Yeast beta-glucan: “Feeding” the mega-trend immunity for human health and animal nutrition

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Leiber GmbH, Germany

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Say Yes! to Yestimun® Beta–Glucan

Yes!

Yeast Beta-Glucan in its most natural form.
Immunity for human health and animal nutrition

Product and Mode of Action
Brewers’ yeast...

... a valuable raw material

- Brewers yeast ➤ fungi belonging to the Saccharomyces cerevisiae species
- Eucaryotes
- Average cell size 5 to 13 µm
- Membrane ca. 200 nm thick ➤ 25 to 40% of overall dry mass
**Yestimun®: Before and after purification**

Native „ghost“ cell after autolysis process:
- approx. 25–30% MOS (outer layer)
- approx. 20–25% Glucan (inner layer)

Purified Yestimun® particle after additional washing steps:
- approx. 0 – 2 % MOS
- min. 85% Glucan (now the outer layer)
The small intestine as an immune organ

- Highly purified beta–glucan structure of Yestimun® can be identified by immune cells
- Functional, rapid and unspecific immune response is triggered
  → activation of so-called scavenger cells in the Peyer’s patches
- Scavenger cells start to destroy pathogens or activate other defense cells (B and T cells, dendritic cells)
- Yestimun® Beta-Glucan boosts the immune system to enable it to react quickly in the event of an infection
Stimulation of the innate immune system

- The stimulation on the innate immune system is strongly depending on the purification grade of the yeast cell wall.
- „Native“ yeast cell walls do not show a direct stimulating effect.
Immunity for human health and animal nutrition

Differences in the markets for human and animal nutrition
The approach for livestock

- Earning money!
  = more output than input
- Fulfil regulations!
  e.g. zero tolerance on antibiotic residues in food
Results of trials – Pigs

**Fig. 3:** Effect of 0.05% Leiber Beta-S on IgG (mg/ml) and Lysozyme (mg/10ml) in sows and piglets
Results of trials – Pigs

Effect of **0.05 % Leiber Beta–S** on performance parameters of breeding sows

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Leiber Beta–S</th>
<th>Difference (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sows (litters)</td>
<td>35</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>Live born piglets (n)</td>
<td>525</td>
<td>517</td>
<td></td>
</tr>
<tr>
<td>Live–born piglets/litter (n)</td>
<td>13.6</td>
<td>13.3</td>
<td></td>
</tr>
<tr>
<td><strong>Birth weight/piglet (kg)</strong></td>
<td>1.39</td>
<td>1.48**</td>
<td>+ 6.5</td>
</tr>
<tr>
<td><strong>Birth weight/litter (kg)</strong></td>
<td>18.9</td>
<td>19.7</td>
<td>+ 4.2</td>
</tr>
<tr>
<td>Weaned piglets (n)</td>
<td>365</td>
<td>380</td>
<td></td>
</tr>
<tr>
<td>Weaned piglets/litter (n)</td>
<td>10.4</td>
<td>10.6</td>
<td>+ 2.0</td>
</tr>
<tr>
<td>Suckling piglet losses (%)</td>
<td>24.3</td>
<td>20</td>
<td>-17.7</td>
</tr>
</tbody>
</table>

** p < 0.01
### Trial with fish

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Beta-S</th>
<th>%-Diff.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animals (n)</td>
<td>20</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Leiber® Beta-S (g/to)</td>
<td>0</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td><strong>Rainbow trout:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phagocyte killer activity</td>
<td>0.34&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.48&lt;sup&gt;a&lt;/sup&gt;</td>
<td>+41</td>
</tr>
<tr>
<td>T-Lymphocytten immune resp.</td>
<td>0.42&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.63&lt;sup&gt;a&lt;/sup&gt;</td>
<td>+50</td>
</tr>
<tr>
<td>B-Lymphocytten immune resp.</td>
<td>0.30&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.50&lt;sup&gt;a&lt;/sup&gt;</td>
<td>+67</td>
</tr>
<tr>
<td>Lysozyme (mg/L)</td>
<td>23.4&lt;sup&gt;b&lt;/sup&gt;</td>
<td>37.0&lt;sup&gt;a&lt;/sup&gt;</td>
<td>+58</td>
</tr>
<tr>
<td>Immune globulins (g/L)</td>
<td>18.9&lt;sup&gt;b&lt;/sup&gt;</td>
<td>28.9&lt;sup&gt;a&lt;/sup&gt;</td>
<td>+53</td>
</tr>
<tr>
<td><strong>Carp:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phagocytten killer activity</td>
<td>0.30&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.49&lt;sup&gt;a&lt;/sup&gt;</td>
<td>+63</td>
</tr>
<tr>
<td>T-Lymphocytten immune resp.</td>
<td>0.40&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.58&lt;sup&gt;a&lt;/sup&gt;</td>
<td>+45</td>
</tr>
<tr>
<td>B-Lymphocytten immune resp.</td>
<td>0.27&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.47&lt;sup&gt;a&lt;/sup&gt;</td>
<td>+74</td>
</tr>
<tr>
<td>Lysozym (mg/L)</td>
<td>1.4&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.4&lt;sup&gt;a&lt;/sup&gt;</td>
<td>+143</td>
</tr>
<tr>
<td>Immune globulins (g/L)</td>
<td>10.5&lt;sup&gt;b&lt;/sup&gt;</td>
<td>18.5&lt;sup&gt;a&lt;/sup&gt;</td>
<td>+76</td>
</tr>
</tbody>
</table>

<sup>a, b</sup> = Values with different superscript letters in one line show significant differences (P < 0.05)
Trial with fish: Challenge study

Influence on survival rate of trout and carp after infection with a lethal pathogens

- Control trout
- Beta-S trout
- Control carp
- Beta-S carp

![Graph showing the survival rate of trout and carp after infection with a lethal pathogen against different dosages of Leiber® Beta-S.](image-url)
Influence of length of time of supplementation with Leiber Beta−S on survival rate of rainbow trout

![Bar chart showing survival rate of rainbow trout with different treatments and periods of supplementation.](chart.png)
The approach for companion animals (pets)

- Caring for your pet
- Having a happy pet, but also
- Avoiding side effects of “malfunctioning” pets
### Trial with dogs suffering diagnosed IBD

<table>
<thead>
<tr>
<th></th>
<th>Group I Before supplementation</th>
<th>Group I After supplementation</th>
<th>Group II Before supplementation</th>
<th>Group II After supplementation</th>
<th>Group III Before supplementation</th>
<th>Group III After supplementation</th>
<th>Group IV Before supplementation</th>
<th>Group IV After supplementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lysozyme mg/L</td>
<td>1.621±0.221</td>
<td>1.389±0.244</td>
<td>1.406±0.208</td>
<td>1.419±0.285</td>
<td>1.520±0.354</td>
<td>1.516±0.216</td>
<td>1.177±0.178</td>
<td>1.286±0.281</td>
</tr>
<tr>
<td>RBA A</td>
<td>0.434±0.034</td>
<td>0.704±0.024**</td>
<td>0.446±0.021</td>
<td>0.603±0.069**</td>
<td>0.444±0.048</td>
<td>0.631±0.027**</td>
<td>0.429±0.038</td>
<td>0.396±0.030</td>
</tr>
<tr>
<td>PKA A</td>
<td>0.704±0.029</td>
<td>0.589±0.016**</td>
<td>0.35±0.018</td>
<td>0.516±0.063**</td>
<td>0.349±0.025</td>
<td>0.547±0.026**</td>
<td>0.347±0.023</td>
<td>0.363±0.021</td>
</tr>
<tr>
<td>Con A A</td>
<td>0.453±0.028</td>
<td>0.706±0.019**</td>
<td>0.473±0.010</td>
<td>0.646±0.035**</td>
<td>0.447±0.031</td>
<td>0.601±0.010**</td>
<td>0.451±0.021</td>
<td>0.463±0.025</td>
</tr>
<tr>
<td>LPS A</td>
<td>0.360±0.015</td>
<td>0.551±0.010**</td>
<td>0.356±0.010</td>
<td>0.480±0.042**</td>
<td>0.337±0.024</td>
<td>0.480±0.038**</td>
<td>0.349±0.012</td>
<td>0.357±0.017</td>
</tr>
<tr>
<td>IL-6 pg/mL</td>
<td>63.500±40.901</td>
<td>5.557±2.104*</td>
<td>47.72±9.1177</td>
<td>5.214±1.456**</td>
<td>34.714±31.917</td>
<td>4.114±2.058</td>
<td>34.214±5.417</td>
<td>37.986±34.882*</td>
</tr>
</tbody>
</table>

Values are given as mean ± standard deviation; IU: International Units; A: absorbance; RBA: Respiratory Burst Activity; PKA: Potential Killing Activity; Con A = Concanavalin A; LPS: Lipopolysaccharide; IL-6: Interleukin-6; IL-10: Interleukin-10; *significant difference at P = 0.05; ** significant difference at P = 0.01; statistical comparison between dogs before and after therapy.

I: Yestimun; II β-hydroxy-β-methyl butyrate (HMB); III Levamisole; IV no treatment

Trial duration: 6 weeks
## Trial with dogs suffering diagnosed IBD

Changes of CIBDAI index during the study and recurrence rate – statistical comparison between dogs before and after therapy

<table>
<thead>
<tr>
<th>Group</th>
<th>CIBDAI Before immunomodulation (mean ± SD)</th>
<th>CIBDAI After immunomodulation (mean ± SD)</th>
<th>n</th>
<th>Dogs with clinical symptom recurrence (CIBDAI ≥ 4)</th>
<th>Recurrence percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>6.000 ± 1.45</td>
<td>0.914 ± 0.45**</td>
<td>7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>II</td>
<td>6.285 ± 2.12</td>
<td>1.286 ± 0.54*</td>
<td>7</td>
<td>1</td>
<td>14</td>
</tr>
<tr>
<td>III</td>
<td>6.143 ± 1.98</td>
<td>2.142 ± 0.89</td>
<td>7</td>
<td>3</td>
<td>43</td>
</tr>
<tr>
<td>IV</td>
<td>5.857 ± 1.84</td>
<td>7.142 ± 0.11</td>
<td>7</td>
<td>7</td>
<td>100</td>
</tr>
</tbody>
</table>

Mean ± SD: mean ± standard deviation; *significant difference at P = 0.05; **significant difference at P = 0.01; statistical comparison between dogs before and after therapy

I: Yestimun; II β-hydroxy-β-methyl butyrate (HMB); III Levamisole; IV no treatment

Trial duration: 6 weeks / Recurrence rate after 6 month without treatment
The approach for humans

- Dietary supplements: Stay healthy!
- Adjuvant supplements: Maintenance of immune function
- “borderline” supplementation: Balance chronic inflammation
Chronic inflammation: Overweight subjects

Clinical trial results about inflammation markers (Germany):

- 12 overweight participants, placebo-controlled, 500 mg/capsule, 3 capsules/d, 2 x 4 weeks
- Significant increase of anti-inflammatory IL-10

Publication

- Kohl et al. (2009), Nutrition Research 29 (2009), 248–254

Increased interleukin-10 but unchanged insulin sensitivity after 4 weeks of (1, 3)(1, 6)-β-glycan consumption in overweight humans

Angela Kohl¹, Özlem Gögebakan², Matthias Möhlig¹, Martin Osterhoff¹, Frank Isken¹, Andreas F.H. Pfeiffer¹, Martin O. Weickert¹

¹Department of Clinical Nutrition, German Institute of Human Nutrition Potsdam-Rehbrücke, Nutheatal, Germany
²Department of Endocrinology, Diabetes and Nutrition, Charité-University-Medicine, Berlin, Germany

Received 9 December 2008; revised 12 March 2009; accepted 12 March 2009
Chronic inflammation: Overweight subjects

Clinical trial results about inflammation and waist circumference (Thailand):

- 44 overweight participants, placebo-controlled, 477 mg/capsule, 1–2 capsules/d, 6 weeks
- Significant **reduction of waist circumference**
- Significant **reduction of blood pressure**
- Significant **increase of** anti-inflammatory IL–10 at week 2 and 6
- Significant **decrease of** pro-inflammatory IL–6 (week 6) and tumor necrosis factor–α (week 2)

Publication

- Mosikanon et al. (2017), Journal of Dietary Supplements, 14(2); 173–185
Challenge studies: Reduction of cold episodes

Clinical trial results about reduction of Upper Respiratory Tract Infections (Germany):

- 100–300 healthy adults, placebo-controlled, 900 mg/d, 16–26 weeks
- **Fewer common cold episodes** during the most intense infection season
- In cases of illness, **less severe cold symptoms**
- In cases of illness, **shorter average duration of an episode**
- **No side effects**, good self assessment

Publications

- Graubaum et al. (2012), Food and Nutrition Sciences 3, 738–746
- Stier et al. (2014), Nutrition Journal 13:38
Fewer common cold episodes

No. of episodes in the first 3 month of intake

- **Yestimun**
- **Placebo**

<table>
<thead>
<tr>
<th>No. of episodes</th>
<th>Yestimun</th>
<th>Placebo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without episode</td>
<td>13</td>
<td>7</td>
</tr>
<tr>
<td>1 episode</td>
<td>22</td>
<td>1</td>
</tr>
<tr>
<td>2 episodes</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>3 episodes</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4 episodes</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>
Decreased rate of common cold symptoms

Rate of cold symptoms on the first episode day

- Sore throat:
  - Yestimun: 65%
  - Placebo: 85%

- Croakiness:
  - Yestimun: 60%
  - Placebo: 75%

- Nose snivel:
  - Yestimun: 70%
  - Placebo: 90%
Shorter average duration of an episode

Recovery rate shown by clinical course of episodes

cold score: 0 = free of complaints, 10 = all symptoms strong complaint

Yestimun® Beta-Glucan
Good self assessment by probands

Probands self assessment on therapeutic effect

- **Yestimun Beta-Glucan**
- **Placebo**

<table>
<thead>
<tr>
<th>Self Assessment</th>
<th>Yestimun</th>
<th>Placebo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>20%</td>
<td>10%</td>
</tr>
<tr>
<td>Good</td>
<td>50%</td>
<td>30%</td>
</tr>
<tr>
<td>Moderate</td>
<td>30%</td>
<td>20%</td>
</tr>
<tr>
<td>Poor</td>
<td>10%</td>
<td>5%</td>
</tr>
</tbody>
</table>
Modell of improvement for shown benefits
Conclusion
Knowledge to take home

- Animal trials and human studies are different in terms of approach, design and desired benefit, but do have in common: **Performance** of a collective group or individual person.

- Do not believe in single or several immune-markers alone (in vitro and in vivo).

- Always look for the complete proof of efficacy, i.e. clinical endpoints or beneficial improvements shown in the same or other studies of this ingredient.
Where to find us at exhibitions?

Vitafoods Europe

Health ingredients Europe

Food ingredients Europe

Food ingredients Asia

Vitafoods Asia

Supply Side West
Thank you for your time!

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