



Does kimchi deserve the status of a probiotic food? 작성방법

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REVIEW



Does kimchi deserve the status of a probiotic food?

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ABSTRACT

Kimchi is a traditional fermented vegetable side dish in Korea and has become a global health food. Kimchi undergoes spontaneous fermentation, mainly by lactic acid bacteria (LAB) originating from its raw ingredients. Numerous LAB, including the genera *Leuconostoc*, *Weissella*, and *Lactobacillus*, participate in kimchi fermentation, reaching approximately 9–10 log colony forming units per gram or milliliter of food. The several health benefits of LAB (e.g., antioxidant and anti-inflammatory properties) combined with their probiotic potential in complex diseases including obesity, cancer, atopic dermatitis, and immunomodulatory effect have generated an interest in the health effects of LAB present in kimchi. In order to estimate the potential of kimchi as a probiotic food, we comprehensively surveyed the health functionalities of kimchi and kimchi LAB, and their effects on human gut environment, highlighting the probiotics function.

KEYWORDS

fermented food; kimchi;
lactic acid bacteria; probiotic

Introduction

Kimchi is a traditional fermented vegetable side dish in Korea, prepared by blending the pre-brined main vegetables such as kimchi cabbage or radish, various seasonings such as red pepper, garlic, ginger, green onion, sliced radish, salt, sugar, and minor ingredients including fermented seafood, fruits, vegetables, meat, fish, and cereals. The mixture of input ingredients in the fermentation process gives kimchi unique organoleptic characteristics that influence appetite. Kimchi is sorted based on various criteria, including water-iness, main ingredients, and preparation differences. There are hundreds of varieties of kimchi that differ in ingredients and methods, with distinctive nutritional, biochemical, and organoleptic features (Jung, Lee, and Jeon 2014). Broadly, the common characteristics of kimchi are salted ingredients, fermentation at a relatively low temperature (below 10 °C), and fermentative microbes derived from various raw ingredients (Jung, Lee, and Jeon 2014; Lee et al. 2020).


Kimchi is a well-known health food worldwide. Kimchi has low calories (18kcal/100g), several vitamins (vitamin A, vitamin C, thiamin, and riboflavin), minerals (calcium, potassium, iron, and phosphorus), and dietary fiber (24% on a dry basis) (Patra et al. 2016). In addition, kimchi contains functional and bioactive components including gingerol, capsaicin, carotenoids, allyl compounds, isothiocyanate, and indole-3-carbinol. Several health benefits of kimchi consumption in the experimental animal models have been

reported: anticancer activity in mouse with colitic cancer models by kimchi intake (Han et al. 2020b); anti-obesity activity in mice by kimchi or kimchi-derived LAB intake (Park, Oh, et al. 2020; Park, Kwon, et al. 2020); antidiabetic activity in rats by kimchi intake (Islam and Choi 2009); alleviation of obesity-induced neuroinflammation in mice by kimchi intake (Kim, Dang, and Ha 2022b). These health benefits result from the high nutritive raw ingredients as well as fermentation by kimchi microbiota (Patra et al. 2016). Kimchi undergoes spontaneous fermentation, mainly by lactic acid bacteria (LAB) originating from its raw ingredients (Lee, Jung, et al. 2015). A study conducted by Lee et al. (2020) reported that in cabbage kimchi, the LAB count reached approximately 9–10 log colony forming units (CFU) per gram or milliliter of food. Numerous LAB, including the genera *Leuconostoc*, *Weissella*, *Lactobacillus*, and *Pediococcus*, participate in kimchi fermentation (Kim, Dang, and Ha 2022a). The kimchi microbiota, including LAB, varies depending on its raw ingredients (Jeong et al. 2013).

Fermented food is an excellent source of LAB. Accordingly, dietary intake of kimchi may contribute to the enrichment of the microbiota of the gastrointestinal tract. Several reviews have described fermented foods containing identified or potential probiotics, particularly LAB, and human studies have reported that microorganisms in fermented foods can remain alive during the digestion process and reach the colon (David et al. 2014; Han et al. 2015; Heinen, Ahnen,

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