Nutrient Comparisons for Different Ham Products

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Abstract: Cured ham, available in bone-in or boneless form, may contain "added ingredients" such as water, salt, flavorings, sodium erythrobate, sodium nitrite, potassium and magnesium. These "added ingredients" may affect taste, texture and price. Our objective was to determine the effect of curing/preparation on moisture, total fat, protein, minerals, and choline content of four ham types: Ham (H) - at least 20.5% protein in the lean area with no water added; Ham with Natural Juices (HNJ) - at least 18.5% protein with a small addition of water when cured; Ham -- Water added (HWA) - at least 17% protein with no more than 10% added solution; Ham and Water Product (HWP) - less than 17% protein and contains water but labeling must indicate percentage of "added ingredients". Sixty-six ham products were randomly purchased from 12 retail outlets using the sampling plan developed for USDA's National Food and Nutrient Analysis Program (Pehrsson, P. et al. J. Food Comp. Anal 13:379, 2000). Nutrient analyses were conducted on 48 heated (prepared according to package directions) and 18 unheated ham products. Quality assurance methods included analyses of duplicate samples, in-house control and standard reference materials, which were used to validate analytical methodology. Nutrient data were statistically evaluated using SAS General Linear Model Procedure (critical value = p<0.05). Moisture was higher for all "added ingredient" ham products compared to ham (HWA=HWP=HNJ>H). Sodium concentration (mg/100g) was directly related to the level of "added ingredients" (HWP-1300-1400; HWA-1100-1200; HNJ-1000-1100; H-800-900), while choline, potassium, and magnesium concentrations were inversely related. Heating resulted in a significant loss of moisture (p<.0001), but significantly increased in choline (p=0.003) and protein (p=0.009) concentrations. Concentrations of fat, betaine, sodium, potassium and magnesium were slightly, but not significantly, increased with heating. This research enhances consumer awareness of nutrient variability among similar but distinctive ham products.

Introduction

The word ham refers to pork meat from the hind leg of a hog. Hams are either fresh, cured, or smoked and are available in bone-in or boneless form.

Cured hams are classified into four categories:

- Ham - at least 20.5% protein in the lean area with no water added;
- Ham with Natural Juices (HNJ) - at least 18.5% protein with a small addition of water when cured;
- Ham -- Water added (HWA) - at least 17% protein with no more than 10% added solution;
- Ham and Water Product (HWP) - less than 17% protein and contains any amount of water but labeling must indicate percentage of "added ingredients".

"Added ingredients" may vary for each ham product. These solutions, flavorings or "added ingredients" may include water, sugar, salt, sodium erythrobate, sodium nitrite, potassium, and magnesium leading to flavor enhancement[1]. Binders such as soy or milk proteins may also be added to help hold water in the ham[2]. These additions of water and flavor enhancers in ham affects its taste, texture and price.

Objectives

- To determine the effect of curing/preparation on moisture, total fat, protein, minerals, and choline content for each category of ham products.
- To determine the effect of heating on selected nutrients for each category of ham products.
- To obtain data for updating the nutrient profile of various ham products in the USDA National Nutrient Database for Standard Reference (SR).

Methodology

- Sampling: Sixty-six ham products were purchased from 12 retail outlets using the nationwide sampling plan developed for the USDA National Food and Nutrient Analysis Program[3].
- Preparation: Nutrient levels were determined in 48 heated (prepared according to label instructions) and 18 unheated ham products. Heated hams were roasted in a 325° F convection oven and cooked to the internal temperature specified on the label.
- Analyses: Proximates (ash, moisture, nitrogen, fat and selected vitamins) were determined by a commercial laboratory using standard AOAC methodology; minerals were analyzed by ICP; choline and betaine were analyzed using liquid chromatography -electrospray ionization-isotope dilution mass spectrometry [4].
- Quality Control: Quality assurance was monitored through the use of standard reference materials (SRM), in-house control materials, and random duplicate sampling.
- Statistics: Data were evaluated using the Proc Mixed procedure of SAS[5]. Critical value was set at P<0.05.

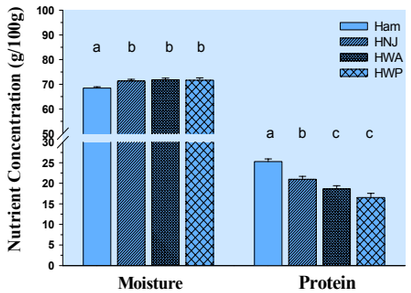

Fig. 1 Moisture and protein content of unheated and heated ham products. N=18 (Ham); 17 (HNJ); 19 (HWA); 12 (HWP).

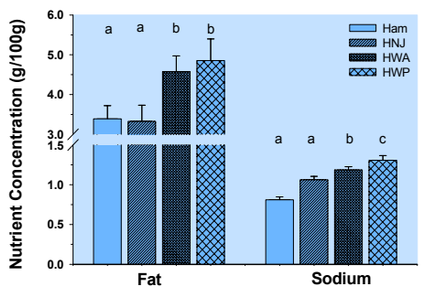

Fig. 2 Fat and sodium content of ham products. N=18 (Ham); 17 (HNJ); 19 (HWA); 12 (HWP).

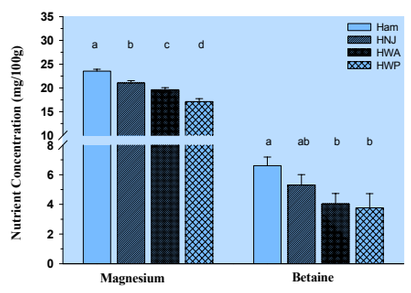

Fig. 3 Magnesium and betaine content of ham products. N=18 (Ham); 17 (HNJ); 19 (HWA); 12 (HWP).

Common Figure Legend

- HNJ = Ham with Natural Juices
- HWA = Ham -- Water Added
- HWP = Ham and Water Products
- AI refers to the Adequate Intake as defined in the Dietary Reference Intake report[6].
- Columns represent Least Squares Means ± S.E.M.
- Bars with similar superscript letters are not significantly different at p<0.05 (ANOVA).

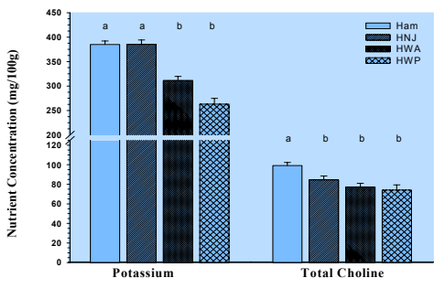

Fig. 4 Potassium and total choline content of ham products. N=18 (Ham); HNJ, 15 (potassium), 17 (choline); 19 (HWA); 12 (HWP).

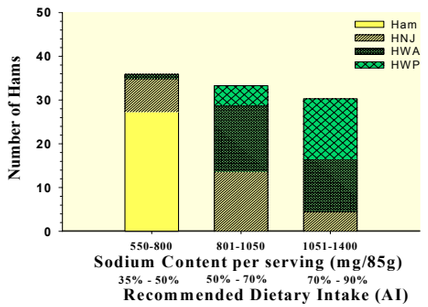

Fig. 6 Distribution of sodium content (mg/serving) by ham type. The stacked columns represent the number of each ham type which fall within the range of sodium providing < 50% AI, 50% - 70% AI, or > 70% AI.

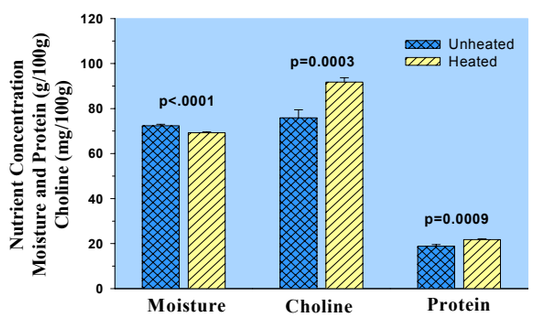

Fig. 5 Effect of heating on moisture, total choline, and protein concentration of ham products. N=8 (unheated Ham);10 (heated Ham); 4 (unheated HNJ);13 (heated HNJ); 4 (unheated HWA); 15 (heated HWA); 2 (unheated HWP);10 (heated HWP).

Table 1. Effect of Heating on selected nutrients[1]

Nutrients	Preparation	
	Unheated	Heated
Fat (g)	3.1 ± 0.49 (18)	3.7 ± 0.44 (48)
Betaine (mg)	5.9 ± 0.86 (18)	7.3 ± 0.77 (48)
Sodium (mg)	777 ± 53.1 (18)	845 ± 47.6 (48)
Potassium (mg)	374 ± 10.7 (18)	396 ± 9.6 (46)
Magnesium (mg)	23.1 ± 0.56 (18)	24.0 ± 0.50 (48)

Values represent Least Squares Means ± S.E.M. per 100g of edible product; N is designated in (). There were no significant differences due to heating at p<0.05 (ANOVA).

Results

- Moisture concentration was higher for all "added ingredients" ham products when compared to Ham. Protein concentration was inversely related to the level of "added ingredients" (Fig. 1).
- Fat and sodium content was directly related to the level of "added ingredients" in ham products (Fig. 2).
- Potassium, choline, betaine, and magnesium concentrations were inversely related to the level of " added ingredients" in ham products (Figs. 3,4).
- Heating resulted in a significant loss of moisture (p<.0001), and significantly increased choline (p=.0003) and protein (p=.0009) concentrations (Fig. 5). Heating had no significant effect on concentrations of fat, betaine, sodium, potassium, and magnesium (Table 1).
- The range of sodium concentration per serving overlapped considerably among different ham types (Fig. 6).
- A single serving of ham product can provide from 35% to 90 % of the Adequate Intake for sodium (Fig. 6).

Conclusion

- The protein content of various ham types was consistent with the product classification.
- The concentration of most nutrients was inversely related to the level of enhancement, due to the diluting effect of added moisture.
- Sodium concentration was directly related to its presence as an "added ingredient".
- Nutrient content increases with heating due to the concentrating effect of moisture loss.
- The broad range of sodium distribution among ham types provides the consumers with a variety of choices for selecting lower sodium ham products. Based upon this limited national sampling, 5% of HWA and 30% of HNJ provide the levels of sodium as low as those in natural Hams.
- This new data will be used to update the nutrient profile of the various ham products in SR.

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