

Determination of Cooking Yields and Nutrient Retention Factors of Choline in Meat Products

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INTRODUCTION

- Choline is a nutrient involved in the metabolism of the liver and kidneys, among other tissues. An Adequate Intake of 550 mg/day for men, and 425 mg/day for women, was established by the Institute of Medicine, The National Academies, for this reason¹.
- Estimates of choline intake by Americans have been impeded by a lack of information on the choline content of many foods.
- Cooking yields (CY) and nutrient retention factors (RF) are important components in better estimating the nutrient content for cooked foods.
- The availability of choline retention factors are critical to expanding estimates of choline content in cooked foods where only raw analytical values are known. This is the first report of retention factors for choline.
- Data on cooking yields are also required for the calculation of nutrient retention factors. Values for cooking yields were last published by USDA in 1975².

OBJECTIVES

- To determine choline retention factors for meat and meat products
- To compare and update cooking yield values for meat products

METHODS

Sampling

- Reserve samples of foods were collected through the National Food and Nutrient Analysis Program (NFNAP)^{3,4} over several years, using the 'Key Foods'⁵ approach. Most samples were obtained from 12 retail outlets nationwide using probability sampling plans developed for NFNAP.

- Additional foods of special interest, such as organ meats, were obtained through local sampling.

Analytical Methodology

- Choline metabolites (phosphatidylcholine, sphingomyelin, phosphocholine, glycerophosphocholine, and free choline) were extracted and partitioned into organic and aqueous phases using methanol and chloroform, then analyzed directly by liquid chromatography-electrospray ionization-isotope dilution mass spectrometry (LC-ESI-IDMS)⁶.

Quality Control

- Analytical quality control was monitored through the use of duplicate sampling, in-house control and certified reference materials which were added to the sampling stream.

Calculations

- Total choline was determined by quantification and summation of the five choline metabolites.

$$CY = \frac{ckd\ wt}{raw\ wt} * 100$$

$$RF = CY * \frac{nutrient\ content\ ckd\ food}{nutrient\ content\ raw\ food}$$

TABLE 1: COOKING YIELDS AND CHOLINE RETENTION OF MEAT ITEMS

Category	Food Item	AH 102	Cooking Yield	Choline Retention
Poultry	Roasted chicken	65%-84%	65%	71%
Sausage	Pan-fried pork sausage	37%-65%	80%	108%
	Heated beef frank	56%-100%	98%	115%
	Heated meat frank	56%-100%	100%	97%
Pork	Shoulder, blade, braised	51%-87%	65%	90%
	Loin, top loin, boneless, pan-broiled	61%-85%	79%	105%
	Loin, tenderloin, roasted	66%-69%	80%	88%
	Cured ham, bone-in, rump, heated	NA	90%	99%
	Cured ham, bone-in, shank, heated	NA	91%	91%
	Cured ham, bone-in, slice	NA	86%	105%
	Cured ham, water product, boneless, whole, heated	NA	97%	94%
	Cured ham, water added, boneless, whole, heated	NA	94%	97%
	Cured ham, natural juices, boneless, whole, heated	NA	94%	101%
Beef	Round, knuckle, tip center, choice, grilled	58%-91%	75%	95%
	Round, knuckle, tip side, choice, grilled	58%-91%	75%	89%
	Chuck, shoulder clod, top blade, grilled	58%-91%	76%	93%
	Chuck, shoulder clod, shoulder top and center, choice, grilled	58%-91%	76%	84%
	Chuck, shoulder clod, top blade, select, grilled	58%-91%	76%	83%
	Chuck, shoulder clod, shoulder tender, choice, grilled	58%-91%	77%	105%
	Chuck, shoulder clod, shoulder top and center, select, grilled	58%-91%	77%	92%
	Round, outside round, bottom round, choice, grilled	58%-91%	77%	87%
	Chuck, shoulder clod, shoulder tender, select, grilled	58%-91%	78%	103%
	Round, outside, round, bottom round, select, grilled	58%-91%	78%	79%
	Round, knuckle, tip side, select, grilled	58%-91%	79%	88%
	Round, knuckle, tip center, select, grilled	58%-91%	79%	96%
Variety meats	Chicken liver, braised/simmered	55%-75%	64%	96%
	Chicken liver, pan-fried	49%-70%	64%	108%
	Turkey liver, braised/simmered	66%-74%	83%	82%
	Beef liver, braised/simmered	64%-69%	63%	87%
	Beef liver, pan-fried	66%-81%	73%	91%
	Veal liver, braised/simmered	60%-67%	69%	89%
	Veal liver, pan-fried	60%-67%	66%	90%

RESULTS AND DISCUSSION

- For most meats, cooking yield validated previously published data².
- Cooking yields for roasted pork tenderloin were higher than previously reported. This may reflect change in proximate composition, i.e. increased moisture from 65%⁸ to 69%⁹ and decreased fat from 6%⁸ to 4%⁹.
- Cooking yields for simmered turkey liver were higher than for all other types of liver studied. Turkey liver compared to chicken, beef and veal had substantially higher fat content (25% vs. 5%-6.5%, respectively).
- Average choline retention factors were 94% for fresh pork, 98% for cured pork, 91% for beef cuts, 92% for assorted livers, and 71% for poultry. While it appears that the choline retention factor was substantially lower in poultry, this value is from a single observation.
- Variation in choline retention factors within a food category may be due to differences in moisture and fat content or may reflect distribution of the choline metabolites in these fractions.

CONCLUSIONS

- Cooking yields for many meat products validated previously published values.
- Cooking yields for new products, enhanced cured hams, have been determined.
- Nutrient retention factors for choline will be disseminated in the USDA Table of Nutrient Retention Factors, Release 6.
- These values represent the first determinations of choline retention in meat products.

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