

WALNUT MEAL COMPOSITION AND ITS USE

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Abstract. *This paper includes a bibliographic study of the chemical composition of walnut meal. Also there are presented various ways to use the meal. There are characterized the benefits that can be obtained using the meal at bread baking. In the meal, obtained by cold pressing of *Juglans regia* L. walnuts were determined the total oil content, total acidity and total water content. They baked bread samples with and without walnut meal. In control and research bread samples there were appreciated following indicators: bread porosity, acid value, specific volume. It was found that the introduction of walnut meal in bread composition led to obtaining a quality product with relevant nutritional value and pleasant sensory properties. It is important to mention that the shelf life of the samples with introduced meal was comparatively higher than those of controls. Microbiological stability of work samples has been comparatively higher than those of control.*

Key Words: walnut meal, ways for using meal, baking bread meal

I. Introduction

Walnut *Juglans regia* L is a species of great importance across Central Asia, Europe and SUA. Walnuts are collected for home consumption, sold at local roadside stands and markets. Walnut trees are further utilized for their high/quality timber to make a wide array of products. The leaves, barks and other plant parts are used for medicinal remedies; trees are grown and maintained for soil conservation purposes [8].

Currently, nut orchards area in Moldova is 12,000 hectares. Annually, about 80 percent of production is exported to 40 countries, including Italy, France, Germany, England etc. [16-18].

Walnut's fruit has a remarkable nutritional composition. Walnut contains quinones, oils, tannins. Nuts contain essential fatty acids, including cis-linoleic and alfa-linolenic acid. The kernels contain oil, mucilage, albumin, mineral matter, cellulose and water. Walnut is considered a good source of dietary minerals. Potassium, phosphorus, magnesium and iron are found in significant quantities in these nuts [2].

Walnut are nutrient-rich food due to high contents of fats, proteins, vitamins and minerals. They are also good sources of flavonoids, sterols, pectic substances, phenolic acids and polyphenols [1, 7]. Walnuts have a special value in dietary food, resulted from their carbohydrate content (11-14%), proteins (14-16%) and represented of the essential aminoacids and lipids (62-65%), of which 44-48% are polyunsaturated fatty acids [11].

Therefore, the walnut is classified as a strategic species for human nutrition and is included in the

FAO list of priority plants [10]. The part of the fruit (kernel) is consumed fresh, toasted or mixed with other confectionaries [9].

The major component of walnut oil are triacylglycerols (980 g/kg oil), which are monounsaturated FAS (mainly oleic acid) and polyunsaturated FAS (PUAS, linoleic and linolenic acid). Oil contents reported by *Juglans regia* L. leaves have been used mostly in worldwide traditional medicines as antimicrobial, antihelminthic, astringent, keratolytic, antidiarrhoeal, hypoglycaemic, depurative, tonic, diabetes and asthma etc. [3, 6, 8].

Proteins are major and essential components of healthy and wholesome food. In solving the problem of giving population food proteins, it is essential the integrated and rational use of them, contained in plant materials or to prepare food based on proteins. One type of such raw materials is walnuts.

Integrated use of walnuts as a source of edible oil, food and protein, will create full, rich in protein foods, significantly cheaper, compared to products from the expensive animal protein.

After nut oil extraction it is obtained the meal, which is 30-47% depending on the used method for oil extraction: cold pressing, hot pressing, solvent extraction and so on [12]. Composition of walnut meal obtained from extraction of oil is less studied. Usually nut meal is used as animal feed.

We aimed to evaluate the chemical composition of the meal and find ways to use as an ingredient in various food compositions. This paper is the first research study of the chemical composition of walnut meal *Juglans regia* L., nutritive value, the

benefits which can provide the oil industry waste materials, and ways to use it in food.

It was found that the introduction of walnut meal in bread composition led to obtaining a qualitative product with relevant nutritional value and pleasant sensory properties. It is important to mention that the shelf life of the samples with introduced meal was comparatively higher than those of controls. Microbiological stability of work samples has been comparatively higher than those of control.

II. Materials and methods

2.1. Plant material

Walnuts *Juglans regia* L. were collected manually in October 2011 in Chisinau, the center of Moldova. Were dried and stored them at room temperature. Walnut oil is obtained by cold pressing. Meal was collected and served as research object.

There were introduced different proportions in baking dough composition to study how to use the meal as a partial substitute for flour. However, taking into account the chemical composition of the meal rich in protein, amino acids, minerals, vitamins, antioxidants we can obtain a product with a relevant nutritional value.

2.2. Chemicals and reagents

Other materials used for bread baking: wheat flour, wate , salt, yeast.

Bread quality control and research (with added walnuts meal) was determined by standard metods.

The following indicators were tested:

- *Porosity*, as GOST 5669-96. Bread. Method for determining the porosity.
- *Organoleptic indicators and product weight*, as GOST 5667-65. Bread and bakery products. Rules for receiving, sampling methods, methods for determining the organoleptic indicators and weights of products.
- *Acidity*, as GOST 5670-96. Bread. Methods for determining the acidity.
- *Humidity*, as GOST 21094-75. Bread and bakery products. Methods for determining the moisture.

III. Results and discussion

In addition, nuts have significant economic and medicinal value to human health because of their biochemical composition of polyunsaturated fatty acids, especially 18:2 and 18:3 and protein value [12]. Well, they contain other beneficial components such as vegetable proteins (e.g., arginine, leucine), carbohydrates (e.g., dietary fiber), vitamins (e.g.,

vitamin A, E), pectic substances, minerals (magnesium, potassium, phosphorus, sulfur, copper and iron), plant sterols and phytochemicals [4, 12].

Walnut meal proteins contain a lot of amino acids such as histidine, trionina, tryptophan, valine, isoleucine, leucine [13-15].

After pressing, it is got the cake (meal) rich in proteins, in which there are a lot of essential amino acids, especially lysine. According to the content of the latter (6.2g per 100g) walnut proteins are superior to egg proteins. Nuts contain minerals as potassium, calcium, iron, cobalt salts, phosphorus and sulfur. Especially a lot of them are potassium, phosphorus and sulfur. From trace elements in the fruit should note the presence of iodine and zinc [6, 7].

Study [1, 14] shows that meal chemical composition of coconut is rich in remarkable quantities of complex amino acid proteins, essential fatty acids, minerals, flavonoids and dietary fibers, which are sources of micro flora healthy bowel, improve digestion and eliminate toxins from the body (Figure 1).

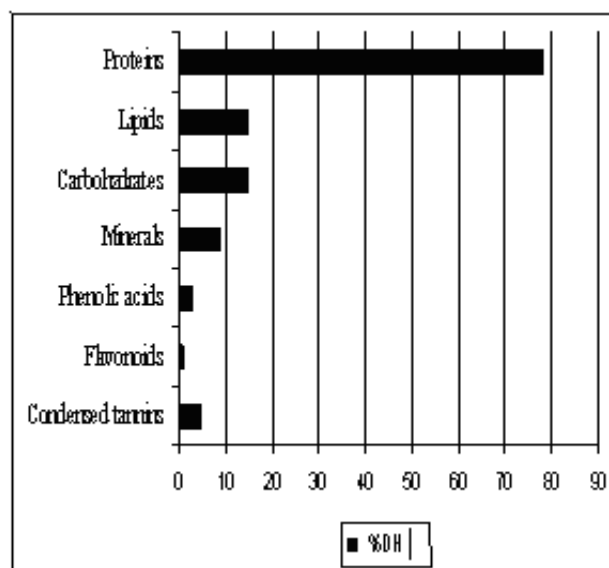


Figure 1. Chemical composition of coconut meal

Meal is contained in 100g of 26% of the daily dose of vitamin B₆, vitamin B₁, 23%, 25% - folic acid, 34%, phosphorus, 79% - copper and manganese. Nut flour has a rich source of polyphenols and other compounds endowed with antioxidant properties. Meal nut has a rich source of proteins and dietary fibers which can be used to increase the nutritional value of foods such as: bakery products, various houses, sauces etc.

Quality indicators are presented in the table 3.1. of walnut meal: sensory, physicochemical and microbiological indicators.

Table 3.1. Quality indicators of walnut meal

Indicators	Characteristic	
Sensory	Pieces or fine yellow powder-brown. Not contain foreign particles or additives and impurities. Specific taste of walnut products. Contains no aromatic additives.	
Physicochemical	Structure	Pieces or powder, not containing compressed blocks.
	Granulation	Min 99% passing through sieve 300 microns / HD
	Moisture	9% max (GOST13979.1-68)
	Protein	34 % min (N2x6.25)
	Fat	10 % max (GOST 13979.2-94)
	Ash	7% max (ash, 10% HCl insoluble < 1%, GOST 13979.6)
	Microscopy	Opaque particles (IF/RH) are missing.
Microbiological	Aerobic microbiological quantity	10.000/g max
	Yeasts and molds	100/g max
	Coliforms	10/gmax
	E. coli	no
	Salmonella	No/25g

Walnut meal is added to the dough along with the flour in amounts of 2.5, 5 to 10%. The research results have been established as the quality of the finished product and depend on the amount of admixture (Table 2).

The ratio estimation of height / diameter of bread sample showed that this indicator is directly proportional to the amount of used cake (maximum value was 0.56 when meal was replaced with 10% flour. Indicator for the control sample was value of 0.42.

Thus, it was found that when using walnut meal bread volume increases from 1 to 3.66%, the best results were obtained when using meal of 2.5%.

Table 3.2. Physicochemical indicators of the quality of bread with the addition of walnut meal

Quality indicators	Control sample	Content meal in used bread, %		
		2,5	5	10
Specific volume of bread, cm ³	690,26	715,53	692,77	696,6
Ratio height / diameter	0,42	0,47	0,52	0,56
Core porosity, %	76,47	77,91	78,85	75,40
Humidity core, %	41,0	44,4	42,1	41,5
Core acidity, degree of acidity	2,8	3,0	3,1	3,2

IV. Conclusions

Using recycled materials in the production of walnut oil solve rational use of food resources by non waste technology.

Walnut meal is a rich source of biological active substances such as protein composition of essential amino acids, polyunsaturated fatty acids, mineral compounds, flavonoids and dietary fiber.

Chemical composition of walnut meal showed prospects of their application as a source of protein and dietary fiber to increase the biological value of bakery products.

It was found that the quality of finished bakery products depends on the amount of nut meal introduced together with flour.

Study carried out showed that the best results of bread quality indicators are achieved when amounts of 5% flour are used.

It was found that the introduction of walnut meal in bread composition led to obtaining a qualitative product with relevant nutritional value and pleasant sensory properties.

It is important to mention that the shelf life of the samples with introduced meal was comparatively higher than those of controls. Microbiological stability of work samples has been comparatively higher than those of control.

References

- [1] Caglarirmak N. 2003. Biochemical and physical properties of some walnut genotypes (*Juglans regia* L). *Nahrung Food* 47: 28-3.

- [2] Cosmulescu S., Baci A., Achim G. et al, 2009. Mineral Composition of Fruits in Different walnut (*Juglans regia L.*) Cultivars. *Not. Bot. Hort. Agrobot. Cluj* 37 (1), pp. 156-160.
- [3] Kaileh M. B., Berghea W. L., Boonec E. et al. 2007. Screening of indigenous Palestinian medicinal plants for potential anti-inflammatory and cytotoxic activity *J. Ethnopharmacol*, 113: pp. 510-516.
- [4] Kris-Etherton M., Yu-Poth S., Sabate J. et al. 1999. Nuts and their bioactive constituents> effects on serum lipids and other factors that affect disease risk. *The Am. J. Clin. Nutr.*, 70: pp. 504-511.
- [5] Mamadjanov D 2006. Walnut fruit forests and diversity of walnut tree (*Juglans regia L*) in Kyrgyzstan. *Acta Horticulturae (International Society for Horticultural Science)* 705: pp. 173-176.
- [6] Kim H. G. Cho J. H. Jeong E. Y. et al. 2006. Growth inhibiting activity of active component isolated from *Terminalia chebula* fruit against intestinal bacteria. *J. Food Prot.*, 69: pp. 2205-2209.
- [7] Martinez M. L., Labuckas D.O., Lamarque A.L. et al. 2010. Walnut (*Juglans regia L.*) genetic resources, chemistry, by-products. *J. Sci. Food. Agric.*, 90; pp. 1959-1967.
- [8] Mouhajir F., Hudson J. B. Rejdali M. et al. 2001. Multiple antiviral activities of endemic medicinal plants used by Berber people of Morocco. *Pharm. Biol.*, 39: pp. 364-374.
- [9] Nael Abu Taha, Mohammed A. Al-wadaan. 2011. Utility and importance of walnut, *Juglans regia Linn*: A review. *African Journal of Microbiology Research* Vol. 5(32), pp.5796-5805.
- [10] Gandev S. 2007. Budding and grafting of the walnut (*Juglans regia L.*) and their effectiveness in Bulgaria (review). *Bulgar. J. Agri. Sci.* 13:pp. 683-689.
- [11] Popa V. M., Hadaruga N. G., Hadaruga D. I. et al, 2010. Fatty acids composition of some vegetable oils obtained in the west area of Romania, *Journal of Agroalimentary Processes and Technologies*, 16 (3), pp. 394 – 498.
- [12] Savage G. P. D. L. Mc Neil Duta P. C. 2001. Some nutritional advantages of walnuts. *Acta Hort.*, 544: pp. 557-563.
- [13] Земляк, К. Г. Маньчжурский орех как перспективное сырьё для получения пищевых продуктов сбалансированного состава. К. Г. Земляк, А. И. Окара, Т. К. Каленик // *Масложировая промышленность*. 2009. №5. сс. 34 – 36.
- [14] Земляк, К. Г. Разработка, оценка качества и применение белкового продукта «Ореховит» из плодов *Juglans mandshurica* / К. Г. Земляк // *Новые технологии переработки сельскохозяйственного сырья в производстве продуктов общественного питания: сборник материалов международной конференции с элементами научной школы для молодёжи*. Владивосток: Издательство ТГЭУ, 2010. сс. 161 – 166.
- [15] Окара, А. И. Использование белкового концентрата из ореха маньчжурского для обогащения пищевых продуктов Международной научно-практической конференции – М.: Российский университет кооперации, 2010. – сс. 141 – 145.
- [16] В Молдове начался сбор урожая орехов. http://www.noi.md/ru/news_id/14986, 2012.
- [17] *Cultura nucului*. <http://ru.scribd.com/doc/52569019/Cultura-nucului>, 2011
- [18] Moldova remains the largest exporter of walnut to France.
- [19] <http://www.renastereanucului.com/index.php?go=news&n=1>, 2010.