LUPIN INCORPORATED NOVEL HEALTHY FOODS AS A SOLUTION TO OBESITY AND MALNUTRITION

Prof Vijay Jayasena and Dr Syed Abbas

Food Science & Technology, School of Public Health, Curtin University of Technology
Centre for Food and Genomic Medicine, Perth, Australia

International Congress on Food Technology
Antalya, Turkey, Nov, 03 - 06, 2010
Lupin Research at Curtin

A large team with expertise in

- Food Science & Technology
- Nutrition
- Dietetics
- Food Safety
- Food Micro-biology
- Food Chemistry
- Public Health
- Etc
# World Health Challenges

<table>
<thead>
<tr>
<th>Developed Countries</th>
<th>Developing countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Problems due to the (over) consumption of unhealthy (junk) foods</td>
<td>• Problems due to limited availability of foods</td>
</tr>
<tr>
<td>• Obesity, diabetics, cardiovascular diseases</td>
<td>• Hunger, malnutrition, starvation</td>
</tr>
</tbody>
</table>

- Problems due to the (over) consumption of unhealthy (junk) foods
- Obesity, diabetics, cardiovascular diseases
- Problems due to limited availability of foods
- Hunger, malnutrition, starvation
World Health Challenges

Developed Countries

• More than half of the population is overweight (around 60% of Australians are overweight)
• Around 20% children are overweight
• Increased risk of cardiovascular diseases, type 2 diabetes, etc
• Low dietary fibre intake
• High sugar/carbohydrate & fat intake
• Excess food (energy) consumption
In Developing Countries

- Malnutrition (mainly protein) especially among children and women
- Hunger and starvation not uncommon
- Limited availability of food
- High cost
- Most population depends on cereals

According to the FAO, around 1 billion hungry people in the world in 2009
World Health Challenges
An Ideal Food Ingredient for the World

- High fibre
- Low fat
- High protein
- Low starch
- Low Glycemic Index (GI)
- Contain bioactive compounds (weight control, reduce cholesterol level, etc.)
- Low cost

Lupin meet all the above
What is lupin

- A grain legume similar to soybean
- Grown in Australia, South America, USA, Europe, etc
- Costs less than half of the cost of soybean
- Can be grown under marginal conditions (less water, fertiliser and chemical requirement)
- Environmentally friendly – fixed nitrogen
Soybean  Lupin  Dehulled lupin
# Lupin and Soybean – Flour Composition

<table>
<thead>
<tr>
<th>Contents (%)</th>
<th>Lupin</th>
<th>Soybean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>Fat</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>Minerals</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Dietary fibre</td>
<td>30</td>
<td>5</td>
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</table>
## Composition of Lupin, Wheat and Rice Flours

<table>
<thead>
<tr>
<th>Contents (g/100g)</th>
<th>Lupin flour</th>
<th>Wheat flour</th>
<th>Rice flour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy (kJ)</td>
<td>1074</td>
<td>1483</td>
<td>1527</td>
</tr>
<tr>
<td>Protein</td>
<td>40</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Fat</td>
<td>6</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Dietary Fibre</td>
<td>28</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Starch</td>
<td>&lt;1</td>
<td>72</td>
<td>80</td>
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</table>
## Composition of Lupin, Wheat and Rice Flours

<table>
<thead>
<tr>
<th>Contents (mg/100g)</th>
<th>Lupin flour</th>
<th>Wheat flour</th>
<th>Rice flour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ca</td>
<td>86</td>
<td>21</td>
<td>7</td>
</tr>
<tr>
<td>K</td>
<td>970</td>
<td>162</td>
<td>148</td>
</tr>
<tr>
<td>Mg</td>
<td>172</td>
<td>34</td>
<td>52</td>
</tr>
<tr>
<td>P</td>
<td>310</td>
<td>130</td>
<td>211</td>
</tr>
<tr>
<td>Fe</td>
<td>4.1</td>
<td>2.1</td>
<td>0.2</td>
</tr>
<tr>
<td>Zn</td>
<td>2.1</td>
<td>0.5</td>
<td>1.1</td>
</tr>
</tbody>
</table>
Composition of Lupin, Wheat and Rice Flours

- **Protein**
  - Lupin Flour
  - Wheat flour
  - Rice flour

- **Dietary fibre**
  - Lupin Flour
  - Wheat flour
  - Rice flour

- **Fat**
  - Lupin Flour
  - Wheat flour
  - Rice flour

- **Non-starch polysaccharide**
  - Wheat
  - Pea
  - Soybean
  - Lupin

- **Starch**
  - Wheat
  - Pea
  - Soybean
  - Lupin

- **Lipid**
  - Wheat
  - Pea
  - Soybean
  - Lupin

- **Protein**
  - Wheat
  - Pea
  - Soybean
  - Lupin
Lupin Foods- Health Benefits

• Reduces obesity
• Lowers cholesterol
• Reduces risk of cardiovascular diseases
• Improves bowel health
• Reduces risk of colon cancer
• Acts as a pre-biotic

“Let thy food be the medicine and thy medicine be thy food” - Hippocrates
High Satiety

Higher satiety foods help reduce obesity by reducing energy intake

*Archer et al., 2004 – clinical trial*

Lupin kernel fibre patty more satiating (4.5 h) than the full-fat sausage patty and resulted lower energy intake

*Lee et al., 2006 – clinical trial*

The lupin bread resulted in significantly higher self-reported satiety and lower energy intake
Cholesterol Lowering Effect

Arnoldi, 2008 – clinical trials
Lupin Proteins fed rats - significantly lower both plasma cholesterol and triglycerides

Hall et al., 2005 - clinical trials
Lupin fibre diet reduced total cholesterol (4.5%), low-density lipoprotein cholesterol (5.4%)

Sirtori et al., 2004 - animal trials
In rats - lupin protein extract reduced plasma total and VLDL+LDL cholesterol concentrations by 21 and 30%, respectively
Low Glycemic Index (GI)

Hall *et al.*, 2005 - clinical trials
Lupin flour addition to bread reduced the glycaemic index
  - Lupin bread = 74
  - Standard white bread = 100

Johnson *et al.* 2003 - clinical trials
A reduction of 18.8% was seen in IAUC (Incremental areas under curves) for insulin of lupin fibre containing bread compared with the control
Reducing Cardiovascular Disease Risk Factors

Sirtori et al (2004) - animal trial
In high cholesterol rats daily intake of 50 mg (for 2 weeks) of total lupin protein extract reduced plasma total and VLDL+LDL cholesterol concentrations by 21 and 30%, respectively.

*L. angustifolius* seeds reduced LDL-cholesterol in pigs fed a high cholesterol diet.

High cholesterol rabbits fed lupin protein supplemented diet for 3 months showed beneficial changes to cholesterol levels and development of thickening of the arteries that those fed milk protein.

*L. angustifolius* protein reduced cholesterol levels in high cholesterol rats, presumably through down regulation of genes involved in lipid synthesis; however the effect was dependant on lupin variety.
Pre-biotic Effect

Lupin is a rich source of raffinose family oligosaccharides (12 % on dry weight basis) which have proven pre-biotic effects

Martinez-Villaluenga et al., 2008
The numbers of faecal bifidobacteria in rats increased after oral administration of raffinose family oligosaccharides (RFOS) from lupin
We have Developed a Range of Lupin Based Healthy Foods

Lupin Based Snacks

Lupin Flour ~ 30%
Lupin Based Snacks

Lupin flour ~70%
Lupin Based Pasta
Lupin Muffins
Lupin Noodles
Lupin Noodles (cooked)
Lupin Biscuits

20% lupin flour
Lupin Chips (Crisps)

70% lupin flour

100 g = 70% of the daily dietary fibre requirement
Lupin Based Yoghurt
Lupin Burger

50% lupin flour
Lupin Chapatti
Innovation Display – Curtin Open Day
Innovation Display – Curtin Open Day
Lupin Chips
Protein (g/100g)

- **Normal**
- **Lupin based**

<table>
<thead>
<tr>
<th></th>
<th>Noodles</th>
<th>Biscuits</th>
<th>Crisps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lupin based</td>
<td>20</td>
<td>30</td>
<td>30</td>
</tr>
</tbody>
</table>
Dietary Fibre (g/100)

- Normal
- Lupin based

<table>
<thead>
<tr>
<th></th>
<th>Normal</th>
<th>Lupin based</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noodles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biscuits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crisps</td>
<td>25</td>
<td></td>
</tr>
</tbody>
</table>
Lupin Tempe - Indonesia

• Funded by the Grain Foods CRC (GRDC)

• International patent has been granted

• Commercialisation is in progress
Lupin Tempe - Indonesia

• Joint project with the Indonesian Institute of Sciences (LIPI)

• Officially launched by the Minister for Agriculture and Food, Hon Terry Redman in Jakarta in April 2010
### Major Lupin Producing Countries in the World

<table>
<thead>
<tr>
<th>Country</th>
<th>Production (MT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>707,900</td>
</tr>
<tr>
<td>Poland</td>
<td>39,600</td>
</tr>
<tr>
<td>Chile</td>
<td>31,600</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>21,800</td>
</tr>
<tr>
<td>Morocco</td>
<td>14,000</td>
</tr>
<tr>
<td>South Africa</td>
<td>13,300</td>
</tr>
<tr>
<td>Peru</td>
<td>8,400</td>
</tr>
<tr>
<td>Italy</td>
<td>4,500</td>
</tr>
<tr>
<td>Spain</td>
<td>4,300</td>
</tr>
<tr>
<td>Egypt</td>
<td>2,300</td>
</tr>
<tr>
<td>Ecuador</td>
<td>1,500</td>
</tr>
<tr>
<td>Lebanon</td>
<td>1,000</td>
</tr>
</tbody>
</table>

Lupin Consumption in Europe

- Around 15,000 tons/year lupin-based ingredients are sold in Europe for human food
- Around 500,000 tonnes/year foods containing lupin is consumed in Europe
  - Bread
  - Cookies
  - Snacks
  - Pasta
  - Beverages
  - Etc

Some chemical properties of white lupin seeds (*Lupinus albus* L.)

M. Erbaş *, M. Certel, M.K. Uslu

Department of Food Engineering, Faculty of Agriculture, Akdeniz University, 07059 Antalya, Turkey

Received 3 October 2003; received in revised form 25 February 2004; accepted 25 February 2004

Abstract

Lupin seeds (*Lupinus albus* L.), grown in Turkey, were investigated. Dem seeds were 1.16 g/cm³, 411.4 g, and 68.12 kg/100 l, respectively. The results showed that the seeds contained 32.2% oil, 16.2% fibre, 5.95% protein, and 5.82% ash. Seed oil was composed of 31.1% polyunsaturated fatty acids. Sucrose constituted 71% of total sugars, 2.3 mg/kg of riboflavin and 39 mg/kg of niacin. It can be concluded that the nutritional value is high.

Keywords: White lupin; *Lupinus albus* L.; Chemical composition

Fat and fatty acids of white lupin (*Lupinus albus* L.) in comparison to sesame (*Sesamum indicum* L.)

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* Department of Field Crops, Faculty of Agriculture, Akdeniz University, TR-07059 Antalya, Turkey

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Received 7 March 2005; received in revised form 23 March 2006; accepted 23 March 2006

Abstract

The study was undertaken to compare fat and fatty acid profiles in white lupin (*Lupinus albus* spp. *albus*) and sesame (*Sesamum indicum* L.), representing two different families, Fabaceae and Pedaliaceae. Fat levels were 10.74% and 55.44% in seeds of white lupin and sesame, respectively. The results indicated that oleic, linoleic and arachidic acids in seed fat were higher in white lupin than in sesame cultivars. Oleic acid was the predominant fatty acid in white lupin, whereas linoleic acid was predominant in sesame. Fat content of lupin was statistically significantly correlated with linoleic, linolenic and arachidic acids at the genotypic level. The fatty acid composition of white lupin is useful for human consumption. Although oil content of white lupin was lower than that of sesame, white sweet lupin could be...
Could lupins be the new global ‘super food’?

Western Region

Lupins may finally be moving out from the shadow of more mainstream, and profitable, cereal crops as food technologists start serving up the first commercial lupin-based foods. A range of lupin-based biscuits, pastas and ‘crisps’ has been developed and is in the process of being commercialised. Because of their high nutritional value the products are destined not only for the snackfood shelves, but also the higher-value health foods market.

Researchers at the School of Public Health at Curtin University of Technology have developed the range of lupin-based foods to suit western and Asian tastes. The research has been funded through the Centre for Food and Genomic Medicine and the Grain Foods CRC (which is partly funded by the GRDC).

Project leader Associate Professor Vimla Jaya Dena says lupin-based foods have the potential to become ‘super foods’. “They are high protein, high fibre, low fat, low GI and low carbohydrates foods that contain bioactive compounds, taste good and are low cost.”

So far the Perth-based team, working with food manufacturers, has developed lupin-based tempeh (a popular fermented soybean product in South Asian countries), pasta, instant noodles, biscuits and crisps.

To make the products appealing they have been given the guise of snack and convenience foods. The crisps, for example, have been an instant hit among test markets – crunchy, mouth filling ... but with five times more protein and 10 times more dietary fibre than potato chips.

Broccoli made from 80 per cent wheat flour and 20 per cent lupin flour contains 83 per cent more protein than wheat-only broccoli, and 150 per cent more dietary fibre — but for less carbohydrate.

Similarly, pasta and noodles containing 20 per cent lupin flour have double the amount of protein and 30 per cent more dietary fibre.

At the recent GRDC-sponsored International Lupin Conference in Perth, Dr Mark Sweetingham, the manager of legumes and grain food research with the Department of Agriculture and Food, Western Australia (DAFWA), said there was growing interest in lupins because of the functional food and nutraceutical opportunities that may flow from their unique protein and fibre profiles.

Refia Sipahi, also from DAFWA, told the conference lupins could be sold to the food market as flour (Kernel Flour), bread, sprouts, tulsi, kernels, protein concentrates, protein isolates and kernel fibre, with end uses as diverse as protein for milk and ice-cream, and extracts used in cosmetics.
**Lupins promise perfect junk food**

**MICHAEL HOPKIN**

Talk about flower power — lupins are being hailed by WA scientists as the magic ingredient set to usher in an era of "healthy" junk food.

Curtin University researcher Vijay Jayasena has created snacks from lupin seeds which contain four times the protein and 10 times the fibre of regular potato chips, and says the seeds could be the next "superfood".

The snacks, made from ground lupin-seed "flour" fried in vegetable oil, could help parents give their children the treats they want without harming their health or denting the weekly budget. The snacks could be given flavours just like regular potato chips, Associate Professor Jayasena said.

The list doesn’t stop at chips — the Curtin team has also created recipes for cookies, cakes and Indonesian tempeh.

The food industry had been slow to recognise the health benefits of lupins, he said. Typically, they were used only for expensive, specialist products such as gluten-free pasta, which can cost $20 a kg.

WA, which grows 80 per cent of the world’s lupins, was poised for a boom, Professor Jayasena said.

The crop could be grown with less water and fertiliser than many traditional crops. Farmers grew lupins only as a rotational crop. But a boom in demand could see farmers planting the flowers as a cash investment.

The first lupin treats are set to hit supermarket shelves within three weeks, when Fremantle’s Beeliar Parkhouse and the Gourmet Delight launch a line of lupin-based choc-chip cookies.

Owner Arman Gholmati said the high-protein cookies gave a full feeling and were lower in sugar than normal biscuits.

“Who wouldn’t like a chocolate biscuit that’s healthy?”

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**Merriwa family deny obstructing police at bar**

**MICHAEL BENNETT**

A Merriwa family of four accused of injuring and obstructing police on Friday night have pleaded not guilty to all charges in Perth Magistrates’ Court.

Mrs Hamilton was arrested on charges of disorderly conduct and refusing to leave the scene after being issued a move-on notice.

After the incident, one officer was treated for a back injury, another for a broken frame, while a third officer...
Weight-loss bread a first for WA baker
31st July 2007, 6:15 WST

A new high-protein, low-carbohydrate bread baked in Perth is being dubbed the choice of slimmers because of its ability to keep people full for longer, helping them eat less and potentially lose weight.

Made from lupins, a legume, the bread has been found by a University of WA study to help people consume up to 30 per cent less energy during a meal.

One study participant recorded weight loss of about 4kg over four weeks.

Called Slimmer’s Choice, the bread was developed by Fremantle bakery Bodhi’s Bakehouse, in conjunction with research at the University of Western Australia’s Centre for Keto Research.

Flab busters: It is high in fibre and protein but low in carbohydrates and a university study found this lupin bread baked by John Noonan, left, and Keith Jarvis helped produce dramatic weight losses. Report, P11 Picture Terry Nathan
WA’s researchers tackling ‘diabesity’

Researchers from the Centre for Food and Genomic Medicine (CFGM) are making great strides in the fight against ‘diabesity’ with the development of healthier alternatives to wheat-based foods.

The twin epidemics of diabetes and obesity, known as ‘diabesity’, are of growing concern in Western Australia and the world. Currently, more than 140,000 Western Australians are affected by diabetes and over 15 per cent of adults are classified as obese.

Research at CFGM has shown that flour produced from lupin kernels, as opposed to wheat, is higher in protein and fibre, with very few carbohydrates. Its low fat content and glycaemic index (GI) helps to reduce overall energy intake and appetite.

Slimmer’s choice, a lupin-based bread developed by CFGM, has proven to be successful in helping people reduce meal sizes as a means for weight control, therefore driving the researchers at the centre to expand their product range.

In April, Fremantle’s Bodhi’s Bakehouse released a new low fat and sugar, high protein and fibre choc-chip lupin biscuit, based on the one developed by CFGM.

CFGM researcher, Associate Professor Vijay Jayasena of Food Science and Technology at Curtin University of Technology, said the lupin enriched biscuits had twice the protein and four times the fibre of similar products.

“We already know lupin flour foods can help people feel fuller for longer and curb calorie intake thanks to the legume’s high protein and fibre content, so with the help of manufacturers such as Bodhi’s Bakehouse we’re creating a line of foods that offer lupin benefits, and choc-chip biscuits are the latest addition,” he said.

CFGM Director Professor Peter Leadman said lupin-based foods were an exciting WA-made prospect that could help alleviate a global problem.

“It seems lupin foods have global potential which would not only lend possible health benefits to the State, but fantastic economic results as well, with WA at the head of the pack.”

The Centre for Food and Genomic Medicine, based at the Western Australian Institute for Medical Research, was established through a three year State Government investment of $4.5 million, managed by the Department of Commerce.
Tempe market a boost for WA lupin industry

The use of lupins to produce the food product ‘tempe’ in Indonesia is expected to significantly boost the Western Australian lupin industry through increased demand and higher prices to growers.

The new market will benefit WA growers who produce about 80 per cent of the world’s lupin crop, with researchers predicting demand for WA lupins for tempe production could rise to as much as 200,000 tonnes within a few years.

The Grains Research and Development Corporation (GRDC) has supported research leading to developing lupins as a partial substitute for soybeans in the production of tempe.

Tempe is one of the most commonly consumed foods in Indonesia and lupins are a cheaper yet nutritionally superior grain compared with soybeans.

Lupin tempe was officially launched in Jakarta by the WA Minister for Agriculture Terry Redman in April and the product is expected to become commercially available in Indonesia in coming months.

Lupin tempe has been developed as a result of a joint project led by Vijay Jayasena, of the School of Public Health, Curtin University, conducted in collaboration with Leonardus Kardono of the Indonesian Institute of Sciences-LIPI.

The research is funded by the GRDC-supported GrainFood Cooperative Research Centre (CRC). The CRC is actively working with tempe manufacturers in Indonesia to commercialise the process for making tempe from lupin.

Professor Jayasena said he expects initial demand for WA lupins for tempe production in the coming year will be about 50,000 tonnes.

Current WA lupin production is less than 1 million tonnes and supplies predominantly the stock feed industry.

"Lupins are currently grown in WA mainly for their rotational benefits and are largely a break-even crop," Professor Jayasena said.

"But increased demand for lupins through this new market could help to increase..."
Tempe made from lupins

Peter Hemphill
June 10, 2010

WEST Australian researchers have developed an Asian fermented food product called tempe from lupins.

This displaces its traditional base ingredient of soybeans.

The breakthrough, after more than four years of research at Curtin University in Western Australia, should see lupins elevated from being a traditional stockfeed-type grain to a food-quality product.

Tempe, which looks similar to tofu, originated from Indonesia but is also popular in Malaysia, Thailand and other South East Asian countries.

The lupin tempe was developed by a team led by Curtin University’s Vijay Jayasena, with collaboration from Indonesian scientists.

It was supported by the Grain Foods Co-operative Research Centre in Sydney and the Grains Research and Development Corporation.

The new tempe was made from a 50:50 mix of dehulled lupins and soybeans.

Prof Jayasena said he hoped the research team would have a tempe made totally from lupins within 12 months.

He said the current stumbling block in achieving that goal was finding an appropriate inoculant with a microorganism to ferment the lupin.

Dehulled lupins are cheaper but more nutritional than soybeans.

Prof Jayasena said lupins were high in protein and fiber.

Also in Grain & Hay

* Switch from dairy to fodder
* Get help managing stubble
* No easy fix for locust plague
* Reducing nitrous oxide levels
* Rain kick starts crops

Feed to food: tempe made from lupins will soon be served on the plates of Indonesian consumers thanks to a West Australian breakthrough.
Lupin Based Healthy Foods

• A number of large national and international food companies, including the largest chip manufacturer in the world, have expressed their interest

• Some foods are commercially available (bread, pasta, biscuits)
Lupin Research Collaborations – National

- Centre for Food and Genomic Medicine
- Grain Foods CRC
- University of Western Australia
- University of Western Sydney
- Department of Agriculture and Food
- Midwest Development Commission
- Murdoch University
- Corporate Bulk Handling (CBH)
- Bodhi’s Bakery
Lupin Research Collaborations – International

- Indonesia: Indonesian Institute of Sciences (LIPI)
- India
- Thailand
- Sri Lanka
- Malaysia
- USA
Where we are and where we will be?
Prof Vijay Jayasena
Food Science & Technology
School of Public Health
Curtin University of Technology
Perth, Western Australia

Email: v.jayasena@curtin.edu.au
Grazie al **LUPIDOR®** è possibile ottimizzare i processi economici nella produzione di alimenti e aumentare le caratteristiche nascoste del Lupino, le quali, grazie ai recenti studi dei progetti di ricerca della comunità europea, stanno mettendo in evidenza gli effetti salutari per l’alimentazione umana.

**SENZA GLUTINE - GLUTEN FREE**
Le sue eccellenti capacità come agente emulsionante, il suo colore dorato e i suoi delicati sapori ed aromi permettono la preparazione di alimenti adatti ai celiaci.
Lopino® is a fresh protein derived through a patented process from the sweet lupin. It has a yellow appearance and a neutral to slightly nutty taste.

The production of Lopino® makes no use of any coagulating agent. The protein coagulation (protein precipitation) occurs solely through heat.

The ingredients for making Lopino®: water, sweet lupin beans

Benefits
- contains all essential amino acids
- has large amounts of unsaturated and multiple unsaturated fatty acids
- has a high amount of lysine, more than found in most grains
- unsurpassed degree of digestion at 98%
- high-quality protein (20% versus 9% for soy tofu)
- cholesterol free, gluten free, yeast free
- Non-GMO
- low GI and low GL

Applications
Lupin8

NO DIET REQUIRED,
CONTROL SNACK ATTACKS.

“ I would recommend this to anyone who struggles with over eating ”
read more +

WHAT IS LUPIN8?

Lupin8 is a total weight control / lifestyle product that is used in everyday cooking and diet regimes.

All the products contained within Lupin8 come from nature.

Lupin8's ingredients are not made in a laboratory but are a mixture of grains from nature's basket. We have combined the
Sweet products

- **List of applications**

- **Pastry base**: Pie crust, yellow cakes, pancakes and waffles, brownies, cakes, crumbles, sponge cakes...

- **Biscuits**: Biscuits, wafers, speculoos...

- **Sweet Breads and buns**: Breakfast goods, Danish pastry, brioches, croissants, etc.
Over 500,000 tonnes of food consumed annually in Europe contains lupins (Fletcher, 2006)
Chile

Lupin Production Trends 1976-2006

[Graph showing lupin production trends for Chile, France, Peru, South Africa, and Spain from 1976 to 2006.]