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CHEMICAL EVALUATION OF BIOCHEMICAL CONSTITUENTS IN GRAPE (*VITIS VINIFERA*) AND OLIVE (*OLEA EURPEA*) POMACES

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ABSTRACT: Three Egyptian pomaces were studied. They were white grape pomace, red grape pomace as well as olive pomace. Grape pomaces had a high content of total carbohydrates (40.0% and 37.5% for red and white grape respectively) and noticeable contents of total protein (13.0% and 12.0% for red and white grape pomaces respectively). Olive pomace had a 10.0% of total carbohydrates and 5.0% of total protein. Also pomaces contained 71.0%, 35.0 % and 32.0% of fiber for olive, white grape and red grape respectively. Calcium (4121.7 ppm in white grape pomace), Potassium (5614.1 ppm in olive pomace), Magnessium (327.8 ppm in olive pomace), Sodium (1315.2 ppm in red grape pomace) and Phosphorous (643.0 ppm in red grape pomace) were the predominant minerals. Olive pomace contained highest percentage of both total and free phenolic compounds (4.1% and 1.4% respectively), while white grape pomace contained highest percentage of conjugated phenolic compounds (2.3%). Pomaces were contained noticeable percentages of Methionine (2.5%, 2.0% and 1.5% for white and red grape pomaces and olive pomace respectively). Acedic amino acids (Glutamic and Aspartic acid) were highest in three pomaces.

Key words: **Pomaces, carbohydrates, proteins, minerals, phenolic compounds, amino acids.**

INTRODUCTION

Residues arising after pressing grapes can be used as a fuel, where grape pomace combustion was similar to wood combustion and that furnace slagging was not a problem because combustion temperature was considerably below the ash fusion temperature. Also, grape pomace burned at efficiencies of 44 % to 61 % with only low pollution hazard (Mason *et al.*, 1983 and 1985).

Grape pomace has nutritive and feeding values, while young cattle were finished from 230 Kg to 400 Kg liveweight on a mixed diet containing 0.0 , 7.5 , 10.0 , 15.0 , 20.0 or 22.5 % dried grape pomace. (Stojanovic *et al.*, 1989).

Extracted grape waste material proved good growth substrate for Pinicillium funiculosum 515, Myrothecium verrucaria 9095 and specially Aspergillus niger TMF – 15 which are using in production of mycelial protein and cellulolytic enzyme . (Kuzmanova *et al.*, 1991).

Also , the effectiveness of factors stimulating the growth of Basidiomycetes on a grape pomace extract was studied in order to evaluate the use of grape processing waste for the production of microbial protein and industrial enzyme preparations . (Ezhov *et al.*, 1991).

Fourteen weeks after the application of dimethylhydrazine , serium cholesterol level decreased by 38 – 48 % in animals feed grape pomace diet when compared to cellulose diets. Also, grape pomace diet reduced conjugated Diene content in Plasma , Erythrocytes and Liver by 30 – 60 % and it significantly increased catalase activity in Erythrocytes and Colon. (Bobek and Galbavy, 1999).

Chemical analysis of plant pomace showed that the total extractaple polyphenols assayed by Folin – Ciocalteu method in white grape pomace (6.5%), skins (5.3%) and seeds (9.2%) , were higher than in red grape pomace – 2.2 , 2.1 and 2.1% respectively – (Larrauri *et al.*, 1996).

The main characteristics of a natural antioxidant dietary fiber, rich in dietary fiber and polyphenolic compounds obtained from red grape pomace is described. Both non-extractable pro-anthocyanidins (28.6%) and extractable polyphenols (2.0%) were associated with dietary fiber matrix. (Saura – Calixto, 1998).

Dried grape pomace contained crude protein 11.67%, crude fiber 34.73 %, crude fat 9.70 %, minerals 4.81% and nitrogen free extract 39.09 % DM . (Stojanovic , *et al.*, 1989) .

The highest concentration of amino acids composition in grape pomace was Glutamic acid (about 18 %) followed by Tyrosin and Aspartic acid (about 12 %) . Limiting amino acid were Lysin and Tryptophan. (Igartuburu, *et al.*, 1991).

The chemical composition of extracted dried olive pomace indicated that the main component was fiber with values above 70.0%. (Clemente , *et al.* , 1997).

Grape pomace was analysed and the composition in vitro indigestible fraction characterized. The samples were rich in protein (12 – 14 % DM), Fat (7-12 % DM) and minerals (6-9% DM), with a smaller amount of soluble sugars (about 3.0% DM). (Bravo and Saura- Calixto, 1998).

Residue arising after pressig grape was analysed for proximate composition. Determination of mineral elements confirmed the high Potassium and low Manganese content of grape pomace. (Nikolic , *et al.*, 1986).

The antioxidant capacity of some pomace was determined in vitro by lipid oxidation inhibition and free radical scavening procedures and results showed that polyphenol of grape pomace does higher antioxidant capacity than DL – alpha – tocopherol..

This study was conducted to evaluate the chemical composition of grape pomaces and olive pomace as a reliable index with which we can use these byproducts.

MATERIALS AND METHODS

Material :

1 – Olive (**Olea eurpea**) pomace obtained from olive press station of Al – Salhia – Sharkia – Egypt .

2 – Grape (**Vitis vinifera**) pomace , white and red species obtained from local market .

Methods :

Preparation of grape samples:

Seeds were eliminated from the two species of the grape and extracted the juice by mixer then filtered to obtain the pomace .

Determination of moisture , ash , fat and fiber were carried out according to the standard methods of A . O . A . C . , 1985 .

Determination of total protein was caculated by multiplying the total nitrogen by 5.75 .

The total nitrogen was determined by using microkjeldahel method according to A . O . A . C . , 1985.

Determination of soluble protein was carried out according to Lowary *et al.*, 1951.

Determination of non – soluble protein was caculated by subtracting the amount of soluble protein from total protein content.

Determination of carbohydrate fractions (total carbohydrate – total soluble sugers – reducing sugars) were carried out according to Bernfled (1955) and Miller (1959).

Determination of non – reducing sugars was calculated by subtracting the amount of total reducing sugars from total soluble sugars.

Determination of non – soluble sugars was calculated by subtracting the amount of total soluble sugars from total carbohydrate.

Determination of minerals composition was carried out according to Nation and Robinson, (1971).

Determination of phenolic compounds (total and free) were carried out according to Snell and Snell, (1953).

Determination of conjugated phenols by subtracting the amount of free phenols from total phenols .

Determination of Tryptophan was carried out according to Opienska – Blauth , *et al.*, (1963).

Determination of total amino acids was carried out according to Block, *et al* ., (1958).

Determination of phosphorus was carried out according to Murphy and Riley , (1962).

RESULTS AND DISCUSSION

This study was carried out to evaluate chemical constituents in grape and olive pomaces, where two samples of grape pomace (white and red) and one sample of olive pomace were taken .

The results in table (1) presented fat, ash and fiber percentage. It can be noticed that, white grape pomace content of moisture is more than moisture content in red grape pomace, 87.2 and 84.0% respectively, but

moisture content of olive pomace was less than that of both two grape pomaces (43.5%).

Fat contents (table, 1) were 6.5, 7.0 and 10.0 % for white, red grape pomaces and olive pomace respectively.

Grape pomaces and olive pomace were characterized by 9.0, 8.0 and 4.0 percentages for ash content respectively (table, 1).

Percentages of fiber contents were 35.0, 32.0 and 71.0 in white, red grape and olive pomaces.

These results were in agreement with those obtained by Mason *et al.*, (1983 and 1985) and Clemente *et al.*, (1997).

Results in table, 2 showed different contents of carbohydrate and protein fractions in white, red grape and olive pomaces.

Grape pomaces (red and white) were characterized with higher total carbohydrates content than olive pomace content of total carbohydrates (40.0, 37.5 and 10.0% respectively), also non-soluble carbohydrate contents had the same trend, while percentages were 35.8, 34.5 and 6.72 (table, 2) respectively.

In the same table (2) reducing sugar contents were 2.8, 2.0 and 2.9% for red, white grape and olive pomaces respectively, while non-reducing sugar percentages were 1.4, 1.0 and 0.38 in red, white grape and olive pomaces respectively.

Also results for protein fractions presented in table, 2.

It can be noticed that grape pomaces had total protein values higher than that of olive pomace, (13.0, 12.0 and 5.0 % in red, white grape and olive pomaces respectively) and the percentage content of soluble protein was as follow; 5.2, 4.7 for red and white grape pomaces and 2.0 for olive pomace respectively.

In the same table (2), generally, the contents of non-soluble protein were higher in all samples that contects of soluble protein, while they were 7.8, 7.3 and 3.0 % for red, white grape pomaces and olive pomace respectively.

Generally, these trends were noticed in studies carried out by Stojanovic, *et al.*, (1989), Bravo and Saura – Calixto , (1998). In response to minerals and phenolic contents, their results were presented in (table 3).

Minerals contents of white grape pomace were, in descending order as follow:- Calcium, Potassium, Magnessium, Sodium, Phosphorous, Iron, Manganese and Lead (4121.7, 3872.0, 2303.5, 1315.2, 557.3, 81.0, 59.8 and 2.0 ppm respectively), while for red grape pomace in the same order were as follow:- Potassium, Calcium, Magnesium, Sodium, Phosphorous , Iron , Manganese and Lead (4601.0 , 3811.8 , 1901.6 , 1203.4 , 643.0 , 75.0 , 68.4 and 3.0 ppm respectively), but for olive pomace in the same order were as follow :- Potassium , Calcium , Sodium , Magnesium , Phosphorous , Iron , Manganese and Lead (5619.1, 1377.0 , 750.1 , 327.8 , 188.2 , 102.7 , 6.2 and 1.2 ppm respectively) .

Total phenolic compounds percentage presented in table (3) were 4.1, 3.7 and 2.5 for olive pomace, white grape pomace and red grape pomace respectively, while percentage of free phenolic compounds was 1.9, 1.4 and 1.1 for olive pomace, white grape pomace and red grape pomace respectively, but percentage of conjugated phenolic compounds were 2.3, 2.2 and 1.4 for white grape pomace, olive pomace and red grape pomace respectively.

These trend in results were in agreement with those were noticed by Nikolic, *et al.*, (1986) and Larrauri, *et al.*, (1996).

Data for amino acids percentages in different pomaces was presented in table (4).

These results showed predominant amino acids percentages in each pomace, where they were, glutamic acid (9.7); tyrosine (8.2); aspartic acid (8.0); serine (7.9); alanine (7.9); threonine (7.8) ; leucine (7.5) and arginene (7.0) for white grape pomace, while they were glutamic acid (11.2), tyrosine (9.3), aspartic acid (9.0), alanine (8.7), leucine (8.4), serine (7.7), Iso-leucine (7.6) and arginene (7.0) for red garpe pomace, but they were glutamic acid (15.9), aspartic acid (13.2); leucine (11.0) serine (8.0); threonine (7.3) and alanine (7.0); for olive pomace .

The before mentioned results showed that studied pomaces very benefit as a source of fuel (Mason *et al.*, 1983 and 1985) , as a nutrition supplement (Stojanovic *et al.*, 1989), as a good growth substrate for microorganisms (Kuzmanova *et al.*, 1991), as a growth stimulator (Ezhov *et al.*, 1991), as a farmacutical substances (Bobek and Galbavy, 1999) and as

a source of natural antioxidants (Saura-calixto, 1998) and Amany , M., (2000) .

There was noticeable percentages of methionine, generally, in three pomaces; 2.5 , 2.0 and 1.5 for white , red grape pomaces and olive pomace respectively.

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Table (1): Moisture, Fat, Ash and Fiber percentage of grape and olive pomaces.

Component	White grape pomace	Red grape pomace	Olive pomace
Moisture	87.2	84.0	43.5
Fat	6.5	7.0	10.0
Ash	9.0	8.0	4.0
Fiber	35.0	32.0	71.0

Table (2): Carbohydrates and protein fractions percentage in white, red grape and olive pomaces (on the base of dry matter) .

Materials	Carbohydrates					Protein		
	Total	Soluble	Non - soluble	Reducing	Non - reducing	Total	Soluble	Non - soluble
White grape pomace	37.5	3.0	34.5	2.0	1.0	12.0	4.7	7.3
Red grape pomace	40.0	4.2	35.8	2.8	1.4	13.0	5.2	7.8
Olive pomace	10.0	3.28	6.72	2.9	0.38	5.0	2.0	3.0

Table (3): Minerals and phenolic contents in white , red grape and olive pomaces .

Parameter	White grape pomace	Red grape pomace	Olive pomace
Minerals content (ppm)			
Calcium	4121.7	3811.8	1377.0
Potassium	3872.0	4601.1	5619.1
Magnesium	2303.5	1901.6	327.8
Sodium	1315.2	1203.4	750.1
Phosphorous	557.3	643.0	188.2
Iron	81.0	75.0	102.7
Manganese	59.8	68.4	6.2
Lead	2.0	3.0	1.2
Phenolic content % (DM)			
Total	3.7	2.5	4.1
Free	1.4	1.1	1.9
Conjugated	2.3	1.4	2.2

Table (4): Amino acids contents percentage in white, red grape and olive pomaces (on the base of dry matter of protein).

Amino acids	White grape pomace	Red grape pomace	Olive pomace
Aspartic acid	8.0	9.0	13.2
Threonine	7.8	6.7	7.3
Serine	7.9	7.7	8.0
Glutamic acid	9.7	11.2	15.9
Proline	3.4	2.8	2.0
Glycine	6.6	6.3	5.0
Alanine	7.9	8.7	7.0
Valine	6.0	5.0	6.0
Methionine	2.5	2.0	1.5
Isoleucine	8.0	7.6	5.5
Leucine	7.5	8.4	11.0
Tyrosine	8.2	9.3	4.0
Phenylalanine	4.0	3.5	4.5
Histidine	3.5	2.3	2.0
Lysine	0.5	0.7	0.5
Arginine	7.0	7.0	6.0
Tryptophan	1.5	1.8	0.6

التقييم الكيميائي للمكونات الكيميائية الحيوية في تفلة العنب والزيتون

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تمت دراسة التركيب الكيميائي لتفلة العنب الابيض والاحمر وتفلة الزيتون. حيث تم الحصول علي تفلة الزيتون من معصرة زيتون الصالحية – شرقية. أما تفلة العنب فتم الحصول عليها بعد نزع البذور منه وإجراء عملية عصر للعنب. وقد أوضحت الدراسة ارتفاع نسبة البروتين في تفلة العنب (١٢% للعنب الابيض و ١٣% للعنب الأحمر) أما تفلة الزيتون فكانت منخفضة في نسبة البروتين (٥%). وأيضا ارتفاع نسبة الكربوهيدرات الكلية في العنب (٣٧,٥% في العنب الابيض و ٤٠ % في العنب الأحمر) أما تفلة الزيتون فكانت نسبة الكربوهيدرات بها ١٠%. مما يدل علي أن تفلة العنب ذات قيمة غذائية عالية عند استخدامها في صناعة الاعلاف الحيوانية. بالاضافة الي ارتفاع نسبة بعض العناصر المعدنية في نوعي التفلة مثل الكالسيوم والبوتاسيوم والماغنسيوم في حين ارتفاع نسبة الصوديوم في تفلة العنب عنها في تفلة الزيتون. بالإضافة الي ارتفاع نسبة الفينولات الكلية في تفلة الزيتون (٤,١%) عنها في تفلة العنب بصنفية (٢,٥ – ٣,٧%). كما تصل نسبة الرماد إلى ٩% في تفلة العنب مما يجعلها مصدر جيد كوقود. أما بالنسبة للاحماض الامينية فيعتبر حامض الجلوتاميك أعلي مكون في تفلة العنب والزيتون مع تركيز أقل لحامض الليسين في كلا من نوعي التفلة (العنب والزيتون). بالإضافة إلى إمكانية الاستفادة من هذة التفلة كبيئة جيدة لنمو الكائنات الدقيقة وكمصدر جيد لمضادات الاكسدة الطبيعية.