SILO

The production area is about 30,000 square metres. The production capacity is 120,000 tons of Monoglycerides per year. SILO is the leader in the development and production of glycerides of short and medium chain fatty acids.

SILO products have been developed in scientific collaboration with:

- University of Parma - Professor Afro Quarantelli
- University of Florence - Professor M. Antongiovanni
- IRTA (Barcelona)
- Universidad Autonoma de Barcelona - Professor Rafael Codony
- Guelph University (Canada) - Professor Steve Leeson

SILO was established in 1950

SILO patented 1-Monoglycerides from C1 to C7 for treating animals

Patent n. EP 2 410 871 B1
**USAGE**

**SiLOhealth 104** is a synergistic combination of short, medium and long chain 1-Monoglycerides.

In 2009 SILO patented the use of Monoglycerides from C1 to C7 with glycerol, as antibacterial and anti-mould substances for treating animals, under the international patent number **EP2410871B1**.

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**Effects of SILOhealth 104 in broiler chickens, with dosage 0.05 - 0.1% in the feed:**
- **Salmonella**, **Clostridium perfringens** and **E.coli** control
- stimulation of villi growth and tight junctions expression
- reparation of lesions in gut mucosa caused by bacteria and intolerances
- dramatic increase of the intestinal surface for nutrients absorption

**Effects of SILOhealth 104 in broiler chickens, with dosage 0.2 - 0.3% in the feed:**
- dramatic increase of muscle mass of breast and thighs

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**SiLOhealth 104 Liquid** can be used for poultry species in dry feed (pellets or mesh) or drinking water to control dysbiosis and to increase the trophic action in the gut as follows:
- **0.05 - 0.1% in the feed** from the first day of life until slaughtering
- **0.2 - 0.3% in the feed** is the dosage to increase the breast muscle weight up to + 80 grams (data by Guelph University).
  Administration: from the first day of life until slaughtering

**SiLOhealth 104 Powder** can be used for poultry species in dry feed (pellets or mesh), to control dysbiosis and to increase the trophic action in the gut as follows:
- **0.08 - 0.2% in the feed** from the first day of life until slaughtering
- **0.35 - 0.5% in the feed** is the dosage to increase the breast muscle weight up to + 80 grams (data by Guelph University).
  Administration: from the first day of life until slaughtering

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**EFFECTS ON VILLI**

The effects of **SiLOhealth 104** on villi were measured at University of Veterinary and Pharmaceutical Sciences - Brno - Institute of Pathological Morphology, by Prof. MVDr. Roman Halouzka.

In the scientific trial, broiler chickens received 0.2% of product in drinking water during the first 15 days of life. The effects on villi growth were measured in different tracts of the gut and compared with a control group.

<table>
<thead>
<tr>
<th>Tract</th>
<th>Control</th>
<th>SILOhealth 104 0.2%</th>
<th>Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meckel's diverticulus</td>
<td></td>
<td></td>
<td>+35.8%</td>
</tr>
<tr>
<td>Central ileum</td>
<td></td>
<td></td>
<td>+26.3%</td>
</tr>
<tr>
<td>Ileocaecal valve</td>
<td></td>
<td></td>
<td>+7.8%</td>
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</tbody>
</table>

Comment of Prof. Halouzka:
“The results show, and you can see it clearly, that the height of villi in some chicken groups increases towards the large intestine, which is surprising”
**SILOhealth 104**

**NUTRITIONAL PROPERTIES**

SILOhealth 104 is the result of numerous studies conducted in scientific collaboration with Guelph University (Prof. S. Leeson) and the Public Animal Health Institute “Bruno Ubertini” (Italy).

SILOhealth 104 directly stimulates the beneficial formation of new blood vessels in the intestinal epithelium due to specific short chain monoglycerides in the formula. New blood vessels are able to transport more nutrients to the intestinal epithelium and to stimulate the gut development and integrity.

**The effects are:**

- villi growth
- reparation of lesions in gut mucosa
- stimulation of tight junctions expression
- dramatic increase of the intestinal surface for nutrients absorption
- energy delivery to colonocytes

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**IN VITRO STUDIES CONDUCTED BY THE PUBLIC INSTITUTE FOR ANIMAL HEALTH “BRUNO UBERTINI”**

It is known that free organic acids and their salts like Sodium and Calcium Butyrate have a very limited antibacterial efficacy at pH 6 or 7 (intestinal pH) since at neutral or slightly alkaline pH they are present in dissociated form. On the contrary, the 1-Monoglycerides contained in SILOhealth 104 do not dissociate and exert a strong antibacterial action against *E. coli*, *Salmonella* and *Clostridium perfringens*.

<table>
<thead>
<tr>
<th>Public Animal Health Institut of Brescia and Forlì - L. Alborali, G. Tosi</th>
<th>MIC of SILOhealth compared to organic acids &amp; sodium butyrate</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>Salmonella typhimurium</td>
</tr>
<tr>
<td>----</td>
<td>------------------------</td>
</tr>
<tr>
<td>SILOhealth 104 4.5</td>
<td>0.06%</td>
</tr>
<tr>
<td>SILOhealth 104 7</td>
<td>0.06%</td>
</tr>
<tr>
<td>Formic Acid 6</td>
<td>1.5%</td>
</tr>
<tr>
<td>Propionic Acid 6</td>
<td>2.4%</td>
</tr>
<tr>
<td>Sodium Butyrate 6</td>
<td>2.8%</td>
</tr>
</tbody>
</table>

The trials *in vitro* carried out by the Public Institute for Animal Health “Bruno Ubertini” - Italy proved that the MIC (Minimum Inhibitory Concentration) of SILOhealth 104 L at pH 6-7 ranges between 0.06% e 0.12% against *Salmonella*, *E.coli* and *Clostridium perfringens*, while beneficial *Lactobacillus* in not inhibited.
The inclusion of SILOhealth 104 liquid in the feed reduced by $6 \log_{10}$ the CFU amounts of Salmonella typhimurium in the birds caeca even in presence of high Salmonella typhimurium infection. This trial support the use of SILOhealth 104 liquid from early age to prevent Salmonella colonization.

**Trials Conducted by the Public Institute for Animal Health “BRUNO UBERTINI” Forlì - ITALY.**

**BROILER CHICKENS EXPERIMENTALLY INFECTED WITH SALMONELLA**

**Trial design:** 60 SPF birds were allotted to two groups and placed into isolators (30 birds per group). All the birds were orally infected with $10^7$ CFU of Salmonella Typhimurium at the 7th day of age. The control group received a standard commercial feed; the treated group received the same feed supplemented with 0.3% of SILOhealth 104 liquid from day 1 to day 34 in the feed. 10 birds from each group were sacrificed at day 14, 24, 34; caecal samples were analyzed for CFU amount of Salmonella typhimurium after 24 hours incubation at 37°C.

**S. typhimurium CFU counts in the caecal content of the birds**

<table>
<thead>
<tr>
<th>Days of Life</th>
<th>Control</th>
<th>SILOhealth 104</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 7 post-infection (14 days of life)</td>
<td>6,400,000</td>
<td>2,226,000</td>
</tr>
<tr>
<td>Day 17 post-infection (24 days of life)</td>
<td>25,120,000</td>
<td>1,242,100</td>
</tr>
<tr>
<td>Day 27 post-infection (34 days of life)</td>
<td>22,490,000</td>
<td>1,242,100</td>
</tr>
</tbody>
</table>

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**BROILER CHICKENS EXPERIMENTALLY INFECTED WITH EIMERIA OOCYTES AND CLOSTRIDIUM**

**Trial design:** 3 groups of Ross 308 (female); 30 birds per group, in isolators; no coccidiostatics in feed, no anticoccidial vaccination were used. Oral individual challenge: at day 5th of life each bird was challenged with 3000 sporulated oocysts of E. acervulina, maxima, tenella; at day 10th–11th of life each bird was challenged with $10^8$ CFU of C. perfringens. At day 16th – 21st – 35th 10 birds per group were sacrificed and analyzed for C. perfringens and coccidiosis intestinal lesion score.

**Conclusions**

The administration of SILOhealth 104, even at the low dosage of 0.025%, prevented the Clostridium perfringens colonisation and lesions in the gut. As shown in the histogram, the SILOhealth 104 groups do not show any lesion or very mild lesions, while the control group shows severe lesion score, corresponding to focal necrosis. Furthermore, in the control group a mortality of more than 6% was recorded, while no mortality was observed in the SILOhealth 104 group.
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**S. typhimurium** CFU counts in the caecal content of the birds

![Graph showing CFU counts in the caecal content of the birds](image)

**Infection with $10^7$ CFU**

**Reduction by 6 log$_{10}$**

**P = 0.02**

(Two-way ANOVA)

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<table>
<thead>
<tr>
<th>Treatments in feed (Days)</th>
<th>0 – 10</th>
<th>11 – 21</th>
<th>22 – 35</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive Control</td>
<td>=</td>
<td>=</td>
<td>=</td>
</tr>
<tr>
<td>Group 1: SILOhealth 104</td>
<td>0.5%</td>
<td>0.25%</td>
<td>=</td>
</tr>
<tr>
<td>Group 2: SILOhealth 104</td>
<td>0.5%</td>
<td>0.025%</td>
<td>=</td>
</tr>
</tbody>
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*Means with different superscripts differ significantly; p<0.05*

**Score 1:** thin / friable walls; **Score 2:** focal necrosis

**Clostridium perfringens lesion score in the small intestine**

![Graph showing lesion score in the small intestine](image)

**Conclusions**

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