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INFLUENCE OF GRAPESEED OIL MICROEMULSION ADDITIONS ON TEXTURAL AND SENSORY PROPERTIES OF A WHEAT-RYE BREAD AND A WHEAT FRENCH LOAF

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Abstract

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Additions of o/w microemulsions made from *Vitis vinifera* virgin grape seed oil on textural and sensory properties of wheat-rye bread and wheat French loaf were evaluated. Texture analysis of the final products showed no differences in firmness. The samples of wheat French loaf with additions of the microemulsion had lower dryness in comparison to control wheat French loaf. The samples of wheat French loaf with higher additions of the microemulsion (30-40 g/kg) had better quality than the control sample of the wheat French loaf. Selected assessors evaluated the samples of French loaf with additions of the microemulsion as better quality and less dry.

Key words: bread, microemulsion, sensory analysis, texture

Introduction

Grape seeds (GSE) have become more and more into the focus of interest in the last decades because of their considerable amounts of unsaturated fatty acids, phenolic compounds, high vitamin E content and low values of cholesterol. Therefore, it is recognized that its intake may be beneficial to prevent heart and circulatory problems (Oomah et al., 1998; Pardo et al., 2009).

Thermal processing decreased the antioxidant activity of GSE additive in bread. However, using GSE as an additive could greatly enhance the total antioxidant capacity of bread. Peng et al. (2010) said that with appropriate levels of addition, GSE could lead to a favourable change in the colour of bread without causing significant changes in other sensory properties. High-quality grape seed oil is characterized by light flavor with fruity touches, high smoke point (216°C), high digestibility, and a slight increase in viscosity when used for batch frying (Kinsela et al., 1974).

The textural properties of a food have been described as ‘‘that group of physical characteristics that are sensed by the feeling of touch, are related to the deformation, disintegration, and flow of the food under the application of a force and are measured objectively by functions of force, time and distance’’ (Bourne, 1982). Another way to view texture is that texture is a sensory characteristic, thus it is only the human being which can perceive, describe and quantify it. Texture is generally regarded as a multi-parameter attribute (Szczesniak, 1987). Bakery products have a very short shelf-life and their quality is dependant on the period of time between baking and consumption. During storage, a decrease in bread freshness parallel to an increase in crumb hardness produces a loss of consumer acceptance known as staling (Hebeda et al., 1990). Staling has been defined as ‘a term which indicates decreasing consumer acceptance of bakery products caused by changes in crumb other than those resulting from the action of spoilage organisms’. Characteristics of bread crumb that have been used to determine the staling rate are changes in the taste, aroma, hardness, opacity, crumbliness, starch crystallinity, absorptive capacity, susceptibility to alpha amylase and soluble starch content, however no one method will completely measure or describe the degree of staling noticed by the consumer

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(Sidhu et al., 1996). Changes during staling occur in both the crumb and the crust of the bread (D'Appolonia and Morad, 1981). Changes, which occur in the texture of the crumb, are: the crumb becomes harder, tougher, as well as more crumbly and opaque. Although a complex series of events occur during staling including changes in the crystallinity of the starch during storage, bread staling is mainly associated with the firming of the crumb (Pateras, 1998). Crust staling is generally caused by moisture migration from the crumb to the crust (Lin and Lineback, 1990) resulting in a soft, leathery texture and is generally less objectionable than crumb staling.

Many papers provide information about effects of grapeseed and grapeseed oil, especially health effects. Thus, they are very valuable (raw material) additives that should be added to food products. It is known that bread generally belongs to the most frequently consumed food. Information about influence grapeseed and mainly about the grapeseed oil emulsion on final food products, especially in pliancy, taste and smell, colour of crust and crumb, crumb texture of crumb bakery products are very limited. Thus, the aim of this work was focussed on monitoring the influence of grapeseed microemulsion on textural and sensory properties of dough and wheat-rye bread and wheat French loaf.

Materials

Flour

A commercial wheat flour, ground T512 (moisture content (MC) = 14.8%, gluten content in dry matter (GC) = 35.1%, Falling number (FN) = 305 s, ash = 0.47; P= 84 mm H_2O, L= 106 mm, P/L= 0.79, G= 22.9, W= 299 10E-4 J, Ie= 59.8%), provided by Mills Kojetín s.r.o., Kojetín, Czech Republic, wheat flour bread T1050 (moisture content (MC) = 14.1%, gluten content in dry matter (GC) = 39%, Falling number (FN) = 297 s, ash = 1.20; P= 84 mm H_2O, L= 79 mm, P/L= 1.06, G= 19.8, W= 187 10E-4 J, Ie= 40.7%) and dark rye flour bread T930 (moisture content (MC) = 13.7%, Falling number (FN) = 195 s, ash = 1.0), provided by Penam a.s. Brno, Czech Republic were used. Alveograph (Chopin – Tripette & Renauld, France) was used for determination of basic characteristics of the wheat flour according to ISO 5530-4 (2002). Moisture and ash were determined by NIR spectroscopy (Inframatik 8620, Perten Instruments, Sweden). Falling number of wheat flour was measured by Falling Number 1700 (Perten Instruments, Sweden). All the analyses were realized in MALITAS Company, Slatinice, Czech Republic).

Ingredients

Edible rock salt, potassium iodate (Salt Mills, a.s., Sladkovského 234/47, Olomouc - Holice, Czech Republic); yeast - *Sacharomycec cerevisiae Hansen* (dry matter 26%; Lesaffre Česko, a.s., Olomouc, Czech Republic); sugar (Hanácká Food Company s.r.o., Prosenice, Czech Republic); yeast - NATURAL 1200 (ingredients: rye flour, water, yeast basis, lactic acid, acetic acid; IREKS ENZYMA s.r.o., Brno, Czech Republic); cumin (Vitana, a.s., Byљice, Czech Republic) were the ingredients used in this study.

Microemulsion from grapeseed

Dry clean grape seed from red grapes (Zweigelt-ZG), white grapes (Weissen Cuvee-WC) and mixed grapes (VP) was separated from a residual biomas (pomace) after wine processing by a wet sieving process. The samples of virgin grapeseed oils were cold-pressed from the grape seed samples.

Sterile soybean lecithin (90.3 g as emulsifier) and vitamin E (0.7 g a mixture of tocopherols and tocotrienols, as antioxidant) were added to a 700 g of virgin grapeseed oil warmed up to 35°C. 3500 ml of distilled water was added to the mixture to form a stable (o/w) microemulsion. The mixture was mixed, homogenized and emulsified at 6000 rpm for 10 min in loop mixer. Then the premix (gross primary microemulsion) was processed in the high-pressure homogenizer (Hyd-Lok, Les Essarts-le-Roi, France) for continuous cooling ($t \leq 51$°C) at a pressure of 540 bar. The antimicrobial agent (1.5 g of potassium sorbate) was added to the final microemulsion. By the above preparation procedure, a homogeneous grapeseed oil (o/w) microemulsion (oil in water, size of lipid particles 250-350 nm, Biomedica s.r.o. Prague) was obtained. It can be also claimed that these microemulsions will be sufficiently stable (at least 12 months) and well suitable as carriers of other lipophilic (in the lipid phase) or hydrophilic (in the aqueous phase) biologically active substances (only assumption). Table 1 shows contents of essential fatty acid in samples of cold-pressed grapeseed oils.

Methods

Baking of wheat-rye bread

Five samples of wheat-rye bread (four samples containing 10 g/kg, 20 g/kg, 30 g/kg and 40 g/kg of microemulsion and a control sample - 0 g/kg of microemulsion) were baked (in the school bakery in the Secondary Vocational School and Apprentice Training Centre Kroměřiž, Czech Republic) each day. Composition of wheat-rye bread was 1.500 g/kg of the wheat flour bread (T 1050), 1.000 g/kg of the rye flour bread (T 930), 30 g/kg of the yeast natural 1200, 50 g/kg of salt, 65 g/kg of yeast, 5 g/kg of cumin and 1.800 g/kg of water.

The dough samples were mixed in a spiral stirring machine (ESPM 40, P.S. Progres/Progress – CBT s.r.o, Ústí nad Labem, Czech Republic) for 8 min (3 min slow mix, 5 min fast mix). Then dough was divided into smaller pieces (1.200 kg) that were manually kneaded. Then dough pieces were left

Table 1
Contents of essential fatty acids in samples of cold-pressed grapeseed oils determined by a gas chromatography-mass spectrometry (GC-MS)

Fatty acids, %	WC (one volume of oil)	ZG (two volumes of oil)	VP*
C4:0.C6:0	n.d.	n.d.	n.d.
C8:0	n.d.	n.d.	n.d.
C10:0-C13:0	n.d.	n.d.	n.d.
C14:0	0.04	0.04	0.04
C15:0 IS	0.02	0.01	0.01
C15:1n5c	n.d.	n.d.	n.d.
C16:0	6.18	6.67	6.63
C16:1n7c	0.12	0.1	0.1
C17:0	0.06	0.05	0.05
C16:3n4c	0.02	0.02	0.03
C17:1n7c	n.d.	n.d.	n.d.
C18:0	3.9	3.53	3.95
C18:1n9t	n.d.	n.d.	n.d.
C18:1n9c	14.7	14.2	17.0
C18:1n7c	0.85	0.91	0.97
C18:2n6t	n.d.	n.d.	n.d.
C18:2n6c	73.4	74.0	70.3
C18:3n3c	0.41	0.38	0.52
C20:0	0.14	0.13	0.17
C20:1n9c	0.13	0.12	0.17

The relative representation of fatty acids, *Vinopol mixed pomace (c. 1:1 red and white grapes); addition of vitamin E, The final microemulsions contained (batch No. 120709/A - two volumes of oil from red grape seed ZG with one volume of oil from white grapeseed WC).

to stand for further 15 min, shaped into wheat loaf and put into the baskets. Then, the pieces of dough were put into the trug, on a baking tray and left to rise for 40 - 50 min at a temperature of 35°C and at a humidity of 80% in the proofer (APPAREK AA24B1PAN; proofer PANEM International – Z.I., France). Pieces of dough were folded out from baskets, moistened by water and put into the turbace. Then they were baked for 43 min at a temperature (at 260°C for 5 min and then at 215°C for 38 min) in the onfloor furnace FORNATA 10 (KORNFEIL, s.r.o., Čejč, Czech Republic). Weight of loaves was controled to have almost 1.0 kg at the end of baking.

Baking of wheat French loaf

Composition of wheat French loaf was 1.000 g/kg of wheat flour, ground (T512), 24 g/kg of salt, 40 g/kg of yeast and 560 g/kg of water. 5 different samples of wheat French loaf (0 g/kg of microemulsion - control sample, 10 g/kg, 20 g/kg, 30 g/kg and 40 g/kg of microemulsion) were prepared.

The wheat dough samples were mixed in a spiral stirring machine (ESPM 40, P.S. Progres/Progress – CBT s.r.o, Ústí nad Labem, Czech Republic) for 7 min (3 min slow mix, 4 min fast mix). Then dough was divided into smaller pieces (0.400 kg). The pieces were manually kneaded and left to stand for further 15 min. Then pieces of dough were shaped into the wheat loaf by the roll machine (TOPOS, Topos a.s. Lípa, Krásná Lípa, Czech Republic) and put on corrugated sheets into the proofer (APPAREK AA24B1PAN). Then, the pieces of dough were left to rise for 30 min at a temperature of 35°C and at a humidity of 75% in the proofer. Then they were baked for 15-18 min at a temperature 220°C in the onfloor furnace FORNATA 10. Final weight of wheat loaves was 0.35 kg.

Texture analysis

The texture of the samples of wheat-rye bread and wheat French loaf was evaluated by a TA-XT Plus Texture Analyzer (O.K. SERVIS BioPro, s.r.o., Prague, Czech Republic), and conducting a ”measure force in compression” test with a AACC 36 mm cylinder probe with radius (P/36R) using 5 kg load cell as described by the texture analyzer manufacturer. The analyzer was set at a ‘return to start’ cycle, a pre-test speed of 1 mm/s, a test speed of 1.7 mm/s, a post-test speed 10.0 mm/s and a distance of 10 mm. Firmness is defined in this metod as the force (in grams) required to compress the product by a pre-set distance. Firmness testing was performed on bread and loaves after baking. Five samples of wheat-rye bread and wheat French loaf sliced to 25 mm thick for texture analysis. The testing was performed in triplicate, and the force recorded in grams.

Sensory analysis of wheat-rye bread and wheat French loaf

Sensory evaluation (taste, sourness, sensation when swallowing, dryness, pliancy, crispness, gumminess, feeling full, oral cavity, quality) was performed by 15 panelists at the level of “a selected assessor” according to ISO Standard No. 8586-1 (1993) within the sensory laboratory equipped in accordance with ISO Standard No. 8589 (1988). A control sample (sample A-without grapeseed microemulsion), samples of wheat-rye bread/wheat French loaf with grapeseed microemulsion (40.0 g/kg – sample B, 30.0 g/kg – sample C, 20.0 g/kg – sample D, 10.0 g/kg – sample E) were presented anonymously at room temperature (22 ± 2°C) in each run. All the samples with additions of the grapeseed microemulsion (the samples B - E), and the control sample (the sample A-without the grapeseed microemulsion) were evaluated for the following characteristics: taste, sourness, sensation when swallowing, dryness, pliancy, crispness, gumminess, feeling full, oral cavity, quality.

Statistical data analysis

The results of sensory analyses were statistically evaluated by means of non-parametric analysis of variance (Kruskal-Wallis test), Friedman test (Agresti, 1984). The results of texture analyses were statistically evaluated by STATISTICA CZ (Statsoft, Inc., Tulsa, USA), version 9.1. Differences had to achieve $P<0.05$ to show significance in all cases.

Results and Discussion

Texture analysis of wheat-rye bread and wheat French loaf

Table 2 shows negligible differences among samples of wheat-rye bread and wheat French loaf in firmness. The additions of the grapeseed microemulsion did not influence firmness after baking (most of the strength of bread differ in each sample after baking) Our results are not in agreement with Mildner-Szkudlarz et al. (2011), They found that the hardness of breads significantly increased with an increasing level of grape by-products (GP – a fine powder of red grapeseeds – grapeseed flour).

Sensory analysis of wheat-rye bread and wheat French loaf

The influence of the grapeseed microemulsions on the sensory characteristics of final products (wheat-rye bread and wheat loaf) after baking was studied.

Statistically non-significant differences (P>0.05) were found in all sensory characteristics at the level of significance of 5 %.

Table 2
Firmness of wheat-rye bread and wheat French loaf

Samples*	Firmness, g				
	A	B	C	D	E
Wheat-rye bread	17.0±1.6 ^{a}	17.1±1.7 ^{a}	17.0±1.5 ^{a}	16.5±1.6 ^{a}	15.3±1.7 ^{a}
Wheat French loaf	21.5±9.7 ^{a}	21.2±3.3 ^{a}	21.0±2.8 ^{a}	17.5±2.1 ^{a}	16.9±2.0 ^{a}

*A control sample without grapeseed microemulsion;
B samples with additions 10 g/kg of grapeseed microemulsion; C samples with additions 20 g/kg of grapeseed microemulsion;
D samples with additions 30 g/kg of grapeseed microemulsion; E samples with additions 40 g/kg of grapeseed microemulsion.

Table 3
Results (expressed as median) of the sensory analyses of the tested wheat-rye breads (samples B-E) or the wheat French loaf (samples B-E) after baking

Characteristics*	** Median values									
	A	B	C	D	E	A^{a}	B^{a}	C^{a}	D^{a}	E^{a}
	wheat-rye bread					wheat French loaf				
Taste	$2^{a,b}$	2^{a}	$2^{a,b}$	$2^{a,b}$	$3^{b,c}$	3^{a}	2^{a}	2^{a}	2^{a}	2^{a}
Sourness	2^{a}	2^{a}	2^{a}	2^{a}	2^{a}	1^{a}	1^{a}	1^{a}	1^{a}	1^{a}
Sensation when swallowing	3^{a}	3^{a}	3^{a}	3^{a}	3^{a}	3^{a}	3^{a}	3^{a}	3^{a}	3^{a}
Dryness	3^{a}	4^{a}	4^{a}	4^{a}	3^{a}	2^{a}	3^{b}	3^{b}	3^{b}	3^{b}
Pliancy	3^{a}	3^{a}	3^{a}	3^{a}	3^{a}	4^{a}	$3^{a,b}$	$3^{a,b}$	$3^{b,c}$	$3^{b,c}$
Crispness	3^{a}	3^{a}	3^{a}	4^{a}	3^{a}	4^{a}	3^{a}	3^{a}	4^{a}	3^{a}
Gumminess	3^{a}	3^{a}	3^{a}	3^{a}	3^{a}	3^{a}	3^{a}	3^{a}	3^{a}	3^{a}
Feeling full, Oral cavity	3^{a}	2^{a}	3^{a}	3^{a}	3^{a}	3^{a}	3^{a}	3^{a}	3^{a}	3^{a}
Quality	3^{a}	2^{a}	2^{a}	2^{a}	3^{a}	3^{a}	2^{b}	2^{b}	$2^{a,b}$	$2^{a,b}$

* Hedonic scales used: Taste: 1-very good to 5 very bad. Sensation when swallowing: 1-very good to 5 - very bad.
Sourness: 1-not occur to 5 very significant. Sensation when swallowing: 1-considerably improves to 5 considerably worse.
Dryness: 1-very dry to 5 very wet. Pliancy: 1-very high to 5 very low. Crispness: 1-very crisp to 5 tough.
Gumminess: 1-very high to 5 hardly noticeable. Feeling full, oral cavity: 1-very good to 5-very bad.
Quality: 1-excellent to 5 very bad.

** Median values having the same superscript letter in each column are not significantly different ($P\geq0.05$); each group was evaluated separately, for sample abbreviations see below.
A/A^{a} control sample of wheat-rye bread/wheat French loaf without grapeseed microemulsion
B/B^{a} samples of wheat-rye bread/wheat French loaf with addition 40 g/kg of grapeseed microemulsion
C/C^{a} samples of wheat-rye bread/wheat French loaf with addition 30 g/kg of grapeseed microemulsion
D/D^{a} samples of wheat-rye bread/wheat French loaf with addition 20 g/kg of grapeseed microemulsion
E/E^{a} samples of wheat-rye bread/wheat French loaf with addition 10 g/kg of grapeseed microemulsion

The sensory assessors were not be able to recognize differences among individual wheat-rye bread in these characteristics. Our results are not in agreement with author Mildner-Szkudlarz et al. (2011) who said that typical aroma of freshly baked breads also decreased with increasing GP (fine powder of red grapeseeds) levels and who stated that the bread volume, porosity and overall acceptance decreased as the level of GP (fine powder of red grapeseeds – a grapeseed flour) increased (Table 3).

Statistically significant differences among wheat French loaves (P<0.05) were found in the sensory characteristics such as dryness, pliancy and quality. The samples of wheat French loaf with additions (10-40 g/kg) of the grapeseed microemulsion had lower dryness in comparison to the control sample. Our results are in agreement with Yemis et al. (2008), who found that the addition of antioxidants is a method of increasing shelf life, especially of lipids and lipid-containing foods. In connection with this, the pliancy was higher in the samples with the additions 10-20 g/kg of the grapeseed microemulsion in comparison to the control sample of the wheat French loaf. Quality was better in the samples with the 30-40 g/kg additions of the grapeseed microemulsion in comparison to the control sample. The samples of the wheat French loaf with additions of the grapeseed microemulsion are less dry and they had better quality in comparison to the control sample (Table 3).

Statistically non-significant differences (P>0.05) were found among the wheat French loaves in the other sensory characteristics (taste, sourness, sensation when swallowing, crispness, gumminess, feeling full, oral cavity) at the level of significance of 5%. Our results are in agreement with Matthäus (2008). He stated that refined grape seed oil is neutral in taste. It means that grapeseed oil should not influence taste of final products. The sensory assessors were not able to recognize differences among individual wheat French loaf in these characteristics. Our results are in agreement with Mildner-Szkudlarz et al. (2011), they concluded that cohesiveness and resilience did not change significantly up to 6% grapeseed flour addition (Table 3).

Dryness and pliancy in samples of the control wheat French loaf and the wheat French loaf with additions of the grapeseed microemulsion were lower due to the lower fat content in the final products since it is well known that fats improve structure of bread crumb, taste and extend shelf life.

Conclusion

Our results show qualitative changes of the wheat French loaf and the wheat-rye bread with additions of the grapeseed microemulsions. The grapeseed microemulsions decreased dryness, increased pliancy and quality of wheat French loaf. No influence had additions of microemulsion on monitored characteristics of wheat-rye bread and firmness of both products. This work demonstrates the use of other product obtained from grape seeds in bakery. These results are an example of the influence microemulsion on the texture and sensory properties of wheat-rye bread and wheat French loaf. The research in this area will be further continued.

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References

Agresti, A., 1984. Analysis of Ordinal Categorical Data. *John Wiley & Sons*, New York, 396 pp.

Bourne, M. C., 1982. Texture, viscosity and food. In: Bourne, M.C. (Ed.), Food Texture and Viscosity. Concept and Measurement. *Academic Press,* New York, 23 pp.

B. L. D'Appolonia and M. M. Morad, 1981. Bread staling. *Cereal Chemistry,* **58:** 186-190

Hebeda, R. E., L. K. Bowles and W. M. Teague, 1990. Developments in enzymes for retarding staling of baked goods. *Cereal Foods World,* **35:** 453-457

ISO 5530-4, 2002. Wheat flour (*Triticum aestivum* L.) -Physical characteristics of doughs - Part 4: Determination of rheological properties using an alveograph, International Organization for Standardization, Genève, Switzerland.

ISO 8586-1, 1993. Sensory Analysis -- General Guidance for the Selection, Training and Monitoring of Assessors -- Part 1: Selected Assessors, International Organization for Standardization, Genève, Switzerland.

ISO 8589, 1988. Sensory Analysis -- General Guidance for the Design of Test Rooms, International Organization for Standardization, Genève, Switzerland.

Kinsella, J. E., 1974. Grapeseed oil: A rich source of linoleic acid. *Food Technology,* **28**: 58-60

Lin W., and D. R. Lineback, 1990. Changes in carbohydrates fractions in enzymes-supplemented bread and the potential relationship to staling. *Starch*, **42:** 385-394

Matthaüs, B., 2008. Virgin grape deed oil: Is it really a nutritional highlight? *European Journal of Lipid Science and Technology*, **110:** 645-650

Mildner-Szkudlarz, S., R. Zawirska, A. Szwengiel and M. Pacyňski, 2011. Use of grape by-product as a source of dietry fibre and phenolic compounds in sourdough mixed rye bread. *International Journal of Food Science and Technology*, **46:** 1485-1493.

Oomah, B. D., Liang, J., D. Godfrey and G. Mazza, 1998. Microwave heating of grapeseed: effect on oil quality. *Journal of Agricultural and Food Chemistry,* **46:** 4017-4021.

Pardo, J. E., Fernández, E., Rubio, M., A. Alvarruiz and G. L. Alonso, 2009. Characterization of grape seed oil from different grape varieties (*Vitis vinifera*). *European Journal of Lipid Science and Technology,* **111:** 188-193.

Pateras, I. M. C., 1998. Bread spoilage and staling. In: Cauvain, S.P., Young, L.S. (Eds.), Technology of Breadmaking. *Blackie Academic and Professional*, London, 397 pp.

Peng, X., Ma, J., Cheng, K.-W., Jiang, Y., F. Chen and M. Wang, 2010. The effects of grape seed extract fortification on the antioxidant activity and quality attributes of bread. *Food Chemistry,* **119:** 49-53.

Sidhu, J. S., J. Al-Saqer and S. Al-Zenki, 1996. Comparison of methods for the assessment of the extent of staling in bread. *Food Chemistry,* **58:** 161-168.

Szczesniak, A. S., 1987. Correlating sensory with instrumental texture measurements - an overview of recent developments. *Journal of Texture Studies,* **18:** 1-15.

Yemis, O., E. Bakkalbasi and N. Artik, 2008. Antioxidative activities of grape (*Vitis vinifera*) seed extracts obtained from different varieties grown in Turkey. *International Journal of Food Science and Technology,* **43:** 154-159.

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