Bread Making

by

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The principles of bread making.

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Yeasts are the natural agents which produce fermentation. The action which results in fermentation is a disappearance of the maltose together with the production of alcohol and carbon dioxide gas. The former remains in liquid; the latter rises to the surface and causes the boiling apperance in a mixture. The yeast plants are microscopic about 1/2800 of an inch in diameter. They exist in three different states, the resting, growing state; and the spore-bearing state. The yeast in the ordinary yeast cake is in the resting state. When a little resting yeast is placed in a solution which contains proper material for food it begins at once to consume the food and grow. As it grows it multiplies by budding. Each bud at first appears as a little swelling on the side of the larger cell which when full grown may produce a new plant. Under some conditions yeast plants produce a different kind of production body known as spores. If yeast be placed where it has moisture but not sufficient food it does not grow normally but forms spores. When the cell breaks, the spores burst forth and are ready to be distributed by the wind. Some species form spores while others do not.

Yeast is found widely distributed in nature since it is easily scattered in its spore stage and this wild yeast causes spontaneous fermentation in almost any sugary medium.

All common species of yeast require sugar for food and will not grow rapidly unless sugar is present in abundance. It is through this agency that bread dough ferments. The yeast thriving on the sugar present. Flour itself contains a large amount of starch, which is not fermentable; but in the bread dough some of the starch is changed to sugar by a diastatic action so that fermentation is possible.

Almost all sugar solutions furnishes a proper medium for yeast

growth, but it cannot live upon absolutely pure sugar, since it needs certain other materials for food: as yeast cells likewise contain nitrogenous matter, and also contain certain inorganic constituents, it is evident that nitrogen in some form, and also the requisite mineral salts, must be supplied to the growing yeast. Summing these up, yeast requires for its growth, sugar, nitrogenous compounds, and inorganic matter. The original source of yeast is wild yeast which may be obtained by exposing any sugary solution to the air.. The first method of obtaining yeast was by salt raising process. To the quantity of milk was added a little salt, sufficient to delay the growth of the bacteria which otherwise quickly sour it. The milk was then placed in a warm place for several hours. The yeast which found entrance from the air were not injured by the salt, and grew rapidly. The milk began to froth from the carbon dioxide. This material was then mixed with dough for raising. This process has gone out of use.

At the present time, the compressed yeast cake is most commonly used. It is made of a soft, somewhat soggy material, composed of a large quantity of yeast plants mixed together with a certain amount of carbohydrates and healthy nitrogenous nutriment.

The mixture is allowed to stand at a convenient temperature, that being about 35° C to form lactic acid. This will prevent the formation of a lactic fermentation. It also serves the purpose of peptonising and breaking down the nitrogenous matters so as to render them available as yeast foods. The yeast grows vigorously on the top of the vats in the distillery. This mass is washed and pressed into cakes ready for use. It has a disadvantage it will not keep long and must be used while fresh. The compressed yeast is never pure, and from the presence of bacteria causes it to decay.

The second type of commercial yeast is the dried yeast cake.

This is prepared by cultivating yeast, with starchy material and pressing it into cakes, then drying the product out at low heat. The drying kill some of the yeast plant but when the mixture is moistened and put in some sugar media the living yeast soon develope. The great advantages that they do not need be entirely fresh but they loose their strength if kept too long. Sunlight if used for drying this yeast, kills the plants.

The Brewers yeast may be grown at the top or bottom of the brewers fermenting vats. The flavor of the bread raised with brewers yeast is a little different from that raised by other kinds and is sometimes slightly bitter. The hops present in this method tends to prevent disease fermentation, as the bitter principle is a hindrance to bacterial growth. They also give a slightly nutty flavor to the bread.

Conditions to hasten fermentation are of several different kinds. First the variety and quantity of yeast used. Good brewers yeast is almost universally admitted for its nutty flavour, while it has an energetic diastasic action on the proteid and starch of dough yet its fermentative power is low in that medium. One of the reasons why potatoes are used in the brewers yeast is because of the stimulating effect on the power of producing gas. This is not so true in the compressed yeast since it produces alcohol fermentation in the dough. The best temperature for yeast growth and action is between 75°F and 90°F at a temperature lower than 25°C growth proceeds, but not rapidly. At a temperature of about 90°C the action of yeast is arrested, the vitality, is not destroyed, for with a higher temperature it again acquires the power of inducing fermentation. Actual freezing does not destroy the yeast, providing the cells do not get mechanically ruptured or injured. Above 35°C the effect of heat is to weaken the action of yeast, until at a temperature of about 60°C being that at which proteid principles begin to

coagulate, the yeast is destroyed. This applies to moist yeast for the dry yeast can stand a higher temperature.

On account of yeasts uncertain working and because it uses up some of the nutritive ingredients of the bread by feeding upon them, attempts have been made to find some substitute for it. Various chemicals have been used to produce carbon dioxid gas in the dough. The first substitute tried was yeast powder, it was a mixture of calcium, phosphate and bicarbonate of soda and potassium chlorid. When mixed with dough these were supposed to give off carbon dioxid as effectively as yeast. The self raising flour contains such mixtures. The chief objections to such yeast substitutes are that unless carefully prepared they may be inefficient or harmful, they are easily adulterated, and bread made from them is usually rather tasteless, lacking the flavor and aroma which good yeast imparts. The aerated bread is another form. The water used for wetting the dough is charged with requisite amount of carbon dioxid gas and then mixed with the flour is a specially constructed machine. Some times a little fermented barley infusion is put into the water. This aids it in absorbing the gas, renders the gluten more elastic, and improves the flavor of the bread.

Another important constituent of bread is the flour. Flour is made by the grinding of the various cereals. Wheat is the most important partly because it can be cultivated in any temperate climate, but chiefly because it yields the flour best suited to bread making, the aim of which is to produce the most appetizing and nutritious loaf at the least expense. The wheat grain is a small oval seed. Its six outer layers are known to the miller as the bran. Of these, the three outermost form is called the skin of the grain and constitutes 3% by weight of the entire seed. The three remaining layers of the bran form the envelope of the seed proper. Inside

of this lies a thin layer of membrane. Inside of this is the endosperm which constitutes the larger part of the grain and consists of irregular shaped cells containing starch granules. At the lower end of the grain, almost surrounded by the endosperm, is the germ or embryo. When this begins to germinate it feeds on the starch present in the endosperm. The fine outer layers of the bran contain very little except cellulose. The endosperm contains, besides the cellulose of its cell walls large quantities of starch, a little sugar, and nitrogenous substances known as gluten. The grem contains cellulose, nitrogenous substance, sugar and about 9 to 12 per cent of fat.

Different kinds of wheat also vary as to the amount and quality of gluten which they contain. The hard wheats are rich in gluten of a strong, tenacious character, while soft wheat contains less gluten and proportionately more starch. The gluten of hard wheat can be mixed with a large amounts of water, and produce a large loaf from a comparatively small quantity of flour. Soft wheat on the other hand, while it does not yield so large a loaf, makes a bread containing less water, and having a milder and more agreeable flavor. Flours which contain abundant cellulose cannot make as white a loaf and its value in the flour is questioned. The germ which is rich in fat and ash, is also of doubtful value in the flour, as it tends to darken the color, and its fat occasionally grows rancid and spoils the taste.

The endosperm is by far the most important contributor to the flour. In its starch lies the chief nutritive ingredients of bread. The gluten, as the principal nitrogenous constituent of wheat is called, is equally necessary, mixed with water it forms a tenacious, elastic body which expands under the pressure of the gas from the yeast until the dough

is full of gas-filled holes whose walls of tough gluten do not allow the gas to escape, and thus make the dough light and porous. The more gluten a flour holds, the more water it can be made to take up in dough, and the greater will be the yidld in bread from a given amount of flour. Gluten has a high nutritive value as it is an easily digested proteid. The strength of a flour largely depends on the quantity and character of the insoluble proteid contained in it.

There are various methods used in making bread although about the same constituents are made up in each case. Milk is used in the place of water. Dough mixed with the milk is slower to rise but makes an equally light loaf. Milk bread naturally contains a larger percentage of proteids and fats than water bread and is equally digestible. The same is true in bread in which egg and butter have been added these retard the growth of the yeast. All liquids used should be well sterilized before using. Salt is used in bread because it imparts a flavor without which bread is usually considered insipid, it also exerts slightly retarding influence on the chemical process by which starch is converted into sugar and also hinders the fermentation of the yeast, but hinders to a greater degree to acetic fermentation.

As a yeast developes best at a moderately high temperature (77° - 95° F.) the materials of the dough should be at least lukewarm, and the mixing and raising should be done in a warm place, as free as possible from drafts. The yeast should be thoroughly mixed with the flour and water. Too little yeast will yield a badly raised loaf, but too much yeast will form bubbles in the gluten of the flour, and this will be unable to resist the pressure of the excessive amount of gas, breaks open, the gas escapes, and the dough is soggy. The amount of yeast used depends on the strength of

the flour. A flour in which the gluten is abundant and tenacious can resist a much stronger pressure of gas than one poor in gluten. The gluten is composed of gliadin and glutenin. The gliaden constitutes the binding material of the flour and enables the dough to retain the gas and to become light when the bread is made. A flour which contains an excess of gliadin is soft and sticky, while one deficient in this material is lacking in power of expansion. The glutenin is the material to which the gliadin adheres and thus prevents the dough from becoming too soft and sticky. The quality of gluten determines very largely on the quality of the bread which is produced. Two samples of flour may contain about the same relative amounts of carbohydrates and proteid compounds, and have about the same amount of gas produced during fermentation, and yet produce bread of entirely different physical properties because of the difference in the gluten in the two flours.

The difference in the quick and slow process in bread making is first a larger quantity of yeast is used in the quick process and sugar is usually added to hasten the growth of the yeast plant and thus the desired action of the yeast is brought about by the proper feeding and the proper amount of heat. In mixing the sponge a portion only of the flour that it is intended to convert into bread, taken and made into a comparatively slack dough, with a portion on the whole of the water to be used in making all the flour into bread. The yeast is incorporated into the sponge together with a little salt. Because of the slackness of this com pared with dough, fermentation proceed more rapidly in the sponge. In the dough the whole of the flour and liquid with the yeast are mixed stiff, and allowed to rise in this condition.

In baking a loaf the heat in the oven should not be too great,

especially at first, or the outside of the bread will harden too quickly and the interior will not be done before the crust is thick and dark; further the gas expanding in the crumb will be unable to escape through the crust and will ligt up the latter, leaving large holes beneath it. The best temperature is between 400° - 500° F. Both the temperature and time depends a great extent on the size of the loaf. For a medium sized loaf from 1 hour to 1 hour and quarter. On being taken from the oven bread should be placed on slats or sieves so that the air can circulate about it until it is thoroughly cooled. By that time all the gas and steam have escaped which are likely to escape, and the bread is not so liable to mould when the dampness is not shut in.

The characteristics of a good loaf, when taken from the oven and cooled is, first an even sponginess should characterise the crumb of good bread. The inside should be a creamy white and of uniform color throughout The crust on top, bottom and sides should be smooth and a delicate golden brown. It should not be crumbly but cut clean. The loaf should not be too large so that it will bake too hard on outside and not enough on the inside. Good fresh bread has a crisp crust.

One of the most common dangerous faults in bread is heaviness and sogginess. This may be caused by the use of cheap flour, poor in gluten, which can not absorb all the water put into the dough; by too little or by too poor, yeast; or by insufficient kneading, rising, or baking. Another fault is a crumb full of large, irregular holes instead of the small even pores. These occur in overkneaded or overraised dough. The sticky slimy bread is caused by a bacillus, a minute organism which finds its way into the materials of the dough, survives the baking and, growing in the bread, causes it to decompose.

Not infrequently, especially in damp weather, mold forms on the outside, or even in the inside of bread. Mold, like yeast, is a minute plant whose spores are floating about everywhere in the air, ready to settle down and grow wherever they find a suitable place.

But all these faults seem insignificent compared to sour bread. This is due to lactic or in worse cases, butyric, acid given off by undesirable bacteria in their growth. The fundamental cause of this action is the unclean condition of the utensils in which the bread was made, or perhaps the yeast contained an undue proportion of these bacteria. If these bacteria are found only in normal quantities, possibly the yeast itself was weak and was quickly exhausted. The trouble may be due to the fact that the dough was allowed to stand too long after mixing, the yeast ceased working and this gave these harmful bacteria chance to work. If none of these conditions exist, the undesirable bacteria may have came from the flour. This impurity in the bread may be remedied by absolute cleanliness in the vessels and use of good yeast, some that works vigorously so that if these bacteria are present they will have no chance to work. And only the best grade of flour should be used, so that it will furnish plenty of food material and be free from undesirable bacteria.

In conclusion we will consider the use of bread in the dietary. If we wish to know which of several foods furnishes the most actual nourishment for the least expense we must know not only the actual price and the nutritive ingredients of each but also their relative digestibility. From various dietary standards it is reckoned that the average man at moderate work requires .28 lbs. of protein and .99lb of carbohydrates in his daily food. Bread contains the three classes of nutrients in about the right proportion; still in order to get the requisite amount of protein from it one

would have to take more carbohydrates than is necessary. In the analysis of flour the low grade flour; rye and wheat bread contain the largest amount of protein; corn bread and wheat rolls the most fat; wheat rolls, wheat bread from high-grade patent flour, the most carbohydrates. The amount of fat would, of course, vary greatly with the amount of shortening added in making the bread. In wheat flour the carbohydrates are present mainly in the form of insoluble starch. The extent to which soluble carbohydrates are either comsumed or produced during bread making is important, because flour contains on an average 65 per cent or more of starch, and any change affecting the starch starch has a direct effect upon both the composition and value of the bread produced. The changes which the carbohydrates undergo in bread making are both physical and chemical. From six to eight percent of the insoluble starch is changed to soluble forms, the combined action of the ferments and heat ruptures a large portion of the starch grains, rendering them more susceptible to furthur changes.

The proteids of wheat are an albumin soluble in water and coagulable by heat; a globulin soluble in dilute salt solutions and coagulable by heat; a proteose body soluble in water and not coagulable by heat; gliadin soluble in dilute alcohol: and glutenin which is insoluble in water, salt solutions or dilute alcohol. The last two are present in larger quantity than the others and together form the gluten. The next question is, Which kind of bread furnishes the greatest amount of digestible nutrients. It may be shown by the comparison of nutrients digested and energy utilized in different kinds of bread.

Nutrients Digested.

Kinds of Foods.	Protein percent	Fat	C H	Energy utilized.
White bread alone	.82	70.7	98.4	92.2
White bread with milk	88.3	66.6	98.2	94.8
Graham bread with milk	77.	58.1	92.4	88.
Entire wheat bread with milk	86.6	46.2	97.2	94.

The nutritive value of bread depends not only on its chemical composition, but also on its digestibility and the digestibility seems to depend largely on the lightness of the loaf. As compared with most meats and vegetables, bread has practically no waste and is very completely digested. It is too poor in protein to be fittingly used alone, but when used in due quantities of other foods it is invaluable and the cheapest source of protein.