

Fermented Vegetables: Kimchi and Its Health Benefits

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Abstract: Kimchi is a fermented and salted vegetable dish common in Korea. Kimchi comes in just as many variations as there are vegetables and almost any vegetable can be fermented. This kimchi is made with baechu, also known as napa cabbage, and is known as baechu kimchi or pogi kimchi because the head of the cabbage is left intact. Kimchi (Cabbage) is a low-calorie food high in vitamins (vitamin C, beta-carotene, vitamin B complex, and so on), minerals (Na, Ca, K, Fe, and P), dietary fiber (24 percent dry basis), and other functional components such as capsaicin, allyl compounds, gingerol, isothiocyanate, and chlorophyll. Anticancer, antiobesity, and antiatherosclerotic effects have been demonstrated for phytochemicals found in kimchi, such as benzyl isothiocyanate, indole compounds, thiocyanate, and b-sitosterol. Yellow-green vegetables, which are commonly used in kimchi, have been shown to help prevent cancer, improve immunity, delay the aging process, and prevent constipation. When kimchi is fermented, it becomes more flavorful and versatile, as well as a strong source of probiotics. This article summarized the health benefits of kimchi.

Keywords: kimchi, cabbage, fermented food, phytochemicals, functional components

I. Introduction

Kimchi is a popular Korean dish made from fermented and salted vegetables. Since almost any vegetable can be fermented, kimchi comes in almost as many varieties as there are vegetables. This kimchi is made with baechu, also known as napa cabbage, hence the name baechu kimchi, or pogi kimchi because the cabbage is kept intact at the head. Pogi refers to both a vegetable's "head" and a Korean radish. It comes with a variety of flavors. Garlicky, sour, and spicy tastes are predominant. These flavors are derived from the ingredients in the Seasoning. Chili peppers, scallions, garlic, and ginger are popular seasonings. Depending on the type of kimchi you produce, there are hundreds of different varieties. Some can be very spicy, but with homemade kimchi, you can control the amount of heat. Kimchi is commonly served as a side dish or as an ingredient in traditional Korean dishes such as porridges, soups, and rice. Kimchi, also known as kimchee, is a popular Korean side dish. Kimchee is how South Koreans spell it. Apparently, the term 'kimchi' was coined by Japanese, and it's a word war. Korean kimchi has gained global popularity as a safe probiotic food over the last decade or so.

Nutritive value of kimchi

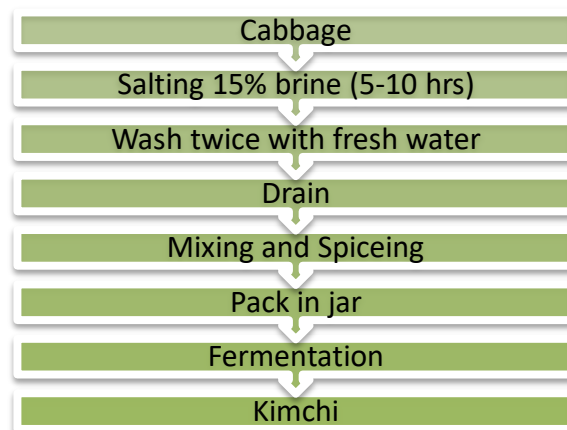
Nutritive value per 100 g

Nutrients	Value
Total calories	15 Kcal
Protein	1 g
Carbohydrate	2 g

Dietary fiber	1 g
Omega 3-EPA	8 mg
Omega 3-DHA	11 mg
Cholesterol	0 mg
Calcium	33.00mg
Potassium	151 mg
Iron	2.50 mg
Vitamin A	94 µg RAE
Vitamin B6	0.1 mg
Vitamin B12	0.2 µg
Vitamin C	28 mg
Vitamin D	0 µg

Table 1: Nutritive value of Kimchi per 100g

Process flowchart of kimchi



Kimchi seasonings

The flavor of kimchi varies greatly depending on the consistency, form, and proportion of seasoning ingredients used. Every Korean household has its own recipes, which are also influenced by the local flavors. Gochugaru (Korean red chili pepper flakes), garlic, ginger, and chopped radish, in addition to Korean coarse sea salt.

II. Procedure for Making Kimchi

The thick white section of the cabbage should be cut in half lengthwise. Make a brine solution with half the salt and soak each cabbage quarter in the salt water in a bowl one at a time. Starting with the outermost leaf, generously sprinkle the other half of the salt over the thick white portion of each leaf. Now it's your turn. Over the cabbage, pour the remaining salt water from the bowl. Allow for 6 to 8 hours of rest time, rotating the bottom ones to the top every 2 to 3 hours. After brining, thoroughly rinse three times, paying particular attention to the white pieces. Drain well with the cut side facing down. Toss together all of the seasoning ingredients with the shredded radish. You can now combine this seasoning with cabbage cubes or fill each leaf portion of the cabbage with it. Place it in a jar or an airtight bag, cut side up. Pour some of the radish mix over the kimchi after diluting it with water. Depending on the weather and how quickly you want your kimchi to ripen, leave it out at room temperature for a full day or two. After that, put it in the freezer.

Starter culture: Kimchi starter cultures must be able to adapt to the kimchi fermentation climate, which involves low temperatures, low pH, and the presence of NaCl. *Leuconostoc* spp. are often used as kimchi starters because they are thought to have beneficial effects on kimchi fermentation, such as improved sensory characteristics.

III. Physicochemical Change During Fermentation

Changes of pH during Storage

During the fermentation of kimchi, microorganisms use different enzymes to degrade or synthesize major components found in Chinese cabbage as well as minor ingredients (salted seafood, chili powder, green onion, garlic, and ginger). The breakdown of carbohydrates, a major component of Chinese cabbage, produces numerous organic acids, which give kimchi its distinct flavor. Kimchi stored at 10°C had a very short initial fermentation stage and a rapid pH decrease in the intermediate fermentation phase of 6 to 8 weeks, when pH remained 3.7 and pH values remained constant.

Changes of acidity during Storage

Various organic acids are produced during the fermentation of kimchi by the reproduction of microorganisms, lowering the pH and increasing the acidity of the kimchi. Microorganisms, sugar content, salt concentration, and temperature have all been confirmed to have a major impact on total acidity and pH. The buffer reaction of proteins and amino acids in kimchi is thought to be the cause of the pH drop, which is a steady decrease relative to the rise in total acidity. Since aerobic microorganisms not associated with acid development are temporarily involved during the early ripening of kimchi, lactobacillus remains inactive, and water is released from Chinese cabbage, the acidity does not increase significantly. Kimchi that had been ripened for two weeks at 10°C had a pH of 4.3 and an acidity of 0.7 percent.

Changes of Salinity during Storage

According to studies, the salinity variations between kimchi prepared on day 0 and kimchi stored at 4 and 10 degrees Celsius were investigated. With respect to temperature, the salt content ranged from 1.81 percent to 2.35 percent, indicating that the salinity of kimchi did not change significantly over time and temperature, and that salinity does not hinder the growth of microorganisms for kimchi fermentation.

Changes in Organic Acids Content

Oxalic acid, citric acid, tartaric acid, malic acid, succinic acid, lactic acid, fumaric acid, and acetic acid are all present during the fermentation of kimchi. The highest content of malic acid was found in kimchi stored from one week to eight weeks at different temperatures, with the highest content of malic acid being found at 4 C during early storage and the highest content of lactic acid being found at 10 C, followed by acetic acid. Citric acid and malic acid levels in kimchi steadily decrease as ripening progresses, while lactic acid and acetic acid levels rapidly rise. At the end of the ripening process, lactic acid is the most important organic acid.

IV. Type of Kimchi

Kimchi is a traditional Korean dish that has gained worldwide popularity in the last decade or so due to its health benefits and sheer deliciousness. Most people who are unfamiliar with Korean cuisine think of kimchi as the red, spicy, garlic-laden fermented cabbage dish that typically comes with Korean restaurant main courses. Kimchi can be made with a variety of vegetables and can also contain fish or meat.

- 1) Baek (White) Kimchi: Baechu kimchi is made by a similar process but uses milder ingredients.
- 2) Kkakdugi (Cubed Radish Kimchi): Kkakdugi is made of cubed Korean radish with about the same ingredients and in the same way as baechu kimchi.
- 3) Oi Sobagi (Cucumber Kimchi): Oi sobagi or “stuffed cucumber” kimchi is a refreshing, crisp, and spicy variation of kimchi with the traditional seasonings, Etc.

These are some types of kimchi prepared by using different vegetables in thick or watery consistency.

V. Health Benefits of Kimchi

Kimchi (Cabbage) is a low-calorie food that is rich in vitamins (vitamin C, b-carotene, vitamin B complex, and so on), minerals (Na, Ca, K, Fe, and P), dietary fiber (24 percent on a dry basis), and other functional components including capsaicin, allyl compounds, gingerol, isothiocyanate, and chlorophyll. Phytochemicals present in kimchi, such as benzyl isothiocyanate, indole compounds, thiocyanate, and b-sitosterol, have been shown to have anticancer, antiobesity, and antiatherosclerotic properties. Kimchi is often made of yellow-green vegetables, which have been shown to help prevent cancer, boost immunity, slow the aging process, and prevent constipation. When kimchi is fermented, it gains in flavor and versatility, as well as being a good probiotic food.

Following are the diseases controlled by consumption of Kimchi

1. Kimchi's anticancer properties are primarily attributed to the regulation of cancer cell apoptosis and the suppression of inflammation.
2. The antioxidative compounds in kimchi can act as hydrogen donors, removing free radicals produced in the body.

3. Treatment with kimchi, especially optimally ripened kimchi, reduced oxidative stress in cells by increasing cell viability and inhibiting lipid peroxidation.
4. Capsaicin, found in red pepper, stimulates spinal nerves, causing catecholamines to be released in the adrenal glands, causing body fat loss. This substance boosts metabolism and energy consumption.
5. Consumption of kimchi reduced very low-density lipid cholesterol while substantially raising HDL cholesterol levels in the blood.

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