

THE BENEFICIAL ROLE OF LACTO-FERMENTED VEGETABLE FOOD KIMCHI: A REVIEW

Abstract

Kimchi is a fermented vegetable dish prepared from vegetables, usually Chinese cabbage, and a variety of seasonings. Due to its distinctive flavor, nutritional advantages, and potential health-promoting properties, it has gained worldwide acclaim. This review will highlight the beneficial role of kimchi in human health. Kimchi is a rich source of probiotics which are beneficial bacteria that promote gut health. *Lactobacillus* and *Bifidobacterium* are two kinds of lactic corrosive microorganisms that are delivered during the maturation cycle used to make kimchi. The gut microbiota's composition could be improved and digestive health could be supported by these bacteria. The probiotics are found to boost immune system function, reduce the risk of gastrointestinal tract disorders, and improve bowel movements. Kimchi is also packed with multiple types of minerals and vitamins such as vitamin C, calcium and vitamin K which are essential for overall health. As we all know vitamin C is known for its antioxidant properties which help boost the immune system and protect against oxidative stress. Calcium is necessary for healthy teeth and bones, and vitamin K is necessary for blood and bone coagulation. Additionally, carotenoids and flavonoids, phytonutrients with antioxidant and anti-inflammatory properties, can be found in kimchi. These phytonutrients have been linked with lower chances of chronic diseases such as cardiovascular due to their ability to neutralize harmful free radicals and modulate inflammation. It is low in calories and fat and the fermentation process enhances the bioavailability of nutrient-dense food. Its probiotic content supports

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gut health while its vitamins, minerals, and phytonutrients contribute to overall well-being. Fiber content in kimchi promotes satiety, reduces appetite, and regulates blood sugar control.

Keywords: lacto-fermented; kimchi; probiotic; phytonutrients; bioavailability

I. INTRODUCTION

Geographically Korea peninsula is encircled on three direction (east, west, and south) and is widely confined on the north by mountain ranges which widely contributed the ancient Koreans to form autonomous and racial culture. Because simplicity has emerged as a fundamental principle in Korean philosophy, dietary practices clearly reflect this simplicity. Preservation of pulses, fish, meat, and vegetable is the basic components of this culture be it the times of plentiful supply to period of limited supply for more than 1500 years and still counting through Lactic fermentation (Oh et al., 2014).

According to the Food and Agriculture Organization (FAO) and the World Health Organization (WHO), a certain amount of fruits and vegetables can help reduce the risk of stroke, heart disease, and other chronic conditions (Swain et al., 2014). Fermentation of food and beverages ranging from plant or animals are plays an important role in people's diet across the world consisting of the Asian and Western countries. Fermented food serves more than the essential nutrients; however, they also have significant potential in maintaining health and prevent disease. The most significant Microbes present in fermented food is Lactic Acid Bacteria. This process of preserving and storage of different food products is scientifically known as Fermentation which promotes their nutritional benefits and boost their shelf-life and to conserve various types of fruits and vegetables for the period of scarcity furthermore there is desirable flavour, texture, decreased toxic effects and efficient food preparation (Rolle et al., 2002; Kabak et al., 2011).

Fermentation can be described as the process where organic substances are slowly decomposed with the help of organism or enzymes that leads to in transformation of carbohydrates to organic acids or alcohol. Because of the availability of numerous types of raw materials and producers used there are difference in the products that vary. Initially, Lactic acid (LA)fermentation of any kinds of fruits and vegetables have been used to enhance the nutritional properties of food (Swain et al, 2014).). Bacteria like *Lactobacillus brevis*, *Lactobacillus fermentum*, *Weissella confusa*, *Leuconostoc mesenteroides* and *Pediococcus pentosacues* are frequently tracked down and are broadly utilized in the processing of fermentation (Jung et al., 2014).

Pretty much every country utilize a few sorts of matured food like cereal based aged food, non-cocktails, matured milks, aged organic products, vegetables, and meat items among others. Fermentation offers many benefits notably availability of food, better health and improved social stability for people living in marginalised and economically disadvantaged area. Fermentation based enterprise offer substantial revenue and job opportunities in Asia, Africa and Latin America (Kabak and Dobson, 2011). Nevertheless the most popular practices used in traditional food preservation includes salting and drying (Jung et al., 2014). A wide range of preserved food found in Korean cuisine have been researched to some extent. Let's take an in depth dive into it.

A traditional Korean cuisine, Kimchi which is created by fermenting vegetables, has attracted popularity around the world owing to its organoleptic, therapeutic, and nutritional features. Diverse lactic acid bacteria (LAB) are formed during the fermentation of kimchi in raw materials that are not sterile. Diverse lactic acid bacteria (LAB) are formed during the fermentation of kimchi in raw materials that are not sterile. This results in differences in the

kimchi's flavor and sensory qualities and issues with standardized industrial kimchi production. Heterofermentative LAB from the genera *Leuconostoc*, *Lactobacillus*, and *Weissella* are probably important players in the fermentation of kimchi. They have been the subject of genetic and functional studies to learn more about the process of fermentation and the benefits of kimchi fermentation. Starter cultures for the industrial manufacture of high grade, standardised kimchi has been considered. The piece and natural chemistry of kimchi microflora utilitarian, networks and hereditary examinations of kimchi LAB, and possibilities for creation of modern kimchi are talked about in this paper (Jung et al, 2014).

II. KIMCHI A FERMENTED TRADITIONAL FOOD OF KOREA

Kimchi, a fermented vegetable dish that has long been a popular side dish in East Asian nations like Korea, Japan, and China. The historic Korean book "Samkuksaki," published in the year 1145 A.D, and many other texts such as the following "Naehun," "Hunmongjahoe," "Sinjeung-yuhap," and "Kanibuckonbang" states that Kimchi was the result of a basic vegetable fermented in a earthenware (Cheigh and Park 1994). From that point forward various sorts of Kimchi has arranged relying upon its variety of readiness strategy and its substance (Swain et al., 2014). People have been eating traditional fermented foods for a long time due to the health benefits they offer and the microorganisms that were used in their fermentation. In Korea, Kimchi is the most typical traditional fermented food. It is a vegetable product fermented with lactic acid. In point of fact, such foods have emerged as an crucial component of the Korean diet, and it is well documented that they have health benefits (Park et al., 1994 and Shin et al., 2015). The "Book of Odes (Sikyung)," which was published around 500 BC, contains a mention of kimchi. Kimchi, a vegetable product that is fermented with lactic acid, has been around for at least 2,000 years (Kwon et al., 2014). Kimchi has been pronounced by The American Diary of General Wellbeing to be one of the world's best food varieties in the year 2006, and its prevalence till date. In addition, Kimchi was designated a world intangible heritage product in 2013. There are approximately 200 varieties of kimchi in Korea, all of which are prepared with new vegetables like Chinese cabbage or radish. Conventional matured food sources are great assets for disconnection of different microorganisms holding onto antimicrobial exercises as microorganisms showing solid antimicrobial action might assume a significant part as specialists that contend with normal microorganisms during unconstrained maturation (Chang et al., 2007). Besides, microorganisms from conventional matured food sources, for example, kimchi is viewed as protected on the grounds that it has been eaten for quite a while (Cheigh et al., 1994 and Shin et al., 2015). In Korea, kimchi has been made at home for a long time, but more recently, it has been sold on an industrial scale (Cheigh et al., 1994). The maturing cycles occur through the microbial movement of various microorganisms regularly present in the kimchi raw parts, as Kimchi is ready from new vegetables (Chang et al., 2010). Heterofermentative LAB, such as *Leuconostoc* sp., during the initial and middle stages of fermentation are primarily utilized in the spontaneous fermentation of kimchi, whereas homofermentative LAB, such as *Lactobacillus* sp., are utilized in subsequent stages. are used more frequently. Homofermentative LAB typically takes over from heterofermentative LAB during the kimchi fermentation process (Chang et al., 2010 and Jung et al., 2014) Controlling kimchi maturation utilizing a sort of homofermentative Lactic acid bacteria(LAB). It is much simpler to use LAB as a starter culture than heterofermentative LAB because it is more acid tolerant. During kimchi maturation, ethanol, CO₂, and mannitol as metabolic items, are created by heterofermentative LAB produce while more corrosive is delivered by homofermentative

LAB. These characteristics leads to the high tactile nature of kimchi besides its reviving taste and wonderful flavour. The influence of progressive homofermentative LAB can bring about the decrease of tactile characteristics joined by unreasonable off-flavour, acidic taste, and surface relaxing (Chang et al., 2010). Thus, it has been advised by Korean kimchi fabricates to utilise market kimchi under refrigerated condition within 28 days.

The raw material for making kimchi is cabbage and radish, but other vegetables like cucumber and green onions are also used in the preparation. Other varieties of kimchi can be found in local markets on the Korean peninsula, including cucumber (Sobagi), lettuce (Gotchorri), eggplant (Burdock), pumpkin (Nabak), leek, garlic, scallion, chicken, ear shell, pheasant, green laver, and seafood. Kimchi is unique among amongst goods produced using Lactic acid fermentation due to its various range of raw materials used in its production. The cultivator produces a range of good with increasing organoleptic intensity, making it compatible for people of all ages and taste. Kimchi is pre-brined and other raw materials are salted after prebrining, several types of spices are added and the process of fermentation starts after all the ingredients are combined.

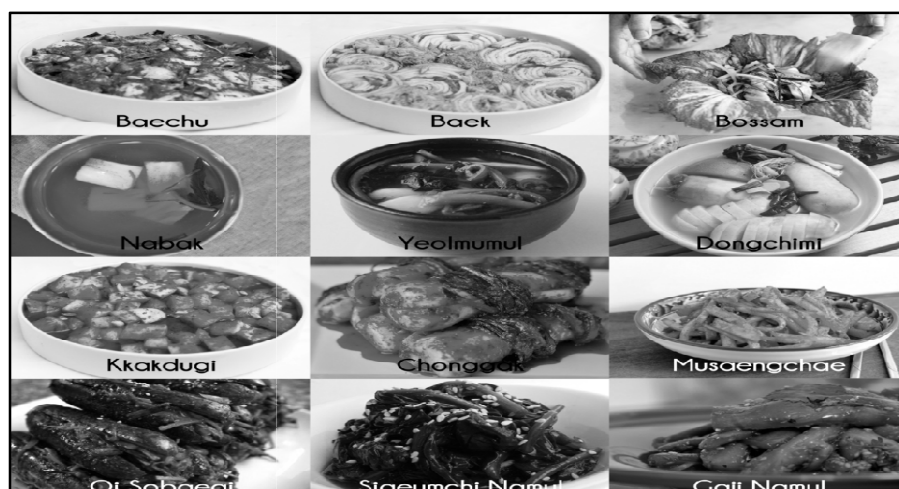


Figure 1: Types of Kimchi

III. BASIC INGREDIENTS OF KIMCHI

Kimchi is made primarily from the four main raw materials: seasonings, spices, and additional materials. The common raw materials for making kimchi include roughly 30 different vegetables, including Chinese cabbage, pigtail radish, radish, young oriental radish, and cucumber. Where as for spices, spring onion ,red pepper, garlic, ginger, onion black pepper, are commonly used. Seasonings include salt, sesame seed, monosodium glutamate, and other ingredients like soyabean sauce. Cereals of all kinds (like rice and barley), vegetables (like water cress, mushrooms, and carrots), and fruits (apple, pear), shellfish (shrimp, oysters), and numerous other species depending on the availability of raw materials (Kim et al., 2012). Since the sensory qualities of the finished product indicate the qualitative and quantitative variation of the aforementioned ingredients, flavor modification is possible. Chinese cabbage privately named as 'Bacchu' is the most well known type of kimchi in Korea. Composition of the raw materials needed to make kimchi: Chinese cabbage (74.5 percent),

radish (13.5 percent), ginger (0.5 percent), garlic (0.0 percent), onion (0.0 percent), red pepper powder (0.0 percent), leek (0.5 percent), green onion (1.0 percent), shrimp paste (1.5 percent), and 3 sucrose (1.0 percent) anchovy paste (0.5 percent) (Cho et al., 2006).

Nutritional Index of Kimchi

Components	Composition
Protein	2.0
fibre	7.2
Sugar	1.3
Vitamin A	492
Vitamin B1	0.03
Vitamin B2	0.06
Vitamin C	12
Calcium	28
Niacin(mg)	2.1

According to the principal of raw materials and minor components, vitamin content varies substantially. Furthermore, vitamin destruction can be caused by fermentation and storage. In addition, kimchi's mineral composition includes consumption and/or synthesis. Calcium is a key mineral, but phosphorus and iron are scarce (Suwon 1981).

IV. TYPES OF KIMCHI AND IT'S METHOD

1. **Chinese cabbage Kimchi:** Koreans have long enjoyed Chinese cabbage kimchi as a traditional fermented dish. red pepper, Garlic, spring onion, ginger, and other components used to make kimchi impact the kimchi maturation rate contrasting with sorts and measure of fixings(Lee et al., 1995). After being pretreated, cabbage is cut into walnut-sized pieces, brined for two to seven hours in a salt solution with a concentration of 8 to 15%, and then laved in water. Independently cut carrots, radish, spring onions, as well as diced garlic, red pepper, ginger, protected fish and dry salt, are joined by the recipe, to make a mix of flavors and other minor fixings. The treated cabbage blends well with this premixture. The mixture is then fermented in an airtight container for one to three days at low temperatures (two to ten degrees Celsius) or one to three weeks at room temperature. Kimchi is best served cold and is typically made at lower temperatures (between 0 and 8 degrees Celsius) (Shin et al., 1984).

2. **Bossam Kimchi:** Tong-baechu kimchi is like Bossam Kimchi anyway with a slight distinction in planning, Bossam kimchi is made by covering a premixture of various vegetables, mushrooms, fruits, nuts, and seafood in cabbage leaves and seasoning it with spices. The step of dicing the Chinese cabbage is skipped for the preparation of Bossam Kimchi; all things considered, the leaves of the head are isolated subsequent to tenderizing and washing and are put in a level bowl. The premixture and other components of the garnish are squished on top of each leaf. The stuffing paste is wrapped with the leaves and afterward left to mature in a vessel. It's a one-of-a-kind Kimchi with a unique flavor and high nutritional value; However, due to the additional time and effort required for preparation, it isn't widely used (Shin et al., 1984).

3. **Dongchimi (Radish with Water):** The main element is the whole oriental radish which is typically rinsed and garnished with dry salt. In a huge amount of brine solution, the garnished whole of radish is mixed with other ingredients and they are fermented in a vessel. In most cases, enough brine is poured into the containers for completely soaking of the ingredients. Red pepper powder and seafood that has been salt-pickled are also not used (Shin et al., 1984).
4. **Kaktugi:** Kaktugi is a common variation of the kimchi. It is basically diced radish which is eaten a lot in the winter. The main ingredient being oriental radish. For five to thirty minutes, radishes are cut into peanut sized cubes and seasoned with dry salt. The cut radish cubes are blended with a spice and other ingredient premix. A container is used to ferment the mixture (Shin et al., 1984)

V. ORGANOLEPTIC PROPERTIES OF KIMCHI

Kimchi is typically reddish in colour due to chili peppers in the seasoning, flavourfully spicy, sour, and slightly salty and has pungent sour aroma. The spiciness comes from the added chili peppers while the sourness is due to the lactic acid produced while the fermenting of kimchi is on process. The saltiness comes from the added salt which helps to preserve the vegetable and regulate the fermentation process (Cheigh et al., 2009). Other than organic acids, many molecules including carbohydrates, nucleic free amino acids, acid-related chemicals and salt leads to common tastes including savoury, sweet, and salt (cheigh et al., 2009). There are different types of sugar that influence the sweetness of kimchi, fructose, glucose, and mannitol plays an important function (Cho and Rhee 1997). It has crunchy texture that comes from the fermentation process. The cabbage is typically still crunchy while the other ingredients that are include in the recipe are slightly soft. Although kimchi that has been properly fermented has a typical texture and mildly acidic flavour, these characteristics are altered by subsequent fermentation or preservation in unfavourable conditions following optimal ripening. The physical composition of the kimchi changes continuously. Fermentable sugars may undergo complete acid conversion and drastic disintegration of the component's texture. As a result, the product is overfermented kimchi with a delicate surface and a very acidic flavor and aroma. The course of aging and the handling of the unrefined components make the average surface of kimchi. When Chinese cabbage is salt-treated for baechu kimchi preparation, the solid tissue becomes less crisp and more flexible, making it easier to chew. The chemical structure changes, in the cell wall components, particularly in pectic substances, as well as the compositional alteration brought on by the tissue's loss of moisture and air are primary causes of these texture shifts (Lee et al., 1988 and Park et al., 1991).

VI. PREPARATION OF KIMCHI

The basic method for preparation of kimchi; all the raw materials should be collected and easily accessible and their selection varies depending upon on availability and taste preferences, family traditions and their social status etc. The initial step is the pre-treatment of the oriental cabbage they are chopped into small pieces before brining and washed thoroughly (Cheigh and Park et al., 1994) the cabbages are immersed in 10-14% salt water for 16-18 hours and is rinsed for three times (Cho et al., 2006). and while on the process other ingredients and condiments are chopped, grinded and prepared for the mixture. After brining

additional water is strained and the other raw materials are mixed. The blended mixtures are then fermented under the suitable conditions preserved in the air tight container and fermented for 1-3 weeks at low temperature (2-10 degree Celsius) or for 1-3 days under room temperature and served cold. Hence the results of preparation method and components will have significant effect on the biochemical, microbiological and nutritional properties (Cheigh et al., 1994). Kimchi aging occurs principally on the ground of the microorganism normally present in the unrefined components which contains various and differed microflora, including lactic corrosive microbes. Although a variety of microorganism may initiate fermentation, lactic acid gradually takes the lead in the production of organic acids. Numerous, physical, chemical, biological factors can all have an impact on the rate of fermentation and microorganism growth. Microorganism, salt concentration, fermentable carbohydrates, others nutrients that are easily available, inhibitory compounds, oxygen, pH, and temperature are the most significant influences on kimchi fermentation. Temperature, pH and salt concentration are the main components which is easily influenced by lactic acid fermentation. The salt concentration and temperature during the fermentation process determine the optimal fermentation time and the most acceptable kimchi quality (Lee 1997).

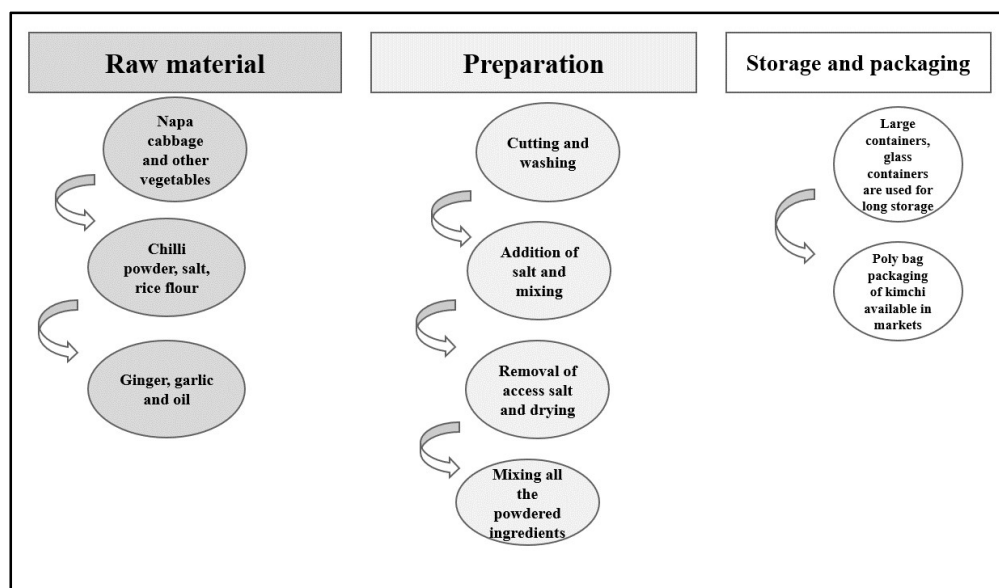


Figure 2: Steps of Kimchi Preparation

VII. STORAGE AND PRESERVATION OF KIMCHI

Once the process of fermentation is done it can be called as Kimchi. Among the ingredients used in kimchi the red pepper plays an important role it contain antioxidant capacity and contain high vitamin c and the compound that makes it spicy red peppers also prevents the growth of pathogenic microorganism and preserves the food from decaying. Due to the use of red pepper powder, which can be preserved for longer despite being a lower-sodium food product, kimchi requires little salt (Oh and Park et al., 2014). As we have seen in the above mentioned sentences kimchi can be stored for 1-3 weeks at 4 degree or 2-3 days at room temperature (it is one of the best ways to have kimchi). Kimchi also being a reactive present products i.e LAB there are some preservation issues which leads to over ripening and

forming of pungent smell because of the fermentation and preservation issues kimchi is typically prepared during winters commonly. However gradually the product got commercialised and the launch of modern refrigerators contributed in solving the issue preservation resulting in specialised freezers for kimchi while controlling of kimchi at home can be another problem but it is seen manageable depending on the family strength. The contemporary refrigerators have temperature controlling facilities which is really helpful for the huge production or in industries (Cho and lee et al., 2006). It is an ideal method of preserving the lifespan if vegetable through Lacto-fermentation process, which helps to develop flavour and immensely increase the nutritional profile of the vegetable (Cheigh et al., 1994)

VIII. KIMCHI AS PROBIOTIC

Kimchi, like yogurt as a diary probiotic, acts as a probiotic vegetable food product that has rich nutritional qualities. Furthermore, the ingredients in the kimchi production contains many nutrients starting from the main ingredient cabbage from cruciferous family other functional and beneficial properties from spices and condiments. Kimchi is also considered to be the source of Lactic acid bacteria as all the nutrients present are fermented by LAB and the residues helps in enhancing and functioning of the product, helps promote gut microbe and strong immune system (Cheigh et al.,). Probiotics are live microorganisms which are nutritious to the body when taken in appropriate quantity. They are also known as "good bacteria" and are mostly found in fermented foods like yogurt, kimchi, and kefir. Kimchi is a natural source of probiotics, containing a variety of beneficial bacteria that can help improve gut's strength and overall health.

Kimchi Acts as a Probiotic in the Following Ways:

- 1. Lactic Corrosive Microorganisms:** The fermentation of Lactic Acid Bacteria, such as *Lactobacillus brevis* and *Leuconostoc mesenteroides*, is the process by which kimchi is made. The bacteria convert the vegetables' carbohydrates into lactic acid, which gives kimchi its sour flavor and keeps the food fresh.
- 2. Boosts Digestive Health:** The probiotics in kimchi can help improve digestive health by balancing the gut microbiome. Consuming kimchi on a daily basis has been shown to lower the risk of digestive disorders like Irritable Bowel Syndrome (IBS) and inflammatory bowel disease (IBD).
- 3. Healthy Immune System:** Probiotics in kimchi can help support the immune system by promoting growth of beneficial gut bacteria. A healthy gut microbiome is essential for a strong immune system, as it helps prevent harmful pathogens from taking hold and causing illness.
- 4. Improved Mental Health:** Some research has suggested that probiotics may have favourable effect on mental health. Studies have found that consuming probiotics may help reduce symptoms of depression and anxiety, as well as improve mood and cognitive function.

IX. NUTRITIONAL QUALITIES OF KIMCHI

Minerals and Vitamins are great source of Kimchi such as vitamin C, vitamin and calcium. In order to prevent chronic diseases, the World Health Organization (WHO) and the Food and Agriculture Organization (FAO) recommend including a specific amount of fruits and vegetables in one's daily diet. This is due to the properties of high content fibre and low calorie count of kimchi as well as the presence of compounds with antioxidants and anti-inflammatory properties. Incorporating Kimchi into balanced diet offers several health benefits and a flavour full addition to wide range of meals (Cheigh et al., 1994). B-sitosterol, indole compounds, thiocyanate benzyl and isothiocyanate, as well as other phytochemicals like thiocyanate, have been shown to have anti-obesity, anti-cancer, antioxidant, and anti-atherosclerotic properties in kimchi.

- 1. Cholesterol Lowering Activity :** Kimchi a fermented traditional dish have found to have cholesterol lowering effects. The ideal impacts of Kimchi on cholesterol are believed to be because of fiber content, as well as presence of bioactive mixtures like the normal Lactic Corrosive Microscopic organisms and flavonoids. They have the capacity to improve metabolism, reduce the absorption of cholesterol in the gut and decrease the production of cholesterol in liver. Elevated degree of cell reinforcements in kimchi which might assist with forestalling the oxidation of Low-thickness Lipoprotein (LDL) cholesterol which is a significant gamble factor for cardio vascular illness. In essence, adding kimchi is a delicious way to improve cardiovascular health (Park et al., 2005).

LAB aids in the metabolization of dietary cholesterol and deconjugates bile salts within the colon, preventing reabsorption in the liver and thereby lowering blood cholesterol levels in serum. Kimchi stimulates lipid mobilization from the epididymal fat pad and lipid excretion through feces (Park et al., 2005).

- 2. Anti-Oxidative Activity of Kimchi:** The antioxidants properties of kimchi are gained from the raw materials carried in Kimchi preparation and other biological compounds released during fermentation. The active principle 3-(4'-hydroxyl3'5'- dimethoxyphenyl), flavonoids, Chlorophyll, , polyphenols, carotenoids, vitamin E, vitamin C, and propionic acid found in Chinese cabbage kimchi have all been identified as primary antioxidant (Lee et al., 2004). In vivo, in vitro, as well as clinical studies have all confirmed kimchi's antioxidant properties. Kimchi scavenged free radicals (Ryu et al., 2004) and slowed down linoleic autooxidation(Hwang et al., 2000) and LDL oxidation(Kwon et al., 1998). Many researchers have proposed that kimchi's anti-oxidative property is one of the mechanisms by which it prevents mutation/cancer, atherogeneity, and aging (Kwon 1998).
- 3. Kimchi as Anti-Aging Activity:** One of the most widely accepted hypotheses for describing the aging process is the free radical theory. The interaction of biochemical in the body with active oxygen species or lipid radicals can be harmful. Thus, in order to get rid of free radicals, animals try to keep antioxidants and antioxidant enzymes in their bodies. kimchi parts worked on the action of cell reinforcement compounds, for example, catalase, superoxide dismutase, and glutathione reductase, as well as carotene and Vitamin E rate in the plasma and liver (Kwon et al., 1998 and Kim et at., 2000). GSH and GSH/GSSG were higher in the plasma of the elderly who consumed more kimchi than the average intake (112 g), while the percentages of total free radicals and hydroxyl radicals

were lower. These findings suggested that kimchi may either reduce or eliminate free radicals more effectively (Kim et al., 2002). This observation was confirmed by the animal studies. The consumption of kimchi decreased the formation of free radicals in the brain of SAM as a result of senescence (one year of feeding) and increased the activity of antioxidative enzymes in the brain (Kim et al., 2002).

- 4. Activities of Kimchi as Anti-Mutagenic and Anti-Tumour:** The organic mixtures in kimchi having hostile to mutagenic and against growth exercises are L-ascorbic acid, B-carotene, phenolic compounds, isothiocyanate, indole compound, β -sitosterol, diallylsulfide, dietary fiber, matured items, and lactic corrosive microscopic organisms (Park KY 1996). Kimchi's ability to detoxify the liver, which converts carcinogens into water-soluble compounds that can be excreted, or its ability to slow down responsible enzyme activities, inhibit pro-carcinogen to carcinogen transformation, inhibit DNA replication and protein synthesis in tumour cells, or stimulate apoptosis in tumour cells may account for the kimchi's chemo preventive or chemotherapeutic effects. When kimchi ingredients like radish, Chinese cabbage, garlic, green onion, leek, or kimchi were given to rats, the detoxification system's phase II enzyme, hepatic glutathione S-transferase (GST), showed increased activity. The materials' sulforaphane or S-containing compounds are partially to blame for the increased activity of GST. Lactic corrosive microbes in kimchi is professed to have antimutagenic and anticancer movement by inactivating or inhibiting the development of cancer-causing agents in gastro-intestinal tract, or animating the resistant framework that impedes the cancer-causing process (Park KY, Cheigh HS 2000). The activity of β -glucosidase and β -glucuronidase was inhibited by lactic acid bacteria in kimchi when it reached the large intestine, resulting in a lower production of carcinogen in the colon, explaining the low prevalence of colon cancer in Korea (Sheo HJ, Seo YS 2003). The Lactic Acid Bacteria's cell wall components, glycopeptides, are to blame for these activities, as evidenced by the anti-mutagenic properties of both viable and non-viable Lactic Acid Bacteria (Park KY, Cheigh Hs 2000 and Shin et al., 1998). Sarcoma-180-induced abdominal cancer was directly inhibited by the cell wall extracts of *Lactobacillus plantarum* (Shin et al., 1998). The short-chain unsaturated fats delivered by lactic corrosive microscopic organisms in the colon might prompt the apoptosis (Houston et al., 1994 and Moraca et al., 1997). Furthermore, apoptosis induced by kimchi extracts may either halt the cell cycle or promote DNA fragmentation (Cho et al., 1997). Kimchi extracts also showed anti-tumor activity by enhancing the phagocytic cell activity (Choi et al., 1997). Close with these impacts. The anti-genotoxic properties of Chinese cabbage, radish, and yulmu kimchi against DNA damage were demonstrated (Shin et al., 1999). The dynamic standards in kimchi for hostile to malignant growth were not distinguished at this point anyway the dichloromethane part of Chinese cabbage kimchi showed the most noteworthy enemy of malignant growth movement (Cho et al., 1999).
- 5. Kimchi as Weight Controlling Activity:** Kimchi is a natural health food that is high in phytochemicals, vitamins, minerals, fiber, as well as low in carbohydrates and lipids. Vitamin A, beta-carotene, chlorophyll, and flavonoids are found in Chinese green, cabbage, carrot, anion, and red pepper powder, while vitamin C is primarily found in Chinese cabbage and red pepper powder. The calorie content of the soup-based radish kimchi is approximately 9 kcal/100 g. Ca, Mg, and P are from aged fish sauce, red pepper powder and clam. By dry base, Chinese cabbage kimchi has less than ten percent

crude fiber (Sheo and Seo 2004). S-allylcysteine sulfoxide and S-methylcysteine sulfoxide from garlic, as well as β -sitosterolin from Chinese cabbage, capsaicin from red pepper, and the biologically active ingredients that are known to lower lipid levels in kimchi. Red pepper was found to have lipolytic activity in adipocytes, and the activity increased with the pepper's spiciness, indicating that capsaicin compounds are the ones responsible for this activity (Hong et al., 2004). Additionally, numerous scholars have stated that kimchi has lipid-lowering effect.

X. CONCLUSION

Since time immemorial, people on the Korean peninsula have consumed a variety of fermented foods. In Korean food culture and history, kimchi is the most well-known and beloved fermented food in the world. It has numerous nutritional and therapeutic properties. Kimchi is also frequently devoured and adored fermented cuisine in the world. Its major ingredients are red chilli powder, napa cabbage as well as a variety of vegetables and spices that have been enhanced with useful LAB. It has numerous health benefits, and its quality can be improved by altering the fermentation conditions, components, and quantities. Despite a variety of problems in the manufacturing of kimchi, this fermented meal plays a significant contribution if consumed in appropriate quantity.

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