Concurrent Session 14: Folate

Enhancing folate levels in cereal products
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Background – Folate is a B vitamin, which acts as a coenzyme in single carbon transfer reactions to synthesize components of DNA, RNA and proteins. Folate deficiency causes megaloblastic anemia and neural tube defects. In addition, association of folate with cardiovascular diseases, certain cancers and cognitive disorders is under active research. In many countries folate intake has been shown to fall below recommendations. Therefore, mandatory or voluntary fortification is widely accomplished. In countries, which do not practice fortification, enhancing folate levels by other means is important. In Finland, cereal products provide ca. 40% of the daily folate intake. Therefore, increasing folate levels in cereal products further would significantly effect folate status of the population.

Review – We have studied possibilities to increase folate levels in cereal products by selecting optimal cereal raw materials and by utilization of in situ folate synthesis. We have mainly focused on rye and wheat fractionation and bioprocesses, such as fermentation, malting and germination. Variation of folate levels between varieties has also been investigated. A microbiological assay on microtiter plates after tri-enzyme extraction was used to measure total folate contents and HPLC after purification with affinity chromatography to determine folate vitamer composition of selected samples.

Genetic and environmental factors affect folate levels in cereal raw materials. However, fractionating the grains and utilizing the folate-rich fractions was shown to be a more efficient mean to enhance folate levels in cereals raw materials and thus those of the final products. Fractionation of rye grains by a roller mill at laboratory scale to bran, short, and two flours led to products with folate contents ranging from ca. 10 µg/100 g (flour) to ca. 110 µg/100 g (bran). In wheat fractions, taken from a commercial scale mill, the folate contents increased linearly with the ash content up to 4% ash. In rye milling fractions the correlation was not that unambiguous. However, when the ash content exceeded 3% (approximating to 25% fibre content) the folate levels were relatively high, ca. 110–130 µg/100 g.

Both germination/malting and fermentation enhanced folate contents. As an example, germination of rye grains for six days at 25 °C led to 3.5-fold higher levels as compared with the grains. Fermentation with yeast in rye and wheat baking processes was shown to significantly enhance folate levels. For instance, a total folate content 62 µg/100 g in the flour led to a folate content 162 µg/100 g after the fermentation step in rye bread baking. Some bacteria also produce folate.

Conclusions – Utilization of folate-rich cereal fractions would significantly increase folate levels and simultaneously contents of many other bioactive compounds in cereal-based foods. Developing further bioprocesses, especially fermentation, offers a useful means to enhance folate contents in foods available for the entire population.

References