# COOKING YIELDS AND NUTRIENT RETENTION FACTORS OF BACON, LIVER, AND SAUSAGES

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## ABSTRACT

Objective: In the past, the USDA Nutrient Data Laboratory released a special table of nutrient retention factors. Recently, the nutrient database processing software (ADM, NDBRS) has been updated to include an improved nutrient retention module as well as a cooking yields module. Yield and retention studies have recently been conducted on bacon, liver, and sausages. The objective of the studies reported here was to analyze and determine nutrient values, cooking yields, and nutrient retention factors for bacon, liver (beef, calf and chicken livers) and sausages. Methods and Material: The products analyzed were obtained from 12 nationwide retail outlets through the National Food and Nutrition Analysis Program (NFNAP). All food items were analyzed raw and cooked. Bacon was baked, microwaved, and pan-fried. The livers were pan-fried or braised. The fresh sausages were pan-fried. Smoked pork and beef sausages were analyzed as purchased. Precoked sausages were analyzed after heating. Nutrient analyses including proteins, cholesterol, trans fatty acids, iron, zinc, thiamin, riboflavin, and vitamins B, B12, and B6, were conducted by a commercial laboratory. Nutrient data and weights were processed through the yields and retentions module of ADM, NDBRS. Results: Yields varied according to trimming and cooking method. For example, baked and pan-fried bacon averaged a 31% cooking yield and microwaved bacon averaged a 26% cooking yield. While a few retentions were updates of existing ones, most retention factors were completely new and will be reported. Significance: The advent of the new yields and retentions module in the ADM, NDBRS system streamlined the process of calculating cooking yields and nutrient retention factors from nutrient data. The recent studies performed on bacon, liver and sausages afforded an opportunity to update nutrient data, cooking yields and nutrient retention factors within a relatively short period of time. Yield and retention data will be used in food service operations, the food industry, universities and government agencies. These new cooking yields and nutrient retention factors will enhance the nutrient database scope of food items from which users will be able to estimate data for cooked foods.

## INTRODUCTION

The Nutrient Data Laboratory's (NDI) Nutrient Database Processing Software (ADM, NDBRS) has been updated and includes both an updated nutrient retention module and a cooking yields module. Recognizing a future need for updated and additional nutrient retention factors and cooking yields, NDI has conducted several studies on meat products. Items analyzed in the current study include: bacon, beef, calf and chicken livers and various sausages. This study provides an update to existing nutrient data and includes new products in the database, and provides new information for the calculation of nutrient retention factors and cooking yields.

## OBJECTIVES

To analyze and determine the nutrient values, nutrient retention factors and cooking yields of bacon, liver, and various sausages.

## METHODS AND ANALYSES

### Sampling

- Naturally representative frozen samples were obtained from retail stores through the National Food and Nutrition Analysis Program (NFDNP) and locally in Maryland and Wisconsin.

- Samples were taken from each package.

- Samples were shipped to and prepared at the University of Wisconsin, Madison.

### Cooking Procedures

- Bacon: Microwaved, baked, and pan-fried.
- Beef, calf, and chicken livers: Braised and pan-fried.
- Sausages: Smoked pork and beef as purchased. Precoked sausages were analyzed after heating.

### Nutrient Analyses

- Nutrient analyses including proteins, cholesterol, trans fatty acids, iron, zinc, thiamin, riboflavin, and vitamins B, B12, and B6, were conducted by a commercial laboratory.

### Nutrient Data Processing

- Nutrient data and weights were processed through the yields and retentions module of ADM, NDBRS.

## RESULTS

### Calculations and Formulas

<table>
<thead>
<tr>
<th>Formula</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Nutrient</td>
<td>Total Nutrient x 100</td>
</tr>
<tr>
<td>Protein</td>
<td>Protein x 100</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>Cholesterol x 100</td>
</tr>
<tr>
<td>Trans Fatty Acids</td>
<td>Trans Fatty Acids x 100</td>
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</tr>
<tr>
<td>Zinc</td>
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<tr>
<td>Thiamin</td>
<td>Thiamin x 100</td>
</tr>
<tr>
<td>Riboflavin</td>
<td>Riboflavin x 100</td>
</tr>
<tr>
<td>Vitamin B12</td>
<td>Vitamin B12 x 100</td>
</tr>
<tr>
<td>Vitamin B6</td>
<td>Vitamin B6 x 100</td>
</tr>
</tbody>
</table>

### Summary

- Bacon had the lowest yield.
- Thiamin in baked bacon was more labile due to a higher cooking temperature.
- Beef and chicken livers had fairly equal retention values for most nutrients studied.
- Calf liver had lower retention values when compared to beef or chicken livers.
- Fresh beef sausage had lower cooking yields, as well as moisture and fat loss, than pre-cooked beef sausage.
- Apparent fat gain in turkey, fresh, sausage reflects nutrient concentration due to moisture loss.
- Nutrient factors were similar for fresh cooked and precooked sausages, despite lower cooking yields for the fresh cooked product.
## CALCULATIONS AND FORMULAS

### Fat Gain/Loss

\[
\left( \% \text{ fat ckd sample} \times \text{g ckd sample} \right) - \left( \% \text{ fat raw sample} \times \text{g raw sample} \right) \times 100
\]

\[
\text{g raw food}
\]

### Moisture Gain/Loss

\[
\left( \% \text{ H}_2\text{O ckd sample} \times \text{g ckd sample} \right) - \left( \% \text{ H}_2\text{O raw sample} \times \text{g raw sample} \right) \times 100
\]

\[
\text{g raw food}
\]

### Yield

\[
\frac{\text{Cooked sample cooked weight} \times 100}{\text{Cooked sample raw weight}}
\]

### Retention

\[
100 \times \frac{F^a \times Ne^b \times We^c}{Nr^d \times Wr^e}
\]

- \(F^a\): raw sample raw wt
- \(Ne^b\): nutrient value per 100 g of raw food
- \(We^c\): weight in g before cooking
- \(Nr^d\): nutrient value per 100 g of cooked food
- \(Wr^e\): weight in g after cooking