Type them into questions box!

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Making Sense of the Global Economy
U.S. Manufacturing, the Chemical Industry, and You

Date: Thursday, April 8, 2021 @ 1:30pm ET
Speaker: Robert H. Atkinson (Economics, LLC)
Moderator: Erin Wing, Erin Wing Consulting

What You Will Learn:
- The future of domestic manufacturing and chemical industry
- The speed and timing of the recovery of the 2020 recession
- The long-term implications of the COVID-19 pandemic and the policy response

Co-produced with: The Science History Institute and Chemical & Engineering News

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Preparing Students
FOR COLLABORATIVE WORK BEYOND GRADUATION

Date: Thursday, April 8, 2021 @ 1:30pm ET
Speaker: Ann Smith, Auburn University and Amy Peterson, The University of Massachusetts-Lowell
Moderator: Bryant Vogt, Penn State University

What You Will Learn:
- Practical skills for effective collaboration
- Strategies for building a strong professional network

Co-produced with: ACS Career Development and Education

Food Fraud
COMBATING ADULTERATION IN OLIVE AND AVOCADO OILS

FREE Webinar | TODAY at 2pm ET

THIS ACS WEBINAR WILL BEGIN SHORTLY...
Food Fraud: Combating Adulteration in Olive and Avocado Oils

Presentation slides are available now! The edited recording will be made available as soon as possible.

www.acs.org/acswebinars

This ACS Webinar is co-produced with Chemical & Engineering News.
Food fraud is an old and modern problem

Source: Food Protection Plan FDA
“The man who robs a fellow subject of a few shillings on the high-way, is sentenced to death; while he who distributes a slow poison to a whole community, escapes punishment.”

Fredrick Accum
*A Treatise on Adulterations of Food and Culinary Poisons* (1820)

“They make olive-oil out of cottonseed-oil, now a days, so that you can’t tell them apart.”

Mark Twain
*Life on the Mississippi* (1883)
Food Quality

Food Safety

↑ Public health risks
↑ Public fear
↓ Consumer confidence

Motivated by Economic gains

Motivated by Terrorism/Sabotage

Unintentional

Intentional

• Postharvest spoilage
• Shelf life
• E. coli-contaminated fresh leafy greens

Food Fraud/EMA
Food Defense

Infant formula
Honey, spice, juice
Horsemeat, oil

Industrial sabotage
Terrorism
There is no statutory definition of food fraud or “economically motivated adulteration” or EMA of foods or food ingredients, which is generally considered a subset of food fraud.

In 2009, FDA’s EMA Working Group had defined EMA as the “fraudulent, intentional substitution or addition of a substance in a product for the purpose of increasing the apparent value of the product or reducing the cost of its production, i.e., for economic gain….”
What the % of olive oil consumed in the U.S. is domestically produced?

- 1 Percent
- 5 Percent
- 25 Percent
- 50 Percent
Toxic Oil Syndrome (TOS)

In 1981, 600 people died and 25,000 more were hospitalized by an outbreak of “toxic oil syndrome” in Spain. Street vendors had sold tainted olive oil.
October 19, 1981, Section A, Page 3

- A scandal involving the illicit sale of toxic cooking oil, which has taken at least 160 lives and spread panic among Spanish consumers, has begun to concern nations that import Spanish canned goods and vegetable oils.

- A week ago, the European Parliament in Strasbourg, France, voted in favor of a system that would permit the rapid withdrawal of contaminated products sold in the Common Market in light of the Spanish situation, which has affected some 15,000 people who consumed rapeseed oil that had been intended for industrial use.

- As a precautionary measure, Italy earlier this month temporarily blocked imports of Spanish olive oil and canned goods such as fish that contain oil until health authorities had determined the toxic agent that has produced the fatalities. The French Government is expected to follow the Italian example by banning the import of similar products for three months beginning tomorrow.
SLIPPERY BUSINESS
The trade in adulterated olive oil.

By Tom Mueller
August 6, 2007
The specific findings of our tests include (see Table 3 for summary of results):

- **69 percent of imported olive oil samples and 10 percent of California olive oil samples labeled as extra virgin olive oil failed to meet the IOC/USDA sensory (organoleptic) standards for extra virgin olive oil.** The Australian sensory panel found that each of these samples scored a median of up to 3.5 sensory defects such as rancid, fusty, and musty and were classified at the lower grade of “virgin.” Sensory defects are indicators that these samples are oxidized, of poor quality, and/or adulterated with cheaper refined oils.

- **31 percent of the imported samples that failed the sensory standards also failed the IOC/USDA standards for UV absorbance of oxidation products (K232 and K268),** which indicates that these samples were oxidized and/or were of poor quality.

- **83 percent of the imported samples that failed the IOC/USDA sensory standards also failed the German/Australian DAGs standard.** Two additional imported samples that met the IOC/USDA sensory standard for extra virgin failed the DAGs standard.
Important events for olive oil fraud:

- 1993: USDA olive oil standards
- 1991: Spain
- 1997: USA
- 2007: USDA updates
- 2008: Italy, Spain
- 2010: United States Standards for Grades of Olive Oil and Olive-Pomace Oil
  - Effective: October 25, 2010

This is the second issue of the United States Standards for Grades of Olive Oil published in the FEDERAL REGISTER on April 28, 2010 (75 FR 22363) to become effective October 25, 2010. This issue supersedes the first issue, which has been in effect since March 22, 1948.
<table>
<thead>
<tr>
<th>Year</th>
<th>Event/Comment</th>
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<tr>
<td>1948</td>
<td>USDA olive oil standards</td>
</tr>
<tr>
<td>1981</td>
<td>Adulteration - Spain</td>
</tr>
<tr>
<td>1991</td>
<td>Adulteration - Turkey, Italy</td>
</tr>
<tr>
<td>1993</td>
<td>USDA updates - USA</td>
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<td>1997</td>
<td>Adulteration - Canada</td>
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<tr>
<td>2007</td>
<td>USDA updates - Italy, Spain</td>
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<td>2008</td>
<td>Adulteration - Italy, Spain</td>
</tr>
<tr>
<td>2010</td>
<td>Australian standards, USITC investigation</td>
</tr>
<tr>
<td>2011</td>
<td>UC Davis</td>
</tr>
<tr>
<td>2012</td>
<td>USDA updates</td>
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"Unenforced standards lead to mislabeled products, weakening the competitiveness of quality producers"

- USITC Report
### Quality: Extra virgin failure rates

<table>
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<tr>
<th>Test</th>
<th>Standard</th>
<th>Failed</th>
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<tr>
<td>Sensory</td>
<td>defects = 0 and fruity &gt; 0</td>
<td>54.2%</td>
</tr>
<tr>
<td>Free Fatty Acid</td>
<td>USDA ≤ 0.8</td>
<td>0.0%</td>
</tr>
<tr>
<td>Peroxide Value</td>
<td>USDA ≤ 20</td>
<td>0.7%</td>
</tr>
<tr>
<td>UV K232</td>
<td>USDA ≤ 2.50</td>
<td>8.8%</td>
</tr>
<tr>
<td>UV K268</td>
<td>USDA ≤ 0.22</td>
<td>11.2%</td>
</tr>
<tr>
<td>UV ΔK</td>
<td>USDA ≤ 0.01</td>
<td>1.5%</td>
</tr>
<tr>
<td>DAGs</td>
<td>AUSTRALIA ≥ 35</td>
<td>25.7%</td>
</tr>
<tr>
<td>PPP</td>
<td>AUSTRALIA ≤ 17</td>
<td>26.1%</td>
</tr>
</tbody>
</table>

Source: UC Davis Olive Center, based on 260 domestic and imported samples of "EVOO"
Relationship of sensory and chemistry

260 samples
141 failed sensory

- # failing chemistry standard
- % also failing sensory standard

Chart 1. Free fatty acidity (FFA)

Relationship of sensory and chemistry

260 samples
141 failed sensory

- # failing chemistry standard
- % also failing sensory standard

Chart 2. Peroxide value (PV)
### Fatty Acid Profiles

<table>
<thead>
<tr>
<th>Varietal</th>
<th>Location</th>
<th>Palmitic Acid (C16:0)</th>
<th>Oleic Acid (C18:1)</th>
<th>Linoleic Acid (C18:2)</th>
<th>Linolenic Acid (C18:3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arbequina</td>
<td>Central Valley</td>
<td>17.7±1.0</td>
<td>64.6±1.8</td>
<td>13.2±1.1</td>
<td>0.6±0.2</td>
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<tr>
<td></td>
<td>Dry, hot dessert</td>
<td>22.4±1.1</td>
<td>44.2±6.6</td>
<td>25.5±4.6</td>
<td>1.1±0.1</td>
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<tr>
<td></td>
<td>Outside CA</td>
<td>18.1±5.2</td>
<td>62.5±12.2</td>
<td>13.5±5.5</td>
<td>0.8±0.1</td>
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<td>Arbosana</td>
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<td>17.1±2.0</td>
<td>70.6±6.2</td>
<td>8.2±2.7</td>
<td>0.6±0.4</td>
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<td>21.0±0.9</td>
<td>50.9±4.7</td>
<td>20.5±3.5</td>
<td>1.2±0.5</td>
</tr>
<tr>
<td>Koroneiki</td>
<td>Central Valley</td>
<td>13.8±1.7</td>
<td>75.5±3.4</td>
<td>6.2±1.3</td>
<td>0.7±0.2</td>
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<td>Dry, hot dessert</td>
<td>17.3±0.4</td>
<td>65.3±2.3</td>
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<td>Outside CA</td>
<td>14.2±3.5</td>
<td>74.6±5.9</td>
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<td>1.0±0.0</td>
</tr>
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</table>

### Sterol Profiles

<table>
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<tr>
<th>Varietal</th>
<th>Location</th>
<th>Campesterol ≤4.5</th>
<th>Apparent B-sitosterol ≥93.0</th>
</tr>
</thead>
<tbody>
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<td>Arbequina</td>
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<td>3.5±0.3</td>
<td>94.0±0.5</td>
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<td>5.3±0.3</td>
<td>92.3±0.5</td>
</tr>
<tr>
<td></td>
<td>Outside CA</td>
<td>3.6±0.2</td>
<td>94.0±0.3</td>
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<td>Arbosana</td>
<td>Central Valley</td>
<td>3.7±0.1</td>
<td>94.1±0.4</td>
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<td>4.5±0.6</td>
<td>92.7±0.9</td>
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<tr>
<td>Koroneiki</td>
<td>Central Valley</td>
<td>4.4±0.3</td>
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<td>92.5±0.9</td>
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<td></td>
<td>Outside CA</td>
<td>4.4±1.0</td>
<td>93.3±1.1</td>
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</table>
The Effects of Variety, Growing Region, and Drought Stress on Fatty Acid and Sterol Compositions of California Olive Oil

Xueqi Li¹ · Jon D. Flynn¹ · Selina C. Wang¹,²

DOI 10.1002/aocs.12192

Original Article

About 20% of CA authentic oil do not meet the standards.
The Olive Oil Scam: If 80% Is Fake, Why Do You Keep Buying It?

Cecilia Rodriguez  Senior Contributor
Arts

The biggest fraud in olive oil
January 3, 2020

False stories frightening consumers come from untrustworthy sources

Nearly all of the "fake news" about "fake" olive oil originated from one flawed report from a biased source published years ago.

In 2010, the UC Davis Olive Center, an organization created to promote the sale of California olive oil, published a report funded by California olive oil producers and companies. The purpose of the report was to make news that would discredit their competition – imported olive oils. The now-infamous report claimed "69 percent of imported olive oil samples and 10 percent of California olive oil samples labeled as extra virgin olive oil failed to meet the IOC/USDA sensory standards for extra virgin olive oil." In layman's terms, this means these samples failed a taste test. Sounds pretty fishy that something as subjective as a taste test would be used to determine if an olive oil has been adulterated, doesn't it?
Olive Oil Has a Fraud Problem—Can the FDA Fix It?

Trade groups are petitioning the federal government to actively enforce standards in the olive oil industry.

By Mike Pomranz  Updated November 07, 2019

The AOOPA and Deoleo—the world's largest olive oil producer known for America's best-selling Bertolli brand among others—submitted a citizen petition to the FDA asking for "science-based, enforceable standards for olive oil," a product the FDA has never regulated before.

"Buying quality extra virgin olive oil is hard, but not because there aren't quality products on supermarket shelves. It's because there are just no rules to stop bad actors from misrepresenting what they're selling"

- Chairman of the American Olive Oil Producers Association
Global avocado oil market reached $461 million in 2018 and is projected to reach $708 million in the next five years.

The market has been primarily driven by nutritional and health benefits associated with the oil.

There are currently no official standards for avocado oil.

Avocado oil is made from what part(s) of an avocado?

- Skin
- Flesh
- Pit
- All of above

Sample Information

- 22 samples, representative of avocado oils available in the US.
- Extra virgin (EV), refined (R), unspecified (U).
- Price/fl oz varied from $0.25-$2.35 ($8.45-79.4/Liter).
**Quality**

- Free fatty acidity (FFA)
- Peroxide value (PV)
- UV absorbance

**Purity**

- Fatty acids profile (FAP)
- Sterols profile
- Triacylglycerols (TAG)

**Minor Components**

- Tocopherols
- Chlorophylls

---

**Peroxide value: Indicator of oxidation**

Dashed lines indicate proposed limits for extra virgin and refined avocado oils.

1. Refined: ≤ 2.0 meq O₂/kg oil
2. Extra Virgin: ≤ 4.0 meq O₂/kg oil

---

1. CODEX proposed standards, 2019.
2. Woolf (2009), Avocado Oil. Gourmet and Health-Promoting Specialty Oils.
Which of the following oil does NOT have comparable oleic acid level as avocado oil?

- Olive oil
- Canola oil
- High oleic safflower oil
- Soybean oil
## Fatty acid profile: Purity Parameter

<table>
<thead>
<tr>
<th></th>
<th>C16:0</th>
<th>C16:1</th>
<th>C18:0</th>
<th>C18:1</th>
<th>C18:2</th>
<th>C18:3</th>
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<tbody>
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<td>16.5±0.12</td>
<td>6.9±0.01</td>
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<tr>
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<td>21±0</td>
<td>54.7±0.01</td>
<td>8.2±0</td>
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## Tocopherols (Vitamin E)

![Tocopherols Graph](image-url)
**Key Findings**

- 82% of the samples were of poor quality or adulterated.

- Adulteration with soybean oil was confirmed in three samples (two labelled as EV)

- Adulteration in at least three samples is highly likely.

- More research is needed to understand how chemical compositions change with climate, region, and cultivars.

Food fraud compromises consumers trust, reduce livelihood of honest producers, and undermines the credibility of industry and government over the quality and safety of food.
LOOK INTO THE FUTURE
Know compositional difference between the authentic and fraudulent food.

Concisely-define standard based on the chemical composition of the authentic product.

Validate analytical methods and develop faster, better and cheaper methods.
As scientists,

We need to be thorough and thoughtful.

We need to put safety, honesty, justice over fear and greed.
Food Fraud: Combating Adulteration in Olive and Avocado Oils

Selina Wang
Faculty, Department of Food Science and Technology, University of California, Davis

Britt Erickson
Senior Editor, Chemical & Engineering News

Presentation slides are available now! The edited recording will be made available as soon as possible.

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