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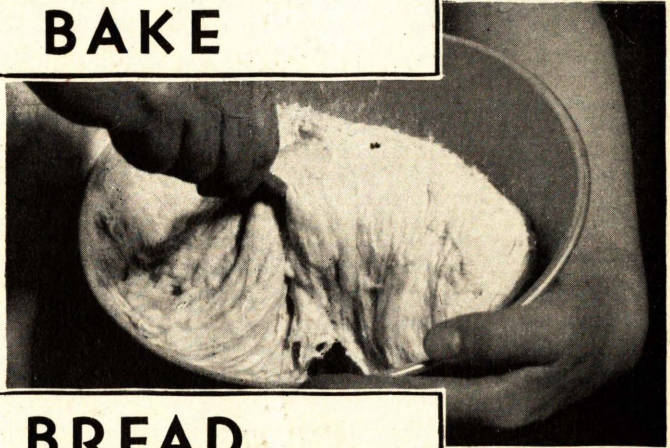
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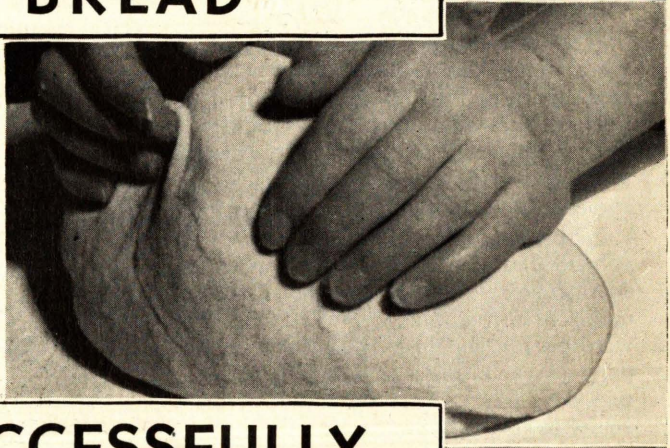
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BAKE



BREAD



SUCCESSFULLY



EXTENSION SERVICE
SOUTH DAKOTA STATE COLLEGE
BROOKINGS

U. S. DEPARTMENT OF AGRICULTURE COOPERATING

Bake Bread Successfully

By ANNA M. WILSON*

During the latter spring and summer months of 1946 the United States was able to send more wheat abroad to starving peoples because we used 80 percent extraction flour instead of the customary 72 percent.

Using 80 percent extraction flour taught us that degree of refinement does make a difference in the way flour must be handled in making yeast bread.

In this circular we shall learn why wheat means so much to a world harassed with famine and how we can make better use of wheat by understanding the principles involved in breadmaking.

Why was so much emphasis placed on wheat alone? From our study of nutrition we have learned that there must be protein, minerals and vitamins as well as calories in the human diet. The starvation study made at the University of Minnesota gives us the answer to this question.

In this study 36 young men were given only 1800 calories a day. Their diet consisted mainly of potatoes, turnips, rutabagas, macaroni and spaghetti. These young men were encouraged to expend 3500 calories daily in exercising and walking. After a period of five months on this diet, these young men's bodies were starved.

The next step was to find what foods would bring recovery. Proteins and vitamins helped sustain life, but they did not rebuild. It took 1500 to 2000 additional calories, a total of 3300-3800 calories daily, before any improvement was made. This high caloric diet had to be continued four to six months to bring the starved men to any level of efficiency.

This means that it takes calories to bring a body back from starvation—wheat, potatoes, anything so long as the starved person gets sufficient calories.

We can be proud of the manner in which consumers in this country accepted emergency flour. Now that we again have our customary extraction flour, let us make better use of this product by a greater under-

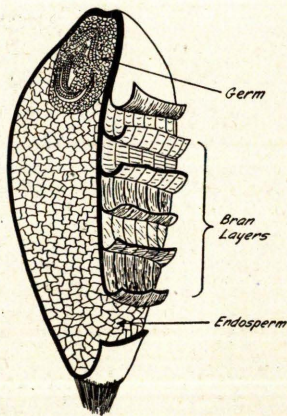
standing of the ingredients in bread and how to handle them.

Ingredients

Wheat and Flour

Wheat supplies more than 25 percent of the total number of calories in the American diet. This is a smaller percentage of calories than wheat furnished 50 years ago. However, in light of the enrichment of wheat products and our greater knowledge of the balancing effect carbohydrates have on fats, nutritionists believe our present level of cereal consumption is an advantage.

Let us look carefully at the cross section picture of a kernel of wheat. A kernel of wheat is 14.5 percent bran, 1.5 percent germ and 84 percent endosperm. The endosperm consists of granules of starch surrounded by



gluten with cellulose walls dividing the cells.

Suppose we take an imaginary tour with this kernel as it is milled into flour. First it is mixed with other kernels, some of hard, some of soft wheat. This is done to get the right blend, as wheats vary in protein content. Next the wheat is cleaned to free it of foreign substances, scrubbed to remove the fine hairs, and moistened to toughen the bran.

Then it is ground and sifted. The huge corrugated rollers, revolving in opposite directions, crack the kernels and flatten most of the germ and bran into flakes which sift out. Some of the endosperm is ground into flour as the wheat passes through the first roller. Other parts of the endosperm are

*Nutrition Specialist

ly gradually divided into flour-sized particles, making repeated grinding and sifting necessary.

Some of the endosperm resists grinding into particles small enough for flour. Some particles of bran and germ are broken into such small pieces they are not separated out with the bran. This mixture of endosperm, bran, and germ is called middlings or shorts.

In emergency flour, a larger part of the middling portion was included in the flour. The bran and germ increased the food value of the flour, but lessened its keeping quality, as weevils seem to prefer flour containing bran, and made a flour which required greater precision when making bread. There are substances in bran and germ which have a weakening action on gluten. Dough made of emergency flour could be allowed to just double, and then had to be kneaded down or baked. The customary better grade patent bread flours are 64 to 68 percent extraction. Their gluten content is stronger, and we have more leeway in allowing doughs made of them to over-rise.

Hard wheat flour is especially desirable for bread making because of the larger amount of gluten it contains and the firmness with which the starch is embedded in the gluten. When moisture in the proportions used in yeast bread is added to this flour, the starch absorbs a little and swells slightly; the gluten absorbs a greater amount of liquid and takes on a quality of sticking to other gluten. The starch and other ingredients in the bread dough become enmeshed in the gluten strands.

If one uses an all-hard-wheat flour for bread making, larger loaves for a given weight of flour can be made because of the extra rising which this dough will stand.

Many of us are inclined to use family or all-purpose flour most of the time. It makes good bread. All-purpose flour consists of a blend of wheats in which the gluten content has been reduced to an amount suitable for most kinds of home baking. The loaves of yeast bread made from it will not be as large per unit of flour. We cannot let the dough over-rise quite as much.

Blending wheats for bread flour has two advantages. It enables the miller to produce a flour of the desired gluten content and

enzyme activity. The gluten gives the dough stretching quality, making it possible for the dough to be leavened by gas. The enzyme in the flour acts upon the starch converting it to sugar at the correct rate for the use of the yeast plant.

Concern over the loss of nutrients in the milling of wheat for white flour brought about the enrichment of bread and flour. Six months after the close of the war, the federal enrichment legislation ended. South Dakota and a number of other states have a state law requiring enrichment of white flour and white bread.

Enriched bread is not equal in nutritive value to whole wheat bread. The comparison is given in Table I.

Table 1. The Degree Enrichment Increases Food Value*

	Cal- ories	Iron	Thia- mine	Niacin	Ribo- flavin
	%	%	%	%	%
Whole Wheat Bread	8	19	24	15	6
Enriched Bread	8	15	16	15	8
Unenriched Plain White Bread	8	4	4	5	3

*The percent of the daily requirement of these nutrients supplied by 4 slices of commercial bread.

Whole wheat, graham, or entire wheat flour are synonymous terms. This flour contains bran, germ, and endosperm in the same proportion as in wheat.

Yeast

We purchase yeast in the form of dry cakes, dry granular, or moist-compressed cakes. Dry cakes consist of a few dormant yeast plants mixed with corn meal or starch, and dried. The sponge method of making bread must be used with this yeast, as the yeast plants need a longer revival and growing period. Dry granular yeast consists of a number of active yeast plants combined with corn meal and dried. This yeast may be used with either the sponge or straight-dough method of mixing. Dry cake and dry granular yeast will retain their activity longer if stored in the refrigerator. Compressed yeast consists of many active yeast plants combined with starch. This yeast deteriorates in quality rapidly when stored, unless it is put in the freezing compartment of the refrigerator, where it may be kept satisfac-

torily for several weeks or even months.

The species of yeast called *Saccharomyces cerevisiae* is preferred for bread making. There are many yeasts. The reason that starter breads often have a flavor not altogether characteristic of good bread is due to the contamination of the yeast with wild yeasts.

When too much yeast is used in making bread, the flavor is yeasty, the fermentation too rapid, and the size of the loaves smaller. When not enough yeast is used, the fermentation is too slow. Bakers like to use two to three percent yeast. A range of one to six percent is possible. This range explains why recipes vary in the quantity of yeast used.

Yeast plants will grow in a temperature range of 77° to 100° F. They are killed at a temperature of 130° F. The lower temperatures, 77° to 85° F., are preferred for bread making as the resulting product will have a better flavor. There are two reasons for this: (a) there is less danger of growth of undesirable organisms in the dough; and (b) the growing yeast plant produces a larger quantity of a by-product which is oxidized in the dough to a material that has the flavor characteristic of butter.

Liquid

The liquid used in making bread may be water, potato water, milk, buttermilk, or whey. The amount of liquid used varies with the flour and ranges from one-half to three-fourths of the weight of the flour. Hard wheat bread flour will absorb liquid amounting to 60 to 65 percent of its weight. Doughs which are too stiff or too soft produce loaves of smaller volume and poorer colored texture.

Potato water is used in bread making to stimulate the growth of the yeast. A little mashed potato is also helpful, as the gelatinized starch which it contains is a readily available yeast food. Gelatinized starch may also be produced by scalding a little flour.

When milk, buttermilk, or whey is used as the liquid the overall food value of the bread is greatly increased. These liquids must be scalded, heated to 167° F., before they are used to destroy organisms which may produce undesirable flavors or interfere

with the yeast growth. Scalding the milk also overcomes a dough-softening action which unscalded milk has.

Sugar

Although naturally there is a little sugar in flour and an enzyme in flour which converts the starch into sugar, a little sugar or sirup is generally added to yeast bread dough. The sugar supplies a readily available yeast food at the beginning of the bread making process. It also gives the slightly sweet taste desired in bread. The sugar remaining in the dough at the end of the rising period caramelizes during baking, producing the golden brown crust.

Salt

Salt is added to bread for three reasons: (a) flavor, (b) to stimulate the enzyme that converts starch to sugar, and (c) the toughening effect it has on the gluten cell walls. Due to its toughening effect, salt has a favorable influence on the grain, texture, and color of bread.

Too much salt has a retarding action on yeast growth, and for this reason it is not added to some sponges in which the quantity of active yeast may be small. The enzyme-stimulating influence of salt would indicate that where the quantity of sugar added to the sponge is limited, there would be an advantage in adding the salt when the first ingredients are combined.

Shortening

Bread can be made without the addition of shortening. It is often added, however, as it improves the flavor, makes the crumb more tender, and tends to increase the size of the baked product.

Large amounts of shortening interfere with the development of gluten, and the dough rises more slowly.

Other Ingredients

Eggs are added to the richer bread doughs. Egg tends to bind ingredients together, and when the quantity of shortening used is large enough to have a detrimental influence on the formation of gluten, there is a definite advantage in adding

eggs. Eggs are also used in rather large numbers in no-knead bread. Since the dough is not kneaded enough to develop gluten, the binding effect of eggs is necessary.

Rye flour has enough natural gluten that bread can be made using it alone. However, its gluten does not retain gas well, and as a result the volume of the loaf is small. More desirable sized loaves are obtained by using some wheat flour when making rye bread.

Whole wheat flour contains enough gluten for bread making, but it also contains germ and bran which weaken the strength of the gluten. One hundred percent whole wheat breads are heavy; for this reason many whole wheat breads contain one-half to two-thirds white flour. Making the sponge using whole wheat flour, and mixing the sponge stiff with white flour makes a good proportion. The additional soaking the whole wheat flour receives in the sponge seems to be an advantage. To avoid crumbly bread, make whole wheat bread doughs slightly less stiff than white bread doughs.

Corn meal, oatmeal, potato, and soybean flour may be used in making yeast bread. These flours do not contain gluten, so must be combined with wheat flour. The resulting product will be less strong in gluten. It will over-rise and fall more readily than all-wheat flour bread. However, use of these flours gives variety to bread, and we can make successful bread with them by using a little extra care.

Manipulation

There are two standard methods of combining ingredients in bread making: (a) the sponge method, and (b) the straight dough. In the sponge method only one-third to one-half of the flour is combined with the other ingredients, and this mixture is allowed to rise before the remainder of the flour is added. With the straight-dough method all the flour is added when the ingredients are first mixed.

The sponge method has the advantage of achieving thorough mixing more easily. If the wheat has grown under drought condi-

tions, the additional soaking of a part of the flour seems to stimulate greater activity of the enzyme that converts starch to sugar.

No two people can make bread that is exactly alike, even though both use the same ingredients. The manner in which the dough is handled and judgment as to the right amount of rising appear to be the reasons why this is true; therefore, the ability to make good bread is an art. A little study of the science behind this art may help us make better bread.

When we mix the dough stiff we are endeavoring to achieve three things: (a) an even distribution of ingredients, (b) development of the gluten, and (c) combining just the right proportion of liquid and flour so that dough will have the greatest stretching quality possible.

Kneading helps produce these qualities up to a certain point, then we must stop or we lessen the sticking-together quality of the gluten. The proper kneading motion is a stretching and folding of the dough. (See two bottom cover pictures.)

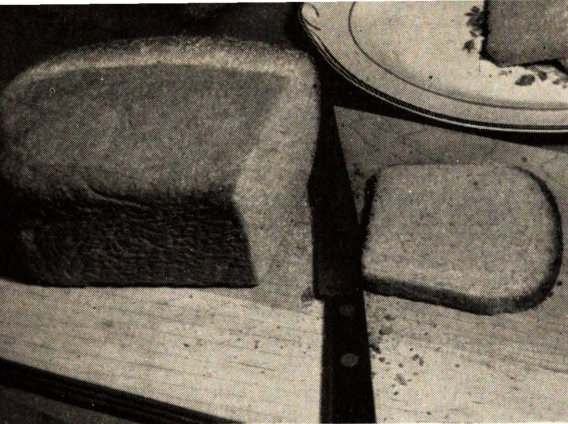
The dough should be put to rise in an ungreased or very lightly greased bowl. If the bowl is heavily greased, it may produce streaks in the bread. The dough should be set to rise where the temperature is ideal for yeast growth at the proper rate, 80°—85° F.

The purpose of punching the dough down is to lengthen the period of rising and to unite the gluten strands so that they will have better stretching qualities. This punching should not be too severe and should consist of folding and stretching, not cutting or tearing.

We should handle the dough lightly when it is being formed into loaves, as at this point we can reduce the dough's capacity for stretching.

The baking pans are greased on the bottom only. This gives the dough a better chance to cling to the sides and the loaves will be larger in volume.

The shape of the pan influences the size and texture of the loaf. Larger and better textured loaves will result from baking in shallow pans, which may explain why round loaves often have an extra nice texture. However, this shape is not considered the standard shape for bread.



Corn Meal Bread

The amount the dough may be allowed to rise in the pan before baking depends upon the kind of flour used. More rapid growth of the yeast plant is desirable during the last rising. For this reason we set the loaves of dough where the temperature is 90° to 95° F.

Baking

Ideally, we should put the bread in the oven to bake when it has risen just the right amount and before a balance between gas production and gas loss in the dough is reached. When we succeed in doing this, the loaf will rise rapidly in the oven for the first ten minutes, but a crack or rip will not form on the side of the loaf. A crack or rip is caused by the gluten leaking gas.

In general, bread should be baked at a temperature of 400°, but the temperature should be lower for large loaves or for dough containing considerable sugar. Single loaves may be baked in 45 minutes. Large loaves may require an hour or longer.

When bread is done we should remove it from the pan and allow it to stand uncovered at room temperature for two hours. It may then be wrapped in moisture-proof paper or placed in a ventilated bread box which reduces the drying out. Staling of bread cannot be prevented. Staling means loss of moisture from the loaf and loss of crispness of the crust.

We can refresh bread by heating. Heating drives moisture from the gluten back to the starch. Experimental study has shown

bread can be refreshed by heating as many as seven times.

Problems

Ropy Bread

Ropiness in bread is a common complaint during warm weather. It is caused by a bacteria which gets into the bread through the yeast, flour, mixing bowl, flour bin, or bread box. The heat of baking does not kill this bacteria. One to three days after the bread has been baked, the center of the loaf has a peculiar gummy sticky texture.

This difficulty may be overcome by washing the flour bin, mixing utensils, and bread box with strong vinegar water. Then purchase new flour and fresh yeast and use whey, buttermilk, or one to two tablespoons of vinegar to a quart of water for the liquid. If we still have ropy bread, we might just as well stop making bread until cool weather.

Weevil

It is not known how weevil eggs get into flour. Because it seems impossible to remove all weevil eggs in milling, there can be no assurance that weevils will not develop in time. Weevils appear more quickly in coarser flours. It may be they like the coarser materials best, or the smaller degree of milling may make the difference. Cake flour is the only finely milled flour which becomes weevily more quickly than coarse flours. This may be due to the greater age of the cake flours which we receive in this area of hard wheat production.

There is less danger of weevils developing in flour if it is stored in cool, dry places in air-tight containers. Sacks of flour should be stored on slatted shelves and in cord wood pile formation.

Flour which has become weevily may be fumigated using a vaporizing material consisting of 25 percent carbon tetrachloride and 75 percent ethylene dichloride, which can be purchased at drug stores. Directions for its use are given on the container.

Recipes

White Bread

- 2 c. liquid—milk, water, whey or buttermilk
 2 tsp. fat
 2 tsp. sugar or 3 tsp. sirup
 3 tsp. salt
 ½—1 cake dry, compressed, or granular yeast
 soaked in ¼ c. slightly cool water
 6—7 c. bread flour

Pour hot milk over sugar, ¼ cup flour, fat, and salt. The flour is gelatinized by the hot milk and forms more readily available yeast food. Soak yeast as directed on package, soaking it in "slightly cool" water.

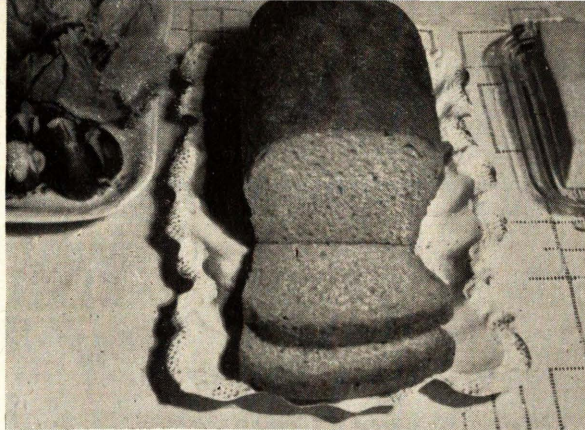
Cool milk mixture to lukewarm and add soaked yeast. Add 2 cups flour and beat well. Add remaining flour. The dough should be quite stiff, yet soft. Turn dough onto a floured board and allow to stand 10-20 minutes. Then knead until smooth and velvety to the touch and tiny gas bubbles are showing on the surface. Place in an ungreased bowl to rise. Cover with a damp cloth or a tight fitting cover. Set where temperature is 80° to 85° F. Let double in bulk. Knead down. Let rise again until double or almost double.

Divide into loaves, knead each loaf until air bubbles are evenly distributed, cover. Allow to stand 10 to 20 minutes. Reshape into loaves. Place in oiled baking pans. Let rise until double in size. Bake at 400° for 45 to 60 minutes.

Corn Meal Yeast Bread

- | | |
|------------------------------|--|
| 1 c. milk | 1 cake yeast |
| 2 tsp. sugar or 3 tsp. sirup | 2 c. white flour, or enough to make a soft dough |
| 2 tsp. salt | 1 c. yellow corn meal |
| 2 tsp. fat | |

Heat the milk to steaming and pour it over the sugar, salt, and fat in a mixing bowl. Stir until sugar is dissolved and fat melted. Cool to lukewarm. Soften the yeast in 1 tablespoon of the liquid and stir it into the liquid. Add enough of the flour to make a stiff batter. Stir out all lumps and beat vigorously until smooth. Cover the bowl with a lid and set in a warm place until batter is almost doubled. Add the corn meal and enough more flour to make a dough that can be kneaded without sticking either to hands or board. Knead until it feels soft and velvety. Grease the mixing bowl and



Oatmeal Bread

place dough in it; cover and set in a warm place until light. Shape into 1 loaf and put in a well-oiled pan for baking. Let double in bulk and then bake 40 to 45 minutes in a moderate oven, 350° F. Remove at once from pans when baked.

Oatmeal Bread

SPONGE

- | | |
|--|---|
| 1 cake yeast | 1 c. lukewarm water |
| 1 c. flour | 1 tsp. sugar |
| Dissolve sugar in water, soak yeast, add flour and beat well. Let stand in a warm place until light. | |
| Add: | |
| 1 c. milk, scalded, and cooled | 2 tsp. fat, melted |
| 1½ c. rolled oats | White flour to make a medium firm dough (2½—3 cups) |
| 1 tsp. salt | ¼ c. raisins |
| ¼ c. brown sugar or molasses | |

Turn dough onto bread board. Cover and let stand for 10 to 15 minutes. Knead until the dough is smooth and rebounds to the touch. Cover. Let rise almost double. Divide into 2 loaves. Knead loaves gently. Cover for 10 to 20 minutes. Shape into loaves. Let rise in pans until almost double in bulk. Bake 40 to 45 minutes at 375° F.

Pumpnickel

- | | |
|---------------------|----------------------|
| 1½ c. cold water | 2 c. mashed potatoes |
| ¾ c. corn meal | 1 tsp. caraway seed |
| 1½ c. boiling water | 1 cake yeast |
| 1½ tsp. salt | ¼ c. lukewarm water |
| 1 tsp. sugar | 6 c. rye graham meal |
| 2 tsp. fat | 2 c. wheat flour |

Stir the cold water into the corn meal until smooth. Add the boiling water and cook, stirring constantly, about 2 minutes, to a mush. Add salt, sugar, and fat and let stand until lukewarm. Add potatoes, caraway seed, and yeast which has been dis-



Rye Bread

solved in the lukewarm water. Finally, add the rye meal and wheat flour. Mix and knead to a smooth stiff dough, using wheat flour on the board. Cover, and set aside in a warm place until double its bulk. Shape into 3 or 4 loaves; place in greased pans. Let rise to top of pans. Bake 1 hour or longer in a moderately hot oven (375 degrees F.)

Rye Bread

1 cake yeast	1 tbsp. each of salt,
1 c. potato water	lard, and molasses
4 c. white flour	¼ c. sugar, sorghum,
3½ c. rye flour	or molasses
	2 c. boiling water

Soak yeast in lukewarm potato water, add 1 cup white flour and cover. Let rise 2 hours. Sift rye flour into a pan, add salt, lard, molasses and sugar. Pour boiling water over rye mixture and beat well. Let cool. Add rest of white flour and yeast batter. Work well for about 15 minutes. Let rise in a warm place 4 hours. Make into loaves, let rise again, and bake 1 hour at about 350° F. This makes 2 to 3 loaves.

Butter Horns

1 c. milk	3 eggs
½ c. butter	1 cake yeast
½ c. sugar	4 c. flour (approx-
1 tsp. salt	mately)

Scald milk, cool a small portion and soften yeast in it. Pour the remainder of the scalded milk over the fat, sugar and salt. Add about half the flour, beat well, then add the softened yeast and well beaten eggs. Add the remainder of the flour and mix well.

Let rise until double in bulk. Divide into four parts. Roll each part into a circle. Cut

into sections and roll the sections from out edge to point. Brush with melted butter. Place on cookie sheet and let rise until light. Bake at 400° for 15 minutes.

Yuletide Breakfast Cake

2 cakes yeast	4 c. flour
⅞ c. milk	1 tsp. salt
¼ c. shortening	¾ c. chopped dates
½ c. sugar	½ c. chopped figs
2 eggs	½ c. chopped nut meats

Scald the milk, cool a portion slightly, and dissolve the yeast in it. Cream the shortening, add the sugar and salt, and cream well. Add the well-beaten eggs and mix well. Add a portion of the flour alternately with the milk to keep the batter smooth. Add the dissolved yeast and mix thoroughly. Add the remaining flour to make a stiff batter. Fold the fruit and nuts in carefully. Pour into a greased angel food cake pan. Cover with a moistened cloth. Let rise in a warm place.

Bake at 375° F. for 35 minutes.

Basic No-Knead Bread

1½ c. milk, scalded	3 cakes yeast soaked as
½ c. fat	directed on the pack-
¼ c. sugar or light sirup	age. Use part of
2 tbsp. salt	water called for in
1½ c. water	the recipe
3 eggs	9 c. flour

Combine fat, sugar or sirup, salt, and hot milk. Cool by adding water. Add soaked yeast. Mix well. Blend in the eggs. Add flour gradually, beating well so that dough is well blended. This dough is softer than a kneaded dough and may or may not be chilled. (See top cover picture.)

If dough is not chilled, shape immediately into three loaves and place in baking pans which have been greased on the bottom. Let rise where temperature is 80°—85° F. until double in bulk. This will take about an hour.

The dough may be chilled after it is mixed. This facilitates handling. Proceed the same as with unchilled dough only allow two hours for rising.

Bake bread one hour in oven at 350° F.

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