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Aleta™: an immune modulator in sows and their piglets

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Key Conclusions

Aleta™ supplementation of sows and their piglets induced immune modulating effects, such as:

- **a decrease of haptoglobin (=acute phase protein, a biomarker of inflammation) in the serum of piglets, demonstrating an alleviation of inflammation**
- **a shift in T-cell population: more effector (active) cells and less progenitor (naive) cells in serum of piglets, showing a more mature immune system and activated cell-mediated immune response**
- **an increase of IgA in piglet serum**

This confirms that supplementation of the sow is important for the health of her piglets.

INTRODUCTION

In pig production, the period following weaning is especially associated with stress and accompanying digestive disorders and growth performance depression. During this period, antibiotics and minerals (ZnO and $CuSO_4$) were often included in diets to control post-weaning diarrhea and optimize growth performance. There is, however, an increasing regulatory and consumer pressure to reduce therapeutic antibiotic usage in animal production due to concerns on antibiotic resistance. The inclusion of minerals in the diet is also under pressure due to concerns on environmental accumulation. Therefore, alternatives such as natural immune modulators are gaining traction in the industry.

β-glucans are known immune modulators, and have been demonstrated to stimulate specific and non-specific immune responses, and as such increase resistance to infections and diseases. β-glucans are typically found in the cell walls of yeast and fungi as β-(1,3)-glucan with β-(1,6)-glucan side branches. Another, rather new source of β-(1,3)-glucan is the unicellular alga *Euglena gracilis*.

This organism produces β-(1,3)-glucan as an energy store in its cytoplasm. In the animal's body, immune cells like macrophages and dendritic cells can recognize β-glucan structures by cell surface receptors such as dectin-1. In response to binding β-glucan, immune cells will become more active in engulfing, killing and digesting invading pathogens and will initiate a signaling cascade stimulating the attraction, formation and activation of other immune cells. The aim of the current research was to investigate whether supplementing sows and/or their piglets with β-(1,3)-glucan obtained from *Euglena gracilis*, Aleta™, had a positive effect on the performance and immune status of sows and their piglets.

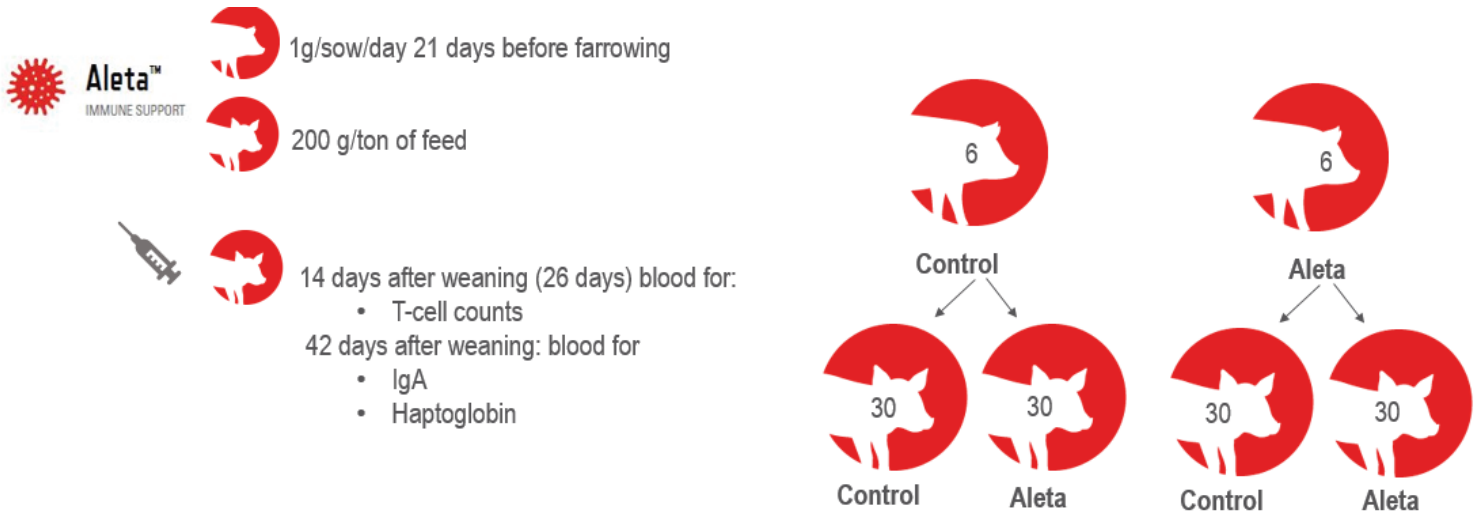
KEYWORDS

Aleta™, sow, piglet, IgA, T-helper cell, haptoglobin, cell mediated immunity, inflammation

MATERIAL AND METHODS

This trial was performed at the research and education institute for agriculture in Belgium (Fig. 1). Six sows (Topigs 20) were supplemented with Aleta™ (1g/sow/day) 3 weeks before and throughout lactation (26 days). The negative control group (not supplemented) was composed of 6 non-supplemented sows. The piglets (Topigs 20 x Piétrain) of supplemented and non-supplemented sows were divided into a supplemented (200 g/T Aleta™) and a non-supplemented piglet group, resulting in 4 groups (30 piglets/group). Piglet performance starting from weaning until six weeks after weaning was monitored. Blood was taken from the piglets at 14 and 42 days after weaning and analyzed for T-lymphocyte counts, and haptoglobin plus IgA respectively.

Fig. 1. Trial set-up



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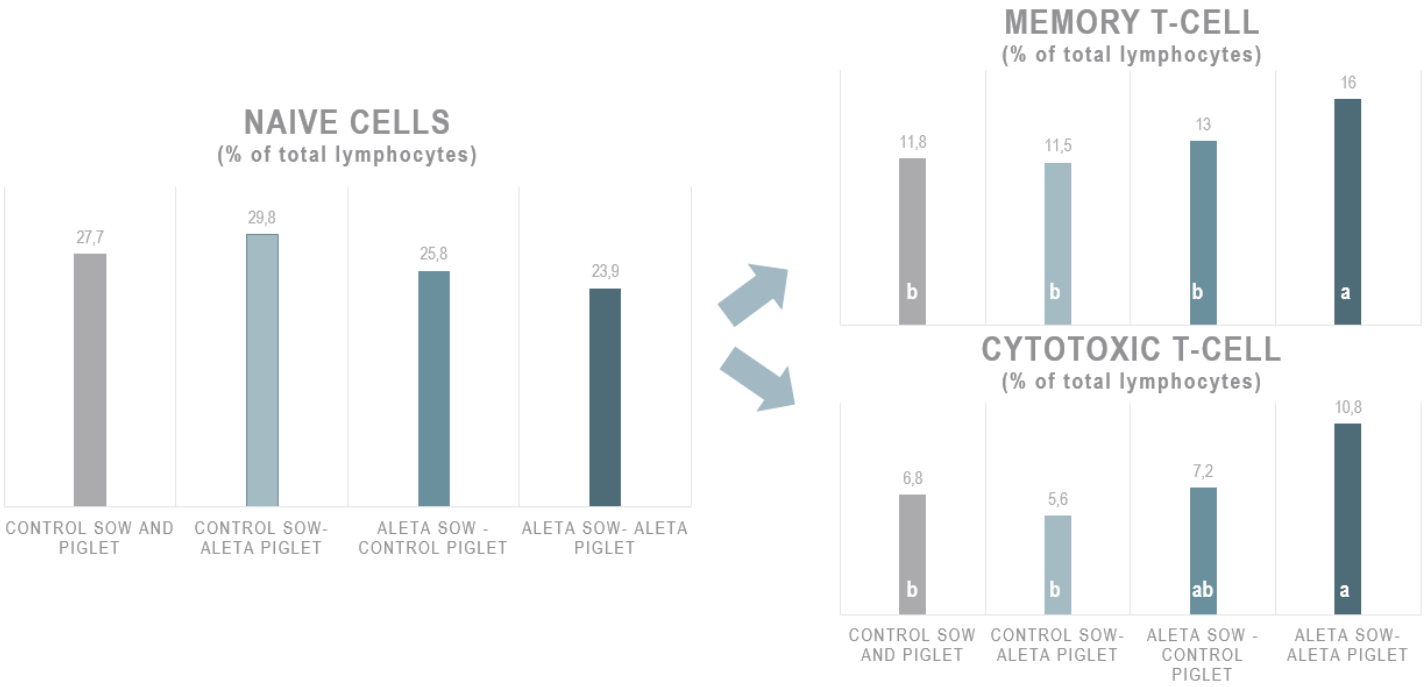
RESULTS AND DISCUSSION

The quantification of different immune cells in piglet blood can be found in graph 1. Two weeks after weaning an increased population of memory T-cells[1] and cytotoxic T-cells[2], and a decreased population of progenitor or naïve T-cells after feeding Aleta™ to both the sow and the piglet (and smaller differences when only fed to the piglet) was observed. These results show an increased lymphocyte proliferation and activity, consequently leading to a more mature immune system and active cell mediated immunity in Aleta™ fed animals.

[1] Memory cells respond to antigens by producing cytokines (IFN-γ, IL-2) and stimulating immunoglobulin production by porcine B-cells
[2] cytotoxic T-cells respond to antigenic stimulation by proliferating, secreting cytokines (IFN-γ, TNF-α) and killing target cells such as cells infected with a virus.

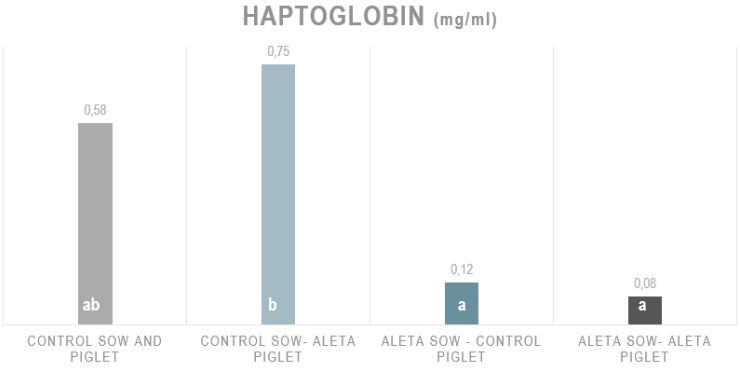
Graph 1. Quantification of different immune cells (cell-mediated immunity) in piglet blood



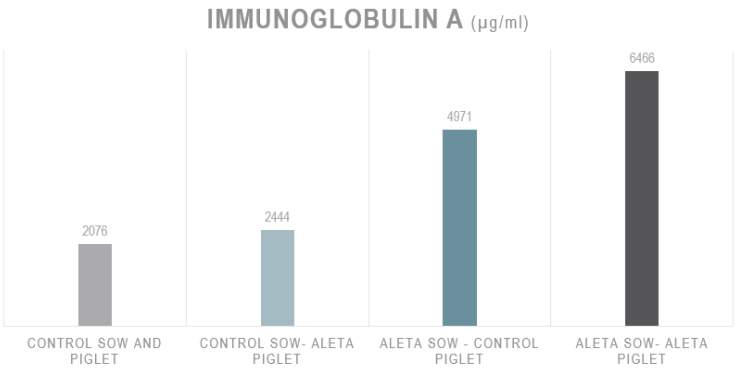
A significantly lower concentration of haptoglobin was observed in the piglets originating from supplemented sows at 6 weeks after weaning (Graph 2). Haptoglobin is a marker for inflammation, as it is one of the major acute phase proteins in pigs and has been used to identify clinical and subclinical diseases. A low haptoglobin concentration indicates a lower inflammatory cytokine production. These observations reveal the immune modulating effect of Aleta™ and demonstrate that algal β-glucan does not cause chronic inflammation but helps to maintain immune homeostasis and can even have an anti-inflammatory function in the absence of a challenge.

An increase in serum IgA concentration in piglets supplemented with Aleta™ 6 weeks after weaning could be measured (Graph 3). IgA has both pro- and anti-inflammatory properties that contribute to maintaining immune homeostasis under normal health conditions.

Graph 2. Haptoglobin levels in piglet blood.

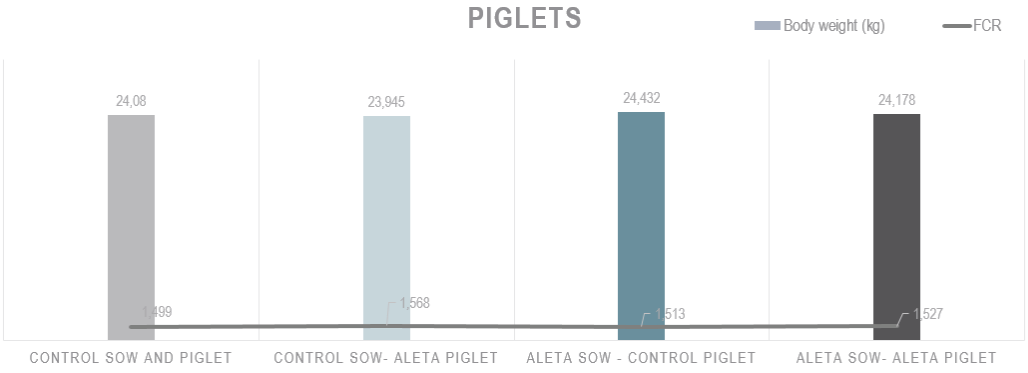


Graph 3. IgA levels in piglet blood



Piglet performance (final body weight and FCR) after weaning was not affected by feeding Aleta™; this was expected as, in the clean research institute environment, there was a lack of challenge or other stressor. These results show that Aleta™ 's immune modulating effects have no negative effect on performance, which is often feared in case of use of immune modulating ingredients.

Graph 4. Performance (FCR and body weight) of piglets.



CONCLUSION

In conclusion, the results indicate that supplementing sows and their piglets with Aleta™ results in an alleviation of inflammation and an enhancement of cell-mediated immune responses, as well as an immune maturation in young animals.

REFERENCES

1. SD-18-00095