California Dried Plum Board

Research Report

November 2007

Dried Plums…Single Solution To Sandwich Shelf Life

Abstract

The U.S. sandwich market reached $121 billion in sales in 2005 (Packaged Facts). Americans are eating sandwiches for dinner at home more than any other entrée. Sandwiches are now the No. 1 dinner entrée eaten at home (NPD). Twenty-five years ago, far more people ate restaurant food inside the store than took it out. However, by 2006, the typical American ate 81 meals inside restaurants but ordered 127 to go (NPD). In 2006, 168 of the leading 200 foodservice restaurant chains offered 2,355 different sandwiches on their menus. Sixty-seven chains added 158 new sandwiches (Food Beat).

In most instances sandwich bakery and meat components are purchased by foodservice operators and retailers already prepared. Because of upstream manufacturing of the primary sandwich components, some degradation can occur in moisture loss, bacteria growth, flavor loss, etc. Take-out meals double the problems of food quality and shelf life when it reaches the final time of consumption.

Time, temperature, oxygen, moisture, bacteria and other enemies of sandwich shelf life and food quality are constantly at work eroding the best efforts of R&D, production and quality assurance. Dried plums, powders, and juice concentrates provide a natural defense against the enemies of sandwich shelf life.

DRIED PLUMS' NUTRIENT COMPOSITION STACKS UP TO SOLVE SANDWICH SHELF LIFE

	% Per 100 grams
Fiber	7.5
Sorbitol	15.0*
Malic Acid	1.5-2.0
Antioxidants (ORAC)	6552

* Dried plum powder 25% sorbitol

Delivering restaurant-quality and convenience to consumers ordering sandwiches and other portable foods is a considerable challenge for food processors and foodservice operators. The entire process is a race against time, with everything from lipid oxidation to microbial growth to moisture retention and mold all conspiring against success. Confronting these issues while consumers are also demanding fresh, nutritional and natural food ingredients compounds the problems. Fortunately dried plums are available as a single food ingredient capable of resolving all of these issues.

Background

Whether clubs, gyros, melts, po'boys, muffalettas, wraps, subs, burgers, paninis, mini's or any number of sausages on a bun, sandwiches continue to be a dominant force in consumer eating at home and away from home. In 2005, Packaged Facts estimated the U.S. sandwich market reached $121 billion in sales through sandwich chains, convenience stores, burger chains and other foodservice outlets as well as retail supermarkets and club stores. Hamburger chains accounted for 45% of this market with sandwich chains accounting for another 25%. Sandwich chains such as Subway and Quiznos, however, are growing at a much faster pace than hamburger chains.

Americans are eating sandwiches for dinner at home more than any other entrée. Sandwiches are now the No. 1 dinner entrée eaten at home (NPD). Just over one out of every nine such dinners, or 11.1% features a sandwich. Twenty years ago 5.3% of all dinners included a cold sandwich, while 7.9% included a hot sandwich (NPD). In 2006, cold sandwiches accounted for 4.4% of dinners, while hot sandwiches totaled 8.9%.

Behind the growth of sandwiches is consumer demand for convenience and speed in meal preparation and consumption. This demand is evident at all demographic levels from kids to working parents to seniors. In fact the growth of seniors driven by baby boomers is targeted to be a significant sandwich opportunity particularly when low fat proteins and whole grain breads are included in the convenience equation. Heart health, digestive health and weight management are all important food issues to the aging population.

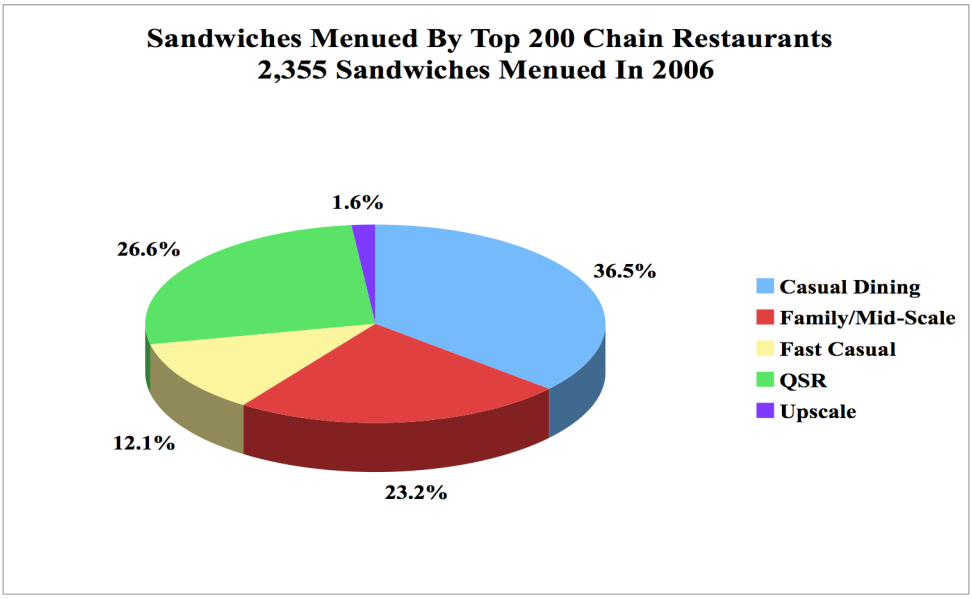
Sandwiches have continued to go upscale with growth coming from artisan breads and rolls, paninis, focaccia, ciabatta, crostini, flatbreads, tortillas, etc. Proteins from almost every animal are being used while alternative sauce creations are endless.

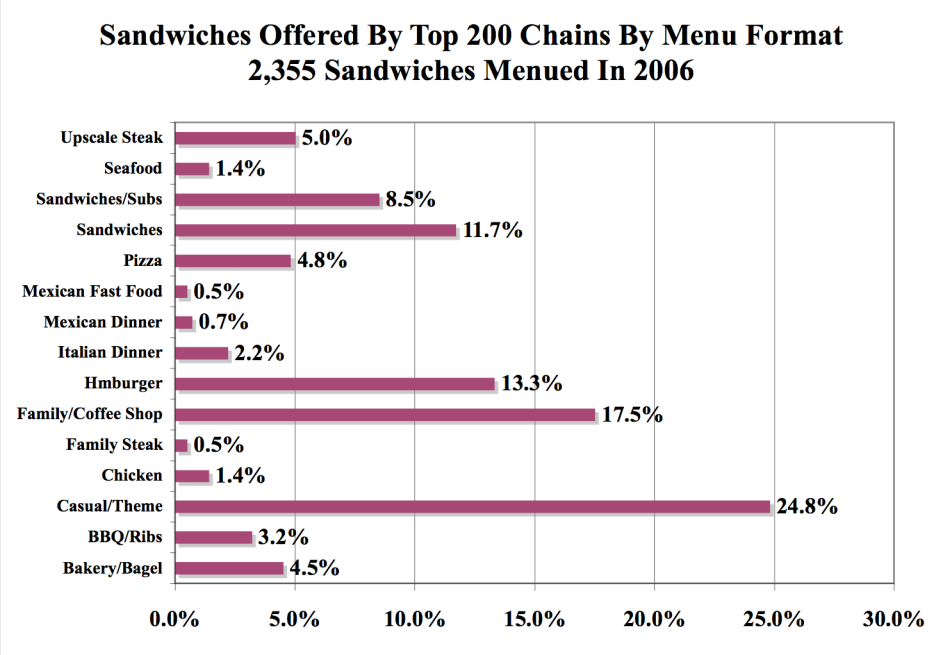
In most instances sandwich bakery and meat components are purchased by foodservice operators and retailers already prepared. Some baked goods are baked on site while others are ready to serve. Meats are purchased either ready to serve or require partial cooking/heating. Some meats are already portioned while others require slicing.

Because of upstream manufacturing of the primary sandwich components, some degradation can occur in moisture loss, bacteria growth, flavor loss, etc. Consumer interest in extra-lean proteins used in sandwiches can provide further difficulties for sandwich marketers due to reduced fat and thus less moisture. In some instances various additives, flavors and preservatives are used to mask or otherwise compensate for changes in the sandwich components prior to final preparation and serving.

Foodservice Sandwich Market

The California Dried Plum Board evaluated sandwiches served by the top 200 chain restaurants in 2006 as reported by Food Beat a market research firm. One hundred sixty-eight of these leading foodservice chains offered 2,355 different sandwiches on their menus with casual dining chains accounting for over a third (36.5%) of all sandwiches and quick service restaurants (26.6%). Sixty-seven chains added 158 new sandwiches.

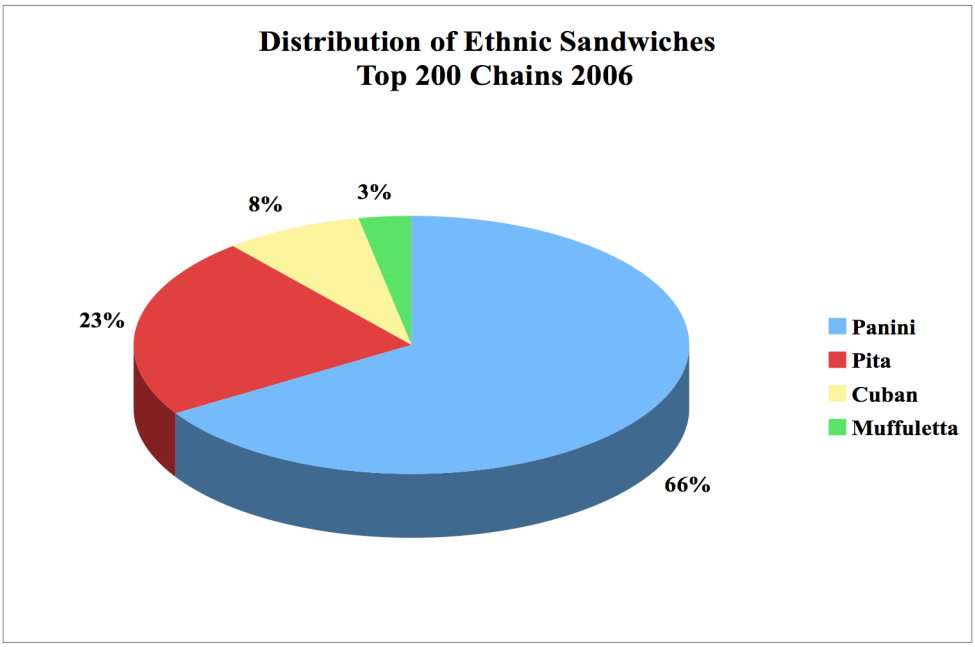




Sandwich Diversity

Traditional sandwiches usually consist of bread, protein and a condiment or sauce of some kind. Pastrami or corned beef on rye, ham & cheese on whole wheat, a Reuben and BLT are good examples.

Today, however, a variety of ethnic sandwiches are taking center stage on the menus of the top 200 chain restaurants. For example, 19 chains menu a panino resulting in a total of 49 panini offerings. Nine chains have a pita for a total of 17 sandwiches. And, six chains menu a Cuban while two offer a single muffuletta on their menu.



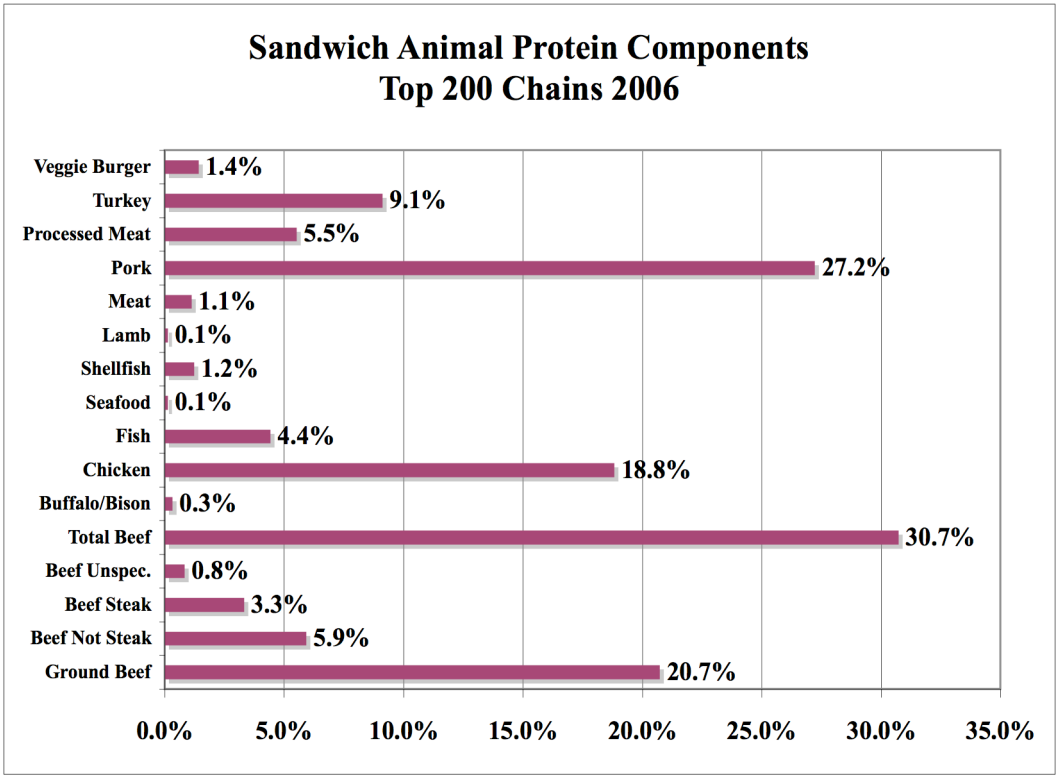
The sandwich takes full advantage of the diversity of the American population. Innovative menu developers have, in recent history, introduced the fajita to the pita and the panino to the Cuban. They use some of the world's most intriguing flavors—Cajun spices, Jamaican jerk, Mexican chipolte—and take advantage of the finest breads.

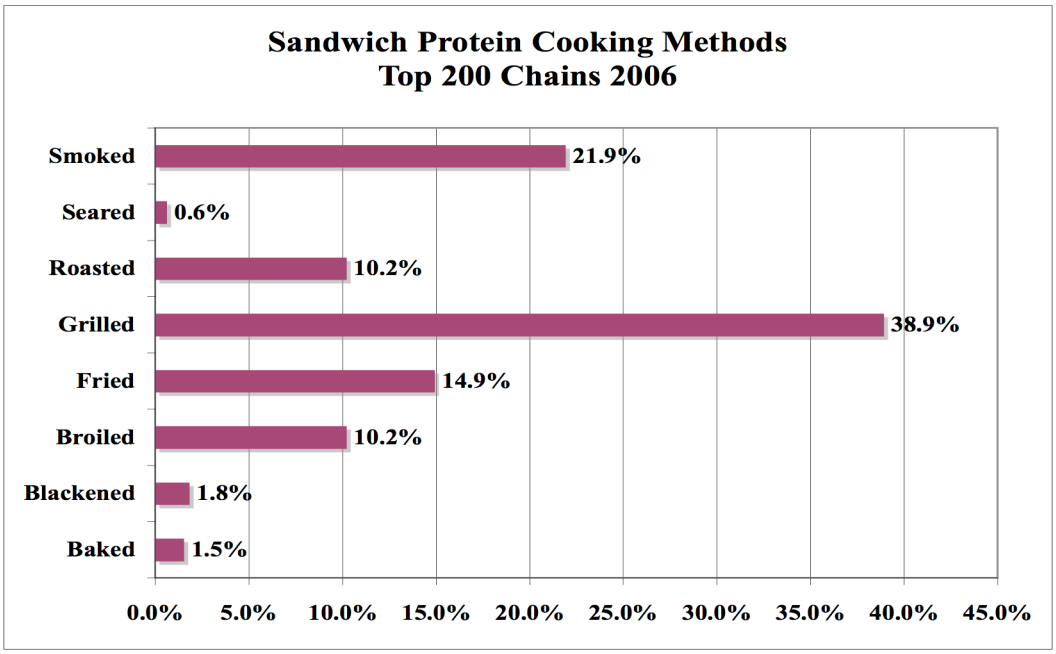
Flatbreads are another example of the sandwich moving beyond tradition. This upscale bread often carries an upscale price, which is why so many chains are endorsing the baked good. People perceive flatbreads as being lighter which is one reason why Quiznos is devoting much of its salad line to flatbread to replace the crouton crunch. Dunkin' Donuts is testing flatbread sandwiches for lunch, dinner and possibly breakfast. Arby's is promoting flatbread melts—fajita beef and Philly beef.

The success of the sandwich largely rests on the product's ability to adapt to new trends. These include the rise in popularity of ethnic foods, on the back of a growing Hispanic population as well as a general demand for more adventurous tastes. In addition, organic is expected to bring added value to the sandwich sector, while quality and premium remain important motivators of consumer demand.

Sandwich Proteins

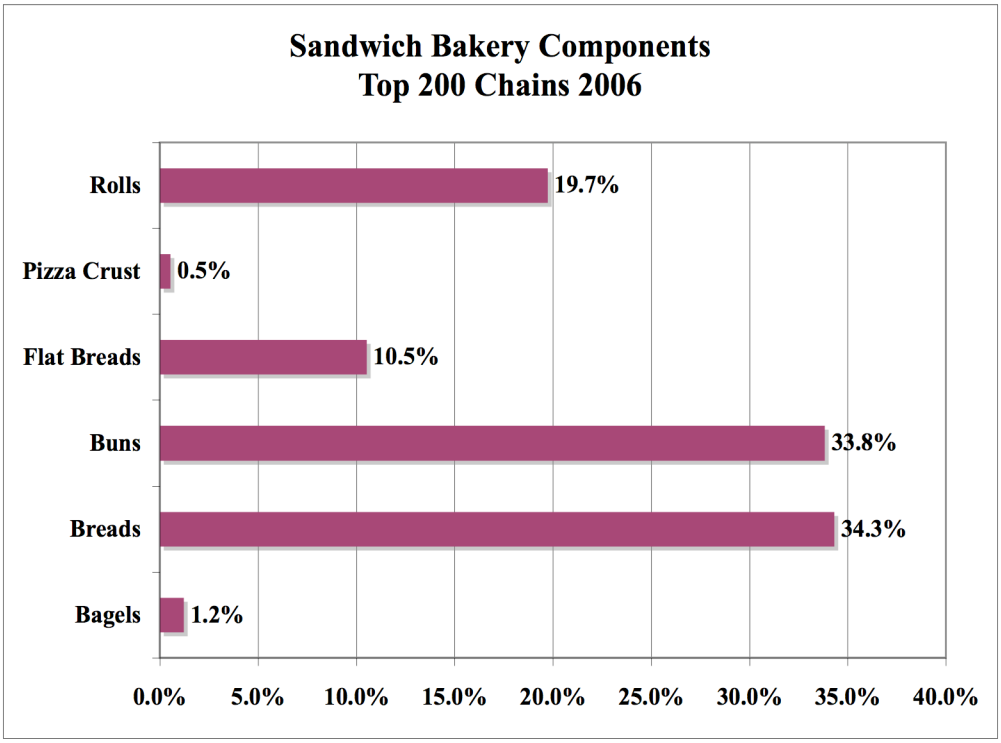
The leading animal proteins used as sandwich components by the top 200 chains include beef of all types (30.5%), pork (27.2%) and chicken (18.8%). These proteins are most often grilled (38.9%), smoked (21.9%) or fried (14.9%).

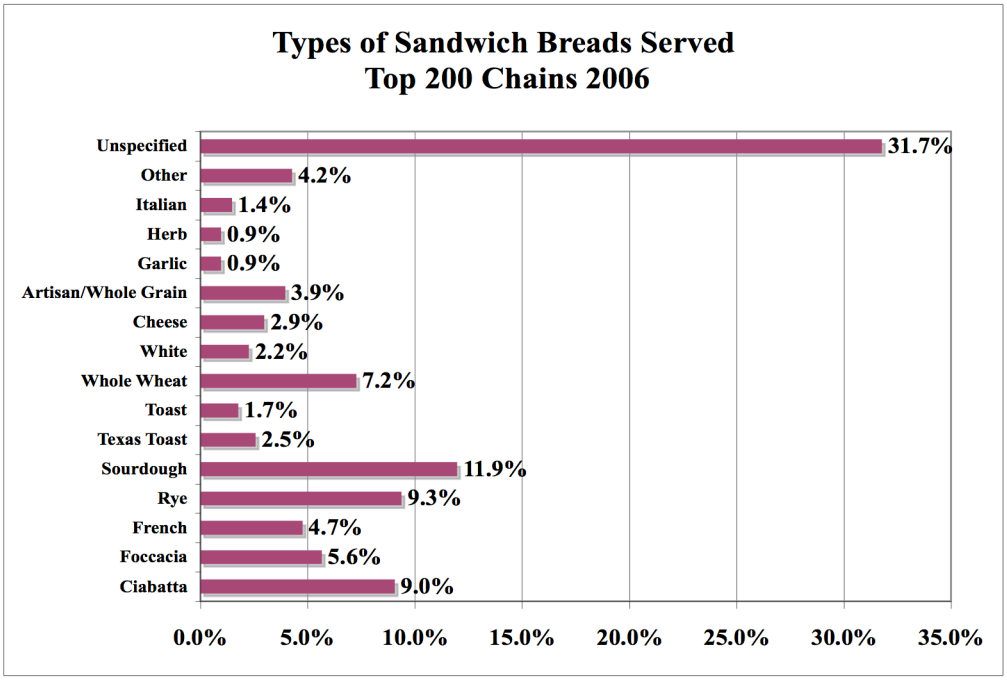


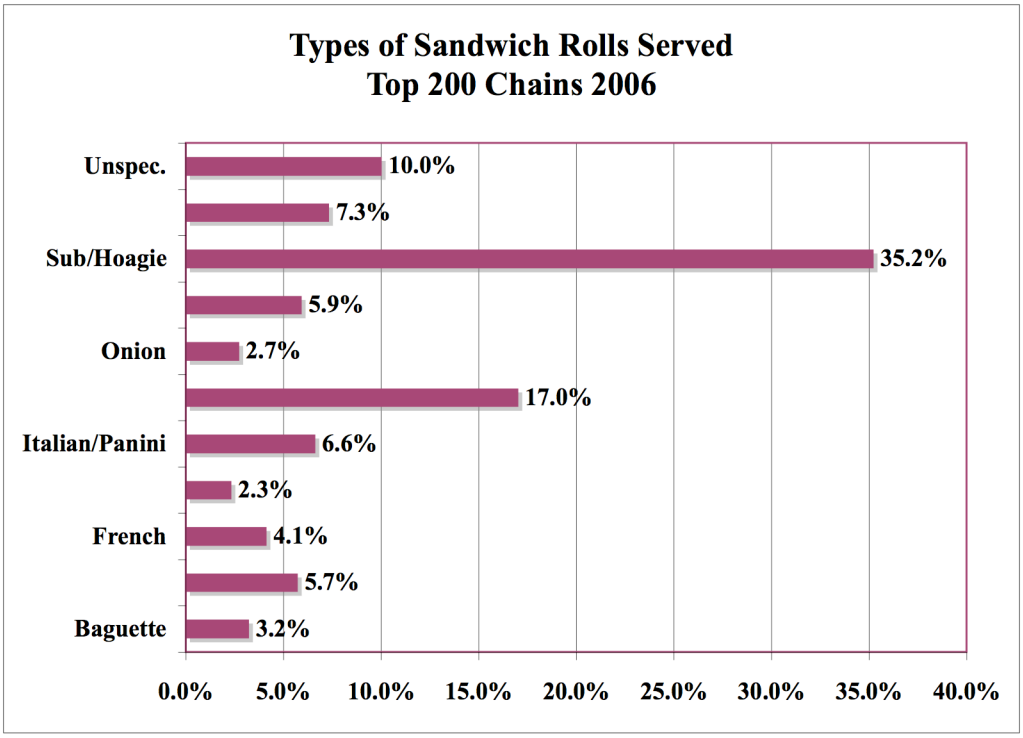


Sandwich Baked Goods

Sandwiches are most often served on bread (34.3%) and buns (33.8%) and to a lesser extent rolls (19.7%). Flat breads (10.5%) continue to gain in popularity as a sandwich component. Sourdough (11.9%), rye (9.3%) and ciabatta (9.0%) are leading breads used in sandwiches while sub/hoagie (35.2%) and Kaiser (17.0%) and leading roll types.

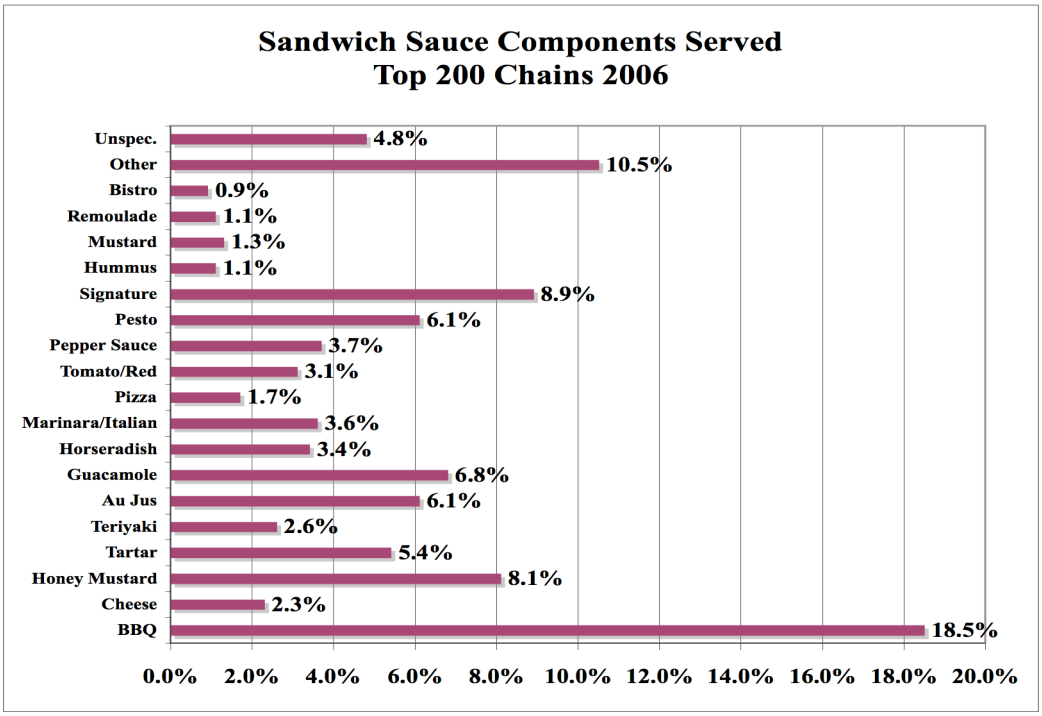






Sandwich Sauces

Leading sandwich sauces served by the top 200 chains include BBQ (18.5%), honey mustard (8.1%), Italian/red/pizza 8.4% and a signature sauce of some kind (8.9%).



The Sandwich Shelf Life Problem

The growing popularity of foodservice sandwiches is part of a larger trend towards hand-held, portable foods for consumption at home, in the car, at school, at the office…just about anywhere. Twenty-five years ago, far more people ate restaurant food inside the store than took it out. However, by 2006, the typical American ate 81 meals inside restaurants but ordered 127 to go (NPD). Take-out meals double the problems of food quality and shelf life when it reaches the final time of consumption. With most ingredients prepared off-site prior to final assembly and the finished sandwich or meal often traveling to a further destination for consumption, eating quality can be sacrificed.

Maintaining food shelf life and eating quality is thus a never-ending challenge for food formulators and foodservice operators. Time, temperature, oxygen, moisture, bacteria and other enemies of shelf life and food quality are constantly at work eroding the best efforts of R&D, production and quality assurance.

The Dried Plum Sandwich Solution

Dried plums, powders, and juice concentrates provide a natural defense against the enemies of sandwich shelf life. Dried plums are naturally rich in fiber and high in sorbitol (as much as 25% sorbitol in dried plum powder) to bind and maintain moisture in meat and bakery products. Dried plums' acidic profile, particularly malic acid, along with a high antioxidant content fend off the corrupting effects of bacteria and oxygen.

Dried Plums Improve Sandwich Moisture

Sandwich Meat Products

Meat products, particularly lean, low-fat versions and extensively processed meats used in sandwiches often become dry when thermalized and re-thermalized. Because of the abuse of double heating, favorable sensory characteristics can be reduced or lost leaving consumers dissatisfied. The addition of as little as 3% dried plums to the raw meat block can help retain and control moisture. Dried plums' fiber and sorbitol attract and hold meat moisture resulting in the final product being more moist and juicy.

Sandwich Baked Goods

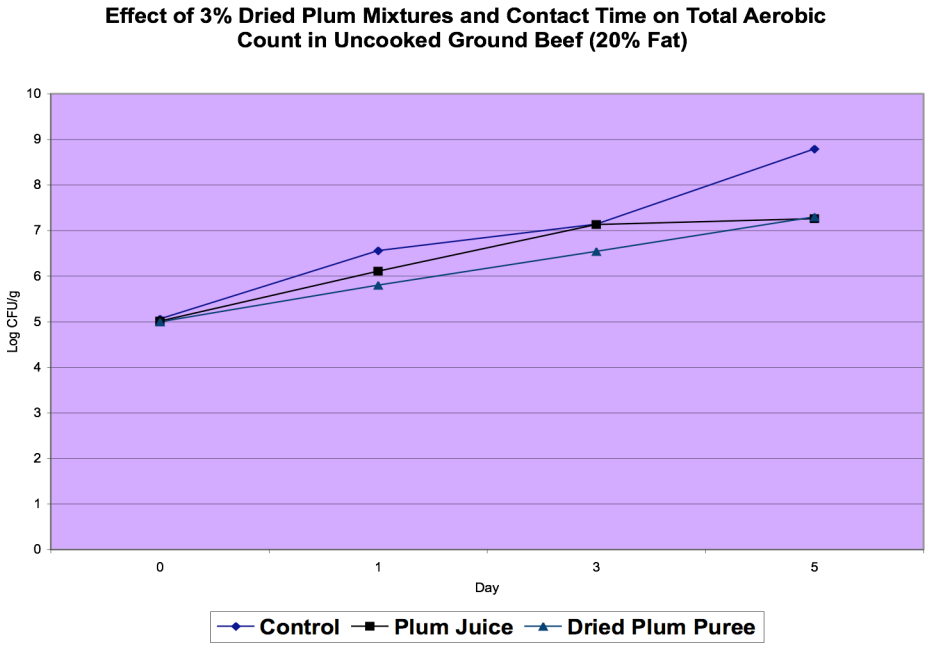
Dried plums are also an effective bakery humectant. This is due to the combination of fiber (half of which is soluble), sorbitol and other reducing sugars (glucose and fructose) that retain and then hold moisture.

Dried plums are unique among natural humectants due to the presence of this high level of naturally occurring sorbitol. Thus, dried plums can be effectively used in place of sorbitol or other sugar alcohols while maintaining a "natural" formulation. While sorbitol is an effective humectant, it is only 60% as sweet as sucrose. In fact, dried plums contain virtually no sucrose. As the sorbitol in dried plums is not readily fermentable, unlike

honey or high fructose corn syrup, it remains largely as a humectant in yeast-leavened baked goods.

Dried Plums Contribute to Sandwich Meat Safety

Research conducted at Kansas State University discovered that the addition of dried plum mixtures can control foodborne pathogens in uncooked meat products. All inoculated pathogens in ground beef decreased by 1-2 log CFU/g and decreased in total aerobic count, *Escherichia coli* O157:H7, *Listeria monocytogenes*, *Y.*



Dried Plums Improve Sandwich Flavor

Sandwich Meat Products

Lipid oxidation (rancidity) is a major cause of deterioration in the quality of further processed meat and poultry products, and can be accelerated by several factors such as less saturation, oxygen, heat, UV light, metal ions (e.g., iron), salt, and oxidative enzymes. Oxidation of lipids not only produces rancid flavors in foods, but also can decrease their nutritional quality and safety by formation of secondary products after cooking and processing.

Lipid oxidation results when double bonds in unsaturated fatty acids react with molecular oxygen via a series of free radical chain reactions to produce breakdown products such as short chain acids (e.g., butyric, propionic, aldehydes and ketones). These compounds contribute to the 'warmed-over flavor' (WOF) found in many meat/poultry products, especially those that have been pre-cooked, frozen and re-heated. Products with higher fat content and/or more unsaturated fatty acids (e.g., sausages, commercial grade ground beef, and poultry products) are particularly affected.

Research at Texas A&M University discovered that dried plum puree used at 3 and 6% levels was as effective as synthetic antioxidants butylated hydroxyanisol (BHA) and butylated hydroxytoluene (BHT) in retarding lipid oxidation of precooked pork sausage patties. *Yersinia enterocolitica*, and *Staphylococcus aureus* and in uncooked pork sausage of at least 0.5 log CFU/g. Any recontamination of cooked meat products can be further controlled by the preservative effect of these dried plum mixtures.

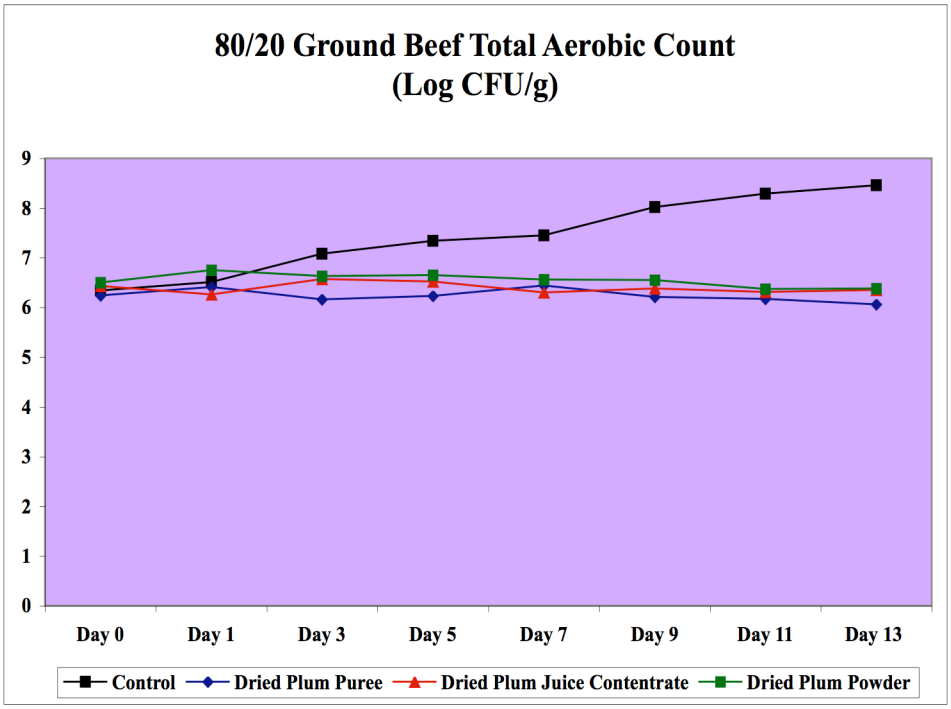
Sandwich Baked Goods

Dried plums contain about 1.5% malic acid. Even when present in small amounts, malic acid has been shown to be an effective flavor potentiator, particularly in reduced-fat baked goods. Malic acid coats the mouth during mastication, thus extending food flavor during the chewing process. This leads to improvements in sensory satisfaction while improving the nutritional content of the finished product.

Dried Plums Improve Sandwich Shelf Life

Sandwich Meat Products

Kansas State University conducted further research into the ability of dried plums to extend the shelf life of raw ground beef by suppressing the growth of normal flora found in ground beef. Dried plums were added at a 6% level for each of several different dried plum forms.

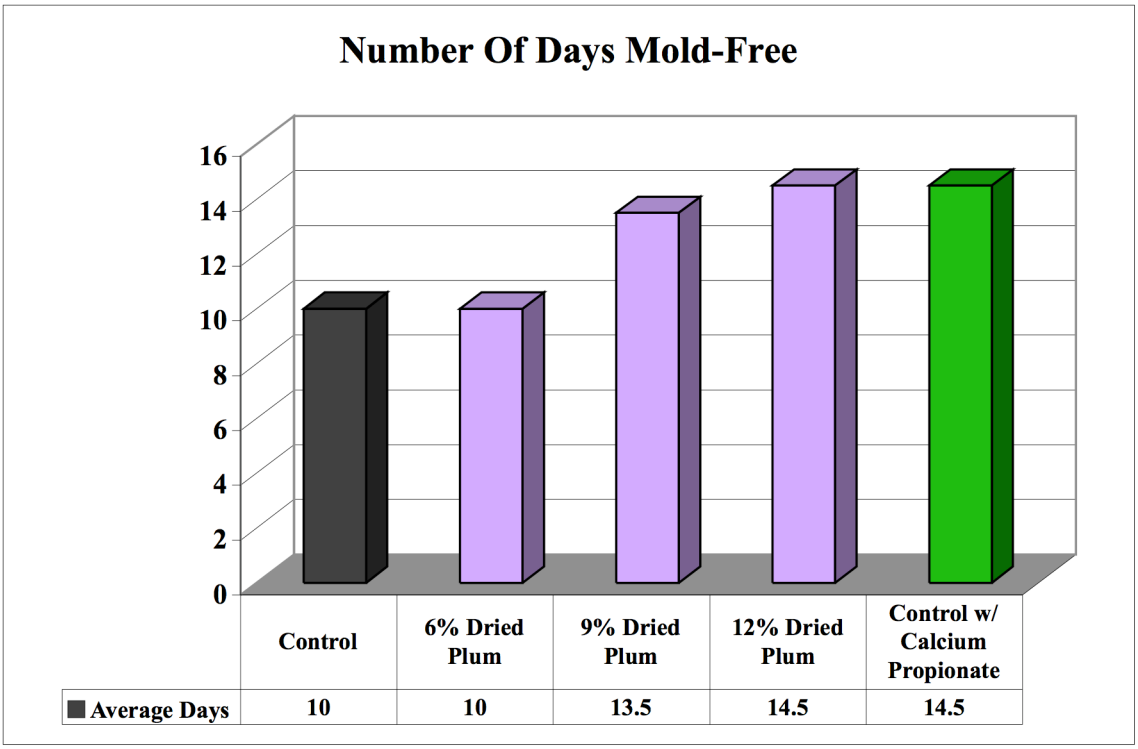


All fresh ground beef samples treated with dried plums showed virtually no bacteria growth over the entire 13-day period. When compared with the untreated control, differences in the samples containing dried plums began to appear after day 3. By day 13

there was on average, a 2-log difference (99%) between the untreated control samples and those treated with dried plum products.

Sandwich Baked Goods

In baked goods, dried plum purees, powders and juice concentrates provide a natural solution to maintaining moisture and inhibiting mold development. Dried plum powders can be easily incorporated into dry bakery mix systems using a simple all-purpose formula with endless possibilities for creative customization.



Dried plum juice concentrate appears to inhibit mold growth at 9.0 and 12.0% usage levels. At 9.0% addition, an additional 3 days of mold-free shelf life has been achieved, beyond that of a sucrose control. At 12.0% usage, this increased to 4-1/2 days, equal to the effect of calcium propionate. Of course, usage levels will depend on the specific formula and process in new product development. For typical yeast fresh baked goods, a starting usage level of 9.0% seems appropriate for mold inhibition purposes.

Satisfying Sandwich Sauces, Marinades And Rubs

Dried plum purees, juice concentrates and particularly powders are an effective addition to scratch-made marinades, rubs and sauces or can be added to processed versions for a noticeable improvement in flavor, moisture and shelf life. Dried plums are naturally rich in fiber and high in sorbitol to bind and maintain moisture in red meat and poultry products Dried plums' acidic profile, particularly malic acid, along with a high antioxidant content fend off the corrupting effects of bacteria and oxygen.

The flavor of dried plums can be described as non-characterizing. That is, dried plums do not impart a flavor but rather, enhance and round out other food flavors in a recipe or formulation. This makes dried plums the perfect ingredient for complete flavor systems whether sweet or savory, sauces, marinades, or rubs. This is particularly important when developing ethnic flavor systems with complex formulas and ingredients.

Some 71% of respondents in the 2007 Prepared Foods Magazine trends survey on new flavoring systems indicated a greater emphasis on natural flavors by food processors. However, concerns over natural flavor's stability throughout a finished product's shelf life remain. Not only are dried plums a natural ingredient, the addition of dried plums to marinade, rub and sauce formulas potentiates and rounds-out the natural flavors of herbs and spices while improving the shelf life of proteins.

Flavor improvement and stability, however, are not the only benefits food designers can achieve when using dried plums. The natural ability of dried plums to bind and retain moisture in proteins is impressive. This is true whether dried plums are added as part of a marinade formula, or rub or sauce. Related to moisture retention is the antioxidant capacity of dried plums to assist in suppressing the growth of both normal flora and various meat pathogens. All of these dried plum natural components contribute to extending the shelf life of beef, pork, poultry, lamb and many other animal proteins.

With more sandwich proteins and prepared meals entering the retail and foodservice markets pre-cooked and seasoned, the need for deeper flavors to both differentiate proteins and increase demand has never been greater. Retaining these flavors and moisture, particularly if the proteins are re-heated or held under heat, make the addition of dried plums all that more important.

Conclusion

Delivering restaurant-quality and convenience to consumers ordering sandwiches and other portable foods is a considerable challenge for food processors and foodservice operators. The entire process is a race against time, with everything from lipid oxidation to microbial growth to moisture retention and mold all conspiring against success. Confronting these issues while consumers are also demanding fresh, nutritional and natural food ingredients compounds the problems. Fortunately dried plums are available as a single food ingredient capable of resolving all of these issues.

For further information, recipes and formulas contact:

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