Postharvest Handling of Tree Nuts

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Nutritional Quality of Tree Nuts

<table>
<thead>
<tr>
<th>One-Ounce Serving</th>
<th>Protein (grams)</th>
<th>Dietary Fiber (grams)</th>
<th>Calcium (mg.)</th>
<th>Vitamin E (mg.)</th>
<th>Riboflavin (mg.)</th>
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</thead>
<tbody>
<tr>
<td>Almonds</td>
<td>5.7</td>
<td>3.1</td>
<td>75</td>
<td>6.9</td>
<td>0.221</td>
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<tr>
<td>Brazils</td>
<td>4.1</td>
<td>1.5</td>
<td>50</td>
<td>5.0</td>
<td>0.235</td>
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<tr>
<td>Cashews</td>
<td>4.4</td>
<td>1.5</td>
<td>13</td>
<td>1.2</td>
<td>0.057</td>
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<tr>
<td>Hazelnuts</td>
<td>3.7</td>
<td>1.8</td>
<td>53</td>
<td>7.2</td>
<td>0.031</td>
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<tr>
<td>Macadamia</td>
<td>2.4</td>
<td>1.8</td>
<td>20</td>
<td>0.5</td>
<td>0.031</td>
</tr>
<tr>
<td>Pecans</td>
<td>2.2</td>
<td>1.8</td>
<td>10</td>
<td>5.6</td>
<td>0.036</td>
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<tr>
<td>Pistachios</td>
<td>5.9</td>
<td>3.1</td>
<td>38</td>
<td>1.5</td>
<td>0.049</td>
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<tr>
<td>Walnuts</td>
<td>4.1</td>
<td>1.4</td>
<td>27</td>
<td>5.6</td>
<td>0.042</td>
</tr>
</tbody>
</table>

Sources: USDA; Journal of American Dietary Assn. 75:64, 1979

Fatty acids composition of nuts influences their storage potential.

Stability Comparison of Various Nuts

- **Stable (Saturates)**
- **Stable (Monounsaturate)**
- **Unstable (Polyunsaturate)**
Comparison among various cooking oils in their fatty acid composition

Maturity Stages
Almond

Walnut

Postharvest Handling Systems for Tree Nuts
Collecting Almonds from Windrows

Sorting Almonds at the Hulling Facility

Concealed damage of almonds due to high temperature and relative humidity
Tree Shaker for Harvesting Walnuts

Windrowed Walnuts

Pick-up Machine for Walnuts
Kernel Darkening due to Exposure of Harvested Walnuts to the Sun

SUN

SHADE

Walnut Kernel Color Chart

Price is inversely related to kernel color

Pistachio shell split is desirable while early hull split is not desirable because it increases potential for fungal infection
Pistachio Nut Maturity Indexes

- Ease of hull separation from shell
- Shell dehiscence (splitting)
- Change in shell color (green to ivory)
- Decrease in fruit removal force
- Kernel dry weight and crude fat content

Tree Shake Catch System for Pistachio Harvesting

Pistachio nuts require more careful handling due to their higher water content at harvest than other tree nuts.

Sorting Pistachio Nuts to Remove Defects
Separating Pistachio Nuts by Size

Pistachio Nut Hull Removal

Pistachio Staining

Yellow staining caused by delay in hull removal.

Maximum brown color allowed for light staining. Any color darker is considered dark stain.
Visual Shell Staining Scores for Pistachio Nuts

Drying Methods

Sun drying
Ambient-air drying
Two-stage drying
1. Heated-air drying to about 12% moisture
2. Ambient-air drying to 5-6% moisture
Heated-air drying

Cross-flow Dryers Used for Pistachio Nuts
Storage Factors for Nuts and Dried Fruits and Vegetables

- Moisture content of the product
- Relative humidity of storage
- Storage temperature
- Oxygen concentration
- Effective insect control

Moisture Content vs Water Activity of Nuts and Dried Fruits and Vegetables
Relationship between water activity and mold growth on dried fruits and nuts

Severe Insect Damage in Almond Kernels
Stored Products Insects cause Qualitative and Quantitative Losses

- Navel orangeworm
- Indian meal moth
- Dried fruit beetles
- Saw tooth grain beetle
- Merchant grain beetle
- Raisin moth
- Fruit fly

Insect Control Procedures for Nuts and Dried Fruits and Vegetables

- Fumigation (methyl bromide or phosphine)
- Irradiation at 750 Gy
- Freezing at -18 °C for longer than 2 days
- Use of heat treatments (50-55 °C)
- Exposure to 100% carbon dioxide for longer than 2 days
- Storage at temperatures below 5 °C reduces insect activity
- Storage in 0.5% oxygen (balance nitrogen) atmosphere reduces insect activity

Experimental Insect Control Treatments

- Fumigation with carbonyl sulfide, methyl iodide, or sulfuryl fluoride
- Insecticidal atmospheres (below 0.5% O₂ and/or 40-60% CO₂)
- Heat treatments (radiofrequency)
- Ultraviolet radiation
- Vacuum treatments