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A New Milky Way, Whole and Nonfat Dry Milk for Quantity Recipes
Michigan State University Agricultural Experiment Station
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A NEW

MILKY WAY ⁸⁸⁻²³

whole and nonfat

DRY MILK

for your own favorite **quantity** recipes



MICHIGAN STATE UNIVERSITY
Agricultural Experiment Station
and College of Home Economics

East Lansing

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Additional separate copies of the two substitution tables on pages 18 and 19 of this bulletin are available at the Bulletin Office, Michigan State University, East Lansing. The tables are printed on stiff cards suitable for posting on your bulletin board for ready reference.

A New Milky Way for Your Own Favorite Quantity Recipes

By PEARL J. ALDRICH and GRACE A. MILLER

To You, the Food Service Operator ★ ★ ★ ★ ★

USING DRY MILK for all of your cooking is simple and easy. With the suggestions in this booklet, you can successfully adapt your own favorite quantity recipes to use dry milk instead of fluid milk.

We feel sure you will be delighted with the results. Your food will bring exclamations of delight. Your refrigerators need no longer be filled with bulky milk cans. A small amount of dry, cool storage space will take care of your dry milk supply. You will have no more worries about running out of milk or losing milk as a result of souring.

Using the suggestions in this booklet, your cooks will find that the preparation of many food items is easier. And they will thank you for doing away with the heavy lifting of bulk milk cans.

Last but not least, you can cut your expenditures for fluid milk by 40 to 70 percent—the amount of savings depends upon whether you use dry whole milk or nonfat, and whether you make the fat adjustment in your recipes with butter or with shortening when you use nonfat dry milk.

Selecting Dry Milk for Quantity Food Preparation

When you select dry milk for use in your food service, you will need to base your decision on several factors. You will, no doubt, be concerned with flavor, ease of use in preparation, and cost.

Shall I Buy Whole or Nonfat Dry Milk?

Consider using both dry whole milk and nonfat dry milk in your favorite recipes. Each of these types of dry milk offers you special advantages.

DRY WHOLE MILK

Dry whole milk may be, in some respects, easier to substitute than nonfat dry milk in many of your recipes. To use dry whole milk in the place of fluid whole milk, you need only to calculate the quantities of water and dry milk needed to replace the fluid milk in the recipe (see page 19). No adjustment of the fat content or change in the proportion of other ingredients in the recipe is necessary.

In substituting dry whole milk for fluid whole milk, reconstitute it by gently stirring the dry milk into the correct amount of warm water. Using the reconstituted milk, follow your regular procedure for combining ingredients.

Or, you may wish to simplify your procedure by blending the whole milk solids in **dry form** with other dry ingredients. Then, using the correct amount of water (page 19), **add it in** the same way that you added the fluid milk in the original recipe.

Dry whole milk is available to institutional food services in two forms. The first of these is the regular **spray-dry process** milk. It is excellent for all food preparation, and it is especially satisfactory for use in cream puddings, fillings, sauces, and soups. It dissolves readily when stirred gently into warm water.

A new dry whole milk is now available for institution use. Special processing has resulted in crystals which require much less time to stir into solution. This type of dry whole milk can also be dissolved in hot water, thus saving a good deal of time in the preparation of many foods.

NONFAT DRY MILK

Converting your recipes for nonfat dry milk is not quite as simple as converting them for dry whole milk.

However, by careful attention to product development, you can obtain foods of excellent eating quality by properly substituting nonfat dry milk for fluid whole milk in your recipes.

Often, the amount of fat in the recipe must be adjusted. Each quart

of fluid whole milk contains about 1¼ ounces of butterfat. Omitting this much fat in many recipes originally developed for whole milk may result in products of inferior quality. This is especially important in "lean" batters and doughs.

In addition, building up nonfat milk solids beyond the amounts shown in Table 1 is necessary to obtain the desired "body" and richness of "feel" desired in sauces, soups, and some desserts.

Changing the procedure for combining ingredients is sometimes essential to avoid pastiness and stickiness in certain products.

In selecting nonfat dry milk for general food preparation, choose either the regular **spray-process** dry milk or one of the "instant" process brands. You can produce fine food with either kind by following suggestions outlined in this bulletin.

Regular **spray-process** dry milk is fairly easy to dissolve by stirring it gently into warm water. After the initial mixing, allow it to stand about 15 minutes and stir it occasionally while you prepare other ingredients. In this way, much of the process of getting the milk into solution will take care of itself. Avoid whipping or vigorous stirring; this will cause excessive foam formation.

Some "instant" brands, which look very much like spray-process milk, require almost as much stirring as the spray-process milk to dissolve the powder. Other brands of "instant", which have large, fluffy clusters of crystals, dissolve quickly with little stirring.

For general food preparation, you will **NOT** want to buy spray-process dry milk labeled **high-heat**. This type of nonfat dry milk is made especially for making yeast bread in commercial bakeries. Nor will you find nonfat dry milk made by the **roller-process** satisfactory for general use in your kitchen. **Roller-process** dry milk granules are somewhat coarse and are not readily soluble. This type of nonfat dry milk is very satisfactory for making yeast breads commercially and for preparing certain sausage products.

What Other Factors Should I Consider?

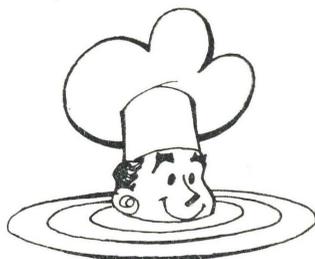
In selecting dry milk, whether non-fat or whole, whether "instant" or noninstant, keep these factors in mind.

1. **Flavor:** There is no substitute in food preparation for the fine, delicate flavor of good milk. To



check the flavor of a dry milk, reconstitute a sample, chill it, and taste it. You may be surprised at differences among samples. Dry milk with off-flavors cannot be expected to produce foods of high quality.

2. **Solubility:** Products must be easy to use if they are to be satisfactory for quantity food preparation. To



make your choice among the different brands of dry milk, observe the length of time and the amount of stirring needed to obtain a lump-free solution of dry milk and water.

In making many products, however, the milk solids can be mixed in dry form with other **dry** ingredients. For these products, instant solubility is not extremely important. For other items, dry milk which goes into solution quickly may offer some advantages.

3. **Packaging:** Packaging which will keep out both moisture and air is important when you select dry milk. Poor packaging may mean that the quality of the dry milk has deteriorated before the product is delivered to you.

Nonfat dry milk may be satisfactorily packaged in fiber drums or tough paper bags, both lined with polyethylene bags which are tightly sealed.

Dry whole milk must also be packaged to guard against moisture and air. Some processors use

polyethylene bags in fiber drums; others seal the dry whole milk in 5-pound metal tins in which the air has been displaced by nitrogen to help retain the freshness of the butterfat. Although this special packaging in tins is more expensive than other methods, it does prevent quality deterioration for longer storage periods.

4. **Cost:** Both dry whole milk and nonfat dry milk will save money on your milk bill. Changes in the market price for fluid milk are reflected to a lesser degree in the cost of dry milk.



The cost per pound of dry whole milk of the spray-dried type varies between one-half to two-thirds of the cost per gallon of fluid whole milk. Instantly soluble dry whole milk is usually somewhat more expensive than the spray-dried type, but it is usually less expensive than fluid milk.

The cost per pound of nonfat dry milk of the regular spray-process variety is usually about one-fourth to two-fifths of the cost of a gallon of fluid whole milk.

Even when the cost of making a fat adjustment with butter is added, you can still cut your milk bill by about 50 percent.

Most brands of "instant" nonfat dry milk are somewhat more expensive than regular spray-dry process nonfat milk of comparable quality. You can still save about 30 to 35 percent on your milk bill by using "instant" nonfat dry milk, even after adding the cost of the fat adjustment made with butter.

When fat adjustments recommended for use with nonfat dry milk are made with shortenings other than butter, the possible savings from the use of nonfat dry milk are even more dramatic. Many operators feel, however, that the use of butter for the fat adjustment improves flavor and increases other palatability factors in many products.



Deciding How Much

DRY MILK to Buy

Dry milk is available in several different kinds and sizes of packages. Usually, you will notice substantial savings in the cost per pound if you purchase the larger containers. However, the handling convenience of small containers is a point smaller

operators may wish to consider. The following market units are generally available:

Dry Whole Milk

- 5-pound metal tins, hermetically sealed, six cans per case.
- 50-pound fiber drums or bags with polyethylene bag liners.
- 75-pound fiber drums or bags with polyethylene bag liners.
- 100-pound fiber drums or bags with polyethylene bag liners.

Nonfat Dry Milk (spray-process)

- 50-pound fiber drums or bags with polyethylene bag liners.
- 100-pound fiber drums or bags with polyethylene bag liners.
- 200-pound fiber drums or bags with polyethylene bag liners.

Bulk poundage may be purchased at local dairy processing plants.

Where to Buy DRY MILK

You can get both whole and nonfat dry milk from your wholesale food dealer. If he cannot supply you, contact a local dairy for information. You may also wish to write to companies which advertise dairy products nationally, requesting information about suppliers of dry milk in your locality.

Storing DRY MILK

Spray-process dry milk of the "non-instant" type takes up moisture from the air quite readily and may become lumpy if not properly stored. Because of this tendency, keep both whole and nonfat dry milk in **tightly** closed containers to keep out air and moisture.

Polyethylene bags (tightly closed with a rubber band) or metal containers with tightly fitted lids are fine for storage. Keep dry whole milk in a cool, dry place to prevent the development of rancidity and off-flavors in the butterfat.

Pointers As You Travel the New Milky Way

1. Use the proportions given in Table 2 when you convert your recipes to use dry whole milk in place of fluid milk. Use Table 1 proportions for cakes and breads. For sauces, soups, and desserts increase nonfat solids $1\frac{1}{2}$ to 2 times the amount given in Table 1.
2. Weigh dry milk carefully for all recipes. If you rely on "guess-work" or casual estimates, product quality is almost certain to suffer.
3. Study your recipe procedure to determine where it might be simplified and clarified when you convert recipes to dry milk.
4. Combine dry milk with other dry ingredients wherever possible, and use the **calculated** amount of water to replace the fluid milk of the original recipe in the mixing procedure. For recipes in which reconstituting the milk is necessary, let reconstitution of the exact amount needed be the first step of preparation.
5. Use **lukewarm** water to reconstitute dry milk, unless package directions indicate hot water may be used. Hot water will cause

the dry material to form gummy, insoluble lumps unless the crystals have been especially made for use with hot water.

6. Sprinkle dry milk on the surface of the warm water, and stir **gently** with a french whip until fairly well dissolved. Allow the mixture to stand 15 to 20 minutes without heating, but stir occasionally. In this way, dry milk goes into solution easily with very little effort on your part. Brisk stirring or beating, by hand or with an electric mixer, produces a heavy foam layer which is difficult to break down.
7. Use a double boiler or steam jacket kettle (low steam) when you make sauces, soups, fillings, or puddings. Direct heat or prolonged high temperature causes mixtures to scorch and brown on the bottom and sides of utensils. Although a tendency to scorch also occurs in products made with fluid milk, this behavior is more pronounced and occurs more quickly when dry milk is used.
8. Cook thickened mixtures made with dry milk **below** the boiling point. You get the best thickening results from flour, starches, and eggs at temperatures below boiling. Boiling mixtures containing dry milk may result in a "rough" texture or curdled appearance.
9. Note special suggestions in the bulletin for making fat adjustments in certain products when

you use nonfat dry milk to replace whole fluid milk in recipes. In making some foods, the fat adjustment is extremely important; in others it is optional. In still other products, increasing the dry milk solids above the normal reconstitution level gives better results than making the fat adjustment.

10. Note that in handling batters and doughs, you may find them softer than comparable products made with fluid milk. Do **NOT** add extra flour. Instead, allow these mixtures to stand 15 to 20 minutes before scooping, rolling, cutting, or shaping if you wish to retain delicacy and tenderness.



Beverages

Kind of dry milk: nonfat or whole

You can prepare chocolate-flavored drinks quickly and easily. To make 1 gallon of beverage: Sprinkle 1 pound dry milk on top of $3\frac{1}{4}$ quarts water, stirring gently until dissolved.

For hot cocoa, heat the milk over hot water or low steam. Stir in chocolate syrup, using $2\frac{1}{2}$ to 3 cups per gallon of beverage, depending on the desired flavor. Add 1 tablespoon of vanilla.

For cold chocolate drink, stir chocolate syrup into the unheated milk. Chill well. Add a scoop of softened vanilla ice cream for a special treat.

Delicious "Coolers" with Dry Milk

With a blender, and shaved or finely crushed ice, you can make delicious, creamy, thick cold drinks. For each 8-ounce glass of finished beverage, place 1½ cups of shaved ice in a blender. Add 3 tablespoons of water, ¼ cup nonfat dry milk, and 1 to 2 tablespoons of powdered sugar. Add flavoring ingredients as desired.

Put the top on the blender, and blend on high speed until fluffy and thick.

Suggested amounts of flavoring ingredients (per 8-ounce glass):

- 2 Tbsp. fruit juice concentrate or fruit puree
- ⅓ cup frozen fruit
- 1½ tsp. instant coffee + ¼ tsp. vanilla
- 2 Tbsp. chocolate syrup
- 2 Tbsp. chocolate syrup + peppermint oil
(1 drop of peppermint oil is enough for 1 quart)
- 1 egg + ¼ tsp. vanilla + dash of nutmeg
- ½ medium-size ripe banana + ¼ tsp. vanilla

Cream Soups and Sauces

Using dry **WHOLE** milk: See proportions of ingredients on page 10.



Sprinkle dry milk on warm water in double boiler or steam jacket kettle. Stir gently with french whip. If you use "noninstant" milk, let stand 20 minutes, stirring occasionally. Remove ¼ cup of milk for each ounce of flour to be used in thickening. Add butter or shortening to remaining milk, and scald.

Make a **smooth** pouring paste of the flour and the small amount of milk removed from the kettle (above). Slowly add to scalded milk-butter mixture, stirring with french whip until smooth and thickened. Cook covered over low heat 10 minutes, stirring occasionally. Add seasonings.

Reducing the amount of both the fat and flour below the generally accepted proportions for **thick** and **very thick** sauces gives smoother and more stable products. Suggested proportions for 1 gallon of cream sauce made with dry **WHOLE** milk are shown in the table at top of page 10.

Use steam jacket kettle or double boiler. Do **NOT** boil the mixture. All cream sauces tend to thicken during long periods of standing in heated kettles. Do not prepare too far in advance of use.

Cream Sauce with Dry Whole Milk: 1 Gal.

Kind of sauce	Water	Dry whole milk	Butter	Cake or pastry flour
Thin (soups).....	3½ qt.	1 lb. 1 oz.	2 oz.	2¼ oz.
Medium (vegetables).....	3½ qt.	1 lb. 1 oz.	4 oz.	4 oz.
Thick (entrees).....	3½ qt.	1 lb. 1 oz.	5½ oz.	5½ oz.
Very thick (croquettes).....	3¼ qt.	1 lb.	9 oz.	10 oz.

Cream Sauce with Nonfat Dry Milk: 1 Gal.

Kind of sauce	Water	Nonfat dry milk	Butter	Cake or pastry flour
Thin.....	3½ qt.	1 lb. 6 oz.	6½ oz.	2¼ oz.
Medium.....	3½ qt.	1 lb. 6 oz.	8¼ oz.	4 oz.
Thick.....	3¼ qt.	1 lb. 5 oz.	9¾ oz.	5¼ oz.
Very thick.....	3¼ qt.	1 lb. 5 oz.	12½ oz.	10 oz.

Using **NONFAT** dry milk: See proportions of ingredients given above. Follow the same directions for combining the ingredients as given for using dry **whole** milk in sauces.

Special adjustment of butter or fat and of milk solids is important for best quality. Suggested proportions for 1 gallon of cream sauce made with **NONFAT** dry milk are shown in the table at bottom of page.

Special care is needed to keep the melted fat from floating on cream soups and thin cream sauces. Blending the flour paste into the scalded milk and fat mixture **thoroughly with a french whip** helps to keep the fat globules suspended as the product thickens. Do **NOT** boil.

Thin sauces can also be made by the usual method (adding scalded milk to the roux of melted fat and flour), but this method is more difficult for making large quantities.

Puddings, Pies, and Desserts



Butterscotch Pie or Pudding

Using **NONFAT** dry milk: Increase solids 1½ times the amount given in

Table 1. Sprinkle on warm water in double boiler or steam jacket kettle, stirring **gently** till dissolved. If you use "noninstant" milk, let stand 15 to 20 minutes, stirring occasionally. Save a small amount of milk (equal to the amount of egg) to use later. Scald the remaining milk.

Blend brown sugar well with cornstarch and/or flour. Add to scalded milk, stirring continuously with a french whip until smooth and thickened.

Blend the eggs and the small amount of milk previously removed from kettle thoroughly. Slowly add to hot mixture, stirring constantly till well blended. Cook about 25 minutes, stirring continuously throughout the cooking period. Remove from heat and blend in butter, vanilla, and salt. Cool before dishing or pouring into shells.

If the original recipe is high in butter, no fat adjustment is needed. If your recipe is low or medium in butter content, use Table 1 for adjusting the butter.

Never use direct heat. Use steam jacket kettle or double boiler. **NEVER BOIL** the mixture. Nonfat dry milk shows less tendency to form flecks in the finished product than does dry whole milk.

Pumpkin Pie or Custards

Using **dry WHOLE milk**: In figuring the amount of dry milk to use, **double** the quantity shown in Table 2.

Blend dry milk with half of the sugar; sprinkle dry mix on calculated amount of warm water (page 19) in the

bowl of an electric mixer. Stir **gently** with french whip—**not** the mixer whip. If you use "noninstant" milk, let stand 20 minutes, stirring occasionally.

Blend remaining sugar with spices and add to milk; add slightly-beaten eggs and then the pumpkin. Blend well with mixer and proceed as usual.

For extra richness in pumpkin pies and custards, increase milk solids as suggested here. Granulated sugar is easier to use than brown sugar in this product. Dark brown sugar or strong baking molasses may cause white flecks of milk to appear in the pumpkin pie mixture. These flecks usually dissolve during baking.

Nonfat dry milk, even when increased proportions are used, does not give a product comparable in creaminess and richness to one made with dry whole milk.

Chocolate Pie or Pudding

Using **dry WHOLE milk**: Mix dry milk with about one-third of the sugar. Sprinkle on **calculated** amount of warm water (page 19) in double boiler or steam jacket kettle. Stir **gently** with french whip. Let stand 20 minutes without heating; stir occasionally. **Do not** scald at this point.

Blend **sifted** cocoa with cornstarch and remaining sugar. Add dry-mix slowly as you **heat the milk mixture**, stirring constantly till smooth and thickened. (Do not scald milk before you begin to add the dry-mix; the thickening sets in too fast for easy handling.)

For pies, cook chocolate cream filling made with cornstarch and dry whole milk until it reaches 185°F. Use a thermometer to take the temperature at the center of the mixture; hold the thermometer halfway between the surface of the pudding and the bottom of the kettle—and an equal distance from all sides of the kettle. When 185°F. is reached, turn off the heat; blend in butter, vanilla, and salt. Cover the kettle, and allow the filling to stand undisturbed for 15 minutes. Pie filling may be poured into baked shells while hot, or it may be cooled before pouring.

For pudding, use the same temperature endpoint as for pie, omitting the final 15-minute holding period. Cool pudding partially before dishing.



Dry whole milk makes a superb product, creamy and rich even with recipes which do not include eggs. Do not use direct heat. **Never boil.**

Using NONFAT dry milk: Increase solids 1½ times the amount given in Table 1. Follow procedure for pudding made with dry whole milk. Cook the filling made with cornstarch and nonfat dry milk to 173°F. When this temperature is reached, follow same procedure used for filling made with dry whole milk.

The amount of butter required in the original recipe may be increased according to Table 1, if desired.

If your recipe calls for eggs, mix them with an equal amount of milk taken from the kettle before the thickening has been added. After the cornstarch mixture thickens, add the egg-milk mixture slowly, stirring till well blended. Reheat this mixture to 160°F. and proceed as outlined before.

Vanilla Cream Pie or Pudding

With dry WHOLE milk: Combine dry whole milk with all the sugar. Sprinkle dry-mix on the calculated amount of warm water (page 19) in double boiler or steam jacket kettle, blending gently with french whip. If you use "noninstant" milk, let stand 20 minutes, stirring occasionally. Remove enough milk to make a paste with the cornstarch. Scald the remaining milk.

Mix the cornstarch to a smooth paste with the milk you saved; blend beaten eggs into this paste. Add gradually to scalded milk, stirring constantly with french whip till smooth and thick.

For pies, cook vanilla cream filling made with cornstarch and dry whole milk until it reaches 170°F. Use a thermometer to take the temperature at the center of the mixture; hold the thermometer until the reading is steady at 170°F. Keep the thermometer halfway between the surface of the pudding and the bottom of the kettle — and an equal distance from all sides of the kettle. When 170° F. is reached, blend in vanilla, salt, and

butter. Turn off the heat, cover the kettle, and allow the filling to stand undisturbed for 15 minutes. Pie filling may be poured into baked shells while hot, or cooled before pouring.

For pudding, use the same temperature endpoint as for pie, omitting the final 15-minute holding period. Cool partially before dishing.

Using NONFAT dry milk: To produce comparable richness and creaminess in vanilla puddings made with nonfat dry milk, be sure your recipe has four to five eggs per quart of milk for flavor and color. Folding the hot custard into a stiff meringue (made by beating together the egg whites and part of the sugar) makes the finished product the most delicate and delicious vanilla cream you have ever eaten. Without this technique, vanilla cream made with nonfat dry milk seems "pasty" and lacks the full flavor and creamy consistency which makes it so popular and versatile.

You will find the "meringue method" outlined here **increases the yield** of your recipe by almost one-third. For example, if your original recipe yields 6 quarts, it will yield about 2 gallons when you convert it to nonfat dry milk and use the "meringue method" for combining ingredients.

Double the amount of solids given in Table 1 when you substitute nonfat dry milk for fluid whole milk in your recipe.

Combine nonfat dry milk with about half of the sugar. Sprinkle the dry-mix on the **calculated** amount of warm water (page 18), blending

gently with french whip. If you use "noninstant" milk, let stand 20 minutes, stirring occasionally. Remove about one-sixth of the milk to use later. Scald the remaining milk. Separate the egg yolks and whites. Mix the cornstarch to a smooth paste with the milk you saved; blend beaten egg yolks into this paste. Add gradually to scalded milk mixture, stirring constantly till smooth and thickened.

For pies, cook vanilla cream filling made with nonfat dry milk until it reaches 165°F. Blend in vanilla, salt, and butter (adjusted according to Table 1). Use a thermometer to take the temperature **at the center** of the mixture; hold the thermometer until the reading is steady at 165°F. Keep the thermometer halfway between the surface of the pudding and the bottom of the kettle—and an equal distance from all sides of the kettle.

Make a **stiff meringue** by beating the egg whites and remaining half of the sugar **together** on high speed till very stiff. Slowly add the hot custard to the meringue, folding carefully till no white flecks remain. Pour this filling while still hot into baked pie shells. Cool. Make these pies on the day you plan to use them; the filling will become too soft if they are kept till the next day.

For pudding, follow directions outlined for pie, using same endpoint temperature. Cool slightly before dishing.

Tapioca Cream

Using dry WHOLE milk: Mix dry milk with about half of the sugar. Sprinkle dry-mix on **calculated** amount of warm water (page 19), blending **gently** with french whip. If you use "noninstant" milk, let stand 20 minutes, stirring occasionally.

Cook tapioca and milk mixture in double boiler or steam jacket kettle, without boiling, till tapioca is clear. Blend egg yolk with an equal amount of hot milk mixture. Add to tapioca mixture and cook, stirring over **low** heat, till a smooth custard forms. Add vanilla and salt.

Make **stiff** meringue by beating the remaining sugar and egg white **together** on high speed. Slowly, add hot custard **to** meringue, folding carefully till no white flecks remain. Partially cool before dishing.

Using NONFAT dry milk: Follow procedure outlined for dry whole milk. Cook to same end temperature used for dry whole milk.

In figuring the amount of nonfat dry milk to substitute for fluid milk in your recipe, use 1 pound of solids to reconstitute each gallon of milk (instead of the amount shown on page 18).

It is not necessary to adjust butterfat in this recipe.

Baked Custard and Variations (rice puddings, bread puddings)

Using dry WHOLE milk: Mix dry milk with sugar; sprinkle on top of **calculated** amount of warm water

(page 19) in mixing bowl. Stir **gently** with french whip. If you use "noninstant" milk, let stand 20 minutes before adding other ingredients; stir occasionally. Then, proceed as usual in making custard.

Or, instead, blend the slightly beaten eggs with an equal amount of the milk mixture. Scald the remaining milk and then slowly add the blended egg mixture to it, stirring well.

Custards have been baked satisfactorily at 400°F. without a waterbath if heavy aluminum pans are used in ovens with firebrick bottoms.

Custards made with dry milk will seem a bit more quivery at the center when completely baked than will custards made with homogenized fluid milk. **Avoid overbaking.** Allow to cool until lukewarm before cutting.

Using NONFAT dry milk: In making baked custard with nonfat dry milk, your recipe should have 20 to 24 eggs per gallon of milk for color and richness of flavor. Increasing nonfat dry milk solids to 24 ounces per gallon (instead of the amount given on page 18) is necessary for giving "body" and richness. The consistency of the finished product differs somewhat from that of custard made with dry or fluid whole milk. Do **NOT** make the fat adjustment shown on page 18 when you make custard with nonfat dry milk.

Custard made with nonfat dry milk is more satisfactory if baked in individual cups or in small sheet pans. It shows a tendency to "boil up" in the center and break open if baked in standard 22- by 13-inch pans.

Puddings and Pies With Prepared Mixes

Our own laboratory tests in which dry milk was used in making puddings and pies from commercially prepared mixes have not included all brands of mixes or all brands of dry milk.



However, we believe that food service operators will find that whole fluid milk generally gives better results than either whole or nonfat dry milk in preparing desserts from these mixes. The great number of variations among the pudding and pie mixes makes a general recommendation for using dry milk in preparing these items impossible.

Cakes, Cookies, and Quickbreads

Using NONFAT dry milk: Excellent quality can be attained by using nonfat dry milk instead of fluid whole milk in your recipes for these foods.

Making the fat adjustment (as explained on page 18) is very important in maintaining lightness, tenderness, and delicacy of crumb. This is a "must" for batters which have

low-to-moderate amounts of fat in the original recipe, such as griddlecakes, muffins, cottage puddings, and "quick", low-fat cakes.

Using nonfat dry milk in batters is easy. Just mix dry milk with flour, using a french whip. Use **calculated** amount of water (page 18) in place of milk in original recipe and follow normal mixing procedure. Do **NOT** add extra flour, even though doughs and batters may appear too soft immediately after mixing. Instead, allow them to stand at room temperature 15 to 20 minutes before handling, kneading, rolling, or scooping, and they will be the right consistency to handle.

Use double-action baking powder so that very little leavening power will be lost during the period between mixing and baking.

Expect some increase in surface browning of baked products made with dry milk. You will like the golden-brown, "picturebook" appearance.



Because you can have excellent product quality much more economically with NONFAT dry milk than with either fluid or dry whole milk, we suggest you use NONFAT dry milk for all of your baked products.

Cakes and Quickbreads With Prepared Mixes



Using dry **WHOLE** milk: Most prepared mixes which require the addition of milk at the time of mixing have been developed for using fluid whole milk. If you plan to use dry whole milk, the simplest procedure will be to reconstitute the required amount (page 19) and proceed with the mixing as outlined by the manufacturer of the mix.

Using **NONFAT** dry milk: When **NONFAT** dry milk is substituted for whole fluid milk in the preparation of commercially prepared mixes, you may find that tenderness and delicacy of crumb are lost. Tunnels may even appear in some products.

Each quart of fluid whole milk contains $1\frac{1}{4}$ ounces of butterfat and nonfat dry milk contains only a very small amount. We suggest that you make a fat adjustment by adding $2\frac{1}{2}$ ounces of salad oil or liquid shortening for each quart of milk required. Add it along with the milk so that it is well blended into the batter.

Increase nonfat solids $1\frac{1}{2}$ to 2 times the amount given in Table 1.

If the mix you use requires only the addition of water or water and eggs, you will know that the dry mix already contains the proper amounts of dry milk and shortening. For these, simply follow directions on the package.

Yeast Breads

Using **NONFAT** dry milk: Making yeast breads with nonfat dry milk is simple and easy. Check Table 1 for figuring the amounts of dry milk and water you will need and the fat adjustment you should make in your formula.

Using dry milk simplifies the procedure for making yeast breads, too. You no longer need to scald and cool fluid milk. Use the **calculated** amount of hot water (page 18) to replace the quantity of scalded fluid milk required in the original recipe. Add shortening, sugar, and salt. Stir until fat melts and the mixture is lukewarm. Add yeast. If eggs or flavoring are used, add them next. Mix dry milk with about half the flour. Use this mixture in making the soft dough or sponge before adding remaining flour.



Immediately after mixing, the dough will appear softer and stickier than dough made with fluid milk.

Avoid adding extra flour if you wish a delicate, tender crumb. During proofing, the dough will become the right consistency for shaping.

Potatoes



Scalloped Potatoes

Using **WHOLE** or **NONFAT** dry milk: Here are three ways to make scalloped potatoes.

(1) For creamy scalloped potatoes, prepare thin cream sauce according to directions on page 10 for whole or for nonfat dry milk. Combine sliced potatoes and sauce as usual.

(2) For scalloped potatoes made without cream sauce, try this easy method. For each standard counter pan, 12 x 20 x 2 inches, dissolve 1 pound of **nonfat** dry milk in 2 quarts of warm water. Add this gradually to the flour and seasonings and blend until free from lumps. Pour over sliced raw potatoes in a greased counter pan. Push potatoes down so that they are almost covered by the mixture. Add butter and bake uncovered at 400°F. until tender. Deep counter

pan are not satisfactory for scalloped potatoes made in this way.

(3) For scalloped potatoes made by the dry-mix method, blend together thoroughly the **nonfat** dry milk, flour, salt, and pepper. Drain sliced raw potatoes well and place them in a large, flat bowl; sprinkle with the dry-mix, tossing until slices are coated. Place in well-greased standard counter pans, and pour hot water in at the edge of the pan. Add butter and bake uncovered until potatoes are tender (about 1 hour).

This method is particularly well adapted to handling large quantities. Standard counter pans, 2 inches deep, are much more satisfactory than deep pans.

Suggested proportions for one standard counter pan for methods 2 and 3:

- 1 lb. **nonfat** dry milk.
- 3½ to 4 oz. cake or pastry flour¹
- 1½ oz. salt
- ½ tsp. white pepper
- 2 qt. water
- 4 oz. melted butter
- 6 lb. sliced raw potatoes, well drained

Mashed Potatoes

Using **WHOLE** or **NONFAT** dry milk: Place steamed or drained boiled potatoes in bowl of electric mixer. (Save cooking water if potatoes are boiled.) With heavy whip, break up potatoes thoroughly. Add
(Continued on Page 20)

¹The larger amount of flour is needed with new potatoes or potatoes which have a high water content.

Table 1—Substituting NONFAT Dry Milk for Fluid Whole Milk

Proportions in this table are given for use in batters and doughs. For using nonfat dry milk in soups, sauces, desserts, and other items, see special suggestions for proportions and procedures in this bulletin (Cir. Bul. 225).

A	B	C	D
To equal this amount of FLUID WHOLE MILK	Use this amount of		
	WARM WATER	NONFAT DRY MILK	BUTTER OR SHORTENING
1 qt.....	3¾ c.	3¼ oz.	1¼ oz.
2 qt.....	1 qt. 3½ c.	6½ oz.	2½ oz.
3 qt.....	2 qt. ¾ c.	9¾ oz.	3¾ oz.
1 gal.....	3¾ qt.	13 oz.	5 oz.
2 gal.....	1 gal. ¾ qt.	1 lb. 10 oz.	10 oz.
3 gal.....	2 gal. ¾ qt.	2 lb. 7 oz.	15 oz.
4 gal.....	3¾ gal.	3 lb. 4 oz.	1 lb. 4 oz.
5 gal.....	4 gal. ¾ qt.	4 lb. 1 oz.	1 lb. 9 oz.
6 gal.....	5 gal. 2½ qt.	4 lb. 14 oz.	1 lb. 14 oz.
7 gal.....	6 gal. 2¼ qt.	5 lb. 11 oz.	2 lb. 3 oz.
8 gal.....	7½ gal.	6 lb. 8 oz.	2 lb. 8 oz.
9 gal.....	8 gal. 1¾ qt.	7 lb. 5 oz.	2 lb. 13 oz.
10 gal.....	9 gal. 1½ qt.	8 lb. 2 oz.	3 lb. 2 oz.

Different brands of nonfat dry milk vary greatly in crystal size and shape. Various forms of spray-process and "instant" nonfat dry milk differ in the number of cups of dry crystals per pound. Thus, for accurate substitution in your recipes, weigh the amount required. If you do not have a scale, follow with special care the package directions for measuring to reconstitute the brand of dry milk you are using.

How to use the Substitution Table

To find the amounts of water, nonfat dry milk, and extra fat you will need for a specified amount of milk, refer to the table. In Column A, locate the amount of reconstituted milk that you wish to make (for example, 1 gallon). Read across on the same line to Columns B, C and D to find the amounts of water, nonfat dry milk, and extra fat needed.

If the amount of milk you need is not in even gallons (for example, 5 quarts), proceed in the same way. Read across from 1 quart and across from 1 gallon. Now add the amount for 1 quart to the amount for 1 gallon to obtain the total amount of 5 quarts, as shown below:

A	B	C	D
Amount of fluid milk	Amount of warm water	Amount of nonfat dry milk	Amount of extra butter or shortening
1 gal. (4 qt.) 1 qt.	3¾ qt. ¾ c.	13 oz. ¾ oz.	5 oz. 1¼ oz.
Total 5 qt.	3¾ qt. ¾ c. or 4 qt. ¾ c.	1 lb. ¼ oz.	6¼ oz.

For fat adjustment in batters and doughs, add the amount of fat you calculated from the substitution table to that required in your original recipe. Proceed as usual.

Check the appropriate sections of this bulletin to determine whether fat adjustment is needed in soups, sauces, and desserts. If you make an adjustment, butter will add that special, delicate flavor.

Table 2—Substituting Dry WHOLE Milk for Fluid Whole Milk

A	B	C
To equal the amount of FLUID WHOLE MILK listed below	Use this amount of	
	WARM WATER	DRY WHOLE MILK
1 qt.....	3¾ c.	4½ oz.
2 qt.....	1 qt. 3½ c.	9 oz.
3 qt.....	2 qt. 3¾ c.	13½ oz.
1 gal.....	3¾ qt.	1 lb. 2 oz.
2 gal.....	1 gal. 3½ qt.	2 lb. 4 oz.
3 gal.....	2 gal. 3¼ qt.	3 lb. 6 oz.
4 gal.....	3¾ gal.	4 lb. 8 oz.
5 gal.....	4 gal. 2¾ qt.	5 lb. 10 oz.
6 gal.....	5 gal. 2½ qt.	6 lb. 12 oz.
7 gal.....	6 gal. 2¼ qt.	7 lb. 14 oz.
8 gal.....	7½ gal.	9 lb.
9 gal.....	8 gal. 1¾ qt.	10 lb. 2 oz.
10 gal.....	9 gal. 1½ qt.	11 lb. 4 oz.

Different brands of dry whole milk vary somewhat in crystal size and shape. This means that, in the dry form, some products are "fluffier" than others. Thus, the number of cups per pound of dry crystals may vary considerably from one brand to another. Therefore, you will be able to substitute dry whole milk for fluid whole milk with much greater accuracy by *weighing* it.

If you have no scales, follow the package directions for measuring carefully to reconstitute the brand of dry milk you are using.

How to use the Substitution Table

To find the amounts of water and dry whole milk you will need to use for a specified amount of milk, refer to the table.

In Column A, locate the amount of reconstituted milk that you wish to make (for example, 1 gallon). Read across on the same line to Columns B and C to find the amounts of water and dry milk to use.

If the amount of milk you need is not in even gallons (for example, 5 quarts) proceed in the same way. Read across from 1 quart and across from 1 gallon. Now add the amount for 1 quart to the amount for 1 gallon to obtain the total amount for 5 quarts, as shown below:

A	B	C
Amount of fluid milk	Amount of warm water	Amount of dry whole milk
1 gal. (4 qt.)	3¾ qt.	1 lb. 2 oz.
1 qt.	3¾ c.	4½ oz.
Total 5 qt.	3¾ qt. 3¾ c. or 4 qt. 2¾ c.	1 lb. 6½ oz.

In your figuring, remember

- | | |
|------------------------|--------------------------------------|
| 1 pound = 16 ounces | ¾ cup = 10 tablespoons + 2 teaspoons |
| 1 gallon = 4 quarts | ½ cup = 8 tablespoons |
| 1 quart = 4 cups | ¼ cup = 5 tablespoons + 1 teaspoon |
| 1 cup = 16 tablespoons | ¼ cup = 4 tablespoons |
| ¾ cup = 12 tablespoons | ½ cup = 2 tablespoons |

salt and about half the amount of hot water or hot potato water you expect to need for fluffing. The amount of water varies with the kind and condition of the potatoes. Sprinkle dry milk on the mixture (allow 4 to 5 ounces for each 10 pounds of cooked potatoes.) Whip very thoroughly. Gradually add hot water, and continue whipping until the exact degree of fluffiness desired for serving is obtained.

Mashed potatoes tend to stiffen somewhat on standing if too little

water is added. Overbeating causes them to become spongy if the potatoes are held very long. Plan to serve each batch as soon after mashing as possible. Mash potatoes several times during serving if your meal period is long. If you **must** hold the mashed potatoes before serving, make them a little softer than desired for immediate serving and avoid excessive beating. Mix melted butter into the finished mashed potatoes if you wish—or dress up each pan or portion with melted butter as it is served.

Additional Pointers for

Using Dry Milk in Recipes



When You Need SOUR WHOLE Milk in Recipes

For each quart of sour milk in your recipe, use the following:

Dry whole milk

3½ c. water
¼ c. vinegar
4½ oz. dry whole milk

Nonfat dry milk

3½ c. water
¼ c. vinegar
3¼ oz. nonfat dry milk

When You Need LIQUID SKIM Milk in Recipes

Recipes for batters which are developed for use with high-ratio or emulsified fats often require liquid skim milk. You can use nonfat dry milk and water in these recipes in the proportion given below. The nonfat dry milk can be added with the flour, and the water can be added in the same way that the fluid milk was added in the original recipes.

For each quart of liquid skim milk in your recipe, use 3¼ ounces of nonfat dry milk and 3¾ cups plus 2½ tablespoons of water.