

Nutritional and bioactive properties of hulled and naked genotypes of oat intended for cultivation in Poland

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The area under oat cultivation is steadily shrinking over the last few decades in Poland, though in 2014 it was grown on nearly 0.460 Mha, constituting 6% of the area applied for all cereals. With the production of 1.460 Mt. Poland is one of the world's biggest producers of this cereal, utilizing about 80% for feed and 5% for human consumption, while the rest for sowing. Each of the end-uses of oat requires grains of specific quality parameters. Selection towards high end-use quality has been adopted as a priority direction in the oat breeding program in Poland. The following quality-related parameters of oat are executing in this program: the weight of grains, grain density and adjustment, content of hull, protein, fat and β -glucan (Nita, 2003; Prażak and Romanowicz, 2014). This breeding program is resulting in 31 cultivars of Polish origin currently admitted to the National List, representing 27 hulled genotypes and 5 naked genotypes and only one hulled cultivar from abroad.

What quality features should distinguish the oat cultivars for two major end-uses? Briefly, beyond general good parameters of agronomic suitability, excellent cultivars for feeding purposes should characterise with a large grain, low content of hull and high content of protein and fat. High hull content of oat is the main determinant of its use in feed for monogastrics (Svihus and Gullord, 2002). Considering the chemical attributes of oat genotypes with grains suitable for human consumption, such cultivars should stand out also in content of β -glucan, main component of dietary fibre, and other bioactive components (Wood, 2007; 2011). Regular eating of foods produced from oat, cereal having the greatest content of soluble β -glucan, which is considered to increase the viscosity of the gastrointestinal contents, leading to slower gastric emptying, enhanced gut fill, and slower absorption of nutrients, reduces the level of blood cholesterol and post-prandial glycaemic responses (Wood, 2007; Granfeldt et al., 2008; Whitehead et al., 2014). Knowledge regarding variability of the chemical composition is therefore of significant importance and help in proper and full utilization of established and newly developing varieties of oat.

The objective of this study was to determine the suitability of advanced breeding materials and varieties of oat currently approved for cultivation in Poland either as sources of high nutritional, bioactive and pro-healthy properties in human food or as valuable feed components for monogastrics. This objective was accomplished through the parallel examination of intact grain and its dehulled counterpart.

Material for the study comprised of 30 genotypes of hulled and 6 genotypes of naked types of oat, including 17 breeding lines and 19 cultivars registered in Poland, grown in one location in 2014. The following physico-chemical parameters were determined: thousand kernel weight, density, content of gross energy, protein, ash, lipids, starch, free sugars and dietary fibre (TDF) as a sum of water soluble and water insoluble non-starch-polysaccharides (NSP), including β -glucan and Klason lignin. To determine hullability and also for providing material for analyses, 50 g of the grain of each cultivar was dehulled by hand. All analyses were performed in duplicate with

standard procedures of AACC, 2011) and the results were expressed in dry matter basis (as % of DM).

On average, hull constituted 28% of the kernel weight and Bingo cv. had the lowest content (23.5%). This cultivar together with Scorpion showed the greatest weight of thousand kernels (40g vs. average value 31.7g). Hullability had the significant impact on chemical characteristics of the grain, negative on content of lipids, starch and soluble fractions of dietary fibre, while highly positive on TDF and its insoluble fractions. It was found a small, although significant variation in content of nutrients among the hulled oat analysed, in range from 3% for mineral, 8% for protein and to nearly 9% for free sugar contents and only lipids had value 11%. Overall, Bingo was the cultivar with the best nutritional characteristics, measured as a sum of protein, lipids, minerals, starch and free sugars content, equal 71%, while the average value was 66%. Three breeding lines set in this respect apart from the others, showing the values exceeding 69%. In the case of dietary fibre oats tested characterised with content of this pro-healthy component in range from 28% in a breeding line to more than 39% in Berdysz cv. The insoluble components made up 89% of the total TDF quantities, specifically 58% I-NSP and 31% lignin.

Removing hulls from oat increased content of these ingredients, which are located in endosperm and germ of the kernel. In this way, content of nutrients has been increased by an average of 25%, with the greatest changes in lipids (by 39%) and protein (by 31%). TDF content dropped by 65% to the level comparable with wheat (12%), although β -glucan increased by 38%. Chemical characteristics of hullless cultivars was similar to that of dehulled grains.

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