NUTRITIONAL PROPERTIES OF ANCIENT WHEATS AVAILABLE ON THE BELGIAN MARKET

Introduction
There is an increasing interest in ancient wheats from farmers, companies and consumers. To be able to apply these ancient wheats in bakery products, more knowledge is necessary on the quality, processability and nutritional properties of the cereals and derived meal or flour. The ancient wheats are believed to have a superior nutritional composition to the modern ones due to the "yield dilution phenomenon" causing lower micronutrient contents. However, information on the quality aspects and nutritional properties of ancient wheats in Belgium is scarce, especially of refined flour. In Alterbake, a research project, the application possibilities of ancient wheats are being investigated. A sample set of ancient wheats including einkorn (T. monococcum), emmer (T. dicoccum) and khorasan wheat (Kamut, T. turgidum ssp. farroculinum) was purchased from local suppliers. The aim of this study was to compare the nutritional composition of the ancient wheats to bread wheat and gain insight on some functional properties, digestibility and the influence of milling.

Methods
Einkorn, emmer and Kamut kernels or whole meals (n=5) were purchased from the Belgian market. Refined flours (n=2) were milled with a Bühler pilot mill. Macro- and mineral composition were determined on each sample once and vitamin composition on 2 samples per ancient wheat (2 whole meals and 2 refined flours). Therefore, no statistics could be performed on refined flours and vitamin composition. Macronutrients were determined according to standard methods: protein content (Dumas X N 5.7; ISO 16645-1); crude fat (ISO 6492); total dietary fibre (AOAC 985.28); moisture content (ICC 1101); and ash content (ICC 104). Carbohydrates were calculated by difference. Mineral composition was measured with ICP-AES (ISO 11885). Vitamin B1 (NIN EN 14122), B2 (NIN EN 14525) and E (NIN EN 12822) were evaluated as vitamins in 2 whole meal and 2 refined flours per species. Nutritional properties of the ancient wheats were compared with wheat data found in usda database (n=5). Some functional properties of the refined flour were also analysed (Zeleny sedimentation (ICC 116), wet gluten content and quality (Glutomatic, ICC 155) and damaged starch (SMatic Chopin, ICC 172) and compared with a commercially available flour (Epi B, Panflower). In vitro- starch digestibility was determined using an assay kit GohGOd-format K-GLUC O9 (Megazyme International Ireland Ltd), the in vitro protein digestibility (IPD) was performed by a multi-enzyme system, as described by Hou et al. (1997).

Results
Macro composition

Minerals
All ancient wheats appear to have higher mineral content than bread wheat. However, this could not be statistically proven for all analyzed minerals. Only einkorn has a significant higher content of Ca and K, while emmer has a higher P content (p<0.05). Furthermore, the ancient wheats have statistically significant higher sodium contents (p<0.05). Intensive selection and cultivation of bread wheat could lead to the ‘yield dilution phenomenon’. Also, because of the dwarfing gene in common wheat (which is not present in the ancient wheats), the roots have a lower capacity to collect minerals from the soil. Among the ancient wheats, the highest mineral losses can be found in einkorn. Because of the soft texture of einkorn kernels, it was extremely difficult to mill using a roller mill. The refined einkorn flour is very sticky and regularly clogged the mill. As a result the flour yield was low and large parts of the endosperm were lost with the bran. Because minerals are mainly located in the bran, the larger losses for einkorn could be explained.

Vitamin composition

In vitro digestibility
Emmer showed the highest fraction of resistant starch (85%, 9.3% starch) while Kamut showed a low fraction of RS (3%, 5.2%). Resistant starch is fermented in the large intestine, releasing short fatty acids which are considered as beneficial. Kamut consists of a high portion of rapid digestible starch (RDS), which causes a rapid increase in blood glucose level after ingestion. Slowly digestible starch on the other hand, releases glucose slowly and consistently over and extended time. Einkorn showed the highest values for this parameter of starch digestibility. No statistical difference could be found in protein digestibility between einkorn and emmer.

Conclusion
Ancient wheats commercially available on the Belgian market were investigated for their nutritional profile. It was shown that differences with normal bread wheat were limited. Einkorn and emmer have higher ash- and fat content. Vitamin B1 content of einkorn and Kamut was superior to bread wheat, while vitamin E content in emmer was higher than in bread wheat. When introduced into an normal diet, these small nutritional differences will not have great health beneficial effects. The differences in (in-vitro) digestibility may not necessarily mean they are healthier, as the digestibility depends on the structure of the end product (e.g. baking and storage time, compact vs airy...). Einkorn in specific, but the ancient wheats in general, have weak protein quality (compared to bread wheat), which makes it difficult to use them for Belgian breads. Other techniques, e.g. sourdough, poolish, overnight proofing, cold doughs, could be used to produce breads with an aimed, more open crumb structure and good volume.

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