

Dried Plums: A Multi-Functional Bakery Ingredient

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Bakers are undoubtedly familiar with the use of dried plums in producing items such as Danish. Recent research, however, has revealed many novel applications for dried plum products as functional natural bakery ingredients. This bulletin will review the composition of dried plums and suggest how their unique components can be used effectively by bakers.

NUTRITIVE VALUE

Dried plums are noted for their high content of dietary fiber, carotenes (Vitamin A precursor), iron and potassium (TABLE 1). Their use as ingredients generally results in an enhancement of vitamin, mineral and fiber values. Health authorities (1.2.3) strongly suggest that healthy adults and children over the age of 2 reduce fat intake to 30% or less of total calories, increase dietary fiber to 20-30 grams/day, and increase consumption of fruits, vegetables and grain products. All of this, made especially lucid through the use of U.S.D.A.'s new Food Pyramid, has resulted in an ideal positioning for combining the benefits of dried plums with those of bakery products.

DRIED PLUM FORMS

Dried plums are available in many forms suitable for bakery use (TABLE 2). Diced and extruded dried plum bits can be used to enhance fruit breads, pastries, muffins and cakes. Gaining in popularity are the extruded bits, which are guaranteed pit-free. These bits can also be modified by adding other flavors, fruits and colors to extend the use of more expensive fruits.

The relatively low cost of dried plum paste makes it an ideal base to create various fruit filling flavors for Danish pastry and bar cookies. The flavor of dried plums is compatible with other fruits, spices and chocolate. In fact, dried plums act in a manner similar to vanilla to round out and enhance other flavors. Thus, dried plums can be used to reduce the cost and improve the quality of fillings. For example, strawberries can be used as the characterizing fruit in a high quality filling using dried plum paste as the base fruit. The high pectin content in dried plums provides added stability to heat processes, and can eliminate the need for added stabilizers.

Dried plum purees are available which contain approximately 45%-dried plums pureed with added water and/or corn syrup. Dried plum puree has the advantage of being soft and easily incorporated into batters and doughs. As will be illustrated later, it has been found to be an excellent fat replacer in bakery products.

Another convenient form of product made from dried plums is juice concentrate. This is used as a natural sweetener, color and preservative in baked products. As such, it can replace caramel color, calcium propionate, molasses and refined sugars.

Very low-moisture (i.e. 4%) forms of dried plums are available for use in dry mixes and very stiff doughs. Available in powdered, flaked and granular form, these products are used to provide identity and functional aspects, which will be discussed below.

FAT REDUCTION

Over the past several years, food manufacturers have developed many new reduced- and fat-free products. Many of these products rely on the use of fat-based emulsifiers as a part of the fat replacement system. The use of these emulsifiers must now be reevaluated in light of the new labeling laws passed by Congress and in effect May 1994. The FDA defines fat as "**The sum total of lipid fatty acids expressed as triglycerides.**" This would include all lipid materials such as mono- and diglycerides, free-fatty acids, phospholipid fatty acids and stearyl fatty acids. This definition means that the ether extract method for fat analysis will no longer be valid. Either the acid extract or chloroform/methanol extraction procedures must be used. When emulsifiers are a part of the formula, the use of these methods will result in the determination of a higher fat value.

Recent research has indicated that a puree made from dried plums can serve as a fat replacement in many baked foods without the need for fat-based emulsifiers. Natural components of dried plums have been identified which are believed to be responsible for their fat-sparing ability as follows:

Pectins. Dried plums contain a unique blend of both soluble and insoluble pectins, which help to form a stable film around air and leavening gas during mixing and bench time. The pectins are also believed to have the ability to entrap flavor components for gradual release during mastication

Sorbitol/Reducing Sugars. Dried plums are unique in their naturally high sorbitol content. Sorbitol is an effective humectant, and thus helps to keep bakery products soft and moist over an extended shelf life. The reducing sugars, fructose and glucose, work with sorbitol to provide further humectancy.

Malic Acid. Dried plums contain about 2% naturally occurring malic acid, which has been shown to be an effective flavor enhancer. Malic acid is released more slowly than other organic acids (FIGURE 1), and thus has a greater carry-through during the chewing process. Additionally, malic acid helps to inhibit microbial spoilage and can also serve as the natural acid component of chemical leavening systems.

TABLE 3 illustrates how a dried plum puree can be used to replace emulsifiers and modified starches in a "fat-free" muffin. Egg whites were reduced as the pectins in dried plums served in a similar manner to entrap air while not causing excessive toughness sometimes associated with egg whites. The crystalline fructose was also removed due to the high percentage of reducing sugars present in the dried plums. The resulting product contains less than 1/2 gram of fat/ oz. versus over 1 gram of fat in the old formula. Thus, the reformulated product maintains fat-free status. Additionally, labeling is more acceptable to consumers and costs are reduced.

Dried plum puree is an effective fat replacer in soft cookies, cakes, muffins, brownies and icings. It has traditionally been used to produce fillings. The dark color, however, limits its use to non-white bakery products. TABLES 4-6 provide starting formulas, which are all "fat-free" or low fat. Bakers may also wish to start with their own formulas, merely replacing the shortening with the puree. It has been found that 1 lb of shortening can be replaced with between 1/2 to 1 lb of puree. Mixing times are generally reduced to prevent excessive gluten development in cake items.

MOLD INHIBITION

Dried plum juice concentrate has been shown to be equal to or more effective than raisin juice concentrate as a natural preservative in whole grain bread (4). In addition to mold inhibition, the concentrate has superior softness and moistness properties due to its high content of naturally occurring sorbitol and reducing sugars. It was also noted that dried plum juice concentrate helped to "round out" the flavor and reduce the bitterness associated with the bran fractions of whole grain.

NATURAL BAKERY PRODUCTS

As of May 1994, nearly all packaged bakery products require nutritional labels. Many foods are now being reformulated to both simplify ingredient statements and enhance nutritional content. TABLE 7 illustrates how a dried plum puree can be used in a wheat bread formula to help accomplish these objectives. Dried plums have replaced emulsifiers, caramel color and calcium propionate. A reduction of salt was made possible due to the flavor enhancing effects of the malic acid in dried plums. Shortening and refined sugars were also reduced. Thus, the resulting product has a shorter, simpler ingredient statement, lower fat and lower sodium content.

TABLE 8 summarizes some of the functional attributes of dried plums, and suggests additives, which are candidates for reduction or replacement. In many cases, resulting products have improved nutritional profiles in addition to fewer artificial additives. The cost of using dried plums will of course vary according to the application. The impact on most products ranges from a slight increase to a cost savings depending on the additives being removed. In addition, processing costs may be lowered when using dried plum products owing to fewer scaled ingredients and reductions in "creaming" time. Any cost increase should be weighed against the possible increase in sales due to a more favorable marketing position.

SUMMARY

Dried plums, once limited to the old stand-by "Danish," are now being used as natural functional bakery ingredients. Consumer's desires for more natural, nutritional processed foods point to continued increase in the use of dried plums. The timing is right for researchers to focus on the use of natural products to replace chemical additives. Dried plums contain a unique combination of nutrition and functional components which bakers can use to help achieve their product and marketing objectives for the 1990's and beyond.

REFERENCES

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TABLE 1. COMPOSITION OF DRIED PLUMS*

Proximate		Per 100 Grams
	Moisture (g)	25.00
	Energy (Kcal)	251.00
	Protein (g)	2.75
	Fat (g)	0.66
	Ash (g)	4.96
	Total Dietary Fiber (g)	8.10
	Soluble Fiber (g)	4.60
	Total Carbohydrate (g)	66.60
	Available Carbohydrate (g)	58.50
Minerals		Per 100 Grams
	Calcium (mg)	56.00
	Copper (mg)	0.47
	Iron (mg)	2.78
	Magnesium (mg)	40.00
	Manganese (mg)	0.24
	Phosphorous (mg)	88.00
	Potassium (mg)	829.00
	Sodium (mg)	4.40
	Zinc (mg)	0.58
Vitamins		Per 100 Grams
	Vitamin C (mg)	3.64
	Thiamin (mg)	0.09
	Riboflavin (mg)	0.18
	Niacin (mg)	2.32
	Pantothenic Acid (mg)	0.51
	Vitamin B6 (mg)	0.30
	Folacin (microg.)	4.10
	Beta Carotene (mg)	1.31
Simple Carbohydrates		Per 100 Grams
	Fructose (g)	14.00
	Glucose (g)	21.00
	Sorbitol (g)	15.00
Other Properties		
Water Activity: 0.65-0.83 for a moisture range of 19-35%		
pH (10% solution): 3.5-4.0		
Organic Acid Content: 1.2-2.0 (primarily malic)		
*Values represent industry averages. As with all natural products, they may vary somewhat.		

TABLE 2. DRIED PLUM BASED BAKERY INGREDIENTS

PRODUCT FORM	SUGGESTED USES
Diced Dried Plums and Extruded Bits	Breads, muffins, cookies, cakes, fillings
Dried Plum Paste	Fillings, breads, bagels, cookies
Dried Plum Juice Concentrate	Breads, pastries, cakes, cookies, muffins, fillings
Dried Plum Powder/Granules/Flakes	Dry mixes, bagels, reduced-fat/fat-free mixes
Dried Plum Puree	Reduced-fat/fat-free bakery cakes, cookies, muffins, fillings

TABLE 3. LOW -/REDUCED-FAT BRAN MUFFINS

INGREDIENT	Baker's % OLD FORMULA	Baker's % DRIED PLUM FORMULA
Sugar (granulated)	31.00	31.00
Fructose (crystalline)	15.00	-----
Salt	1.25	1.00
Bread Flour	75.00	75.00
Wheat Bran	25.00	25.00
Baking Powder	2.00	2.00
Baking Soda	1.00	1.00
Modified Starch	1.00	-----
Emulsifier Blend	6.00	-----
Tapioca Starch	4.75	-----
Non-Fat Milk	64.00	64.00
Water	50.00	50.00
Egg White	34.00	15.00
Sodium Benzoate	0.10	-----
Dried Plum Puree	-----	30.00
APPROX. COST/LB. BATTER	\$0.2862	\$0.2628

INGREDIENT LISTINGS

OLD FORMULA:

Wheat flour, non-fat milk, water, egg white, wheat bran, sugars (sugar, fructose), tapioca starch, modified wheat starch, salt, baking powder, baking soda, mono- and diglycerides, sodium stearoyl lactylate, diacetyl tartaric acid esters of mono- and diglycerides, polysorbate-60, sodium benzoate (a preservative).

NEW, IMPROVED FORMULA:

Wheat flour, non-fat milk, water, sugar, wheat bran, egg white, dried plums, salt, baking powder, baking soda.

THE BOTTOM LINE:

OLD FORMULA FAT CONTENT:

Approximately 1.0 grams/oz., Higher Cost, Cluttered Label

NEW FORMULA FAT CONTENT:

Less than **0.5 grams/oz.**, Less Cost, Shorter Ingredient Statement

TABLE 4. FAT-FREE CHEWY BROWNIES

STAGE 1	
INGREDIENT	AMOUNT (BAKERS %)
Dried Plum Puree	60.00
Sugar (granulated)	95.00
High Fructose Corn Syrup (71%)	30.00
Egg White	11.00
Dutch Cocoa (10 to 12% fat)	40.00
Salt	0.25
Procedure: Blend at low speed for 1 minute, scrape, then at high speed for 4 minutes. Scrape	
STAGE 2	
Flour (all purpose)	100.00
Baking Soda	2.00
Water	50.00
Procedure: Add to stage 1 and mix at low speed for 1 minute, scrape, then mix at medium speed for 4 minutes.	
Spread about ½” deep in lightly greased pan. Bake at 365 degrees Fahrenheit for 20-26 minutes or until middle springs back to a light touch.	
Optional topping: Chopped walnuts (will increase fat content)	
Serving Size: 1 oz.	
Fat: Less than 0.5 grams/oz.	
Calories: 90/oz.	
Calories from Fat: 5%	

TABLE 5. REDUCED-FAT CARROT CAKE/MUFFINS

STAGE 1	
INGREDIENTS	AMOUNT (BAKERS %)
Dried Plum Puree	91.0
Sugar (granulated)	89.0
Egg White	15.0
Vanilla Extract	1.4
Almond Extract	0.7
Procedure: Mix at low speed for 30 seconds, scrape. Mix at high speed until smooth and light.	
STAGE 2	
Flour (all purpose)	100.0
Baking Powder	1.9
Baking Soda	2.4
Salt	1.4
Cinnamon	1.0
Carrots (shredded)	72.0
Pineapple (crushed, in juice)	64.0
Golden Raisins	19.8
Walnuts (diced)	18.0
Water	84.0
Procedure: Add to stage 1 and mix at low speed for 30 seconds. Scrape. Mix again at low speed for 2 minutes or until well distributed. Deposit into oiled pans, about 2/3 full. Bake at 350 degrees Fahrenheit until top springs back to a light touch (30-35 minutes for cakes; 25-30 minutes for muffins).	

TABLE 6. FAT-FREE FUDGE SNACK CAKE MIX (16 OZ. BOX)

INGREDIENTS	PERCENTAGE	GRAMS
Dried Plum Powder	10.0	45.4
Sugar (granulated)	47.0	213.4
Egg White (Powdered)	0.4	1.8
Cocoa (Red, 10-12% Fat)	11.7	53.1
Flour (all purpose)	30.0	136.2
Baking Soda	0.4	1.8
Salt	0.3	1.4
INSTRUCTIONS:		
<ol style="list-style-type: none"> 1. Pre-heat oven to 350 degrees Fahrenheit. 2. Pour mix (16 oz.) into mixing bowl. 3. Add 1-cup cold water and stir just until blended. 4. Pour into lightly oiled pan, about 1/2" to 3/4" thick. 5. Bake for 20-25 minutes or until center springs back to a light touch. 		
NOTE: This mix can also be baked with microwave using a suitable microwavable baking pan.		

TABLE 7. NATURAL WHEAT BREAD IMPROVEMENT

INGREDIENT	OLD FORMULA	COST	NEW FORMULA	COST
Patent Flour	70.00	7.000	70.00	7.000
Whole Wheat	25.00	2.750	25.00	2.750
Water	61.00	-----	63.00	-----
Wheat Gluten	2.00	1.600	-----	-----
Salt	2.25	0.135	1.50	0.090
Soybean Oil	3.00	0.390	0.50	0.065
High Fructose Corn Syrup	11.00	1.100	6.00	0.600
Monoglyceride	0.50	0.250	-----	-----
Yeast	3.50	1.220	3.50	1.220
Yeast Food	0.50	0.200	-----	-----
Sodium Stearoyl Lactylate	0.50	0.410	-----	-----
Caramel Color	0.50	0.200	-----	-----
Calcium Propionate	0.20	0.110	-----	-----
Enzyme Conditioner*	-----	-----	.025	0.325
Dried Plum Puree	-----	-----	4.00	2.760
TOTALS	179.95	\$15.365	173.75	\$14.810
Cost/24 oz. loaf (27 oz. scale wt.) Old Formula: \$0.1441 New Formula: \$0.1438				
*Enzyme-Based Bromate Replacer				
COMPARATIVE INGREDIENT STATEMENTS				
OLD FORMULATION Enriched Wheat Flour [(Wheat Flour, Malted Barley Flour, Iron (Ferrous Sulfate), Thiamine Mononitrate (Vit. B-1), Riboflavin (Vit. B-2), Niacin (a B vitamin)], Water, Whole Wheat Flour, Corn Syrup, Contains 2% or less of each of the following: Yeast, Soybean Oil, Salt, Caramel Color, Dough Conditioners (May contain one or more of the following: Calcium or Sodium Stearoyl Lactylate, Ethoxylated Monoglycerides, Mono- and Diglycerides, Monocalcium Phosphate, Calcium Carbonate, Potassium Bromate), Yeast Nutrients (May contain one or more of the following: Ammonium Sulfate, Ammonium Chloride), Calcium Propionate (a preservative).				
NEW FORMULATION: Enriched Wheat Flour [(Wheat Flour, Malted Barley Flour, Iron (Ferrous Sulfate), Thiamine Mononitrate (Vit. B-1), Riboflavin (Vit. B-2), Niacin a B Vitamin)], Water, Whole Wheat Flour, Corn Syrup, Dried Plums, Yeast, Salt, Soybean Oil, Soy Flour, NO ARTIFICIAL PRESERVATIVES.				

TABLE 8. FUNCTIONAL ATTRIBUTES OF DRIED PLUMS

FUNCTIONAL ATTRIBUTES	CANDIDATES FOR REDUCTION/REPLACEMENT
Humectancy	Mono- and Diglycerides, SSL
Natural Color	Caramel Color, Molasses
Flavor Enhancement	Salt, Artificial Flavors
Natural Sweetness	Refined Sugars
Natural Preservative	Calcium Propionate
Fat Replacement	Emulsifiers, Modified Starches, Fats

FIGURE 1. RELATIVE FLAVOR RELEASE PROFILE OF MALIC ACID

