



Taste of Korea: Kimchi

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What is Kimchi?

Kimchi is a well-known fermented vegetable food originating from Korea.¹ It was invented thousands of years ago and unique recipes making kimchi have been passed down from generation to generation in Korea.² Kimchi is made with many varieties of vegetables (examples: cabbage, radish, cucumber.), Korean red pepper, and other various seasonings and spices. It has long served as Korea's national dish and its use has recently been expanding globally. The popularity of kimchi has grown and it is enjoyed not only as a side dish but also as a key ingredient in a variety of Korean and Westernized dishes.³ Its spicy and crisp flavors blend in with a wide range of foods. In this article, basic information about Korea (kimchi's place of origin), kimchi (history, nutritional content, health benefits, kimchi products and prices), a family Kimchi recipe, and unique recipes using kimchi are introduced.

Korea

Korea is located on the Korean Peninsula in Northeast Asia. (See Figure 1) The peninsula is surrounded by the Yellow Sea to the west, and the East China Sea to the south. Since 1945, Korea has been divided into 2 states, North and South Korea. North Korea is bordered by China to the northwest and Russia to the northeast. South Korea is located on the southern half of the Korean Peninsula. The population of Korea is about 75 million (North Korea: 25 million, South Korea: 50 million). The most representative food preparation method in Korean cuisine is fermentation, which enhances the taste and quality of foods while preserving the foods. Kimchi is made using a distinctive fermentation process for preserving vegetables, predominantly cabbage but also many other vegetables. Kimchi is served with almost every meal in Korean households.⁴



Figure 1. Map of Korea

History of Kimchi

Agriculture was a prominent industry in ancient Korea. The cultivation of Korean red pepper (gochu) was recorded in many historical documents during the Three Kingdoms Period (37 BC – 668 AD), indicating that kimchi was being made by fermenting Korean red pepper powder / flakes (“gochugaru” See Figure 2) during this period.² According to historical records, the ancient farmers of Korea developed a storage method in response to the long cold winters, the most difficult season for agriculture. This method, known as “fermentation”, is a way of preserving kimchi by encouraging the growth of natural microorganisms—beneficial bacteria, such as lactic acid bacteria—that are present in kimchi’s raw ingredients including cabbage, red pepper, spices.²

Korean Red Pepper:

Red pepper powder (“gochugaru – Go-chu-ga-ru” See Figure 2) is the staple spice used to give kimchi its distinctive, intense, and spicy flavor. This hot powder also contributes on a microbial* level. Studies have found that the sole presence of gochugaru affects the fermentation of kimchi, increasing metabolite concentrations during the process. Particularly, the development of *Weissella cibaria*—a lactic acid-fermenting bacillus—has shown to be influenced by the addition of gochugaru (versus no pepper). It has been recently reported that *W. cibaria* possesses anti-inflammatory, anti-cancer, and anti-bacterial properties.⁵

***microbial** – from Greek, micro – small, bios – life; Characteristic of microorganism, such as bacterium,



Figure 2. Korean Red Pepper Powder (*Gochugaru*)

Napa cabbage:

Napa cabbage originated in China. It is a cool season vegetable and commonly grown in Arizona during fall and winter.⁶ Napa cabbage, the main ingredient of kimchi, is a barrel-shaped dense head with a firm, crunchy texture and milder flavor than traditional green head cabbage.⁷ (See Figure 3) Similar to other green vegetables, Napa cabbage is a good source of many vitamins and minerals. Napa cabbage can be eaten raw or cooked. When shopping for Napa cabbage, look for fresh, crisp-looking leaves that are firmly compact. At home, store Napa cabbage inside the refrigerator, wrapped



Figure 3. Napa cabbage

with newspaper for later use. Pests are commonly found in leafy cabbages. Thus, wash thoroughly in cold running water prior to use. Pepper spot, another name for black fleck on the midribs or leaf of Napa cabbage, develops from a physiological problem⁷ and adversely affects the appearance, but is safe to consume.

Nutritional and Health Benefits of Kimchi

The global expansion of kimchi is attributable to not only its unique taste and flavor, but also to its notable nutritional and health benefits. To explain the nutritional values of kimchi, *Napa cabbage kimchi*—the most traditional and popular kimchi—was reviewed here. (See Table 1)

Calorie, fat, and fiber:

Kimchi is a low-calorie, low-fat, and no-cholesterol vegetable-based side dish. There are 15 calories in ½ cup of Napa cabbage kimchi. Also, ½ cup of kimchi contains 1 gram of fiber. (The recommended daily amount of fiber is 25 grams for women and 38 grams for men. After age 50, the daily fiber recommendation drops to 21 grams for women and 30 grams for men.)⁸

Vitamins, minerals, and phytochemicals:

Kimchi is a rich source of various vitamins and minerals. It contains a range of vitamins, primarily vitamins A, B, C, and K. Kimchi contains minerals such as calcium, iron, phosphorous,

Table 1. Kimchi Nutrition Facts (1/2 cup, Napa Cabbage Kimchi)

Nutrient	Amount	% of Daily Target or Limit
Total Calories	15	1% limit
Protein	1 g	3% target
Carbohydrate	2 g	2% target
Dietary Fiber	1 g	2% target
Total Sugars	1 g	No daily target or limit
Total Fat	0 g	0% limit
Saturated Fat	0 g	0% limit
Monounsaturated Fat	0 g	No daily target or limit
Polyunsaturated Fat	0 g	No daily target or limit
Linoleic Acid	0 g	0% target
α-Linolenic Acid	0.0 3g	2% target
Omega 3 - EPA	8 mg	No daily target or limit
Omega 3 - DHA	11 mg	No daily target or limit
Cholesterol	0 mg	0% limit
Minerals		
Calcium	48 mg	5% target
Potassium	173 mg	4% target
Sodium	128 mg	6% limit
Copper	39 µg	4% target
Iron	0.39 mg	3% target
Magnesium	13 mg	4% target
Phosphorus	34 mg	5% target
Selenium	1 µg	1% target
Zinc	0.2 mg	2% target

Vitamin A	94 µg RAE	13% target
Vitamin B6	0.1 mg	10% target
Vitamin B12	0.2 µg	7% target
Vitamin C	28 mg	37% target
Vitamin D	0 µg	0% target
Vitamin E	0.15 mg AT	1% target
Vitamin K	28 µg	31% target
Folate	32 µg DFE	8% target
Thiamin	0.0 3mg	3% target
Riboflavin	0.1 mg	5% target
Niacin	1 mg	4% target
Choline	5 mg	1% target
Reference: SuperTracker – Food-A-Pedia (https://www.supertracker.usda.gov/foodapedia.aspx)		

and selenium. However, a word of caution, kimchi has high sodium content (128mg in ½ cup of kimchi). Consume in moderation, if sodium intake needs to be monitored.

Kimchi acquires phytochemicals (“phyto” means plant in Greek) — health-promoting compounds — from Napa cabbage, green onion, and garlic. Phytochemicals have overlapping mechanisms of action, including detoxification, anti-inflammation, and anti-oxidative, immune-stimulating properties, antibacterial, and antiviral effects.^{9,10} Phytochemicals found in kimchi have demonstrated anti-cancer¹¹ and anti-atherosclerotic functions.¹²

Health Benefits: Bacteria and Probiotics:

Supplying probiotic microorganisms, primarily bacteria, is one of the most important health-promoting features of kimchi. **Probiotics** are live microorganisms, bacteria that are used in the production of fermented dairy, vegetable and soy products.^{12, 13} The ingredients in kimchi— vegetables, garlic, gingers, and red pepper powder, function as a growth media for the bacteria and are the source of numerous bioactive compound produced during the fermentation process. Therefore, kimchi is an excellent vegetable-based, health-promoting probiotic food.^{12, 13}

Kimchi has many effects including prevention of inflammation, immune system promotion, and cholesterol reduction in relation to prevention of atherosclerosis. In addition, anticancer effects of kimchi have been reported. Kimchi’s main ingredient, Napa cabbage, has been considered to be effective for preventing stomach cancer and is known to prevent colorectal carcinogenesis due to its rich source of dietary fiber.¹⁴ Garlic, another ingredient of kimchi, has

shown possible cancer preventive effects in stomach cancer development by its antimicrobial activities against *Helicobacter pylori*, a major risk factor of stomach cancer.¹⁵ In addition to each ingredient of kimchi, lactic acid probiotics presented in kimchi suppress expression of carcinogen activating enzymes.¹⁶ Also, research has found lactobacillus (extracted from kimchi) to be effective against the Avian Influenza (bird flu).¹⁷ The mechanisms responsible for the efficacy of kimchi protecting against viral diseases are not well understood, and thus warrant future studies.

All of these properties make kimchi a nutritious, healthy food.

Buying Kimchi

Kimchi comes in a variety of flavors and sizes in the market. (See Figure 4) The types of kimchi include traditional Napa cabbage kimchi, cucumber kimchi, radish kimchi, and many more. Currently, three basic packages of kimchi products found in local supermarkets are 1) freshly-packed items of salad-type kimchi (called *Geotjeori* – fresh kimchi, seasoned, without fermentation), 2) refrigerated items of fermented kimchi, and 3) fermented, pasteurized items of shelf-stable kimchi.

Some kimchi products are made and distributed from Los Angeles, California, which holds the nation’s largest Korean population. Others are preserved and distributed directly from Korea in response to increasing consumer demand in both domestic and foreign markets. Table 2 shows the average prices of various kimchi available in Tucson, Arizona.

Table 2. Various Kimchi Types and Prices

Types of Kimchi	Average Price per 10 ounce
Whole Cabbage Kimchi (Beachu Kimchi)	\$1.71
White Kimchi (Beakkimchi)	\$1.40
Radish Cube Kimchi (Kkakdugi)	\$1.41
Young Radish Kimchi (Yeolmukimchi)	\$1.74
Whole Radish Kimchi/ Ponytail Kimchi (Chonggak Kimchi)	\$3.00
Cumcumber Kimchi (Oi-so-bagi)	\$1.52

Price of each type of kimchi were checked at 4-5 Asian markets in Tucson in 2015 and 2016, and averaged. There are many different types and packages are found in a market.



Figure 4. Kimchi in a Market

How to Make Your Own Kimchi - Korean Way³

Would you like to make your own kimchi at your home? Here, we introduce the ingredients and directions of making kimchi according to one family's tradition (Angela Kim). Various secondary ingredients (spices, nuts, fish sauce, etc.) may be added, depending on family traditions, seasonal and regional variations.

Making kimchi requires good hygiene practices, including proper hand washing, using clean utensils and countertop, and carefully following all directions in the recipe.^{3,18} A sharp knife and cutting board, a large mixing bowl, a colander, a glass storage container with a tight-fitting lid, disposable food handler gloves* are needed. Let's make your own kimchi!

*Food handler gloves are highly recommended for protection from red pepper powder.

Napa Cabbage Kimchi

Cooking time: 6-8 hours (not including fermentation)

Estimated cost: ~\$20 (for making with 3 medium head Napa cabbage)

Ingredients:

- 2-3 medium heads Napa cabbage (about 6-7 pounds total) (Tip: Look for green-colored Napa cabbage for best taste)
- 1 cup coarse salt for dissolving in water + 2/3 cup coarse salt for sprinkling on cabbage (Tip: Why do we use coarse salt? - easy to sprinkle and distribute salt evenly, but if you don't have coarse salt, use the same amount of table salt)
- 2 tablespoons sweet rice / "mochiko" flour (if you don't have mochiko, substitute sweet rice/ mochiko flour with water and a few tbsp. of sugar)
- 2 tablespoons minced garlic (adjust to your taste)
- 1 tablespoon minced ginger

- 1-1½ cups Korean red chili pepper powder (Gochugaru, See Figure 2)
- 1.5 pounds Korean radish
- 5-6 green onions (scallions)
- 3-4 tablespoons fish sauce (optional)

Directions:

Wash your hands with warm water and soap for 20 seconds before and after handling food. Wash all of the necessary utensils and containers before beginning.

1. Prepare Napa cabbage

- Rinse heads of Napa cabbage under cold water and drain.
- Trim cabbage cores, if they stick out
- Cut the cabbage lengthwise into quarters by cutting the stem end in half only about 3-4 inches in and then pulling apart to separate into two pieces by hand. Do the same for each half to make quarters.



2. Salt cabbage, set aside for 3-4 hours, and then wash

- In a large bowl, dissolve 1 cup of salt (coarse or table salt) in 8 cups of cold water in large mixing bowl.
- Dip each cabbage quarter in the saltwater one at a time, and place in another bowl.
- Using the other 2/3 cup salt (coarse or table salt), sprinkle over each trunk of cabbage equally.
- Allow cabbage to sit at room temperature for ~4 hours.
- Rinse cabbage quarters thoroughly 3 times with cold water to rinse away the salt.
- Drain well, and then place in a colander to drain out excess water (about 30 minutes).



3. Prepare seasonings

- Add sweet rice flour to 1 cup water in small saucepan. Simmer over low heat until it thickens to a thin paste. Set aside to cool.
- Wash, peel and finely mince garlic and ginger.
- Mix minced garlic, ginger with cooled sweet rice flour paste, and add Korean red pepper powder. (Now, you made seasoning paste.)
 - Tip: For those who cannot handle spicy foods, follow all the same steps except, omit red pepper powder to make white kimchi. To compensate for the lack of the bold flavors of red pepper powder, add pine nuts, chestnuts, and/or shredded pears to white kimchi.
- Wash, peel, and shred radish (using knife or “Mandoline” slicer). Wash and clean green onions, and cut into 1-inch long pieces. Set aside.

- Using disposable food handler gloves (recommended for hand protection from red pepper powder), mix the above seasoning paste and vegetables together in large mixing bowl. Then, mix in fish sauce. Mix well. (Now, you made kimchi paste mix.)



4. Spread kimchi paste and pack into a container

- Place the cabbage (cut side up) in a clean container. Spread kimchi paste mix onto each cabbage leaf, enough to smear each leaf and pack in between leaves.
 - Caution: Beware of overstuffing as spiciness will increase with more paste mix.
- When every leaf in a quarter of cabbage is covered with kimchi paste mix, wrap it around the outermost leaf, and place it in your container.
- Tightly pack all finished cabbages into the container.
- Press down hard and squeeze out excess air between the leaves.



5. Ferment

- Place sealed container out at room temperature for 18-24 hours, tasting it daily for your favorite sourness taste.
 - Tip: Around 18 hours, open the lid of the container to see if there are bubbles forming in the broth. For the best taste, place kimchi in refrigerator after bubbles start forming.
- Then, store in the refrigerator.

6. Store and enjoy!!

- Store fermented kimchi covered tightly in the refrigerator.
 - Tip: When kimchi ages and sours over time, it can be cooked and used in various dishes. (see recipes below)
 - Note: In Korea, most families have kimchi refrigerators, which keep the optimal temperature to achieve the best tasting kimchi. After 1-2 weeks of its creation, kimchi begins to sour. The consistent optimal temperature of a kimchi refrigerator keeps it from over-fermenting and souring.



Cooking with Kimchi

The growth of kimchi use is seen in Korea as well as globally. Younger generations of Koreans are adapting more Westernized tastes and gradually choosing fusion rather than kimchi as a traditional Korean side dish, which is why kimchi

is steadily being incorporated in many Western dishes today. It is a key ingredient in a variety of recipes, including a few examples below.

Kimchi Fried Rice

Korean dishes are generally served with several side dishes, including kimchi. However, it can be time-consuming for busy people to make so many side dishes for one meal. In that case, a dish like kimchi fried rice makes the perfect meal or snack that can be enjoyed any time of the day.

Serves: 2 people

Cooking time: 15 minutes

Ingredients:

- 1/2 cup kimchi
- 1/2 medium white, yellow, or red onion
- 2 bundles fresh green onion
- 2/3 cup cooked rice
- 1 egg (optional)
- 1 teaspoon kimchi "juice"
- 1/2 teaspoon gochujang (hot pepper paste: miso 1 teaspoon, sugar 1/2 teaspoon, soy sauce 1/8 teaspoon)
- 1 teaspoon sesame oil (or vegetable oil)
- Toasted sesame seeds (as desired)

Directions:

1. Cut kimchi into small pieces and chop both onions.
2. Mix gochujang and "juice" from the kimchi to create a flavoring sauce.
3. Warm the half of sesame or vegetable oil (1/2 teaspoon) in a pan over a medium heat.
4. Add the kimchi and stir-fry until it becomes relatively soft.
5. Then add the onions in and continue to cook.



6. Add the rice and lightly press down with a spatula while continuing to cook.
7. Pour in the sauce and mix well until the rice is no longer white.
8. Turn off the heat, drizzle half of sesame or vegetable oil (1/2 teaspoon) onto the rice, and mix. Then, sprinkle the sesame seeds over the rice.
9. (Optional) Make a sunny side up fried egg and serve with the finished kimchi fried rice.

Per Serving: ~\$2

Calorie: 185 kcal (including fried egg), **CHO:** 26g, **Protein:** 6g, **Fat:** 6g, **Sodium:** 350mg;

Calorie: 150 kcal (without fried egg), **CHO:** 26g, **Protein:** 3g, **Fat:** 4g, **Sodium:** 350mg

Kimchi Pancake

Kimchi and scallion pancakes are simple yet delicious Korean snacks that are typically served as a side dish or as midnight snacks for large groups of people.

Serves: 2 people

Cooking time: 15 minutes

Ingredients:

- 1/3 cup flour
- 1/3 cup water
- 1 egg
- 1 tablespoon kimchi “juice” (if available)
- 1/3 cup finely chopped kimchi
- 1/2 onion
- 2 bundle of green onion
- 1/2 pepper
- 1 teaspoon vegetable oil

Directions:

1. Mix flour, water, egg, and kimchi juice (in that order) well so that the resulting batter is slightly watery.
2. Finely chop the kimchi and other vegetables and add to the batter. Mix well.



3. Drizzle vegetable oil on a hot pan and spread the batter to cover the entire pan.
4. Cook until both sides become a golden color, pressing down with a spatula.

Per Serving: ~\$1.50

Calorie: 160kcal, **CHO:** 22g, **Protein:** 6g, **Fat:** 5g, **Sodium:** 165mg

Kimchi Pancake (Vegetable version)

This flourless pancake is a good option for adding vegetables on your meals.

Serves: 2 people

Cooking time: 15 minutes

Ingredients:

- 1 potato (shredded)
- 2 carrot (shredded)
- 1 egg
- 1/3 cup finely chopped kimchi
- ¼ onion (chopped)
- 2 bundles of green onion (chopped)
- 1 teaspoon vegetable oil

Directions:

1. Mix all ingredients well.
2. Drizzle cooking oil on a hot pan and spread the batter to cover the entire pan.
3. Cook until both sides become a golden color, pressing down with a spatula.



Per Serving: ~\$1

Calorie: 160kcal, **CHO:** 23g, **Protein:** 6g, **Fat:** 5g, **Sodium:** 208mg

Kimchi Quesadilla

Korean-infused Mexican dishes have been gaining popularity as many fusion food trucks and restaurants are opening in Korea and spreading worldwide. The combination of Korean and Mexican ingredients has produced plenty of flavorful, exotic dishes.

Serves: 2 people

Cooking time: 30 minutes

Ingredients:

- 1 teaspoon vegetable oil or use a nonstick spray made from vegetable oil
- 1 bell pepper (use different color such as half yellow and half red if possible)
- 4 medium-sized mushrooms
- 1/2 cup of chopped kimchi
- 2 oz. of cheese (any kind of cheese)
- 2 whole wheat tortilla (10-inch)
- Cumin (optional)
- Oregano (optional)

Directions:

1. Sauté chopped bell pepper and sliced mushrooms with a 1/2teaspoon of cooking oil on a pan (or use nonstick cooking spray) over medium heat until slightly browned. Add dashes of cumin and oregano if desired. Then remove from heat and set aside.
2. Drain juice from kimchi and cut into small pieces. Cook kimchi with 1/2 teaspoon of cooking oil (or use nonstick cooking spray) over medium heat until kimchi reaches



transparent color. Then remove kimchi from heat and set aside.

3. Lay tortilla on pan (small to medium heat) and sprinkle half of cheese, bell pepper, mushrooms, kimchi on 1 half /side of tortilla so half of the tortilla is covered. Add half of cheese on top of vegetables.
4. Close tortilla and press down with spatula and continue to heat until cheese inside has melted.

Per Serving: ~\$2

Calorie: 340kcal, **CHO:** 38g, **Protein:** 16g, **Fat:** 14g, **Sodium:** 530mg

Calories: 300kcal, (using cooking spray), **CHO:** 38g, **Protein:** 16gm, **Fat:** 10g, **Sodium:** 530mg

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Abstract

Kimchi is a traditional Korean side-dish made with a variety of fermented vegetables, such as Napa cabbage, hot red pepper, garlic, ginger and other spices. Throughout

generations for thousands of years, kimchi has been served daily at virtually all meals in Korean households. It gives the flavors of garlic, ginger, scallions, and chili. Kimchi is an ingredient with many culinary uses and it is commonly added to soups, noodles, and rice dishes. Besides its exotic and refreshing taste, kimchi also has its own unique nutritional value and ingredients that are linked to promoting health and preventing some diseases. This article contains information on the varieties of kimchi, its nutritional value, health benefits, a family kimchi recipe (how to make kimchi), and recipes that contain kimchi.



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