TECHNICAL BULLETIN

DRIED PLUM PUREE HELPS RETAIN THE MOISTURE AND FLAVOR OF HOT DOGS WHILE LOWERING COST

Summary
In foodservice operations, hot dogs and other processed sausages are generally kept warm and ready-to-serve using roller grills, rotisseries, chaffing dishes, or heated boxes. Extended holding periods result in loss of flavor and dryness—and a decrease in consumer acceptance and/or loss of product. Research conducted by the California Dried Plum Board suggests that the addition of small amounts of dried plum puree (3-5%) can help retain moisture and flavor of these American favorites.

And, because dried plum puree is used to replace beef and the use of corn syrup is eliminated, the overall cost of frankfurters can be reduced both in terms of ingredient costs as well as the cost of discarding an unacceptable product.

Background

In 1996, Americans consumed almost 800 million pounds of frankfurters at retail. A conservative estimate is another 400 million pounds of frankfurters were consumed in various foodservice outlets—a total of 1.2 billion pounds!

Beef by itself or in combination with pork is the most common protein used to process hot dogs. Leaner cuts of meat have recently been used to reduce fat and increase the nutritional content of many processed meats including hot dogs. These improvements generally yield an acceptable cooked product if consumed immediately. However, in many foodservice situations hot dogs are held under heat for extended periods of time. Holding provides convenience for the foodservice operator to facilitate serving, as well as immediate availability to consumers.

When held under heat, hot dogs can lose moisture and flavor. The use of vegetable proteins, food starches and gums in hot dogs are alternatives to correct these problems. But, because the expected flavor and texture of hot dogs is so well understood by consumers—even enhanced in a foodservice situation (at higher than supermarket prices)—foodservice operators must be particularly concerned about sensory delivery.

The cost of frankfurters is another consideration when selling to consumers. Purchase price is critical. Added cost due to food waste only increases foodservice operator cost. Over millions of pounds even a fraction of a cent becomes significant.

Prototype Development

Prototypes were developed at *Texas A&M University's Department of Animal Science* to simulate full scale production.

Two versions of the beef hot dogs were developed. One formula used 3.5% dried plum puree (a blend of principally dried plums and juice concentrate) that is specially produced for purchase by the USDA and made available to the school lunch program. The other formula used dried plum puree (a blend of principally dried plums and other fruits). In each formula, dried plum puree was used to partially replace beef and eliminate corn syrup solids.

ALL BEEF FRANKFURTER FORMULAS
(28% Fat Finished Product)

Ingredient	Control Lbs.	%	3.5% USDA Dried Plum Puree Lbs.	%	5.0% Dried Plum Puree Lbs.	%
Beef Lean, 19.23% fat	8.5000	25.80	5.9000	18.00	5.8000	17.6
Beef Trim, 47.98% Fat	14.0000	42.40	15.2000	46.20	15.0000	45.4
Salt	0.6750	2.10	0.6750	2.10	0.6750	2.1
Corn Syrup Solids	0.6000	1.80	--	--	--	--
Hydrolyzed Milk Protein HMP 36%	0.3000	0.90	0.6000	1.80	0.6000	1.8
Hydrolyzed Beef Stock	0.1500	0.60	0.1500	0.50	0.1500	0.5
Sodium Tripolyphosphate	0.1350	0.40	0.1350	0.40	0.1350	0.4
Frank Seasoning	0.1500	0.60	0.1500	0.50	0.1500	0.5
Sodium Erythorbate	0.0165	0.05	0.0165	0.05	0.0165	0.5
Modern Cure (Nitrite/Salt)	0.0750	0.20	0.0750	0.20	0.0750	0.2
Ice (10% added, cooking shrink)	8.3000	25.20	8.9000	27.10	8.9000	27.0
Dried Plum Puree	--	--	1.0500	3.20	1.5000	4.5
TOTAL	**32.9000**	**100.00**	**32.8500**	**100.00**	**33.0000**	**100.0**

Natural hardwood smoke applied during cooking.

Source: Texas A&M University, Department of Animal Science

Cost Analysis

When dried plum puree is used at the 5.0% level, the cost per pound is unchanged. Minimized shrinkage and food waste due to unacceptable hot dogs, however, would lower foodservice operator cost.

Using USDA dried plum puree the cost savings is significant. **The cost per pound is reduced by $.04 or 12.8%.**

ALL BEEF FRANKFURTER COST ANALYSIS
(28% Fat Finished Product)

Ingredient	Approx. Cost/ Lb.	All Beef Control	3.5% USDA Dried Plum Puree Lbs.	5.0% Dried Plum Puree Lbs.
Beef Lean, 19.23% Fat	$ .75	$ 6.38	$ 4.43	$ 4.35
Beef Trim, 47.98% Fat	.26	3.64	3.95	3.90
Salt	.20	.14	.14	.14
Corn Syrup Solids	.34	.20	--	--
Hydrolyzed Milk Protein HMP 36%	1.21	.36	.73	.73
Hydrolyzed Beef Stock	1.66	.25	.25	.25
Sodium Tripolyphosphate	.55	.07	.07	.07
Frank Seasoning	1.12	.17	.17	.17
Sodium Erythorbate	4.50	.07	.07	.07
Modern Cure (Nitrite/Salt)	.20	.02	.02	.02
Ice (10% added, cooking shrink)	--	--	--	--
Dried Plum Puree	1.10	--	*	1.65
TOTAL		**$11.30**	**$9.83**	**$11.35**
Cost Per Pound		**$ .34**	**$ .30**	**$ .34**

* Dried plum puree is available to schools as a bonus buy without cost.

Analysis of Moisture Content

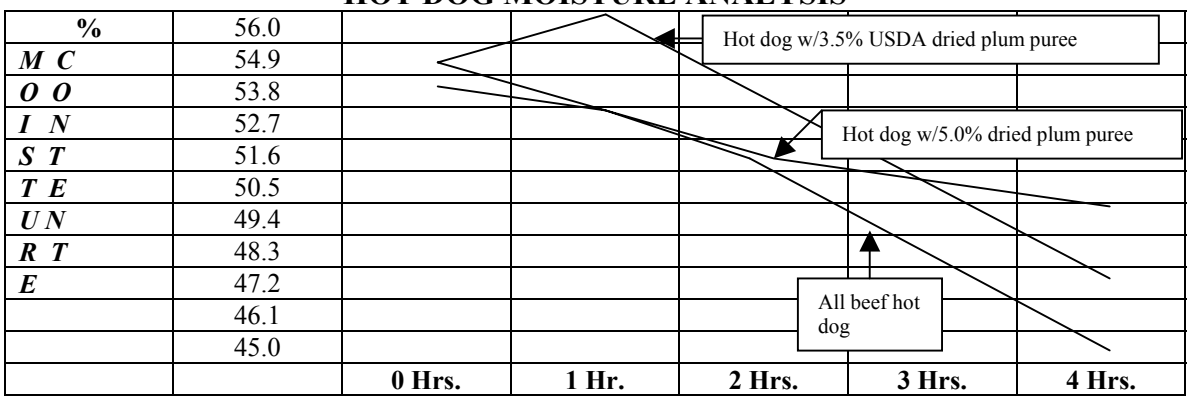
Both hot dog formulas were analyzed by *Medallion Laboratories,* Minneapolis, MN for moisture retention. A commercially available all beef hot dog (23% fat) was used as a control. After heating all three products to serving temperature (102 C) each was analyzed for moisture in one hour intervals up to four hours.

The hot dogs using dried plum puree and USDA dried plum puree were significantly more moist after four hours than the all meat hot dog.

Net Results:

- **The hot dog with 3.5% USDA dried plum puree had 4.9% more moisture after four hours than the control.**
- **The hot dog with 5.0% dried plum puree had 8.4% more moisture after four hours than the control.**
- **The hot dog with 3.5% USDA dried plum puree lost 23.7% less moisture than the control across 4 hours.**
- **The hot dog with 5.0% dried plum puree lost 47.1% less moisture than the control across 4 hours.**

HOT DOG MOISTURE ANALYSIS



Source: Medallion Laboratories

Consumer Evaluation of Hot Dogs with Dried Plum Puree

Consumers (sample size = 175) in Chicago and San Francisco were asked to evaluate the dried plum puree enhanced hot dogs. Consumers were screened to have eaten a hot dog in the past 90 days. The sample was split evenly men/women, under/over 18.

Sensory Evaluation

Respondents rated these hot dogs containing dried plum puree **at or near 4.00** in most sensory characteristics. These ratings were even higher among women and respondents under the age of 18. Most important, **overall flavor received the highest rating** of all characteristics. In fact, **taste/flavor and juicy were the two most often mentioned reasons for liking these hot dogs.**

Consumer Sensory Evaluation of
Hot Dogs Containing 5.0% Dried Plum Puree
(1 = Unsatisfactory, 5 = Excellent)

	Total (175)	Men (90)	Women (85)	Under 18 (88)	Over 18 (87)
Outer Color	3.63	3.46	3.81	3.75	3.51
Inner Color	3.32	3.18	3.47	3.41	3.23
Inner Texture	3.70	3.54	3.87	3.89	3.52
Aroma	3.95	3.90	4.00	4.23	3.67
Overall Flavor	3.99	3.93	4.05	4.30	3.68
Overall Texture	3.75	3.69	3.81	4.01	3.48
Overall Preference	3.85	3.80	3.89	4.10	3.59

- **79% rated the hot dogs the same or better** than conventional hot dogs. This rose to 91% among respondents under 18.

- What respondents **liked most** about the hot dogs: Tastes good/tastes better than other hot dogs (59%); Juicy/juicier than others (17%); Looks good (13%); Easy to bite into (12%).

Purchase Intention

When asked if they would purchase these hot dogs, **71% indicated that they would definitely or probably purchase** – this was even higher among women (78%).

PURCHASE INTENTION
OF HOT DOGS CONTAINING 5.0% DRIED PLUM PUREE

	Total %	Men %	Women %	Under 18 %	Over 18 %
Definitely would purchase	25.9	19.0	33.3	29.3	22.2
Probably would purchase	44.6	44.8	44.4	43.1	46.3
May/may not purchase	23.2	27.6	18.5	24.1	22.2
Probably would not purchase	1.8	3.4	0.0	0.0	3.7
Definitely would not purchase	4.5	5.2	3.7	3.4	5.6

- Reasons for purchase intention included: Tastes good (39%); Liked the flavor (13%), It was juicy (10%); Better than the ones I eat now (7%).

Evaluation of Hot Dogs with USDA Dried Plum Puree by Consumers Under 18

Respondents under the age of 18 are the most likely to consume hot dogs containing the USDA dried plum puree. **Sensory evaluation of this product by these consumers was generally very positive** – typically approaching 4.00.

Purchase interest was exceptionally high with 85.7% indicating a positive purchase intention.

CONSUMERS UNDER AGE 18

SENSORY EVALUATION OF
HOT DOGS CONTAINING 3.5% USDA DRIED PLUM PUREE
(N = 87)
(1 = Unsatisfactory, 5 = Excellent)

Outer color	3.48
Inner color	3.26
Texture	3.50
Aroma	3.85
Overall flavor	3.88
Overall texture	3.66
Overall preference	3.76

PURCHASE INTENTION
OF HOT DOGS CONTAINING 3.5% USDA DRIED PLUM PUREE

Definitely would purchase	35.7%
Probably would purchase	50.0%
May/may not purchase	11.9%
Probably would not purchase	0.0%
Definitely would not purchase	2.4%

Nutritional Information

	3.5% USDA Dried Plum Puree		5.0% Dried Plum Puree	
	100 Grams	**Per Serving (56 grams)**	**100 Grams**	**Per Serving (56 grams)**
Calories (FBND subtracted)	299.0	167.4	307.0	171.9
Calories from fat	240.0	134.4	248.0	138.9
Calories from saturated fat	106.0	59.4	110.0	61.6
Fatty acid analysis w/profile				
Total fat	26.7%	14.95g	27.5%	15.4g
Saturated fat	11.8%	6.608g	12.2%	6.832g
Monounsaturated fat	10.8%		0.9%	
cis-cis Polyunsaturated fat	1.09%		1.10%	
Trans fat	1.86%		1.96%	
Cholesterol by GC	54.6 mg	30.58 mg	60.5 mg	33.88 mg
Potassium by AA	212 mg	118.7 mg	178 mg	99.68 mg
Carbohydrates, Available FBND	2.7%	1.512 g	3.5%	1.96 g
Carbohydrates total	2.8%		3.6%	
Fiber group				
Total dietary fiber	5.9%		4.1%	
Insoluble fiber	5.7%		3.9%	
Soluble fiber	0.2%		0.2%	
Fiber, natural detergent	0.10%	0.056 g	0.10%	0.056 g
Sugars by HPLC				
Total sugar	3.18%	1.781 g	2.61%	1.462 g
Fructose	.36%		0.13%	
Glucose	1.99%		1.87%	
Sucrose	0.00%		0.00%	
Maltrose	0.00%		0.00%	
Lactose	0.83%		0.61%	
Protein by Dumas (F=6.25)	11.9%	6.664 g	11.4%	6.384 g
Vitamin A Retinol	<100 IU	0.0 IU	<100 IU	0.0 IU
Vitamin C, Total	55.9 mg	31.3 mg	55.1 mg	30.86 mg
Metals Short Scan by ICP				
Sodium	1030 mg	576.8 mg	963 mg	539.3 mg
Calcium	50.6 mg	28.34 mg	34.6 mg	19.38 mg
Iron	1.19 mg	0.6664 mg	1.14 mg	0.6384 mg
Folic acid, total (micro)	<25.0 ug		<25.0 ug	
Moisture	55.4%	31.02 g	54.2%	30.35 g
Ash analysis	3.227%		3.343%	
Sorbitol analysis	0.480%	0.2688 g	0.140%	0.0784 mg
Water activity	0.90		0.93	

Source: Medallion Laboratories