Analecta
REVIEW OF FACULTY OF ENGINEERING
Analecta Technica Szegedinensia
ISSN 2064-7964

Vol. 10, No. 2 2016

USE OF JUVENILE GRAPE BERRY AS ANTIOXIDANT RICH FOOD INGREDIENT

P. Sipos, R. Nyárádi
University of Debrecen
Faculty of Agricultural and Food Sciences and Environmental Management
Institute of Food Technology
138 Böszörményi street, 4032 Debrecen, Hungary P.O.Box 400
siposp@agr.unideb.hu

ABSTRACT

Both grape and wine production have several useful by-products what have been discovered more and more due their important positive health effects in the last decades. The grape seed is one of them because its high antioxidant power. On the other hand, the marc is also more and more widely evaluated because of its high amount and useful chemical components. However, the grape berries what arise during cluster or grape thinning are rarely evaluated. Their positive properties and high antioxidant activity has been well known for a long time but their utilization is very rare. It is known as verjus, that is known from its sour taste as souring agent, but in Hungary it is not known. In our research we have evaluated six grape varieties in the Tokaj region during grape maturing in three stages of veraison. Clusters were collected and berries were removed from the pedicles manually and the chemical composition of whole berries, separated seeds and peel and flesh were analysed. Furthermore, dried berry parts were grinded and added to wheat flour and biscuits made from them were also analysed both chemically and sensory. We found that their use can result antioxidant rich and tasty bakery products.

Keywords: grape, cluster thinning, by-products, biscuits

1. INTRODUCTION

High amount of wastes are produced in the agriculture and food processing and they requires proper handling. But in several cases these wastes are not useless results of the main process but they can be used in further processing. In the case of viticulture high amounts of juvenile grape berries are produced in the grape thinning. These berries contain high amounts of organic acids, tannins, anthocyanins and phenolic compounds. Ref. [1] presents that the concentrations of tannins are highest in the period of grape veraison, in the further stages of maturing their concentrations decrease. He found that the concentration of malic acid increases until the veraison and decreases after it, while the tartaric acid concentration also increases in the maturing periods before veraison but the increase still remains later with a much more moderate slope. Ref. [2] also found that the total acid content increases until veraison, but in the further growing stages it decreases. Lőrincz et al. also described the same tendency in the change of the concentration of tannins. The concentration of anthocyanins also starts to increase in the veraison but it remains until harvest. Ref. [3] evaluated the changes of the concentration of phenolic compounds during maturing. It was found that total phenol content increased in the first stages of maturing, but later they decreased continuously.

Grape thinning is an important task of viticulture. Due to the thinning, the matured berries will be larger and the bunch will be also larger [4]. The removed grapes are very poor in sugars and therefore sweet taste but contain a lot of acids and phenolic compounds [5]. The use of these berries is very accidental. Almost the only way of use is the production of verjus, what is a pressed and filtered grape berry juice. The ancient Greeks used it for the treatment of ulcers and due its digestive and antiseptic properties and later as dressing. Its popularity decreased in the XVIIIth century due to the expansion of lemon, but nowadays it is experiencing a renaissance and used as salad dressing and component of soft drink, fruit compote [5]. In our research work we have evaluated the changes of acid content, phenol and flavonoid content and antioxidant activity of grapes of six grape varieties three times during the maturing and we used its flour as a component of functional biscuits and we were curious if the advantageous chemical properties can be

Analecta
REVIEW OF FACULTY OF ENGINEERING
Analecta Technica Szegedinensia
ISSN 2064-7964
Vol. 10, No. 2 2016

seen in the properties of biscuits too and how the juvenile grape flour addition influences the consumer's opinion about this product.

2. MATERIALS AND METHODS

Six grape varieties were evaluated in the experiments: Sárgamuskotály, Zéta, Furmint, Kövérszőlő, Chardonnay and Hárslevelű. The samples were collected near to Tarcal in the Tokaj Wine Region by the collaboration of the colleagues of Tokaj Wine Region Institute of Vine and Wine Nonprofit Ltd. The samples were collected at three times during maturing: the first sampling was performed at 17th June, the second at 13th August and the third at 17th September, during harvest. 10 bunches of grapes were collected from every variety at all sampling times. The samples were stored frozen at -80°C before the analysis.
The samples were unfrozen just before the chemical analysis. After that the berries were removed from the bunch and were separated into grape seed and grape flesh. The analysed parameters were dry matter content by MSZ 6367-3:1983 [6], the total acid content by the MSZ EN 12147:1998 [7], content of total phenolic components by Ref. [8], content of total flavonoid compounds by Ref. [9], and the antioxidant activity by the DPPH method [10]. All the results are presented on dry matter basis.
Two grape varieties were selected for the biscuit production, Zéta and Chardonnay. Seven products were prepared:

1. control biscuit
2. biscuit made with addition of seed flour of Zéta
3. biscuit made with addition of flesh and skin flour of Zéta
4. biscuit made with addition of whole berry flour of Zéta
5. biscuit made with addition of seed flour of Chardonnay
6. biscuit made with addition of flesh and skin flour of Chardonnay
7. biscuit made with addition of whole berry flour of Chardonnay

The samples used for biscuit making were collected in the first sampling time as it is the common period for thinning. We made biscuits from BL55 winter wheat flour mixed with the seeds, fleshes (with skin) and whole berries. The different berry parts were dried in drying oven at 40°C until reaching of constant weight, than the samples were grinded by household coffee grinder. The concentration of grape seed was 5% in the flour mixtures, while the whole berries and the fleshes were added in 10% concentrations. The biscuits were made from 700 g wheat and grape berry part flour mixture, 250 g margarine, 250 g icing sugar, 4 eggs, 20 g vanillin sugar and 18 g baking powder. The dry raw materials were simply mixed. The margarine, icing sugar and eggs were mixed to foamy stage and were blended with other components. The dough was kneaded, formed and baked at 220°C in kitchen oven for 10 to 12 minutes. Dry matter content, concentrations of total phenolic components and total flavonoid compounds, and the antioxidant activity were measured from the biscuits. A sensory analysis was also performed on a group of 14-15 years old children, as the potential consumers of this product. The biscuits were valuated by their appearance, colour, texture, taste and odour from 1 (poor) to 5 (excellent). The testers also had to make an order from the biscuits by their overall impressions and they had to choose that which ones were consumed willingly or regularly if it would be commercially available.

2. RESULTS AND DISCUSSION

First we have evaluated that how the analysed parameters changed during the maturing in the berries and the different parts of berries. Although the time of thinning depends on the demands of the plant it is important to know that how the concentrations of physiologically important quality parameters of berries changes by time. The dry matter contents were the lowest in the sampling in June. The dry matter contents of Kövérszőlő, Hárslevelű and Furmint were increased continuously until harvest while in the case of Sárgamuskotály, Chardonnay and Zéta an increase was found until august, but later their dry matter contents were decreased in the last month of the ripening. The dry matter contents of grape seeds can be seen on Fig. 1. Both the dry matter contents of seed and flesh were the lowest in June too and significantly

Analecta
REVIEW OF FACULTY OF ENGINEERING
Analecta Technica Szegedinensia
ISSN 2064-7964
Vol. 10, No. 2 2016

higher values were measured in the last month of maturing. The order and differences between the values of August and September depended on the variety.

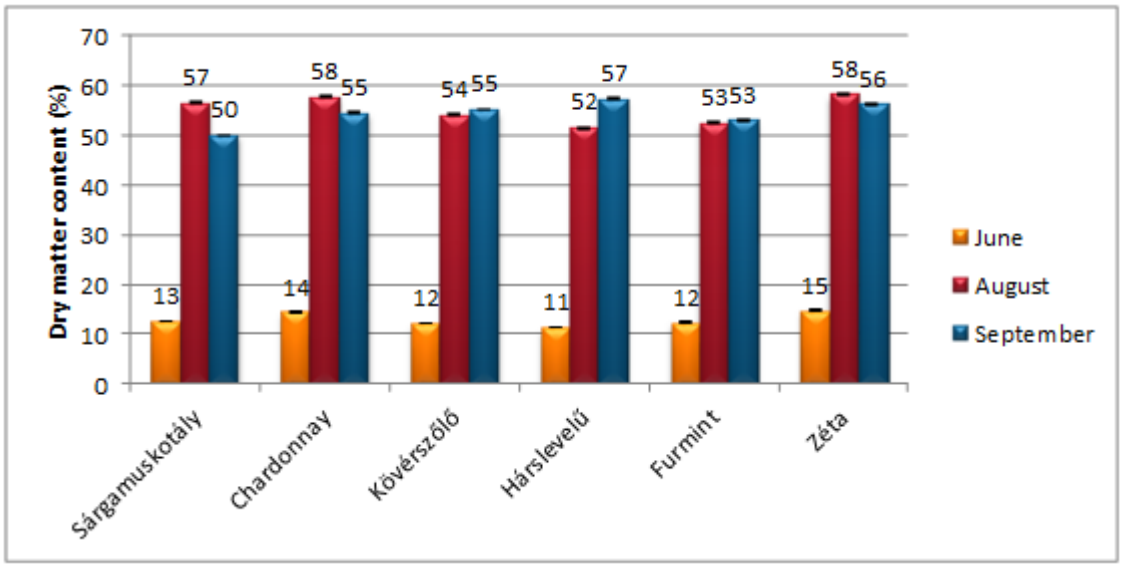

Figure 1. Dry matter content of grape seeds during maturing

The total acid contents were evaluated only from the flesh as the seeds showed extremely low values. The lowest acid values were measured in the first sampling time and the readings were decreased continuously by the time.

The tendencies for the change of concentration of total phenolic compounds of the seeds were similar to the one which was observed in the case of acid content. The phenol contents of the fleshes of the berries were highest in the samples collected in June, much moderated concentrations were determined in August, but the reading were slightly higher in the samples of harvest.

In the case of the changes of total flavonoid content we found differences in the case of the varieties. The highest values for the seeds were measured in the first sampling time. The Sárgamuskotály, Kövérszőlő and Hárslevelű varieties showed continuously decreasing values until harvest, but Chardonnay, Furmint and Zéta varieties showed strong decrease to August, but a slight increase was experienced for September. The total flavonoid contents of seeds can be seen on Fig. 2. The readings for the flavonoid contents of fleshes were high ones in the first sampling time, than a decreasing tendency could be experienced and a slight increase were found for all the varieties.

Analecta
REVIEW OF FACULTY OF ENGINEERING
Analecta Technica Szegedinensia
ISSN 2064-7964
Vol. 10, No. 2 2016

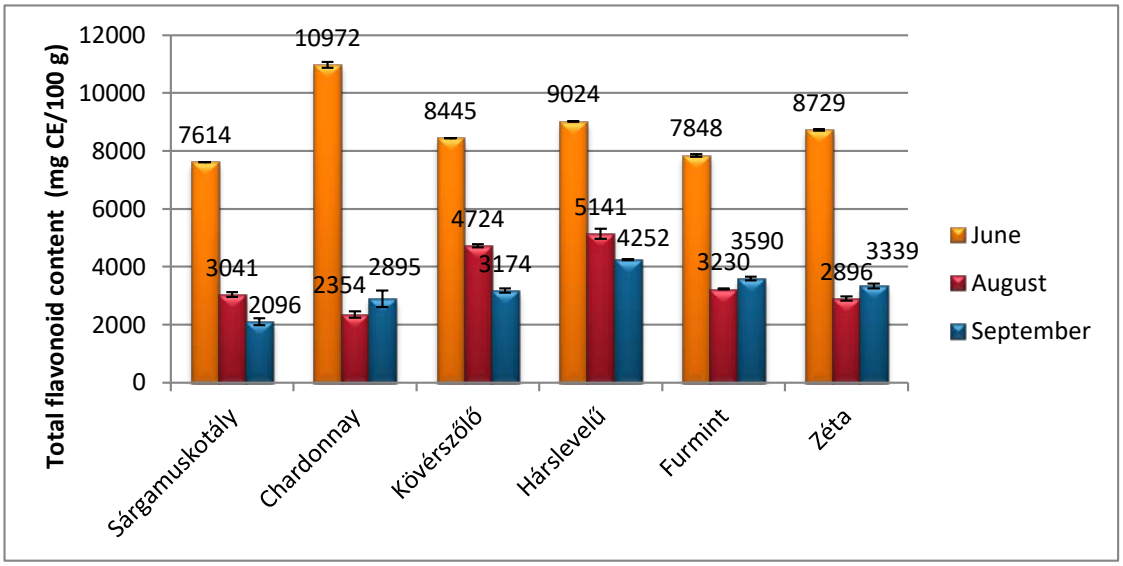

Figure 2. Total flavonoid content of grape seeds during maturing

Both for grape seeds and fleshes decreasing tendencies were experienced for the antioxidant activity. High values were observed in the beginning of ripening, but the values decreased to the third to half values of the initial ones and did not changed significantly in the further maturing. Sárgamuskotály showed a slight decrease to September, but the antioxidant activity increased for all the other varieties. The readings of fleshes can be seen in Fig. 3.

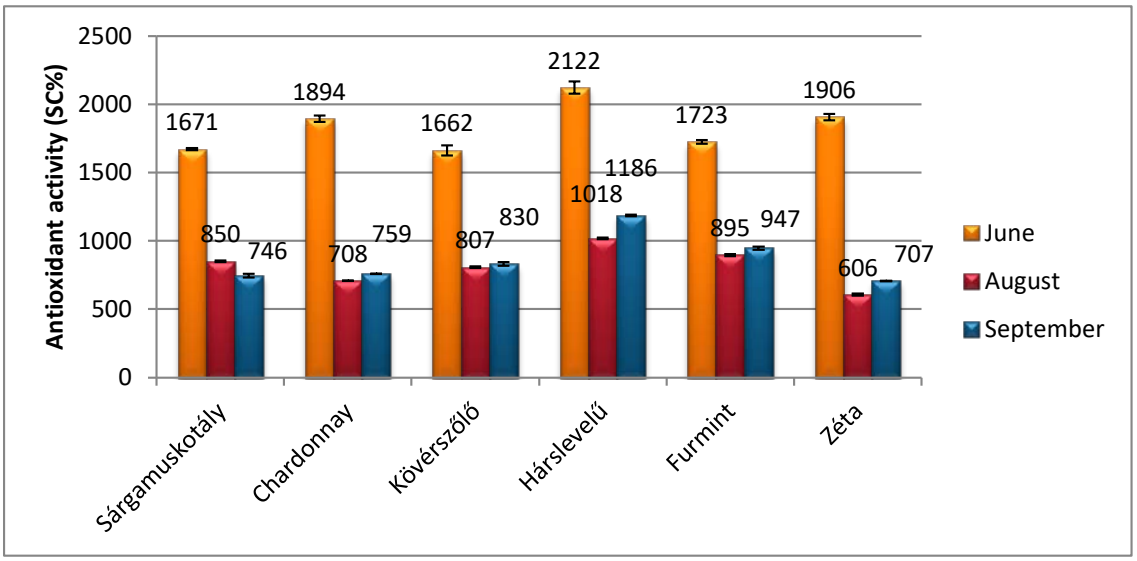

Figure 3. Antioxidant activity of grape fleshes during maturing

Two grape varieties were selected for the biscuit production based on the analysis of grapes: Chardonnay and Zéta, because the highest antioxidant readings were measured in the case of Chardonnay while Zéta

Analecta
REVIEW OF FACULTY OF ENGINEERING
Analecta Technica Szegedinensia
ISSN 2064-7964
Vol. 10, No. 2 2016

showed average values. The dried and milled whole berries, the flesh with skin and the seeds were used for biscuit making. The products can be seen on Fig. 4.

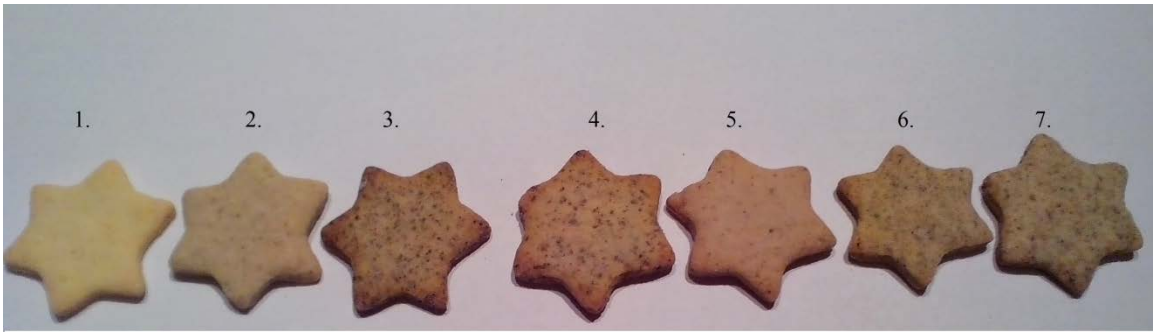

Figure 4. The biscuits made from BL55 flour and dried and milled grape berries and berry parts

Legends: 1: control biscuit, 2: biscuit made with addition of seed flour of Zéta, 3: biscuit made with addition of flesh and skin flour of Zéta, 4: biscuit made with addition of whole berry flour of Zéta, 5: biscuit made with addition of seed flour of Chardonnay, 6: biscuit made with addition of flesh and skin flour of Chardonnay, 7: biscuit made with addition of whole berry flour of Chardonnay

The highest dry matter content was measured in the case of control products, the ones made with addition of grape seed flours showed the highest values while the ones made with berry flash addition showed slightly lower values. The total acid contents were highest for the biscuits made with grape berry flesh addition and the product made with Zéta flesh flour had the highest value. The lowest acid content was measured for the control biscuit. The control biscuit showed the lowest total phenol content too and the addition of berry flour significantly increased the values (Fig 5.).

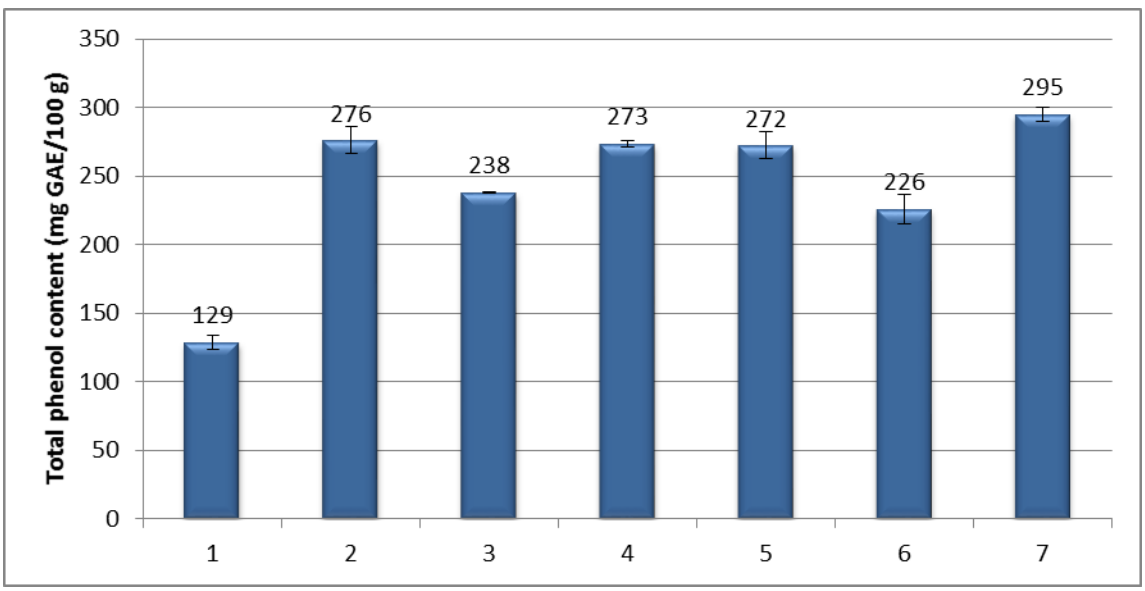

Figure 5. Total phenol contents of biscuits made from BL55 flour and dried and milled grape berries and berry parts

Legends: 1: control biscuit, 2: biscuit made with addition of seed flour of Zéta, 3: biscuit made with addition of flesh and skin flour of Zéta, 4: biscuit made with addition of whole berry flour of Zéta, 5: biscuit made with addition of seed flour of Chardonnay, 6: biscuit made with addition of flesh and skin flour of Chardonnay, 7: biscuit made with addition of whole berry flour of Chardonnay

Analecta
REVIEW OF FACULTY OF ENGINEERING
Analecta Technica Szegedinensia
ISSN 2064-7964
Vol. 10, No. 2 2016

The highest total flavonoid contents were found in the case of biscuits made with grape seed flours and the control product had the lowest value. The biscuit made with the addition of flesh of Zéta had also moderate value. The highest antioxidant activity was found the products which were made by the addition of seed flour of Chardonnay while the lowest value was measured in the case of biscuit made with the use of flesh flour of Chardonnay.

The sensory analysis of biscuits was the final step of the tests. The sensory assessors found the biscuit made with the addition of flour of Chardonnay seeds the most appealing. In the case of the valuation of odour and taste the biscuits made with the flesh of Zéta gave the highest points. The sensory assessors found the biscuits made with the addition of seed flour of Zéta to have the best texture and colour. The results of sensory analysis can be seen on Fig. 6.

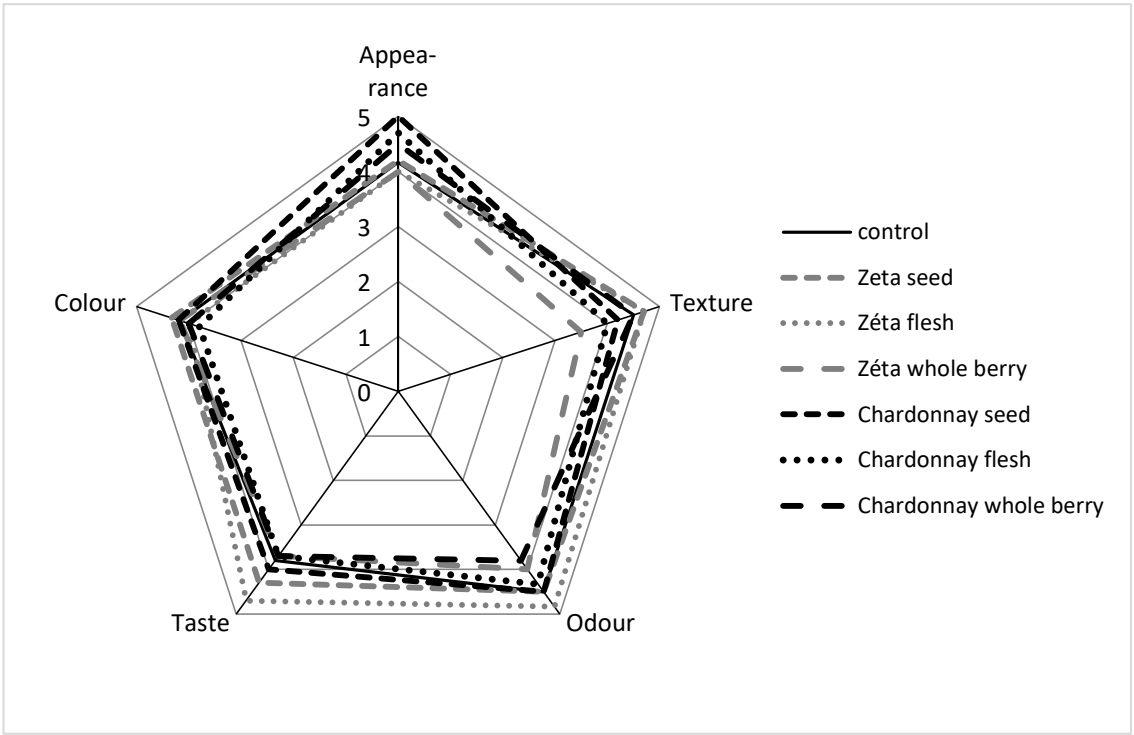

Figure 6. Scores of sensory analysis of biscuits made from BL55 flour and dried and milled grape berries and berry parts

The assessors were asked to make a preference order for the biscuits. The top rated one was the one made with addition of flesh parts of Zéta and the least favourite was the one made with whole berry of Chardonnay. The control biscuit was in the mid-range. The assessors also had to answer that if they would have opportunity to consume these biscuits in the everyday life which would be the most likely consumed one. Generally the assessors would choose more products. The best value was reached by the biscuits made with Chardonnay seeds and the one made with the flesh of Zéta. The control and the one made with Zéta seed flour got a slightly worse readings and the biscuits made with whole berry of Chardonnay was the one what would remain on the shelves of the shops – do not like to buy any of the assessors.

3. CONCLUSIONS

Nowadays it is important to use the by-products of agriculture and food processing as they have physiologically significant chemical components and it is a waste to leave them unused. The grape berries harvested during grape thinning are one of these important by-products but there is only a very low importance of their use. We found an alternative use for their utilization in the food industry. We have evaluated that how the concentrations of valuable chemical components were changing during maturing and we found that not the matured grapes have the highest physiological value but the berries originated from the grape thinning has much higher phenol and flavonoid contents and antioxidant activity, more or less independently from the variety. We found that this value remains when we use the dried and milled grapes in biscuit making in relatively low concentration and their presence results in high antioxidant power for the biscuit products despite the drying and baking process. On the other hand, their presence in biscuits also results in increase in the sensory value too and the consumers would kindly welcome these products if they were commercially available. It was found that the best consumer's scores were experienced in the case of the use of Zéta, while better chemical results were found in the case of use of Chardonnay flour. We can state that these kinds of by-products of viticulture are an untapped resource for the development of healthy foods.

REFERENCES

[1] A. Deloire, Grapevine berry morphology and composition: A review. Wineland Magazine, Yearbook. 104-119 p., 2010
[2] I. Eperjesi, Borászati technológia. Mezőgazda Kiadó, Budapest, 2010
[3] E. Obreque-Slier,A. Peña-Neira, P. López-Solís, A. Cáceres-Mella, H. Toledo-Araya, A. López-Rivera, Phenolic composition of skins from four Carmenet grape varieties (Vitis vinifera L.) during ripening. LWT-Food Schience and Technology, 54 (2), (2013), pp. 404-413.
[4] S. Czáka, L. Valló, A metszés ábécéje. Mezőgazda Kiadó, Budapest, 2000
[5] Gy. Lukácsy, Zs. Tóth, E. Stefanovitsné Bányai, G. Győrffy, G. Zanathy, A. Lőrincz, Gy. D. Bisztray, Verjus készítése a fürtritkítás során leszedett termésből a Tokaji borvidéken. Kertgazdaság Horticulture 42 (3-4), (2010), pp. 73-80.
[6] MSZ 6367-3:1983 Élelmezési, takarmányozási, ipari magvak és hántolt termények vizsgálata. Nedvességtartalom meghatározása
[7] MSZ EN 12147:1998 Gyümölcs-és zöldséglevek. A titrálható savasság meghatározása
[8] D. O. Kim, S. W. Jeong, C. Y. Lee, Antioxidant capacity of phenolic phytochemicals from various cultivars of plums. Food Chemistry, 81, (2003), pp. 321-326.
[9] A. Meda, C.E. Lamien, M. Romito, J. Millogo, O. G. Nacoulma, Determination of the total phenolic, flavonoid and proline contents in Burkina Fasan honey, as well as their radical scavenging activity. Food Chemistry, 91, (2005), pp. 571-577.
[10] A. Pasqualone, A. M. Bianco, V. Paradiso Michele, C. Summo, G. Gambacorta, F. Caponio, Physico-chemical, sensory and volatile profiles of biscuits enriched with grape marc extract. Food Research International, 65. C, (2014), pp. 385-393.