Chemical characterization of *Lupinus mutabilis* Sweet and *Lupinus angustifolius* seeds and oil

**Repo-Carrasco-Valencia, Ritva,**

Chamorro, R, Delgado, V, Ollennu-Chuasam, P and Suomela, JP

Universidad Nacional Agraria La Molina, Perú,

University of Turku, Finland
• Bitter lupin, also known as tarwi in Peru (Lupinus mutabilis Sweet), is widely cultivated in the Andean region of South America.
• In Finland Lupinus angustifolius has been introduced recently to be used for human consumption.
• This study is part of PeruCrop project, a collaborative research between University of Turku, Finland and Universidad Nacional Agraria La Molina, Peru
• The aim of this study was to carry out the chemical characterization of seeds and oil of these two lupin species.
The tarwi, *L. mutabilis* (Andenes variety) samples originated from Cajamarca, Peru and the *L. angustifolius* (*Sonetia* variety) from Finland.
The following analyses in grain samples were carried out:

- Proximate composition
- Dietary fiber
- Total flavonoids
- Antioxidant activity
- Total phenolic compounds
- Fatty acid composition in oil
Oil Extraction

The oil was extracted with a thermopress expeller using two temperatures (50°C and 70°C) for Andean lupine and 90°C for *L. Angustifolius*.
Results
Proximate composition of lupine seeds
g/100 g in fresh weight

<table>
<thead>
<tr>
<th>Sample</th>
<th>Moisture</th>
<th>Protein</th>
<th>Fat</th>
<th>Ash</th>
<th>Carbohydrates</th>
<th>Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tarwi</td>
<td>8.21</td>
<td>36.9</td>
<td>18.4</td>
<td>3.60</td>
<td>33.1</td>
<td>1870</td>
</tr>
<tr>
<td>Sweet lupine</td>
<td>12.73</td>
<td>20.9</td>
<td>8.15</td>
<td>4.16</td>
<td>54.0</td>
<td>1576</td>
</tr>
</tbody>
</table>
Dietary fiber content of lupine seeds

![Bar chart showing dietary fiber content of Lupinus angustifolius and Lupinus mutabilis.](chart.png)
Content of total phenolic compounds in lupine seeds
Content of total flavonoids in lupine seeds

Flavonoides totales mg CE/100g muestra

lupinus angustifolius
lupinus mutabilis
Antioxidant capacity of lupine seeds

Actividad antioxidante según DPPH
μmol TE/ 100g muestra

Lupinus angustifolius  Lupinus mutabilis
<table>
<thead>
<tr>
<th></th>
<th>16:00</th>
<th>18:00</th>
<th>18:1(n-9)c</th>
<th>18:1(n-7)</th>
<th>18:2(n-6)c</th>
<th>18:3(n-3)</th>
<th>20:00</th>
<th>22:00</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lupin</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. Mutabilis - 50°C</td>
<td>9.60±0.16</td>
<td>9.06±0.15</td>
<td>51.71±0.46</td>
<td>0.819±0.01</td>
<td>24.23±0.41</td>
<td>2.76±0.15</td>
<td>0.93±0.01</td>
<td>0.90±0.01</td>
</tr>
<tr>
<td>L. Mutabilis - 70°C</td>
<td>9.92±0.20</td>
<td>9.10±0.12</td>
<td>51.21±0.86</td>
<td>0.54±0.47</td>
<td>24.52±0.44</td>
<td>2.88±0.05</td>
<td>0.93±0.01</td>
<td>0.91±0.01</td>
</tr>
<tr>
<td>L. Angustifolius - 90°C</td>
<td>11.03±0.11</td>
<td>7.04±0.08</td>
<td>31.57±0.06</td>
<td>0.46±0.02</td>
<td>42.36±0.09</td>
<td>4.92±0.03</td>
<td>0.89±0.01</td>
<td>1.73±0.00</td>
</tr>
</tbody>
</table>
Conclussions

- The tarwi seeds had significantly higher protein and oil content compared with *L. angustifolius*.

- There were significant differences in carbohydrate and ash content, with *L. angustifolius* having a higher content of these compounds.

- The total, soluble and insoluble dietary fiber content in *L. angustifolius* was significantly higher than the content of these compounds in *L. mutabilis*.

- The content of phenolic compounds, flavonoids and antioxidant activity in the two lupin species were similar.
• The analysis of fatty acid composition of the lupin oils demonstrated that the oil of *L. angustifolius* has a higher content of polyunsaturated fatty acids, such as linoleic acid (omega 6) and alpha-linolenic acid (omega 3) than the oil of *L. mutabilis*.

• The temperature of extraction did not affect the content of essential fatty acids in tarwi oil

• Oleic acid content was higher in tarwi than in *L. angustifolius*.

• Both lupines are good sources of high-quality oil, with an adequate composition of essential fatty acids.

• The World Health Organization recommends that the proportion of the omega 6 and omega 3 should be less than 10 :1 \[\Rightarrow\] *L. angustifolius*: 8.6 :1 and *L. mutabilis*: 8.5 :1

• Both species of lupins are very nutritious crops, rich in protein, dietary fiber, good quality oil and bioactive compounds.
The authors wish to thank TEKES (Finland) for their financial support. The work undertaken in this study was part of the PROTEIN2FOOD project. This project has received funding from the European Union’s Horizon 2020 Research and Innovation Program.
Muchas gracias!

Thank you very much!

Contact: ritva@lamolina.edu.pe