Sensory Attributes and Phenolic Content of Precooked Pork Breakfast Sausage with Fruit Purees

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Sensory of fruit enhanced sausage…

Sensory and Nutritive Qualities of Food

ABSTRACT

The aim of this study was to evaluate the phenolic content and sensory attributes of precooked pork breakfast sausage patties enhanced with blueberry puree (BBP) or dried plum puree (DPP). Five treatments at a standardized percent fat were evaluated, which included a control, 5% or 10% BBP, and 5% or 10% DPP. The addition of BBP and DPP at 5% and 10% of the weight increased the total phenolics in the cooked sausage an average of 36%. Comparisons of fruit type, percentage of fruit added, and fruit treatments versus control were all significant ($P < 0.05$) for tenderness, cohesiveness and pork sausage flavor, but were not significant for other attributes. Fruit type × fruit amount interaction was significant for sweetness. As fruit amount increased, sweetness scores also increased with the DPP treatments being sweeter than the BBP treatments ($P < 0.05$). A consumer panel of 10 to 12 year old children (n = 108) rated 5% BBP and control the highest for overall like compared to other treatments, and scored both BBP treatments equal to the control for taste ($P > 0.05$). Approximately, 90% of the children said they would like to eat the BBP sausage again while approximately 70% said they would like to eat the DPP sausage again. Results indicate the addition of BBP or DPP to precooked pork breakfast sausage can increase phenolics that may be nutritionally beneficial while also having consumer appeal.

Key Words: Pork, Breakfast Sausage, Fruit, Phenolics, Children Sensory

INTRODUCTION

The National School Lunch Program (NSLP) is largely responsible for the nutrition of children in the U.S. as it feeds 26 million children a day (USDA 2005). Schools participating in the NSLP must offer lunches that provide at least one-third of the Recommended Daily Allowance for protein, calcium, iron, Vitamin A and Vitamin C, along with meeting the Dietary Guidelines for Americans (CFR 2005; USDA 2005). Gordon and McKinney (1995) reported that the food choices and the preparation methods used by school foodservice professionals can have a significant impact on the fat, cholesterol and sodium content of the foods served. Therefore, intervention methods that can help schools meet the Dietary Guidelines for Americans should be developed and implemented. Even when a school is successful at meeting all the dietary requirements, the only way the student can benefit is if they choose to participate in consuming the school lunch. Furthermore, students who participate may not reap all of the nutritional benefits because they may not eat the foods they are served. Studies have shown that fruits and vegetables are the most wasted foods served in the NSLP (Cullen and others 2000; Garrett and Vaden 1978). Jansen and Harper (1978) reported that milk, along with most entrees and starches were well accepted by students as more than 75% of those served were consumed, while fruits and vegetables were the most wasted foods by students. Plate waste is inevitable, and there is no guarantee that a child will consume the fruits and vegetables they are served. Therefore, it is essential to design enticing food products for children that incorporate servings of fruits and vegetables that children would not typically choose to eat.

Consumption of fruits and vegetables has been associated with reduced risk of cancer and cancer mortality (Ames and others 1993). One reason for this protection against diseases (including cancer, cardiovascular, and cerebrovascular diseases) is the presence of antioxidants

(Vinson and others 2001). Antioxidants are compounds that inhibit or delay the oxidation of other molecules by inhibiting the initiation or propagation of oxidizing chain reactions (Velioglu and others 1998). Foods may contain natural occurring or synthetic antioxidants. Natural antioxidants consist of phenolic compounds, nitrogen compounds or carotenoids as well as ascorbic acid (Velioglu and others 1998). Phenolic compounds include tocopherols, flavonoids and phenolic acid, all of which are found in different foods. Oxygen radical absorbance capacity (ORAC) is a common way to measure the antioxidant capabilities of foods. Dried plums and blueberries have high ORAC values of 5,770 and 2,400; respectively (Cao and others 1995).

Butylated hydroxy anisole (BHA) and butylated hydroxyl toluene (BHT) are synthetic antioxidants that are commonly used in precooked meat products to prevent lipid oxidation and warmed-over-flavor. Knowing that many fruits contain powerful antioxidants, Keeton and others (2001) found that substituting DPP at 3% and 6% in pork sausage was just as effective at retarding lipid oxidation as was a combination of BHA/BHT. Therefore, if fruit can be successfully added to meat to function as an antioxidant it is worthy to consider the additional nutritional benefits that fruit-enhanced meat may have, and how a product may aid in child nutrition programs such as the NSLP.

Therefore, the objective of this study was to evaluate the sensory attributes and antioxidant levels of a precooked breakfast sausage enhanced with blueberry puree (BBP) or dried plum puree (DPP).

MATERIALS AND METHODS

Pork Sausage Manufacturing

Two meat blocks identified as ‘fat’ and ‘lean’, were each mixed for 5 minutes in a Hollymatic 4200 mixer/grinder (Countryside, Ill., U.S.A.), and then coarse ground through a

12.7 mm grinding plate. Once the tissue was coarse ground, eight samples that were evenly collected from the meat block were extracted to determine the percent fat of each. Percent fat was determined according to AOAC approved Ether Extraction Official Method 991.36 (AOAC 1995). After fat determination was complete, Pearson square was used to determine the amount from the 'fat' and 'lean' meat block that should be mixed in order to formulate each pork sausage treatment to be 30% fat.

Precooked breakfast sausage patties were produced at the Texas Tech University (TTU) Meat Laboratory, a USDA inspected facility. Treatments included a control, 5% or 10% BBP, and 5% or 10% DPP. A 22.7 kg standard base formulation was made for all treatments, which included 453.6 g of Old Plantation Pork Sausage Seasoning (A. C. Legg, Calera, Ala., U.S.A.), TENOX 4 food grade antioxidant (Eastman Chemical Company, Kingsport, Tenn., U.S.A.) at a 0.02% level of the fat, and the treatment's respective fruit puree. The BBP was manufactured by Kerr Concentrates Inc. (Salem, Oreg., U.S.A.) and had a moisture content of 84%. The DPP was a product of Sunsweet Growers Inc. (Yuba City, Calif., U.S.A.) and had a moisture content of 30%. In addition to the five treatments, a batch of plain pork sausage was processed which was also 30% fat, but contained no seasonings or antioxidants. The plain pork sausage was manufactured for the purpose of total phenolic determination.

Each batch was mixed, fine ground through a 3.18 mm plate and formed into 42 g sausage patties using a Hollymatic Super Model 54 food portion machine (Countryside, Ill., U.S.A.). Approximately 40 raw sausage patties were randomly removed from each treatment for total phenolic determination. The remainder of the patties in each treatment were cooked on a Magi-Grill TBG-60 conveyor cooking system (MagiKitchen, Inc., Quakertown, Pennsylvania, U.S.A) to an internal temperature of 71 °C (± 5 °C). Patties were allowed to drip for

approximately 10 min before being crust frozen in a blast freezer; vacuum packaged in an Ultravac 2100 dual-chamber vacuum packager (Koch Supplies, Kansas City, Missouri, U.S.A.) at a vacuum setting of 6, boxed and stored frozen (-20 °C to -30 °C) for at least 14 d.

Total Phenolics

Sample Preparation Raw and cooked samples from each treatment and the plain pork sausage were collected for determination of total phenolic content. Each sample was flash frozen in liquid nitrogen and reduced to a fine powder using a Waring Blender (model 1120, Waring Product Division, Dynamics Corporation of America, New Hartford, Calif., U.S.A.). The powdered tissue was sifted through a metal strainer in order to discard any large pieces that were not well homogenized, placed in labeled Whirl Pak® bags (Nasco, Modesto, Calif., U.S.A.) and stored at -80 °C until chemical analysis was performed.

Folin-Ciocalteau Assay Total phenolics were determined using the Folin-Ciocalteau assay (Escarpa and Gonzalez, 2001). This procedure was conducted by Craft Technologies (Wilson, North Carolina). Aliquots of the powdered sausage sample from each treatment were assayed to determine total phenolic content. Methanol was added to 5 g of powdered sausage sample and homogenized to extract polyphenols. A second extraction using Methanol was conducted to cause complete extraction. Folin and Ciocalteu's phenol reagent (SIGMA- F-9252, Sigma Aldrich, St. Louis, Missouri, U.S.A.) and $NaCO_3$ solution were used to stimulate color reaction to occur. Absorbance was determined on a Perkin Elmer 124 Spectrophotometer (Hitachi; Tokyo, Japan) at 765 nm. The plain pork sausage was used as a baseline comparison for this assay as it was unknown if the spices and antioxidants that were added to the treatments would interfere with the assay.

Sensory Analysis

Trained Sensory Panels Sensory panelists were trained according to AMSA (1995) and Cross and others (1978). Panelists were presented 6 different samples in each of 2 training sessions. Panelists were instructed to chew each sample for the same length of time, to expectorate samples into a cup, and then to cleanse their palate between samples using water and apple juice. The panelists rated each sample for 6 characteristics (juiciness, tenderness, cohesiveness, sweetness, pork sausage flavor, and flavor intensity) on an 8-point rating scale (AMSA 1995), and one characteristic (off-flavors) on a 5-point rating scale. Samples used for training were selected to represent the range of sensory characteristics of the treatment samples. Following the evaluation of each training sample, panelists reported their scores, and then the trainer identified the proper range for each characteristic on the rating scale.

Frozen precooked sausage patties were reheated in a Blodgett, Mark V Convection Oven (Burlington, Vermont, U.S.A.) set at 176.7 °C for approximately 6 min to bring them to 71 °C (± 5 °C) internal temperature. Patties were cut into quarters and placed in heated pans for serving. Eight to 10 panelists evaluated each sausage sample for the characteristics described above. A "standard" treatment sausage that represented precooked breakfast sausage currently served in school cafeterias was added as a treatment to the trained sensory analysis. The standard treatment was added to evaluate how closely the treatments manufactured at TTU Meat Lab compared to what was available for purchase by school cafeterias. This comparison was important as it is difficult to mimic industry manufacturing techniques in a small processing facility, and it is well known that differences in mixing and holding times along with temperature affect the bind and cohesiveness of the product. Therefore, 6 samples were evaluated in each of the 6 panels, and no more than 2 panels were served per day.

Children Sensory Evaluation A consumer panel of 10 to 12 year old children (n = 108) was conducted. All children were required to have parental consent to participate, and procedures were approved by the Texas Tech University Human Use Committee. Age, gender and ethnicity were recorded for each child and are shown in Table 1.

Children sensory panels occurred at 5 different locations over a 30-d period. The design of the children's sensory panel was an incomplete block because each child only evaluated 3 of the 5 treatments to avoid fatigue. All children evaluated the control and 2 of the 4 fruit treatments, 3 total samples, and filled out an evaluation sheet for each sample independently. Serving order of treatments and treatments which were served to each panel was kept balanced throughout the study.

The children answered 5 questions about each sausage patty. The questions were as follows: 1) How much do you like the way the sausage looks? 2) How much do you like the way the sausage feels in your mouth? 3) How much do you like the way the sausage tastes? 4) How much do you like the sausage overall? 5) Would you like to eat this again (yes or no)? Questions 1 through 4 were answered according to the P&K scale (Kroll 1990). The P&K scale is a nine-point hedonic scale using "kid talk" that has shown to be more successful with this age category of children then a normal hedonic scale or hedonic face scale (Kroll 1990). The following numeric identification was used for data analysis: 1 = super bad, 2 = really bad, 3 = bad, 4 = just a little bad, 5 = maybe good or maybe bad, 6 = just a little good, 7 = good, 8 = really good, 9 = super good.

Statistical Analysis

The purpose of this study was to generate preliminary data that would lead to more extensive research in this area. Therefore, only one replication was made for each treatment, and for these reasons only percentage differences in total phenolics are presented.

The trained sensory and children's panel data was analyzed using the Proc Mixed procedures of SAS (SAS Inst. Inc., Cary, North Carolina, U.S.A.), with treatments coded as fixed effects. Data from the trained sensory panel was analyzed as a randomized block design with panel serving as the block and random effects of block and panelists. Children's sensory data was organized as an incomplete block design with panel serving as block and with random effects of panel, panelists within rep and panel × treatment. Question number 5 on the children's sensory evaluation form was analyzed using Chi-Square of SAS to determine the frequency that children responded 'yes' or 'no'.

RESULTS AND DISCUSSION

Total Phenolics

For each treatment total phenolics were higher for cooked samples than for raw samples (Table 2). This is interesting as one would assume that the phenolics may decrease during cooking. A possible explanation could be that cook loss (loss of water and fat) increased the concentration of the phenolics in the product. More importantly, cooked fruit treatments had on average 36% more phenolics than cooked control samples (Table 2). The DPP treatments had more total phenolics than the BBP treatments. This higher level of phenolics may indicate this product is nutritionally enhanced due to the fruit that was added.

Trained Sensory

Samples that were evaluated to be more tender tended to be less cohesive (Table 3). These results indicate that as fruit was added, dilution of total soluble proteins increased which

caused lower cohesiveness scores, and a more tender product. More specifically, DPP treatments were less cohesive than the BBP treatments (Table 3). Likewise, 10% fruit treatments were less cohesive than 5% fruit treatments (Table 3).

Control sausage was shown to have the most intense pork sausage flavor of all treatments, and the standard treatment had the least intense flavor and most off-flavors of any treatment (Table 3). The treatment sausages that were manufactured at TTU were rated by the trained panel to be more tender and to have a greater flavor intensity than the standard sausage treatment ($P < 0.05$). This difference may be partially due to the difference in manufacturing process in the industry versus the capabilities of a meat laboratory. Furthermore, the packaging method of the standard was different than that of the TTU treatments. TTU treatments were vacuum packaged, while the industry standard patties came in a poly-liner bag inside a cardboard box.

The effect of fruit type × fruit amount interaction was only significant for trained sensory panel sweetness evaluations (Table 4). The effect of fruit type on sweetness depended on the amount of fruit that was added. Likewise, the effect of the fruit amount on sweetness depended on the type of fruit. The DPP treatments were sweeter than the BBP treatments. Although the fruit purees were added to the sausage at equal percentages of total weight of the sausage, the fruit purees differed in their raw concentration. The DPP was 30% and the BBP was 84% moisture. Therefore, the actual concentrations of DPP and BBP added were not the same. This fact may explain why the DPP treatments were perceived to be the sweetest.

Children's Sensory

A consumer panel of 10 to 12 year old children (n = 108) scored the 5% BBP treatment to be just as acceptable as the control ($P = 0.90$; Table 5). Furthermore, the children scored both

BBP treatments equal to the control for taste ($P = 0.11$; Table 5). The effect of fruit type was significant for mouthfeel, taste and overall like as the children rated these characteristics higher for BBP treatments than the DPP treatments ($P < 0.05$) (Table 6). Similarly, the percentage of fruit used had a significant effect on appearance, taste and overall like as the children scored the BBP treatments higher than the DPP treatments ($P < 0.05$) for these three traits. The control sausages had more desirable ratings for mouthfeel, taste and overall like than all fruit treatments averaged together (Table 6). However, of all the children approximately 90% of them said they would like to eat the BBP and control sausages again (Figure 1). Furthermore, approximately 70% of them said they would like to eat the DPP sausages again (Figure 1).

The DPP treatments may have not been rated as high as the BBP treatments due to the difference in concentration of the fruit added to the product and the difference in sweetness. It appears sweetness and sausage flavor combined is not appealing to the children. Therefore, it is important to conduct additional research in which the fruits are added at equal concentrations to determine the optimal level that will be appealing to the children while still providing nutritional benefits.

CONCLUSIONS

Results indicate that adding BBP or DPP to precooked pork breakfast sausage increased total phenolics which may have health benefits, while having consumer appeal. The DPP treatments contained higher levels of phenolics than other treatments, and 70% of the children said they would eat the DPP sausages again. The BBP treatments were lower in phenolics than DPP treatments, but BBP treatments were more acceptable to children than DPP treatments. Trained sensory panel evaluations showed that DPP treatments were significantly sweeter than all other treatments. Therefore, the concentration of DPP may need to be reduced in order to

increase the number of students that would choose to eat the sausage again. Further research should be conducted to compare various fruits added to meat to determine the specific flavonoids available in the fruit enhanced meat along with the children's acceptability of the product.

ACKNOWLEGMENTS

The College of Human Sciences at Texas Tech University is responsible for funding this study. Additionally, the authors would like to thank Kelly Adams for assisting with sensory testing and chemical analyses. Ana Marie Luna for her assistance in with sensory testing, and Jason Byrd, Greg Clark, Willy Horne, Jolena Fleming, Michael Jaks, Jon Kelimeier, Jarrod Miller, Wendy Palmore, Scott Siggins, Zac Vineyard, and Dale Woerner for assisting with the children's sensory panels. Appreciation is also extended to Dr. David Wester who lent his statistical expertise to this study.

LITERATURE CITED

Ames BN, Shigenaga MK, Hagen TM. 1993. Oxidants, antioxidants, and the degenerative diseases of aging. Proceedings of the National Academy of Sciences of the United States of America. Sep 1; 90(17):7915-22.

[AMSA] American Meat Science Association. 1995. Research guidelines for cookery, sensory evaluation and instrumental tenderness measurements of fresh meat. American Meat Science Association and National Live Stock and Meat Board. Chicago, IL.

[AOAC] Assn. Official Analytical Chemists. 1995. Fat (crude) in meat and meat products, solvent extraction (submersion) method. Official methods of analysis of AOAC International 16th edition. Method 991.36. Washington, D.C.: AOAC.

Cao G, Verdon CP, Wu H, Wang H, Prior RL. 1995. Automated assay of oxygen radical absorbance capacity with the COBAS FARA II. Clin Chem. 41:1738-1744.

[CFR] Code of Federal Regulations. 2005. National School Lunch Program, 7 CFR Part 210, Federal Register. Available: http://www.access.gpo.gov/nara/cfr/waisidx_04/7cfr210_04.html . Accessed Feb 2005.

Cross HR, Moen R, Stanfield MS. 1978. Training and testing of judges for sensory analysis of meat quality. Food Technol. July. 48-54.

Cullen KW, Eagan J, Baranowski T, Owens E, Moor C. 2000. Effect of a la carte and snack bar foods at school on children's lunchtime intake of fruits and vegetables. J Amer Diet Assoc 100:1482-1486.

Escarpa A, Gonzalez MC. 2001. Approach to the content of total extractable phenolic compounds from different food samples by comparison of chromatographic and spectrophotometric methods. Analytica Chimica Acta. 427:119-127.

307 Garrett PQ, Vaden AG. 1978. Influences of student-selected menus on participation, plate waste
308 and student attitudes. School Food Service Research Review 2: 28.
309 Gordon AR, McKinney P. 1995. Sources of nutrients in students' diets. Am J Clin Nutr. 61:
310 232S-240S.
311 Jansen GR, Harper JM. 1978. Consumption and plate waste of menu items served in the National
312 School Lunch Program. J Amer Diet Assoc. 73:395-400.
313 Keeton JT, Rhee KS, Boleman RM, Nunez MT. 2001. Antioxidant properties of DRIED PLUM
314 ingredients in fresh and precooked pork sausage. A final report to the California DRIED
315 PLUM Board.
316 Kroll BJ. 1990. Evaluating rating scales for sensory testing with children. Food Technol. 44(11):
317 78-86.
318 [USDA] U.S. Department of Agriculture, Food Nutrition Service. 2005. National School Lunch
319 Program: U.S. Department of Agriculture. Available from
320 http://www.fns.usda.gov/cnd/lunch/ . Accessed Feb, 2005.
321 Velioglu YS, Mazza G, Gao L, Oomah BD. 1998. Antioxidant activity and total phenolics in
322 selected fruits, vegetables, and grain products. J Agric Food Chem. 46:4113-4117.
323 Vinson JA, Su X, Zubik L, Bose P. 2001. Phenol antioxidant quantity and quality in foods: fruits.
324 J Agric Food Chem. 49:5315-5321.
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Table 1. Demographics of children who participated in children's sensory panel, and U.S. Census statistics for gender and ethnicity of children age 10 to 12 that are enrolled in school

Demographic	# of Children in study	Percent in study	% U.S. population of 10-12 year olds [a]
Age (yr)			
10	36	33.3	35.1 [b]
11	45	41.7	31.9 [b]
12	27	25.0	33.0 [b]
Sex			
Female	60	55.6	47.9
Male	48	44.4	52.1
Ethnicity			
African American	21	19.4	16.9
Asian & Pacific Islander	2	1.9	3.6
Hispanic	26	24.1	15.1
White non-Hispanic	59	54.6	63.3
Other	0	0.0	1.0

[a] U.S. Census Bureau. 2000. School enrollment = social economic characteristics of students. Available from: http://landview.census.gov/population/www/socdemo/school/ppl-148.html. Accessed on May 6, 2003.

[b] The goal of this study was to evaluate 10 to 12 year old children, not to have the same proportion as the U.S. population.

Table 2. Total phenolic content of raw and cooked pork sausage with blueberry puree (BBP) or dried plum puree (DPP) and the percentage that phenolics differ in each cooked treatment from the control

Sample ID	Total phenolics (as catechin) µg/g		Change in phenolic due to cooking, %	Difference from control of cooked sausage, %
	Raw	Cooked		
Plain Pork[a]	272	139	(51.2)	--
Control	350	363	4.0	--
5% BBP	366	421	15.1	15.7
10% BBP	384	452	17.6	24.4
5% DPP	440	483	9.8	32.8
10% DPP	473	628	32.9	72.8

[a]Plain Pork = 30% fat ground pork without spice, fruit or BHA/BHT.

Table 3. Sensory attributes of control, standard and fruit-enhanced precooked pork breakfast sausages

Trait	Fruit type		Fruit amount		Comparison		
	BBP[a]	DPP[b]	5%	10%	Fruit	Control	Standard[c]
Juiciness[d]	5.65	5.88	5.73	5.80	5.76	5.73	5.53
Tenderness[e]	6.27 ^{z}	7.03 ^{y}	6.40 ^{z}	6.90 ^{y}	6.65 ^{x}	5.41 ^{y}	4.10 ^{z}
Cohesiveness[f]	4.56 ^{z}	3.36 ^{y}	4.43 ^{z}	3.49 ^{y}	3.96 ^{x}	6.13 ^{y}	7.57 ^{z}
PSF[g]	6.32 ^{z}	4.80 ^{y}	5.79 ^{z}	5.32 ^{y}	5.56 ^{x}	6.68 ^{y}	6.01 ^{z}
Flavor intensity[h]	6.46	6.39	6.40	6.45	6.43 ^{y}	6.60 ^{y}	6.02 ^{z}
Off-flavor[i]	1.07 ^{z}	1.00 ^{y}	1.04	1.04	1.04 ^{y}	1.03 ^{y}	1.25 ^{z}

[a] BBP = blueberry puree.
[b] DPP = dried plum puree.
[c] The Standard treatment was a precooked sausage patty currently served in school cafeterias.
[d] Juiciness; 1 = extremely dry to 8 = extremely juicy.
[e] Tenderness; 1 = extremely tough to 8 = extremely tender.
[f] Cohesiveness; 1 = extremely non-cohesive to 8 = extremely cohesive.
[g] PSF (Pork Sausage Flavor); 1 = extremely uncharacteristic PSF to 8 = extremely characteristic PSF.
[h] Flavor Intensity; 1 = extremely bland to 8 = extremely intense.
[i] Off-flavor; 1 = no off-flavor to 5 = extreme off-flavor.
[x,y,z] Means within a row, within the same grouping, lacking common superscripts differ ($P < 0.05$).

Table 4. The effect fruit type × fruit amount interaction on sweetness[a] as evaluated by a trained sensory panel

	Amount of Fruit Added	
Fruit Type	**5%**	**10%**
BBP[b]	1.1504 [z, Z]	1.5391 [z, Z]
DPP[c]	3.9060 [y, Z]	5.0711 [y, Y]

[a] Sweetness; 1 = extremely non-sweet to 8 = extremely sweet.
[b] BBP = blueberry puree.
[c] DPP = dried plum puree.
[y,z] Means within a column lacking a common superscript differ ($P < 0.05$).
[Y, Z] Means within a row lacking a common superscript differ ($P < 0.05$).

Table 5. LS means of sensory attributes of precooked breakfast sausage evaluated by 10 to 12 year old children

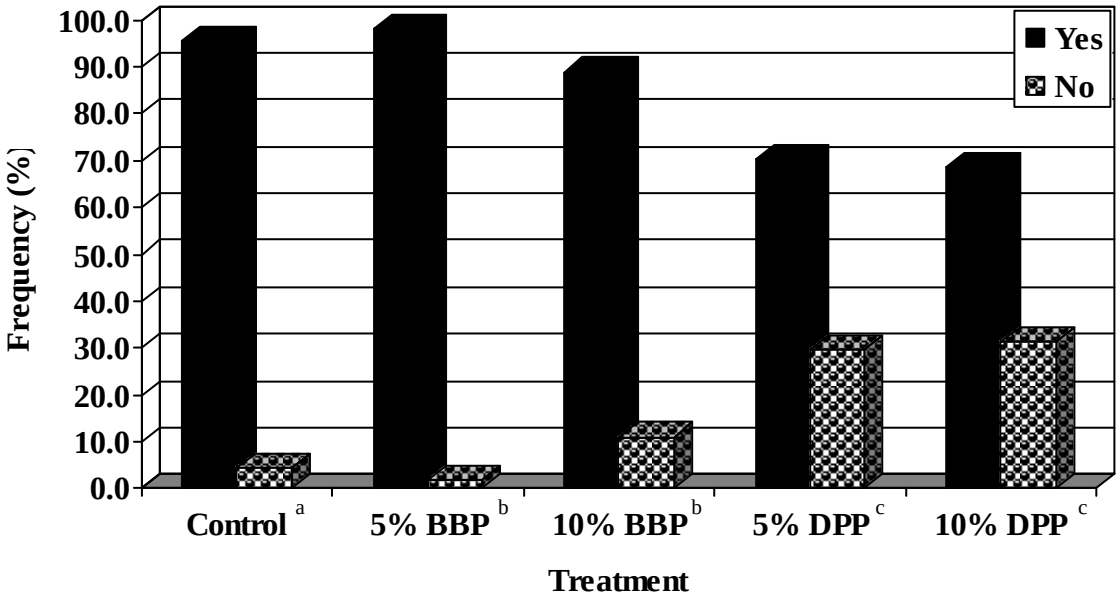
Trait	Treatment LS Means				
	Control (n = 108)	5% BBP[a] (n = 54)	10% BBP[a] (n = 54)	5% DPP[b] (n = 54)	10% DPP[b] (n = 54)
Appearance[c]	7.5 [z]	7.6 [z]	7.0 [y]	7.2 [y,z]	6.9 [y]
Mouthfeel[c]	7.9 [y]	8.0 [y]	7.4 [z]	7.1 [z]	6.9 [z]
Taste[c]	8.2 [y]	8.3 [y]	7.8 [y]	7.1 [z]	6.6 [z]
Overall Like[c]	8.1 [y]	8.1 [x,y]	7.6 [w,x]	7.3 [w,z]	6.8 [z]

[a] BBP = blueberry puree.
[b] DPP = dried plum puree.
[c] Evaluated using P&K scale (Kroll 1990); 1 = super bad to 9 = super good.
[y, z] Means within a row lacking common superscripts differ ($P < 0.05$).

Table 6. Effect of fruit type, fruit amount, and the comparison of fruit treatments versus control on children's sensory evaluations

Trait	Fruit type		Fruit amount		Fruit vs. control	
	BBP[a]	DPP[b]	5%	10%	Fruit	Control
Appearance[c]	7.1	6.9	7.3 [z]	6.7 [y]	7.0	7.3
Mouth feel[c]	7.5 [z]	6.8 [y]	7.4	6.9	7.1 [z]	7.7 [y]
Taste[c]	7.9 [z]	6.7 [y]	7.5 [z]	7.1 [y]	7.3 [z]	8.1 [y]
Overall Like[c]	7.7 [z]	6.9 [y]	7.6 [z]	7.0 [y]	7.3 [z]	8.0 [y]

[a] BBP = blueberry puree.
[b] DPP = dried plum puree.
[c] Evaluated using P&K scale (Kroll 1990); 1 = super bad to 9 = super good.
[y, z] Means within a row, within the same grouping, lacking common superscripts differ ($P < 0.05$).



[a] Control (n=108)
[b] BBP = blueberry puree; 5% BBP (n=54); 10% BBP (n=54)
[c] DPP = dried plum puree; 5% DPP (n=54); 10% DPP (n=54)

Figure 1

Figure 1. Percentage of 10 to 12 year old children who said they would like to eat the sausage they tasted again