Fermented Paste: A Mini Review

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Abstract: Fermented paste are one of the most famous condiment used all around world. Different regions in world have different types of fermented pastes on basis of their culture and ethnicity Fermentation is a process by which not only the shelf life of food product is increased but it also increases the nutritional value of the product and increases the immunity. Not only that it also enhances the taste of the product.

Introduction

Fermented paste is used as a condiment generally as side dish/dip/toppings for several food items. They not only work as a taste enhancer but also are nutritious, and improve the quality of food. Since some of the pastes are fermented by probiotic microorganisms like Lactic Acid Bacteria (LAB) they help in better digestion, absorption and assimilation of nutrients. As most of the sugar is broken down in the process, it is easier to digest. It enhances the amount of minerals and vitamins for the absorption by the body. By increasing the useful gut bacteria, it increases immunity by acting as a natural wall and preparing immune system more active. The brain and gut are joined through hypothalamic-pituitary-adrenal (HPA) axis., the gut is aligned with neurons which influences our emotional feelings. Serotonin (which is a neurotransmitter that is associated in mood), is made in the gut and probiotic bacteria develops as a healthy gut, hence they are also joined to healthy mind. That means fermented food products also helps in maintaining mental state of an individual. There are various microorganisms that help in fermentation of food products.

Fermentation of food is the technology that utilizes the growth and the metabolic activity of a microorganism for transformation and stabilization of a food product. The basic idea for fermentation was to increase the perishability of the food product. The desirable bacteria increase the shelf life of food by inhibiting the growth of the pathogens or spoiler microorganisms. Some fermentation process lowers the pH of food product hence preventing harmful microorganisms to grow or survive by providing them harsh acidic nature. The control fermentation processes developed the growth of beneficial bacteria which prevent the growth of bad microbes. Based on the type of food fermented or the type of fermentation, or type of fermentation, food product kept non-perishable for several years.

The main phylum that is involved or used as a starter culture is Lactobacillus with Leuconostoc, Lactococcus, and Streptococcus. Fermentation of dairy, cereal, vegetables, and meats involve LAB. On the basis of their metabolic activity LAB can be homo-fermentive like Lactococcus (produces only Lactic acid) and hertro-
fermentive like *Leuconostoc* (produces variety of metabolized leading to complex organoleptic properties). Other phylum that plays a major role is Proteobacteria, which are *Acetibactir, Glucobactoer* and *Glucanoacetobacter*, the generally produce acetic acid from ethanol but also use any other sugar compound.

There are various types of fermented paste both by vegetarian and non-vegetarian food products. Such as soybean, garlic, ginger, red chili, green chili, black red sweet bean, shrimp, ginger garlic, fish, tomato and many others. Countries such as Korea are extremely popular for its red chili pepper pastes i.e. Gochujang whereas black ginger fermentation is popular in Japan. Shrimps pastes have their popularity in Thai regions. Japan also takes credits for fermented fish pastes.

There are various fermentation process and conditions that are linked with different types of pastes. Every paste requires certain conditions to be fermented and have its own uniqueness and cultural value.

The fundamental procedure of fermented paste making remains the same for most of the products, but as mentioned before every paste is having their own specific conditions which are: pH, incubation time, optimum temperature, type of carbohydrate source or salt, starter culture and other ingredients.

The base procedure is as follows –

**Types of Fermented Pastes**

In recent years, fermented food pastes have become very popular; this would be mainly due to their health benefits and longer shelf life. People from different walks of life are coming up with new recipes to new pastes almost every day. Different pastes have unique flavors, textures, scents. All these features which come as a result of protein and lipid breakdown by autolytic and bacterial enzymes at the time of fermentation process[Cha and Cadwallader 1995]. In this review we will discuss and characterize various fermented pastes, their benefits and sensory characteristics. Different food products are being used to make pastes. Examples include; soybean, shrimp, red pepper, fish, garlic, ginger. Red chilli and tomatoes, all discussed below.
Fermented Shrimp paste

Commonly known as ‘Kapi’ by the people of Thailand, fermented paste which is made of shrimp prepared from the planktonous shrimp or krill (Acetes vulgaris or Mesopodopsis orientalis). To make the paste, the ratio of salt : shrimp is 1:3. The color of a fermented shrimp paste varies. It may be a purple, pink, gray or dark brown in color. It may have a soft or hard consistency. It could be prevented for spoiling for several months. However, variation in raw material, shrimp : salt ratio and fermentation time period can lead to difference in characteristics of final product [Peralta et al. 2008]. Kapi is a high protein product as well as contains high salt concentration.

Fermented soybean paste

Fermented soybean has its origin from Korea. It’s one of the most essential and oldest condiments in Korea. Commonly known as Doenjang, it is made from soybeans and brine. Microorganisms involved in fermentation process include Bacillus subtilis and Aspergillus oryzae. Final product appearance is a thick brown paste. The paste has a pungent smell similar to that of a ripened blue cheese. The paste can be consumed as a condiment in raw-paste form with different dishes, as flavored seasoning or even as a dip. Soy bean paste is rich in vitamins, secondary metabolites, minerals, and plant hormones (phytoestrogens) which are sometimes claimed to have anti-carcinogenic properties. [H.G. Kim, J.H. Hong, C.K. Song, H.W. Shin, and K.O. Kim. 2010]

Fermented red pepper paste

Fermented red pepper paste commonly known as Gochujang by the people from Korea has the following characteristics; it has a pungent smell, a spicy flavor and a sweet taste. [Gyu Min Lee & others. 2016]. The product is known to be rich in different nutrients such as amino and fatty acids, organic acids, and different sugars. These usually produced during the fermentation process as raw materials. Fermented red pepper is also known for its various health benefits. These include anti-tumor, cancer and obesity effects.

Fermented Fish Paste

It is the conversion of organic compounds into simple compounds like amino acids, peptides, and various nitrogenous compounds. It may be by the activities of microorganisms or endogenous enzymes. This procedure is known as fish fermentation. Fish paste is a popular condiment in different dishes. It is made by fermenting fish with salt of 20 to 25% under controlled conditions. The product has a high nutrition value, a unique flavor and long lasting shelf life. Fish paste can be considered a protein source and PUFA (Polyunsaturated fatty acids). However, these could be damaged by severe fermentation conditions. The product has an extremely pungent smell and a salty taste. Usually thick and whitish in color. [Apri Dwi Anggoa *, Widodo F Ma’rufa , Fronthea Swastawatia , Laras Rianingsih.2015]
Fermented Black Garlic Paste

Heating of whole garlic bulbs \((Allium sativum)\) over a period of several weeks results in black cloves. The resulting cloves are used to make the fermented paste. The product has a sweet taste with tangy undertones to it. A good fermented black garlic paste is characterized by a longer aging period, to bring out powerful antioxidants and will also have no odors associated with garlic.

Fermented Milk Tomato Paste

Tomatoes \((Lycopersicon esculentum)\) and its products contain lycopene, a carotenoid and an antioxidant which plays an important role in the health of human beings [Erge and Karadeniz, 2011]. Lycopene is present in even higher content in tomatoes made into a paste. Tomato components can be fermented by lactic acid bacteria such as \textit{Lactobacillus acidophilus}, \textit{Lactobacillus plantarum}, and \textit{Lactobacillus casei}. The paste has a bright red color, however color may vary depending on tomatoes used or fermentation time.

Table 1

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Region of Origin</th>
<th>Appearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fermented Shrimp Paste</td>
<td>Commonly known as Kapi, high Protein product, grey/dark brown color</td>
<td>Thailand</td>
<td></td>
</tr>
<tr>
<td>Fermented Soy bean Paste</td>
<td>Commonly known as Doenjang, \textit{Bacillus subtilis} and \textit{Aspergillus oryzae} (starter culture)</td>
<td>Korea</td>
<td></td>
</tr>
<tr>
<td>Fermented Red pepper paste</td>
<td>Commonly known as Gochujang, health benefits include anti-tumor, cancer and obesity effects</td>
<td>Korea</td>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
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<td></td>
</tr>
<tr>
<td>Fermented Fish Paste</td>
<td>A good protein source, has a high nutrition value, a unique flavor and long lasting shelf life</td>
<td>Philippines</td>
<td></td>
</tr>
<tr>
<td>Fermented Black garlic paste</td>
<td>Has antioxidant properties and high nutritional value</td>
<td>Korea</td>
<td></td>
</tr>
<tr>
<td>Fermented milk tomato paste</td>
<td><em>Lactobacillus acidophilus, Lactobacillus plantarum, and Lactobacillus casei</em> are microbes involved in fermentation process</td>
<td>Italy</td>
<td></td>
</tr>
</tbody>
</table>
Fermentation Processes involved in Production

Fermented shrimp paste

Thai conventional fermented paste which made by shrimp is generally called as Kapi. Kapi is customarily arranged from mysid shrimp blended with salt at a ratio of 3–5:1 and afterward dried of sun light to diminish the dampness material, lastly it is crushed into get a uniform paste. At the time of fermentation allowed to age for two to six months to create attractive and extraordinary tastes and unique odors.

Kapi Ta Dam which is known as dark paste and Kapi Ta Deang also known as red paste taken from mangrove waterways initial materials of Kapi Ta Dam (M. orientalis) and Kapi Ta Deang (Acetes sp.) were reaped during October to November 2009. The underlying results of Kapi Ta Dam and Kapi Ta Deang were 3-days and 7-days fermented crude materials. The matured shrimp paste items were acquired by further fermentation Kapi Ta Deang and Kapi Ta Dam by hatching at 30 °C for two or four and a half of the year.

Soya Bean Paste

Soya bean paste otherwise called Doenjang fundamentally prepared with meju, it is set up by drenching, steaming, pulverizing soybeans. At that point paste is removed moisture, and hung up with rice straw for one to three months for the development of characteristic microorganisms. That aged meju is brined and aged for more than two to three months.

After done the fermentation process, it is isolated into two sections: the supernatant fluid and hastened strong buildup. That fluids sifted to acquire sauce of soy though the solids are kept into earthenware and further matured for in excess of 2 month to make customary soya bean glue. Since conventional Doenjang is aged in a common habitat, different microorganisms, for example, Bacillus, Rizopus, Mucor, and Aspergillus species are giving their assistance for its Fermentation process.

Fermented Red Pepper Paste

Fermented Korean Red Pepper Paste also known as Gochujang is made by fermentation process using mixed paste made by red pepper powder (Capsicum annum L), glutinous rice, meju, salt and water. For the preparation barley malt soaked in distilled water for whole night with the 20C of temperature. Then take the mixture and filtered it and add the glutinous rice powder to it while stirring. Then heat the mix in 60C for completed the saccharification.

Then add salt for the prepared solution and boiled it for 30 mins. After boiling allow cooling it till 40C, and then add meju powder and red pepper powder to it and mixed properly with rice paste. Finally the mixture keeps for fermentation at 25C for 90 days in aerobic incubator.
Fermented Fish Paste

Fermentation Method i

Koshihikari rice (*Oryza sativa*) which is made by Japan, was absorbed two volumes of new water for 12 hours at normal room temperature and along these lines steamed at 90°C temperature for 1 hour. In the wake of cooling to room temperature, the rice was immunized with the koji shape, hatched at 35°C temperature for 48 hours, and the subsequent malt-rice was utilized as koji, the starter for aging. New fishes were guillotined, gutted, washed, cleaned, and deboned utilizing a model NF2 deboning machine outfitted with a drum containing holes (4 mm with distance across).

The fish grounded independently with a model M-22 processor (Nantsune Tekko, Osaka, Japan) and afterward put in to an aluminum-covered, stable for heat polyvinylchloride pocket, which was in this way vacuum-fixed and steam-warmed at 90°C temperature for 1 hour. Parts were then channel squeezed at 2 MPa to accomplish dampness substance somewhere in the range of half and 55 percent by utilizing a model KS-1 channel press (Komagata Kikai Seisakusho, Tokyo, Japan). The subsequent got dried out meat was washed multiple times with five volumes of fresh water before squeezing. Koji, fish and salt were blended in a processor at a ratio of 5:5:1 to wet weight. Roughly 3 kg of fish paste was stuffed into a 5-L plastic holder and matured at a heat somewhere in the range of 25°C and 30°C for 90 days. The substance of every compartment was blended altogether once per month. The readied material was named fish miso, which signifies "matured fish paste" in Japanese. Following 90 days of maturation, fish miso items were put away at 2 unique temperatures—10°C and 25°C. The items were inspected at 0, 15, 30, 60, 90, 135, 180, 270, and 365 days for examination.

Fermentation Method ii

Fermented fish paste prepared by using dried anchovy fish was set up with 2% of sodium chloride (NaCl) (w/w), allow to Fermented at normal room temperature for 8 and 32 days of fermentation period. Fish used as crude material and sunlight based salt acquire nearby market in Semarang. 98% of fish and 2% of sun oriented salt were completely blended then pounded. Crushed salt and fish mixture was dried using the sun until it get proper texture non clingy and afterward granulated once more. Semi dried fish paste was aged for two days at encompassing temperature. Semi dried paste was framed into tube like structure with 3 cm length across, 10 cm long and dried by the sun two days and afterward wrapped firmly using banana leaves. Then keep it for completed the fermentation process. Tests were oppressed for tangible with synthetic examinations (amino acids and unsaturated fat) on eight days and thirty two days maturation.

Fermented Black Garlic Paste

For the start process of black garlic paste preparation first select the raw materials. Select the non – harmful and organic white skin garlic and clean up them and dry the raw materials properly. Then prepare the mixed bacteria
liquid solution with the mixed bacterium leavening agent and pure water mixed with weight 3 – 4.5% with fermentation nutrient solution. Then cover the mixture and keeps it 35 – 41 C of temperature of fermentation for 8 hours. After that adjust the temperature to be 20 – 24 C of 36 – 50 hours for ferments slowly.

Then mixture heated to 100C for 3 to 5 minutes. After that leave it for 1 week at room temperature. After this step fermentation process is completed and allow the mixture natural drying for 1- 2 days in shady and cool ventilated place. Then the product is ready to consumption.

**Fermented Milk Tomato Paste**

As a raw materials inside red color, round shaped Tomatoes selected. 2kg of tomatoes taken for the paste preparation. Raw materials washed and dried properly. Then steamed it at 110C for 10 minutes. Then tomato rind was removed and crushed them with the blender.

Yogurt or probiotic fermented milk was prepared by mixing 1 liter of fresh milk with 25 ml plain yogurt. Milk pasteurized by heating 90C for 15 minutes. Then mixture left to stand for 24 hours at normal room temperature 30C.

**Conclusion**

In many countries fermented paste is used as a side dish or a dressing. Each day people make many pastes with new recipes. Most popular countries which are involved in preparation of fermented pastes are Korea, Thailand, China, and Japan. The reason for this could be the usage of spices in the foods by Asian people more than western countries. These countries have used spices in their paste not only to enhance the flavor but also to increase the shelf life. During fermentation process sugar is broken down to other products which confer many health benefits.

The fermentation process involves the metabolic activity of a microorganism to increase the shelf life of the food naturally. Many microorganisms are involved in the fermentation process. Different fermented pastes have different fermentation conditions with cultural values. They possess different tastes and can be classified as vegetarian and non-vegetarian products. Some examples for fermented pastes can be state as fermented shrimp paste, fermented soy bean paste, fermented red pepper paste and fermented fish paste. Fermented paste benefits people not only as a food product but also create an environment harmful for pathogens and depending on the food product it can have a prolonged shelf life.

**References**


