

TAPAI from Cassava and Cereals ¹

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Tapai is a traditional fermented food very popular in Asia. As substrate can be used cassava, rice or glutinous rice. Microorganisms found in the traditional ragi tapai are moulds (*Rhizopus oryzae*, *Amylomyces rouxii* or *Mucor* sp.) and yeasts (*Saccharomyces cerevisiae*, *Saccharomycopsis fibuliger*, *Endomycopsis burtonii*). The moulds are strong amylolytic. The cooked substrates are inoculated with 0.1% (w/w) powdered ragi tapai and incubated for 30-72 hours (30°C). The final product has a sweet, slightly sour taste and a pleasant aroma.

Introduction

Traditional fermented foods have always played an important role in the daily life of Asian people. The knowhow to prepare those foods were transferred from generation to generation, very often with improvements without changing the original consistency, organoleptics, and the nutritive value of the product. The fermented foods are later studied and scientifically processed. One of the fermented foods which is very popular in Indonesia and other Asian countries is **TAPAI** or **TAPE**. The difference lies mostly in the **indigenous** microorganisms used.

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Tapai can be found or is made in Indonesia for many traditional ceremonies, like marriages, to welcome a new born, at religion ceremonies, also at birthday parties, or just consumed as a snack. Tapai is not always prepared in the villages, but also in the big cities and is consumed by all strata of the community, even by the high society. In Indonesia, tapai can be found in all food sections of the department stores, and packed in various forms.

To prepare tapai a carbohydrate source and an inoculum containing the microorganisms is necessary. The inoculum is called **ragi tapai**. The success of a good tapai depends on the preparation of the substrate and of the ragi tapai. In the Philippines ragi tapai is called bubod, in Thailand look-paeng, in China peh-chu, in Korea nooruk (Steinkraus, 1996).

Ragi Tapai.

There are various methods to prepare ragi tapai. In the villages it is commonly prepared as follows (Susono *et al.*, 1974; Susono *et al.*, 1986): rice flour is mixed with grounded spices such as garlic (*Allium sativum*), roots of the plant *Alpinia galanga*, white pepper (*Piper retrofractum*), black pepper (*Piper nigrum*), red chillies (*Capsicum frutescens*), cinnamon (*Cinamon burmani*), the fruits “addas” (*Foeniculum vulgare*), cane sugar (*Saccharum officinarum*), lemon (*Citrus aurantiacum* var. *fusca*), coconut water (*Cocos nucifera*) (Saono *et al.*, 1974). Some thin ginger slices or a few drops of ginger extract are mixed in the dough. Water is added to the mixture to make a thick dough which is then molded into small circular flat cakes, the size of 3 cm in diameter and 1 cm thick. Some coconut water is sprinkled (not always) over the cakes, or sometimes mixed in the dough. In the villages the cakes are placed on bamboo trays which are lined with banana leaves and then on top covered again with banana leaves. The trays are kept in a certain wind free place or room for 2-3 days. This is the natural “fermentation” incubator. Then the rather dry cakes are sundried and turned over several times until they are really dry. This will take about 3-4 days depending on the weather. The dry ragi tapai is put in jars or directly into polyvenil bags the size the numbers of the cakes to be stored in it (flow chart ragi

tapai). Good ragi tapai is produced in Central Java under various brands : ragi tapai NKL, Sari Madu, Sumber Urip, and Pohong Padi. In the markets are also sold another ragi tapai (Roda Mas) for the production of Brem Bali or rice wine (Gandjar *et. al.*, 1983).

As inoculum the concentration of ragi tapai is usually 0.1% (w/w). The higher the concentration of ragi tapai used the shorter incubation time is needed. However, this is often risky. In cooler areas a longer incubation period is necessary.

The microorganisms in ragi tapai.

The microorganisms isolated by scientists from various ragi tapai brands of different places and markets in Indonesia are a combination of *Amylomyces rouxii*, *Rhizopus oryzae*, *Endomycopsis burtonii*, *Mucor* sp., *Candida utilis*, *Saccharomycopsis fibuligera*, *Sacharomyces cerevisiae*, and some bacteria : *Pediococcus* sp., *Bacillus* sp. (Gandjar *et. al.*, 1983; Gandjar & Evrard, 2002; Ko, 1972; Ko 1977; Ko 1986; Saono *et. al.*, 1974; Saono *et. al.*, 1982; Basuki 1985; Steinkraus, 1996). Researchers in the Philippines, Malaysia, Thailand, Vietnam found also the same indigenous species of microorganisms in their inoculum. The moulds in the ragi tapai are strong amylolytic and degrade mainly the carbohydrate of the rice or glutinous rice into simple sugars which are then further decomposed by the yeasts into alcoholic compounds. Therefore tapai has always a sweet taste, slightly sour with a soft alcoholic smell. The rice becomes soft and during the fermentation some acids are also formed. The acids react with the alcohols resulting in a pleasant aroma of the tapai. A too long incubation time will result in a sour tapai. The role of the bacteria is minim, because their growth is already suppressed by the ingredients mixed in the rice flour during the ragi tapai making. Garlic and chilly have an anti bacterial effect (Susono *et. al.*, 1974; Susono *et. al.*, 1986).

Tapai Fermentation

Tapai is a very popular fermented product in Asia, especially in Southeast Asia. Commonly as substrates are used: cooked rice, cooked glutinous rice of the black or white variety, or cassava tubers. Occasionally tubers of the sweet potato (*Ipomoea batatas*) are also fermented into tapai. Tapai which has a pleasant taste and aroma is consumed as a snack, uncooked, or fried in case of tubers, or mixed with wheat flour, wrapped in banana leaves and steamed.

Local names for tapai are ; tapai nasi (Indonesia, Malaysia, Singapore), tapai pulut from glutinous rice (Malaysia), basi binubran from cooked rice (Philippines), chao made from rice (Cambodia), lao-chao, chiu-niang from rice (China), khao-mak from rice (Thailand), tapai ketela from cassava roots (Indonesia, Malaysia), peuyeum from cassava roots (West Java, Indonesia) (Saono *et al.*, 1986; Hesseltine & Wang 1986; Steinkraus, 1996).

Preparation of tapai ketan and tapai nasi in Indonesia

Tapai ketan is preferred over tapai nasi and is prepared as follows: glutinous rice as substrate is washed, cooked (not completely soft) or steamed. Cooled to room temperature (28-30°C). Mixed with ragi tapai powder as the starter or inoculum. Placed in wide mouth glass jars which are then covered tightly with a piece of linnen or cheese cloth and placed in a wind free area for 30-36 hours, sometimes longer depending on the quality of the inoculum and on the temperature. The product which is now soft has a sweet and weak alcoholic taste with a pleasant aroma and is ready to be consumed. It can also be kept in the refrigerator until needed. In the villages people wrap the inoculated substrate (one spoon full) in banana leaves or in leaves of the "jambu air" tree (*Eugenia aquia*) to obtain a pleasant additional aroma. A prolonged incubation time will produce a more acid tapai which is still consumed. In Indonesia, sometimes a colour (green or red) is added to break the monotonous white colour of the rice and made the tapai more attractive. The green colour is

obtained from extract of pandanus leaves and the red colour from Angkak, a pigment produced by the mould *Monascus purpureus*.

Traditional tapai from cassava roots as prepared in Indonesia

The cassava roots or sweet potato tubers are peeled, washed, steamed, until cooked, then cooled. The cooked roots are placed or arranged in piles or layers in bamboo baskets which are lined with banana leaves. Over each layer is sprinkled ragi tapai until the basket is full. Then other banana leaves are placed on top of the basket as a cover. Incubation is carried out at 28-30°C for two or three days. The roots become soft and the tapai ketela has a sweet and weak alcoholic taste like tapai ketan or in West Java popular named *peuyeum*. The product which is somewhat juicy can be consumed right away, which is often done. There are many recipes with tapai as main substrate. The cassava tapai is grounded, mixed with brown sugar, molded into balls, dipped in flour and deep fried. Another recipe which is now popular is: the cassava tapai is grounded mixed with ingredients, wheat flour, and egg, mixed well, molded, sprinkled with shredded cheese on top of it and baked as a cake (= cheese tapai cake). Cassava tapai is also cooked in coconut milk with palm sugar and pandanus leaves, a delicious snack.

Since ten years ago, in West Java, dry cassava tapai can be bought along the road side Jakarta - Bandung. The fermented whole cassava roots are sold in a hanging position in glass drawers. The shelf life is around 7 days. The method of preparation is similar as for the common popular cassava tapai. The inoculum used is ragi tapai of a different brand (Ragi Cakra), produced in West Java. The microorganisms in this ragi tapai are not yet analysed (currently under study). As an alternative traditional medicine uncooked fermented cassava is consumed to remove acne.

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