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# CHARACTERISTICS FLAKES PRODUCT WITH DRY RESIDUE OF WILD OREGANO

# KARAKTERISTIKE FLEKS PROIZVODA SA DODATKOM SUVOG OSTATKA DIVLJEG ORIGANA

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## *ABSTRACT*

*Cereals constitute the staple food of the human race. In accordance with the modern nutritionist opinions, cereal products, flakes and snack products are the most common foods in the daily diet, such as ready to eat breakfast cereal, flakes and snacks. Extrusion technology makes it possibile to apply different sources of ingredients for the enrichment of cereal-based flakes or snacks products. Substances with strong antioxidant properties such as wild oregano have a positive impact on human health, therefore attracting the attention of scientists, consumers and food industry experts.This paper investigates the effects of simultaneous addition of dry residue of wild oregano (0.5 % and 1 %), on the physical and colour properties of corn flakes to obtain new products with altered nutritional properties. Post-hoc Tukey's HSD test at 95 % confidence limit showed significant differences between various samples. Addition of dry residue wild oregano positively influenced phisical characteristics (decreased bulk density 30.2 %, increased expansion rate 44.9 %), influenced of decrease hardness 38.1 % and work of compression 40.3 % also significantly change the color of flakes product. Presented data point that investigated corn flakes is a new product with good phisical and sensory properties due to higher level of dry residue of wild oregano.*

***Key words**: flakes product, wild oregano, phisical properties, colour, sensory properties.*

## *REZIME*

*Visok udeo proizvoda od žita u uravnoteženoj i izbalansiranoj ishrani je u skladu sa modernim stilom života i fiziološkim funkcijama. U skladu sa savremenim stavom nutricionista: žita za doručak, fleks i snek proizvodi su najzastupljenije namirnice u dnevnom obroku. S obzirom da su ekstrudirani proizvodi na bazi žita sastavni deo bar jednog obroka prosečnog potrošača i da zauzimaju značajno mesto u konceptu pravilne ishrane, oni predstavljaju pogodne nosioce funkcionalnih komponenti. Ekstruziona tehnologija omogućava obogaćivanje žitarica za doručak, fleks i snek proizvoda raznim dodacima. Ukoliko se obogate funkcionalnim komponentama ovi proizvodi, osim povoljnog nutritivnog sastava imaju ulogu u regulaciji određenih poremećaja zdravlja i prevenciji bolesti. Povećana potražnja za funkcionalnim dodacima usmerila je pažnju stručne i naučne javnosti na valorizaciju različitih sporednih proizvoda, koji se danas smatraju jeftinim izvorom vrednih komponenti. Postojeće tehnologije omogućavaju njihovo očuvanje i povratak u lanac ishrane kao funkcionalnog dodatka u različitim proizvodima. Materije sa izraženim antioksidativnim svojstvom kao što je divlji origano imaju pozitivan uticaj na ljudsko zdravlje što privlači pažnju naučnika, potrošača i stručnjaka prehrambene industrije. Post-hoc Tukey's HSD test na granici poverenja 95 % pokazao je značajne razlike između različitih uzoraka. Dodavanje suvog ostatka divljeg origana pozitivno je uticalo na fizičke karakteristike (smanjenje nasipne mase 30,2%, povećanje stepena ekspanzije 44,9%) uticalo je na smanjenje tvrdoće 38,1 % i rad kompresije 40,3 % takođe se značajno menja boja proizvoda. Ovaj rad istražuje efekte dodavanja suvog ostatka divljeg origana (0,5% i 1%), na fizičke osobine i boju korn fleksa i dobijanje novog proizvoda sa izmenjenim nutritivnim karakteristikama.*

***Ključne reči**: fleks proivod, divlji origano, fizičke karakteristike, boja, senzorne karakteristike.*

## INTRODUCTION

Heat treating of cereals is used for improving their nutritional, hygiene, physico-chemical and other properties, increases the nutrient value of some nutrients, improve sensory properties and provides the microbiological safety of the products *(Sumitra and Bhattachary 2008; Filipović et al., 2010)*. Extrusion technology makes it possibile to apply different sources of ingredients for the enrichment of cereal-based flakes or snacks products. The commonly used heat treatments for processing of cereals such as corn is extrusion which leads to changes in the carbohydrate complex, the decrease in starch content due to its degradation to dextrin many chemical and structural transformations, such as starch gelatinization, protein denaturation, complex formation between amylose and lipids *(Sumitra and Bhattachary 2008; Jozinović et al., 2015)*. Among the ingredients that could be included in corn flakes formulation is wild oregano, which may significantly improve its phisico-sensory properties *(Filipović et al., 2010; Gawlik –Dyiki et al., 2013)*. Uniform soft crisp texture and bright yellow colour are the desired features of the corn flakes while maintaining integrity after putting in milk. Though the extrusion is conducted at a low moisture content, the use of high temperature for a short duration suddenly releases steam leaving behind an expanded non-collapsing structure. The development of crisp texture and characteristic flavour are an integral part of this operation. Physical and chemical changes to proteins occurring during processing of corn flakes could affect the texture of corn-based ready-to-eat (RTE) breakfast cereals *(Sumitra and Bhattachary 2008; Shaviklo et al., 2015; De Brier et al., 2015)*. The last decades have brought constant changes in consumer demands related to food and nutrition *(Košutić et al., 2015)*. Increased demands after healthier and more nutritious products is a

consequence of more conscious consumers which contributes to constant necessity for new products and increased differentiation of product assortment *(Košutić et al., 2013)*.

This paper investigates the effects of replacing of dry residue wild oregano (0.5 % and 1 %) on the psycho-chemical and sensory properties of corn flakes to obtain new products with good technological quality and improved nutritional properties.

## MATERIAL AND METHOD

The flakes product was obtained by extrusion in a twin-screw extruder (Yuninan Daily Extrusion, Republic of China) in industrial conditions on the factory Reprotrade doo Industrial Zone bb, Temerin. Extrusion parameters were as a follows: Length of screw 140 cm diameter 3x6 mm, rotor speed of 180 rev / min, temperature profile: 131 °C / 125 °C / 114 °C. Corn flour, was replaced by dry residue of wild oregano added in the quantity of 0 % (CF 1), 0.5 % (CF 2) or 1 % (CF3) of samples based on corn flour. Obtained extrudates were dried in dry unit at temperature of 84 °C, were cooled for 30 min in contoled temperature 25 °C ±1 and stored in platic bags until requierd for analysis. The moisture of corn flour with or without milled dry residue of wild oregano in a mixer were adjusted to 22 % water of flour.

Corn flour used in this study was obtained from the mill Žitoprodukt d.o.o. Bačka Palanka location Serbia, produced in 2014 with tested following characteristics: moisture content of 13.3 % of samples, sugar, protein, cellulose, starch, lipid content (% dry matter samples) of 0.87 5.59, 0.98, 49.43, and 1.57, respectively *(AOAC, 1990)*. Wild oregano *(Origanum minutiflorum)* harvest 2013 produced by Inan tarim ecodab"- Antalia Turkey. Dry residue of wild oregano was prepared as follows: distillation of wild oregano *(Origanum minutiflorum* is carried out in the production plant of the Institute of Medicinal Plant Research "Dr Josif Pančić " from Pančevo, Serbia. For distillation was used mini distiller based on water vapor principle. The duration of the distillation time was 2 hours and 30 minutes. Trop and the rest in the process of distillation is cooled to drafty place and prepared for further research.

Bulk density was measured with a bulk density tester, Tonindustrie, West und Goslar, Germany. Moisture content during the pelleting process was determined with a rapid moisture analyzer (OHAUS MB 45, Switzerland).

Expansion ratio (ER) was determined according to *Kaluđerski and Filipović (1998) and Kannadhason et al., (2009).* where expansion ratio was calvulated as follows

ER=volume falkes(ml)/volume crude flakes (ml)

Textural properties of flakes product were measured with Texture Analyzer TA.HD plus (Stable Micro System, U.K.) equipped with a 50 kg load cell. Hardness and work of compression of flakes product were measured using a 45 mm cylinder probe (P/45R) by compressing 10 individual flakes at one turn. The maximum force and work of compression correlate to the hardness of the sample. The following settings were used: pre-test speed: 2 mm $sec^{-1}$; test-speed: 2 mm $sec^{-1}$; post-test speed: 10 mm $sec^{-1}$; distance: 2.5 mm; trigger force: 10 g. The tests were performed on 5 replicates per batch.

Flakes colour was measured by objectively colourimeter Chroma meter (CR-400, Konica, Minolta, Japan) and was determined according to the procedure previously described by *Filipović et al., 2015.*

Sensory analysis was conducted according to SRPS ISO 4121:2002 (2002) Sensory analysis-Methodology-Evaluation of food products by methods using scales, by panel of six trained evaluators. Evaluators identified descriptors, and scored taste using 6 point scale (0 – not detected, 5 – strong).

The effect of addition wild oregano was analyzed by variance analysis (ANOVA) using StatSoft Statistica ver.10

## RESULTS AND DISCUSSION

The bulk density of flakes product is important in relation to their packaging requirement and the ability to float or sink when poured into water or milk *(Sumitra and Bhattachary 2008)*. Effect of dry residue of wild oregano addition on bulk density shown in (Table1). The bulk density of flakes varies from 150 to 215 $gdm^{-3}$. With additon of dry residue of wild oregano addition (0.5 % and 1 %) bulk density of extruded product statistically significantly decreased. With additon of dry residue of wild oregano addition (0.5 % and 1 %) expansion ratio of flakes product statistically significantly increased. Explanation for this is in interaction of dry residue of wild oregano addition with starch, and besides that componet can rupture cell walls and prevent air bubbles from expanding to their maximum potential *(Filipović et al., 2015)*.

One of the most important quality parameters of flakes products is the time during which, when soaked in milk, their texture is still acceptable for comsumers. The textural characteristics of flakes product with dry residue of wild oregano addition, hardness and work of compressiom are presented in Table 1. The highest value for hardness (15.51 g) was observed for sample CF 1, while the lowest hardness value was noticed for sample CF 3 (8.88 kg). These results are in accordance with research of Anton et al. *(Anton et al., 2009)* who concluded that texture properties are highly influenced by expansion ratio had lower hardness. Content of dry residue of wild oregano contribute to statistically insignificantly decreased hardness (CF 2, CF 3,) where presence of fibers in oregano caused the increase of product hardness due to reduction of cell wall thickness *(Lazou and Krokida 2010; Nascimento 2012; Yanniotis et al., 2007)*. Addition of dry residue of wild oregano (0.5 % and 1 %) statistically insignificantly decreases work of compression (CF 2, CF 3).

*Table 1. Phisical and texture attributes corn flakes with wild oregano*

| | | Content of wild oregano ( %) | | |
|---|---|---|---|---|
| Sample | N° | CF1<br>0 % | CF2<br>0,5 % | CF3<br>1 % |
| Phisical characteristics | BD ($gml^{-1}$) | 215± 3.60$^{a}$ | 161.6± 1.6$^{b}$ | 150.2± 1.21$^{c}$ |
| | ER ($mlg^{-1}$) | 6.46± 2.89$^{a}$ | 8.6± 0$^{b}$ | 9.36± 5.77$^{c}$ |
| Texture characteristics | HD (kg) | 15.51± 1.51$^{a}$ | 14.35± 2.68$^{a}$ | 8.88± 3.95$^{a}$ |
| | WOC ($kgsec^{-1}$) | 8.27± 2.17$^{a}$ | 7.79± 1.91$^{a}$ | 4.94± 2.40$^{a}$ |

*The results are presented as mean±SD; different letter within the same column indicates significant differences ($p<0.05$), according to Tukey's test, number of repetitions: n=3. BD- bulk density, ER - expansion ratio, HD- hardness, WOC- work of compression*

The colour characteristics of flakes product is important the sensory characteristics of product and play an essential role in determining the final acceptance by consumers. Different values in various colour coordinates were observed for different flakes formulations, table 2. This attributes are very important in creating sensory expectations of consumers, which could affect

their perception and acceptance of the product (Filipović 2015). Statistically significant differences between flakes samples without and with oregano addition were found for $L^*$ coordinate (brightness) due to contribution of oregano addition. The highest $L^*$ (85.50) was observed for sample CF1, while the lowest $L^*$ value (82.51) was noticed for sample CF 3, where 1 % is replaced with wild oregano. Content of dry residue of wild oregano addition wild oregano contributes to decrease of brightness $L^*$, which leads to the formation of darker flakes product, similar results as was observed by *Jozinović et al., (2015)*. The share of green colour (a*) coordinate is found to have no statistically significant difference among all samples. Statistically significant differences in yellow colour (b*) was observed in samples CF 1, CF 2 and CF 3, which indicates content of wild oregano reduces yellow tone in sample. The highest C (34.08±2.18) was measured in sample CF 1 and the lowest C (27.28±1) for sample CF 3. Content of dry residue of wild oregano contribute to statistically significalnty decreased colouration (C). Whitness of flakes statistically significantly incresaed with addition of dry residue of wild oregano. The difference in tone was no statistically significant for most of the samples.The maximum value of h was observed in sample CF 3 (92.2) and the lowest value of h (91.80) was found in sample CF 1. Values of dominant wavelength ranged between 575.52 (sample CF 3) and 575.62 (sample CF 1), thus indicating that dry residue of wild oregano addition were not affecting the dominant wavelength.

*Table 2. Color attributes of corn flakes with wild oregano ( %)*

| | Content of wild oregano ( %) | | |
|---|---|---|---|
| N° Sample | CF1 – 0 % | CF2- 0,5 % | CF3 - 1 % |
| L* | 85.50±0.85$^a$ | 83.15±0.45$^b$ | 82.51±0.64$^b$ |
| a* | -1.06±0.11$^a$ | -1.12±0.21$^a$ | -1.05±0.16$^a$ |
| b$^*$ | 34.06±2.19$^a$ | 30.95±0.80$^b$ | 27.26±1.00$^c$ |
| W | 62.97±2.34$^a$ | 64.74±0.83$^a$ | 67.59±1.10$^b$ |
| C | 34.08±2.18$^a$ | 30.97±0.80$^b$ | 27.28±1.00$^c$ |
| h | 91.80±0.30$^a$ | 92.08±0.39$^a$ | 92.2±0.34$^a$ |
| DW | 575.62±0.09$^a$ | 575.54±0.12$^a$ | 575.52±0.10$^a$ |

The results are presented as mean±SD; different letter within the same row indicate significant differences ($p < 0.05$), according to Tukey's test, number of repetitions: n=3. CWO - content of wild oregano, $L^*$ - brightness, $a^*$ - share of green colour, $b^*$- share of yellow colour, W – whiteness, C - the differences in colouration, h-difference in tone, DW - dominant wavelength.On figure 1 changes of descriptive sensory characteristics of corn flakes with diferrent quntity of wild oregano are shown. Charactersistc taste was in corn flakes with 0 % wild oregano (descriptor was 5) and decreasing with wild oregano addition (figure 1 A). Non-characteristic taste was incresasing with addition wild oregano. Descriptor values for spicy taste and oregano taste, as negative component of taste, had increased with addition of wild oregano. Addition of wild oregano influneced on decreasing characteristic of taste and increasing non-chathcteristic taste, spicy taste and oregano taste. The influence of different quantity of wild oregano used in corn flakes had shown that wild oregano had negattive influence on all oduour descriptors (Figure 1 B). Non-characterstic and oregano odour have the same descriptor values with addition of wild oregano.

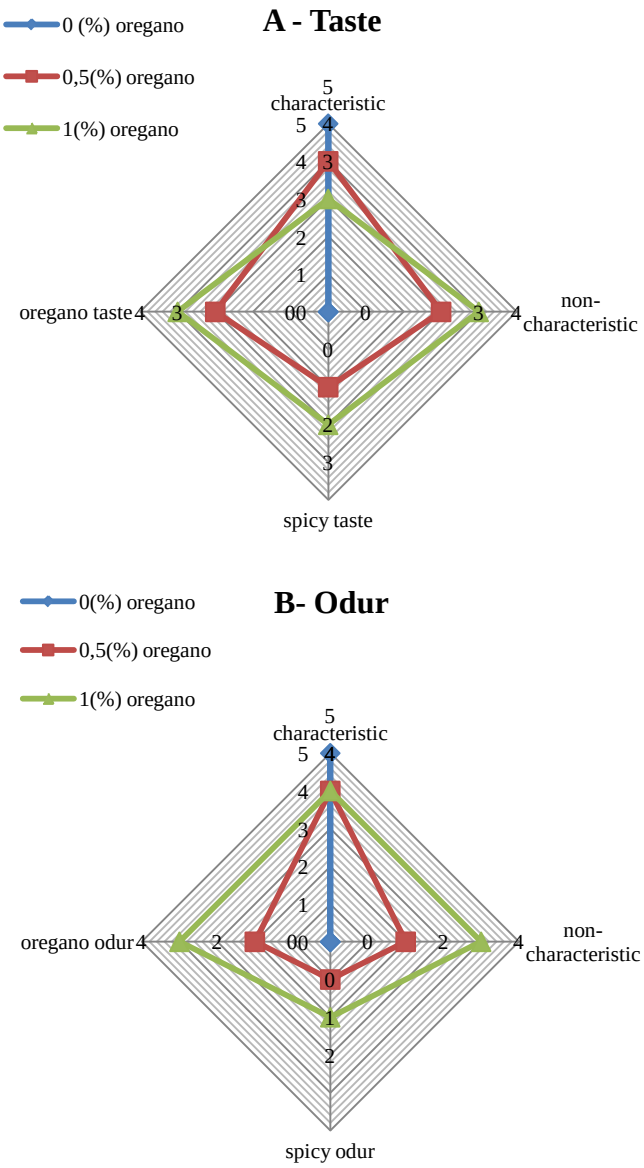


*Fig. 1. Sensory analysis of corn flakes with wild oregano (A- taste, B-odur)*

## CONCLUSION

Based on data resulting from the investigations of dry residue of wild oregano addition influenced in corn flakes physical and sensory properties it can be concluded:

- Addition of dry residue wild oregano positively influenced phisical characteristics decreased bulk density 30.2 % and increased expansion ratio 44.9 %.
- Dry residue wild oregano positively affect the corn flakes texture: increase hardness and increase work of compression (minimum value obtained was 8.88 kg and 4.94 kg $sec^{-1}$ with 1 % of dry residue of wild oregano).
- Dry residue wild oregano addition significantly change the color of flakes product. Addition of dry residue wild oregano influence decreased of brightness, share of yellow colour and difeferences incoloration and added dry residue wild oregano have the impact to increase whiteness.

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