NUTRITION

Food for the Future

Millions of tiny microbes known as yeast cells, filled with vitamins and proteins, may relieve the pain of children suffering with kwashiorkor and other protein deficiency diseases.

By ELIZABETH HALL

➤ A SCREAM OF PAIN from a hungry, pock-marked, disease-ridden child of the tropics.

The scene is a familiar one, occurring daily in overpopulated countries around the world where children do not receive the right kind of food. They develop deforming kwashiorkor and other diseases caused by insufficient protein and essential nutrients.

Nutritionists are trying to solve this universal problem by preparing food supplements containing the healthy proteins, vitamins and minerals found in meat and milk.

One such protein supplement is food yeast, a dried, inactive version of the microbes mankind has used for centuries to change fruit juice into wine and to make bread rise.

Using the protein- and vitamin-packed yeasts for food instead of baking and brewing is a concept of the 20th century. But it is a concept being rapidly developed by war, exploding metropolitan populations, reduced farmland and protein starvation.

Food yeast cells, *Torulopsis utilis,* which live on sugar and nitrogen, can grow at the rate of three and one-half tons of yeast protein a day per 1,000 pounds of food yeast seed. In contrast with this gigantic protein factory, a 1,000-pound steer produces only nine-tenths of a pound of protein in a day; 1,000 pounds of soy seed produce about 82 pounds of protein daily under favorable conditions.

Yeasts Hold Key

That food yeast holds the key to reducing protein and vitamin deficiencies of a nation was discovered by the Germans in World War I. They grew the yeast in the hardwood liquors from the German pulp industry and were in full-scale production by the outbreak of World War II. About 16,000 tons of torula, or food yeast, were then being added each year to human food.

Zellstofffabrik Waldhof, whose aeration process is the one now used in the United States, developed a plant production capacity of 12 tons of yeast a day in their German plant, using the sugars left over from spruce and beech wood pulp production.

Food yeast is an excellent source of B-vitamins and protein to supplement such foods as flour and baked goods, meat and meat products, baby foods, candies, cheese, vegetable dishes, cereals and soups, with such substances as spices, onions or molasses that mask its flavor.

The yeast is also rich in phosphorus, potassium, calcium and occasionally iron, while there are trace amounts of copper, zinc, manganese and cobalt.

However, yeast should be used as a supplement rather than the sole source of protein, a microbiologist at the Massachusetts Institute of Technology, Cambridge, Mass., believes.

During World War II a concentration camp in Java grew food yeast under primitive conditions to supplement the meager diet supplied by the Japanese. They made their own sugar with an enzyme taken from moldy corn and the starch wastes in inedible potatoes.

Spoiled fish and meat supplied the necessary nitrogen, and the yeast cells—everpresent in the air, the soil and growing plants—supplied themselves. The program yielded more than 132 pounds of food yeast a week.

Since the war years, production of food yeast has also been studied and undertaken in the United States, Italy, Russia, France, England, Jamaica, Sweden, Puerto Rico, South Africa, Taiwan (Formosa) and Central America.

The Lake States Yeast and Chemical Division of a Rhinelander, Wis., paper company is one of two U.S. food yeast plants and uses the wood sugar from spruce pulp. The other plant which uses wood sugar is located in Green Bay, Wis. Other types of yeast produced in the U.S. are compressed and dried bakers' yeast, brewers' yeast and feed yeast.

In some cases the food yeast is made from wood sugar left over from pulp, but spent beer, milk sugar recovered from cheese-making, fruit juice, fermentation residue, grain, molasses and sulfite liquor have been successfully used as the raw material for growing yeast.

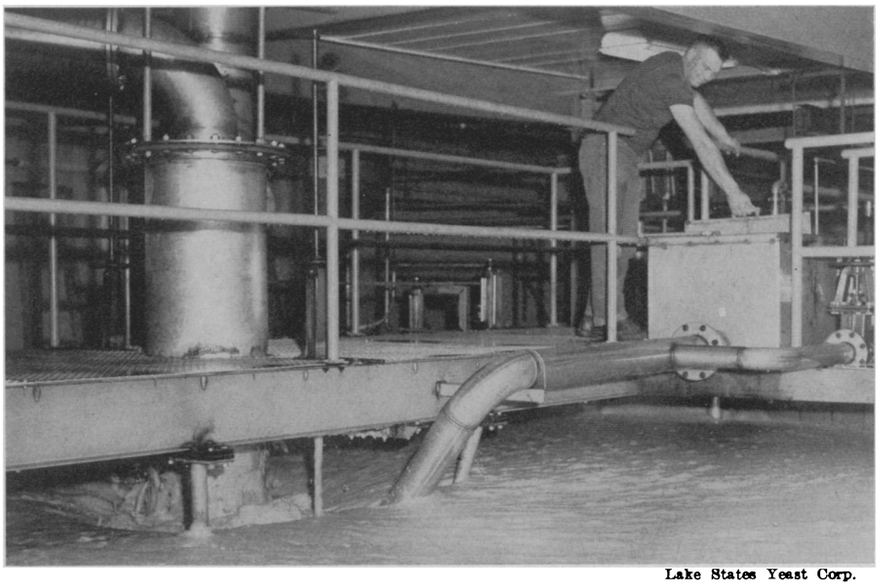
About 50% of the brewers' yeast left over from making beer in the U.S. today is debittered and recovered for use as an animal feed or human food supplement

Dried Yeast

Another type of food yeast is primary dried yeast. This one-celled organism, which reproduces by budding, is the familiar type of yeast used to leaven bread and ferment wines. However, the drying process makes it inactive. Dried yeast has as high a level of protein and B-vitamins as other yeasts, but it is grown on molasses and sometimes far away from molasses-producing regions.

Torulopsis utilis, or torula, is a non-fermenting strain of yeast that does not produce spores. Whereas the fermenting yeasts must be supplied with natural vitamins in order to grow, the torula food yeast produces its own vitamins.

Grown in an organic broth from the forest, dried torula utilizes all the basic substances found in trees to build new cells that can produce their own amino acids, proteins, enzymes, vitamins and organic



Lake States Yeast Corp.

FOOD FROM TREES—The torula food yeast growing in this fermentor vat may help to relieve the annual 30 million- to 40 million-ton protein deficiency of the world. The Rhinelander, Wis., plant has a design capacity of 4.5 tons of dry yeast daily. It is an improved, continuous version of the German Waldhof yeast plants, which helped to keep the Germans fighting in World War II.

mineral complexes. Torula yeast has the flavor of roasted chestnuts.

This particular yeast is the despair of beer brewers if it gets into unfermented beer wort, however, since it will only grow more yeast cells instead of fermenting the grain sugar.

Torula yeast, which contains 50% protein by weight, may be compared with other high-protein foods such as porterhouse steak, 23% protein; round steak, 27%; eggs, 12.8%; tuna, 29%; soybean flour medium fat, 42.5%; peanut butter, 26.1%; non-fat dry milk, 35.6%; wheat germ, 25.2%; milk, 3.5%; Swiss cheese, 27.5%; lamb chop, 24%; veal cutlet, 28%; swordfish, 27.4%; beef chuck, 26%, and almonds, 18.6%.

Using 100 pounds of sugar as a base, torula yeast will convert the sugar into 65 pounds of edible yeast, whereas a pig would convert the same amount of sugar into six pounds of pork, a cow would yield two pounds of dry milk solids, a chicken would make 1.5 pounds of meat and a steer would yield 1.2 pounds of dried beef.

Concentrates as Supplements

A protein concentrate must be a dry, stable product that can be economically produced, stored without refrigeration and blended into various foods. In addition to food yeast, other protein concentrates now being tested to help relieve the world's protein deficiency are pure amino acids, semi-purified protein flour from fish or animals, defatted grain germs, and oil seed concentrates from cottonseed, corn, sesame, peanut, soy and sunflower seed.

These concentrates are being used in nutritional supplements such as the Multi-Purpose Food sent overseas by Meals for Millions, and the anti-kwashiorkor formula called Incaparina. A typical INCAP formula, for example, contains 55% grain, 38% oilseed meal, 3% dried torula yeast, 3% kikuyu leaf meal and 1% calcium carbonate.

These supplementary formulas supply different amounts of amino acids and vitamins, depending on the particular shortage in a particular country. But the annual deficiency of the world is about 30 million to 40 million tons, equal approximately to all the protein drawn from beef slaughtered in the U.S. since 1900.

In order to take advantage of the minimum space, economic production, and rich proteins and vitamins offered in food yeast, man can use resources that he has right now. For example, the human race uses only 0.2% annually of all the plant matter produced to satisfy food, clothing, fuel, and shelter needs. Perhaps some of the 360 billion tons of carbohydrates produced by marine and freshwater algae could be used as the basic raw material in which to grow the yeast. Or more of the 500,000 tons of fermentable sugar from sulfite pulp mills wasted every year could be used.

The oldest, domesticated microbes in existence are thus seen to have a place in the future. Their origin, at least as ancient as bacteria, dates back to the Devonian age, about 400 million years ago. Fossils from this age show evidence of "budding" fungi.

When people in ancient times made bread, the finished loaf was hard and flat. But at some time or other, a piece of dough was left out in the air and wild yeast cells settled and multiplied. As the cells fermented the sugar, carbon dioxide gas bubbled up through the dough, causing it to rise. Yeast became domesticated.

Varied Uses of Yeast

Since that time Swedish scientists have used it for toothpaste, plumbers have recommended it for treating septic tanks and cess pools, and cosmeticians have favored it for curing skin ailments such as pimples and wrinkles.

When a pioneer woman went west, she carried in a pouch against her breast a yeast culture kept alive in a potato and water mixture to use each time she made bread.

Physicians used the powder of dried brewers' yeast as a food supplement for persons with pellagra.

To watch yeast cells at work, open a barrel of pickles preserved in sugar and vinegar that has been standing for a long time. Or examine the fungus-like growth that settles at the bottom of fermenting grape juice.

That grayish-looking scum or film contains millions of tiny yeasts and other microbes, microbes that can help to feed the malnourished millions of the world.

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MEDICINE

Apaches Have High Blood Pressure, Few Coronaries

➤ APACHE INDIANS in Arizona have more high blood pressure than other Americans and almost never have heart attacks, although high blood pressure is usually thought to increase susceptibility to coronary disease.

The tribe's diet is a partial explanation, Dr. Nathan J. Clifford, Buenaventure Medical Clinic, Ventura, Calif., suggested in his report of a two-yaer study of the White Mountain Apache tribe, presented at the meeting of the American Heart Association's Council on Arteriosclerosis at Los Angeles.

The Apache's total caloric intake is relatively low and only 24% of the calories are obtained from fat, in contrast to the average American diet, which consists of from 40% to 45% fat. The Indians consume very little cheese, eggs, bacon or whole milk, foods rich in animal fats, which tend to raise the cholesterol and other fat levels in the blood linked to heart disease risk.

A check of blood cholesterol levels in 188 Apache men and women more than 20 years old showed the levels to be considerably lower than those of the general American population. In 147 Apaches above 40 not a single case of coronary disease turned up when electrocardiograms were recorded during the two-year period of study.

In contrast, a study of nearly 6,000 Jewish men at Beth-El Hospital, Brooklyn, N. Y., showed that high blood pressure, or hypertension, tripled the heart attack risk between the ages of 36 and 50, and doubled it for those between 50 and 65. If hypertension was combined with high cholesterol levels the risk became five times greater.

Reporting the Apache study with Dr. Clifford were Dr. John J. Kelly Jr., San Diego, Calif., Dr. Thomas F. Leo, Hempstead, N. Y., and Dr. Howard A. Eder, The Bronx, N. Y. Dr. David Spain collaborated with Drs. Morris Gellis and Daniel J. Nathan, all of Beth-El Hospital.

• Science News Letter, 85:11 Jan. 4, 1964