.14	5.12	5.11	5.09	5.08	5.15	5.13	5.12	5.12	5.10
	Non-reducing sugars %	2.95	2.94	2.92	2.90	2.89	2.85	2.94	2.92	2.91	2.90	2.89
	Total sugars %	8.10	8.08	8.04	8.01	7.98	7.93	8.09	8.05	8.03	8.02	7.99
	Ascorbic acid (mg/100 g)	35	35	35	36	36	37	35	36	38	39	39
	pH	6.37	6.37	6.36	6.34	6.32	6.30	6.40	6.42	6.46	6.48	6.51
	Total acidity (as citric acid) %	0.25	0.23	0.21	0.20	0.20	0.19	0.24	0.22	0.21	0.19	0.18

Control: Fresh juice without addition.

T1: 1% fresh barley juice (v/v). T2: 2% fresh barley juice (v/v). T3: 3% fresh barley juice (v/v).
T4: 4% fresh barley juice (v/v). T5: 5% fresh barley juice (v/v) . T6: 0.05% magma powder (w/v).
T7: 0.10% magma powder (w/v). T8: 0.15% magma powder (w/v). T9: 0.20% magma powder (w/v). T10: 0.25% magma powder (w/v).

Table (6): Organoleptic evaluation of some prepared fresh juices fortified with fresh barley juice and green magma powder (mean±SE).

Treatments	Colour	Odour	Taste	Appearance	Overall acceptability	Total score
	Grapefruit juice					
Control	10.00±0.00	10.00±0.00	10.00±0.00	10.00±0.00	10.00±0.00	50.00±0.00
T1	9.19±0.09	9.50±0.16	8.94±0.11	8.56±0.18	8.69±0.16	44.88±0.32
T2	8.69±0.16	8.50±0.19	8.63±0.18	8.13±0.23	8.19±0.09	42.14±0.54
T3	7.94±0.18	7.69±0.16	7.75±0.13	7.44±0.15	7.69±0.13	38.51±0.57
T4	7.25±0.25	7.19±0.23	7.13±0.21	6.81±0.19	6.81±0.13	35.19±0.84
T5	6.06±0.36	5.88±0.30	5.75±0.23	5.56±0.22	5.56±0.18	28.81±1.16
LSD at 0.05	0.58	0.55	0.46	0.50	0.36	1.92
T6	9.00±0.00	8.81±0.13	8.88±0.08	8.38±0.16	8.63±0.16	43.70±0.41
T7	8.19±0.09	8.13±0.13	8.31±0.16	7.88±0.13	7.88±0.13	40.39±0.23
T8	7.44±0.15	7.56±0.15	7.63±0.13	7.19±0.09	7.38±0.08	37.20±0.34
T9	6.88±0.13	7.00±0.09	7.06±0.06	6.69±0.16	6.69±0.13	34.32±0.41
T10	5.56±0.22	5.81±0.13	5.75±0.16	5.69±0.16	5.94±0.15	28.75±0.46
LSD at 0.05	0.35	0.33	0.32	0.36	0.34	0.69
	Balady orange juice					
Control	10.00±0.00	10.00±0.00	10.00±0.00	10.00±0.00	10.00±0.00	50.00±0.00
T1	8.63±0.13	9.13±0.08	8.81±0.09	8.31±0.13	8.56±0.15	43.44±0.37
T2	7.88±0.08	8.25±0.09	8.13±0.08	7.81±0.09	8.13±0.08	40.20±0.21
T3	7.19±0.09	7.56±0.18	7.75±0.09	7.19±0.13	7.44±0.15	37.13±0.38
T4	6.25±0.25	6.69±0.13	7.00±0.16	6.75±0.16	6.56±0.15	33.25±0.51
T5	5.25±0.13	5.50±0.19	5.63±0.18	5.50±0.19	5.44±0.18	27.32±0.75
LSD at 0.05	0.38	0.36	0.33	0.37	0.37	1.22
T6	8.38±0.13	9.06±0.06	8.75±0.09	8.19±0.09	8.50±0.16	42.88±0.26
T7	7.69±0.13	8.25±0.09	8.00±0.00	7.75±0.09	8.06±0.11	39.75±0.21
T8	7.13±0.08	7.63±0.18	7.63±0.16	7.13±0.08	7.25±0.13	36.77±0.31
T9	5.94±0.15	6.88±0.13	7.13±0.08	6.50±0.16	6.38±0.16	32.83±0.28
T10	5.13±0.13	5.81±0.13	6.06±0.06	5.63±0.18	5.38±0.16	28.01±0.37
LSD at 0.05	0.32	0.32	0.24	0.33	0.37	0.74
	Cantaloupe juice					
Control	10.00±0.00	10.00±0.00	10.00±0.00	10.00±0.00	10.00±0.00	50.00±0.00
T1	9.65±0.13	9.25±0.13	8.94±0.06	8.38±0.16	8.50±0.16	44.72±0.13
T2	8.94±0.06	8.63±0.16	8.38±0.16	7.81±0.21	8.06±0.06	41.82±0.06
T3	8.06±0.18	7.88±0.21	7.56±0.15	7.06±0.06	7.31±0.09	37.87±0.18
T4	7.31±0.23	7.38±0.16	6.94±0.15	6.69±0.13	6.50±0.16	37.82±0.23
T5	6.38±0.28	6.13±0.23	5.63±0.18	5.38±0.18	5.38±0.18	28.90±0.28
LSD at 0.05	0.49	0.46	0.37	0.40	0.36	2.17
T6	9.69±0.13	9.38±0.18	9.00±0.00	9.25±0.16	9.25±0.16	46.57±0.43
T7	9.00±0.00	8.75±0.16	8.25±0.09	8.31±0.25	8.25±0.16	42.56±0.41
T8	8.25±0.09	7.88±0.08	7.63±0.13	7.50±0.19	7.50±0.13	38.76±0.40
T9	7.56±0.15	7.19±0.09	6.88±0.13	6.69±0.16	6.81±0.19	35.13±0.36
T10	6.88±0.18	6.38±0.13	5.88±0.13	6.19±0.09	5.81±0.19	31.14±0.38
LSD at 0.05	0.38	0.35	0.27	0.46	0.43	1.01

Control: Fresh juice without addition.

T1: 1% fresh barley juice (v/v).
T2: 2% fresh barley juice (v/v).
T3: 3% fresh barley juice (v/v).
T4: 4% fresh barley juice (v/v).
T5: 5% fresh barley juice (v/v).
T6: 0.05% magma powder (w/v).
T7: 0.10% magma powder (w/v).
T8: 0.15% magma powder (w/v).
T9: 0.20% magma powder (w/v).
T10: 0.25% magma powder (w/v).

juice and green magma powder. The obtained results showed that the grapefruit juices containing different levels of fresh barley juice i.e. 1, 2, 3, 4 and 5% (v/v) had total scores 44.88, 42.14, 38.51, 35.19 and 28.81, respectively, comparing with the total scores of control (50.00). On the other hand, the grapefruit juices supplemented with different concentrations of green magma powder (from 0.05 to 0.25% w/v) achieved the same scores or little different if compared with the same juices fortified by fresh barley juice. Gradual reduction was noticed in all the parameters as the ratio of fresh barley juice and green magma powder increases. These may be attributed that these blends need more time for mixing. In the same time, sensory characteristics of balady orange juices fortified with different concentrations of fresh barley juice and green magma powder as mentioned before are recorded in Table (6). The obtained results showed no difference in total scores at the materials above-mentioned as compared with score of control. Also, the organoleptic evaluation of cantaloupe juices fortified by different levels of fresh barley juice and green magma powder showed no difference in total scores. The mean values of total scores with fresh barley juice were 44.72, 41.82, 37..87, 37.82 and 28.90 at the above-mentioned levels comparing with total scores of control, 50.00. while, the mean values of total scores with green magma were 46.57, 42.56, 38.76, 35.13 and 31.14.

From the above-mentioned results, it could be observed that the addition of fresh barley juice or green magma powder at different levels i.e. 1 and 2% (v/v), 0.05 and 0.1 (w/v) had no difference in clour, odour, taste, appearance and overall acceptability for prepared grapefruit, balady orange and cantaloupe juice. Beside that these additives may be rise its nutritional value, natural source of antioxidants and minerals of these juices.

REFERENCES

A.O.A.C. (2000): Official Methods of Analysis Association Official Analytical Chemists, Washington, D.c. 17th Ed. U.S.A.

Arimoto, T.; Ichinose, T.; Yoshikawa, T. and Shibamoto, T. (2000): Effect of the natural antioxidant, 2"-O-glycosylisovitexin on superoxide and hydroxyl radical generation. Food and Chem. Toxica., 38(9): 849-852.

Beveridge, M.C.M. and McAndrew, B.J. (2000): Tilapias: Biology and Exploitation. Kluwer Academic publishers. Dordrecht, Boston, London. 1: 375.

Cremer, L.; Herold, A.; Avram, D. and Szegli, G. (1998): A purified green barley extract with modulatary properties upon TNF alpha and ROS released by human specialized cells isolated from RA patients. Romanian Archives of Microbiol. and Immunol., 57(3-4): 231-242.

Cress, C.E.; Vander, V. and O'Neil, C.B. (1997): Oxidants, antioxidant, respiratory system. Environ. Health Perspect, 56: 85-91.

Durham, J.J.; Ogata, J.; Nakajima, S.; Hagiwara, Y. and Shibamoto, T. (1999): Degradation of organophosphorus pesticides in aqueous extracts of young green barley leaves (*Hordeum vulgare* L.). J. Sci. Food Agric., 79: 1311-1314.

Economides, C.V. and Gregoriou, C. (1993): Growth, yield and fruit quality frost "Marsh" grapefruit on fifteen rootstocks in Cyprus. J. Am. Soc. Hort. Sci., 118(3): 326 – 329 .

Hagiwara, Y. (1996): In a good health guide. Ed. By Passwater R.A. Keats publishing, New Canna, CT.

Hartland, B.S. (1994): Common alternative therapies: Green barley leaf extract. Gay Men's Health Crisis (GMHC): Treatment Issues, 7(11/12): 1-2.

Ibrahim, M.M. (1985): Studies on production of concentrates for carbonated beverages. Ph.D. Thesis, Fac. Agric., Cairo Univ., Egypt.

Kitta, K.; Hagiwara, Y. and Shibamoto, T. (1992): Antioxidative activity of an isoflavonoid, 2"-O-glycosylisovitexin isolated from green barley leaves. J. Agric. Food Chem., 40: 1843-1845.

Lester, J.N. and Birkett, J.W. (1999): Microbiology and Chemistry for Environmental Scientists and Engineers. 2nd Ed. New Fetter Lane, London, p. 386.

Marschner, H. (1995): Nutritional physiology. Part 1. In minerals nutrition of higher plants. 2nd Ed. p. 18-30, 313-363. Academic press limited, London.

Moustafa, B.E.M. (2002): Chemical and technological studies on some vegetable and fruit juices. Ph.D. Thesis, Fac. of Agric. Moshtohor, Zagazig Univ. (Benha Branch).

Nakajima, S.; Hagiwara, Y.; Hagiwara, H. and Shibamoto, T. (1998): Effect of the antioxidants, 2"-O-glycosylisovitexin from young green barley leaves on acetaldehyde formation in beer stored at 50°C for 90 days. J. Agric. and Food Chem., 46(4): 1529-1531.

Osawa, T.; Katsuzaki, H.; Hagiwara, Y.; Hagiwara, H. and Shibamoto, T. (1992): A novel antioxidant isolated from young green barley leaves. J. Agric. and Food Chem., 40(7): 1135-1138.

Snedecor, G.W. and Cochran, W.G. (1980): Statistical Methods. 7th Ed. Oxford and IBIT Pub. Co.

Wallrauch, S. (1995): Evaluation of Cuban orange and grapefruit juices. Fluessiges Obst., 62(4): PP. 115-118, 120-124.

Wettestein, D (1957): Chlorophyll letal und der submicroskpische formech sellder-plastiden. Experimental cell Research, 12: 427–506. (c.f. Moustafa, 2002):

التقييم الكيميائى الحيوى للبودرة الخضراء لعصير الأوراق الغضة لنبات الشعير وتطبيقاته فى تجهيز بعض العصائر الطازجة

فرحات فودة على فودة* – محمود حسن محمد**

* قسم الكيمياء الزراعية، ** قسم علوم الأغذية – كلية الزراعة– جامعة بنها – مصر

يهدف البحث إلى التقييم الكيميائى الحيوى للبودرة الخضراء لعصير الأوراق الغضة للشعير ودراسة المكونات الأساسية والمركبات الحيوية ذات القيمة الغذائية وكذلك محتواه من العناصر المعدنية. كما تم دراسة تأثير إضافة عصير الأوراق الخضراء وكذلك مسحوق عصير الأوراق الخضراء (Magma) إلى عصائر الجريب فروت، البرتقال البلدى والكانتلوب بنسب ١، ٢، ٣، ٤، ٥% (حجمة/حجمة)، ٠,٠٥، ٠,١، ٠,١٥، ٠,٢٠، ٠,٢٥% (وزنية/حجمية) على الترتيب. وقد تم تقدير بعض الخواص الكيميائية لهذه العصائر وكذلك التقييم الحسى لتلك العصائر المعدة بعد الإضافة مقارنة بعينة الكنترول لكل عصير على حدة.

وأظهرت النتائج المتحصل عليها أن المكونات الأساسية لمسحوق أوراق الشعير الجافة كانت ٢,٧٢% دهون كلية، ٢٣,٦٩% بروتين، ١٦,٥٩% ألياف خام، ١٩,٢٦% رماد، ٣٧,٧٤% كربوهيدرات متاحة. بينما فى بودرة عصير أوراق الشعير المجففة كانت ٢,٧٥% دهون كلية، ٢٣,٥٢% بروتين، ١٤,٥٧% ألياف خام، ١٩,٨٢% رماد، ٣٩,٣٤% كربوهيدرات متاحة. ولكن فى البودرة الخضراء (ماجما Magma!) المستخدمة فى الأسواق فكانت ٢,٩٠% دهون كلية، ٣٨,٦١% بروتين، ٠,٢٥ ٠% ألياف خام، ١١,٥٩% رماد، ٣٦,٦٥% كربوهيدرات متاحة.

كذلك تم تقدير بعض المركبات الحيوية مثل الكلوروفيل (أ، ب) والكاروتينات وفيتامين ج (حمض الأسكوربيك) فكانت نسب هذه المكونات فى مسحوق أوراق الشعير الجافة هى ٧٦١، ٧٣٣، ٢٢٦، ٣١٧ ملليجرام/كيلوجرام، بينما فى بودرة عصير الأوراق المجففة هى ٧٤٨، ٦٨٧، ٢١١، ٢٢١ مجم/كجم، أما فى المجما الخضراء فكانت نسب هذه المكونات ٦٦٩، ٦٥٨، ٢١٤، ٢٧٣ مجم/كجم على الترتيب (على أساس الوزن الطازج).

أما بالنسبة لمحتوى هذه المواد من العناصر المعدنية حيث تم تقدير كل من الكالسيوم، البوتاسيوم، الصوديوم، الماغنسيوم، الفوسفور، الحديد، الزنك، المنجنيز والنحاس فى المواد السابقة وكان محتوى هذه العناصر فى مسحوق أوراق الشعير الجافة ٩٨٢,٥، ٣١٢٥، ١١٤,٣٣، ١٣,٦٧، ٤٩٦,٣٣، ١٤,٩٧، ١٦,٥٠، ٦,٦٠، ١٦,٨٧ ملليجرم/١٠٠ جرام على الترتيب (على أساس الوزن الجاف)، بينما كانت نسب هذه العناصر فى البودرة الخضراء لعصير أوراق الشعير المجفد ١٠٥٨,٣٣، ٣٢٥٣، ١٢٥، ١٥,١٧، ٥٠٢، ١٣,٩٥، ٣٣,٣٣، ٩,١٥، ٢١,٠٧ ملليجرام/١٠٠ جرام على الترتيب. أما فى الماجما الخضراء فكانت نسب هذه العناصر ١٠٤٨,٣٣، ٣٨٩٩، ٦٢٨,٣٣، ١٨,٦٧، ٥٣٣,٠٠، ١٦,٥٣، ٢٦,١٧، ٧,٣٣، ٢١,٧٨ ملليجرام/١٠٠ جرام على الترتيب.

كما تم دراسة الخواص الكيميائية للعصائر الطازجة من الجريب فروت والبرتقال البلدى والكانتلوب والتى سوف تدعم بعصير أوراق الشعير الغضة وبودرة المجما الخضراء بهدف رفع القيمة الغذائية والحيوية للعصير. وقد أظهرت التحاليل الكيميائية لعصير الجريب فروت احتوائه على ٩٠,٢٢% رطوبة، ٩,٧٢% مواد صلبة ذائبة، ٠,٣١% رماد، ٠,٧٤% بروتين، ٧,١٨% سكريات كلية، ٤٥ ملليجرام/١٠٠ جرام حامض الأسكوربيك (فيتامين ج)، رقم الـ pH كان ٣,٣، الحموضة الكلية ٢,١٦% (كحمض ستريك). بينما كانت نسب العناصر المعدنية مثل البوتاسيوم، الصوديوم، الكالسيوم، الماغنسيوم والحديد ١٥١,٥٠، ١,٩٧، ١٧,٢٢، ١٦,٣٧، ١٠,٤٢، ٠,٢٧ ملليجرام/١٠٠ جرام على الترتيب (على أساس الوزن الطازج).

أما بالنسبة لعصير البرتقال البلدى فقد احتوى على ٨٧,٩٢% رطوبة، ١٢,٠٣ مواد صلبة ذائبة، ٠,٤٣% رماد، ٠,٦٥% بروتين، ٩,٨٦% سكريات كلية، ٤٢ ملليجرام/١٠٠ جرام فيتامين ج، رقم الـ pH كان ٤,٠٩، الحموضة الكلية ١,٨٨% (كحمض ستريك). بينما كانت نسب العناصر المعدنية مثل البوتاسيوم، الصوديوم، الكالسيوم، الماغنسيوم والحديد ١٩٣,٦٧، ١,٠٥، ١٧,١٨، ١٢,٥٠، ١٠,٥٠، ٠,٢١ ملليجرام/١٠٠ جرام على الترتيب (على أساس الوزن الطازج).

فى حين احتوى عصير الكانتلوب على ٩٠,٣٩% رطوبة، ٩,٦٩% مواد صلبة ذائبة، ٠,٥٥% رماد، ٠,٨٠% بروتين خام، ٨,١٠% سكريات كلية، ٣٥ ملليجرام/١٠٠ جرام فيتامين ج، ورقم الـ pH ٦,٣٧، والحموضة الكلية ٠,٢٥% (كحمض ستريك). أما محتوى العناصر المعدنية فكان ٢٣٧,٣٣، ١٢,٦٢، ١٦,٠٨، ١٤,٠٥، ٩,٩٢، ٠,٤٤ مجم/١٠٠ جم على الترتيب (على أساس الوزن الطازج).

كما تم أيضا دراسة الخواص الكيميائية للعصائر الطازجة المجهزة والتى تم تدعيمها بعصير وريقات الشعير الغضة بتركيزات ١، ٢، ٣، ٤، و ٥% (حجمية/حجمية) ومسحوق الماجما الخضراء بتركيزات ٠,٠٥، ٠,١٠، ٠,١٥، ٠,٢٠ و ٠,٢٠% (وزنية/حجمية). وتبين من النتائج عدم وجود فروق معنوية بين هذه العصائر المجهزة بالمقارنة بالكنترول.

كما أظهرت نتائج التقييم الحسى للعصير المجهز من العصائر السابقة بعد تدعيمها بعصير وريقات الشعير أو الماجما الخضراء بالنسب سالفة الذكر عدم وجود فروق معنوية بين الكنترول والعصائر المجهزة بعصير وريقات الشعير بنسب ١، ٢% أو بالماجما الخضراء بنسب ٠,٠٥، ٠,١% فى اللون والطعم والرائحة والقوام والقابلية العامة.

وبناء على النتائج المتحصل عليها نوصى بإضافة عصير أوراق الشعير الغضة المنزرعة زراعة عضوية عمر ثلاثة أسابيع من الإنبات وكذا مسحوق الماجما الخضراء التجارى إلى بعض العصائر الطازجة تحت الدراسة بهدف زيادة محتواها من مضادات الأكسدة الطبيعية والعناصر المعدنية.