DE GRUYTER
OPEN

Effects of white grape preparation on sensory quality of cookies

Veronika Kuchtová, Jolana Karovičová, Zlatica Kohajdová, Lucia Minarovičová, Veronika Kimličková

Department of Food Technology, Institute of Food Science and Nutrition, Faculty of Chemical and Food Technology, Slovak University of Technology, Radlinského 9, Bratislava, Slovakia
veronika.kuchtova@stuba.sk

Abstract: Grape skin pomace is rich in proteins, ash, lipids, carbohydrates, vitamins, and compounds with important biological properties such as phenolic compounds. Because of its complex composition, grape skin pomace can be used for nutritional enrichment of various cereals products. The aim of study was to investigate the effects of grape skin pomace on the sensory properties of cookies. Results indicated that grape skin pomace can be incorporated in cookies as a partial replacement up to 15 % of composite flour without negatively affecting the sensory quality of cookies.

Key words: grape skin pomace, sensory properties, cookies, overall acceptability

Introduction

The grape pomace occurred due to the production of wine or grape juice (Acun and Gul, 2013; Abdrabba and Hussein et al., 2015). Pomace represents approximately 20—50 % of the weight of grapes processed. It is a waste by-product that is difficult to dispose of and causes environmental pollution. The grape pomace is commonly used as feed and fertiliser (Acun and Gul, 2013; Abdrabba and Hussein, 2015). The residues of grape are composed of water, proteins, lipids, carbohydrates, vitamins, minerals, and compounds with important biological properties such as phenolic compounds (tannins, phenolic acids, anthocyanins, and resveratrol), depending on the type of waste, the cultivar, climatic and cultivation conditions (Sousa et al., 2014; Karovičová, et al., 2015). Grape pomace may have applications as food additives with nutritional benefits. Currently, there is more focus on the utilization of the skin and seeds of grape as nutraceuticals (Abdrabba and Hussein et al., 2015).

The grape belongs to the berry family as it is found attached to the stem (Zhu et al., 2014). Nowadays, the second most planted variety in Slovakia is Devín. It is a genuine Slovakian wine hybrid, bred by crossing Tramín červený (Roter Traminer) and Veltlínské červeno-biele (Rot-weisser Veltliner). Devín grapes were introduced into the Slovakian list of approved cultivars in 1997 (Peťka et al., 2006).

Cookies belong to the group of food products that are very popular in daily diet of almost all profiles of consumers and are widely accepted and consumed nearly in all parts of the world due to its ready to eat nature, good nutritional quality, affordable cost and availability in different taste and longer shelf life (Turksoy and Ozkaya, 2011; Popov-Raljić et al., 2013). Cookies are snacks, which can be easily enriched with grape fibre preparations, that is rich in bioactive compound (Karnopp et al. 2015). However, fortification with grape pomace may impact the sensory characteristics of products, such as flavour, colour, and texture as well as water and fat absorption.

From this reason, the aim of this study was to evaluate the influence of white grape preparation variety Devín on the sensory properties and overall acceptability of enriched cookies.

Materials and methods

Materials

The fine wheat flour type T650 and other ingredients applied for cookies were purchased from Slovak local market. Grape (*Vitis vinifera L.*) of white variety Devín was provided from the Slovak wine region, south-western Slovakia.

Methods

Grape fibre preparation. The grapes used were harvested at optimum technological maturity. Grape berries was washed with potable water and placed on a sieve to drain out surface water. Then, grapes were used for the juice extraction by juicer. Grape skin (GSP) was manually separated from the grape pomace. Afterward, the grape skin was dried at ambient temperature for six days (until moisture level decreases to 7.14 %). The dried GSP was then milled to the particle size of 400—750 μm, and stored in plastic bags until used.

Acta Chimica Slovaca, Vol. 9, No. 2, 2016, pp. 84—88, DOI: 10.1515/acs-2016-0014

Cookies Preparation. Cookies were prepared according to the modified method of Kohajdová et al. (2014). Cookies containing 0, 5, 10 or 15 % GSP as replacement of fine wheat flour were prepared according to the following basic formula: fine wheat flour (150 g), sugar (42.4 g), shortening (39,75 g), sodium chloride (1.33 g), sodium bicarbonate (1.65 g), and water (18 mL). After mixing, the dough was cut with circular form to a uniform diameter of 40 mm, and a thickness of 2 mm. Cookies were baked at 180 °C in a conventional electric oven for 8 min, cooled, packaged in polyethylene bags, and stored at room temperature.

Sensory evaluation of cookies

For sensory evaluation, 9 assessors (students) were selected from the Faculty of Chemical and Food Technology, Slovak University of Technology, Bratislava Slovakia, using 5-point hedonic scale 5 and 1 represent extremely like and extremely dislike values. The sensory evaluation was performed under day-light room conditions. The assessor's panel evaluated: appearance, texture, mouth sensation, aroma, colour, hardness and taste in prepared cookies. Overall acceptability of the prepared biscuits was evaluated by 100 mm unstructured graphic line segments, which are indicated on the extreme points (minimum and maximum intensity from 0 to 100 %) (Kohajdová et al., 2014).

Statistical analysis

All data were analysed at least in triplicate. Results are presented as the mean value with the standard deviation. The statistical data were performed by one-way analysis of variance (ANOVA) using Microsoft Excel Data Analysis. Differences at $p \leq 0.05$ were considered significant.

Results and discussion

The sensorial quality of food products plays an important role in the choice of food. Hedonic testing is often used to determine consumer's attitude towards the food by measuring a degree of acceptance of a new product or improving the existing food product (Muresan et al., 2012).

The results of the sensory evaluation of cookies incorporated with GSP at different levels are presented in Table 1. In general, it was concluded that, the addition of grape skin pomace caused changes in the textural properties in the structure of cookies.

Texture: Texture and mouthfeel are fundamental sensory properties of foods (Guinard and Muzzuchelli, 1996). Texture is fundamental acceptability factor of foods, recently takes place in purchasing and decision-making mechanisms of consumers (Aksoylu et al., 2015). The scores for texture of cookies samples, increased with the increase in GSP addition compared to control sample. The cookies with 15 % GSP addition had a highest score. The judges reported that cookies with 15 % addition grape skin pomace had uniform porosity and structure and no crumbing.

Hardness: Moreover, it was found that cookies with 15 % level of GSP became significantly harder compared to control sample. It was stated previously that factors influenced the hardness in cookies are: high water holding capacity fibre preparation, which increased the water content of the dough, constituted the extensive gluten structure and stiffened the cookies; consequently, the breaking strength of the cookies increased (Turksoy and Ozkaya, 2011). The same was also observed by several authors after incorporation apple fibre, mango fibre, citrus dietary fibre, carrot and pumpkin fibre (Kohajdová et al., 2014; Ajila et al., 2008; Kohajdová et al., 2011; Turksoy and Ozkaya, 2011).

Colour: Colour is very important parameter in judging the properly baked cookies that not only reflects the suitable raw material used for the preparation but also provides information about the formulation and quality of the product (Hussain et al., 2006). Cookies with 15 % GSP were characterised by high scores for colour due to their brown colour. The

Tab. 1. Sensory parameters of cookies incorporated with grape skin pomace.

Preparation addition [%]	Appearance	Texture	Mouth sensation	Taste	Aroma	Hardness	Colour
0 (control)	4,06 ± 0,17	4,93 ± 0,14	4,92 ± 0,17	4,89 ± 0,22	4,79 ± 0,23	4,09 ± 0,18	4,06 ± 0,17
GSP preparation							
5	3,97 ± 0,07	3,92 ± 0,17*	3,04 ± 0,10*	3,67 ± 0,10*	3,03 ± 0,10*	4,04 ± 0,10	4,07 ± 0,17
10	4,06 ± 0,17	4,70 ± 0,13*	4,09 ± 0,18*	4,09 ± 0,20*	3,97 ± 0,07*	4,88 ± 0,18*	4,09 ± 0,20
15	4,97 ± 0,10*	4,96 ± 0,23	4,97 ± 0,05	4,84 ± 0,24	5,00 ± 0,00*	4,91 ± 0,23*	4,99 ± 0,03*

*Indicate a statistically significant differences ($p \leq 0.05$). GSP — grape skin pomace.

Tab. 2. Effect incorporated of grape fibre on the overall acceptability of final products.

Grape type/ product/ Grape fraction	Variety/ country	Addition levels/%	Effect on overall aceptability of products	References
buiscuits, cookies				
WG/skin/	*Devín*	5/10/15	From the overall acceptability rating, it was concluded that GSP could be incorporated up to 15 % level in the formulation of cookies without affecting their sensory quality.	This study
WG/pomace	Poland	10/20/30	The increasing addition of WG in biscuits decreased their overall acceptabillity. Higher addition were not acceptable for their intensities of fruity-acidic taste and for the biscuit's brown colour.	Mildner-Szkudlarz, et al. (2012)
RG/pomace	*Cabernet Sauvignon*	5/10/15/20	The 5 % addition of RG into cookies obtained that the maximum score in all sensory parameters except colour. In terms of overall acceptability achieve higher rating than the control sample When the grape pomace exceeded more than 10 % levels, overall acceptability of cookies was decreased	Maner et al. (2014)
RG/pomace/ seeds flour/	*Uluğbey*	5/7.5/10/15	In the evaluation of taste the cookies with incorporated 5 % seeds flour were desirable more than the control sample and cookies with 7.5 % seeds flour. All samples were evaluated as control samples.	Acun and Gul (2013)
Commercial product/ defated grape seeds powder	Turkey	5	The buiscuits with defated grape seeds powder had lower flavour scores than any of the other samples in the study. The reason for the less flavour scores was for the grainy and rough structure of grape seed powder.	Aksoylu et al. (2015)
Bread				
RG/pomace	*Cabernet (Franc and Sauvignons) Muscadine (Noble)*	5/10	The results of sensory evaluation showed, that aroma and texture of the breads containing 5 % and 10 % Cabernet Sauvignon pomace were the most preferred by consumers, and the acceptability of the fortified bread was similar to that of control sample (white bread). Comparing the cultivars Cabernet Sauvignon and Muscadine Noble, cultivar Muscadine Noble was less acceptable, for panelists.	Ivy N Smith and JianmeiYu (2015)
RG/pomace	*PinotNoir*	5/10/	Both the 5 % and 10 % breads with RG were well received by panelists based on the sensory properties and overall acceptability.	Walker et al. (2014)
RG/seeds	*Merlot*	2.5/5/7.5/10	The supplement – grape seed flour with RG and seeds in bread It may replace the flour up to 5 % (w/w) for the product, which has to remain acceptable to consumers. The higher amounts of grape seed flour caused a lower overall acceptance.	Hoye and Ross (2011)
RG/skin	Poland	4/6/8/10	This study found that the sensory properties such as aroma, taste and overall acceptance decreased as the level of GP in bread increased. However, no significant differences were observed up to 6 % of GP. Higher differences were observed for breads aroma.The dominating descriptors for aroma at higher addition of GP, were alcoholic and sharp notes. Typical aroma of freshly baked breads also decreased with increasing GP levels.	Mildner-Szkudlarz, et al. (2011)
WG/pomace	*Muscadine (Scuppernong)*	5/10	The bread containing 10 % Muscadine Noble/ Scuppernong pomace had unpleasant texture and flavour, which significantly reduced its overall acceptability. The maximal addition of this type of grape was up to 5 %.	Ivy N Smith and JianmeiYu (2015)
Grape pomace from juice product/seeds	Iran	5/10/15/20	The sensory parameters such as for taste, aroma and texture decreased upon increasing the level of GSP in the formulation of bread. Breads containing 5 % GSP did not differ significantly as compared to the control sample. The overall acceptability decreased especially at levels of 15 % and 20 % GSP. The overall bread acceptability decreased after prolonged storage of the product.	Peighambardoust and Aghamirzaei (2014)
By-product to produce grape oil/ defated grape seedsflour	Czech Republic	2/4/6/7/8/10	The results of sensory analysis of bread showed that sourness, salinity, sensation when swallowing, impalpability, gumminess, sogginess was not significantly affected with increasing amounts of grape seed flour. On the other hand, higher additions of grape seed flour were unacceptable for a part of assessors.	Pečivová et al. (2014)
brownies, muffins				
RG/pomace	*PinotNoir*	10/15/20/25	Grape fibre mostly affected the texture of brownies, probably due to the pomace particle size. The RG at 15 % (w/w) replacement for flour in brownies was acceptable for consumers.	Walker et al. (2014)
RG/pomace	*PinotNoir*	5/10/	Muffins supplemented with RG were different in two sensory attributes: colour and aroma. 5 % RG had higher rating of colour as compared with the control sample. Five and 10 % addition of RG in muffins were acceptable for panelists.	Walker et al. (2014)

brownish colour of cookies could be directly related to the increase in fibre content (Ndife et al., 2011). On other hand brown colour of cookies could also occur due to caramelization and Maillard reactions, when an amino acid and reducing sugar are heated. This possibility is closely connected with the baking process (Mildner-Szkudlarz et al., 2012; Ndife et al., 2011; Walker et al. 2014). The Maillard reaction in the cookies occurred, because of the higher sugar content of GSP (Walker et al., 2014). The darker colour of baked goods is expected to have the largest impact on the consumer. Consumers usually see darker bread and muffins, cookies as being healthier and containing more fibre or whole grains (Walker et al., 2014).

Taste: It was recorded that addition of GSP significantly influenced taste of cookies. From sensory evaluation it can be also concluded that cookies supplemented with grape GSP were characterized by higher intensity of sweet taste. Sugars represent fundamental components of edible quality fruits, predominantly conferring sweetness, one of the main attributes influencing consumers (Cirilli, et al. 2016). Similar increasing in sweet taste was observed by Mildner-Szkudlarz (2011) in biscuits with incorporated grape pomace. Moreover, it was reported that the addition of GSP avoids the use of any other flavouring ingredients because GSP has a pleasant fruity flavour (Sudha et al., 2007; Dhingra et al., 2011; Kohajdová et al. 2011).

Aroma: Wine aroma and taste is derived from hundreds of volatile chemical compounds arising from the grape berry (King et al., 2010).From this study also resulted that the increasing addition of grape skin pomace of cookies increased pleasant fruity aroma. A similar effect was observed by authors Walker et al. (2014) and Mildner-Szkudlarz (2011) using grape preparations in biscuits and muffins incorporated with grape preparations. Walker et al. (2014) described that the unique wine aroma carried over from the grape skin pomace can be used for cereals products (Walker et al., 2014).

Overall acceptability is governed by all dominant sensory quality attributes (Ganorkar and Jain 2014). Data including effect of grape skin pomace addition overall acceptance of cookies described with various studies are summarized in Tab. 2. The overall acceptances of cookies incorporated with GSP of our research are showed in Figure 1. The cookies with addition level 15 % of GSP had the highest overall acceptability from enriched cookies.

Conlusion

This study describes not only the utilization of waste products in the wine industry, but also allows the introduction of natural functional ingredients in foods, widely consumed cereal products. WGP use has the potential to go further than the products used in this study. Further studies are needed for the application of GSP in other cereal products such as bread, cakes and muffins. It can be stated that the addition of GSP to cookies had benign influence on the sensory parameters of prepared products.

Acknowledgments
This work was supported by grant VEGA No. 1/0487/16.

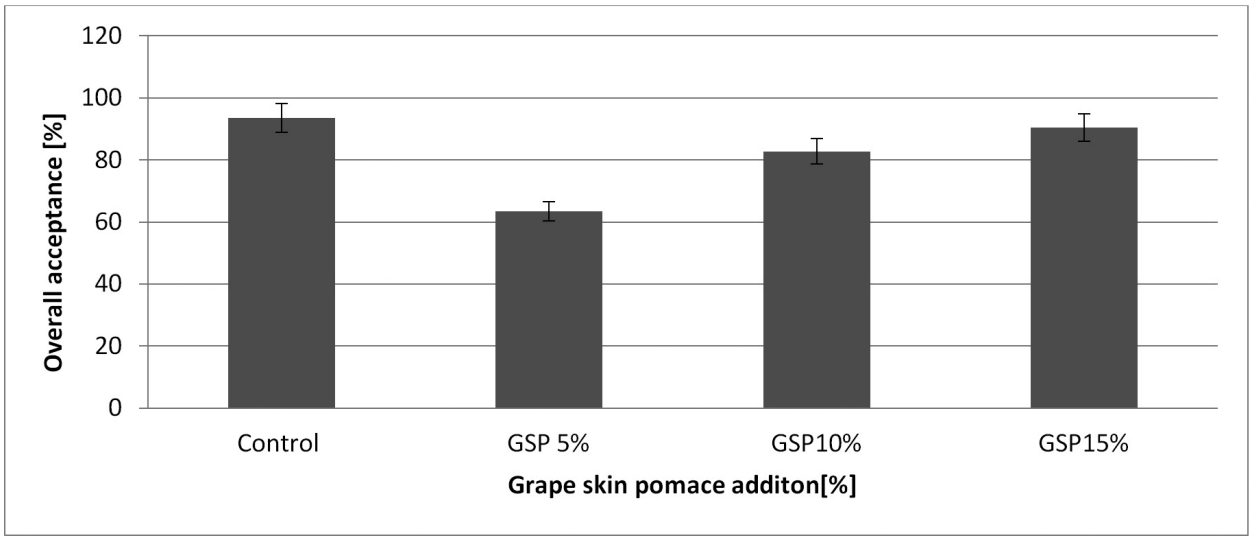

Fig. 1. Overall acceptance of cookies incorporated with GSP, GSP- grape skin pomace.

References

Abdrabba S, Hussein S (2015) GJSR Journal (3): 6—11.

Acun S, Gül H (2013) Qual Assur Saf Crop, 6: 81—88.

Ajila CM, Leelavathi K, Rao UP (2008) J. Cereal Sci. 48(2): 319—326.

Aksoylu Z, Çağindi Ö, Köse E (2015) J. Food Qual. 38(3): 164—174.

Cirilli M, Bassi D, Ciacciulli A (2016) Hortic. Res. (3): 15067.

Dhingra D, Michael M, Rajput H, Patil RT (2011) J. Food Sci. Technol. 49 (3): 255—266.

Ganorkar PM, Jain RK (2014) Int. Food Res. J. 21(4): 1515—1521.

Guinard JX, Mazzucchelli R (1996) Trends Food Sci. Technol. 7(7): 213—219.

Hoye C, Ross C (2011) J. Food of Sci. 76: 428—436.

Hussain S, Anjum FM, Butt MS, Khan MI, Asghar A (2006) Turk. J. Biol. 30(2): 87—92.

Karnopp AR, Figueroa AM, Los PR, Teles JC, Simões DRS, Barana AC, Granato D (2015) Food Sci. Technol. 35(4): 750—756.

Karovičová J, Kohajdová Z, Minarovičová L, Kuchtová V (2015) Sci. J. Food Indus. 9: 53—57.

King ES, Kievit RL, Curtin C, Swiegers JH, Pretorius IS, Bastian SE, Francis IL (2010) Food Chem. 122(3): 618—626.

Kohajdová Z, Karovičová J, Jurasová M, Kukurová K (2011) Acta Chim. Slovaca 4(2): 88—97.

Kohajdová Z, Karovičová J, Magala M, Kuchtová V (2014) Chem. Pap. 68(8): 1059—1065.

Maner S, Sharma AK, Banerjee K (2015) Natl. Acad. Sci., India, Sect. B Biol. Sci. 1—5.

Mildner-Szkudlarz S, Zawirska-Wojtasiak R, Szwengiel A, Pacyński M (2011) Int. J. Food Sci. Technol. 46(7): 1485—1493.

Mildner-Szkudlarz S, Bajerska J, Zawirska-Wojtasiak R (2012) J. Sci. Food Agric. 93(2): 389—395.

Muresan C, Stan L, Man S, Scrob S, Muste, S (2012) J. Agroaliment. Processes Technol. 18(4): 304—306.

Ndife J, Abdulraheem LO, Zakari UM (2011) Afr. J. Food Sci. 5(8): 466—472.

Pečivová PB, Kráčmar S, Kubáň V, Mlček J, Jurikova T, Sochor J (2014) Mitt. Klosterneuburg 64: 114—119.

Peighambardoust SH, Aghamirzaei M (2014) J. Food Process. Technol. 5: pp. 1—5.

Peťka J, Ferreira V, González-Viñas MA, Cacho J (2006) J. Agric. Food Chem. 54(3): 909—915.

Popov-Raljič J, Mastilovič J, Petronijevič J, Kevrešan Ž, Demin M (2013) Hemijska industrija 67(1): 123—134.

Smith IN, Yu J (2015) EC Nutrit. 2: 291—301.

Sousa EC, Uchôa-Thomaz AMA, Carioca JOB, Morais SMD, Lima AD, Martins (2014) Food Sci. Technol. (Campinas) 34 (1):135—142.

Sudha ML, Baskaran V, Leelavathi K (2007) Food Chem. (104): 686—692.

Turksoy S, Özkaya B (2011) Food Sci. Technol. Res. 17(6): 545—553.

Zhu FM, Du B, Li, J (2014) Food Sci. Technol. Int. 20(1): 55—62.

Walker R, Tseng A, Cavender G, Ross A, Zhao Y (2014) J. Food Sci. 79(9): 1811—1822.