

# Health promoting foods from cabbage using lactic acid bacteria



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## Introduction

Consumption of cruciferous vegetables, rich in secondary metabolites glucosinolates, has been shown in numerous studies to reduce cancer risk at several organ sites including breast carcinoma. The hydrolytic products of glucosinolates, indoles and isothiocyanates (ITC), have shown chemoprotective efficacy against various cancers.

## Objectives

At MTT, a lactic acid bacterium (LAB) *Lactobacillus sakei* DSM 14486 was isolated and used in sauerkraut production. The results showed that *L. sakei* DSM 14486 was able to increase the amount of degradation products. The effect of fermented cabbage was studied in a pre-clinical mammary cancer model.

## Methods

White cabbage was inoculated with mixed culture of *Lb. sakei* DSM 15298 (90 %), *Leuconostoc* sp. DSM 14486 (5%), and *Lactobacillus paraplantarum* DSM 14485 (5%) for two weeks. Control cabbage was shredded, mixed with water, heat treated at 85 ° C in order to inactivate myrosinase and microbial activity and homogenized. Both treatments were dried with a blow drier at room temperature for two days and finally freeze dried. The samples were stored at -20 ° C before the animal test. In a preliminary experiment it was confirmed that breakdown products, including ITCs remained after the process.

Four different test feeds and a control feed were prepared using a semi-synthetic basic feed in order to control the feed composition. Test feeds contained either 2 % or 10% of freeze-dried cabbage or sauerkraut. According to the original hypothesis, the fermented sauerkraut contained more glucosinolate breakdown products than unfermented cabbage. The compositions of all feeds were equilibrated for their nutrient, salt and energy concentration.

The concentration of glucosinolates was determined by HPLC method (EN ISO 9167-1:1995) and the volatile breakdown products, e.g. ITCs by GC-MS method in as in Tolonen et al. (2002) and Tolonen et al. (2004).

The study was conducted using experimental hormone-responsive mammary cancer model, in which a single oral dose of the carcinogenic dimethylbenzanthracene (DMBA) induced mammary tumorigenesis in rats.

## Results

This experiment showed that the addition of fermented sauerkraut or unfermented cabbage to the feed inhibited the growth of mammary tumors in rats. The effect was dose-responsive in animals fed with unfermented cabbage, while in animals fed with 2% or 10% sauerkraut, tumor growth inhibition was similar. The findings suggest that both unfermented and fermented cabbage (sauerkraut) contain tumor growth repressing components.

In sauerkraut fed animals, the ratio of regressing tumors increased, meanwhile the ratio of progressing tumors decreased. This suggests that the fermentation of cabbage increases the amount of components, such as breakdown products of glucosinolates, which more efficiently attenuate the tumor growth compared with unfermented cabbage.

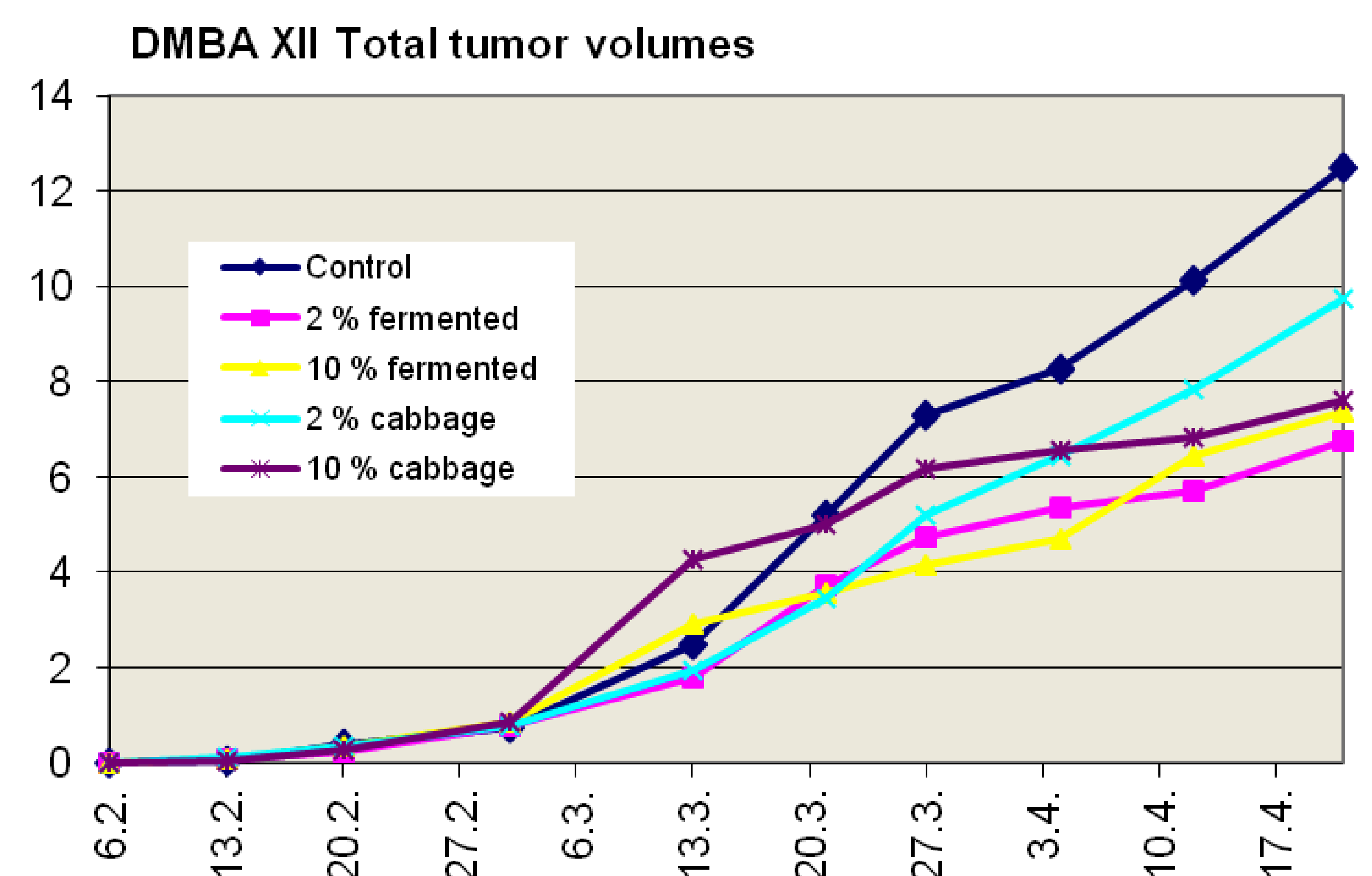


Figure 1. Cumulative volumes of carcinogen-induced mammary tumors of rats during the experiment.

## Conclusions

The fermentation efficiency and quality of the final products can be improved by selected LAB cultures and the process can provide new alternatives for the development of food products with potential beneficial health effects.

## References

- Tolonen et al. 2002. J Agric. Food Chem. 50, 6798-6803.
- Tolonen et al. 2004. Food Microbiology 21:167-179.

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