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Grape pomace in sheep and dairy cows feeding

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Abstract The grape is one of the most valued conventional fruits worldwide and winemaking is a large industry in many regions of Romania and all over the world. The major waste form wineries are pomace and marc. Even tremendous quantities results each year few studies on the feeding value of grape pomace have been conducted, because has a high fiber content and lower feed value than other fruit-wine pomaces. The objectives of this study was to examine the effects of grape pomace on milk yield and milk composition in dairy cattle and the evolution of weight gain and body mass in Tsigai lambs at the end of the 90 days of fattening. The group of lambs that had the highest body weight was L_1 (28.37 kg), to which was experimentally administered 100 g/day grape pomace (GP). Addition of grape pomace resulted in a very small increase in milk yield in dairy cows. The viticulture grape pomace can be recycled to add value to ruminants feed rations, otherwise being a wasted product.

Key words

dairy cows, grape pomace, feeding, lambs, milk, weight

Pomace is the general term for any solid material, such as the skins, pulp and seeds, which remain after wine or juice has been made from grapes. Tremendous amounts of wine grape pomace (WGP) are available annually in Romania and all over the world [5].From ancient Rome until now, winemakers are still trying to answer the universal question of what to do with their pomace after the fruit has been pressed [3]. The chemical composition of grape pomace is known to vary depending on the grape cultivar, growth climates, and processing conditions [4]. Moisture depends on the pressure to obtain the juice. The composition of grape pomace, whether white or red, is complex: Un-fermentable sugars, tannins, anthocyanins, trace amounts of several organic acids, tartaric acid and not finally, a lot of cellulose [12]. Regardless of composition, grape pomace is considered a waste product problematic for wineries, to avoid pollution, because is about 10% by weight of the total grape input. One of the efficient use of this vineyard waste, is to be used in feeds for ruminants because it can replace the traditional fodder in a situation where the increasing number of people in the world, increase the demand for animal products. Depending on the species, can be used in different amounts in the daily intake [1]. The correct use of this by-product can help to replace fodders that are not enough for all the livestock and especially for ruminants [13].

Material and Method

Fresh pomace was obtained from harvested grapes of Burgund after juice have been extracted by crushing and pressing in the autumn of 2013. Winery waste pressed with the stalks contains about 30% stalks, 30% seeds and 40% skin and pulp. Composition of grape pomace obtained from red grapes was analyzed on dry matter basis (88.6%) and the result was: 7.68% ash, 12.17% crude protein, 49.41% crude fiber, 6.11 %lipids, 1.82% soluble sugars, 0.38% calcium, 0.42% phosphorus, 0.13% magnesium, and 5.2% tannins.

Limited quantities (3 – 5 kg and 0.100-0.150 kg for lambs respectively) of dry grape pomace was add in the daily normal ration of 16 Romanian Spotted cows and 20 lambs (Tsigai breed) for 90 days, in private farms from Timis (Padureni) and Arad (Rosia village) counties. Each main group of animals was divided in four subgroups. For digestibility measurement was used a basal diet and a mixed of basal diet with grape pomace. Because pomace quickly alters the amount that has not been consumed by the animals was removed after 12 hours and weighed. Lambs were weighed twice a week in the morning to record average daily gain. Lambs acquisition was made in July after weaning, and were selected randomly so as to represent the average population of origin. To assess the growth rate was used a decimal electronic scale, with low deviations. Evolution and determining weight gain and body mass was estimated by weighing all individuals at

the beginning and at the end of the 90 days of fattening. The second objective of this study was to examine the effects of grape pomace on milk yield and milk composition in dairy cattle. Data were analyzed as a complete design with four treatments using GraphPad Prism 5.04 [7]. Means were compared with Anova multiple range test at [$p < 0.05$].

Results and Discussions

Grape pomace was used for centuries in ruminant's feed, but only in emergency situations such as drought or other natural disasters or simply to provide them feeling of satiety. Most animals cannot digest grape seed hulls, so the protein that pomace contains is wasted [4].The inclusion of alternative feedstuffs such as grape pomace in ruminat diet in stead alfalfa, even in small amounts is limited due to the lack of information regarding their nutritive value.

Table 1

Parameters for fattening of lambs according with amounts of grape pomace in Tsigai lambs daily diet

Variable	Experimental diet (kg/day)				SE	P p< 0.05	CV%
	Control	L_1 (0.100kg GP)	L_2 (0.125kg GP)	L_3 (0.150kg GP)			
Body weight, kg (100 days)	15.66	15.83	15.74	15.93	± 0.05	0.1004^{ns}	0.73%
Body weight, kg (190 days)	28.14	28.37	27.92	24.13	± 1.00	0.041*	7.42%
Total weight gain (kg)	12.48	12.54	12.18	8.20	± 1.05	0.143^{ns}	18.55%
Weight gain (g/day)	0.156	0.157	0.152	0.103	± 0.01	0.137^{ns}	18.37%

From the dates related to Table 2 it can be seen that at the beginning of the experiment, the group that had the highest body weight was L_1 (28.37 kg), to which was experimentally administered 100 g/day grape pomace (GP). In terms of total increasing, this group had also the best performance. In this case, the total average increase was 12.54 kg, higher value by 0.9% and 6.5% respectively compared to the gain realized by lambs belonging to the other two experimental groups. Bahrami and Chekani-Azar [2] found in the Iranian male lambs Lori Bakhtiari breed, a higher daily weight increase from 140g/day for grape pomace adding of 20% of ration until 236.77g/day, for 5% grape pomace adding in the daily ration.

As data from table 1 shows, adding GP to lambs ration more than 0.125 g/day can not improves performance of Tsigai lambs. The inclusion of GP decreased the apparent digestibility of crude protein and energy also in the feed rabbits [10]. On the other side, Guerra-Rivas [8] found no significant differences between experimental treatments on intake, average daily gain, and carcass yield and carcass characteristics of Merino lambs.

Notably good performance obtained at lambs of the first experimental group, this group having the largest daily increase in weight. The fact that this group lambs reacted better, it may be because at start of the experiment had a higher weight compared with the control and the other two groups. Only the body weight at the end of the experiment period was significantly different among the treatments, with a difference of 4.24 kg in the favor of L_1 compared with L_3.

The low coefficient of variation value (.73%) as regards the body weight of lambs in the initial groups, suggesting that was made very homogeneous groups. Body weight at the end of the experiment is also very homogeneous in all three experimental groups. With a very close value of the coefficient of variation of 18.37% and 18.55%, average daily gain and from the whole period, confirming the homogeneity of lambs lots.

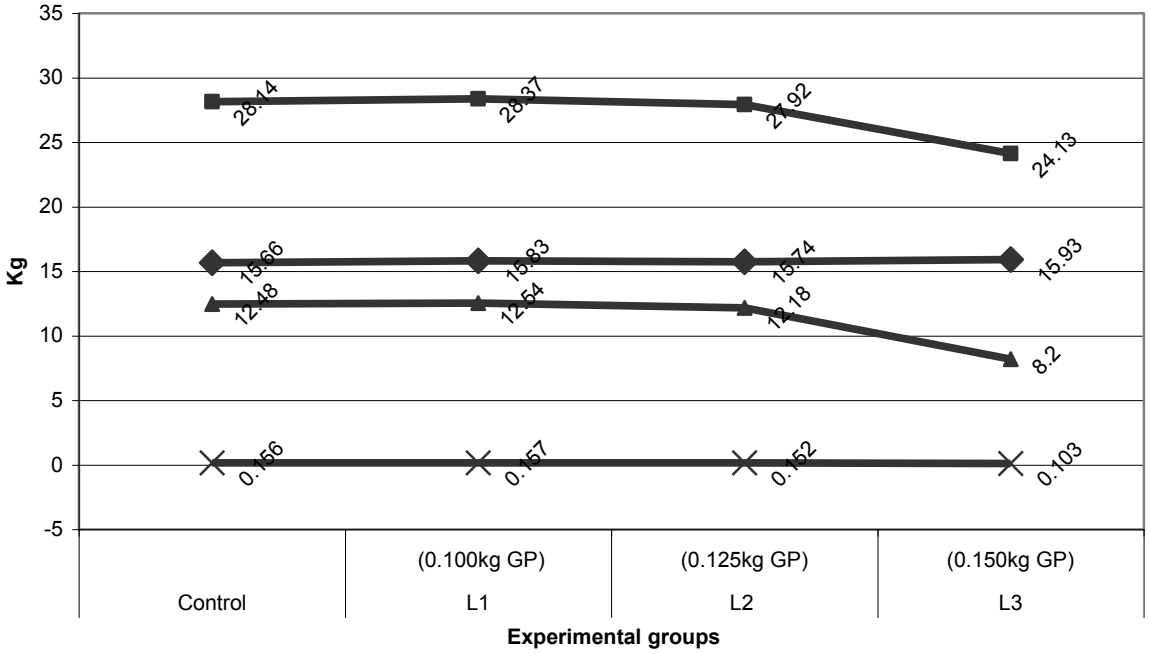

Fig 1. Parameters for fattening according to amounts of grape pomace in Tsigai lambs

The viticulture field by- products can be recycled to add value to current feed rations with the high availability with the added value of recycling otherwise wasted product. For dairy cows, milk yield, protein and fat content were recorded daily, and mean values were calculated every week.

Table 2

Effect of grape pomace on milk yield and milk parameters in Romanian spotted dairy cows

	Control	L_1 3 kg	L_2 4 kg	L_3 5 kg	SE	P P < 0.05	Cv%
Milk yield, kg/cow/day	23.6	23.9	24.08	22.3	0.51	0.192^{ns}	11.17
Protein kg total	0.92	0.94	0.97	0.89	4.25	0.0068^{ns}	66.77
%	3.62	3.58	3.65	3.41	4.32	0.0064^{ns}	64.30
Fat kg total	1.20	1.31	1.43	1.03	4.35	0.0085^{ns}	62.23
%	4.16	4.14	4.17	4.02	4.04	0.0062^{ns}	68.92

No significant differences in milk yield could be observed at the p=0.05 level although L_1 and L_2 experimental groups had an increased milk yield of 0.3 and respectively of 0.48 kg/cow/day which means a small variation (Cv=11.17%). For the protein and fat in milk differences among experimental groups was also without significance. The same insignificant results were obtained in the Danish Red Holstein Dairy cows [11]. Addition of grape pomace resulted in a very small increase in milk yield. High value of the variability coefficient shows parameters of milk production among the individuals from the experimental groups and the media is not representative.

Grape pomace in the dairy cow feeding doesn't bring an important improvement of the milk yield, protein or fat in the milk. This is the consequence of the reduced ruminal protein degradation with direct effect on the protein content from milk.

The amount of grape pomace supplemented with concentrates and legumes hay, add in the daily ration was limited to 3.5 kg in the third experimental group, less than the maximum of 6.5 kg/day specified by Fuller [6].

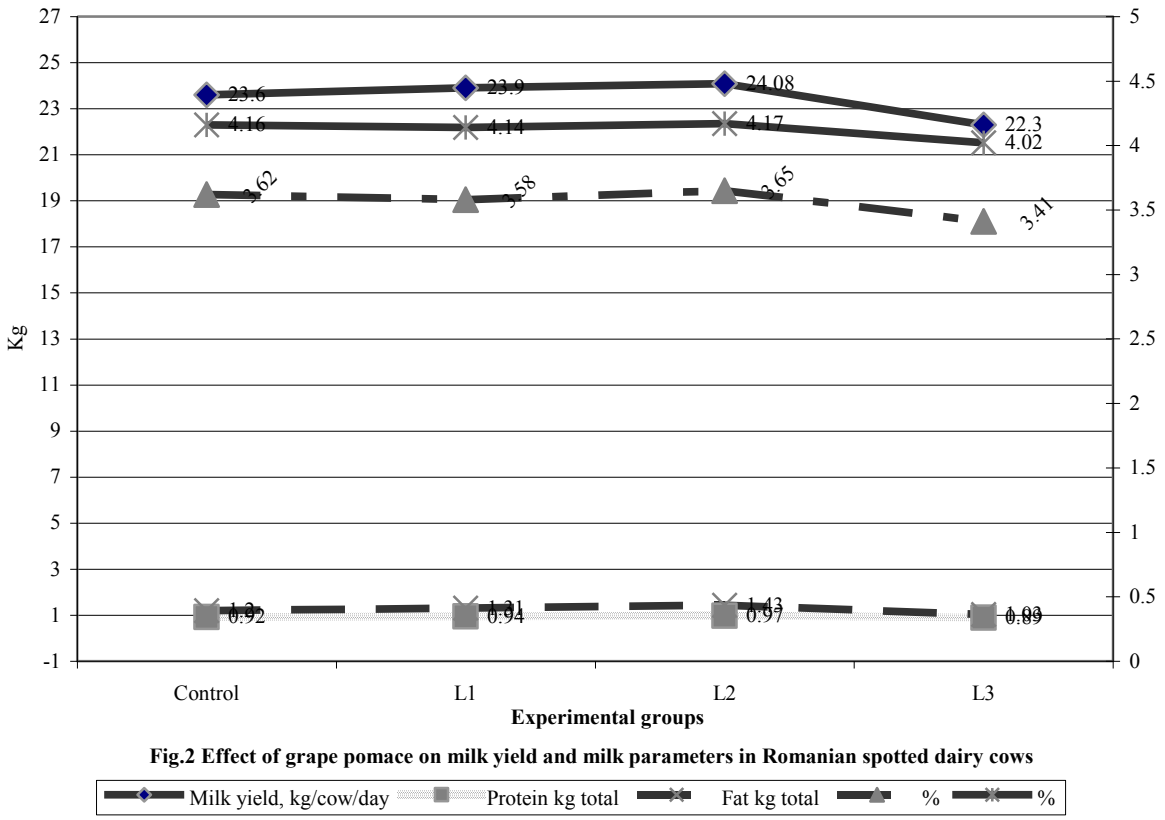

Fig.2 Effect of grape pomace on milk yield and milk parameters in Romanian spotted dairy cows

As data of table and graphics 2 shows, with increasing amount of added grape pomace in ratio over the limit of 4 kg, decreases both yield and other components of milk yield parameters.

New research made in Australia coordinate by Moate P.,[9] has found that feeding cattle the stems, seeds and skins from wine grapes can dramatically cut their methane emissions with 20%. They supplemented the diet of dairy cows with five kilos of dried grape marc over 37 days. The same researcher confirm that grape pomace in dairy cow fed, increases the healthy fatty acids in milk by more than six times that of standard autumn fodder.

Conclusions

Grape pomace is a source of protein and it was expected that fattening lambs would improve their weight with the increase of grape pomace amount in the daily diet, but the effects of high fiber, lignin and tannin exist in the grape waste decrease the rate of digestibility. Grape pomace induced a negative effect on feed digestibility. According to results of this research it may be conclude that grape pomace is a good source of fiber and may be use in small quantities in ruminants to meet the requirements of energy and nitrogen. The viticulture grape pomace can be recycled to add value to ruminants feed rations, otherwise being a wasted product.

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