SPECIAL TRADITIONAL FOODS OF INDONESIA

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ABSTRACT

This paper presents some of special traditional foods of Indonesian origin both fermented as well as non fermented. Some of those foods have unique characteristics in the sense that they are able to convert non edible by products or waste products which usually used as animal feeds into nutritious and sometimes very tasty foods, such as oncom and some kinds of tempe.

Most of the fermented foods in Indonesia are available in solid form, liquid and semi liquid, generally prepared from vegetable products, particularly legumes, cereals, and tubers, or their by products. The technology of traditional fermentation is simple with extremely low cost production.

There are so many kinds of traditional non fermented foods available in the country. However, only a few are discussed as they also have unique characteristics. Some of them are rice chip, palm sugars, and *sale pisang.*

Traditional foods are important component in Indonesian diets especially due to their contribution as source of protein, calorie and vitamins. Moreover, since most of them are made from plant origin, they become more suitable as important diets for Indonesian people who seem depend increasingly on plant rather than animal products.

These special traditional foods are processed by traditional methods without sufficient hygienic precautions and therefore natural contamination is always possible. For that reason in this presentation the wholesomeness of some traditional foods are summarized.

INTRODUCTION

In Indonesia enormous variety of traditional foods both from fermented as well as non fermented are easily found in the market place and in the street food vendors. For that reason the traditional foods which will be presented in this paper are only selected based on its unique characteristic in nature. Those particular foods are unique in many respects, originated and traditionally have been produced in Indonesia for centuries.

Some of those foods has the ability to convert non edible by products or waste products which usually used as animal feed into nutritious and sometimes very tasty human foods.

With the existing population growth rate of 2.34%, Indonesia should review its present usage of all raw materials potentially suitable for food and convert more of its agricultural waste products to human use. As the prospect of food shortages become more acute, people in Indonesia seem depend increasingly on plant rather than animal product for their calorie and protein diets.

Traditional foods are important components in Indonesian diet especially due to its contribution as source of protein, calorie and vitamin.

The technology of traditional fermentation is simple with extremely low cost of production. Like many other traditional foods, the process is carried out by traditional method without sufficient hygienic precautions, and therefore natural contamination is always possible. For that reason, in this presentation, the wholesomeness of some traditional foods will also be discussed.

FERMENTED FOODS

TEMPE

Tempe is a key protein source for millions people in Indonesia and generally serve as a meat substitute together with their grain centered diets. For that reasons tempe will receive better attention and elaboration in this paper. Tempe is one of the most popular foods among common people and still popular also for the affluence families.

Depending on the raw material used tempe may be grouped into several kinds i.e.

tempe kedelai, using soybean as raw material, solid and white color.
tempe "gembus", using tofu residue as substrat, solid and white color.
tempe "bongkrek", using coconut presscake as raw material, solid and white color.
tempe "benguk", using legumes koro benguk (*Mucuna puriens*) solid and white color.

Regardless the source of the raw material as substrate, all tempe product utilizing *Rhizopus oligosporus* as the predominant microorganisms.

In general the word tempe usually means as tempe "kedelai" or soybean tempe. This particular product is the most popular among the Indonesian population.

As shown in Table 1, tempe kedelai or soybean tempe has the highest protein content and more nutritious than tempe from other kind.

TEMPE KEDELAI (Soybean tempe)

The Indonesia, centuries ago without modern chemistry and microbiology, develop a fermentation product called tempe, in which soybeans are soaked, dehulled, partially cooked, and inoculated with molds belonging the genus *Rhizopus.* During 1 to 2 days of incubation at warm place, to soybean are knitted into a tight compact cakes by the fibrous mold mycellium.

Eventhough in the old days most of the tempe production was still using banana leaves as a wrapping material, to day several tempe cottage industries have adopted the tray and plastic bag methods. The tray method was

practiced by spreading the inoculated beans on a tray, covered with a layers of banana leaves or wax paper and incubated at room temperature. Martinelli and Hesseltine (1964) developed a new method of incubating the tempe in plastic bags or plastic tubes with perforations at 0.25 to 1.3 cm intervals to allow access of oxygen.

It's protein content is over 40 percent on dry basis. Due to its high nutritive value, tempe make a good substitute for meat in the food. Indonesian have has this product in their diet for centuries. Tempe fermentation is characterized by its simplicity and rapidity. After being fermented soybean required only 3—4 minutes deep fat frying (190°C) or 10 minutes boiling, as compare to raw soybeans which generally required about 6 hours boiling to prepare them for consumption. Tempe is actually the first "quick cooking" food developed in the world (Steinkraus, undated).

Table 1. Typical Proximate Composition of Important Traditional Fermented Foods in Indonesia* (per 100 g).

Commodities	Moisture	Energy Kcal	Protein g	Fat g	Carbohydrates g	Ash	Reference
VEGETABLE PRODUCTS							
Tempe							
Soybean tempe	64	149	18.3	4.0	12.7	1.0	
Tempe gembus	81	..	4.9	2.3	..	0.8	(a)
Tempe bongkrek	73	119	4.4	3.5	18.3	1.4	
Tempe benguk	64	141	10.2	1.3	23.2	..	
Oncom							
Orange oncom (Peanut presscake)	77	..	8.6	3.6	..	1.4	(a)
Black oncom (Peanut presscake)	57	187	13.0	6.0	22.6	1.4	
Orange oncom (Tofu residue)	84	..	4.0	2.1	8.4	..	(b)
Tape							
Tape singkong (cassava root)	56	173	0.5	0.1	42.5	0.8	
Tape ketan (glutinous rice)							
Tauco	65	165	10.4	4.9	24.1	7.4	
Soysauce	63	46	5.7	1.3	9.0	15.4	

* Indonesian Foods Composition, Ministry of Health, 1967. (a) Slamet D. and Ig. Tarwotjo (1971); (b) Saono S. (1976).

Fermentation made soybean much softer when compare to cooked beans. Much of the soybeans composition is solubelized by the fermenting organism. Half of the original protein was broken down into water soluble decomposition products, such as amino acids.

In a general, fermented foods are more attractive to the consumer than the raw ingredient and one of the advantages of tempe and so other fermented foods are that it left no waste.

Although it is a firm cake, yet the specific gravity is approximately 0.9 only, the tempe cake float in water. Tempe has lost its beany flavor of cooked raw soybeans and when fried in oil it has a pleasant flavor, aroma and texture.

In Indonesia, particularly for people who live at Java island, tempe is a key protein source for millions people, who enjoy it daily in quantities of 1 to 4 ounces (30—120 gr) and generally served as a meat substitute together with their grain centered diet. The estimated nation wide tempe production annually is about 325,000 tons or equal to more than 35 percent of the total annual Indonesian soybean production is transformed into tempe. The conversion factor from dry soybean into tempeh 61.2 moisture is 100 : 174.3 (Winarno, 1984). Tempe is also becoming an important food in Malaysia.

Microorganism in Tempe

Ko Swan Djien and Hesseltine (1979) stated that at least four species of *Rhizopus* including *R. oligosporus* Saito, *R. oryzae, R. stolonifer* (Ehrenbex Fries) Lind, and *R. arrhizus* Fischer, could be used to make tempe. The species of *R. oryzae* and *R. arrhizus* isolated from tempe used successfully in Holand to make tempeh.

In an extensively survey to determine which mold species are generally used by traditional Indonesian manufacturers to make good tempeh, 118 cultures were isolated from 81 tempeh samples collected from markets in various parts of Indonesia. Tempeh collection were made on the islands of Java and Sumatera, and ranged from locations at sea level to places in the mountains up to 1000 m above sea level, with mean temperature ranging from 15°C to above 30°C. Collection sites were selected internationally to answer the question of whether or not mold cultures isolated from cooler regions would be different from those from warm places. Most of the cultures which could produced tempeh in pure culture, however turned out to be *R. oligosporus* and it was proved from that finding that it is not depended on the place where tempeh is produced (Ko and Hesseltine, 1979).

In addition to the mold, numerous bacteria of both spore and non spore forming types exist in tempeh. Yeast and other micro-organisms were also found (Van Veen & Shaefer, 1950). Saono *et al.* (1976) collected samples of tempe from throughout West Java and isolated 69 mold species, 78 bacteria species, and 150 yeast species. The bacteria were reported as definitely

undesirable, contributing off odors to the tempeh if they were allowed to grow and develop (Dupont, 1954).

Starter for Tempe Production

The availability of a appropriate starter culture is essential for producing a good quality tempe (Wang & Hesseltine, 1982). Traditionally Indonesia people prepare starter culture by collecting small pieces of a previously fermented tempe. The collected pieces of tempe are air dried or sundried, ground to a smooth powder and used as inoculum. In some cases, the surface of a previously fermented tempe cake, where most of the mycellium is found, may be sliced, sundried, ground and used as inoculum (Ko and Hesseltine, 1979).

Usar (also called as waru or laru) is the most popular starter culture used for tempe preparation in Indonesia. *Usar* is prepared by using leaves of either *Erythrina* sp., *Hibiscus dimilis* B_1 or *Hibiscus tiliaceus* Linn Whose local name is *waru putih* in Java. Lowersides of these leaves are covered with downy hairs (*trichomos*) to which the mold mycellium and spore can adhere.

Usar is prepared as follows: First place a *Hibiscus* leaf on a tray with lower hairy side facing, sprinkle 30 to 40 inoculated soybeans over the surface of the leaf. The place a second leaf about the same size with lower side down on top of the first leaf to form a sandwich with inoculated soybeans in between them. Likewise, several sandwiches are prepared and wrapped in a perforated plastic wrap and placed in a wooden tray. The wooden tray containing sandwiches is covered with a gunnysack (cloth) and to ferment for 5 to 6 h. During fermentation, the mold will grow on the soybeans and hairy lower sides of leaves. The leaves are removed, sundried and stored until they are used for inoculation.

A small leaf of *usar* inoculates about 3 kg of dry soybeans that have been previously soaked, dehulled, and cooked (Shurtleff & Aoyagi, 1979). This method is more popular because it produces the pure traditional starter culture. Further, growing the mold between leaves aliminates contamination of microorganisms from outside. In some parts of Indonesia, other leaves with hairs especially teak (*Tectona grandis*) are also used for producing mold starter culture (Shurtleff and Aoyagi, 1979; Ko and Hesseltine, 1979; Burkill, 1935).

Although, "usar", a traditional inoculum or starter have been in use for centuries in preparation of tempe, very little is known about its characteristics and biochemistry. Therefore, it is important to study in detail the microbial and biochemical properties of *usar*.

Tempe and Anaemia

One of four nutrition problems in Indonesia is nutritional anaemia. There are several kinds of nutritional anaemia which have been known among them are due to iron and vitamin B_{12} defficiency.

Consumer eating meat regularly have no problem getting enough vitamin B_{12} in their diets. However, people subsisting principally or totally on rice, or other cereal grains in their diets may be insufficient vitamin B_{12} which lead to pernicious anaemia (Steinkraus, 1961).

There is interesting discoveries that tempe made with the pure mold *Rhizopus oligosporus* contains very little vitamin B_{12} compared with tempe made by traditional processing. The mystery was solved when it was found that a specific bacterium has been identified as *Klebsiella pneumonae* (Curtis *et al.,* 1977), a non pathogenic strain present in commercial samples of tempe, produces vitamin B_{12} during the fermentation. From this finding show that presence of a certain bacterial species is very beneficial from the nutritional point of view (Liem *et al.,* 1977). Tempe actually is one of the first vegetable foods shown to contains nutritionally important amounts of vitamin B_{12} essential for proper formation of erythrocytes and prevention of pernicious anaemia.

Indonesian tempe may contain 30 ug/g of vitamin B_{12}, it means that if the average of tempe- consumption/person/day of 60 g is equal to meet 60 percent of daily requirement of vitamin B_{12} (Liem *et al.,* 1977). Recommended dietary allowance of 3 μ g of vitamin B_{12} per day for adult has been set by the committee on Directory Allowance. The average PER of soy tempe is 2.4 as compared to casein which is of 2.5. The Biological Value (B.V.) and the NPU are 58.7 and 56, respectively. The digestibility quotient of tempe is 86.1%.

Tempe and Antibodies

It has been reported that tempe has the beneficial effects on patients with dysentry in the prison camps of World War II. The antibacterial activity or growth inhibitors produced by *Rhizopus oligosporus* during tempe fermentation have been reported (Wang *et al.*, 1969).

It also reported that eventhough antibacterial tests indicated that the compounds produced by *Rhizopus oligosporus* does not exhibit a broad spectrum activity but it is very active to some gram positive bacteria.

The Indonesian people are constanly exposed to overwhelming source of infection and their diet are frequently inadequate, yet they posses a wonderful resistance to disease.

Tempe and Wholesomeness

Since the tempe is a naturally fermented food, it is always possible for natural contamination of tempe with aflatoxin producing fungi such as *Aspergillus flavus* and *A. parasiticus.* These fungi produce aflatoxin, a known carcinogen. It is reported that the mold species responsible for tempe fermentation do not produce aflatoxin (Hesseltine, *et al.,* 1967; Winarno, 1981; Hesseltine, 1981). Further there have been no reports on toxin found in foods

prepared from soybean. The mold required for tempe fermentation is reported to protect tempe and tempe like foods against aflatoxin production and aflatoxin producing molds (Ko, 1974). The tempe mold *R. oligosporus* prevents accumulation of aflatoxin in tempe by hydrolizing it (Wang and Hesseltine, 1981; Cole and Kirksey, 1972).

A decrease in flatulence producing sugars is also reported during tempe fermentation. Colloway *et al.* (1971) found that- tempe was "essentially" non flatulant when fed to human subjects.

Sudarmadji and Markakis (1977) reported that the *R. oligosporus* in tempe has very strong phytase activity that subsequently hydrolyzes phytic acid in tempe to free mositol and phosphate. Phytic acid decreases the bioavailability of various minerals (Ca, Mg, Za, and Fe) because of its chelating properties, raw soybeans contain about 1.4% phytic acid (Sudarmadji & Markakis, 1977). About 32.9% of phytic acid was hydrolized during tempe fermentation with *R. oligosporus* (Table 2).

Table 2. Phytic acid and flatus factors of tempe before and after fermentation.

Component	Fermentation		Reference
	Before	After	
Phytic acid	1.23	0.96	54
Flatus Factors (mg/g) (raffinose family of sugars)	16.5	2.0	59

Flavor and Color of Tempeh

Good fresh tempe has blend and fragrant odor with withish color. Recently there is a trend in developing a new tempe product with own unique flavor using special strain *Rhizopus oligosporus* to meet the local flavor and taste such as Shrimp flavor using *Rhizopus oligosporus* strain T - 3 (Ching, 1980) or by transplanting new synthetic flavoring agent before or after mold (starter) inoculation.

The other trend is to add coloring agent into tempe. In Lampung, Sumatera, addition of yellow coloring agent into have been practiced during the last one or two year, so that in the market or display food shop are easily from fresh tempe with yellow color. What coloring agent they are using for that purpose is still being studied carefully.

Other tempe from legumes

In Central Java, a variety of mature, adible legume seeds known under the general local name of "koro" are harvested and sold in the market place. Ganjar and Slamet (1979) have studied the amino-acid composition of traditional fermented foods prepared from these beans such as *Posphocarpus tetragonolobus* (winged beans = kecipir), *Mucuna puriens* (koro benguk), *Canavalia ensiformis* (koro pedang) and *Vicia faba* (kacang babi). Saono (1976) reported that the beans of *Leucaena leucocephalia* (petai cina) have also been fermented into tempe. These fermented products are mostly consumed by the low socio-economic groups.

TEMPE GEMBUS

Tempe gembus is prepared from fresh solid residue from tofu processing.

The preparation or manufacture of these products is usually confined to the urban area only, where tofu is manufactured. If the inoculum used is *Rhizopus oligosporus,* the greyish - white endproduct is called the tempe gembus.

The peroximate composition and the nutritive value of the protein as depicted at Table 1, are dependent upon the raw material used as substrate soybean presscake as tofu residue have varies in residual protein as fat content also varies from one tofu manufacturer to the other. Depending on their efficiency of the preparation of tofu. The protein content is 4—5% and fat content 2%.

TEMPE BONGKREK

Tempe bongkrek is a special type of tempe which contains partly defatted coconut residue, which remains after coconut meat is pressed to obtain oil or when shredded coconut meat is extracted with water to obtain coconut milk, and is obtained by fermentation, using *Rhizopus oligosporus,* soybean may be added to partly defatted coconut.

A well made product is a compact cake, which is completely covered and penetrated by the white mold mycellium. Occasionally the mold mycellium does not develop and bacteria overgrow the mold. Than the mass remains granular and loose: it becomes slimy and develope a putrefactive odor by extended incubation. Such poorly fermented product could be poisonous.

Outbreaks of food poisoning by tempe bongkrek still occur periodically. During the latest large outbreak, shortly after new year 1977, more than 400 persons were involved and more than 70 victims died (Anon, 1974).

Bongkrek poisoning, which has been responsible for many death in Indonesia, is produced by a specific bacterium *Pseudomonas cocovenenans.* The bacterium grows readily on moist coconut presscake, which appear to be a specific substrate for production of toxin.

The bongkrek toxin consists of two substances: toxoflavin and bongkrek acid (BA.). Bongkrek acid particularly, has been responsible for dealy food poisoning, which until recently demands victims in Indonesia. Bongkrek acid is an active antibiotic against the mold *Rhizopus* used in production of white bongkrek. Thus, if conditions are favourable for development of the *Pseudomonas*, the mold is further inhibited from growing. Then the mass remain granular and loose, develop a putrefactive ador by extended incubation. Such poorly fermented product could be poisonous.

To reduce the possibility of bongkrek poisoning, people in that region add pounded dried or extract of "calincing" leaves (*Oxalis sepium*). The purpose of adding the leave probably to reduce the pH, so it can inhibit the growth of *Pseudomonas cocovenenans.* Recent studies (Bambang Soebardjo, 1984) that indicated that the calincing leaves with different concentration do not have any ability to inhibit or to stop the growth of *P. cocovenenans* and toxin production in the tempe bongkrek.

It has been reported that addition of NaCl (1.5—2.0%) to the raw material, could suppress the accumulation of bongkrek acid in tempe bongkrek, NaCl also neutralized the inhibiting affect of *Pseudomonas cocovenenans* on the growth of *Rhizopus oligosporus.* This discovery have a promising method to reduce the bongkrek victims in Indonesia.

ONCOM

Oncom and tempe are two products which are not easily to differentiate. Some oncom were prepared utilizing exactly the same microorganisms (*Rhizopus oligosporus*) as in the tempe preparation. Other oncom utilizing *Neurospora* sp. (Winarno, *et al.,* 1977).

For that reason, there is a need to develop a system of grouping which has practical means to differentiate between tempe and oncom. Based on the starter used: all fermented food utilizing *Rhizopus oligosporus* as the starter may grouped into tempe family and fermented products utilizing *Neurospora* sp. into oncom family.

Traditionally Indonesia people have recognized two different kind of oncom i.e.: *Oncom hitam* (black oncom) and *oncom merah* (orange oncom). When fermentation is carried out by strains of mold belonging to the genus *Neurospora* the product is called red oncom and black oncom, if *Rhizopus oligosporus* was used.

ONCOM HITAM (black oncom)

Peanut presscake for along time have been use for animal feed. Their content of fiber and relatively high content of undigestable component made them undesirable for human foods. Centuries ago the Indonesian has also demonstrated to the world the way to convert essentially animal feeds to human quality food, through traditional fermentation process.

Oncom which has been prepared by allowing the mold to grow on peanut presscake for approximately 48 hours, makes a food used in the daily diet of some 25 millions people. The average oncom consumption in West Java, Indonesia is 0.69 g per person perday. Like many other fermented foods, the fermentation of oncom and tempe are carried out with traditional method, in home and small scale industries.

The active microorganisms on the oncom production from peanut presscake are: *Rhizopus oligosporus* which produce oncom with black color and if *Neurospora* sp. is used could produce orange color. Through work of enzymes produced by the mold which deeply penetrated into the substrate, making the protein, lipids and other components more digestable and at the same time flavor is changed and improved.

Related to tempe, oncom can also produce vitamin B_{12} in substantial amount (31 $\pm$ 7 ng/g). The source of vitamin B_{12} in this product is not known and need further investigation.

Commercial black oncom are reported to have relatively high content of iron (55.7 mg/100 g).

Aflatoxin Problem

When peanut presscake was used as substrate, particularly for oncom production, then the possible danger of aflatoxin exist. This was actually found to be the case in Indonesia. Raw peanut presscake contain from 0.23 to 5.00 ppm of aflatoxin as received and only aflatoxin B_1 was present.

Like many other traditional fermented foods, the fermentation of oncom and also Tempe is carried out by traditional methods without sufficient hygienic precautions and therefore a natural contamination with aflatoxins producing fungi is always possible.

Neither the Tempe mold, *Rhizopus oligosporus* nor *Neurospora sitophila,* produced mycotoxin of the aflatoxin type (van Veen *et al.,* 1968) and even opposed aflatoxin production by *A. flavus.* It has also been shown that during fermentation of peanut presscake with *Neurospora* or *Rhizopus oligosporus* into Oncom, no aflatoxin was produced, even when a considerable amount of *A. flavus* spores purposedly added prior to fermentation. Van Veen *et al.* (1968) reported that *N. sitophila* and *R. oligosporus* reduced aflatoxin B_1 content by 50% when aflatoxin was already present in the growth substrate. Thus the fermentation process of oncom is beneficial in protecting the food against aflatoxin.

The basic danger is that the peanut presscake used as substrate may already be contaminated with aflatoxin. Muhilal and Karyadi (1972) reported that peanut presscake contains 450 ppb aflatoxin, and aflatoxin B_1 was present.

A survey conducted by Husaini and Karyadi (1973) showed that commercial black oncom samples contain 268 ppb aflatoxin B_1 and 115 ppb aflatoxin G_1 while red oncom contains neither B_1 nor G_1 aflatoxin. The content of aflatoxin is mainly due to the initial content of aflatoxin in the raw material. It is worthwhile to note that these data my not automatically represent the general condition of the Oncom in Indonesia.

Unfortunately, we still do not know the danger of aflatoxin to humans. Information on the effect of aflatoxin on humans is indeed very limited and even if the aflatoxin is degraded, we do not know the effects of the metabolites or toxin products.

ONCOM MERAH (*Orange oncom*)

Orange oncom is the product locally produced in West Java particularly at Bogor area. Those kind of oncom produced in that area usually made solely from tofu residue and *Neurospora sitophila* is the active predominant microorganisms. In some areas orange oncom may be prepared from peanut presscake.

Orange oncom made from tofu residue usually have low content of protein and fat. However contain considerable amount of iron (9.6 mg/100 g) and 23 ± 2 mg per g vitamin B_{12}.

Beside peanut presscake, or tofu residue, Oncom is sometimes be prepared by mixing with coconut presscake, cassava residue or tofu residue.

Oncom (black and orange) are consumed by 25 millions people daily, in particular by those who live in West Java. The average consumption is 255 g per person per year. Oncom is generally served as a snack in the form of fried oncom, or in vegetable soups and other Indonesian cuisine.

TAUCO

Tauco is one of Indonesian fermented foods which has a very good place in Indonesian diet particularly in West Java. Traditionally tauco is used as flavoring agent in Indonesia preparation consisting of meat, fish or vegetable.

Tauco is prepared through mold fermentation and then followed by brine fermentation. This first stage of the preparation of tauco is using soybean inoculated with *Rhizopus oligosporus, R. oryzae* and *Aspergillus* oryzae which may work individually or in comb-ination. Microorganisms which active during brine fermentation are *Lactobacillus delbrueckii* and *Hansenulca* sp.

The mold fermentation allowed to proceed: for 3—5 days and followed by brine (20%) fermentation which may take 20—30 days or more.

After brine fermentation is complete, the brine was drained palm sugar (25%) was added, then the mixture was cooked and stored for 24 hr or directly fill into bootles.

In addition to viscous liquid form, Tauco is available in a semisolid form obtained by sun drying of the liquid product to a final moisture content of 25%.

Liquid tauco contain 10% protein, 5% fat and 24% carbohydrate. The consumption of tauco in Indonesia is very limited due to its high salt content. Since tauco is some what similar to miso, it has the potential to be developed into a mass consumption product as practice in Japan.

Tauco and soysauce had some similarity in the product preparation. Both products are prepared using the same microorganisms mainly *Rhizopus oligosporus* and some lactic bacteria. Generally soysauce made from black soybean and tauco from yellow soybean. Tauco is consist of whole beans while soysauce consist only disolved material from the soybean.

TAPE SINGKONG (*Cassava Root Tape*)

"Tape singkong" is a fermented product traditionally prepared from cassava (*Manihot utilisma*) roots. This product is also commonly recognized as "peuyeum". The preparation is very simple which include peeling, washing, steaming, cooling and inoculation with "ragi" at the level of 0.05%. During fermentation the roots are arranged in the bamboo basket and covered wi-th banana leaves and kept at room temperature for 2—3 days (Winarno, 1983).

Some microorganisms originated from "ragi" are responsible for the changes taking place during fermentation. The microorganisms had been identified by many workers are *Candida lactosa, C. javanica, C. japonica, C. nycoderma, Hansenula malanga, Sacharomyces vordermanii, Torula* sp., *Chlamydomucor oryzae, Mucor javanicus, M. roxii, M. dubius, Rhizopus oryzae, Fusarium* sp., *Endomycopsis* sp., *Penicillium* sp., (Dwidjoseputro and Wolf, 1980: Gandjar and Steinkraus, 1967; Saono *et al.,* 1974; Apandi *et al.,* 1979; *in* Pudji Rahayu, 1980). The fermentation process has two main stages, i.e. the conversion of starch into simple sugars carried out by amylase producer molds and the conversion of sugars into acids and alcohols carried out by certain yeast like *Saccharomyces* and *Zycosaccharomyces* species (Winarno, 1983).

According to Ko Swan Djien (1979) the processing of cassava roots into tape singkong results in the improvement of taste, aroma, nutritive value and palatability while good quality of tape is sweet, slightly sour and aromatic taste, too much acid content in tape is undersirable.

The other important components of tape singkong are as follows 0.5 percent protein, 0.1 percent fat, 42.5 percent carbohydrate and 56 percent moisture (Winarno, 1983).

It is interesting to note that process of fermentation causes the HCN content decreases drastically (Tuilan, 1979). Apart from that Pudji Rahayu (1980) reported that fermentation of a bitter variety of cassava (Muara Putih)

resulted in high amino nitrogen and reducing sugar concent eventhough its taste was not much acceptable.

A new diversified product of tape singkong has been developed, namely the dried tape singkong flour (tepung tape singkong). In its preparation the readily fermented cassava roots are cut into thin chips, dried, milled and sieved to an extent of about 60 mesh.

Wilda and Winarno (1981) reported that the tape singkong flour, especially those which underwent fermentation period of 36 and 48 hours, had thermoplastic and higroscopic properties so that it required quick handling and hermetic storing. She also added that the specific characteristics of tape in term of its organoleptic properties, flavour and aroma were remain preserved at the flour.

TAPE KETAN

This product is basically the same as tape singkong only they are different in raw material used. Tape ketan is prepared from glutinous rice *Oriza sativa glutinosa* which may be the black or the white variety one. For its incubation process, a glass jar or a container made from bamboo claled "besek" is used. When the second type container is used, the rice is based and covered with banana leaves. An interesting result had been during fermentation process was the increasing for amino acids lysine and thiamine content which would be very important for those who use the fully scraped rice as staple food (Gandjar and Steinkraus, 1976). The important components of tape ketan which characteristic its taste are acidity 3.4—4.5 meq/100 g, reducing sugar 5—11 percent and alcohol 1.8—2.9 percent (Nuraini, 1980). The acidity of tape singkong as it was reported by Pudji Rahayu (1980), was in the range of 2.7—7.7 meq/100 g.

BREM CAKE

When the white tape ketan is prolonged to ferment up to 5—6 days and then pressed, a quite amount of juice is relased. The juice is then concentrated by gradual heating and spreaded into layer of about 1.0 cm thick followed by drying in the sun for 6—7 hours, finally a sweet alcoholic solid is left. This solid is a usually then cut into bars of 10 × 1 cm size and called brem cake.

This product is a very popular fermented food in East and Center Java, characteristized by slightly saur and sweet in taste, yellowish white in color and readily disolved in the mouth. It has the important compositions as follows: sugar 65—68 percent, starch 4.5—14.4 percent, soluble solid 1.2—2.4 percent, moisture 8.7—18.9 percent, acidity 1.6—2 percent, protein 0.3—0.6 percent and fat 0.1—3.7 percent (Saono, *et al.*, 1982).

From nutritional value point of view, brem cake is also a nutritions food since it may contain lysine up to 0.25 percent and vit. B_1 0.12 mg/100 g.

The quality of brem cake is much influenced by the ragi used. To have a good quality of brem cake, ragi containing, high activity of amilatytic, producing good aroma and having least ability in alcohol formation, is required.

NON FERMENTED FOODS

RICE CHIP

Rice chip which known locally as "kerupuk gendar", "karak" or "lempeng" is very tasty and very popular in Central Java, particularly for the low income family.

Rice chip production is conducted by small family run industries, using rice from the cheapeast quality rice as raw material. Active ingredient involved in the rice chip product is called "air bleng" or "cetilet". Air bleng, is a clear and rather cloudy water solution and having salty taste, collected from "air bleng" mine or from mineral well.

The major producer of "air bleng" in Indonesia is located in Purwodadi area, Central Java. This air bleng production have been practiced for centuries, and started since 1700 i.e. during the Dutch occupation period (Sigit Kartasanjaya, 1981).

Like traditional salt production, air bleng is also produced by collecting water from "mineral well" and placed in the bamboo container which have been split into half, locally known as klakah, having length of 25 cm and width 5—10 cm. From this technique of preparation usually yield two different products in the form of bleng salt crystal and the saturated bleng solution. Traditionally for rice chip production, the producer prefer using "saturated bleng solution" instead of the bleng salt crystal. The rice chip made of "air bleng" is much tastier (gurih) as compare with its crystal.

The use of saturated bleng solution for rice chip industries or kerupuk gendar are still practiced in several area in Central and East Java. However the-major production or rice chip and so the consumption of saturated bleng solution are in Drono area (Klaten) and Kaliungu area (Kendal) both in Central Java.

The production of rice chip is as follows: After cleaning and washing, rice (13 kg) be steamed until half cooked, and mix with "air bleng" as solution or solid. If solid "air bleng" will be used, first disolved in the water 1% (200 gr in 30 liter water) and add 250 g of sodium salt. This solution together with rice was then cooked, and then steam agen until become completely cooked. This rice was then pounded into sticky smooth product, mold and let it cooled down and hardened, sliced and sundried, and sold as product and served after deep fried in oil.

The active ingredient in "bleng" is reported as borax or boric acid which present in "bleng" as much as 4—7%. Boric acid H_3BO_3 orthoboric acid occurs in nature as mineral sasolite, white granule or powder. Borax is also known as pyroborate, diborat, or sodium (1:2) borate. Beside for rice chip production bleng is also used for preparing severa; food industries such as for kecap in Purwodadi, and noodle and makaroni. Noodle and macaroni producers usually use the pure borax acid, white crystal produced from pharceutical industries. The mechanical action on rice chip production is still not understood in depth or in detail.

For dry noodle production the amount of borax added is about 10 gr borax acid per 20 kg wheat flour and for wet noodle need 15 gr per 20 kg wheat flour.

The Wholesomeness

Borax and Boric acid consumption beyond certain level could endanger human health. The intoxication of boric acid have been reported from several countries. The boric acid if consumed will be stored in the body cumulatively, and only very- little, if any will be excreted through urine and faeces. Ingestion or absorption may cause nausea, vomiting, diarhea, abdominal cramps, cyanous, compulsion. Death has occurred from less than 5 g in infants and from 5 to 20 gr in adults. Chronic use may cause borism (dry skin, eruption, gastric disturbances). LD 50 orrally in rats, 3.0 g/kg. The government in July 1979 release a regulation in using boric acid in food. The use of borax in rice chip production in the village should be studied and carefully assessed for possible any health hazard.

PALM SUGARS

Palm sugar in some respect are better than cane or bit sugar. They are not only sweet but also tasty. In the preparation of other Indonesia traditional foods palm sugars are favorably chosen, such as in the preparation of kecap and tauco (Anonymous, undated). There are three kinds of brown sugars produced traditionally in Indonesia i.e. gula aren, gula kelapa, and gula lontar.

Gula aren (Arenga sugars) are produced from juice called "nira" of arenga tree (*Arenga pinnata*). The juice are taken from peduncle of male flower. After preliminary treatment including light beating of the peduncle, the flower spikes are cut off and the sugary juice dropping from the peduncle is collected in a vessel made from bamboo. Other vessels such as pots, tins other receptacles may also be used.

The boiling of the juice is done in open pans. To prevent the liquid from boiling over, various hard objects are put into it, such as coconut endosperm or cuts of wood. As soon as the sugar will set it is stirred and poured into moulds.

Arenga sugar is dark in color, and contains quite a lot of impurities. However, arenga sugar has a very characteristic taste and those who like it will enjoy the unique taste and flavor of arenga sugar.

The amount of sugars in fresh juice is from 5 to about 15 percent. The palms obtains this at the cost of starch in the trunk which dissapear and the palm dies exhausted about two years after flowering begins.

The juice ferments very rapidly. Yeast and bacteria immediately get into the juice, and fermentation has began before the juice is removed. Therefore, the vessel is sterilized by smoking.

Albuminous matter are commonly associated along with the sucrose in the juice which makes the sugar soft, hygroscopic, and very ready to ferment. In addition, unremovable pectins and gum give to the sugar characteristic dark color.

Other palm from which brown sugar can be produced from its juice is coconut (*Cocos nucifera*). The sugar is called gula kelapa. The juice is taken from the inflorescence. The tip of the inflorescence is cut off and the stump bleeds; by hanging a bamboo vessel or earthen ware the juice is collected. The juice which contain 16.5 percent sucrose is then boiled down into brown sugar. Like in arenga juice, fermentation by microorganisms occors in coconut juice. Thereafter, to produce good quality brown sugar fermentation process is hindered by sterilization of collecting vessel.

Brown sugar can also be produced from nira or juice of siwalan or lontar (*Borassus flabellifera* Linn. or *Borassus sundaicus* Becc.) and brown sugar produced is then called gula lontar.

The tappers climb the palm at the sign of its flowering. He cuts off leaves in such away as to allow freedom to access to the young inflorescence. The tip of the inflorescence is sliced off and the juice is collected in vessel. To hinder fermentation little lime is added.

It is said that Borrassus juice is richer in sugar than most of other palms. This sugar is nearly all saccharose (79.12 percent). The area where gula lontar is produced are southern part of South Sulawesi and East Nusa Tenggara, whereas gula aren and gula kelapa produced is mong more places in Indonesia.

SALE PISANG

Banana is probably the only fruit can be found everywhere in Indonesia at anytime since it is widely grown. Yearly production is more than 1 million tons and in 1980 banana production was 1,976,826 tons. (Anonymous, 1982). Meanwhile the production of other Indonesian principal fruits such as mango, durian, rambutan, pineaple and salak are all less than half million a year. Therefore from the economic point of view banana is very important and need more attention.

One of the products from banana is "sale pisang" or it is also called "pisang sale". It is a dried ripe banana contains about 15—25 percent moisture, has brown color, sweet taste and specific flavor. The drying period usually takes 3 to 5 days.

The origin place of sale pisang is not known, though it is believed that sale pisang was originated in West Java. The traditional method sale making is very simple include skin peeling and sun-drying. During drying the banana is pressed carefully each successive day so that the sale produced will have flat shape. During drying banana is placed on a bamboo mat which have been covered by rice straws. It is believed that paddy straw plays a key role in the formation of sale. Unfortunately the phenomenon has not been reported so far.

The principal chemical reactions known during preparation of sale are browning reactions and conversion of the remaining starch of the banana into sugars. Browning reactions both enzymatic and non-enzymatic, make sale has brown to dark brown color, meanwhile conversion of starch into sugar and of course reduction of moisture make sale sweeter than- the original banana. The best banana varieties for making banana are pisang raja siam (*Musa paradisiaca* var *Sapientum*) followed by pisang Ambon (*Musa paradisiaca* var *Forma typica*).

To improve traditional method of sale preparation many research projects have been carried out (Sinaga, 1973; Zachrawan *et al.*, 1973; Randwijani, 1978; Sayekti and Muryati, 1981; Sasmah, 1983; and others). Most of the above workers foccussed their investigations mainly either on the methods of drying or control of formation of brown color of sale. The use of 1000 ppm Natrium metabisulphite solution to which peeled banana is dipped for 10 minutes prior to drying improved the color of sale (Randwijani, 1978) and keeping quality up to 8 weeks (Sasmah, 1983).

The basic research on what actually happen during sale formation, including the role of rice straw in traditional method so that sale has specific taste and flavor has to be conducted in the future.

CONCLUSION

Enormous varieties of traditional food are found easily in the market place and in the street vendors.

Indonesia is considered one of the most richest nation in fermented foods. Several unique fermented foods have been presented and tempe was given better attention and elaboration. The technology of traditional fermented is simple and earned and by traditional method without sufficient hygienic precautions, and therefore natural contamination is always possible. For that reason, the wholesomeness of some traditional foods have been discussed.

Tape singkong technology which is perishable in nature should need better attention on its shelf life and quality control.

Some of the non fermented foods which are unique have also been presented mainly sale pisang, palm sugar, rice chip.

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