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>Vitmn. 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>.221</td>
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<tr>
<td>Brazils</td>
<td>4.1</td>
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<td>50</td>
<td>5.0</td>
<td>.035</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>.057</td>
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<td>Hazelnuts</td>
<td>3.7</td>
<td>1.8</td>
<td>53</td>
<td>7.2</td>
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<td>Macadamia</td>
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<td>20</td>
<td>0.5</td>
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<tr>
<td>Pecans</td>
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<td>1.8</td>
<td>10</td>
<td>5.6</td>
<td>.036</td>
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<td>Pistachios</td>
<td>5.9</td>
<td>3.1</td>
<td>38</td>
<td>1.5</td>
<td>.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>.042</td>
</tr>
</tbody>
</table>

Sources: USDA; Journal of American Dietary Assn. 75:64, 1979
Fatty acids composition of nuts influences their storage potential

Comparison among various cooking oils in their fatty acid composition
Maturity Stages

Almond

Walnut

Postharvest Handling Systems for Tree Nuts
Tree Shaker for Almond Harvesting

Windrowing Almonds to Facilitate Collection
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 darkening

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

C-BROWN STAINING

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
Higher temperatures reduce drying time, but increase separation of kernels from their shells.
Storage Factors for Nuts and Dried Fruits and Vegetables

- Moisture content of the product
- Relative humidity of storage
- Storage temperature
- Oxygen concentration
- Effective insect disinfestation and prevention of reinfestation

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 ethyl formate, 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