Chapter 18
Health Promoting Effects of Kimchi

Kim Hyun Ju
World Institute of Kimchi, Korea

Han Eung-Soo
World Institute of Kimchi, Korea

ABSTRACT

Kimchi is a traditional Korean food manufactured by fermenting vegetables with probiotic Lactic Acid Bacteria (LAB). Many bacteria are involved in the fermentation of kimchi, but LAB become dominant while the putrefactive bacteria are suppressed during salting of baechu cabbage and the fermentation. The addition of other subingredients and formation of fermentation byproducts of LAB promote the fermentation process of LAB to eventually lead to eradication of putrefactive and pathogenic bacteria, and also increase the functionalities of kimchi. Accordingly, kimchi can be considered a vegetable probiotic food that contributes health benefits in a similar manner as yogurt as a dairy probiotic food. Further, the major ingredients of kimchi are cruciferous vegetables; and other healthy functional foods such as garlic, ginger, red pepper powder, and so on are added to kimchi as subingredients. As all of these ingredients undergo fermentation by LAB, kimchi is regarded as a source of LAB; and the fermentative byproducts from the functional ingredients significantly boost its functionality. Because kimchi is both tasty and highly functional, it is typically served with steamed rice at every Korean meal. Health functionality of kimchi, based upon our research and that of other, includes anticancer, antiobesity, anticonstipation, colorectal health promotion, probiotic properties, cholesterol reduction, fibrolytic effect, antioxidative and antiaging properties, brain health promotion, immune promotion, and skin health promotion. In this review we describe the health functionalities of kimchi and the probiotic properties of its LAB.

BLOOD CIRCULATION EFFECTS

Lipid Lowering Effects

Cholesterol in the blood is essential to maintain homeostasis of the human body, being involved in several physiological functions such as producing hormones and vitamins, and maintaining cell membranes,

DOI: 10.4018/978-1-5225-5207-9.ch018

and nerve cells. It is derived from both exogenous dietary sources and endogenous biosynthetic pathways. Dietary cholesterol plays a huge role in serum cholesterol levels, since cholesterol is synthesized to a minimal level for balancing. As diet patterns have been changing towards western style, elevated blood cholesterol is becoming more common. Hypercholesterolemia is one of the major risk factors for cardiovascular disease, and the leading cause of death in many countries (Law et al., 1994). The risk of heart attack is three times higher in those with hypercholesterolemia, compared to those who have normal blood lipid profiles, and it was reported that hypercholesterolemia contributed to 45% of heart attacks in Western Europe and 35% of heart attacks in Central and Eastern Europe from 1999 to 2003 (Yusuf et al., 2004).

In a study investigating blood lipid concentration according to kimchi consumption in middle-aged males, individuals with greater kimchi consumption showed higher dietary fiber and calcium intake, and HDL-cholesterol was positively correlated with kimchi consumption. Meanwhile, there was a positive correlation for salty taste preference with blood neutral lipids and total cholesterol levels, and there was a negative correlation for spicy taste preference with systolic blood pressure, blood neutral lipids, and total cholesterol levels, and these results are consistent with animal studies (Kwon et al., 1999). In one study, the kimchi ingredients known to have a particularly good antioxidant effect were added at 30% the amount of mustard leaf to make cabbage kimchi; this was manufactured into a pill, and when subjects ate 3g per day for 6 weeks, although there was no change in body fat or obesity, blood neutral lipid levels and LDL/HDL-cholesterol ratio significantly decreased. When the water-soluble and water-insoluble fractions of kimchi were made into separate pills, both groups showed a blood lipid-reducing effect, but the water-soluble pill had a greater neutral lipid-reducing effect, and the water-insoluble pill had a greater effect of increasing HDL-cholesterol concentration. Therefore, it is thought that there is a difference in the active ingredients or mechanisms of the two solvent extracts (Choi et al., 2001). These lipid-reducing effects of kimchi and kimchi ingredients have been reported in epidemiological studies, animal studies, and clinical trials. Lactic acid bacteria (LAB) have attracted attention with its cholesterol lowering functionality, especially considering the fact that members of the genera Lactobacillus, Lactococcus, are most commonly given safe or generally recognized as safe (GRAS) status, and the safety of probiotics has been well proved over a long period of experiences. Supplementation of *L. plantarum* CIB 001 can have short-term (6 weeks) effects on blood lipids and liver injury, as well as on the atherogenic index and cardiac risk factors (Cha et al., 2012). Leu. Kimchi GJ2 isolated from kimchi exerts an antiatherosclerotic effect by reducing serum and liver cholesterol levels (Lee et al., 2008). In spite of continued interest in cholesterol lowering potential of LAB strains, all related mechanisms are not fully understood yet, and several hypotheses are still being investigated in an attempt to explain the observed hypocholesterolaemic effects. A study group focused on the effect of 3 LAB strains (*Lactobacillus plantarum* A6a2, *Lactobacillus sakei* C10, *Lactobacillus brevis* J23) isolated from kimchi, for controlling cholesterol efflux in enterocytes, by ATP binding cassette (ABC) transporters, which are direct target genes of liver X receptors (LXR α/ß). *Lactobacillus rhamnosus* LGG was used as control. The treatment of Caco-2 cells with the LAB strains resulted in up-regulation of the LXRs and an increased expression of intestinal sterol efflux transporters ABCG5/ABCG8. Furthermore, cholesterol isotope assay confirmed the results, showing an increase in cholesterol efflux, and therefore, suggesting that up-regulation of LXR-ABCG5/8 is one of the mechanisms for the cholesterol lowering ability of LABs (Kim, 2012). LXRs are ligand-activated transcription factors and key regulators of cholesterol homeostasis. When activated by ligands, they undergo a conformational change that recruits coactivator proteins and regulate transport, catabolism, and elimination of lipid, by enhancing transcription of the