Immune and metabolic status in extensive cattle vaccinated against neonatal diarrhea

Manuel Cerviño López (1), Rubén Prieto Moreno (1,2), Elisa Cáceres Martín (2,3), M. Eugenia Revilla Ruiz (3), José Antonio Zúñiga Montero (4), Susana Astiz Blanco(5)

[1]Boehringer-Ingelheim Animal Heath Spain, Barcelona, Spain. [2]Facultad de Veterinaria, Universidad Complutense de Madrid. Madrid, Spain. [3] Facultad de Ciencias Biomédicas y de la Salud. Departamento de Veterinaria (Universidad Europea de Madrid). [4]Garcisan Distribuciones S.L. [5] Animal Reproduction (INIA-CSIC), Madrid, Spain.

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BACKGROUND and OBJECTIVE

Bovine neonatal diarrhea (ND) is a leading cause of calf morbidity and mortality, limiting profitability in suckler-cow herds (Anderson *et al.*, 2003; Heinrichs & Radostits, 2001; Mellor & Stafford, 2004). In extensive beef-cattle systems, and especially in breeds with high stress levels, scarce epidemiological data and limited sanitary control make ND hard to manage. Vaccine efficacy is influenced by management conditions and nutritional status. This study assesses the serological response to a commercial ND vaccine on a beef-cattle farm and characterize nutritional and welfare-related biomarkers before and after immunization.

MATERIALS AND METHODS

- A **controlled**, **experimental study** was conducted at a commercial suckler-cow herd in central Spain.
- **Statistical analysis**: IBM SPSS® v.30, using Mann-Whitney U, repeated-measures GLM and Spearman correlation.

1 Study population

323 / 382 cows
enrolled in the 2025 calving season

Single farm with a 2024 history of neonatal diarrhoea (ND). Cows split into two groups:

Control	Vaccinated
n = 54	n = 269
unvaccinated	vaccinated

2 Sampling & serology

158 cows
randomly selected for blood sampling

4 weeks apart

M1 (at vaccination) — M2 (4 weeks later)

Serum centrifuged and frozen until analysis.

Antibodies to rotavirus, coronavirus and *E. coli* by commercial ELISA (optical density; BioXDiagnostic Monoscreen, Teknocroma)

3 Biomarkers

12 Biomarkers
measured at M1 and M2

Glucose (mg/dl) • Lactate (mg/dl) • BHB, β-Hydroxybutyrate (mmol/l) • NEFA, Non-Esterified Fatty Acids (mmol/l) • Triglycerides (mg/dl) • Albumin (g/dl) • GOT-AST, Aspartate Aminotransferase (U/l) • GPT-ALT, Alanine Aminotransferase (U/l) • Cholesterol (mg/dl) • HDL, High-Density Lipoprotein Cholesterol (mg/dl) • LDL, Low-Density Lipoprotein Cholesterol (mg/dl) • Urea (mg/dl)

Konelab-20, Thermo-Fisher-Scientific

RESULTS

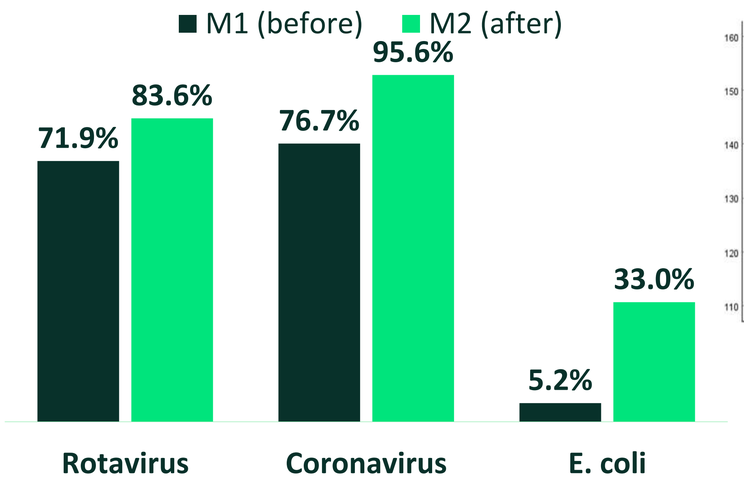

Figure 1: Optical density (%), indicative of antibody levels against major neonatal diarrhea pathogens in beef cows at M1 (vaccination) and M2 (4 weeks post-vaccination).

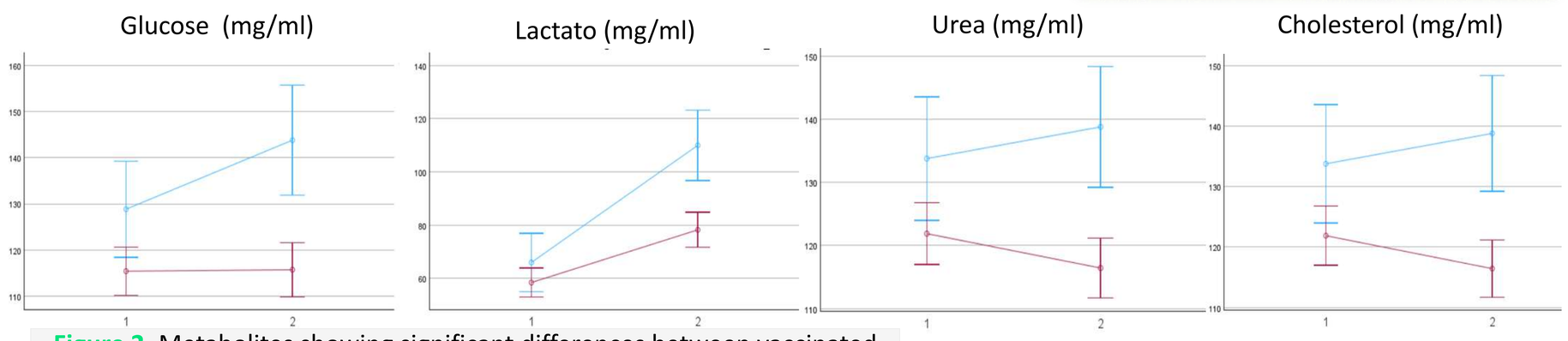

Figure 2. Metabolites showing significant differences between vaccinated (red line) and non-vaccinated (blue line) beef cows at M1 (blood sample collected at vaccination) and M2 (blood sample collected 4 weeks post-vaccination). Values are presented as mean ± SEM.

Table. Significant pathogen–metabolite associations at M1 and M2

Pathogen	Metabolite	Time point	*p*	*P*-value
Rotavirus	Cholesterol	M1	-0,315	0,002
Coronavirus	HDL	M1	-0,277	0,006
Coronavirus	HDL	M2	-0,269	0,008
Coronavirus	Glucose	M1	-0,215	0,034
Coronavirus	Glucose	M2	-0,256	0,011
Coronavirus	Triglycerides	M1	0,219	0,031
E. coli	GOT	M2	0,220	0,031
E. coli	Cholesterol	M2	-0,222	0,030
E. coli	Triglycerides	M2	-0,335	0,001
E. coli	BHB	M2	0,206	0,044
E. coli	Glucose	M2	-0,440	<0,001

Spearman's *ρ* and *P*-values. HDL, high-density lipoprotein cholesterol; GOT (AST), glutamate oxaloacetate transaminase (aspartate aminotransferase); BHB, β-hydroxybutyrate.

DISCUSSION

Similar antibody levels against rotavirus and coronavirus at M1 suggest prior natural exposure to these endemic pathogens (Vlasova & Saif, 2021). In contrast, no detectable antibodies against *E. coli* were found despite the widespread occurrence of F5 (K99)-positive enterotoxigenic *E. coli* in cattle (Kolenda et al., 2015).

The marked post-vaccination increase confirms the strong humoral response induced against rotavirus, coronavirus, and *E. coli* K99 (Nagy, 1980; Snodgrass *et a*l., 1982; Valente *et al.,* 1988). Furthermore, stable glucose, cholesterol, urea, and lactate concentrations, together with negative associations between antibody levels and glucose, cholesterol, and HDL, and positive associations with BHB and GOT, support a link between humoral immunity and metabolism (Loor & Elolimy, 2022; Zachut *et al.,* 2022; Vlasova & Saif, 2021). As glucose, lipids, and ketone bodies contribute to immune-cell function, cows with stronger antibody responses may display distinct metabolic profiles, although causality cannot be inferred (Qiao *et al.,* 2024; Zhao *et al.,* 2024).

- At M1 Ab-levels were similar across groups, with negativity (<20% ELISA optical density; ELISA value) for *E. coli,* and 4 weeks after vaccination, vaccinated cows had higher antibodies titters (figure1).
- Significant correlation was observed between biomarkers and the optical density for antibodies observed (table).
- Metabolic evolution differed between groups for urea (*P*=0.074), cholesterol (*P*<0.001), lactate (*P*=0.002), and glucose (*P*=0.041); values increased in controls but remained stable in vaccinated cows (figure 2)

CONCLUSIONS

Maternal vaccination induces adequate humoral response before calving. The absence of basal immunity against *E. coli* classifies the herd as high-risk without vaccination. The study confirms the close relationship between metabolic status and humoral immune capacity in extensive cattle.

References:

- Anderson et al. Prof Anim Sci. 2003; 19(6), 399-403.
- Heinrichs & Radostits. Herd Health (3rd ed). 2001; 9, 334.
- Kolenda et al. Front Cell Infect Microbiol. 2015;5:23.
- Loor & Elolimy. Anim Front. 2022;12(5):13–22.
- Mellor & Stafford. Vet J. 2004;168(2), 118-133.
- Nagy. Infect Immun. 1980;27(1):21–24.
- Qiao et al. Animals. 2024;14(6):832.
- Snodgrass et al. Infect Immun. 1982;37(2):586–591
- Valente et al. Comp Immunol Microbiol Infect Dis. 1988;11(3–4):189-198.
- Vlasova & Saif. Front Immunol. 2021;12:643206.
- Zachut et al. Anim Front. 2022;12(5):37–45.
- Zhao et al. Front Vet Sci. 2024;11:1347585.

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