

Fermentation to secure food supply



Photo: Hamid Dirar

The winning entry for ILEIA's contest on Rural People's Biotechnology was a 25-page article on "The Indigenous Fermented Foods and Beverages of Sudan". Hamid Dirar spent six years documenting age-old techniques of food fermentation in Sudan, drawing upon the rich knowledge of elderly rural women. This gives a brief taste of the longer paper.

Hamid A Dirar

Fermentation processes have lately caught the attention of food scientists because of the subtle changes that take place in the food as a result of the growth of micro-organisms in it. Positive changes include an increase in vitamin content, an improvement in protein digestibility and the development of desirable flavours and colours.

At least 90 fermented foods are made in the Sudan today. The Sudanese seem to ferment just about anything edible or barely edible. In addition to the conventional raw materials, such as cereals, milk, fish, meat, fruit and honey, unorthodox materials such as bones, hides, hooves, caterpillars, locusts, frogs and cow urine are also fermented as delicacies and/or pounded powders to use as condiments for sauces.

Sophisticated sorghum products

The rural Sudanese traditionally eat sorghum, which makes up about 80% of their staple food. Fermented sorghum products stand out as the most sophisticated foods, prepared by the most complicated procedures. The Sudanese make about 30 different fermented foods and drinks from sorghum.

These products seem to be unique in several ways when compared with those reported from other African countries. Firstly, about 12 types of sorghum bread are prepared in rural Sudan. This is quite surprising, as Africa is not famous for breads. Secondly, a number of foods and drinks are made from malted sorghum grain, including not only opaque but also clear beers, which are also not common in Africa. Energy-rich and easily transportable food for travellers is made from sorghum malt; before eating, only water has to be added, and the food swells to 3-5 times its original volume.

Some 3 million tons of milk are produced annually in Sudan. Much of this is fermented into some kind of dairy product. There are several truly indigenous products and some which were introduced from the Mediterranean and Middle East about 100 years ago. The dairy products vary from lightly fermented byproducts of butter to a thick brownish and rancid product (biruni) which can be ripened up to 10 years.

Women innovate to feed their Muslim husbands during the holy Ramadan month: hulu-mur flakes and drink, to cope with hunger and thirst.

Fermented and sun-dried foods, sausages and moist fermented products are made from several parts of slaughtered animals: heart, lungs, kidneys, livers, alimentary tract, fat and bones. In some cases, meat is also fermented to tenderise it.

Also some vegetable products are made from green leaves, seeds and groundnuts as substitutes for sour milk and meat.

Most reports about fermented fish products come from Asia; in Africa, fish is generally smoked or sun-dried. But in Sudan there are several types of fermented fish products, including sauces, pastes, dried fish and fish eggs or roe.

Wine and mead

In northern Sudan, several types of wine are made out of dates. In southern Sudan, a mead of fermented honey called *duma* is a favourite. The *duma*-making process is unique: it is very fast, taking less than 12 hours; organisms which tolerate heat are involved; and the key link in the process is a special starter culture called *iyal-duma* (seeds of *duma*). Every family brewing *duma* for sale keeps its starter as a secret, transferred from mother to daughter.

The starter is originally raised from the roots of certain trees through a painstaking enrichment technique. It is then made into a paste consisting of an aggregate of a capsulated bacterium and two kinds of yeast. If washed thoroughly with water and sun-dried after each use, *iyal-duma* can be kept for years without losing its capacity to immediately start up fermentation when diluted honey is added. This is an advanced biotechnological process carried out at the cottage level.

Innovations by women

The women's technologies are very dynamic as times and circumstances change. The women are innovative, using their traditional knowledge of food fermentation as a basis for further experimentation.

For example, when the Muslim Arabs entered Sudan some 600 years ago, they married African women. These women were faced with a Muslim husband who fasts the holy Ramadan month and who is quite hungry and thirsty in the evening. This stimulated the women to invent two products, based on traditional fermented foods, for breaking the fast after sunset: *hulu-mur* from brewing technology and *abreh* from sorghum bread. The first product, with 31% absorbable sugar, was developed to replenish glucose in the blood, and the second to quench thirst.

Abreh takes the form of thin (0.25 mm) see-through flakes, and is the finest sorghum product of Sudan. After it is mixed in water, it becomes a sweet, slippery suspension that slips down the throat without being chewed. *Abreh* and many other thirst-quenching fermented products have lactic acid as a common ingredient, and it is possible that this acid has an effect on the physiology of thirst.

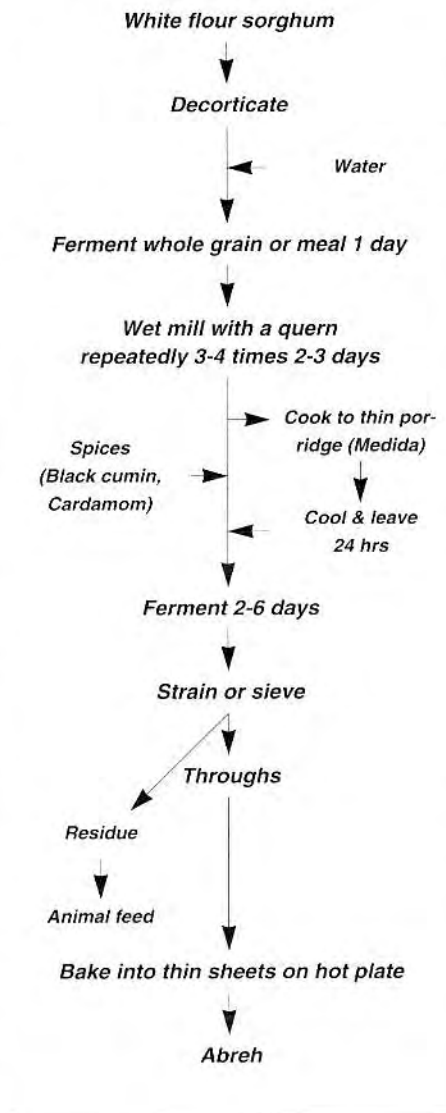
In modern times when food colours entered Sudan, women began to change with time and respond to consumer demands. For example, white, blue, green, yellow and pink *abreh* is now sold on the market.

Coping with famine

The history of fermented foods in Sudan can be traced back to at least the Meroe dynasty (690 BC - 323 AD). Most fermented foods appear to have been developed to ensure dry-season nutrition of the family or as survival foods for the drought years which inevitably occur in the highly variable climate of Sudan. This is indicated by the following:

- Most of the processing methods aim at long storage.
- Most of the foods are prepared during the short rainy season, when more raw materials for fermentation are available, and stored for the 9 lean months of the year.
- The fermentation of marginal foods such as hooves, hides, bones, fat and

Figure: *Abreh* production process



urine suggests that a major aim was to ensure survival during periods of food shortage.

This suggests that the fermentation technologies have long played an important role in indigenous self-help famine relief.

Banks of local food knowledge

The traditional biotechnology of food fermentation has not been a priority on the research agendas of funding agencies. Instead, much attention is given to recombinant DNA techniques and other modern genetic tools. The funds for research and development in biotechnology are made available mainly by multinational companies seeking large profits. Why should they be interested in poor man's food?

It is important for poverty alleviation that the traditional fermented foods and the ways of preparing them be well documented. The knowledge of the women who invented and preserved these techniques should be recognised and valued. This could be done by establishing "food

banks" to preserve information about rural food-processing methods which are in danger of disappearing under the cultural pressure of urban values on rural communities.

Modernisation in food fermentation should be based on the needs of the people who are supposed to benefit from it. Improvements in the existing technology of rural people should aim at strengthening the role of fermented foods and beverages in the struggle against malnutrition, seasonal food shortage and famine.

Traditional and modern

Modern biotechnology could be applied to research and development of fermented foods at three levels:

- raw materials, to improve those which are used in traditional fermented foods;
- process engineering, to develop improved and appropriate bioreactors for the solid substrate fermentation processes common in rural people's biotechnology;
- microbial starters, to improve their performance.

Many areas of modern biotechnology could be enriched by the micro-organisms used by rural women. For example, the yeasts used for *duma* have already proven to be vigorous fermenters of cane molasses.

If the organisms involved in traditional fermentation processes were carefully isolated, purified and characterised, they could probably be used to genetically engineer starter micro-organisms. This might enable the release of larger quantities of vitamins and amino acids in the fermented food, thus helping to improve the nutritional value of the food for rural people.

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Note: The very detailed information which Hamid Dirar gathered during his field research, together with information from the literature on African foods, will be published in December 1993 with CAB International, Wallingford, Oxon OX10 8DE, UK. The title of the book will be **The indigenous fermented foods of the Sudan**.