

THE CHEMICAL COMPOSITION ASSESSMENT OF THE „FETEASCĂ NEAGRĂ” AND „ALIGOTÉ” GRAPE POMACE FRACTIONS

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Abstract

The aim of the hereby study was to analyze and to compare the chemical composition of vegetable fractions: seeds, skins and stalks resulted from the winemaking process of white grape pomace (Aligoté variety, from Huși area) and red grape pomace (Fetească neagră variety, from Iași area). Measurements targeted the dry matter content (DM%), organic matter (OM%), crude ash (CA), crude protein (CP%), crude fat (EE%), crude fiber (CF%), non-nitrogenous extractive substances (SEN%), total polyphenols (TP%) and tannins (Ta%). The results obtained showed significant differences in the chemical composition in favour of the usage of red grape pomace, the seeds having a better contain in DM%, OM%, CP%, EE% TP% and Ta% and in the case of skins in DM%, EE% SEN%, TP% and Ta%. Given the fact that after the processing of grapes, the stalks still remain in the grape pomace, our research targeted their separation; the chemical analysis highlighted the higher content of CF% in stalks (17.7-29.8%) for which reason we recommend their removing from grape pomace when it is used in poultry feed. The results obtained in the hereby study support the possibility of using of grape pomace in the farm animal nutrition.

Key words: grape pomace, vegetable fractions, chemical content, polyphenols, tannins

INTRODUCTION

The grape pomace is a by-product generated during the winemaking process, in a very high quantity, that contains a variable proportion of seeds, skins and stalks fragments.

Studies on the chemical composition of the grape pomace revealed that in addition to its content in proteins, fats, sugars and minerals [12] it contains high amounts of polyphenols with antioxidant properties [1].

Polyphenols accumulate in the solid parts of the grapes, in skins (28-35%) seeds (60-70%) and stalks (less than 10%) which pass, after the maceration-fermentation process into the grape juice and wine, up to 50% of them, the rest remaining in the grape pomace [2].

The skins from the red grapes are rich in anthocyanins, the hydroxy acids and flavonol glycosides, while the seeds contain mainly flavanols and gallic acid. Flavonoids are

distributed in the seeds and stalks that mainly contain catechins, epicatechin and procyanidins. The anthocyanins are present especially in the red grapes, while the flavan-3-ols (catechins, epicatechin and epicatechin monomers - O-gallate) are most abundant in the white varieties [15].

Several studies have shown the beneficial effects of polyphenols including the antioxidant, antibacterial, anti-inflammatory and anti-metagenic ones, as well as a protective role against the degenerative diseases thus being able to present a great interest in animal health and nutrition [3].

The objective of the hereby study was the comparative assessment of the chemical content of the vegetal fractions: seeds, skins and stalks from the white and red grape pomace belonging to the Aligoté and Fetească neagră variety.

MATERIALS AND METHODS

The fresh grape pomace (FGP) resulted from the red (Fetească neagră of Iași area) and white grapes (Aligoté from Huși area) vinification process was naturally dried, in a

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clean and well ventilated space at a constant temperature of 20°C.

Following the drying process, the vegetal fractions (seeds, skins and stalks) from the white and red grape pomace were separated to determine the chemical content of each fraction in part.

In order to determine the chemical composition, the samples were milled up to particles of 1 mm diameter, according to the standard [19].

The chemical composition intended to determine the dry matter (DM%), crude ash (CA%), crude protein (CP%), crude fat (EE%), crude fibre (CF%) using standardised methods [16;17;18;20;21]; total polyphenols (TP%) and tannins (Ta%) of the alcohol extracts (50%) of the pomace obtained from the grape pomace samples according to the patent [2] were determined by the Folin-Ciocalteu method [14]. Three determinations were made for each sample of fraction analysed.

Means and standard deviations were calculated for each component one. The expression of the chemical composition of the analysed grape pomace fractions was made by reporting all the compounds analysed to the DM. The results obtained were statistically processed using the single factor ANOVA test ($p < 0.05$) to highlight significant differences between the calculated values.

RESULTS AND DISCUSSIONS

The results obtained on the chemical composition of seeds from the red and white grape pomace showed a significantly higher content in the case of red grape pomace for the following components: DM (93.09%), OM (96.92%), CP (14.47%), EE (14.82%), TP (4.22%) and Ta (3.63%). The seeds of the white grape pomace showed a higher content in CA (3.52%) and SEN (30.05%).

Table 1 Chemical composition of seeds (% of DM)

Specification	Results (Mean \pm SD)		Statistical significance (Anova)		
	Seeds of red grape pomace	Seeds of white grape pomace	p-value	Significance threshold	
DM	93.09 \pm 0.04	92.61 \pm 0.06	0.0003	$p < 0.001$	
% of DM	CA	3.08 \pm 0.16	3.52 \pm 0.14	0.02	$p < 0.05$
	OM	96.92 \pm 0.16	96.20 \pm 0.16	0.0047	$p < 0.01$
	CP	14.47 \pm 0.25	10.14 \pm 0.41	9.83E-05	$p < 0.001$
	EE	14.82 \pm 0.6	12.15 \pm 0.18	0.0018	$p < 0.01$
	CF	45.57 \pm 1.62	43.86 \pm 2.53	0.38	$p > 0.05$
	SEN	22.07 \pm 1.54	30.05 \pm 2.83	0.013	$p < 0.05$
	TP	4.22 \pm 0.08	2.72 \pm 0.03	4.16E-32	$p < 0.001$
Ta	3.63 \pm 0.09	2.26 \pm 0.03	1,15961E-30	$p < 0.001$	

There are insufficient data on proteins content in grape seeds, in the published literature [9, 11]. The seeds are not considered to be an important source of protein, their average content can vary between 11-13% [6, 8] and it depends on the grape variety, fertilization and climate conditions. The grape seeds from the red varieties have a higher oil content compared with those from white varieties [5]. The oil content of the seeds may vary from 11.6 to 19.6%, being dependent on the variety and maturity of the grapes [13].

In general, the red grape seeds contain high amounts of polyphenolic compounds

compared to the seeds of the white grapes [7]. Grape pomace total polyphenols content differs depending on the grape varieties, climate and environmental conditions, soil type, degree of ripeness and processing method of grapes in winemaking process [7].

Our results on the crude chemical content and seed polyphenolic compounds are comparable to those in the published literature [9; 11; 7].

The results obtained on the chemical composition of the samples of grape skins are presented in Table 2. By analyzing the chemical components, it has shown a significantly higher content in DM (93.04%),

EE (3.65%), TP (1.30%) and SEN (53.54%), in favour of the red grape pomace, appreciation supported by the statistical calculation ($p < 0.001$). Instead, the results

from the white grape pomace have a significantly higher content in CF (17.53%) compared to the red one (12.13%).

Table 2 Chemical composition of skins (% of DM)

Specification	Results (Mean \pm SD)		Statistical significance (Anova)		
	Skins of red grape pomace	Skins of white grape pomace	p-value	Significance threshold	
DM	93.04 \pm 0.01	90.77 \pm 0.04	9.59E-08	$p < 0.001$	
% of DM	CA	11.60 \pm 0.23	10.89 \pm 0.14	0.07	$p > 0.05$
	OM	88.40 \pm 0.23	88.01 \pm 0.16	0.07	$p > 0.05$
	CP	19.08 \pm 0.66	18.40 \pm 0.23	0.17	$p > 0.05$
	EE	3.65 \pm 0.22	2.43 \pm 0.05	0.0008	$p < 0.001$
	CF	12.13 \pm 0.09	17.53 \pm 0.27	5,26E-06	$p < 0.001$
	SEN	53.54 \pm 0.72	49.64 \pm 0.39	0.0012	$p < 0.01$
	TP	1.95 \pm 0.05	0.58 \pm 0.01	1,89E-39	$p < 0.001$
	Ta	1.30 \pm 0.01	0.25 \pm 0.01	2.23E-42	$p < 0.001$

The study carried out by *Deng et al., 2011* [4], on the chemical composition of the skins from five varieties of grapes (two white and three red) reveals that white grapes have a protein content of 5.38 - 6.54% and 11.26 to 12.34% for the red ones. In our research we obtained higher values in both white (18.40%) and red (19.08%) grape pomace.

Regarding the content of CF, *Deng et al., 2011* [4] obtained values ranging between 17.3

to 28.0% for the white grapes, very similar to those obtained in our research, 17.53% respectively. Instead, in the case of the skins from red grapes, they obtained higher values (51.1 to 56.3%) compared with CF obtained in our study, 12.13% respectively. The content differences may be due to the analyzed grape varieties, fertilization conditions and the soil type.

Table 3 Chemical composition of stalks (% of DM)

Specification	Results (Mean \pm SD)		Statistical significance (Anova)		
	Stalks of red grape pomace	Stalks of white grape pomace	p-value	Significance threshold	
DM	90.16 \pm 0.005	89.67 \pm 0.003	8.7E-09	$p < 0.001$	
% of DM	CA	9.62 \pm 0.08	9.43 \pm 0.12	0.08	$p > 0.05$
	OM	90.38 \pm 0.08	89.48 \pm 0.13	0.0005	$p < 0.001$
	CP	19.01 \pm 0.26	9.96 \pm 0.14	7.65E-07	$p < 0.001$
	EE	1.88 \pm 0.08	1.20 \pm 0.08	0.0005	$p < 0.001$
	CF	17.70 \pm 0.36	29.79 \pm 0.48	4.14E-06	$p < 0.001$
	SEN	51.79 \pm 0.72	48.54 \pm 0.54	0,003	$p < 0.01$
	TP	2.15 \pm 0.004	1.02 \pm 0.01	1.62E-49	$p < 0.01$
	Ta	1.49 \pm 0.01	0.66 \pm 0.01	1.6 E-41	$p < 0.001$

Regarding the chemical composition of stalks from the red grape pomace (tab. 3), the results obtained showed this time too a significantly higher content of chemical components: DM (90.16%), OM (90.38%), CP (19.01%), EE (1.88%), SEN (51.79%), TP (2.15%), Ta (1.49%), compared to the stalks of the white grape pomace. A significantly higher content was recorded in CF only for the stalks of white grape pomace,

namely 29.8%. The content of the CF% in stalks can be compared with the one obtained in the published literature (31.6%), being dependent on the grape variety [10].

Given the fact that the stalks fractions present a higher content of CF% (from 17.7 to 29.8%) it is desired to remove the stalks from the grape pomace when this is added in the poultry feed.

CONCLUSIONS

The researches that were carried out have shown the higher content of substances with a nutritional role in the fractions of red grape pomace: CP%, EE%, TP% and Ta%, in the seeds, EE%, SEN% TP%, Ta%, in the skins; CP%, EE%, SEN% TP% and Ta% in the stalks.

The results obtained on the chemical composition determination of the fractions of grape pomace support the possibility of their use or the one of grape pomace in the farm animals' feed, in compliance with the maximum permitted levels of crude fiber for the animal category and species concerned.

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