GCIRCBUL10*23

# Determination of in vivo degradation and transformation of glucosinolates

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## ABSTRACT

Degradation of intact glucosinolates or their transformation into other products and glucosinolate absorption from the gastrointestinal tract were investigated by *in vivo* and *in vitro* experiments with rats. The *in vivo* experiments were performed as a study of the *in vivo* absorption and/or degradation of individual intact glucosinolates in all parts of the gastrointestinal tract of rats. In the *in vitro* experiments, the absorption of intact glucosinolates in form of active- and passive transport across the intestinal wall was investigated using the intestine of rat and hamster as everted sacs. Moreover, *in vitro* degradation studies were performed using rapeseed meal with and without heat-inactivation of myrosinase for the experiments. Analyses of glucosinolates were based on HPLC (1) and HPCE (2) after group separation, purification, and concentration of intact glucosinolates and their on-column desulfatation products (3).

## RESULTS AND DISCUSSION

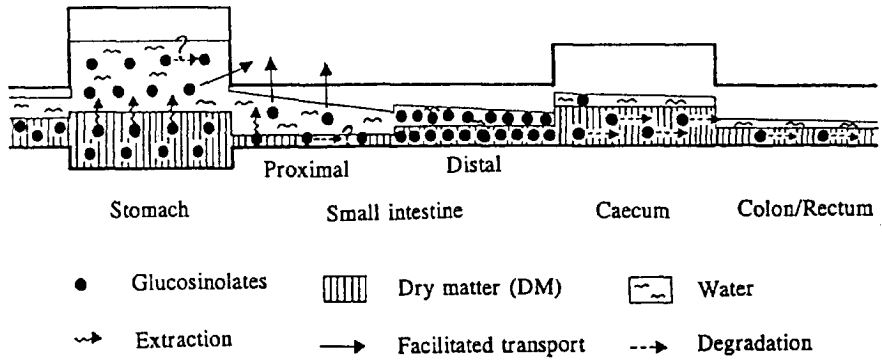
The rats in the *in vivo* experiments were fed a standard diet added isolated glucosinolates and five rats were used per group for each glucosinolate. The results showed a 3- to 20-fold lower concentration of glucosinolates in the content from the stomach and the first parts of the small intestine compared to the concentrations in the applied feed. The glucosinolate concentrations increased again in the contents from the distal part of the small intestine and were finally reduced to very low values in contents from caecum and colon, with great variations between the individual animals.

The *in vitro* studies of glucosinolate degradation were performed to obtain more specific information on the extend of the degradation in the different part of the gastrointestinal tract of rats within a reasonable period of time. The rats were fed a diet containing either unheated rapeseed meal with myrosinase activity or heated rapeseed meal without myrosinase activity (4). The glucosinolate degradation was followed during 24 hours periods in homogenates of the content from all parts of the gastrointestinal tract with and without homogenates of the corresponding parts of the intestinal walls. These studies revealed limited degradations when glucosinolates were dissolved in homogenates of tissue and content of the stomach and small intestine, whereas appreciable degradations were found when the caecum and/or colon contents were used.

Figure 1 show an illustration which explain the results obtained from both the *in vivo* and the *in vitro* experiments. The presence of much water and the physical and chemical activity in the stomach will probably result in extraction of glucosinolates from the feed. The low and varying concentrations of glucosinolates in content from the stomach by the *in vivo* experiments could be explained by extraction of the glucosinolates to the water phase, which will pass faster than the rest of the content in the stomach. Depending on the time passed since the individual animals have partake of feed and water, different times of extractions will

explain the varying decrease in the concentration of glucosinolates in the content of the stomach. The *in vitro* experiments showed that only a limited glucosinolate degradation occur in the first parts of the gastrointestinal tract.

Figure 1. Schematic illustration of glucosinolate content (μmol/g DM) and fate in segments of the gastrointestinal tract of rats.




The heat inactivation of myrosinase activity in the rapeseed meal fed to rats did not affect *in vitro* glucosinolate degradation in contents from stomach or small intestine, whereas the degradation seemed to be prevented in contents from caecum or colon, when feeding heated rapeseed meal compared to unheated meal. This could indicate an effect from dietary fibres or reversibly inactivated myrosinase associated to the dietary fibres in the first parts of the alimentary tract and released after fermentation of dietary fibres in the caecum/colon.

The *in vitro* studies of active or passive transport of glucosinolates across the intestinal walls were performed with individual glucosinolates and everted sacs of intestine of rat and hamster in a special solution for maintaining intestinal wall function. None of the glucosinolates were absorbed actively across the intestinal walls for any parts of the gastrointestinal tract investigated, as found with glucose. However, an appreciable passive or facilitated transport was found. The presence of glucosinolates did not affect the active glucose transport.

The appreciable difference in glucosinolate concentrations in dry matter contents of the various intestinal parts is therefore likely to be caused by extraction of glucosinolates to the fast moving waterphase in the stomach, absorption of intact glucosinolates in the upper gastrointestinal tract, and degradation transformation of the remaining glucosinolates in the distal gastrointestinal tract of rats (Figure 1). A more detailed description of the studies have been published elsewhere (5).

## REFERENCES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