AGENDA

• Swati Kalgaonkar, Almond Board of California, moderator
• Ari Mackler, The Wonderful Company, moderator
• Alison Coates, University of Southern Australia
• Raja Sivamani, UC Davis
Cognitive and Heart Health Benefits Associated With Almond Consumption

A/Prof Alison Coates
Alliance for Research in Exercise, Nutrition and Activity
School of Health Sciences, UniSA
**Nutrients in Almonds**

- **Rich in minerals**
  - Calcium
  - Magnesium
  - Potassium

- **Rich in fibres**

- **Rich in good fats**
  - mono + polyunsaturated fatty acids
  - Plant sterols

- **Rich in vasoactive amino acids**
  - arginine

- **Rich in antioxidants**
  - polyphenols, carotenoids

- **Rich in vitamins**
  - Folate
  - Vitamin E

- **Rich in vasoactive amino acids**
  - arginine

# How key nutrients in nuts contribute to brain health

<table>
<thead>
<tr>
<th>Nutrient/Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B group vitamins (folate, vitamin B2, vitamin B6 and vitamin B12)</td>
<td>Necessary for the production of specific components of the brain, such as neurotransmitters and cell structure</td>
</tr>
<tr>
<td>Polyunsaturated fatty acids</td>
<td>Critical components of neuronal cell membranes, maintaining membrane fluidity and communication between brain cells</td>
</tr>
<tr>
<td>Vitamin E</td>
<td>Directly involved in nervous cell membrane protection through its action as an antioxidant</td>
</tr>
<tr>
<td>Magnesium and calcium</td>
<td>Regulation of brain cell communication (neurotransmission)</td>
</tr>
<tr>
<td>Zinc</td>
<td>Component of enzymes and as a structural component of many proteins, hormones, hormone receptors and molecules involved in brain cell communication (neuropeptides)</td>
</tr>
<tr>
<td>Iron</td>
<td>Necessary to ensure oxygenation of the brain, as well as for the synthesis of neurotransmitters and myelin</td>
</tr>
<tr>
<td>Trace minerals such as manganese and copper</td>
<td>Participate in enzymatic mechanisms that protect against free radical damage</td>
</tr>
<tr>
<td>Phytonutrients (such as carotenoids and flavonoids)</td>
<td>Neuroprotective function through its role as an antioxidant</td>
</tr>
</tbody>
</table>

Healthy dietary patterns, characterized by high intake of

- plant-based foods
- probiotics
- antioxidants
- soy beans
- nuts
- omega-3 PUFA

and a low intake of

- saturated fats
- animal-derived proteins
- refined sugars

Decrease the risk of neurocognitive impairments

• Population studies suggest that regular nut consumption is associated with
  • Better cognitive function
  • Lower rates of cognitive decline
  • Lower risk for depression

Nuts and brain health

Tree nuts, such as almonds, Brazil nuts, cashews, chestnuts, hazelnuts, macadamias, pecans, pine nuts, peanuts and walnuts are rich in a wide range of nutrients that are important for brain health and optimal cognitive performance. These include healthy fats (monounsaturated and polyunsaturated fats) and proteins plus antioxidant compounds (flavonoids and resveratrol). Nuts also contain essential vitamins including several B group vitamins (for example thiamine), vitamin E and minerals such as calcium, iron, zinc, potassium and magnesium, selenium, manganese and copper.

Regular nut consumption is linked to better cognitive function

Longitudinal studies have reported that regular nut consumption is associated with better cognitive function. Many of the health benefits of nuts are thought to be due to the fact that they are high in antioxidants and contain healthy fats.

Several prospective studies have demonstrated a positive association between nut consumption and cognitive performance, with generally consistent results in those with higher nut consumption and with those with lower consumption. One study has also suggested that eating nuts on a regular basis is associated with lower levels of inflammation and better overall health, with a lower risk of developing cognitive impairment or dementia.

Several studies have also shown that regular nut consumption is associated with lower risk of depression, lower risk of cognitive decline, and lower risk of developing dementia.

How key nutrients in nuts contribute to brain health

The essential nutrients in nuts have important roles in aspects of brain health, including brain development, cognitive function, and mood. Nuts are a rich source of proteins, healthy fats, and essential nutrients that are important for brain health.

Mechanisms to explain brain benefits linked to eating nuts

Several systems are shown to influence cognitive function, including improved metabolic regulation, reduced stress and inflammation. These benefits have been linked to a wide range of benefits including reduced cognitive decline, inflammation, and mood problems. Eating a small amount of nuts each day is a great way to ensure these essential nutrients. It is important to remember that nuts may not have the same effects when consumed as part of a meal, compared with eating whole foods.

Nut consumption reduces cardiovascular disease risk factors and improvements in vascular health may also be associated with better brain health

To compare 15% energy from almonds or control snack foods on biomarkers of cognitive function, cardiovascular and metabolic health

Study Aim

- 128 adults aged 50-80 years
- Overweight
- No cognitive impairments
Study Timeline

**Almond group**
- Screening and enrolment
- 12 week dietary phase

**Control group**
- 12 weeks

**Diet visits at weeks 3, 6 and 9**

Australian New Zealand Clinical Trials Registry (ACTRN12615001294549)
# Nutrient Profile of test foods

Amount per 100g

<table>
<thead>
<tr>
<th></th>
<th>Almonds</th>
<th>Cookies (Scotch Finger)</th>
<th>Potato Chips</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Energy (kJ)</td>
<td>2578</td>
<td>2123</td>
<td>2160</td>
</tr>
<tr>
<td>Carbohydrate (g)</td>
<td>6.4</td>
<td>62</td>
<td>45.8</td>
</tr>
<tr>
<td>Protein (g)</td>
<td>21</td>
<td>5.9</td>
<td>6</td>
</tr>
<tr>
<td>Total Fat (g)</td>
<td>55.6</td>
<td>26.3</td>
<td>33.9</td>
</tr>
<tr>
<td>MUFA</td>
<td>36.5</td>
<td>7.4</td>
<td>21.4</td>
</tr>
<tr>
<td>PUFA</td>
<td>13</td>
<td>2.3</td>
<td>2.8</td>
</tr>
<tr>
<td>SFA</td>
<td>3.7</td>
<td>15</td>
<td>7.9</td>
</tr>
<tr>
<td>Fibre (g)</td>
<td>7.4</td>
<td>1.9</td>
<td>3.5</td>
</tr>
<tr>
<td>Sodium (mg)</td>
<td>5</td>
<td>416</td>
<td>14</td>
</tr>
<tr>
<td>Potassium (mg)</td>
<td>740</td>
<td>111</td>
<td>1250</td>
</tr>
<tr>
<td>Magnesium (mg)</td>
<td>260</td>
<td>14</td>
<td>61</td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>250</td>
<td>35</td>
<td>21</td>
</tr>
</tbody>
</table>
Outcome Measures

Energy Intake/Expenditure

Anthropometric

Cardio-metabolic

Blood Lipids
- Total Cholesterol
- LDL/HDL Cholesterol
- Triglycerides

Glucose Regulation
- Glucose
- Insulin
- Inflammation
- C-Reactive Protein

Cardiovascular Function
- Blood pressure
- Arterial function
- Antioxidant Status
- Alpha-tocopherol
• Major cognitive domains assessed using a 45 minute computerised battery of tests (COMPASS software)
  • Attention/concentration
  • Executive function
  • Working memory
  • Secondary memory
  • Spatial memory
  • Mood
• In all cases task outcomes include measures of accuracy and reaction times
## Changes in Diet Profiles

<table>
<thead>
<tr>
<th></th>
<th>Almonds (n=63)</th>
<th>Cookies+ chips (n=65)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Week 0</td>
<td>Week 12</td>
</tr>
<tr>
<td><strong>Energy (kJ)</strong></td>
<td>9128 ± 264</td>
<td>9544 ± 267</td>
</tr>
<tr>
<td><strong>CHO (%E)</strong></td>
<td>41.1 ± 0.8</td>
<td>36.1 ± 0.8</td>
</tr>
<tr>
<td><strong>PRO (%E)</strong></td>
<td>17.8 ± 0.4</td>
<td>17.6 ± 0.4</td>
</tr>
<tr>
<td><strong>Fat (%E)</strong></td>
<td>35.0 ± 0.7</td>
<td>41.3 ± 0.7</td>
</tr>
<tr>
<td><strong>MUFA (% total fat)</strong></td>
<td>40.5 ± 0.6</td>
<td>49.3 ± 0.6</td>
</tr>
<tr>
<td><strong>PUFA (% total fat)</strong></td>
<td>16.4 ± 0.5</td>
<td>19.4 ± 0.5</td>
</tr>
<tr>
<td><strong>SFA (% total fat)</strong></td>
<td>43.1 ± 0.8</td>
<td>32.1 ± 0.8</td>
</tr>
<tr>
<td><strong>Fibre (g)</strong></td>
<td>28.0 ± 1.0</td>
<td>29.2 ± 1.1</td>
</tr>
<tr>
<td><strong>Vitamin E (mg)</strong></td>
<td>13.1 ± 0.6</td>
<td>26.6 ± 0.7</td>
</tr>
</tbody>
</table>

*P<0.01, **P<0.001
Group x diet interaction
## Changes in Anthropometry

<table>
<thead>
<tr>
<th></th>
<th>Almonds (n=64)</th>
<th>Cookies+ chips (n=64)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Week 0</td>
<td>Week 12</td>
</tr>
<tr>
<td><strong>Weight (kg)</strong></td>
<td>83.8 ± 1.7</td>
<td>84.1 ± 1.6</td>
</tr>
<tr>
<td><strong>BMI (kg/m²)</strong></td>
<td>30.3 ± 0.5</td>
<td>30.4 ± 0.5</td>
</tr>
<tr>
<td><strong>WC (cm)</strong></td>
<td>100.7 ± 1.3</td>
<td>100.8 ± 0.9</td>
</tr>
<tr>
<td><strong>Body Fat (%)</strong></td>
<td>36.1 ± 1.03</td>
<td>36.02 ± 1.03</td>
</tr>
</tbody>
</table>
Changes in Lipids

Reductions in Total and LDL-C over time

Total Cholesterol (mmol/L)

LDL Cholesterol (mmol/L)

Triglycerides (mmol/L)

HDL (mmol/L)

*P=0.004
Changes in Lipids

- When limiting the population to total cholesterol below 6.22mmol (consider very high by ATP III)
- Reductions in TChol, LDL,TChol:HDL following almond consumption

![Graph showing changes in total cholesterol and LDL cholesterol over 12 weeks for almonds and cookies + chips, with statistical significance indicated.]
Changes in Blood Pressure and Glucose

Reduction in SBP over time
Trend for reduction with almonds (p=0.054)

When people on antihypertensive medication were removed
• Reduction in SBP became significant p=0.035
Preliminary cognitive results

- No significant differences between groups for changes in:
  - Attention/concentration, Executive function, Working memory, Secondary memory, Spatial memory

- Improvement in alertness ($p=0.026$) when controlling for age, gender, sleepiness
Conclusion

- Inclusion of snack foods at 15%E did not change body composition
- 12 weeks of consuming almonds improved lipids and blood pressure
- The control snack foods did not worsen any markers of cardiometabolic health
- Alertness improved in the almond group but there were no other changes in cognition

Important next steps

- Determine changes in overall diet quality
- Confirm compliance with biomarker assessment
- Determine if changes in cardiometabolic biomarkers and cognitive function are related
Acknowledgements

Study Investigators
• A/Prof Alison Coates
• Dr Alison Hill
• Professor Jonathan Buckley
• Professor Andrew Scholey (Swinburne University)

Research Team
• Dr Catherine Yandell
• Mrs Louise Massie
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Research Students
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• Mr Paul Butler
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• Ms Daria Mosberger
• Ms Christine Chern

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Prospective Randomized Controlled Pilot Study on the Effects of Almond Consumption on Sebum and Wrinkles

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UC Davis, Department of Dermatology
California State University - Sacramento
Disclosures

• Dermveda – Scientific Advisor
• Burts Bees – Consultant
• Dermala – Consultant

• Study presented was supported by funding from Almond Board of California
Photoaging

- Molecular
  - Activity of melanocytes
  - Degradation of collagen
  - Oxidative stress

- Clinical/Physical
  - Wrinkles
  - Dyspigmentation
  - Leathery Skin
  - Loss of texture
Photoaging Causes

- Chronic sun and UV exposure
- Hormones: Estrogen decline

Estrogens and aging skin

M. Julie Thornton
Centre for Skin Sciences; University of Bradford; Bradford, UK

Keywords: estrogen, skin, menopause, phytoestrogen, SERMs, aging, wound healing

Estrogen deficiency following menopause results in atrophic skin changes and acceleration of skin aging. Estrogens significantly modulate skin physiology, targeting keratinocytes, fibroblasts, melanocytes, hair follicles and sebaceous glands, and improve angiogenesis, wound healing and immune responses. Estrogen insufficiency decreases defense against oxidative stress, skin becomes thinner with less collagen, decreased elasticity, increased wrinkling, increased dryness and reduced vascularity. Its protective function becomes compromised and aging is associated with impaired wound healing, hair loss, pigmented changes and skin cancer.

Skin aging can be significantly delayed by the administration of estrogen. This paper reviews estrogen effects on human skin and the mechanisms by which estrogens can alleviate the changes due to aging. The relevance of estrogen replacement, selective estrogen receptor modulators (SERMs) and phytoestrogens as therapies for diminishing skin aging is highlighted.

Understanding estrogen signaling in skin will provide a basis for interventions in aging pathologies.

Classical Mechanism of Action: Genomic Signaling

Two related, but distinct, tissue-dependent intracellular estrogen receptors (ERα and ERβ) have been identified as members...
Vitamin E is Enriched on the Face

Packer L et al, J Invest Dermatol 1999
Hypothesis

Consumption of almonds will slow the development of wrinkles
Study Design

• Inclusion Criteria:
  • Post-menopausal women
  • Skin type I and II

• Exclusion Criteria:
  • Nut allergy
  • Autoimmune photosensitive condition
  • Genetic deficiency in collagen production
  • Already obtained at least 20% of their energy intake from nut consumption
  • Unwilling to discontinue high antioxidant supplements and daily food sources
  • Kidney stone history
Almond Group
Raw almonds supplying 20% of total daily energy

Control
Nut free calorie matched snacks
(a cereal bar, a small granola bar, and pretzels)

ClinicalTrials.gov: NCT02954315
## Demographics

<table>
<thead>
<tr>
<th>Demographic Factor</th>
<th>Almond group (n=16)</th>
<th>Control Group (n=15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean±SD</td>
<td>63.63 ± 7.09</td>
<td>58.93 ± 6.10</td>
</tr>
<tr>
<td>Sex, Female</td>
<td>16</td>
<td>15</td>
</tr>
<tr>
<td>Body Mass Index (kg/m²), mean±SD</td>
<td>30.7 ± 7.31</td>
<td>29.7 ± 7.66</td>
</tr>
</tbody>
</table>
Measures

- High Resolution Images
- Blood lipids
- Sebum excretion rate and lipids
Results: Wrinkles

![Graph showing the percentage change in overall wrinkle severity over 8 and 16 weeks for control and almond groups. The graph indicates a significant reduction in wrinkle severity for the almond group compared to the control group.](image-url)
Results: Skin Barrier - TEWL
Results: Sebum Excretion Rate
No Change in Plasma Lipids

![Graph showing plasma NEFA (mol%) for Snack Group and Almond Group over visits 1, 3, and 5, with data points for different fatty acid percentages (SFA, MUFA, (n-6) PUFA, (n-3) PUFA)].
No Side Effects
Overall Results

- Wrinkles were improved in the almond supplementation group
- Not due to change in sebum production or change in skin barrier function
- Lipids in the blood stream did not change
Further Work

- Tocopherol

- Expanded population and expanded time points are ongoing

- Expand to other measures of photoaging such as pigment and redness
UC Davis Dermatology
- Iryna Rybak
- Simran Dhaliwal
- Aunna Pourang, MD
- Waqas Burney, MBBS
- Manisha Notay, MBBS

UC Davis Ophthalmology
- Francene Steinberg, RD PhD
- John Newman, PhD
- Mark Mannis, MD

Sacramento State
- Robert Crawford, PhD

UC Davis Nutrition
- Francene Steinberg, RD PhD
- John Newman, PhD
- Mark Mannis, MD
Thank you!
What’s Next

Wednesday, December 5 at 11:10 a.m.

• Growing Organic: Panel Update on Practices and Certification – Room 312-313

• Almond Pasteurization - Landscape of Technologies/Equipment (Part 2) – Room 306-307

• More Crop Per Drop – Room 308-309

• India: The Strength Within – Room 314
What’s Next

Wednesday, December 5 at 12:00 p.m.

• Luncheon Presentation – Hall C
  Speaker: David Deak

Luncheon is ticketed and is sponsored by Moss Adams
Start your holiday shopping at our Silent Auction in Hall A+B - all proceeds go towards CA FFA scholarships!

Wednesday & Thursday until 3:00 p.m.
Buy Your Golden Ticket at the FFA Booth

100 Golden Tickets Will Be Sold

Throughout the conference 100 golden tickets will be sold. One lucky person will win and get their choice of one item from the live auction.

MUST BE PRESENT AT THE GALA DINNER TO WIN.

Visit the FFA silent auction booth to purchase a golden ticket and learn more!

The golden ticket winner will be drawn prior to the live auction.