FRI-23-1-BFT(R)-02

NUTRITIONAL PROPERTIES OF EINCORN WHEAT (*TRITICUM MONOCOCCUM L*) - REWIE

Gjore Nakov
Department of Biotechnology and Food Technologies
"Angel Kanchev" University of Ruse, Branch Razgrad, BG
E-mail: gore_nakov@hotmail.com

Viktorija Stamatovska
Faculty of Technology and Technical Science
The University "Ss. KlimentOhridski", Bitola, R. Macedonia
E-mail: vikistam2@gmail.com

Ljupka Necinova
Engineer technology
Veles, R. Macedonia
E-mail: ljupka.necinova@gmail.com

Nastia Ivanova
Department of Biotechnology and Food Technologies
"Angel Kanchev" University of Ruse, Branch Razgrad, BG
E-mail: nivanova@uni-ruse.bg

S. Damyanova
Department of Biotechnology and Food Technologies
"Angel Kanchev" University of Ruse, Branch Razgrad, BG
E-mail: sdamianova@uni-ruse.bg

Abstract: *Cereals are the main source of protein, fat, vitamins, minerals and antioxidants. Einkorn wheat originates from Turkey, but it is also very often found on the Balkan Peninsula. Einkorn wheat contains a large amount of vitamins, minerals and antioxidants, but there are also a number of health benefits.*

Key words: *Nutritional Properties, Einkorn, Wheat*

INTORDUCTION:

Einkorn (*Triticum monococcum*) is one of the ancient wheats, and is potential crop for environmentally friendly organic farming. Compared to common wheat, einkorn is generally more resistant to diseases and has the ability to withstand drought. Einkorn is still cultivated on poor soils in Italy, where other wheat types fail. The yield of einkorn, however, is considerably lower compared to common wheat varieties. Einkorn originated in the mountainous areas of Turkey and its wild progenitor (*T. baeoticum Boiss*.) [8].

Presently einkorn wheat is cultivated only marginally in the Mediterranean area but there is a renewed interest in this crop due to growing sensibility of the public opinion for dietetic-nutritional aspects, probably influenced by preliminary results which provided that an excellent flour composition may have a significant role in the prevention of pathologies such as cancer, diabetes and chronic inflammatory diseases. Indeed, einkorn wheat has high protein, carotenoid, tocol, micro-element, resistant starch and fibre content. Therefore it has been proposed as a promising candidate for the development of new foods such as bakery products, baby food or

enriched foods. Furthermore, due to the simplicity of its genome, einkorn wheat has attracted the interest of the scientific community on nutrition and health aspects in relation to celiac disease [2].

Einkorn wheat (*Triticum monococcum ssp.monococcum L.*), a diploid hulled wheat (2n=2x=14) strictly related to durum (*Triticum turgidum durum*) and bread wheat (*Triticum aestivum*), is regarded as a high nutritional value cereal, especially sonsidering its high protein and antioxidants content [3,4,5].

Compared to other cereals einkorn, wheat flour is characterized by great imbalances of gliadin and glutenin and very low content of High Molecular Weight Glutenin Subunits (HMW-GS). Unlike other cereals, the quality of bread made from einkorn wheat is influenced by the content of the gluten protein [8].

Recently, einkorn was found to be not only a good source of new and useful genes but also a crop that has good agri-biological properties. It is a small-seeded wheat with high flour protein and yellow pigment contents. Doughs prepared form einkorn flour to handle, and produced low bread loaf volumes [1].

EXPLANATORY

Proteins

Triticum monococcum kernels show a protein content sharply superior to that of bread wheat, averaging 18 g/1000g dry matter and often exceeding 20 g/1000g dry matter. Although part of this superiority is linked to reduced seed size, the endosperm is also a good source of protein [3].

Sachambula L. et al., (2015) performed studies of different genotypes of wheat einkorn. They determined amount of protein of 15.8 g [9].

In their own analysis Hidalgo A. et al. (2013) also determined a large amount of proteins (181g kg-1) [5].

According Lùje H. et al (2003) who studied the physicochemical characteristics of einkorn wheat (*Triticum monococcum L.*) the amount of protein was 13.8 ± 3.2% dm [8].

Lipids

Einkorn wheat has a lipid content 50% higher than that of bread wheat (4.2 vs. 2.8 g/100 g d.m., respectively). The analysis of fatty acid composition distinguishes up to 14 different compounds [3].

Minerals and Vitamins

Phosphorus, potassium, sulfur, and magnesium were the major mineral components in the wheats. These analyses were not done on all and locations; rather, a representative sample was selected. Einkorn, which contained the most ash, was significantly higher in content in phosphorus and potassium [3].

The concentration of folic acid, and water soluble vitamin B9 is important in preventing the occurrence of defects of the fetus. Lipophilic (carotenoids and vitamin E) and hydrophilic (phenols, flavonoids and lignin) antioxidants found in fruits, vegetables and cereal grains contribute to slowing aging and onset of chronic diseases [3].

Abdel-all E-S.M et al. (1995) identified in einkorn wheat 415 mg / 100 g of phosphorus, 390 mg / 100 g of potassium, 190 mg / 100 g of sulfur, 4.4 mg / 100 g manganese. The presence of: thiamine (0.50 mg / 100 g), riboflavin (0.45 mg / 100 g), niacin 3.1 mg / 100 g of pyridoxine and 0.49 mg / 100 g. have been found from the group of B vitamins [1].

Antioxidant capacity of Einkorn wheat

Grain and cereal crops are commonly consumed by humans because of their health benefits, primarily because of the high antioxidant capacity [7].

The antioxidative activity of einkorn wheat is due to the presence of antioxidants who belong to the group of hydrophilic and lipophilic compounds, such as polyphenols, carotenoids, phytosterols and selenium [7].

Einkorn wheat contains a large amount of carotenoids that are commonly found in fruits and vegetables and much more rarely in cereal grains. Carotenoids have medicinal properties that help in prevention of serious diseases such as cancer [3].

Vitamin E consists of tocopherols and tocotrienols, including four derivatives. The total content of vitamin E in einkorn wheat is higher than that of bread wheat and durum wheat [3].

Phenolic acids are present in soluble and insoluble bound forms. Insoluble bound forms of phenols are linked by structural cell wall components such as cellulose, lignin and protein and more than the soluble forms of phenols. In terms of phenolic compounds, einkorn wheat contains a very small amount even less than that containing common wheat [3].

Starch and fibers

Endosperm of cereals is a place where the greatest amount of starch commonly accumulates. In the endosperm of *T. monococcum* is determined total starch content of 65.5% and in the endosperm of *T. aestivum* 68.5%. Of these rates around 26% belong to the amylase that has a role in improving the characteristics of the flour and the shelf life of bread [3].

The total amount of starch is not digested rapidly during digestion. Part of it, is resistant to digestion and absorption in the small intestine and is called resistant starch, which has physiological functions similar to the functions of dietary fiber. All types of *Triticum* wheat have a low content of resistant starch, while einkorn wheat contains half the amount of which contains common wheat, which is used in the production of bread [3].

The amount of starch which determined Sachambula L. et al., (2015) during analyzing different genotypes of einkorn wheat, was 62% [9].

Lùje H. et al (2003) when analyzing 22 samples of einkorn wheat concluded that the amount of dietary fiber was 8.7 ± 0.7% dm [8].

Arabinoxylans and β-glucan are constituents of the walls of endosperm in einkorn wheat, and are in limited quantities [3].

Wheat grains are a good source of dietary fiber, which are resistant to digestion and absorption in the small intestine, but partially or completely fermented in the colon. All indigestible carbohydrates are included in dietary fiber. Generally the amount of dietary fiber in the Einkorn wheat is low [5].

Abdel-Aal E. S. M. et al. (1995) conducted studies on the prevalence of dietary fiber (soluble and insoluble) in the einkorn wheat. Based on the results it is established that this type of wheat contains 6.9% dm insoluble dietary fiber and 1.7% dm soluble fiber [1].

Microelements and ashes

Cereal and cereal-based food is widely consumed worldwide and is a major source of iron and zinc in many countries worldwide. However, grains have naturally low concentration of iron and zinc. Iron and zinc are responsible for many health problems, including damage to the immune system, impaired physical growth and mental development, increased rates of anaemia, morbidity and mortality [3].

O¨zkan et al. (2007) in their examination found that depending on the genotype of einkorn wheat, the average value of iron was 47.04 mg / kg, 54.81 mg / kg of zinc, 49.29 mg / kg of manganese and 6.40 mg / kg copper. The total amount of ashes in the einkorn wheat ranges from 21-28 g / kg. In comparison the ash content in the plain wheat flour is less by 2.0% [3].

Upon analyzing 22 samples of einkorn wheat, Lùje H. et al (2003) determined 2.4 ± 0.1% dm ash [8].

Abdel-Aal E. S. M et al. (1995) concluded that the amount of ashes in the einkorn wheat was 1.85% dm [1].

Technological application

Today einkorn wheat is used to make pasta, flour, bread and animal feed. Einkorn wheat has a high content of protein, phosphorus and potassium, compared to other types of wheat [6].

The poor quality of baked goods prepared from einkorn wheat are due to the weak gluten and poor rheological properties of dough. For these reasons, einkorn wheat is suitable for preparation of classic bread (yeast) and used for the production of cookies, pastries and other confectionery products [9].

Agnello PD. et al., (2016) directed their studies to formation of protein polymer in the production of noodles of einkorn (*Triticum monococcum*) and Semolina Mixtures. Pasta was obtained by replacing 50% of Semolina Mixtures with einkorn wheat flour, that was characterized by increased protein polymer in terms of pasta made from other flour. Also, these noodles had greater adhesion and hardness compared to pasta made from other types of flour [2].

CONCLUSION

Einkorn wheat *(Triticum monococcum L.)* originates from Turkey, but it is also very often found on the Balkan Peninsula. It contains a large amount of vitamins, minerals and antioxidants, but there are also a number of health benefits. Furthermore einkorn wheat has a high content of protein, phosphorus and potassium, compared to other types of wheat. Einkorn wheat is used to make pasta, flour, bread and animal feed.

REFERENCES

[1] Abdel-Aal E. S. M, Hucl P., Sosulski W. F., (1995), Compositional and Nutritional Characteristics of Spring Einkorn and Spelt Wheats, Cereal Chemistry Vol.72, No.6 pp. 621-624.

[2] Agnello P. D., Landriscina L., Schiavulli A., Lamacchia C., (2016), Polymeric Proteins Formation During Pasta-making with Einkorn (*Triticum monococcum*) and Semolina Mixtures and Effects on Cooking Behaviour and Acceptability, Journal of Food Processing & Technology Vol.7, Issue 2: 548.

[3] Brandolini A., Hidalgo A., (2011), Einkorn (*Triticum monococcum*) Flour and Bread, Flours and Breads and their fortification in health and diseace prevention Chapter 8 pp.79-87.

[4] Fogarasi L. A, Kun S., Tanko G., Banyai S. E, Vecseri H. B., (2014), A comparative assessment of antioxidant properties, total phenolic content of einkorn, wheat, barley and their malts, Food Chemistry 167, pp.1-6.

[5] Hidalgo A., Brandolini A., (2013), Nutritional properties of einkorn wheat (*Triticum monococcum* L.), J. Sci. Food Agric. 94, pp. 601–612.

[6] http://www.einkorn.com/einkorn-nutritional-facts/

[7] Lachman J., Orsák M., Pivec V., Jírů K., (2012), Antioxidant activity of grain of einkorn (*Triticum mono-coccum* L.), emmer (*Triticum dicoccum* Schuebl [Schrank]) and spring wheat (*Triticum aestivum* L.) varieties, Plant Soil Environ., *58*, (1), pp.15–21.

[8] Lùje H., Mùller B., Laustsen A. M., Hansen A. (2003), Chemical Composition, Functional Properties and Sensory Profiling of Einkorn (*Triticum monococcum* L.), Journal of Cereal Science 37, pp. 231-240.

[9] Sachambula L., Hartman I., Psota V., (2015), Einkorn Wheat Malting Quality, Sladovnická kvalita pšenice jednozrnky, No.61, pp. 320-325.

About the authors:

Eng. Technology's Gjore Nakov, Department of Biotechnology and Food Technologies, University of Ruse "Angel Kanchev", Branch Razgrad, e-mail: gore_nakov@hotmail.com;

Assoc. Prof. Viktorija Stamatovska, PhD, University St. Kliment Ohridski-Bitola, Faculty of Technology and Technical Sciences - Veles, Dimitar Vlahov bb, 1400 Veles, Republic of Macedonia, e–mail: vikistam2@gmail.com;

Eng. Technology's in Healthy Food by Zegin Ljupka Necinova, DOO Zegin, Naroden front 5/3-1 Skopje, Republic of Macedonia, e-mail: ljupka.necinova@gmail.com.

Assoc. Prof. Nastia Ivanova, PhD, Department of Biotechnology and Food Technologies, University of Ruse "Angel Kanchev", Branch Razgrad, e-mail: nastiav2001@yahoo.com;

