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EVALUATION OF LOCAL GRAPE POMACE AS UNTRADITIONAL FEED AND NATURAL ANTIOXIDANT

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ABSTRACT

The nutrient composition of grape pomace (GP) was studied . The results of proximate analysis indicated a low moisture content,up to 5.2%, crude protein content up to 13.4%. Ash, ether extract, crude fiber and nitrogen free-extract contents were 6.7%, 0.48%, 27.4% and 46.82%, respectively. Ca, P, Na, K, Mg, Zn, Fe, Cu and Mn contents were 0.814%, 0.177%, 0.440%, 1.88%, 1.00%, 32.41 ppm, 272.00 ppm, 22.15 ppm and 41.81 ppm, respectively.

Amino acids composition showed a recovery (% total N analyzed) up to 65.61 g/16g N, and sulfur containing amino acids up to 1.94 g/16g N . Seventeen amino acids were detected in varing concentration in GP and among ten essential amino acids assayed. Methionine and cystine were the most limiting amino acids with chemical score of 27.3, all compared with chick requirement reference. Essential amino acids index values were 55.86 , all compared with whole egg reference. Gross energy content was reasonablly high, up to 4.089 kcal/g DM. True starch equivalent was 49.16%.

HPLC analysis of total polyphenolic compounds in grape pomace which play an important role as natural antioxidants represent about 4.96 mg/ g. Some phenolic compounds had been found after hydrolysis in µg/g as ± catechin 360.42, gallic acid 240.60, chlorogenic and caffeic acid were 45.88, 11.07 respectively, rutin and coumarin were 90.62, 55.27 respetively. Pesticide residues (Alachlor, Aldicarb, Chlordane and Atrazine) did not find their way in / on grape pomace.

It can be concluded that grape pomace could be introduced as a raw material as untraditional feedstuff for animal and poultry nutrition .

Keywords : Chemical evaluation, grape pomace, amino acids, polyphenols, pesticide residues, nutrition.

INTRODUCTION

The use of industrial and agricultural wastes as poultry and animal feedstuffs will lower the competition between human kind and livestock on using grains and other edible foodstuffs which will be saved for human use (El Moghazy and El Boushy, 1982; El Boushy, 1990; Boucque and Fiems, 1988; Boda, 1990; Haready and Hamza, 2001a and 2001b).

Several by-products now exist and generate large amounts of residues which could contribute to environmental pollution and require disposal, i.e. date waste (Al-Hiti and Rous,1978), tomato seed (Anwar et al, 1978 ; Goose and Binsted, 1973), potato waste (Smith and Huxsoll, 1987; Talburt, 1987), gums wastes (Whistler, 1959; Haready and Hamza, 2001), citrus wastes (Nagy et al, 1977), slaughtering wastes (El Boushy et al,1984) and other canded food industries.

Due to recycling of industrial wastes, it will be possible to produce cheap processed feedstuffs, which can be fed alone or to be as raw materials for formulating cheap rations for different livestocks use.

During the processing of wine, there is a portion up to 12.4% produced as a waste called "pomace", includes seeds, skin, pulp and some leaves. This by-product is estimated to be some million tons per year (Famuyiwa and Ough, 1982; Sugano et al, 1988; Amado et al, 1995 and Motta Ferreira et al, 1996).

Table (1) contain the annual amount of red and black graps which process to juice, jelly and wine during the last 5 years which extracted by Ganaclis Vinyards Co. in Alexandria.

Table (1): Annual amount of red and black grapes which process to juice during (1995-2001)

Year	Amount (tons)
1995	817.10
1996	747.80
1997	786.80
1998	778.30
1999	956.89
2000	1322.40
2001	2021.80

Source: Ganaclis Vinyards Co. in Alexanderia

The objective of this study is to evaluate chemically the grape pomace locally produced in wine industry (Ganaclis, Alexanderia), and to which extend it can be introduced in animal and poultry nutrition.

MATERIALS AND METHODS

The chemical composition and nutritive evaluation of the target feed-stuffs were carried out at Central Laboratory for Food and Feed (CLFF), Agricultural Research Center, Giza, Egypt.

Chemical analysis:

Homogenized sample from the tested material was divided into subsamples. The subsamples were submitted to the required analysis:

Dry matter, crude protein, ether extract, crude fiber and ash contents were determined according to the standard methods described in the A.O.A.C. (1998).

Nitrogen free-extractives was calculated by difference.

Macro-minerals, i.e. Ca, P, Na, K and Mg ; and micro-minerals, i.e. Fe, Cu, Mn and Zn were determined according to A.O.A.C (1998), where the sample was digested using nitric, sulphoric and perchloric acids (3:4:1 v/v) and the digested sample was kept in poly ethylene bottle; the Atomic Absorption Spectrophotometer, 3300 Perken-Elmer was used.

Amino acids were determined by Beckman amino acids analyzer, model 7300 and data system 7000. Amino acids determination was performed according to the method of Winder and Eggum (1966).Gross energy was determined using an Adiabatic Oxygen Bomb Calorimeter, PARR 1261.

Starch equivalent was calculated by Kellner (1919). Free and conjugated polyphenolic compounds were determined according to Wulf and Nagel, 1976 and Murphy and Sturte, 1978 by using HPLC (Beckman system

126 AA and UV detector 166 with Bondapak C_{18} column). All solvents were HPLC grade and standered samples obtained from sigma co. USA. Polyphenols was determined at the Faculty of Science, Alexandria University. Pesticide residues (Alachlor, Aldicarb, Chlordane and Atra zine) were determined by using Environ – Grad test kits (Millipore). Pesticide concentration can be evaluated with envirogard tube kits. Each kit contains 20 coated tubes, a tube support, the enzyme conjugate, substrate chromogen and stop solution reagent, a blank and two standard solutions. The optical density determined using a standard spectrophotometer with wave length 450 nm, by simply ouring the tube content into the measuring cell (Barabolak, 1988).

Scoring procedures:

(a) Chemical score (CS) was calculated on the basis of amino acids composition according to Block and Mitchell (1946).

(b) Essential amino acid index (EAAI) was calculated on the basis of amino acids composition according to Oser (1951).

RESULTS AND DISCUSSION

The proximate analysis concentration, calcium and phosphorus (P) for grape pomace (GP) is presented in Table(2), and the amino acids composition of GP is shown in Table (3).

Table (2): The proximate analysis , Ca and P of grape pomace, on dry matter basis (in %.)

Material	DM	ASH	CP	EE	CF	NFE	Ca	P
Grape pomace	94.8	7.07	14.14	0.51	28.9	49.38	0.859	0.187

Table (3): The amino acid composition of GP in feed (%) and in protein (g/16g N).

Amino acid	Grape pomace (% in feed)	Grape pomace (g/16g N)
Arginine	0.37	2.76
Histidine	0.27	2.01
Lysine	0.43	3.21
Phenyalanine	0.47	3.51
Tyrosine	0.36	2.69
Cystine	0.11	0.82
Methionine	0.15	1.12
Threonine	0.41	3.06
Iso-leucine	0.42	3.10
Leucine	0.71	5.30
Valine	0.51	3.80
Glycine	0.68	5.07
Serine	0.46	3.43
Alanine	0.51	3.80
Proline	0.51	3.80
Aspartic acid	0.93	6.94
Glutamic acid	1.50	11.19
Total sulfur amino acids	0.26	1.94
Recovery of amino acid–N (% total N analyzed)		65.61

Crude protein content in the tested material is reasonably low, when it compared with some other plant protein sources commonly used in animal and poultry rations. A comparison was made between the experimental material and the following plant protein sources, i.e. soybean meal (SBM); guar germ (GG) and leucaena germ (LG), date pits (DP), olive meal solvent extracted(OMSE),olive meal meachanically extracted,(OMME), sugar beat pulp (SBP) and sugar beat tops dried (SBTD) for crude protein content (%), recovery of amino acids (g/16g N) and sulfur amino acids content (g/16g N), and the results are quoted in Table (4).

The results showed that 14.4% crude protein content for grape pomace against 42.67%, 38.7 and 42.0 of crude protein contents for SBM, GG and LG ,respectively. However, the crude protein content of GP is higher than its content in other feedstuffs in the comparison.

Table (4) : Crude protein content in % ,recovery of amino acids in g/16g N and total sulfur amino acids (SAA) in g/16g N for grape pomace (GP), soybean meal (SBM), guar germ (GG) , leucaena germ (LG), date pits (DP), olive meal solvent extracted(OMSE), olive meal meachanically extracted, (OMME), sugar beat pulp (SBP) and sugar beat tops dried (SBTD) .

Feed	CP(%)	RAA(g/16gN)	SAA(g/16gN)
GP	14.4	65.61	1.94
SBM*	42.67	99.82	2.35
GG**	38.70	63.26	2.99
LG**	42.00	52.33	2.25
DP***	7.3	-	1.63
OMSE***	11.2	-	-
OMME***	9.50	-	-
SBP***	9.00	-	0.13
SBTD***	11.00	-	-

* Data adopted from Mohamed *et al.*. (1988).
** Data adopted from Haready and Hamza (2001a).
*** Data adopted from Feed composition Tables (2001).

The recovery of amino acids GP showed higher value up to 65.61 than the values of GG and LG up to 63.62 and 52.33 g/16g N , respectively. However, the recovery of amino acids value for GP was lower considerablly than the value for SBM, i.e. 99.82 g/16g N.

The sulfur amino acids content showed a low value of 1.94 g/16g N for GP against 2.35, 2.99 and 2.25 g/16g N for SBM, GG and LG, respectively. However, the content of SAA in GP is higher than its content in DP and SBP.

A comparison was made to evaluate the tested material with other plant protein sources for ether extract contents (in %), crude fiber contents (in %) and nitrogen free- extracts (in %), and the results were quoted in Table (5).

The results of ether extract contents (EE) showed that GP had the lower value (0.51%) than the values of other feedstuffs in the comparison.

Table (5) : Ether extract (EE%), crude fiber (CF%) and nitrogen free - extractives (NFE%) for grape pomace (GP) in comparison with soybean meal (SBM), guar germ (GG) , leucaena germ (LG), date pits (DP), olive meal solvent extracted(OMSE),olive meal meachanically extracted,(OMME), sugar beat pulp (SBP) and sugar beat tops dried (SBTD) .

Nutrient	EE (%)	CF (%)	NFE (%)
GP	0.51	28.9	49.38
SBM*	1.11	9.12	31.09
GG **	2.63	8.11	39.43
LG**	3.81	6.73	35.03
DP***	5.00	14.00	66.20
OMSE***	1.50	25.00	45.30
OMME***	5.70	33.00	36.80
SBP***	1.00	20.00	55.10
SBTD***	1.00	13.00	45.00

*** Adopted from Mohamed *et al.* (1988a),**
**** Adopted from Haready and Hamza (2001a).**
***** Adopted from Feed Composition (2001).**

Crude fiber contents (CF) in this comparison showed that GP had a high value (28.9%)comparable with the values of other feedstuffs with exception to OMME. This is a disadvantage for inclution of GP in poultry diets comparable with the possibility of its inclution in animal diets (Motta Ferreira et al, 1996). Nitrogen free- extractives contents (NFE) showed a reasonable value for GP (49.38%) comparable with the values for SBM, LG, OMME, GG, SBTD and OMSE where contain 31.09 35.03, 36.8, 39.43, 45.o and 45.3, respectively. However,GP contains less than DP and SBP which are 66.2 and 55.1%, respectively. Since, NFE contents were calculated by difference, the differences which were appeared between the feed-stuffs, are due to the contribution of other nutrients for each feedstuff in the comparison.

A comparison was made to evaluate the ash content (%), calcium content (%), phosphorus content (%) and calcium to phosphorus ratio in grape pomace (GP), Soybean meal (SBM), guar germ (GG) and leucaena germ (LG), date pits (DP), olive meal solvent extracted(OMSE),olive meal meachanically extracted,(OMME), sugar beat pulp (SBP) and sugar beat tops dried (SBTD) and the results are quoted in Table (6) .

The results of ash content showed that GP containing relatively high ash content than other feedstuffs in comparison with exception to SBTD which contains 20% .

Calcium content of GP was high (0.859%) in comparison with 0.740 , 0.413, 0.373 and 0.30% for SBP ,GG, LG and SBM, respectively, with exception to OMME (1.33%) .

Phosphorus content of GP had a was low value (0.187%) overall the comparison , with exception to its containt in OMME and SBP.

Calcium to phosphorus ratios were uncorrected overall the comparable materials, with badly uncorrect ratio in OMME,SBP and GP where had (13.3:1) , (7.4:1) and (4.6:1) , respectively .

Table (6): Ash , Calcium , phosphorus , and calcium : phosphorus ratio in grape pomace (GP) in comparison with soybean meal (SBM), guar germ (GG), leucaena grerm(LG), date pits (DP), olive meal solvent extracted(OMSE),olive meal meachanically extracted,(OMME), sugar beat pulp (SBP) and sugar beat tops dried (SBTD) .

Nutrient	Ash %	Ca %	P %	Ca: P ratio
GP	7.07	0.859	0.187	(4.6:1)
SBM*	6.50	0.30	0.65	(1:2.2)
GG **	2.63	0.413	0.50	(1:1.2)
LG**	3.73	0.373	0.544	(1:1.45)
DP***	1.50	_	_	_
OMSE***	6.00	_	_	_
OMME***	7.00	1.33	0.10	(13.3:1)
SBP***	4.90	0.740	0.10	(7.4:1)
SBTD***	20.00	_	_	_

* Adopted from Mohamed et al.,(1988).
** Adopted from Haready and Hamza (2001a).
*** Adopted from Feed Composition Tables (2001) .

Table (7): The composition of some macro- and micro-minerals of grape pomace (GP) and soya bean meal (SBM).

Mineral	Na %	K %	Mg %	Zn(ppm)	Fe(ppm)	Cu(ppm)	Mn(ppm)
GP	0.44	1.88	1.00	32.41	272.00	22.15	41.80
SBM*	0.31	2.19	0.30	48	130	30	32

* Data adopted from Cunha (1980).

The essential amino acids composition, chemical score (SC), essential amino acid index (EAAI), limiting amino acids (LAA) for GP, GG, LG and SBM, chick requirements of amino acids composition of whole egg were quoted in Table (8).

The nutritive value of any plant protein source has been shown to correlate quite well with the chemical score of the feed calculated from their amino acids analysis.

The calculation of chemical score was based on the suggested chick requirements of amino acids, NRC (1994).

The results of chemical scores were showed that GP had lower score value (43.85) than the other plant protein source in the comparison.The essential amino acids index (EAAI) was calculated, where, the ten essential amino acids for poultary were considered, and the index was defined as the geometric mean of the egg rations of these acids.The results were showed that EAAI value of GP (55.75) was lower than the index value of SBM (82.71). However GP was relatively higher than the index values of GG and LG ; 53.64 and 46.46, respectively.

Table (8): Essential amino acid composition, chemical score (CS), essential amino acid index (EAAI), limiting amino acids (LAA) for grape pomace (GP), guar germ (GG) leucaena germ (LG) and soybean meal (SBM).

Amino acid	GP	GG*	LG*	SBM**	Chick *** Requir-ement	Whole egg****
Arginine	2.76	9.15	4.73	7.45	6.26	6.4
Histidine	2.01	1.60	1.53	2.28	1.52	2.1
Lysine	3.21	2.84	3.31	6.62	5.22	7.2
Phenyal anine + Tyrosine	6.20	4.80	3.94	7.39	5.83	10.8
Cystine	0.82	1.44	1.17	1.21	1.87	2.4
Methionine	1.12	1.55	1.08	1.14	2.17	4.1
Cystine + Methionnine	1.94	2.99	2.25	2.35	4.04	6.5
Threonine	3.06	1.91	1.76	4.18	3.48	4.9
Iso- Leucine	3.13	1.88	1.81	5.21	3.48	8.0
Leucine	5.30	4.11	4.49	7.58	5.87	9.2
Valine	3.80	2.20	2.21	5.38	3.57	7.3
Glycine +	5.07	3.61	2.70	6.00	-	2.2
Serine	8.50	3.61	5.36	12.66	6.52	-
Total	39.91	38.24	31.39	61.20	45.79	64.6
CS	43.85	54.02	49.77	52.53	100.00	-
EAAI	55.75	53.64	46.46	82.71	-	100.00
First LAA	Cystine	Iso-leucine	Methionine	Methionine		
Second LAA	Arginine	Lysine	Threonine	Cys+Meth		
Third LAA	Cys+ Meth	Threonine	Iso-leucine	Cystine		

GP = Grape pomace, * Data adopted from Haready and Hamza (2001a),
Data adopted from Mohamed *et al.* (1988),* NRC (1994), **** Block and Mitchell (1946).

Based on the calculated value of chemical score, the limiting amino acids (LAA) were defined for each tested feed-stuff in successive order, i.e. first LAA, Second LAA and third LAA, as shown in Table (8).The limiting amino acids of GP are cystine (1st LAA), arginine (2nd LAA) and both (cystine+methionine) is the 3rd LAA. Generally, GP is deficient in sulfer amino acids. In cereal based diets, GP can be included in rations with the supplementation of deficient amino acids , in particular to sulfer amino acids.
The gross energy contents were determined (kcal/g DM) and true starch equivalent values were calculated according to kellner (1919), for GP and a comparison was made with GG, LG and SBM. The results are quoted in Table (9).

The gross energy value in GP was relatively low (4.089 kcal/g DM) in comparison with other feedstuffs in table (9) with exception to energy content of SBP (3.785 kcal /g DM).

The true starch equivalent value of GP (49.16%) was lower than the values of LG, GG , SBM, OMSE and SBP which were 60.8, 60.3 , 55.4 , 61.5 and 50.9% , respectively.

Table (9): The gross energy content (kcal/g DM) and true starch equivalent (%) for grape pomace(GP), guar germ(GG), leucaena germ(LG), soybean meal(SBM), date pits (DP), olive meal solvent extracted(OMSE),olive meal meachanically extracted,(OMME), sugar beat pulp (SBP) and sugar beat tops dried (SBTD) .

Feed	Gross energy Kcal/g DM	Starch equivalent (%)
GP	4.089	49.16
GG*	4.179	60.3
LG*	4.377	60.8
SBM**	4.596	55.4
DP***	-	61.5
OMSE***	-	47.4
OMME***	4.200	47.7
SBP***	3.785	50.9
SBTD***	-	43.6

*** Data adopted from Haready and Hamza (2001a),**
**** Data adopted from Mohamed et al (1988a).**
***** Data adopted from Feed Composition Tables (2001) .**

The low starch equivalent of GP in comparison with GG, LG and SBM, which is the result of low content of ether extract and protein.

Phenolic derivitive represent the largest group of the so-called"secondary plant product" synthesized by higher plant exhibiting a broad variety of functions-not only for plants but also for human and animals (Erich *et al* 1994). Polyphenolic compounds plays an important role as antioxidant where there is increasing interest in antioxidant for capture free radicals and hence very important for protection of diseases. The capacity of antioxidants to scavenge the radical cation obtained from grape seed extract was investigated and the most effective compound were rutin, catechine, diosmn and ascorbic acid respectively (Castillo *et al* 2000) .

Data give in Table (10) show the concentration of free and conjugated phenolic compounds (Catechine, Gallic acid, Chlorogenic acid, Caffeic acid, Rutin and Coumarin) before and after hydrolysis. Concentration of total phenolic compound according to protein precipition method were 4.96 mg/ g for grape pomace. Climent and Pardo, 1993 reported that grape seeds contain about 5-6% total phenolic and can be used as natural antioxidant. Antioxidants play an important role in manfacturing, packing and storage of lipids and food or feed containing lipids. Catechine consider as a monomeric polyphenol and can delay tumor. Physiological intake of specific dietary polyphenol such as catechine and gallic acid plays an important role in cancer chemopreventive(Khan *et al* 2000, Ebeler *et al* 2002). Also catechine has not only bacterial activity on Escherichia coli (EHEC) but also anti-toxin activity on verotoxin ,the main pathogenic factor of EHEC (Okubo *et al* 1998). Chlorogenic and caffeic acid have an important process in the detoification of xenobiotics and endogenous compound where they might enhance the activity of phenolsulfotransferase enzyme specific for sulfate conjugation which is very important in the protection of diseases (Yeh and Yen 2003). Most antibacterial activities of flavonoid especially against *Bacillus cereus* and *Salmonella enteritidis* were enhanced in combination with rutin (Arima *et al* 2002). Coumarine was considered as chemoprotection against aflatoxin induced gene mutation (Goeger *et al* 1998). It is well known that tannins are able to form complexes with dietary protein that can protect protein against ruminal degradation (Driedger 1972, Mangan 1988 and Kamel 2003), where Mc Donald 1948, 1969 showed that some protien are readily degraded by rumin microorganism to ammonia which is then absorbed and excreated as urea, so the dietary protein in the rumin can be decreased by protecting the protein from microbial attach. All of these elucidate some characteristics of polyphenols to shed more light on how much existing of these compound is very important in grape pomace. Also grape pomace can be consider as a source for natural antioxidant. Pesticide residues under the study did not find their way in / on grape pomace.

Table (10): Concentration of phenolic compounds before and after hydrolysis

Compound	Concentration of Phenolic compound in ug/g grape pomace	
	Before hydrolysis	**After hydrolysis**
± Catechine	92.9	360.42
Gallic acid	18.4	240.60
Chlorogenic acid	45.88	-
Caffeic acid	-	11.07
Rutin	5.45	90.62
Coumarin	2.61	55.27

Standered ± catachine concentration = 80 ng/µl
Standered gallic acid concentration = 75 ng/µl
Standered chlorogenic acid concentration = 80 ng/10µl
Standered caffeic acid concentration = 80 ng/10µl
Standered rutin concentration = 80 ng/ 10µl
Standered coumarin concentration = 80 ng/10µl

From the chemical and scoring evaluation and the comparison had been made between the tested material and some other wastes or raw material used in the formulation of poultry and animal rations, the present study could described the grape pomace as a promise feed material with the following properties:

- Low moisture content,
- Low protein content with reasonable recovery of amino acids with low sulfer amino acids content, low chemical score and high amino acid index,
- High fiber content and relatively high nitrogen free extractive content,
- Moderate gross energy content and low starch equivalent,

- High ash and calcium contents with uncorrected Ca : P ratio, high content of sodium, magnisium, iron and manganise contents however, low content of potassium, zinc and copper were found.
- Concentration of total phenolic compounds considered as valuable natural antixidants.
- Free from pesticide residues under the study.

Hence, it may be concluded that grape pomace can be introduce as a raw material in the formulation of ration for ruminants and in a small portion for feeding poultry due to its high content of crude fiber.

Future study could be done to evaluate the nutritive value of grape pomace by sheep and to try to introduce different levels of grape pomace in dairy cattle or growing ruminants.

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تقييم تفلة العنب كغذاء غير تقليدى و كمصدر طبيعى لمضادات الأكسدة

أمـــال محمد عبد الرحمـــن كشـــك ، سيد كـــامل عبد الـــرحيم ، منصور سيد هريـــدى ، سعيد عبد المنعم حسن

المعمل المركزى للأغذية والأعلاف ، مركز البحوث الزراعية ، ص . ب ٥٨٨ الاورمان– جيزة – مصر

أجريت هذه الدراسة لمعرفة التركيب الكيميائى لتفلة العنب. وقد أوضحـــت النتـــائج أن محتـــوى الرطوبة٥,٢ % ومحتوى البروتين الخام ١٣,٤ % وكانت نتائج الرماد ومستخلص الاثير (الدهن) والأليـــاف والمستخلص الخالى من النيتروجين هى : ٦,٧ % ٠,٤٨% ، ٢٧,٤% و ٤٦,٨٢% على التوالى . وكـــانت نتائج الأملاح المعدنية الكبرى و الصغرى : الكالسيوم ، الفوسفور ، الصوديوم ، البوتاسيوم ، المغنيســـيوم ، الزنك ، الحديد، النحاس والمنجنيز على النحو التالى: ٠,٨١٤ % ،٠,١٧٧% ، ٠,٤٤٠%، ١,٨٨% -١,٠% ، ٣٢,٤١ -٢٧٢,٠ ، ٢٢,١٥ ، ٤١,٨١ جزء فى المليون على التوالى.

وبتحليل الأحماض الامينية وجد أن مجموع تركيز الأحماض الأمينية الكلية ٦٥,٦١ جـــم / ١٦ جم نيتروجين وكانت الاحماض الامينية الكبريتينية ١,٩٤ جم/ ١٦ جم نيتروجين وقد تم تقدير سبعة عشـــر حمضاً أمينيا منها عشرة أحماض أمنية ضرورية وكان الميثيونين والسيســـتين همـــا الحمضـــان الأمينيـــان المحددان للمقياس الكيميائى حيث كان ٢٧,٣% مقارنة باحتياجات الدجاج كقيمة مقترحه مرجعية وكانت قيمـــة الدليل الكيميائى للأحماض الامينية الضرورية ٥٥,٨٦ مقارنة بالبيضة الكاملة كقيمه مرجعية وكانت الطاقـــة الكلية مرتفعة إلى حد ما و قيمتها ٤,٠٨٩ ك كالورى / جم مادة جافة – وكان معادل النشأ ٤٩,١٦ % ٠ .

وتلعب المركبات الفينوليه فى تفلة العنب دور حيوى هام كأحدى مواد مضادات التأكسد الطبيعية حيث يصـــل تركيزها إلى حوالى ٤,٩٦ مجم/حم كما لا توجد متبقبات المبيدات (الاكلور – الـــدى كـــارب – كلـــوردان والأترزين) طريقها داخل أو على تفلة العنب و يُمكن الاستنتاج من النتائج المتحصل عليها من الدراسة التـــى أجريت على تفلة العنب إمكانية إدخالها كمادة علفية فى تغذية الحيوان والدواجن .

تفتح هذه الدراسه مجالا لتقدير القيم الغذائيه لتفله العنب مع الاغنام وادخالها بنسب مختلفه في علائق ماشـــيه اللبن والمجترات.