Effect of Cooking on Nutritive Value of Jew's Mallow (*Corchorus olitorius* L.) and Mallow *(Malva parviflora* L.) Leaves

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ABSTRACT

The impact of cooking by boiling on nutritive value of Jew's mallow (*Corchorus olitorius* L.) and mallow *(Malva parviflora* L.) leaves were assessed by determining the proximate chemical composition, some minerals, amino acids and dietary fiber fractions. The results indicated that the raw and cooked leaves of Jew's mallow and mallow (on dry weight basis) contained high crude protein in a range of (36.73-44.77%), crude fibers (9.81-12.73%) and total ash content (9.30-16.85%), but low in crude fat (1.05-3.39%). The energy values ranged between 259.7 and 285.29 k cal/100g. The raw and cooked leaves had high content of total dietary fiber (32.74-41.45%), insoluble dietary fiber (26.10-32.51%), soluble dietary fiber (6.64-8.94%). The neutral detergent fiber were in range of (20.94 to 28.98%), acid detergent fiber (16.97-25.61%) and acid detergent lignin (7.00-8.93%). The sample contained high potassium content (856-1020 mg/100g) followed by calcium (216.5-412.5mg/100g) and magnesium (170-206 mg/100g) and low content of iron (4.68-5.31mg/100g). Cooking of Jew's mallow and mallow leaves significantly ($P\leq 0.05$) increased the crude fiber, non reducing sugars, soluble dietary fiber, acid detergent fiber, cellulose, phosphorus and sodium. Whereas, significantly ($P\leq 0.05$) decreased the reducing sugars, hemicelluloses, calcium and magnesium. All samples contained adequate amounts of the essential and non essential amino acids except that of methionine, which was considered as the first limiting amino acid, followed by leucine and phenylalanine. Both of the cooked leaves can be suggested to act as a functional food.

Key words: Jew's mallow, mallow, cooking, proximate composition, dietary fibers, minerals, amino acids.

INTRODUCTION

Among vegetables, the green leafy vegetables (GLVs) occupy an important position. The GLVs are rich source of macro and micro nutrients, such as proteins, dietary fibers, pigments, vitamins (beta-carotene, ascorbic acid, etc.), as well as non-nutrient bioactive phytochemicals as polyphenols and flavonoids, which offer many functions for health benefits (Khan *et al*., 2015). Fiber has been reported to have beneficial effects on blood cholesterol, prevention of bowel diseases and improve the glucose tolerance (Adebayo, 2010). Phenolic compounds as well as carotenes and vitamins help in the destruction of free radical and other toxic compounds in human body (Saikia & Mahanta, 2013).

Among the GLVs are Jew's mallow (*Corchorus olitorius* L.) and mallow (*Malva parviflora* L.). Jew's mallow is a very popular summer leafy vegetable cultivated and widely consumed in Egypt. Recently, it is widely consumed in Japan as a healthy food, prepared in different forms because of its high content of carotenes, vitamins, minerals, polyphenols and other bioactive phytochemicals as well as proteins and dietary fibers. they are used in different ways as salads, soups, spices, flavouring agent and granishes, (Bhawana & Neetu, 2015).

Mallow (*Malva parvilora* L.) is a perennial herb. It is not cultivated but harvested from wild or from farmers fields, waste ground, roadside and desert planic. Mallow leaves are mostly consumed by rural people in Egypt . Other common names of mallow are cheese weed mallow, Egyptian mallow, and little mallow (Raheem *et al*., 2014). The raw leaves are usually added to salads or eaten in the cooked form. The leaves are rich in phenols and also contain other substances such as terperoids, coumarins, mucilage and pigments (Messaoudi *et al*., 2015).

The GLVs are consumed in raw form or after cooking, where boiling is the common cooking method. Cooking process could cause a number of physical and chemical changes, that could be detrimental or beneficial depending on the extent and type of the cooking conditions (Zhang & Hamauzu, 2004). However, some studies reported that cooking can lead to loss in essential vitamins and antioxidant components (Lin & Chang, 2005).

Information in the literature is scarce regarding the nutritional evaluation of cooked Jew's mallow and mallow leaves in Egypt. Therefore, the aim of the present study is to evaluate the nutritional content of the leaves of Jew's mallow and mallow leaves as affected by cooking (boiling).

MATERIALS AND METHODS

Materials

Fifty kilograms of fresh Jew's mallow plant (*Corchorus olitorius* L.), variety balady, were collected at maturity in July 2014, from local farm in Abeese village, Alexandria, Egypt. Fifty kilograms of fresh mallow plant (*Malva parviflora*) were gathered at the time of its most proper consumption stage in April 2014, from local farm in Abeese, Alexandria, Egypt.

Methods:

Preparation of sample and cooking

All samples were destalked to separate the edible portions (mostly the leaves) . The edible portions were thoroughly washed with tap water followed by distilled water, allowed to drain and the excess water was removed using paper towel. The edible portions were well mixed using a blender (National model-MX- 291N) for 2 minutes, and divided into two portions. The first portion was freeze-dried (Alpha 1-4 LSC plus, Chirst) . The second portion of each of the blended leaves was added to distilled water (1 : 1, w/v) that just reached to boil, in a covered stainless steel pan, and cooked for 10 minutes, then cooled rapidly in an ice bath before being freeze- dried (Alpha 1-4 LSC plus, Chirst). The lyophilized raw and cooked samples were ground using a food grinder (Model M X 491N, National) into powder (40 mesh screen) the poweders were transferred to plastic containers with screw caps and frozen at -20C^{o} and kept until using for analysis.

Analytical methods

Proximate analysis

Moisture, crude protein, crude fat, crude fiber and total ash were determined according to the standard methods of the AOAC (2000).

Sugars were determined calorimetrically (before and after hydrolysis with 2.5 N HCL) using dinitrosalicylic acid at 540nm. Glucose was used as a standard (Miller, 1959).

Total carbohydrates content and caloric value based on Atwater factor (FAO, 2002) were calculated as follows:

%Total carbohydrates content = 100 − (% protein +% fat + % ash).

Caloric value = (% proteins x 2.44) + (% carbohydrates x 3.57) + (% oil x 8.37).

Dietary fiber fractions analysis

Total dietary fiber (TDF) and insoluble dietary fiber (IDF) were determined by the gravimetric enzymatic method as proposed by Prosky *et al*. (1988). Soluble dietary fiber (SDF) was calculated by the difference between TDF and IDF as followes : SDF = TDF−IDF.

Acid detergent fiber (ADF), neutral detergent fiber (NDF) and lignin content were determined as cited by Van Soest *et al*. (1991). Acid detergent lignin (ADL) was determined as outlined in the AOAC (2000). Cellulose and hemicellulose were calculated as follows:

%Cellulose = ADF (Cellulose, lignin, cutin) − ADL (Lignin, cutin).

%Hemicellulose = NDF (Hemicellulose, cellulose, lignin, cutin) − ADF (Cellulose,lignin, cutin).

All the results were calculated as % of dry weight basis.

Minerals element analysis

Samples were digested by dry ashing and dissolved in 1 M HCL. Na and K were determined by Flame Photometry, while Ca, Mg, Mn, Fe and Zinc were determined by Atomic Absorption Spectrophotometer (Chemtech CTA-2000, England). Phosphorus was determined colorimetrically using molybdovandate method (AOAC, 2000).

Amino acids analysis

Amino acids except tryptophan were determined according to the method of Li *et al*. (2006). The chemical essential amino acid (EAA) score was calculated as follows:

$$EAA = \frac{\text{g of EAA in 100g of test protein}}{\text{g of EAA in 100g of FAO reference}}$$

The lowest chemical score was used to predict the first limiting amino acid .

Statistical analysis

The results were expressed as the means ± standard deviation of mean. The LSD analysis was used to compare the means. Significant differences were defined at P ≤ 0.05.

RESULTS AND DISCUSSION

Proximate chemical composition

As indicated in Table (1), the moisture content was 87.32% in raw Jew's mollow leaves being comparable with that reported by Oke (1968), but was higher (76.6%) than that reported by Van Jaarsveld *et al*. (2014). The moisture content in raw mallow leaves was 78.64%, which is in agreement with that reported elsewhere (Abbasi *et al*., 2015). However, high moisture content is important in maintaining the protoplasmic content of the cells, but it makes the vegetables perishable and susceptible to spoilage by microorganisms (George, 2003). Crude protein content based on dry weight was higher (44.77%) in raw mallow leaves than in Jew's mallow leaves (36.73%). Crude protein content in Jew's mallow leaves in this study was very high than that (15.68% on dry weight basis) reported by Van Jaarsveld *et al*. (2014). While, protein content in raw mellow leaves in this study shows a close agreement with that published by Adeniyi *et al*. (2012), who reported that it was 31.01% (on dry weight basis). Crude fat content and energy value were quite low, being higher in raw mallow leaves (3.39% and 285.29 kcal/100g) than that in raw Jew's mallow (1.07% and 263.03 Kcal/100g), which are in agreement with those cited by Abbasi *et al*. (2015). Low calorie and low fat foods, play significant roles in avoiding obesity and reducing the occurrence of diseases associated with damage of the coronary artery (Adenipenkun & Oyetunji 2010). Unfortunately, information on sugars content in GLVs is very scarce. Despite that, the total sugars content in both raw leaves was much closer. The leaves can be considered as a good source of fiber, with higher content (12.3%) in raw Jew's leaves and lower content (9.8%) in raw mallow leaves. These values are higher than those reported by Ndlovu & Afolayan (2008), but lower than those published by Abbasi *et al*. (2015). Fiber lowers the body cholesterol level, thus decreasing the risk of cardiovascular diseases (Hanif, *et al*., 2006). The ash content for the raw leaves of Jew's mallow was high (16.1%) as compared to 10.4% for raw mallow leaves, so this implies that Jew's mallow and mallow leaves are good mineral sources. The ash level (10.47%) in raw mallow was higher than (0.0871%) that reported previously by Farhan *et al*. (2012) and it was comparable (13.53%)with that reported by Barros *et al*. (2010). While the ash level obtained in this study for raw Jew's mallow (16.13%) was higher than (2.4%) that cited by Osman (2005), but was comparable(11.97%) with that published by Yekeen *et al*. (2013). Carbohydrates contents were quite comparable for raw Jew's mallow and mallow leaves, being 46.07 % and 41.37 %, respectively.

Table 1: Proximate chemical composition of raw and cooked Jew's mallow and mallow leaves (on dry weight basis)

Content %	Sample			
	Jew's mallow		Mallow	
	Raw	Cooked	Raw	Cooked
Moisture	87.32±0.08[b]	90.46±0.03[a]	78.64±0.09[b]	92±0.05[a]
Dry matter	12.68±0.09[a]	9.57±0.07[b]	21.36±0.07[a]	8 ± 0.08[b]
Crude protein	36.73± 0.08[b]	37.32±0.40[a]	44.77±0.54[a]	43.74±0.35[a]
Crude fat	1.07± 0.08[a]	1.05±0.04 [a]	3.39±0.08[a]	2.23±0.05[a]
Total sugars	5.98± 0.07[a]	5.22±0.09[b]	5.41±0.08[a]	5.31±0.05[a]
Reducing sugars	3.17± 0.07[a]	2.25±0.09[b]	2.91±0.08[a]	2.36±0.05[b]
Non reducing sugars	2.81± 0.07[b]	2.97±0.09[a]	2.50±0.08[b]	2.95±0.09[a]
Crude fiber	12.33± 0.08[b]	12.73±0.04[a]	9.81±0.08[b]	11.17±0.05[a]
Total Ash	16.13± 0.08[b]	16.85±0.40[a]	10.47±0.54[a]	9.30±0.35[b]
Total carbohydrates	46.07± 1.03[a]	44.78±0.94[b]	41.37±0.68[b]	44.73±0.95[a]
Energy (kcal/100g)	263.03	259. 7	285.29	285.06

*Means± standard deviation

Means with different subscript in the same row separated by shaded column are significantly different at (P< 0.05)

Cooking of minced Jew's mallow and mallow by boiling in water or meat / chicken soup is one of the preferable domestic cooking methods employed in Egypt. The impact of cooking on the macronutrients is presented in Table (1). Cooking of mallow resulted in a significant ($P\leq 0.05$) increase in its crude fiber content by 13.86%. This finding is in agreement with that reported by McDougall *et al*. (2010). The increased temperature during cooking leads to break the weak bonds between polysaccharides and the cleavage of glycosidic linkages, which may result in solubilization of the dietary fiber (Svanberg *et al*., 1997). Cooking also significantly reduced ($P\leq 0.05$) ash content by 11.17% and reducing sugars by 18.9% but significantly increase ($P\leq 0.05$) carbohydrates content by 8.12 %. However, inspit of ash losses, cooked mallow leaves may be considered as a good source of minerals when compared to the values obtained for cereals and tubers (Antia *et al*., 2006). As concern, cooking caused reduction in protein content. This can be attributed to the severity of the thermal process during cooking which leads to degradation of protein.

Cooking of Jew's mallow leaves significantly increased ($P\leq 0.05$) crude fiber by 3.2%, protein by 1.6%, ash by 4.4% and non-reducing sugars by 5.6%, while significantly decreased ($P\leq 0.05$) carbohydrates by 2.8% and reducing sugars by 29.0%.

Dietary fiber fractions

Dietary fiber is a complex of heterogenous components of cell wall, indigestible in human alimentary tract, it includes among other things cellulose, hemicelluloses, lignin, inulin, a-glucanes, pectins, gums and mucilage (Komolka *et al*., 2012). Since each type of dietary fiber, namely soluble dietary fiber (SDF) and insoluble dietary fiber (IDF), exerts a different physiological effect. It is important to obtain information on both, the total dietary fiber (TDF) content as well as the individual components in raw and cooked Jew's mallow and mallow leaves. However, data on their presence in both leaves are scarce or non-existent.

The contents of dietary fiber and its fractions (% on dry weight basis) were influenced by the type of leaves as well as the cooking process (Figures 1-3). TDF, SDF, ISDF, NDF, ADF, ADL, lignin, cellulose and hemicellulose contents were higher in raw mallow leaves than in raw Jew's mallow leaves. Soluble dietary fiber content was lower than the insoluble ones. Neutral detergent fiber content was higher than acid detergent fiber. Furthermore, cellulose content was higher than either lignin or hemicellulose content.

Higher contents for NDF (39.98%), cellulose (11.09%), hemicellulose (22.76%) and lignin (6.01%) in raw Jew's mallow leaves were reported by Islam *et al*. (2004). This may be due to the difference in the variety or cultivars between the two studies. Also, plant species, maturity have a strong influence on fiber components. Islam *et al*. (2004) analysed 15 different varieties of GLVs for NDF, cellulose, hemicellulose and lignin content and found that they vary between (24.98-47.50%), (4.05–11.09%), (15.12–32.24%) and (1.09–6.01%), respectively.

Cooked Jew's mallow and mallow leaves were characterized by significantly ($P\leq 0.05$) higher contents of soluble dietary fiber, acid detergent fiber and cellulose and by significantly ($P\leq 0.05$) lower contents of hemicellulose. Neutral detergent fiber content was significantly higher ($P\leq 0.05$) only in cooked Jew's mallow leaves, while total dietary fiber content was significantly higher ($P\leq 0.05$) in cooked mallow leaves.

The results reported here indicate high variation in the percentage of individual fractions either in raw or cooked leaves. However, there are several reports on the impacts of cooking on the fiber content in vegetables. While some researchers (Thed & Phillips, 1995) have found no effect or limited effect on the fiber content, a number of other workers have noted an increase in one or more fraction of dietary fiber due to cooking. For examples, Rodriguez *et al*. (2006) stated that it was difficult to determine which components of dietary fiber undergo the greatest changes during cooking. Elleuch *et al*. (2011) observed a decrease in content of hemicellulose during cooking.

However, American Dietetic Association recommended the inclusion of dietary fiber by using vegetable sources including GLVs for an active and healthy life, as the consumption of fibrous diet in developed countries is low. So that, Dietary Reference Intakes for Japanese (2010) of dietary fiber (g/day) for children (1-13yr) is 19-31, for adults male (14-50yr) is 38, for adult woman (14-50yr) is 25-26, and 28-29 for pregnant or lactating women.

Mineral contents

Mineral composition of the leaves of raw and cooked Jew's mallow and mallow are presented in Table (2). Raw and cooked Jew's mallow leaves were more superior in all macro-elements than mallow leaves, while micro-elements were more closer in raw and cooked Jew mallow and mallow leaves. Potassium was higher in raw and cooked

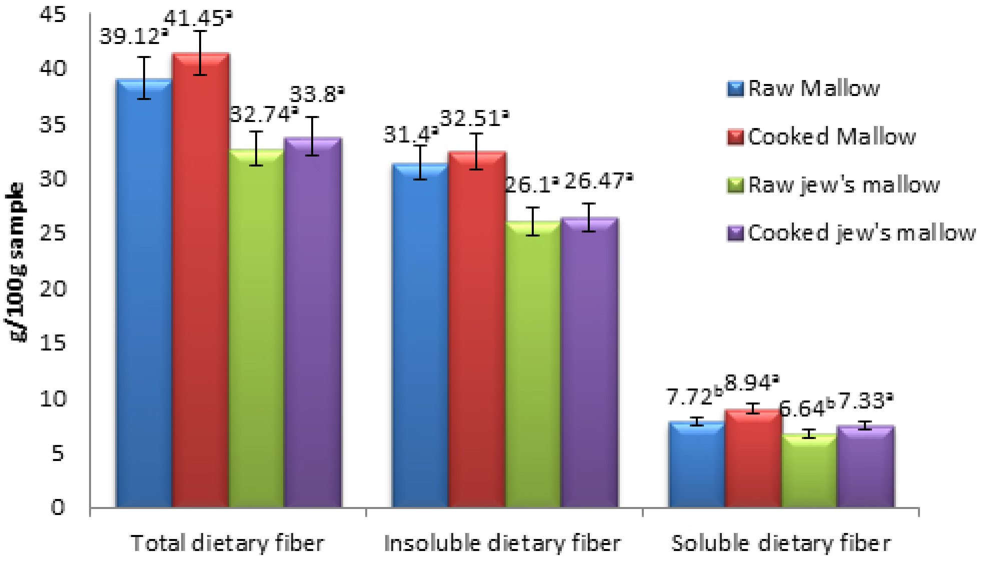

Fig. 1. Dietary fiber fractions of raw and cooked mallow and Jew's mallow leaves (g/100g sample). a,b Different superscript letters in the same property indicate statistical difference ($p \leq 0.05$). Data are the mean ± standard deviation

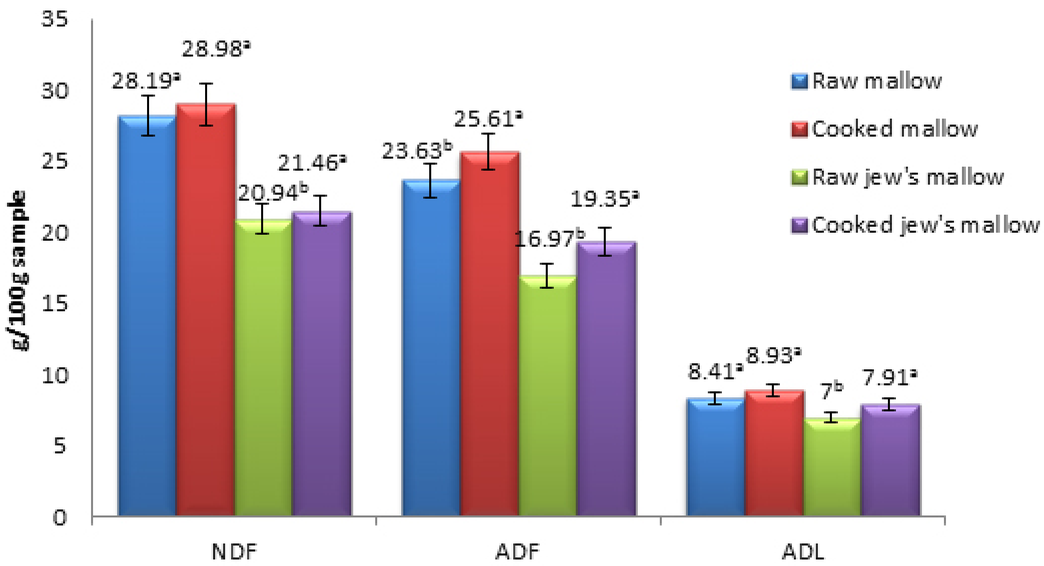

Fig. 2. Neutral Detergent Fiber (NDF), Acid Detergent Fiber (ADF) and Acid Detergent Lignin (ADL) content of raw and cooked mallow and Jew's mallow leaves . a,b Different superscript letters in the same property indicate statistical difference ($p \leq 0.05$). Data are the mean ± standard deviation.

Jew's mallow leaves as compared to raw and cooked mallow leaves. Raw Jew's mallow leaves had the mean value of (mg/100g) 997 K, 15.9 Na, 412.5 Ca, 184 Mg, 53.4 P, 4.85 Fe, 23.4 Mn and 83.4 Zn. Cooking of raw Jew's mallow resulted in significant increases ($P \leq 0.05$) in Na by 24.5% and P by 14.2% and significant losses ($P \leq 0.05$) in Ca by 7.5%, Mg by 7.6% and Mn by 12.4%. Meibei *et al*. (2011) reported that raw Jew's mallow had lower values than found in the present study. This, can be attributed to differences in stage of maturity, plant variety and agroclimatic conditions.

Potassium concentration in raw mallow was 856 mg/100g, while sodium was 20.8 mg/100g. Sodium to potassium ratio of less than one has been recommended for the prevention of high blood

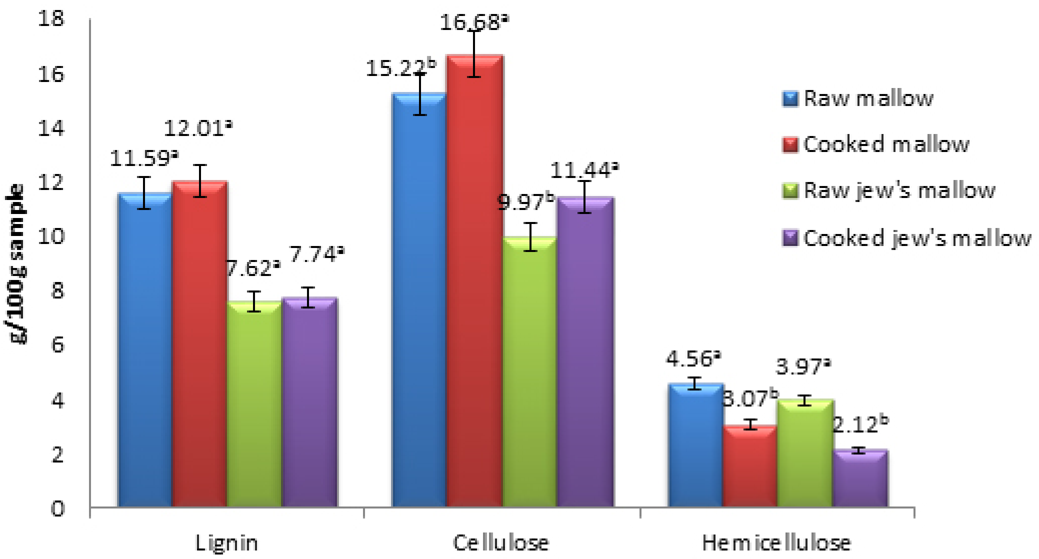

Fig. 3. Lignin, cellulose and hemicellulose content of raw and cooked mallow and Jew's mallow leaves. a,b Different superscript letters in the same property indicate statistical difference (P ≤ 0.05). Data are the mean ± standard deviation

Table 2: Mineral contents of raw and cooked Jew's mallow and mallow leaves (on dry weight basis)

Element mg/100g	Jew's mallow		Mallow	
	Raw	Cooked	Raw	Cooked
Macro elements				
Phosphorus (P)	53.40± 1.09[b]	61.01±1.25 [a]	36.40±1.58 [b]	40.85±1.69 [a]
Potassium (K)	997± 37.47[a]	1020±68.93[a]	856±53.91 [a]	916±57.50 [a]
Calcium (Ca)	412.5±2.59[a]	381±2.25[b]	243±0.58[a]	216.5±2.69[b]
Magnesium (Mg)	184±2.59[a]	170±3.75[b]	206.5±0.58[a]	191.5±2.69[b]
Sodium (Na)	15.9±0.59[b]	19.8±0.75[a]	22.8±0.58[b]	30.4±0.69[a]
Total macro elements	1662.8	1651.8	1364.7	1395.2
Micro elements				
Iron (Fe)	4.85±0.09[a]	4.68±0.09[a]	5.31±0.58[a]	4.84±0.09[a]
Manganese (Mn)	23.4±1.27[a]	20.5±1.09[b]	20.8±1.58[a]	22.2±1.09[a]
Zink (Zn)	83.4±1.27[a]	83.6±1.09[a]	82.4±1.18[a]	82.6±1.09[a]
Total micro elements	111.65	108.78	108.51	109.64

*Means± standard deviation
Means with different subscript in the same row separated by shaded column are significantly different at (P< 0.05)

pressure. Thus, the consumption of these GLV can probably serve to reduce high blood pressure diseases in human.

Cooking of mallow leaves significantly decreased ($P \leq 0.05$) the concentrations of both Ca and Mg from 243 and 206 to 216 and 191, respectively. On the other hand, Na and P were significantly increased ($P \leq 0.05$) by about 33.3% and 12.2%, respectively. Mineral contents of raw mallow leaves were found to be lower than that reported by Ereifej *et al.* (2015). However, the raw or cooked leaves could be a good source of Mg, Fe and Zn for all categories of people when compared with recommended dietary allowance.

Amino acid composition

The total amino acid composition of raw and cooked Jews mallow and mallow leaves showed greater similarity in their amino acid profiles (Table 3). The total amino acids (TAA), Non-essential amino acids (NEAA) and essential amino acids (EAA) were 69.14, 40.81 and 28.33 (g/100g protein) for raw Jew's mallow and 71.06, 40.24 and 30.82 (g/100g protein) for cooked Jew's mallow. The corresponding values in raw and cooked mallow leaves were 65.86, 37.55 and 28.31 for raw leaves, and 74.13, 39.98 and 34.15g/100g protein for cooked leaves, respectively. This is in agreement with the results by Omoyeni *et al*. (2015) for raw Jew's mallow leaves.

Aspartic acid, glutamic acid and leucine were found to be the major ones in raw and cooked Jew's mallow and mallow leaves. Similar finding was also reported by (Ogunwa *et al*., 2015) for Marugbo leaves grown in Nigeria. Ratio of essential amino acids to total amino acids (EAA/TAA) ranged between 40.97 –46.07 for all samples, indicating a good equilibrium between amino acids of proteins.

Chemical scores calculated based on FAO (2013) for methionine which is considered as the first limiting amino acid was between 0.41-0.53.

Table 3: Amino acid composition of raw and cooked Jew›s mallow and Mallow leaves

Amino acid g/100g protein	Sample				**Standard ** (FA0, 2013)**
	Jew's mallow		Mallow		
	Raw	Cooked	Raw	Cooked	
Essential Amino Acids (EAA)					
Therionine	3.00 *(0.97)	3.24 (1.05)	2.80 (0.90)	4.10 (1.32)	3.1
Valine	4.11 (0.96)	4.40 (1.02)	4.51 (1.05)	5.30 (1.23)	4.3
Isoleucine	3.21 (1.00)	3.70 (1.16)	3.00 (0.94)	3.90 (1.22)	3.2
Leucine	6.10 (0.92)	6.93 (1.05)	6.50 (0.98)	7.01 (1.06)	6.6
Phenylalanine	4.51 (0.87)	4.22 (0.81)	4.30 (0.83)	5.10 (0.98)	5.2
Histidine	2.10 (1.05)	2.40 (1.20)	2.20 (1.10)	2.60 (1.30)	2.0
Lysine	4.20 (0.74)	4.70 (0.82)	3.80 (0.67)	4.70 (0.82)	5.7
Methionine	1.10 (0.41)	1.23 (0.46)	1.20 (0.44)	1.44 (0.53)	2.7
Total. E.A.A.	28.33	30.82	28.31	34.15	32.8
Non Essential Amino Acids (NEAA)					
Aspartic	8.10	7.30	9.20	7.80	
Tyrosine	3.10	3.10	2.70	3.42	
Arginine	4.90	5.30	4.00	4.54	
Proline	5.71	4.70	4.22	3.70	
Cyctine	1.20	1.40	1.11	1.32	
Serine	3.20	3.10	3.12	3.70	
Glutamic	8.00	8.54	7.90	9.10	
Glycine	4.10	3.90	3.10	3.80	
Alanine	2.50	2.90	2.20	2.60	
Total. NEAA	40.81	40.24	37.55	39.98	
Total AA	69.14	71.06	65.86	74.13	
EAA/TAA	40.97	43.37	42.99	46.07	
NEAA/TAA	59.03	56.63	57.01	53.93	
1st Liming AA	Methionine	Methionine	Methionine	Methionine	
2nd limiting AA	Lysine	Phenyl alanine	Lysine	Lysine	
3th limiting AA	Phenyl alanine	Lysine	Phenyl alanine	Phenyl alanine	

*Value between bracket is a chemical score of essential amino acid

**FAO (2013) for infant (6 months)

Whereas, lysine the second limiting amino acid was (0.67-0.82), followed by phenylalanine (0.81-0.98) as the third limiting amino acid in raw and cooked Jew's mallow and mallow leaves. These results are in agreement with those reported by Ndomou *et al*. (2014) who found that sulfur amino acids were the most limiting ones in the leaves of *G. africanum*.

It is worth to note that cooking of the Jew's mallow and mallow leaves increases the amounts of total amino acids by 2.77 and 12.59%, respectively. Studies by numerous authors have shown that amino acid content can increase or decrease after cooking depending on the species (Titi Mutiara *et al*., 2013). However, the results indicated that both of the leaves can be considered as a good source of essential amino acids, specially for poor people.

CONCLUSION

Jew's mallow and mallow leaves consumed in Egypt contain substantial amount of macro and micro nutrients which might be useful in prevention of some diseases as reported in literature. They can contribute substantially to minerals, especially potassium, calcium, magnesium and iron and had high amount of protein, dietary fiber and essential amino acids which are usually in short supply in daily diets of poor people. Boiling of minced Jew's mallow and mallow leaves in water or meat soup, as a home cooking method employed in Egypt, have different effects on nutrients. Where, crude fiber, non reducing sugar, SDF, ADF, cellulose, phosphors and sodium were found to increase, reducing sugar, hemicelluloses, calcium and magnesium were found to be reduced by boiling. Most essential amino acid contents are enhanced upon boiling. As a result, the study suggests that boiled leaves can be used to combat nutrient deficiencies, as a functional soup in developing countries.

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تأثير الطهي على القيمة الغذائية لأوراق الملوخية والخبيزة

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تم تقييم تأثير الطهي المنزلي (الغليان) على القيمة الغذائية لأوراق الملوخية والخبيزة من خلال تقدير التركيب الكيميائي ، والمعادن، والأحماض الأمينية، ومشتقات الألياف الغذائية (على أساس الوزن الجاف). ووجد أن أوراق الملوخية والخبيزة الخام والمطبوخة تحتوي على نسبة عالية من البروتين (٣٦,٧٣- ٤٤,٧٧٪)، والألياف (٩,٨١-١٢,٧٣٪) والرماد (٩,٣٠- ١٦,٨٥٪) ومستوى منخفض من الدهن الخام (١,٠٥-٣,٣٩ ٪) و الطاقة (٢٥٩,٧-٢٨٥,٢٩ كيلو كالوري / ١٠٠جم). كذلك احتوت الأوراق الخام و المطبوخة على نسبة عالية من الألياف الغذائية الكلية (٣٢,٧٤ - ٤١,٤٥٪)، الألياف القابلة للذوبان (٦,٦٤-٨,٩٤٪)، الألياف الغذائية غير القابلة للذوبان (٢٦,١٠-٣٢,٥١٪)، ألياف المنظف المتعادل (٢٠,٩٤-٢٨,٩٨٪) وألياف المنظف الحمضي (١٦,٩٧- ٢٥,٦١٪) واللجنين الحامضي (٧,٠٠ - ٨,٩٢٪). واحتوت العينات على نسبة عالية من البوتاسيوم (٩١٦-١٠٢٠ مجم / ١٠٠جم)، الكالسيوم (٢١٦,٥-٤١٢,٥ مجم/١٠٠جم) والماغنسيوم (١٧٠ - ٢٠٦ مجم / ١٠٠جم) ونسبة منخفضة من الحديد (٤,٨٥-٥,٣١ مجم/١٠٠جم). أدت عملية الطبخ لأوراق الملوخية والخبيزة إلى زيادة معنوية في محتوى كل من الألياف الخام ، السكريات غير المختزلة، الألياف القابلة للذوبان ، ألياف المنظف الحمضي ، السليلوز والفسفور والصوديوم بينما أدت إلى انخفاض معنوي في محتوى كل من السكريات المختزلة ، الهيميسليلوز ، الكالسيوم والماغنسيوم. كذلك احتوت العينات على كمية كافية من الأحماض الأمينية الأساسية وغير الأساسية ما عدا الميثيونين الذي كان هو الحامض الأميني الحدي الأول متبوعا بالحمض الأميني الليسين ثم فينيل ألانين، مما يشير إلى أن كلا من أوراق الملوخية والخبيزة يمكن اعتبارهما من الأغذية الوظيفية.