

Traditional fermented food and beverages for improved livelihoods

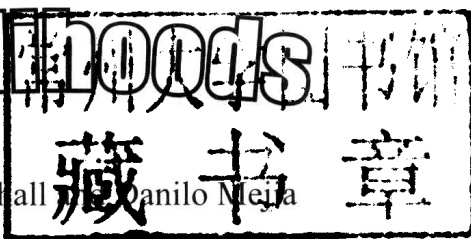
FAO Diversification booklet 21



Diversification booklet number 21

Traditional fermented food and beverages for improved livelihoods

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Preface

The purpose of the FAO Diversification booklets is to raise awareness and provide decision support information about opportunities at farm and local community level to increase the incomes of small-scale farmers.

Each booklet focuses on a farm or non-farm enterprise that can be integrated into small farms to increase incomes and enhance livelihoods. The enterprises profiled in the FAO Diversification booklets selected are suitable for smallholder farmers in terms of resource requirements, additional costs, exposure to risk and complexity. The products or services generated by the enterprises are suitable for meeting demand on a growing, or already strong, local market and are not dependent on an export market. However, in this booklet export markets will be considered, because enterprise development, local markets and prices will be influenced by imports.

The main target audience for these booklets are people and organizations that provide advisory, business and technical support services to resource-poor small-scale farmers and local communities in low- and middle-income countries. It is hoped that enough information is given to help these support service providers to consider new income-generating opportunities and how these might enable small-scale farmers to take action. What are the potential benefits? What are farmer requirements and constraints? What are critical 'success factors'?

The Diversification booklets are also targeted to policy-makers and programme managers in government and non-governmental organizations. What actions might policy-makers take to create enabling environments for small-scale farmers to diversify into new income-generating activities?

The Diversification booklets are not intended to be technical 'how to do it' guidelines. Readers will need to seek more information or technical support, so as to provide farmer advisory and support activities relating to the introduction of new income-generating activities. To assist in this respect,

each booklet identifies additional sources of information, technical support and website addresses.

A CD has been prepared with a full series of Diversification booklets, relevant FAO technical guidelines, together with complementary guidelines on market research, financing, business planning, etc. Copies of the CD are available on request from FAO. FAO Diversification Booklets also can be downloaded from the FAO Internet site.

If you find this booklet of value, we would like to hear from you. Tell your colleagues and friends about it. FAO would welcome suggestions about possible changes for enhancing our next edition or regarding relevant topics for other booklets. By sharing your views and ideas with us we can provide better services to you.

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Acknowledgements for the series

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Introduction

Fermented products can play an important role contributing to the livelihoods of rural and peri-urban dwellers alike, through enhanced food security, and income generation via a valuable small-scale enterprise option. There is such a diversity of fermentable substrate available year round, that the activity can provide a regular income. Although harvesting or substrate may be seasonal, fermentation itself is largely independent of weather, and by-products can be recycled into livestock fodder.

Fermentation activities are highly combinable with a variety of other traditional and domestic activities, and can make a particularly important contribution to the livelihoods of women, the disabled and landless poor who, with appropriate training and access to inputs, can increase their independence and self-esteem through income generation.

In the world there are a large variety of fermented foods and beverages with traditional and cultural value. The diversity of such fermented products derives

from the heterogeneity of traditions found in the world, cultural preference, different geographical areas where they are produced and the staple and/or by-products used for fermentation. In many instances it is highly likely that the methods of production were unknown and came about by chance, and passed down by cultural and traditional values to subsequent generations. Some of the most popular fermented products derive from grain, fruit and vegetables and are alcoholic-based – most notably and popularly a variety of traditional beers and wines. There are also many fermented food products which are extremely important in meeting the nutritional requirements of a large proportion of the global population. Such products have a long history of production via “kitchen” fermentation, contributing to household nutrition and to important socio-cultural practices.

■ *The origin and rationale of fermentation: Traditions and culture*

Together with drying and salting, fermentation is one of the oldest methods of food preservation, and

CASE STUDY 1 Fermented beverages: A 9 000 year history

In 2004 a study confirmed that over 9 000 years ago people of the globe were already fermenting beverages. Ancient organic material preserved in pottery jars from the Neolithic village of Jiahu, in Henan province, Northern China, have revealed, via chemical analyses, that a beverage composed of rice, honey, and fruit was being produced at approximately the same time that barley beer and grape wine were beginning made in the Middle East. Additional liquids, dated at over 3 000 years old were also remarkably preserved inside tightly lidded bronze vessels. These vessels from the capital city of Anyang and an elite burial in the Yellow River Basin, dating to the Shang and Western Zhou Dynasties (ca. 1 250-1 000 B.C.), contained specialized rice and millet "wines." The beverages had been flavoured with herbs, flowers, and/or tree resins, and are similar to herbal wines described in the Shang dynasty oracle inscriptions.

Source: Adapted from Science Daily. 2004. 9 000-Year History of Chinese Fermented Beverages Confirmed (Available at <http://www.sciencedaily.com/releases/2004/12/041206205817.htm>)

embedded in traditional cultures and village life. Fermentation processes are believed to have been developed over the years by women, in order to preserve food for times of scarcity, to impart desirable flavour to foods, and to reduce toxicity (Rolle and Satin, 2002). Today, fermentation is still widely practised as a household or village-level technology in many countries, but comparatively very few operations are carried out at an industrial level (Holzapfel, 2002). As a technology, food fermentation dates back at least 6 000 years, and probably originated from microbial interactions of an acceptable nature (see Case Study 1). Fermentation has enabled our ancestors in temperate and cooler regions to survive winter season and those in the tropics to survive drought

periods, by improving the shelf-life and safety of foods and beverages.

The importance of fermentation in modern-day life is underlined by the wide spectrum of foods marketed both in developing and industrialized countries, not only for the benefit of preservation and safety, but also for their highly appreciated sensory attributes. Fermented foods are treasured as major dietary constituents in numerous developing countries because of their keeping quality under ambient conditions - thereby contributing to food security - and because they add value, enhance nutritional quality and digestibility, improve food safety, and are traditionally acceptable and accessible (Holzapfel, 2002, Rolle and Satin, 2002). Fermentation is a low-input enterprise and provides

individuals with limited purchasing power, access to safe, inexpensive and nutritious foods.

Preservation and safeguarding of foods and beverages remain the principal objectives of fermentation, with wholesomeness, acceptability and overall quality, having become increasingly valued features to consumers, especially in rural areas where old traditions and cultural particularities in food fermentations are generally well maintained. The tradition of fermented beverages is long embedded in many cultures, and despite traditional production technologies remaining, there is potential for extension services to introduce some improved methods, particularly those for hygiene and safety. However, it must be noted in this context, despite modern food biotechnology making significant technological advances, limitations in infrastructure and existing low technologies in rural areas of most countries create challenges to keeping abreast of global developments toward industrialization (Holzapfel, 2002) and also importantly in terms of quality and safety of products.

■ **Diversity of fermented products**

A diversity of fermented products, including porridges, beverages (alcoholic and non-alcoholic), breads

and pancakes, fermented meat, fish, vegetables, dairy products and condiments (Campbell-Platt, 1987; Steinkraus, 1996) are produced from both edible and inedible raw materials in many countries. These are well documented in an FAO publication series on fermented foods (see FAO, 1998, 1999, 2000), and summarised in Box 1, and many are presented as case studies in the section on *Essentials of fermentation*. Fermented cereals and fermented roots and tubers are consumed as dietary staples throughout Africa, Asia, and Latin America, in various forms including breads, porridges, gruels, and pickles.

A wide range of grains, fruit and vegetables are also used to manufacture beverages, both thirst quenching products (mostly non-alcoholic), and those which are generally alcoholic and consumed on special occasions, including festivals. The former include tea, coffee, juices, nectars, syrups, and carbonated soft drinks. In some countries these are also used on special occasions, whereas in others alcoholic beverages, which may or may not be distilled, are preferred (Fellows and Hampton, 1992). In most countries, the market for alcoholic and non-alcoholic drinks is specific with regard to religious and cultural taboos.

BOX 1 Examples of foods and additives manufactured using industrial fermentation processes in developing countries.

- Alcoholic beverages, including some spirits, but largely wines and beer
- Milk and milk products, including cultured milks, yogurts, and cheeses
- Flavours, namely monosodium glutamate, and nucleotides
- Organic acids such as lactic, citric, and acetic acids
- Amino acids of lysine and glutamic acid
- Vitamins A, C, B12, and riboflavin
- Enzymes Amylases such as proteases and invertases.

Source: FAO 2000. *Fermented grain legumes, seeds and nuts: A global perspective*, by S.S. Deshpande, D.K. Salunkhe, O.B. Oyewole, S.Azam-Ali, M. Battcock & R. Bressani, FAO Agricultural Services Bulletin No. 142, Rome

■ Fermented Foods

Table 1 provides an overview of fermented foods from around the world. The fermentation process

of some of these is detailed in the case studies presented in the section on *Essentials of fermentation*.

TABLE 1 Fermented foods from around the world

Region and name of fermented products	Type of product
Indian sub-continent	
Acar, Achar, Tandal achar, Garam nimboo achar	Pickled fruit and vegetables
Gundruk	Fermented dried vegetable
Lemon pickle, Lime pickle, Mango pickle	
South East Asia	
Asinan, Burong mangga, Dalok, Jeruk, Kiam-chai, Kiam-cheyi, Kong-chai, Naw-mai-dong, Pak-siam-dong, Paw-tsay, Phak-dong, Phonlami-dong, Sajur asin, Sambal tempo-jak, Santol, Si-sek-chai, Sunki, Tang-chai, Tempoyak, Vanilla,	Pickled fruit and vegetables

TABLE 1 Fermented foods from around the world (Cont.)

Region and name of fermented products	Type of product
South East Asia	
Bai-ming, Leppet-so, Miang	Fermented tea leaves
Nata de coco, Nata de pina	Fermented fruit juice
East Asia	
Bossam-kimchi, Chonggak-kimchi, Dan moogi, Dongchimi, Kachdoo kigactuki, Kakduggi, Kimchi, Mootsanji, Muchung-kimchi, Oigee, Oiji, Oiso baegi, Tongbaechu-kimchi, Tongkimchi, Totkal kimchi,	Fermented in brine
Cha-ts'ai, Hiroshimana, Jangagee, Nara senkei, Narazuke, Nozawana, Nukamiso-zuke, Omizuke, Pow tsai, Red in snow, Seokbakji, Shiozuke, Szechwan cabbage, Tai-tan tsoi, Takana, Takuan, Tsa Tzai, Tsu, Umeboshi, Wasabi-zuke, Yen tsai	Pickled fruit and vegetables
Hot pepper sauce	
Africa	
Fruit vinegar	Vinegar
Hot pepper sauce	
Lamoun makbouss, Mauoloh, Msir, Mslalla, Olive	Pickled fruit and vegetables
Oilseeds, Ogili, Ogiri, Hibiscus seed	Fermented fruit, vegetable seeds
Wines	Fermented fruits

TABLE 1 Fermented foods from around the world (Cont.)

Region and name of fermented products	Type of product
Americas	
Cucumber pickles, Dill pickles, Olives, Sauerkraut	Pickled fruit and vegetables
Lupin seed, Oilseeds	Pickled oilseed
Vanilla, Wines	Fermented fruit and vegetable
Middle East	
Kushuk	Fermented fruit and vegetables
Lamoun makbouss, Mekhalel, Olives, Torshi, Tursu	Pickled fruit and vegetables
Wines	Fermented fruits
Europe and World	
Mushrooms, Yeast	Moulds
Olives, Sauerkohl, Sauerruben	Pickled fruit and vegetables
Grape vinegar, Wine vinegar	Vinegar
Wines, Citron	Fermented fruits

Source: Adapted from Cambell Platt, G. 1987. Fermented foods of the world-A dictionary and guide, Butterworths, London

■ **Traditional beers and wine**

While there are many different types of fermented drinks (see Case Study

2) the most commonly available and best known are beer and wine (see Table 2).

TABLE 2 Fermented beverages from around the world

Source	Name of fermented beverage	Name of distilled beverage
Barley	beer, ale	Scotch whisky
Rye	rye beer	rye whisky
Corn	corn beer	bourbon whiskey
Wheat	wheat beer	wheat whisky, Korn (Germany)
Rice	sake sonti	shochu (Japan), soja (Korea)
Juice of fruits, other than apples or pears	wine (most commonly thought of from grapes)	brandy, cognac (France), Branntwein (Germany), pisco (Peru/Chile)
Juice of apples	("hard") cider, apfelwein	applejack (or apple brandy), Calvados
Juice of pears	perry, or pear cider	pear brandy
Juice of sugar cane, or molasses	basi, betsa-betsa (regional)	rum, cachaça, aguardiente, guaro
Juice of agave	pulque	tequila, mezcal
Juice of plums	plum wine	slivovitz, tzuica, palinca
Pomace	pomace wine	grappa (Italy), Trester (Germany), marc (France)
Honey	mead	distilled mead ("mead brandy" or "honey brandy")
Potato and/or grain	potato beer	vodka: potato mostly used in Ukraine, otherwise grain
Milk	Kumis	Araka

Source: FAO.2011. *Manufacturing fruit wines-a practical guide*, by J. De La Cruz Medina & H.S. Garcia, Rome (Unpublished)

CASE STUDY 2 Mezcal making in Mexico

Mezcals are spirits prepared by distilling cooked and fermented agave plants: a tradition which has been passed down from one generation to another for hundreds of years, and takes place in small rustic distilleries or *fábricas*, located close to water sources. Mezcal dates back 10 000 years when baked agaves were the main foodstuff for hunters and gatherers, and the fermented beverage a basic alcohol enslaved Filipinos introduced it in the 16th century. After some escaped and blended with the local population, mezcal became the distinctive indigenous liquor. Some 15 agave species are used in different regions of Mexico and each mezcal is different, both because of the species and because of the tools and processes used in its preparation

Traditionally only men are involved in the production and trading of mezcal, and local distilleries are owned by individuals who have managed to accumulate sufficient capital. Such enterprises can offer local men, who choose to be paid in cash rather than mezcal, sufficient employment and income to prevent seasonal migration in search of paid work. From a case study in Guerrero, Mexico, a group of distillers from 30 communities formed a bottling and commercialization enterprise, and a grower and distiller association, which certifies the mezcal as being of high quality, limited supply, and deriving from a sustainable harvest. The vast majority of community produced mezcal is locally and regionally traded and consumed, but observable increases in demand as a result of trends embracing established traditions and customs, have created new brands providing consumers and connoisseurs with a range of different prices and qualities, from US\$25 to US\$2 000 per litre.

Source: Adapted from Marshall, E., Schreckenber, K. & Newton, A. 2006. Commercialization of non-timber forest products in Mexico and Bolivia: Factors influencing success. Research conclusions and policy recommendations for decision-makers, UNEP-WCMC, Cambridge, United Kingdom

Beer

Beer is an ancient beverage: clay tablets describing its brewing process – found in Mesopotamia – date back more than 5 000 years. Sumerians used to prepare “beer bread” out of germinated barley seeds and by crumbling this bread into water, they obtained a liquid called “*sikaru*” which was finally boiled and mixed with a few herbs, resulting in a drink-free of harmful bacteria (FAO, 2009). Over

time, different types of starchy plants have been used for brewing, including maize (in South America), soy (in India and Iran), millet and sorghum (in Africa), and rice (in the Far East), but beer production from barley malt is currently the most common brewing process worldwide (FAO, 2009), and forms the basis of industrial brewing which is of particular importance to European countries in transition, including the Balkan States.

Brewing at industrial level requires mashing, which involves the use of hot water to extract the soluble materials from the grains, to produce a liquid called wort, and is carried out in large vessels which may be made of wood or stainless steel. The wort is then boiled, and sometimes hops (which have antiseptic qualities and assist with biological purity) are added. Boiling takes place in a flask-shaped vessel with the neck to carry away the steam and to prevent over-boiling. Prior to adding the yeast (inoculation), the wort is cooled to a lower temperature, depending on the type of beer to be produced, to prevent inactivating the yeast. Fermentation in large vats or food-grade plastic bins generally

takes one to two weeks, depending on the temperature at which the bottles are kept. The sugar needed for the fermentation process comes from the transformation of the starch in the grain.

Brewing at farm and village level, which is the focus of the “beers” mentioned in this booklet requires three factors: i) an agricultural commodity, such as millet or sorghum; ii) a source of energy that is controllable, for example a wood fire; and iii) a brewing container, for example pottery. The actual process in general consists of three basic stages – mashing, boiling and fermentation. Case Study 3 illustrates local brewing of banana beer.

CASE STUDY 3 Making Banana Beer – a popular alcoholic beverage throughout Africa

Banana beer is a weak alcoholic beverage popular throughout Africa, and is made by fermenting bananas with a cereal flour - often sorghum flour. It is sweet and slightly hazy with a shelf-life of several days under correct storage conditions. In Kenya, banana beer is known as *urwaga*, and in Uganda *lubisi*.

Ripe bananas (*Musa* species) are used as they have a high sugar content which is necessary for fermentation. Preparation involves extracting the juice from peeled bananas, which are unspoiled by micro-organisms or other contaminants. Clean boiled water is added to the extracted juice to dilute the banana juice so that the concentration of soluble solids is low enough for the yeast to ferment the juice. Grinded cereal (sorghum or millet) are lightly roasted over an open fire and then added to the diluted banana juice in a clean bucket. The bucket is covered with a clean lid, and left in a warm place to ferment for 18 to 24 hours. The ground cereal improves the colour and flavour of the beer. After fermentation the beer is filtered through a cotton cloth, sterilised with boiling water.

