

Changes in mouse gastrointestinal microbial ecology with ingestion of kale

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SHORT COMMUNICATION

Abstract

Kale, a cultivar of *Brassica oleracea*, has attracted a great deal of attention because of its health-promoting effects, which are thought to be exerted through modulation of the intestinal microbiota. The present study was performed to investigate the effects of kale ingestion on the gastrointestinal microbial ecology of mice. 21 male C57BL/6J mice were divided into three groups and housed in a specific pathogen-free facility. The animals were fed either a control diet or experimental diets supplemented with different commercial kale products for 12 weeks. Contents of the caecum and colon of the mice were processed for the determination of active bacterial populations by a bacterial rRNA-based quantification method and short-chain fatty acids by HPLC. rRNAs of *Bacteroides-Prevotella*, the *Clostridium coccooides-Eubacterium rectale* group, and *Clostridium leptum* subgroup constituted the major fraction of microbiota regardless of the composition of the diet. The ratio of *Firmicutes* to *Bacteroidetes* was higher in the colon samples of one of the kale diet groups than in the control. The colonic butyrate level was also higher with the kale-supplemented diet. Overall, the ingestion of kale tended to either increase or decrease the activity of specific bacterial groups in the mouse gastrointestinal tract, however, the effect might vary depending on the nutritional composition.

Keywords: *Firmicutes*, *Bacteroidetes*, microbiota, gastrointestinal tract

1. Introduction

Vegetables from the *Brassica* genus (*Brassicaceae* family) are some of the most widely consumed vegetables in the world. Among *Brassica* vegetables, kale (*Brassica oleracea* L. convar. *acephala*) has been reported to exhibit the highest antioxidant capacity and possess high concentrations and varieties of vitamins, minerals, dietary fibre, glucoraphanin, carotenoids, and polyphenols (Nilsson *et al.*, 2006; Williams *et al.*, 2013). Glucoraphanin is a kind of glucosinolate, which is metabolised by certain bacteria in the gastrointestinal (GI) tract. This microbial metabolism may increase the conversion of glucosinolates into bioactive compounds (isothiocyanates), which have been suggested to show health-promoting effects on the host (Mullaney *et al.*, 2013). This includes an antibiotic-like effect, resulting in growth inhibition of harmful bacteria (Aires *et al.*, 2009). In this way, kale ingestion appears to be intimately involved in a change in the intestinal flora but a direct link has to be elucidated yet. Therefore, the present study

was performed to investigate the effects of kale ingestion on the GI microbial ecology of mice, which may affect the metabolic potential of the GI tract.

2. Materials and methods

Animals and diets

Mice were cared for according to the Guide for the Care and Use of Experimental Animals of the Shinshu University. Twenty-one five-week old male C57BL/6 mice were housed in a specific pathogen-free facility. The control diet (67% carbohydrate, 19% protein, 4% fat, and 4% ash) consisted mainly of casein (190 g/kg diet), maize starch (300 g/kg), sucrose (330 g/kg), cellulose (47 g/kg), soybean oil (22 g/kg), lard (18 g/kg), vitamins, and minerals. After a one-week acclimatisation period on the control diet, the animals were fed either the control diet or one out of two experimental diets supplemented with different commercial kale products (referred to as kale A and B)