Nutrient Comparison between Enhanced and Natural Fresh Pork

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Introduction

It is estimated that 45% of fresh pork cuts are "enhanced". The Hormel foods glossary of meat terms defines enhanced meat as "A meat product that has received injections of water, salt, and sodium phosphate to season the meat and to keep it from drying out. As meat producers increasingly raise leaner animals that contain significantly less fat, alternative processes are being developed to replace the flavor and moisture loss due to reduction in fat on the animal. Enhancing the meat is one such process".[1] The USDA National Nutrient Database for Standard Reference (SR) does not currently provide data for the nutrient content of enhanced meat. Therefore, a collaborative study was conducted by scientists at USDA, University of Wisconsin, University of Maryland, and the National Pork Board to determine the mineral nutrient profile of the following enhanced pork products: Shoulder blade steak, Tenderloin, and Top loin chops. These data were then compared to nutrient values of similar non-enhanced cuts obtained from a recent study of nine natural pork products.

Objectives

•To determine the nutrient profile of three enhanced pork products for inclusion in the USDA National Nutrient Database for Standard Reference (SR).
•To compare the nutrient profiles of non-enhanced and enhanced pork for Shoulder blade steak (SHB), Tenderloin (TEN), and Top loin chop (TLC).
•To determine the effect of cooking by braising, broiling and roasting on nutrient content of both product types (Non-enhanced and enhanced).

Methodology

•**Sampling**: Non-enhanced (NE) and Enhanced (E) forms of fresh pork cuts (SHB, TEN, TLC) were randomly purchased from 12 retail outlets using the nationwide sampling plan developed for the USDA National Food and Nutrient Analysis Program.[2]
•**Preparation**: Twelve samples of each cut and product type were frozen and stored in the raw state for later nutrient analysis (total n=72). Twelve additional samples of each cut and product type (NE, E) were cooked by an appropriate cooking method (total n = 72): SHB was braised in a roasting pan to an internal temperature of 325°F in a pre-heated oven with 100 ml of water; TEN was roasted in a pre-heated oven to an internal temperature of 325° F; TLC was broiled in a George Foreman electric grill to a final internal temperature of 160ºF. Separable fat and connective tissues were removed and weighed; the lean portions were homogenized for nutrient analysis.
•**Analyses**: Samples were digested using AOAC method No 984.27.[3] Mineral content of all samples was determined by ICP (Inductively Coupled Plasma methodology).
•**Quality Control**: Quality assurance was monitored through the addition of certified reference materials, in-house controls, and random duplicate sampling to the sampling stream.
•**Statistics:** Data were statistically evaluated for cut (SHB, TEN, TLC), method of cooking (broiling, roasting, braising) and product type (enhanced, non-enhanced) using the Mixed Procedure of SAS.[4] Critical values were set at $p<0.05$.

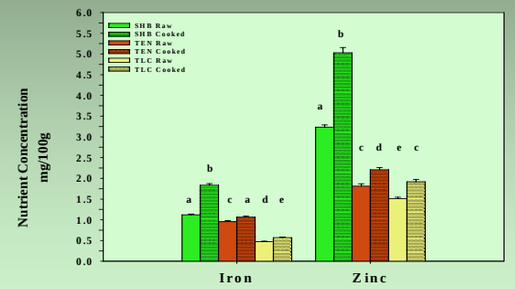

Figure 1. Effect of cooking on iron and zinc content in shoulder blade (SHB), tenderloin (TEN) and top loin chop (TLC) cuts. ANOVA indicated a significant ($p < 0.0001$) interaction between cut type and cooking. Bar height represents Least Square means ±S.E.M. Bars with the same superscript letters are not significantly different at $p<0.05$.

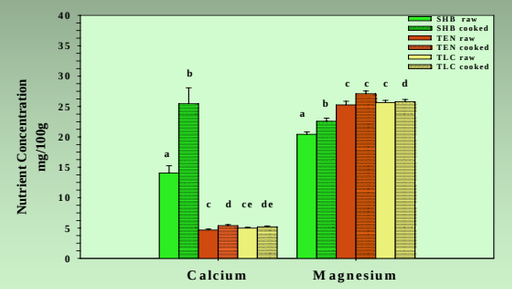

Figure 2. Effect of cooking on calcium and magnesium content in shoulder blade (SHB), tenderloin (TEN) and top loin chop cuts (TLC). ANOVA indicated a significant ($p<0.001$) interaction between cut type and cooking. Bar height represents Least Square means ±S.E.M. Bars with the same superscript letters are not significantly different at $p<0.05$.

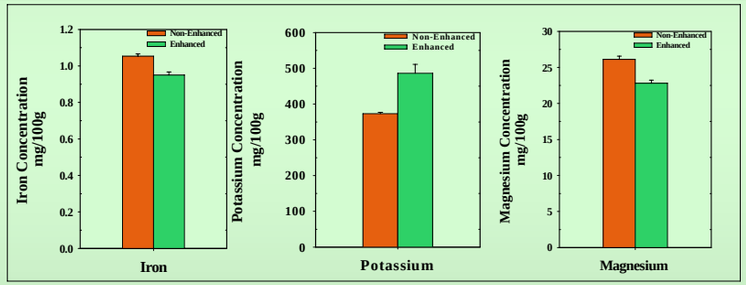

Figure 3. Nutrient Concentration of Iron, Potassium and Magnesium in non-enhanced and enhanced pork cuts. ANOVA indicated statistically significant differences between enhanced and non-enhanced forms for Iron ($p<0.0001$), Potassium ($p<0.0001$) and Magnesium ($p<0.001$). Bar height represents Least Square means ±S.E.M.

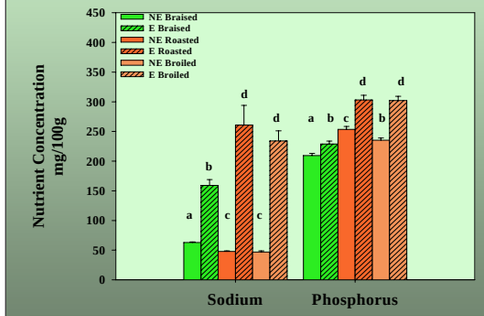

Figure 4. Effect of product type and cooking method on sodium and phosphorus content. ANOVA indicated a significant interaction of product type (enhanced, E, or non-enhanced, NE) and cooking method ($p<.0001$) for sodium and phosphorus. Bar height represents Least Square means ±S.E.M. Bars with the same superscript letters are not significantly different at $p<0.05$.

Table 1. Mineral Content of Raw and Cooked Non-Enhanced and Enhanced Pork Cuts

Cooking Method :		Braised (SHB)				Roasted (TEN)				Broiled (TLC)			
	N	NE[1]	E	NE	E	NE	E	NE	E	NE	E	NE	E
Minerals		Raw		Cooked		Raw		Cooked		Raw		Cooked	
		Mg/100g				Mg/100g				Mg/100g			
Copper	12	0.10 ±0.04	0.12 ±0.02	0.13 ±0.05	0.20 ±0.05	0.09 ±0.06	0.10 ±0.08	0.11 ±0.05	0.10 ±0.09	0.05 ±0.05	0.06 ±0.02	0.07 ±0.08	0.05 ±0.04
Sodium	12	65 ±1.0	165 ±15.0	60 ±1.0	154 ±14	47 ±2.0	243 ±32.0	49 ±1.0	279 ±57.0	49 ±3.0	232 ±22.0	45 ±2.0	237 ±24.0
Phosphorus	12	202 ±4.0	223.4 ±6.9	216.7 ±5.1	234.4 ±5.9	246.5 ±8.2	290.0 ±8.5	260.5 ±3.8	316.1 ±13.0	234.1 ±4.8	296.4 ±8.7	236.6 ±4.1	307.9 ±10.6
Potassium	12	339 ±7.0	419 ±51.0	318 ±7.0	388 ±47.0	407 ±16.0	527 ±65.0	421 ±7.0	567 ±67.0	387 ±7.0	489 ±62.0	367 ±9.0	524 ±65.0
Calcium	12	14.26 ±1.43	13.86 ±1.90	25.0 ±3.18	25.90 ±4.22	4.95 ±0.24	4.41 ±0.18	5.75 ±0.24	5.05 ±0.22	5.16 ±0.19	4.80 ±0.23	5.43 ±0.15	5.00 ±0.19
Iron	12	1.19 ±0.02	1.04 ±0.02	1.84 ±0.03	1.81 ±0.07	0.98 ±0.03	0.92 ±0.04	1.15 ±0.02	0.97 ±0.04	0.50 ±0.02	0.44 ±0.01	0.63 ±0.02	0.50 ±0.01
Magnesium	12	21.88 ±0.55	18.99 ±0.55	24.07 ±0.62	21.09 ±0.81	27.24 ±1.01	23.32 ±0.66	29.18 ±0.52	25.05 ±0.74	27.41 ±0.56	23.85 ±0.50	27.00 ±0.54	24.53 ±0.53
Zinc	12	3.36 ±0.07	3.10 ±0.08	5.20 ±0.16	4.85 ±0.19	1.88 ±0.08	1.73 ±0.08	2.41 ±0.06	1.99 ±0.08	1.59 ±0.04	1.42 ±0.05	2.14 ±0.08	1.68 ±0.06

[1]**Values represent Least Square means ±S.E.M. N=12 for Non-enhanced (NE) and Enhanced (E) pork cuts.**

Results

•The effect of cooking on calcium, iron, and zinc content was significantly greater in SHB than in TEN or TLC (cut x preparation interaction; $p<.0001$). A similar but less substantive effect was observed for magnesium ($p<0.001$) (Figures 1 and 2).
•When compared to non-enhanced cuts, nutrient levels of iron ($p<0.0001$) and magnesium ($p<0.001$) were significantly lower in enhanced cuts, while potassium levels ($p<0.0001$) were significantly higher (Figure 3).
•Levels of sodium and phosphorus were significantly higher in the enhanced products when compared to the non-enhanced products, but differed with cooking method (interaction of product type x cooking method) ($p<.0001$) (Figure 4).
•Regardless of product type, SHB naturally contained higher levels of copper, calcium, iron, and zinc than TEN or TLC (Table 1).

Conclusion

•The impact of cooking on the mineral content of SHB compared to TEN and TLC may be reflective of the confounding effect of the cooking method. SHB was prepared using moist cooking method (braising) while TEN and TLC were prepared using a dry cooking method (roasting and broiling, respectively). However, SHB naturally contains higher levels of copper, calcium, iron, and zinc than tenderloin or top loin chop.
•Nutrient levels of sodium, phosphorus and potassium are significantly elevated in enhanced products and may be further elevated due to the concentrating effect on the nutrients resulting from moisture loss during heating.
•The addition of these new data in SR will provide specific and current product information on enhanced pork cuts for use in nutrition monitoring, research, food policy development, and dietary counseling of individuals, particularly those with sodium and phosphorus-related health issues, such as hypertension and renal disease.

References

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