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CHEMICAL FRUIT CHARACTERISTICS OF FOUR PLUM (*PRUNUS DOMESTICA* L.) CULTIVARS

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Keywords: plum, reducing sugar, ascorbic acid.

ABSTRACT

Plums are among the most consumed fruits in Romania, being a good source of health promoting compounds. The purpose of this study was to determine the chemical fruit characteristics in four plum cultivars. Soluble solids content, reducing and total sugars, acidity and ascorbic acid content were determined. High phytochemicals content was reported for all investigated cultivars. The obtained results show that studied chemical indices vary depending on the analyzed cultivar. The highest soluble solid content (17.08%) and reducing sugars content (4.83%) have been observed in Tuleu gras cultivar. The obtained results recommend all analyzed plum cultivars as having high nutritional qualities.

INTRODUCTION

Plums are among the most consumed fruits in Romania, being a good source of bioactive compounds. Plums are a rich source of health promoting compounds that help prevent many diseases. Consumption of plums has been associated with a reduced risk of degenerative diseases (Walkowiak-Tomczak, 2008; Hooshmand and Arjimani, 2009). These beneficial effects are due to the fact that plums show antioxidant properties attributed to the content in carotenoids, vitamins A, C and E, anthocyanins and phenolic compounds (Nisar et al., 2015, Usenik et al.,2008).

Compounds with antioxidant properties can protect cells from oxidative stress caused by excess free radicals. Epidemiological studies have shown that plums can treat and prevent digestive diseases, cancer, diabetes, obesity (Hooshmand and Arjimani, 2009). Plums contain organic acids, carbohydrates, fibers, pectins, aromatic substances, tannins, enzymes, phenolic compounds, vitamins and minerals such as: potassium, phosphorus, calcium and magnesium (Nisar et al., 2015, Usenik et al.,2008). The content of sugars, organic acids, volatile substances and phenols is important in determining the organoleptic attributes such as flavor, taste, color and firmness. Fruits firmness is determined by the content in pectic substances while the color is given by the content in chlorophylls, flavonoids, anthocyanins and carotenoids.

Physico-chemical characteristics and organoleptic properties vary with cultivar, environmental conditions and agricultural practices (Ciobanu, 2015: Ciobanu, 2018, Paraschivu et al., 2020; Cichi and Cichi, 2019) In the context of guaranteeing access to a healthy food (Bonciu, 2017, Bonciu, 2019a) for a growing population, special attention is given to increasing crop productivity by cultivating drought and diseases resistant genotypes (Bonciu, 2019b, Bonea 2016, Bonea 2020, Paraschivu et al., 2020; Rosculete et al., 2019).

The objective of this study is to determine and compare the chemical composition of the fruits of four plum cultivars in order to evaluate their nutritional value.

MATERIAL AND METHOD

The biological material was represented by fruits of four cultivars of plum: Tuleu timpuriu, Centenar, Tuleu gras and Stanley, grown in private orchard in Olt county. Fruits were picked at harvest maturity.

Analytical methods: Total soluble solids Brix % of the plum fruits was determined using a digital refractometer (Kruss Optronic DR 301-95) at 20°C;

Reducing sugars (%) were extracted in distilled water (1:50 w/V), 60 minutes at 60˚C and assayed colorimetric with 3,5 dinitrosalicylic acid reagent using glucose as standard (Soare al., 2017a). At 1 mL extract, 2 mL of 3,5-dinitrosalicylic acid reagent (1 g 3,5-dinitrosalicylic acid dissolved in 20 mL of 2M NaOH, 50 mL of distilled water, and 30 g of Na-K- tartrate and the final volume was made up to 100 mL) was added. The mixture was incubated for 10 min at 100˚C, cooled and the absorbance was measured at 540 nm after color development. D-Glucose was used as standard and the results were expressed in %. Absorbance was recorded at 540 nm using a Thermo Scientific Evolution 600 UV-Vis spectrophotometer with VISION PRO software.

Total sugar content (%) Non-reducing sugars were converting by hydrochloric acid hydrolysis, 15 min at 100˚C to reducing sugars. After neutralization, total sugar content (%) was assayed colorimetric with 3,5 dinitrosalicylic acid reagent at 540nm (Babeanu et al., 2017).

The titratable acid content (acidity) was determined by titration with 0.1N sodium hydroxide (NaOH) using phenolphthalein as indicator and expressed as % malic acid.

Ascorbic acid was extracted in 2% hydrochloric acid, HCl; 5:50 w/v (Soare al., 2017b). The determination of ascorbic acid is performed from the supernatant with iodometric redox titration in which iodine reacts with ascorbic acid, oxidizing it to dehydroascorbic acid. The ascorbic acid content was expressed as mg/100 g fresh weight.

All determinations were performed in triplicate, and all results were calculated as mean.

RESULTS AND DISCUSSIONS

The obtained results show that studied chemical indices vary depending on the analyzed cultivar. **Total soluble solids content (TSS)** varies with the analyzed cultivar. The values determined in our study vary between 13.7% (Centenar) and 17.08% (Tuleu gras) in the order: Centenar <Stanley <Tuleu timpuriu < Tuleu Gras (figure 1). Our results are similar to data reported in the scientific literature. Nisar et al., 2015 reports values between 8.17% and 16.23%, Usenik et al.,2008 finds values between 13.4% and 15.6 and Ciobanu, 2015 values between 12.66% and 23.10%.

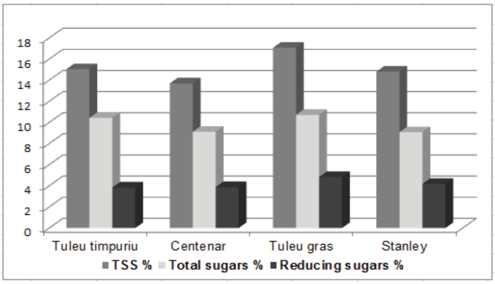

Figure 1. Soluble solid content, total sugars and reducing sugars content

The total sugars content varies between 9.08% (Stanley) and 10.72% (Tuleu gras). **Reducing sugars content:** The results obtained vary between 3.84% (Tuleu timpuriu) and 4.83% (Tuleu Gras) in the order < Tuleu Timpuriu< Centenar <Stanley <Tuleu Gras (figure 1). The values obtained are similar to the results obtained by Nisar et al., 2015 which shows that the content in reducing sugar varies between 25.27 mg / kg and 65.0 mg / kg. Nergiz and Yildiz, 1997, obtains an average value of 51.9 g kg-1; Among the

carbohydrates in plum fruits, glucose is the main component followed by sucrose, fructose and sorbitol (Usenik et al., 2008).

Values for **total acidity** vary between 0.57% and 0.88% in the order: Tuleu Timpuriu (0.57%) <Stanley (0.68%) < Tuleu Gras (0.76%) <Centenar (0.88%). (figure 2).

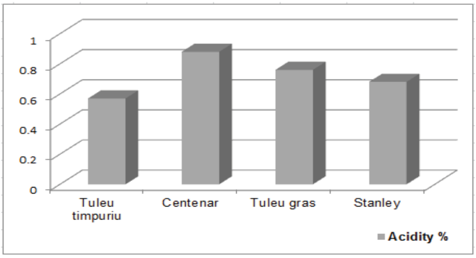

Figure 2. The titratable acid content

The acidity is determined by the content in organic acids. Through HPLC studies, Usenik et al., 2008 finds that malic acid is the predominant acid in plum fruits and also detects the presence of fumaric and shikimic acid, while in another study the presence of tartric acid and citric acid is determined (Ionica et al., 2013).

Ascorbic acid is one of the most important water-soluble vitamins, naturally present in fruits and vegetables.

Ascorbic acid content varies between 77.82 mg / Kg FW and 102.16 mg / Kg FW in the order of Tuleu Gras <Stanley <Centenar <Tuleu Timpuriu (Figure 3).

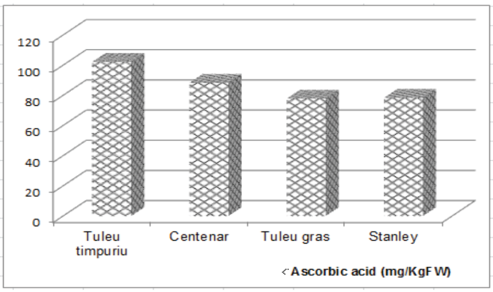

Figure 3. The ascorbic acid content

The results of this study are similar to data reported by other authors. In a review that summarizes characteristics of plums as a raw material with valuable nutritional and dietary properties, it is shown that plums are poor in vitamin C the values ranging between 3mg/100g and 10mg/100g (Walkowiak-Tomczak, 2008).

CONCLUSIONS

The obtained results show that studied chemical indices vary depending on the analyzed cultivar. High phytochemicals content was reported for all investigated cultivars. The highest soluble solid content (17.08%) and reducing sugars content (4.83%) have been observed in Tuleu gras cultivar.

The obtained results recommend all analyzed plum cultivars as having high nutritional qualities.

BIBLIOGRAPHY

Babeanu, C., Matei, G., Dodocioiu A.M., 2017 - *Evaluation of sugar content in stem juice from sweet sorghum hybrids grown in South West of Romania*, Annals of the University of Craiova - Agriculture, Montanology, Cadastre Series, Vol, 47(2), 25-29.

Bonea, D., 2016 - *The effect of climatic conditions on the yield and quality of maize in the central part of Oltenia*. Annals of the University of Craiova - Agriculture, Montanology, Cadastre Series,Vol. XLVI, 48-55

Bonea, D., 2020 - *Grain yield and drought tolerance indices of maize hybrids*. Notulae Scientia Biologicae, 12(2), 376-386.

Bonciu, E., 2017 - *Food processing, a necessity for the modern world in the context of food safety: a Review*. Annals of the University of Craiova - Agriculture, Montanology, Cadastre Series, Vol. 47(1), 391-398.

Bonciu, E., 2019a - *Some observations on the genotoxicity of the yellow food dye in Allium cepa meristematic cells*, Banat's Journal of Biotechnology, 10(20), 46-50. 6.

Bonciu, E., 2019b- *The climate change* *mitigation through agricultural biotechnologies*, Annals of the University of Craiova-Agriculture, Montanology, Cadastre Series, Vol. 49(1), 36-43.

Cichi, M., Cichi, D., 2019 - *Behaviour of some apple varieties grafted on vegetative rootstock in the orchards of southern Romania,* Annals of the University of Craiova - Agriculture, Montanology, Cadastre Series, Vol. 49 (1), 44-51.

Ciobanu, A., 2015 - *Fruit quality in function of the graft/rootstock biosystem with some plum tree varieties,* Annals of the University of Craiova-Agriculture, Montanology, Cadastre Series, Vol. XLV, 77-81.

Ciobanu, A., 2017 - *Researches on the influence of rootstocks on growth and fructification of plum varieties,* Annals of the University of Craiova -Agriculture, Montanology, Cadastre Series, Vol. 47, 95-101

Hooshmand, S., Arjimani, B.H., 2009 - *Viewpoint: dried plum, an emerging food that may effectively improve bone health*, Aging Res. Rev., 8,122–127.

Ionica M.E., Nour V., Trandafir I., Cosmulescu S., Botu M., 2013 - *Physical and Chemical Properties of Some European Plum Cultivars (Prunus domestica L.),* Not Bot Horti Agrobo, 41(2), 499-503

Nergiz C, Yildiz H., 1997 - *Research on chemical composition of some varieties of European plums (Prunus domestica) adapted to the Aegean district of Turkey.* J Agric Food Chem, Vol. 45, 2820–2823

Nisar H., Ahmed M., Anjum M.A., Hussain S., 2015 - *Genetic diversity in fruit nutritional composition, anthocyanins, phenolics and antioxidant capacity of plum (Prunus domestica) genotypes,* Acta Sci. Pol., Hortorum Cultus, Vol. 14(1), 45-61.

Paraschivu M., Ciobanu A., Cotuna O., Paraschivu M., 2020 - *Assessment of the bacterium Erwinia amylovora attack on several pear varieties (Pyrus communis L.) and the influence on fruits sugar content,* Scientific Papers, Series B. Horticulture , Vol. LXIV, 163-168

Roșculete, E., Roșculete, C.A., Petrescu, E., Păunescu, G., 2019- *Production performance of some wheat varieties in the pedoclimate conditions from SCDA Caracal,* Annals of the University of Craiova-Agriculture, Montanology, Cadastre Series, Vol. 49 (1), 190-194.

Soare, R., Dinu, M., Babeanu, C., Sirbu, C., 2017a - *The influence of foliar fertilization with humic acids on the production of white cabbage*, Annals of the University of Craiova-Agriculture, Montanology, Cadastre Series, Vol. 47(2), 246-252

Soare R., Dinu M., Babeanu C., Popescu M., Popescu A., 2017b *Nutritional value and antioxidant activies in fruit of some cultivars of pepper (Capsicum annuum L.),* Journal of Agroalimentary Processes and Technologies, 23(4), 217-222.

Usenik V., Kastelec D., Veberic R., Štampar F., 2008- *Quality changes during ripening of plums (Prunus domestica L.),* Food Chemistry Vol 111, 830–836

Walkowiak-Tomczak, D., 2008 - *Characteristics of plums as a raw material with valuable nutritive and dietary properties - a review,* Pol. J. Food Nutr. Sci. 2008, Vol. 58 (4), 401-405

RESEARCH ON THE VARIABILITY OF QUALITY AND PRODUCTIVITY TRAITS IN SOME VINE VARIETIES IN VÂNJU MARE WINE AREA - OREVIȚA

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Keywords: quantity, quality, vine, production

ABSTRACT

Vânju Mare-Oreviţa viticultural area has a special reputation in viticulture and vinification in our country. The climatic and soil conditions specific to this viticultural area present a high degree of favourability for the production of high quality wines, being from this point of view one of the most favourable areas in our country for this production direction.

The factors that contribute to the quality of grapes for vinification are related to both the characteristics and particularities of the cultivated varieties and the viticultural agrotechniques..

INTRODUCTION

Vizitiu et al., 2015, show that in Romania the vine culture occupies an important place and would not be possible without a high-quality propagating material. Organic agriculture can be considered a viable solution that solves the negative impact of agriculture on the environment and the quality of production, and the replacement of pesticides with organic substances and natural minerals is an alternative to traditional agriculture (Bucur, 2007).

As Ţârdea and Dejeu, 1995, point out, in modern viticulture the optimization of the viticultural ecosystem must aim at maximizing production, quality, profit and minimizing costs and labour force, but also the rational use of ecological and economic resources and habitat conservation against pollution. The average weight of the grapes is a very important character that constitutes both an element of productivity and an element of quality in the vine (Sestras, 2004) being one of the determining factors in achieving the production of grapes on the stump and implicitly the production of grapes in surface unit (Dumitriu, 2003). Based on the values recorded in terms of the average weight (g) of the grapes, we consider that the type of soil did not influence the average weight of the grapes in each cultivar in part from the point of view of this productivity element.

The quality of grapes for wine production is affected by the environment, genotype but also by agricultural management. The typicality of the wine, which depends on the grain content and is controlled by the factors mentioned above, can be negatively affected by global climate change. The new advances made in the molecular physiology of grain growth and maturation, have offered new perspectives for the development of predictive models that would be very valuable for a perennial plant, which can take several years to achieve optimal fruit quality (Dai ZW etc., 2010).

MATERIAL AND METHOD

The researches were carried out within the company S.C.Vie Vin Vânju Mare S.R.L., Oreviţa farm, in three wine years (2016, 2017, 2018), on four varieties: *Cabernet Sauvignon* cultivated on an area of 12 ha (fig.2), *Fetească neagră* which occupies an area of 7 ha (fig.1),*Tămâioasă românească* cultivated on an area of 7.3 ha (fig.4) and *Sauvignon blanc* on an area of 8 ha (fig.3).

Fig. 1. Fetească neagră (original)

Fig. 2. Cabernet Sauvignon (original)

The determination of the quantity of grapes was made by the quantitative reception carried out at the vinification complex by weighing each grape kettle coming from the plantation and registered in the company's documents.

Fig. 3. Sauvignon blanc (original)

Fig. 4. Tămâioasă românească (original)

Each year, the grapes were harvested separately, by variety, for a clear record of the data for each variety. The quality of the grapes was evaluated in the company's laboratory based on a qualitative analysis performed on the studied grape varieties.

This consisted in determining the sugar contents (g / l) and total acidity (g / l H_2SO_4), analysis performed in the analysis laboratory from the vinification complex. The sugar content was determined by the densiometric method, and the total acidity was determined by the titration method with an alkaline NaOH solution, 0.1 N.

RESULTS AND DISCUSSIONS

The quality of the grapes is decisively influenced by three elements: the qualitative potential of the variety, the potential of the viticultural area that includes the climatic conditions specific to the viticultural year, but also by the applied viticultural agrotechniques.

The data presented in Table 1 on grape production show great variability, primarily depending on the productive potential of the studied varieties.

Thus, for the varieties, *Tămâioasă românească* and *Sauvignon blanc*, the productions increased from year to year, being a constant increase, while for the varieties for red wines the increases were different from one wine year to another.

Table 1

Grape production (t / ha) during 2016-2018

Variety	Cultivated area (ha)	Production in t / ha		
		Year		
		2016	2017	2018
Tămâioasă românească	7,3	6,2 t/ha	7,3 t/ha	10,7 t/ha
Sauvignon blanc	8	3 t/ha	3,9 t/ha	4,2 t/ha
Cabernet Sauvignon	12	6 t/ha	4,8 t/ha	6,2 t/ha
Fetească neagră	7	3,7 t/ha	2,7 t/ha	7,2 t/ha

For the *Tămâioasă românească* variety, the production was between 6.2 t / ha in 2016 and 7.3 t / ha in 2017, and for 2018 the production was 10.7 t / ha.

The *Sauvignon blanc* variety registered a constant increase in production, from 3 t / ha for 2016 to 4.2 t / ha for 2018.

The *Cabernet Sauvignon* variety stood out with an increase in production in 2016 of 6 t / ha, and 2018 of 6.2 t / ha, compared to 2017 when production decreased, being 4.8 t / ha.

There was also a variety whose production had unwanted evolutions, this being *Fetească neagră* which registered in 2017 a production of 2.7 t / ha.

These contradictory developments of productions have only one explanation, related to the climatic accidents that occurred during the wine year. Thus, in 2017 the varieties were affected by hail, which led to a decrease in production.

The losses were also amplified by the fact that no grapes with a large number of affected grains were harvested.

Tables 2 and 3 present data on the quality of grape production based on sugar content and total acidity.

Table 2

Quality parameters for white wine varieties

Variety	2016		2017		2018	
	Sugar g/l	Acidity total g / l tartaric acid	Sugar g/l	Acidity total g / l tartaric acid	Sugar g/l	Acidity Total g/l tartaric acid
Cabernet Sauvignon	244	5,3	240	5,5	238	5,7
Fetească neagră	236	5,6	230	5,6	230	5,6

Table 3

Quality parameters for red wine varieties

Variety	2016		2017		2018	
	Sugar g/l	Total acidity g / l tartaric acid	Sugar g/l	Total acidity g / l tartaric acid	Sugar g/l	Total acidity g / l tartaric acid
Tămâioasă românească	222	6,1	233	6	232	6,1
Sauvignon blanc	233	5,9	230	5,8	226	6,2

As can be seen from the data presented in Table 2, the varieties for white wines showed a high capacity for sugar accumulation in the grains, all the more so as they were harvested each year before the varieties for red wines.

In 2016, the highest sugar content among white varieties was Sauvignon blanc (233 g / l) and in 2017 and 2018, the Tămâioasă românească variety had slightly higher sugar contents (233 g / l, respectively 232 g / l). For these varieties, the acidity ranged between 6 g / l tartaric acid and 6.1 g / l tartaric acid for the *Tămâioasă românească* variety and for the Sauvignon blanc variety between 5.9 g / l tartaric acid and 6.2 g / l tartaric acid.

Table 3 shows that the variety with the highest sugar content at harvest in each of the 3 years of study is *Cabernet Sauvignon*. The average sugar content in 2016 was 244 g / l, higher than in 2017 (240 g / l) and 2018 (238 g / l).

This was the highest sugar content of all varieties in all years but also the lowest total acidity, also of all varieties and in all years of the study (5.3 g / l tartaric acid), compared to the variety *Fetească neagră* at which the sugar content was 236 g / l in 2016, and for the years 2017 and 2018 respectively it remained constant with a value of 230 g / l. In this variety the total acidity was constant during the three years, having a heat of 5.6 g / l tartaric acid.

The results are normal, due to the fact that the Cabernet Sauvignon variety is the most important and valuable variety for red wines, these high sugar contents are explained only by the ability of the variety to accumulate carbohydrates during ripening but also by the fact that it is the last harvested variety. being intended for obtaining high quality wines.

CONCLUSIONS

- Vânju Mare-Oreviţa wine-growing area has favourable conditions for the cultivation of varieties intended for the production of high quality wines.
- The varieties cultivated in this area are of quality, so that the interaction of the viticultural variety area is a determining factor of the quality of the obtained wines.
- The *Tămâioasă românească* variety had the highest production of 10.7 t / ha for 2018, and the lowest production was recorded by the *Fetească neagră* variety of 2.7 t / ha for 2017.
- The *Cabernet Sauvignon* variety presented the highest value of sugar content of 244 g / l, and the lowest was registered for the *Tămâioasă românească* variety of 222 g / l.
- The results of the quantitative and qualitative analysis highlight in particular the *Cabernet Sauvignon* variety.

BIBLIOGRAPHY

Bucur Gh., 2007, *Tehnici de producţie în agricultura ecologică*, Lucrări ştiinţifice, vol.15 (3), Chişinău

Dai Z.W., Vivin P., Barrieu F., Ollat N., Delrot S., 2010. *Physiologicaland modelling approache stounder stand waterand carbon fluxes during grape berry growthand quality development: a review*. Australian Journal of Grape and Wine Research, vol. 16, nr. 1 Supl., pag. 70–85.

Diana Elena Vizitiu, Gina Nedelea, Carmen Bejan, Emilia Vişoiu, 2015, *Adaptarea unor genotipuri de viţă de vie la condiţiile de cultură din seră depozitar cu material iniţial de înmulţire viticol G0*, Hortus 14/2015

Dumitriu I.C., 2003. *Tehnologii moderne pentru o viticultură ecologică*. Editura Tipnaste, Piteşti, 4-12

Sestraş R. 2004, *Horticultural plant breeding(in Romanian)*. Ed. AcademicPres, Cluj Napoca

Ţârdea C., Dejeu L., 1995, *Viticultură*, Editura Didactică şi Pedagogică, R.A.- Bucureşti

MILLET FLOUR ADDITION IMPROVES THE QUALITY OF THE GLUTEN-FREE BREADS BASED ON RICE FLOURS

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ABSTRACT

The aim of the present study was to assess the possibility of obtaining high quality gluten-free bread using composite flours consisting of three different varieties of rice grain flours in admixture with millet flour. Fifteen composite flours were obtained and tested by mixing the flours of the long, round and medium rice grain with different amounts of millet flour (10-50%). Bread samples were obtained out of dough prepared through the one-stage method. The results of the specific volume of the bread samples indicated that the composite flours based on rice flours obtained by milling long and round grains allowed obtaining higher quality final products. The most promising results in terms of firmness of the bread crumb after 24 hours of storage were obtained in case of samples prepared with long or round grain rice flours supplemented with 20-30% millet flour.

INTRODUCTION

Rice flour is the main ingredient used for preparing gluten-free bakery products. Trying to compensate for the low content of biologically active compounds, different attempts have been made to obtained composite flours, by mixing it with different other whole grain flours. In this respect Fu et al. (2020) reported that the content of vitamin B2 can be up to ten times higher in millet flour compared to the rice flour, whereas the contents of calcium and iron are seven time higher. Moreover, millet has been reported to have high mounts of phenolic acids and flavonoids. Devi et al. (2014) mentioned the presence of ferulic acid, p-coumaric acid, syringic acid, caffeic acid, syringic acid, and some flavonoids such as quercitin and proanthocyanidins, in millet, which explain the much higher antioxidant activity of millet flour compared to the rice flour.

The aim of the presented study was to compare the bread making behaviour of three different types of rice flours obtained by milling the long, round and medium rice grains (*indica*, *japonica* and i*talica*, respectively) in admixture with wholegrain millet flour. Composite flours were obtained by mixing the different rice flour with various amounts of millet flour (10-50%). The composite flours were further used for preparing breads by means of the one-stage method. The quality of the final products was assessed base on the specific volume and crumb texture.

MATERIALS AND METHODS

Three commercial rice samples (Riceland Magyarorszag Kft distributed by Herba Rice Mills Rom SRL) – *indica* (long grain), *japonica* (round grain) and *italica* (medium grain) were purchased from the local market (Galati, Romania). The rice samples were processed through grinding using a laboratory disc mill (type WZ-2, Sadkiewicz Instruments, Poland), such as to obtain long grain (RFL), round grain (RFR) and medium grain (RFM) flours with particle size lower than 400 µm.

The foxtail millet flour (MF) distributed by La Finestra sul Cielo

(Villareggia, Italy) was purchased from the local market (Galati, Romania).

The baking test was performed as described by Banu et al. (2010). In short, a laboratory mixer was used to prepare the dough using the one-stage method. After proofing at 30°C, the dough pieces were placed in baking trays and were baked at 230°C for 30 min. The samples were further cooled down to room temperature and the specific volume (cm^3/ 100 g of bread) was measured using the SR 91/2007 methods (ASRO, 2008). In agreement with the method described by Banu et al. (2017), the firmness of the crumb was determined as the maximum compression force needed to penetrate for 25-mm-wide the bread slices using the ML-FTA system (Guss, Strand, South Africa) with FTA Win control program.

RESULTS AND DISCUSSION

The best baking behaviour in terms of specific volume was observed for samples prepared with round rice flour (RFR), followed by medium grain flour (RFM) and then by the long grain rice flour (RFL). Specific volume is one of the most important parameters used for assessing quality of bread (Turkut et al., 2016).

The result presented in Figure 1a indicated that, in case of the RFL based samples, the highest specific volume was obtained in case of the bread prepared with 30% millet flour. Further increase of the millet flour addition result in the slight decrease of the specific volume, suggesting that the best composite flour based on RFL includes 30% MF.

In case of the bread samples prepared with RFR (Figure 2a) and RFM (Figure 3a), it was noticed that the increase of the millet flour percentage from 10 to 50% resulted in significant increase of the specific volume. In particular, the specific volume of the RFL based samples increased from 208 cm^3/ 100 g of bread, corresponding to the control samples (prepared without millet flour addition) to 237 cm^3/ 100 g of bread, corresponding to the sample including 50% millet flour. Similarly, in case of the samples including RFM, the specific volume increased from 189 cm^3/ 100 g of bread (control samples) to 218 cm^3/ 100 g of bread (samples with 50% millet flour). The improvement of the specific volume of the bread samples with the increase of millet flour might be explained by the high amount of the water soluble pentosanes found in millet flour (Nemeth et al., 2019). Anyway, these results are lower compared to those found by Bender et al. (2019), who reported specific volume of 2.60 cm^3/g for the gluten-free breads based on buckwheat flour baked using a conventional oven, and even higher values, ranging from 2.86 to 3.44 cm^3/g for bread samples prepared though uniform rapid baking using ohmic heating. Our results in terms of specific volume fall within the range of 1.2 -3.1 ml/g reported by Wu et al. (2019) for the rice flour gluten-free breads. They showed that the specific volume of the rice flour breads and the firmness of the hardness were affected by the increase of the starch damage content. Our observations comply with Foste et al. (2014) who obtained a significant improvement of the volume of the bread by replacing rice and corn flour by 40% whole grain quinoa flour.

The analysis of the crumb firmness indicated that, regardless of millet flour addition bread samples based on RFL (Figure 1b) had higher crumb firmness compared to the corresponding bread samples based RFR (Figure 2b) or RFM (Figure 3b). The composite flours based on RFL having the best baking properties are those including 20% MF. In a similar manner the addition of 20-30% MF to RFR or RFM resulted in improving the bread crumb firmness compared to the corresponding control samples (Figures 2b and 3b). Even if further increase of the MF addition within mixtures up to 50% resulted in the increase of the bread samples testure, it should be anyway noted that, firmness of the breads prepared with 50% RFR or RFM and 50%