Piglet Livability as KPI and how to Influence

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Cargill Animal Nutrition

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Piglet Livability

1. What is “Piglet Livability”?

2. Factors influencing Piglet Livability

3. Nutritional strategies for improving piglet livability

4. Take home messages
What is “Piglet Livability”?

Piglet Livability
Giving piglets the best start in life
What is Piglet Livability?

**DEFINITION**

**PIGLET LIVABILITY**

Livability =

Percentage of new born piglets that a sow can raise until weaning

Driven by

Stillborn piglets and pre-weaning mortality
What is piglet livability?

CALCULATION

Livability \(\% = \frac{100\% - (#\text{ Stillborn} + #\text{ Pre-Wean Mortality})}{#\text{ Total Born}}\)
What is piglet livability?

EXAMPLE OF CALCULATION

<table>
<thead>
<tr>
<th>Total born piglets</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stillborn piglet per litter</td>
<td>1,2</td>
</tr>
<tr>
<td>Live born piglets</td>
<td>13,8 (15 - 1,2)</td>
</tr>
<tr>
<td>Pre-weaning mortality</td>
<td>12%</td>
</tr>
</tbody>
</table>

\[
\text{Livability (\%)} = 100\% - \frac{1,2 + 13,8 \times 0,12}{15}
\]

\[
\text{Livability (\%)} = 81,0\%
\]
Global Market Trends Toward Larger Litters, Rising Mortality

**LARGER LITTERS**
Upward trend, particularly in more mature production markets
*(over 5-year timeframe, several regions gaining 1.5+ piglets per litter)*

**MORE STILLBORN DEATHS**
Percentage of stillborn climbing along with rising litter size

**HIGHER PRE-WEAN MORTALITY**
Smaller piglets, more piglets fighting for milk
Livability around the world

Key swine countries reported average piglet livability rate of 83%

Global trend toward larger litter sizes will continue as pork production matures – increasing risk of mortality

Highest number of stillborn reported at 1.5 per litter, highest pre-wean mortality at 17%

Source: Cargill Research 2015
A growing issue

Average Livability over the last 20 years in the Netherlands.
(Source; “Kengetallenspiegel” Agrovision)

- **LARGER LITTERS**
  Global trend toward larger litter sizes

- **MORE PIGLET STILLBORNS**
  3–8% of total born are stillborn

- **HIGHER PRE-WEAN MORTALITY**
  10–20% of piglets are lost before weaning
Factors influencing Piglet Livability
Piglet livability concept map

Lactation

Farrowing

Gestation

Main parameters of interest

Main drivers

Source: Cargill Research
The physiology behind a stillborn piglet

- Premature attachment of the placenta
- Lack of oxygen in maternal blood.
- Gas exchange and blood flow
- Long farrowing process
- Loss of umbilical cord functionality
The physiology behind pre-weaning mortality

Pre-weaning mortality

Metabolic risk
- Immature piglet
- Sow behavior
- Hypothermia
- Insufficient feeding

Infectious risk
- Respiratory disease
- Diarrhea
- Colostrum
- Hygiene level

Piglet vitality

Early lactation on set
Nutritional strategies for improving piglet livability

Some concepts
3 critical moments in the sow cycle

1. WOI
   - Embryo quality
   - Piglet uniformity
   - Piglet vitality

2. Farrowing
   - Birth weight
   - Piglet vitality
   - Lactation start

3. Piglet early nutrition
   - Litter growth
   - Piglet health
   - Early feed intake

Gestation

Weaning

Lactation
Anti-oxidant concept
Late gestation

HIGH OXIDATIVE STRESS

Oxidative stress during late gestation and farrowing

Adapted from Mahan, 2007
ProviOx / AOX, polyphenols help to regenerate vitamin E

Polyphenols help to regenerate vitamin E

adapted from R. Bouwstra, and Nwose et al., 2008
Antioxidants improved birth weight and weaning weight

Source: Trial at University of Warmia and Mazury in Poland
Number of weaned pigs tends to be increased with Antioxidants

Source: Trial at University of Warmia and Mazury in Poland
Similar benefits were observed from internal trial, Proviox / AOX in gestation tends to improve piglet livability and birth weight (+2%).

- Vitamin E was added at 60 mg/kg; Proviox/ AOX was added on top of vitamin E, at 120 mg/kg to provide 60 mg/kg vitamin E equivalence.
- Gestation diet was fed from d 85 to farrowing
- Trial conducted at SIC (22L)

Source: Cargill Research
Piglet birth weight

→ HIGHER LIVABILITY FOR PIGLETS >1000 G AT BIRTH

Source: N Quiniou, 2016
Optimize sow body condition
## Ideal backfat for sows?

<table>
<thead>
<tr>
<th>Backfat thickness, mm</th>
<th>≤ 14</th>
<th>15-17</th>
<th>18-20</th>
<th>21-23</th>
<th>≥24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth weight, kg/litter</td>
<td>21.8</td>
<td>21.6</td>
<td>22.8</td>
<td>25.1</td>
<td>23.3</td>
</tr>
</tbody>
</table>

*Quiniou (2016)*
Late gestation
SOW MOBILIZE 1 MM BACKFAT FOR PIGLET GROWTH BEFORE FARROWING

108 days gestation

-1 MM BF

Farrow

Weaning

108

108

108

108

W

F

W

W

W

(Cargill research)
Late gestation
SOW MOBILIZE 1 MM BACKFAT FOR PIGLET GROWTH BEFORE FARROWING

108 days gestation
LARGE LITTERS UP TO - 3 MM BF

(Cargill research)
Ideal backfat for sows?

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<td>25.1</td>
<td>23.3</td>
</tr>
<tr>
<td>Weaning weight, kg/piglet</td>
<td>8.14</td>
<td>8.62</td>
<td>9.15</td>
<td>8.67</td>
<td>8.68</td>
</tr>
<tr>
<td>Average daily gain, kg/d/litter</td>
<td>2.98</td>
<td>3.15</td>
<td>3.20</td>
<td>3.23</td>
<td>3.10</td>
</tr>
<tr>
<td>Feed intake, kg/d</td>
<td>8.26</td>
<td>7.51</td>
<td>7.47</td>
<td>6.78</td>
<td>5.33</td>
</tr>
</tbody>
</table>

The best compromise in this herd, with a 4-wk lactation period.

Backfat and livability: Farrowing length influenced

OPTIMIZING SOW BODY CONDITION REDUCES THE DURATION OF FARROWING

(Oliviero et al. 2010)
Farrowing length influenced by backfat

OPTIMIZING SOW BODY CONDITION REDUCES THE DURATION OF FARROWING

(Oliviero et al. 2010)
Farrowing length and birth interval influence Livability

FARROWING DURATION - MAJOR CAUSE OF STILL BORN PIGLETS

(Van den Bosch et al., unpublished)
Optimal backfat

- Long farrowing
- Low feed intake in lactation
- Low colostrum yield

SOW BODY FAT (BF, mm)

Prolonged farrowing's

Normal farrowing's

300 min
Optimal backfat

- Low birth weight
- Low milk yield
- Low persistency
- Long WEI
- Long farrowing
- Low feed intake in lactation
- Low colostrum yield

SOW BODY FAT (BF, mm)

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Optimize fiber
Fiber – Why important?

A HIGH DIVERSITY OF COMPONENTS

Diagram showing the breakdown of dietary carbohydrates and dietary fiber.
Fiber – Why are they so important?

FIBER FRACTIONS CAN BE FERMENTED TO VARIOUS DEGREE IN THE INTESTINE

Dietary carbohydrates

<table>
<thead>
<tr>
<th>Digestible carbohydrates</th>
<th>Dietary fibre (non-digestible carbohydrates and lignin)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starch and sugars</td>
<td>Resistant starch</td>
</tr>
<tr>
<td></td>
<td>Non-digestible oligosaccharides</td>
</tr>
<tr>
<td></td>
<td>NSP</td>
</tr>
<tr>
<td></td>
<td>Pectins</td>
</tr>
<tr>
<td></td>
<td>Fructans</td>
</tr>
<tr>
<td></td>
<td>NDF</td>
</tr>
<tr>
<td></td>
<td>Hemi-cellulose</td>
</tr>
<tr>
<td></td>
<td>ADF</td>
</tr>
<tr>
<td></td>
<td>Cellulose</td>
</tr>
<tr>
<td></td>
<td>ADL</td>
</tr>
<tr>
<td></td>
<td>Lignin</td>
</tr>
</tbody>
</table>

Fermentable

Non Fermentable
Fiber is important influencer of fecal score

1 – Hard small balls
2 – Softer than 1 but still some balls
3 – Large stools can easily be compressed
4 – Soft stools
5 – Very Loose (Goes thru slats)
Fecal score has correlation with Livability

- Stillborn
- Preweaning mortality
- Linear (Stillborn)
- Linear (Preweaning mortality)

Fecal score:
1 – Hard small balls
2 – Softer than 1 but still some balls
3 – Large stools can easily be compressed
4 – Soft stools
5 – Very Loose (Goes thru slats)

Source; Cargill Research 2016
Nitric Oxide manipulation
Athletes commonly use beetroot juice with has nitrates that convert to nitric oxide. This molecule enhances blood vessel dilation, increasing oxygen and blood flow.

The Livapig™ Concept

Patent pending Nitric Oxide booster

NITRIC OXIDE INCREASES OXYGEN AND BLOOD FLOW

• Induce vasodilation — relax smooth muscle cells lining blood vessels
• Increase farrowing efficiency — shorten duration and reduce sow fatigue
The Concept fits the biology

Umbilical cord blood

- pH ↑
- $pO_2$ ↑
- $pCO_2$ ↓
- Lactate ↓

Stillbirth ➔ Asphyxia ➔ Piglet vitality ➔ Birth weight

- Early mortality

Breaking umbilical cord ➔ Placental blood flow ➔ Delivery of oxygen and nutrients

Placental efficiency

Exercise efficiency ↑ ➔ Duration farrowing process ➔ Fatigue

- Power of contractions
- Vascula-risation
- Size

Angiogenesis ➔ Vasodilation ↑ ➔ Exercise efficiency ↑

Livapig™

- NO in sow’s blood ↑
- Confirmed in trial
- Not able to measure in trials
- Not found in trials

Birth weight

The Concept fits the biology
Asphixia: an important factor for Livability

(Van den Bosch et al., unpublished)
Evidence

Maternal Livapig™ supplementation increases piglet livability by 1.5%

- 0.5
Stillborn

1.5%
Livability

Cargill Research van den Bosch et.al. Pending publication
Take home messages
Take home messages

- Livability is an important KPI especially in hyper prolific sows.

- Increasing Livability leads to:
  - Higher profit
  - Animal health
  - Improved animal welfare
  - Improved sustainability

- Livability performance is multifactorial and thus complex

- Proven nutritional interventions influencing Livability are:
  - Feeding for optimal body condition of the sow
  - Mitigation of oxidative stress
  - Optimizing stool quality of the sow
  - Manipulation of Nitric Oxide in the blood
Thanks for your attention
Appendix/spare slides
Transition feeding around farrowing

- Essential amino acids, fatty acids and antioxidants ProviOx to support late embryo development and colostrum yield
- Support birth process and early lactation via improved sow energy metabolism
- Balance electrolytes and fermentable fiber to help sow comfort and stimulate lactation onset
- Formulated with Cargill Nutrient System
2) Transition feeding around farrowing

Birth weight

Livability

+40g birth weight

+0.75 piglets per sow per year

(Cargill research, CSIC 22L -2015, CSIC 25L-2016)
The transition period
KEY DRIVER FOR PIGLET LIVABILITY

- 10 days
Late gestation
Sow body condition
Colostrum production
Mammary & Fetus growth

+5 days
Farrowing
Birth process
Milk yield onset
Sow behavior

Early lactation

→ Piglet livability
Why it matters

Impact on animal welfare.

- Crushed (17%)
- Splay legs (4%)
- Starvation (17%)
- Starve out (3%)
- Lameness (1%)
- Other/Unknown (11%)
- Weak (9%)
- Low birth weight (9%)
- Stillborn (29%)

Distribution of cause of death in a trial in which technicians were not allowed to ‘save’ piglets. Contains data of 350 sows. (Cargill Research Sterksel 2015)