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https://www.acs.org/content/acs/en/acs-webinars/videos.html

Thanksgiving Culinary Chemistry Rebroadcast

This was a past Live ACS Webinar that has been edited and rebroadcast to celebrate Thanksgiving with a little culinary chemistry

Presentation slides available now under “Handouts” in GTW Control Panel... there will be no Live Q&A as it is a recording!
Thanksgiving Chemistry for Your Family’s Feast

Guy Crosby, Ph.D., CFS
Milk Street Kitchen
Harvard School of Public Health

Three Take-Aways with Recipes

1. How to cook juicy, flavorful turkey with crispy skin
2. How to make great gravy and mashed potatoes
3. How to select and cook delicious healthy vegetables
Who is responsible for making Thanksgiving an official U.S. Holiday?

• Benjamin Franklin
• Sarah J. Hale
• Alexander Hamilton
• Susan B. Anthony
• Franklin D. Roosevelt

* You will not be able to respond to this question on screen, but ponder your answer to yourself... ;)

Problems with Cooking Turkey

• Cooking white breast meat and dark drumstick / thigh meat so they both turn out juicy and tender
• Producing crispy brown skin
• Making sure a safe temperature of 165F (74C) is reached throughout
Problems with Cooking Turkey

Cooking shrinks muscle fibers squeezing out moisture

<table>
<thead>
<tr>
<th>Component</th>
<th>Breast Meat</th>
<th>Drumstick</th>
</tr>
</thead>
<tbody>
<tr>
<td>H₂O</td>
<td>75%</td>
<td>76%</td>
</tr>
<tr>
<td>Fat</td>
<td>1.5%</td>
<td>4.0%</td>
</tr>
<tr>
<td>Protein</td>
<td>23.7%</td>
<td>20.5%</td>
</tr>
<tr>
<td>Collagen</td>
<td>2.4 mg/g</td>
<td>4.0 mg/g</td>
</tr>
<tr>
<td>Tₒ</td>
<td>140F (60C)</td>
<td>142F (61C)</td>
</tr>
</tbody>
</table>

\[ Tₒ = \text{onset temperature of shrinkage} \]

Problems with Cooking Turkey

• Muscle fibers shrink about 30% at 150F
• Moisture loss is temperature dependent

<table>
<thead>
<tr>
<th>Pork Shoulder Breakdown</th>
<th>% Weight Loss in Chicken Breast</th>
</tr>
</thead>
<tbody>
<tr>
<td>140F (60C)</td>
<td>10%</td>
</tr>
<tr>
<td>158F (70C)</td>
<td>12%</td>
</tr>
<tr>
<td>176F (80C)</td>
<td>24%</td>
</tr>
</tbody>
</table>

• Collagen breakdown starts 140F, fast 160F
Problems with Cooking Turkey

Brining and salting reduce moisture loss

1 hour 12 hours 24 hours 48 hours

Salting Experiment
Salt 0.5%; Sodium 200mg/100g - *Cook's Illustrated* Nov/Dec 2012

Perfectly Cooked Turkey

Recipe

- Salt 12 -14 lb turkey under skin, refrigerate for 24 - 48 hrs uncovered, thoroughly dry skin
  - 4 tsp 1:1 salt/sugar for breast
  - 2 tsp 1:1 salt/sugar for each drumstick
- Rub 2 Tbsp oil + 1 tsp baking powder on skin
- Roast at 400F (204C) until inner thigh = 160F (71C)
- Rest for 30 - 45 minutes before carving
- Ensure turkey (and stuffing) reaches 165F (74C)
Approximately how many turkeys are eaten over Thanksgiving in the U.S.?

- 750,000 turkeys
- 1 million turkeys
- 10 million turkeys
- 45 million turkeys
- 100 million turkeys

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Problems with Mashed Potatoes

Mealy vs. Waxy Potatoes

- Mealy potatoes like Russets have more starch forcing cells to separate on cooking (baking)
- Waxy potatoes like Red Bliss have less starch and remain intact (potato salad)
- Use intermediate starch Yukon gold potatoes
- Mix with butter and cream or milk if desired; season

Mealy potatoes form clumps of cells
What product owes its existence to Thanksgiving?

• La-Z-Boy Chair
• TV Dinner
• Hula-hoop
• Pepto-Bismol
• Sweatpants

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Making Great Gravy

• Prepare stock with neck, giblets, finely chopped onion, carrot, celery, salt
• Cooking onion slowly produces savory 3-mercaptopentan-1-ol (MMP)
• Remove drippings from roasting pan and separate most fat
• Return drippings to pan with fond
• Strain stock, add to pan plus roux (flour butter mixture)
• Cook slowly to thicken and season
Making Great Gravy

- 3-Mercapto-2-methylpentan-1-ol (MMP)
- Intense savory, onion, gravy-like aroma
  - Highest "odor activity value" in gravy
- Detected at concentration of 7.7 μg/liter
  - Odor threshold 1.6 ppt (0.0016 μg/liter)

Journal of Agricultural and Food Chemistry 2000; 48: 418-423
Journal of Agricultural and Food Chemistry 2011; 59: 13122-13130
Approximately how many calories does the typical Thanksgiving meal have? (ex. appetizers, main dishes, sides, and your obligatory slice of pecan pie)

- 750 calories
- 1,500 calories
- 2,500 calories
- 3,000 calories
- Who’s counting…it’s about giving thanks to great food and family

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Choose Healthy Cruciferous Vegetables

* Flavor is only created when vegetables are chopped

Examples include: broccoli, cauliflower, cabbage, kale, bok choy, arugula, Brussels sprouts, collards, watercress, and radishes
Roasted Brussel Sprouts with Bacon

• Cut medium to small Brussels sprouts in half
• Coat with olive oil, roast in 400F oven 18 min
• Fry bacon and dry on paper towels
• Mix bacon bits + a little fat with sprouts
• Squeeze on lemon juice, salt and pepper

Julia Child’s Brown Braised Onions

• Intense savory umami taste & aroma
• Peel small pearl onions and gently sauté in butter-oil until evenly brown
• Slowly braised in beef stock and wine
• Season with thyme, salt, pepper

• Complex flavors developed: Maillard, caramelization, MMP, dialkyldisulfides and trisulfides, thiophenes, thymol
Cooking with Ria: Mastering the Art of French Cooking, Alfred Knoff, 1961

Julia Child’s Brown Braised Onions

Cooking Science Notes
- To Remember Science
- The Fascinating Science of Salt, Sweet and Sour
- Making Stock of Things
- Righting a Wrong, or What You Don’t Know Can Hurt You
- Bonne cuisine (be nice) while it lasts
- Search in Food: What Mona Lisa Sucks, Why Does Grand Sable, and Eat Your Lantern
- A Note of Place
- The Science of Onion Flavor
- Copper’s influence on the formation of egg in the Frogs
- Guillaume-C. Meine, St. Croix, Ph.D., Sarah Hines, Ph.D.
  Presented at American Chemical Society meeting, San Diego, CA, March 29, 2012
- Modern Science
- Food Science Masters by Anke and Connie Wu, Brown University
- The Science of Cooking with Wine
- What is Temperature, And How Does it Differ from Heat
- Thomas Keller and the Science of Butter-Fried Lobster
- Why Ever Incent of the Maillard Reaction
- The Magic Links (and Loss of Baking Flavor)
- A Common Misconception About Meringue
- Evaporation and Enzymes
- Escalating Sushi
- A Molecular Gastronomer’s Dream Comes True
- What is So Special About Water in Food
- The Difference Between Moly and Moly Products

www.cookingscienceguy.com
Who is responsible for making Thanksgiving an official U.S. Holiday?

- Benjamin Franklin
- Sarah J. Hale
- Alexander Hamilton
- Susan B. Anthony
- Franklin D. Roosevelt

After petitioning the U.S. Government for 17 years, Sarah Josepha Hale finally convinced Abraham Lincoln in 1863 to make it a national holiday to take place every year on the fourth Thursday of November. Ms. Hale is also known as the author of the children’s poem “Mary Had a Little Lamb.”


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Approximately how many turkeys are eaten over Thanksgiving in the U.S.?

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In 2017, Americans ate 45 million turkeys over Thanksgiving, according to an estimate by the National Wild Turkey Federation, an advocacy organization for turkey farmers.

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* * *
What product owes its existence to Thanksgiving?

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- TV Dinner
- Hula-hoop
- Pepto-Bismol
- Sweatpants

In 1953, the Swanson company misjudged the number of frozen turkeys it would sell for Thanksgiving by **260 tons**. So with some quick creative thinking they repackaged the meat with a few sides and created a new category in the food industry, the first TV Dinner!

https://www.smithsonianmag.com/history/tray-bon-96872641/

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Approximately how many calories does the typical Thanksgiving meal have? (ex. appetizers, main dishes, sides, and your obligatory slice of pecan pie)

- 750 calories
- 1,500 calories
- 2,500 calories
- 3,000 calories
- Who’s counting...it’s about giving thanks to great food and family

A typical Thanksgiving meal with appetizers, main dishes, side dishes and a slice of pecan pie has **3,150 calories and 159 grams of fat**, according to the **Calorie Control Council**, an association representing the low- and reduced-calorie food and beverage industries.

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