



Evaluating the role of injectable trace minerals in modulating cytokine responses to bovine respiratory vaccination in dairy calves

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Introduction

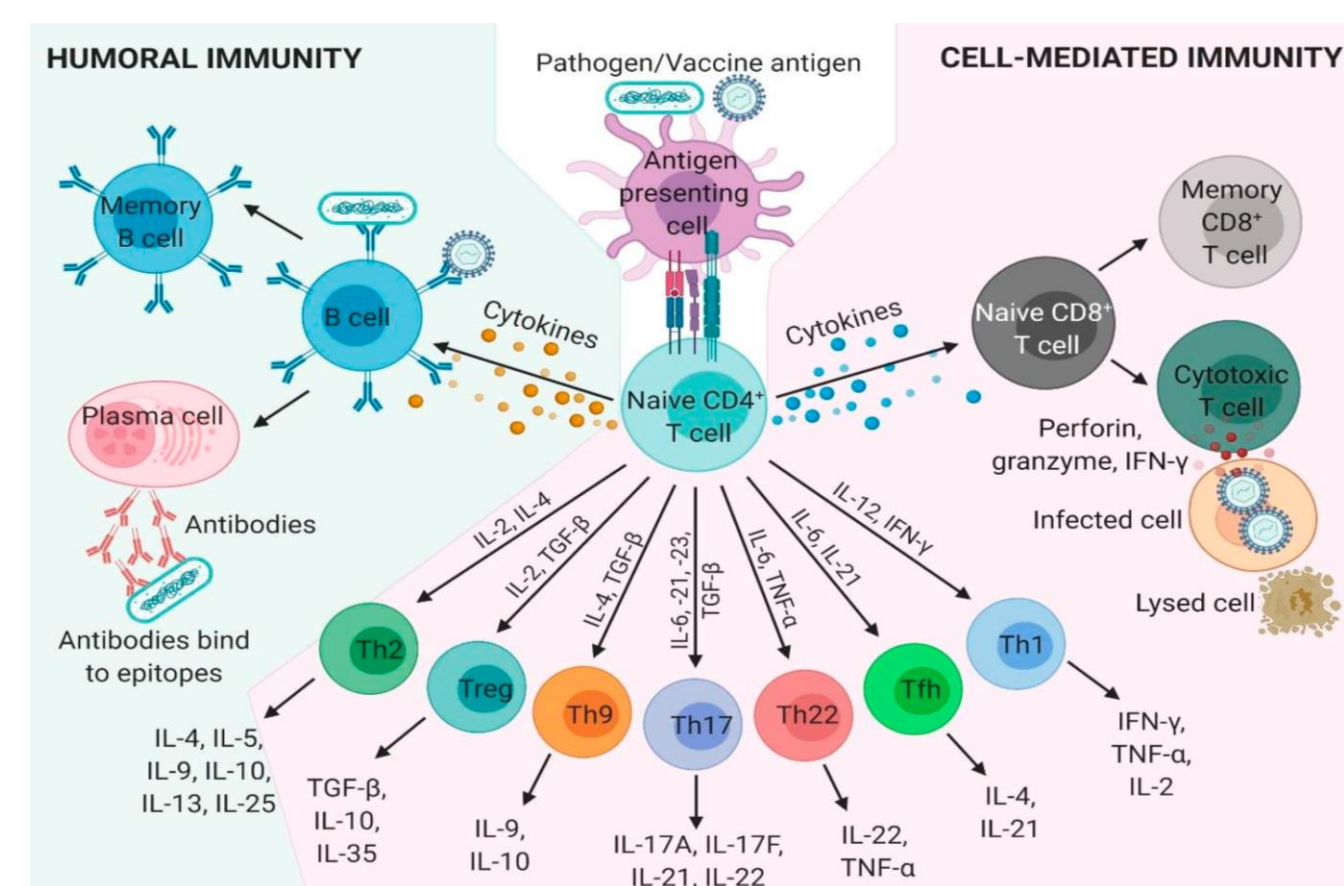
Bovine respiratory diseases (BRD)

- Bovine respiratory disease (BRD) is considered the most common cause of morbidity & mortality in dairy calves, reflecting negatively on the welfare of dairy calves and the economics of dairies^{1,2}

- BRD is responsible for 46.5% of calf deaths after weaning²

Cytokines

- Cytokines response post-vaccination is an important driver of both humoral and cellular immunity^{3,4}



Trace minerals

- It has been found that trace mineral supplementation concurrent with a modified-live virus (MLV) vaccine containing bovine viral diarrhea virus 1 and 2 (BVDV), bovine herpesvirus 1 (BHV), bovine respiratory syncytial virus (BRSV), and parainfluenza 3 virus (PI3V) in dairy calves resulted in earlier and robust antibody titers and leukocyte proliferation.⁵ However, the mechanism underlying this is not well understood

Hypothesis & Objectives

Hypothesis

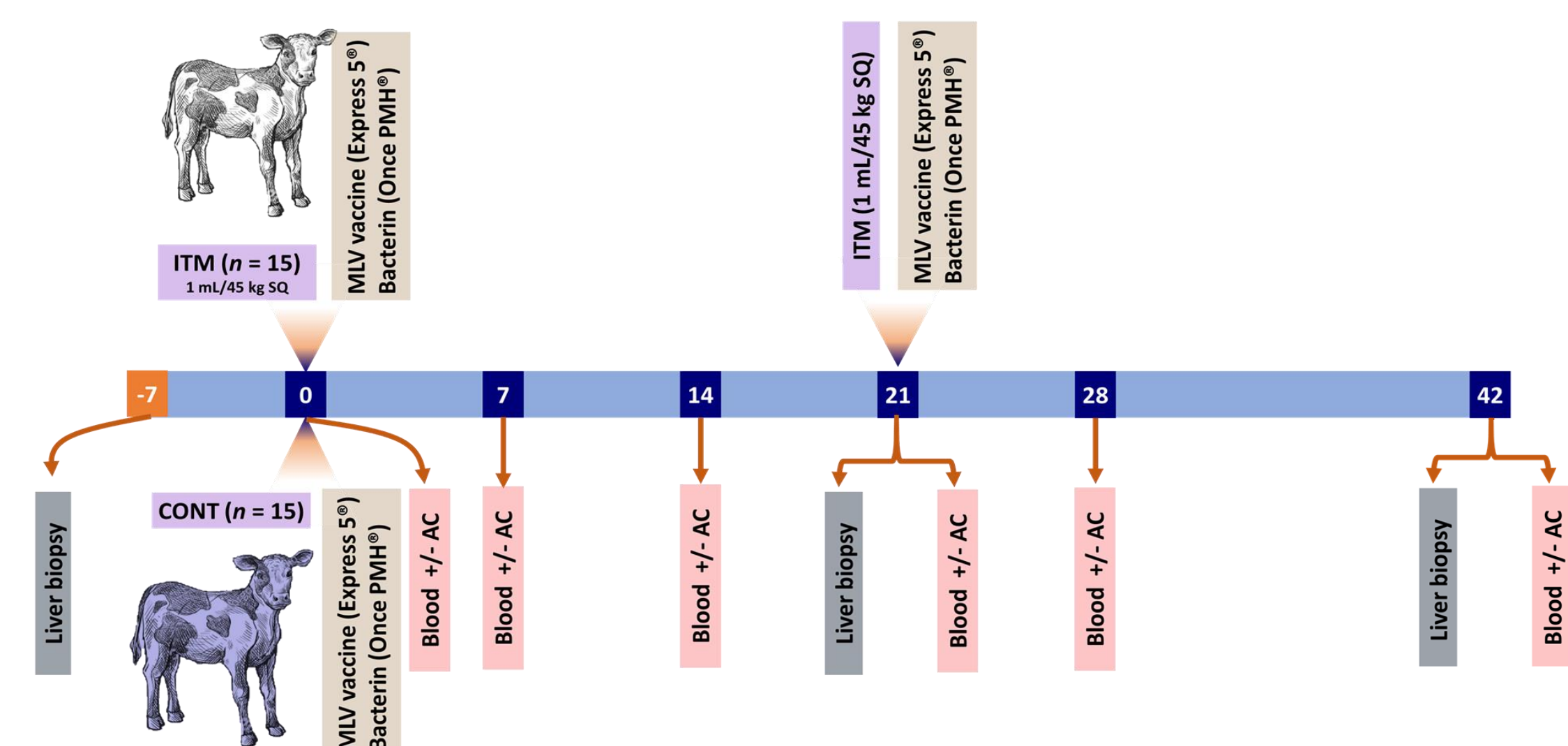
Injectable trace minerals (ITM) supplementation boosts antibody titers and leukocyte proliferation after BRD vaccination by modulating pro-inflammatory cytokines

Objective

To characterize the effects of ITM on the cytokines response to the modified-live virus (MLV) vaccine, and attenuated-live *Mannheimia-Pasteurella* (MP) bacterin in dairy calves

Materials and Methods

Thirty weaned Holstein bull calves (~ 3.5 months) – Randomized clinical trial



Methods

- Trace minerals were assessed in the liver biopsy samples and serum-neutralizing antibody titers against BVDV, BHV, BSV, and MP were determined.
- The level of cytokines mRNA present in a sample was measured using RT-PCR.

$\Delta Cq = Cq \text{ (gene of interest)} - Cq \text{ (housekeeping gene)}$

Statistical analysis

- Because of the naturally occurring variability of cytokine levels, the ratios of the post (d28) to pre-treatment & vaccination (d0) values for each animal were calculated
- Repeated-measures analysis of variance was used

Results

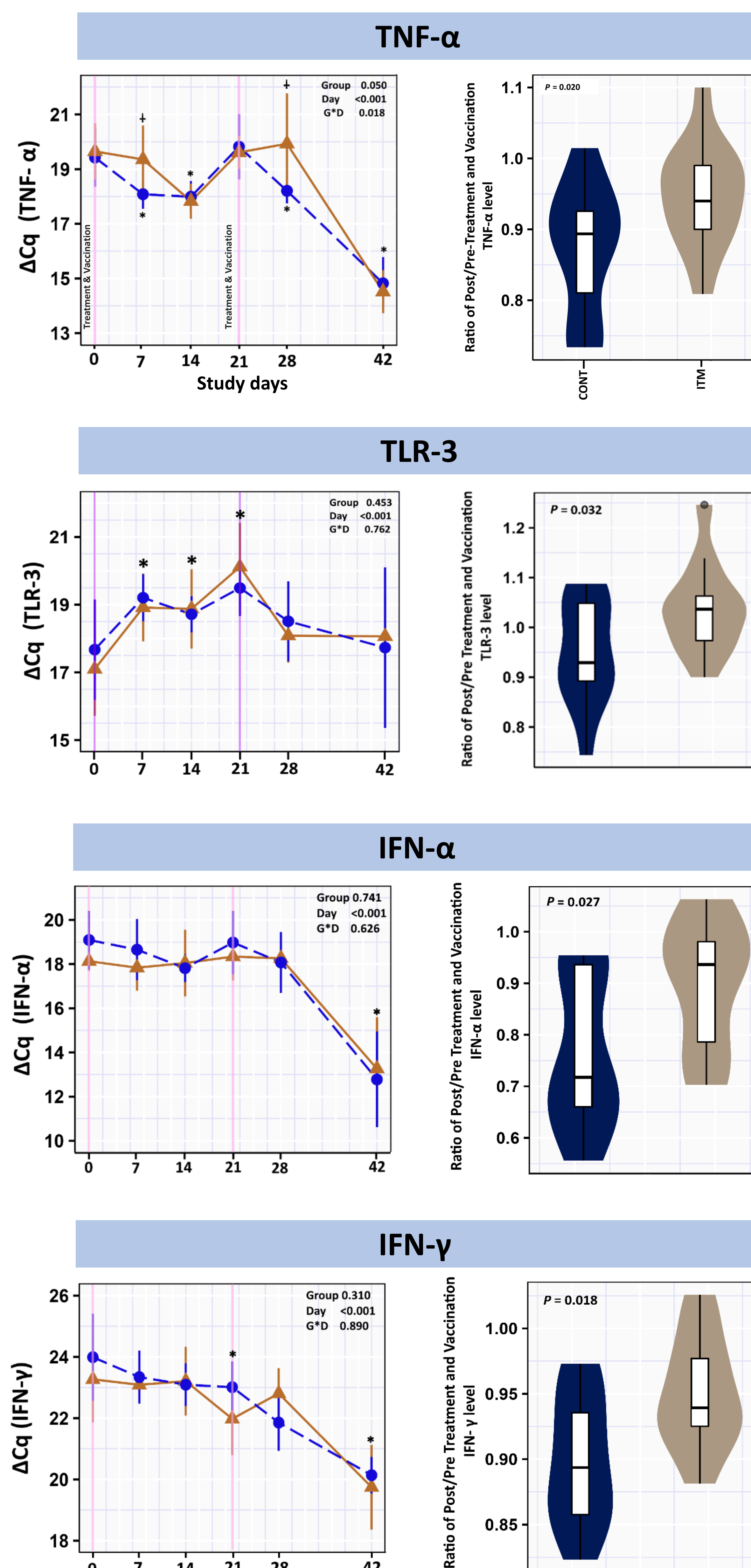


Figure 1. Mean \pm SD of cytokines ΔCq values in ITM-treated calves (**tan solid line**) and CONT-treated calves (**blue dashed line**).

+indicates a significant difference between treatment groups.
*indicate a significant difference in sampling days compared to day 0.

Figure 2. Boxplot of the ratio of the post (d28) to pre-treatment and vaccination (d0) of cytokine levels in ITM-treated calves (**tan violin plot**) and CONT-treated calves (**blue violin plot**).

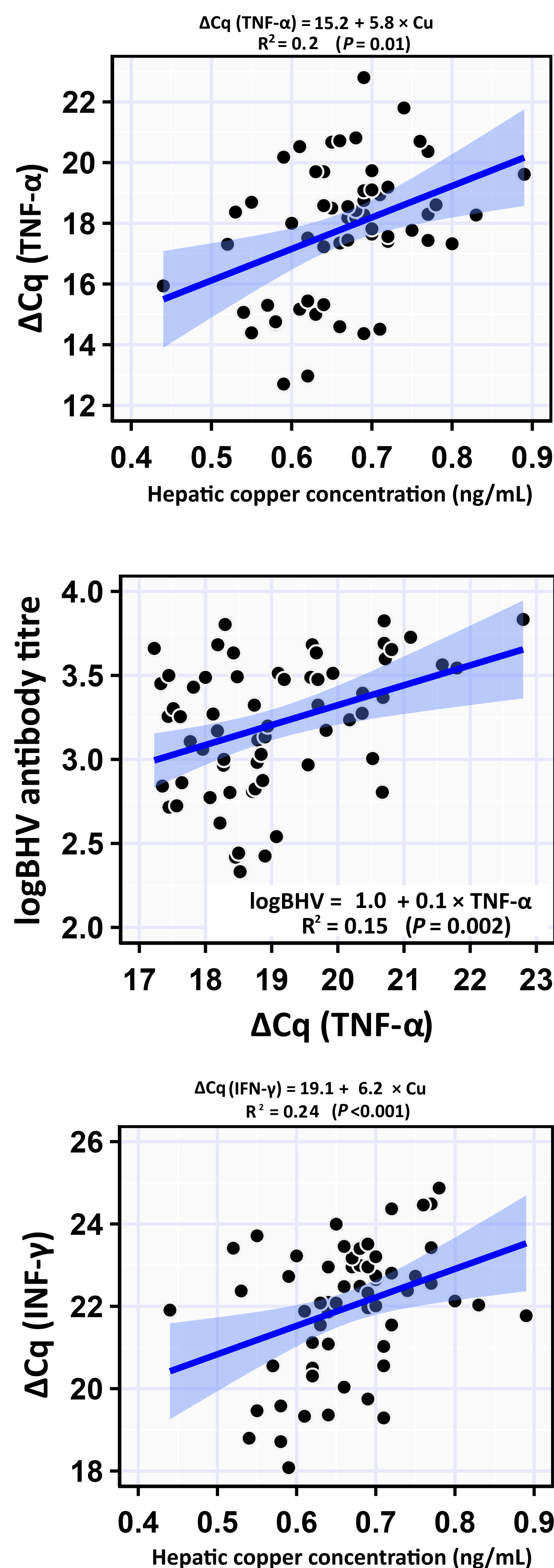


Figure 3. The associations between ΔCq values of cytokines and variables of interest. The solid blue line is the regression line, and the blue shaded area is the 95% confidence interval for the regression line.

Conclusions

Injectable trace mineral supplementations seem to upregulate the expression of inflammatory cytokines, including **TNF- α** , **TLR-3**, **INF- α** , and **INF- γ** post-BRD vaccination in dairy calves. However, no impact was observed on **TLR-7**, **IL-1 β** , **IL-10**, **IL-12**, and **CD80⁺**, **CD86⁺**.

Significance

Injectable trace mineral supplementations likely potentiate the immunogenicity of the BRD complex vaccines through the regulation of inflammatory cytokines release post-vaccination in dairy calves; however, it is unclear whether these effects contribute to improved protection against BRD in dairy calves.

References

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