Effect of PhytriCare® IM supplementation on reproductive performance of sows and growth of suckling piglets

Swine F&F 14160
Evonik trial 42.64.22001
Conducted in Hungary

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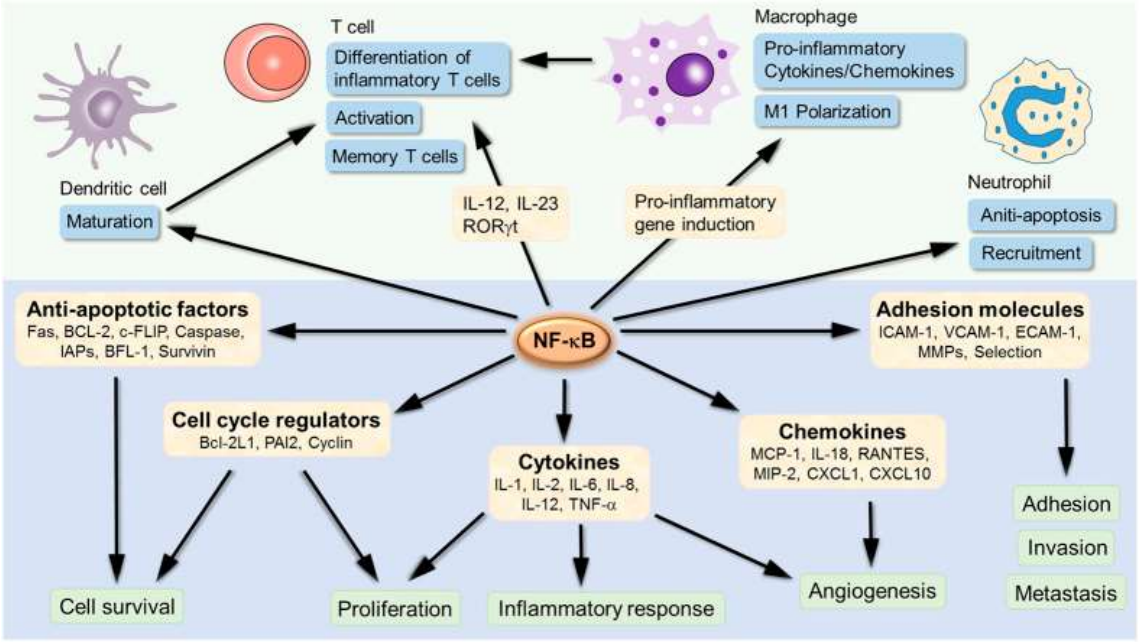
Introduction

- One of the biggest problems in swine industry - **Maintenance of highly productive and healthy sows** (Niemi *et al.*, 2017).
- Modern hyperprolific sows are highly susceptible to **metabolic disorders and systemic inflammation during the periparturient period**, which negatively affects reproductive and litter performance (Kaiser, *et al.*, 2018a,b, Martineau *et al.*, 2013).
- **Farrowing – Most critical phase in pig production**. Farrowing difficulties or reduced milk production can result in higher pre-weaning piglet losses (Peltoniemi *et al.*, 2015).
- **Resolution of inflammation and stress** needs to happen quickly to ensure good reproductive health during periparturient period (Bjorkman *et al.*, 2022).
- Reducing inflammation would be beneficial to avoid inflammatory-induced physiological and behavioral changes such as illness, pain, fatigue and anorexia, which may affect the sow's ability to provide for the piglets and thus impact welfare of both sow and piglets. (Kaiser *et al.*, 2018a).

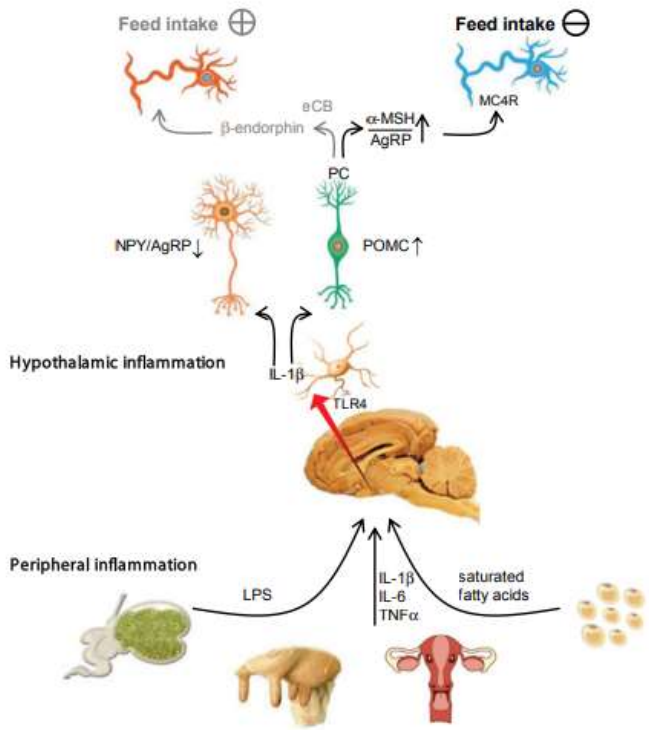
Mechanism of inflammation

- Inflammation is a biological response of the immune system triggered by various factors, including damaged cells and pathogens, and toxic compounds (Chen *et al.*, 2018).
- The transcription factor NF-κB regulates both innate and adaptive immune functions. After its activation, it can activate transcription of various genes and thereby regulate inflammation.
- NF-κB target inflammation not only directly by increasing the production of inflammatory cytokines, chemokines, and adhesion molecules, but also regulating the cell proliferation and cell death (Chen *et al.*, 2018).
- The cell response associated immune response itself requires energy.
- Several compounds can inhibit the NF-κB transcription factor and hereby reduce immune response and save energy cost for the animals.



Mechanism of inflammation through the transcription factor NF-κB (Liu *et al.*, 2017).

Inflammatory bio-markers



Inflammatory bio-markers

1. **Tumor necrosis factor alpha (TNF-)** is a cytokine identified as a major regulator of inflammatory responses The inappropriate or excessive activation of TNF- signaling is associated with chronic inflammation (Jang *et al.*, 2021).
2. Acute phase proteins such as **haptoglobin (Hp)** are known indicators of an activated innate immune system and can be used as an indicator of inflammation (Virpi *et al.*, 2021).
3. **Fecal calprotectin** is largely applied as a non-invasive intestinal inflammation biomarker (Barbosa *et al.*, 2021)
4. **Faecal myeloperoxidase (MPO)** as a biomarker of inflammatory response in the gut of Mammals (Niewold, 2015).

Hypothesis and objective

Hypothesis:

If inflammation around the time of farrowing is controlled, less energy will be required to balance inflammation and it will result in higher energy availability for production/growth.

Objective:

To evaluate the effect of PhytriCare® IM supplementation during the last five days of gestation until end of lactation on reproductive performance of sows and growth performance of suckling piglets.

Trial design

Animals:	20 sows (Topigs TN-70 x DanAvl Duroc)
Replicate:	10 replicates (5 multiparous sow and 5 first-parity sows)/treatment
Diet type	Corn-Wheat-Barley based and in mash
Trial duration	5 days before farrowing until weaning (26 days of lactating) = total feeding period is 31 days
Treatments	1) Lactating sow diet 2) Lactating sow diet + 0.4 kg/ton Phytricare® IM
Location	Hungary

A.L.M. Farm in Barcs-Somogytarnóc, Hungary

Measurements and data analysis

Procedures	• Blood samples were collected (without fasting; absorptive phase) from the jugular vein of all sows on d3 – d5 of lactation to analyze for TNF-α and haptoglobin using porcine specific ELISA kits. • Fecal samples were collected from all sows at d 21 of lactation to analyze fecal myeloperoxidase (MPO) and calprotectin concentrations (inflammation biomarkers) using ELISA kit.
Measurements	• **Sow performance:** Sow body condition score, litter size (born alive and born dead), mortality/removal of sows, Health parameters e.g. number of shows suffering from lameness, Mastitis, Metritis, Agalactia (MMA) • **Piglet performance**: BW (at birth and weaning), litter weight gain, average daily gain (ADG) of piglets, and pre-weaned mortality
Statistical analysis	Data was analyzed by ANOVA using Proc Mixed of SAS and reported as least squares means. The model included treatment and parity as fixed effects, and the sow was the experimental unit. Differences were considered significant if $P < 0.05$ and were described as tendencies if $0.05 < P < 0.10$ using the LSMEANS statement.

Ingredient compositions of experimental diets (%, as-fed)

Ingredients	Control	Phytricare® IM
Barley	28.00	27.96
Wheat	16.50	16.50
Corn	27.00	27.00
Corn germ	4.50	4.50
Malt germ	8.00	8.00
Dried beet pulp	2.00	2.00
Extracted soybean meal	8.00	8.00
Lactation sow premix	5.00	5.00
Phytricare® IM	0.00	0.04
Others	1.00	1.00

Lactation sow premix includes:

- L-Lysine.HCl: 78.3 g/kg
- DL-Methionine: 17.5 g/kg
- L-Threonine: 42.4 g/kg
- L-Tryptophan: 8.02 g/kg
- L-Valine: 5.65 g/kg
- L-Arginine: 7.54 g/kg
- Phytase: 1.00 g/kg
- NSP enzyme: 2.00 g/kg
- Vitamins and minerals

Nutrient compositions of experimental diets (%, as-fed)

	Control	Phytricare® IM
DM	88.6	88.5
CP	14.3	14.3
Crude fat	4.5	4.5
Crude fiber	5.1	5.1
SID amino acids, %		
Lys	0.84	0.84
Thr	0.58	0.58
Met	0.26	0.26
Met + Cys	0.46	0.46
Trp	0.16	0.16
Val	0.53	0.53
Ile	0.43	0.43
Arg	0.67	0.67
NE, MJ/kg	10.45	10.45
NE, kcal, kg	2,498	2,498

Performance results

Trial number 42.64.22001
Hungary

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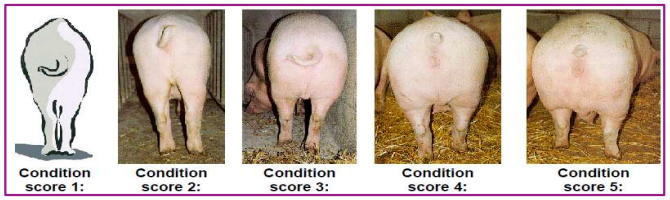
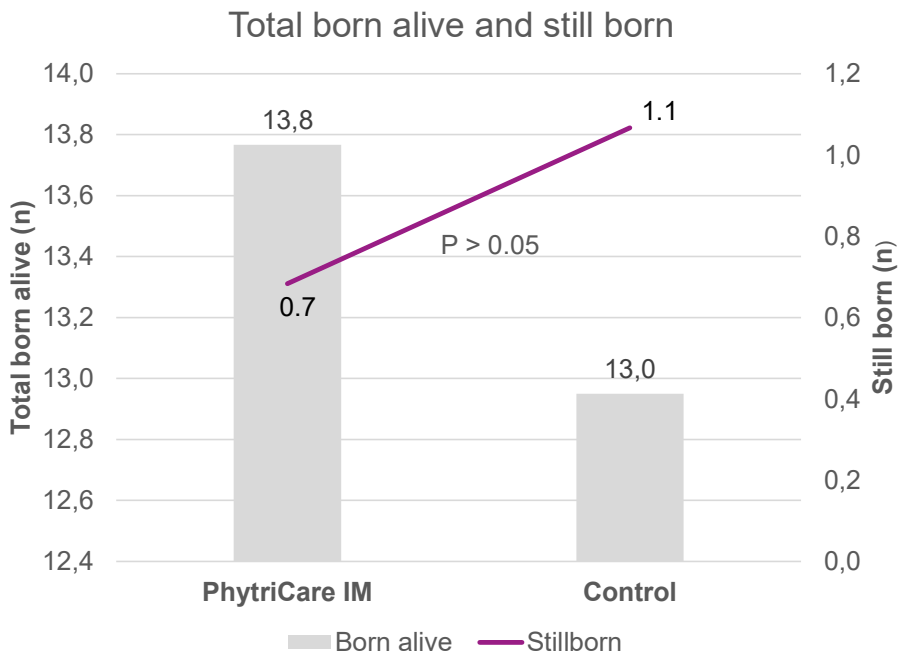
Effect of PhytriCare® IM supplementation on reproductive performance of lactating sows

	Body Condition d0	Body Condition d30	Δ d0 – d30
Phytricare IM	3.5	2.9	-0.6
Control	3.4	2.7	-0.7
SEM	0.100	0.134	0.126
P-values			
Treatment Pr > F	0.390	0.369	0.782



Body Condition Scoring for Sows



- Body condition score and number of piglets born were not different (P>0.05).
- No interaction (treatment x parity) was observed except for total born alive (tendency; P=0.07).

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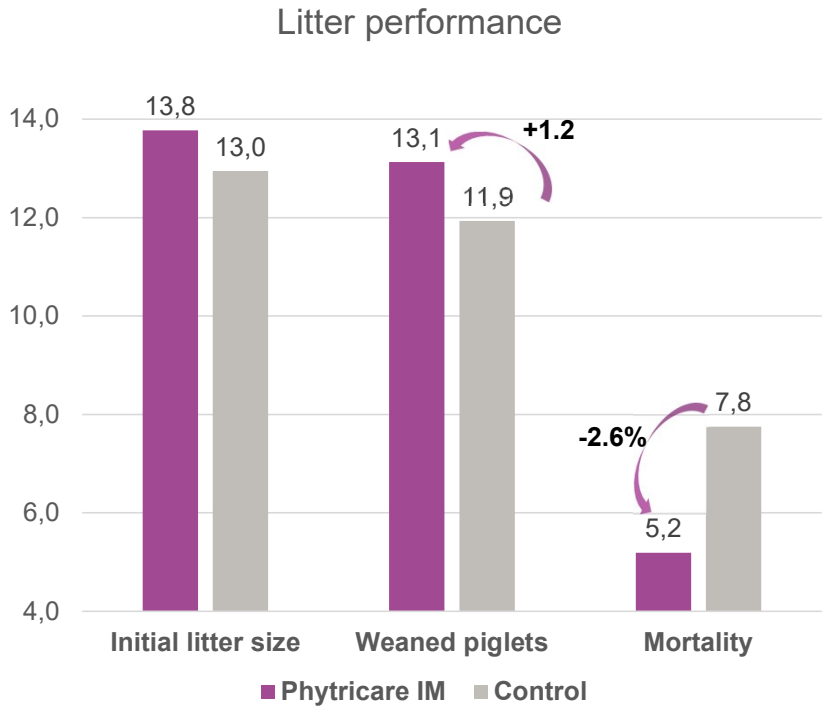
Effect of PhytriCare® IM supplementation on litter performance

	Initial litter weight, kg	Final litter weight, kg	Litter weight gain, g/d	Adj litter weight gain, g/d
PhytriCare IM	21.05	102.7	3052	3133
Control	18.60	90.94	2857	2803
SEM	0.976	5.118	166.4	149.9
P-values				
Treatment Pr > F	*0.093*	0.121	0.417	0.137

- Although statistically not significant (P>0.05), sows fed PhytriCare IM diet resulted about 12 kg more litter weight (+ 13% increase) at weaning.
- Similarly, sows fed PhytriCare IM diet produced +1.2 more weaned pigs and -2.6% less pre-weaning mortality compared with control, although statistically not different (P>0.05).
- Interaction effect (treatment x parity) was observed only for litter weight gain (P<0.05).



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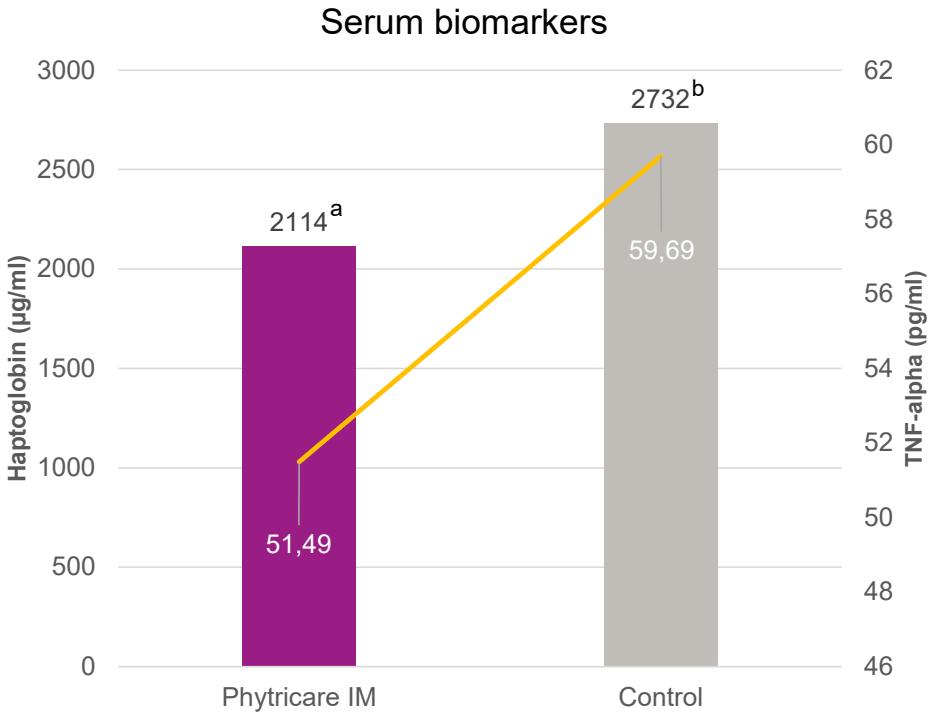
Effect of PhytriCare ® supplementation on serum and fecal biomarkers

	Fecal samples	
	Calprotectin (ng/ml)	Myeloperoxidase (ng/ml)
Phytricare IM	76.51	226.69
Control	74.04	124.96
SEM	1.381	70.427
P-values		
Treatment Pr > F	0.224	0.322



- Fecal Calprotectin and Myeloperoxidase concentration was not affected.
- PhytriCare supplementation reduced serum concentration of haptoglobin (-29%).
- Although statistically not significant (P>0.05), PhytriCare supplementation reduced serum concentration of ÍNF-alpha (-16%).

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Conclusions

- PhytriCare® IM in sow diet during late gestation and lactation increases number of born alive and weaned pigs, reduces pre-weaning mortality and increases litter weight at weaning.
- PhytriCare® IM addition decreases serum haptoglobin concentration which indicates improved systemic inflammatory status of the sows.
- The main mode of mechanism of PhytriCare® IM is by suppressing the inflammatory response which in turn reduces the need of energy requirement for the production of immune cells and fever and several hormonal changes associated with inflammation.
- PhytriCare® IM supplementation in late gestation and lactation diets increases the profitability of the sow operation.

Overall, the supplementation of Phytricare® IM to the feed of lactating sows decreases in the inflammatory biomarker haptoglobin in serum and increases number of weaned pigs, litter weight at weaning.

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