

Passive immunity transfer: Factors impacting passive immunity transfer and strategies to optimize colostrum quality and animal production.

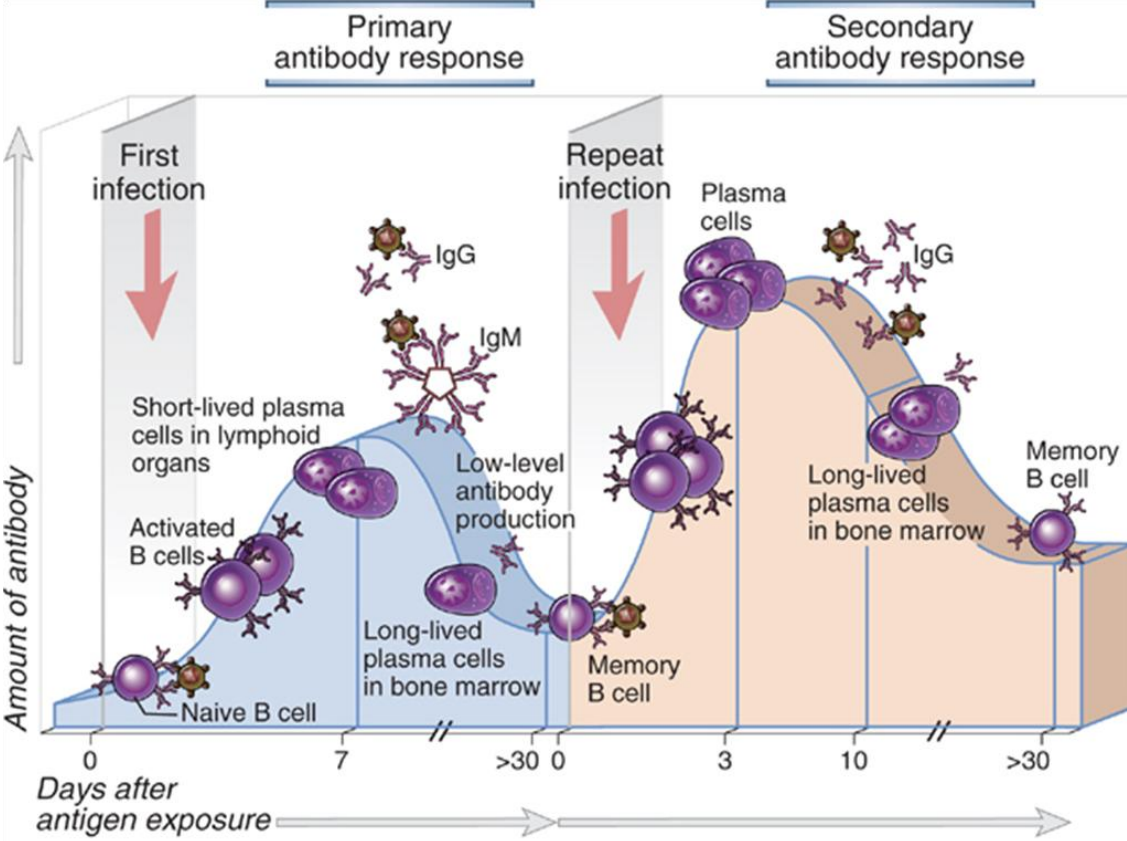
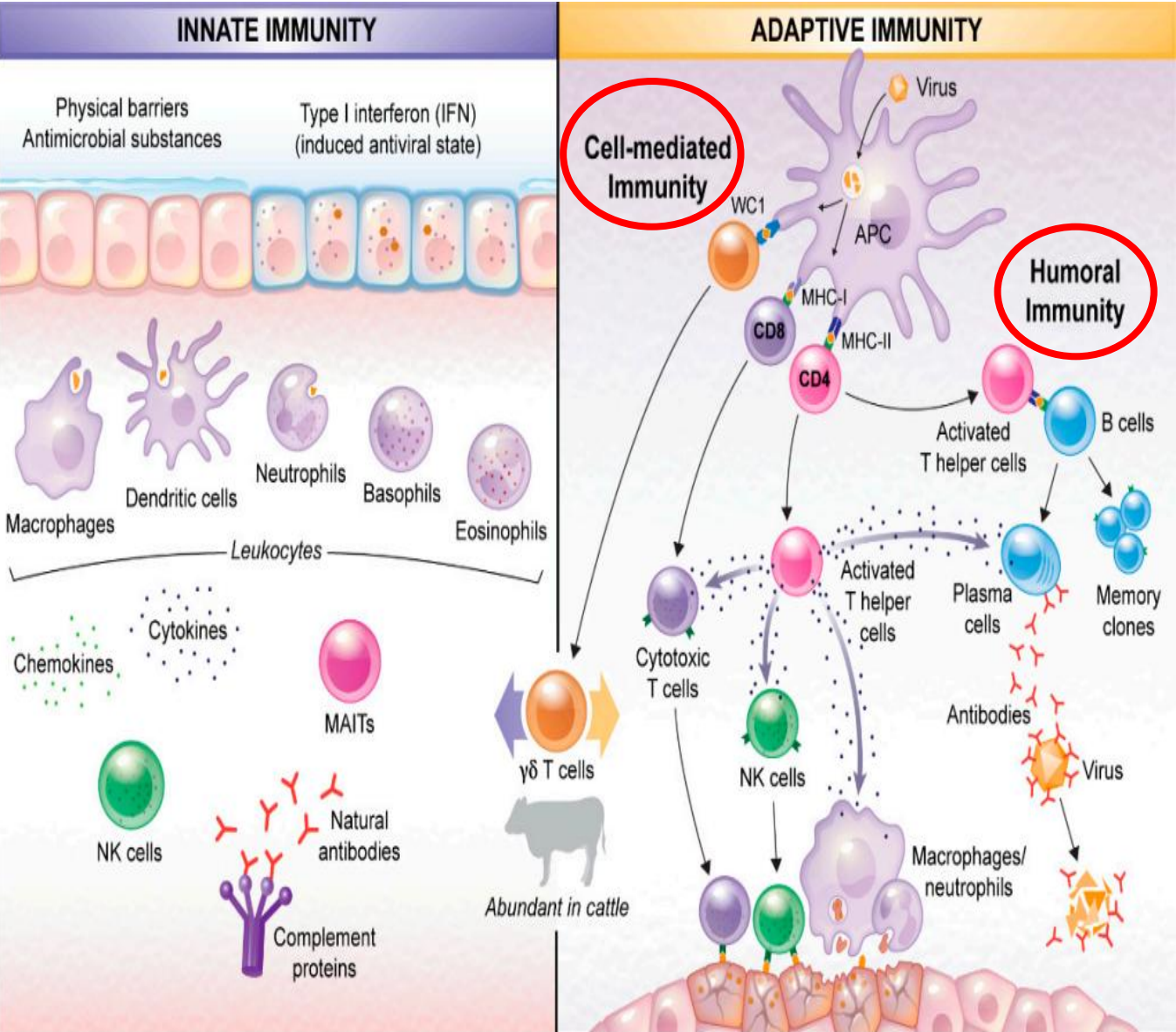


Terry Engle
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Outline

- 1) Review cattle immunity
- 2) Colostrum functions and synthesis
- 3) Calf absorption of colostrum
- 4) Possible reasons for failure of passive transfer
- 5) Nutritional strategies to improve colostrum synthesis, components, and animal production

Cattle Immunity: Innate, adaptive, and passive



<https://microbeonline.com/differences-between-primary-secondary-immune-response/>

Colostrum synthesis (passive immunity for the calf)

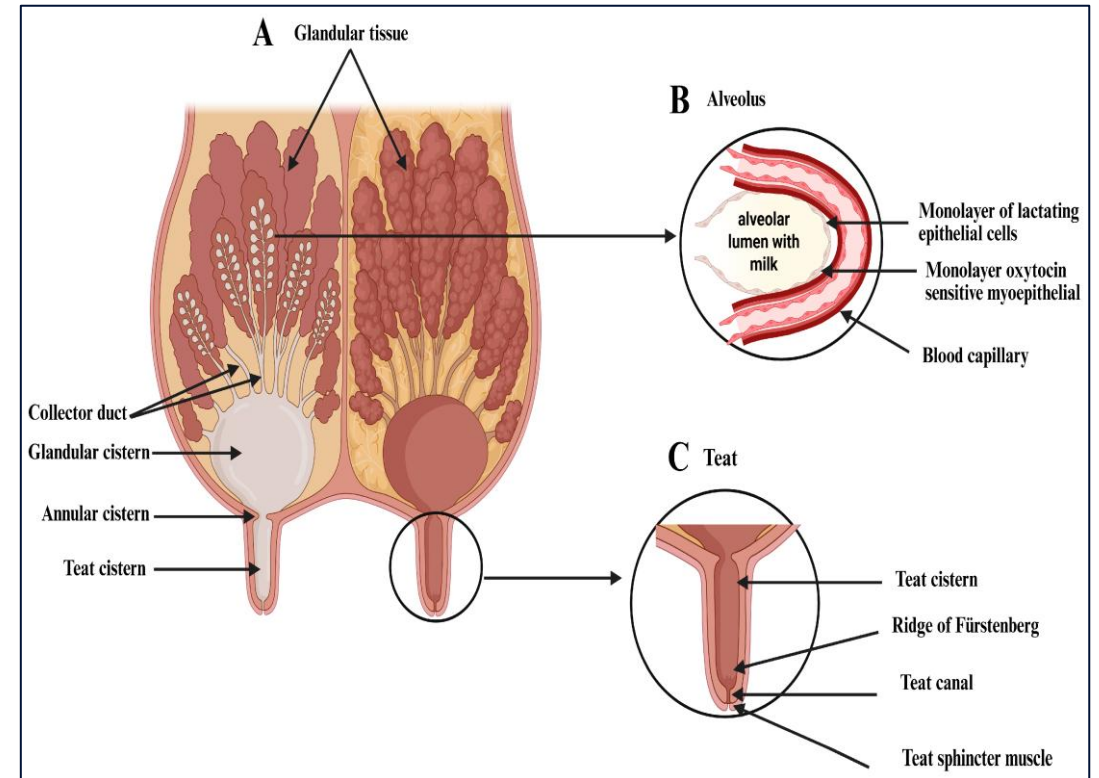
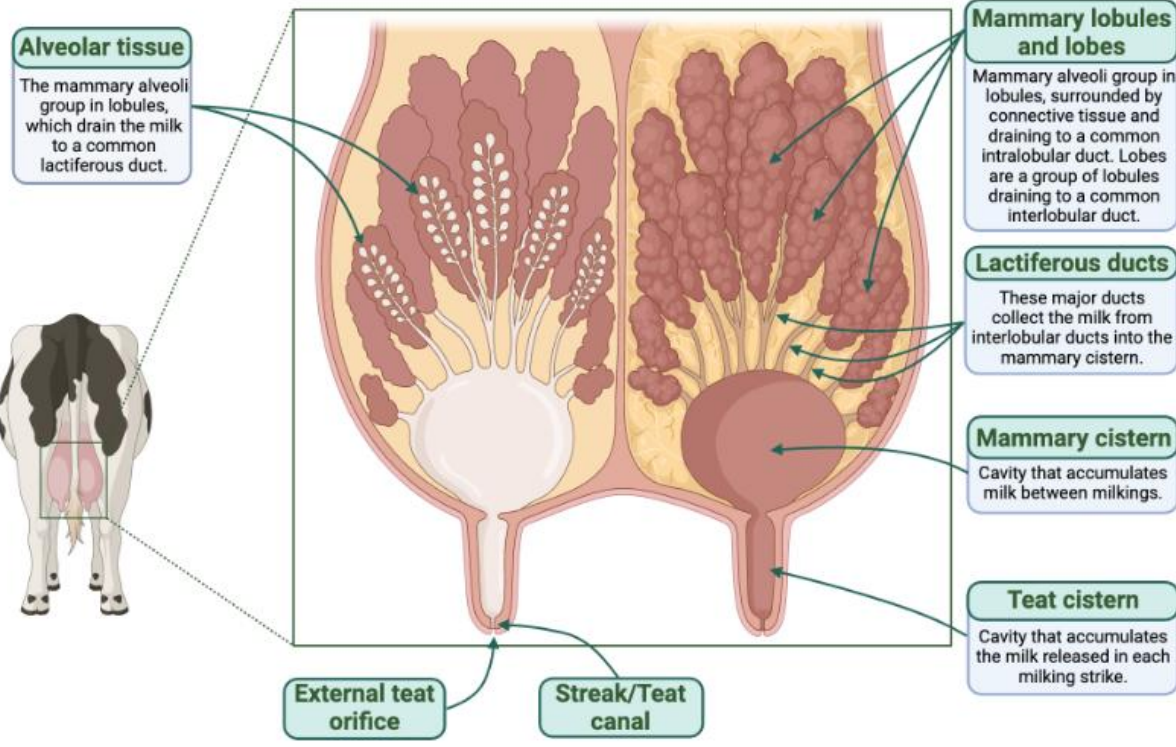
Review

A Review on Bioengineering the Bovine Mammary Gland: The Role of the Extracellular Matrix and Reconstruction Prospects

Fernando Chissico Júnior ^{1,2,*}, Thamires Santos da Silva ^{1,*}, Flávio Vieira Meirelles ³, Paulo Sérgio Monzani ⁴, Lucas Fornari Laurindo ^{5,6}, Sandra Maria Barbalho ^{5,6} and Maria Angélica Miglino ^{6,7,8,*}

Cow Mammary Gland Anatomy

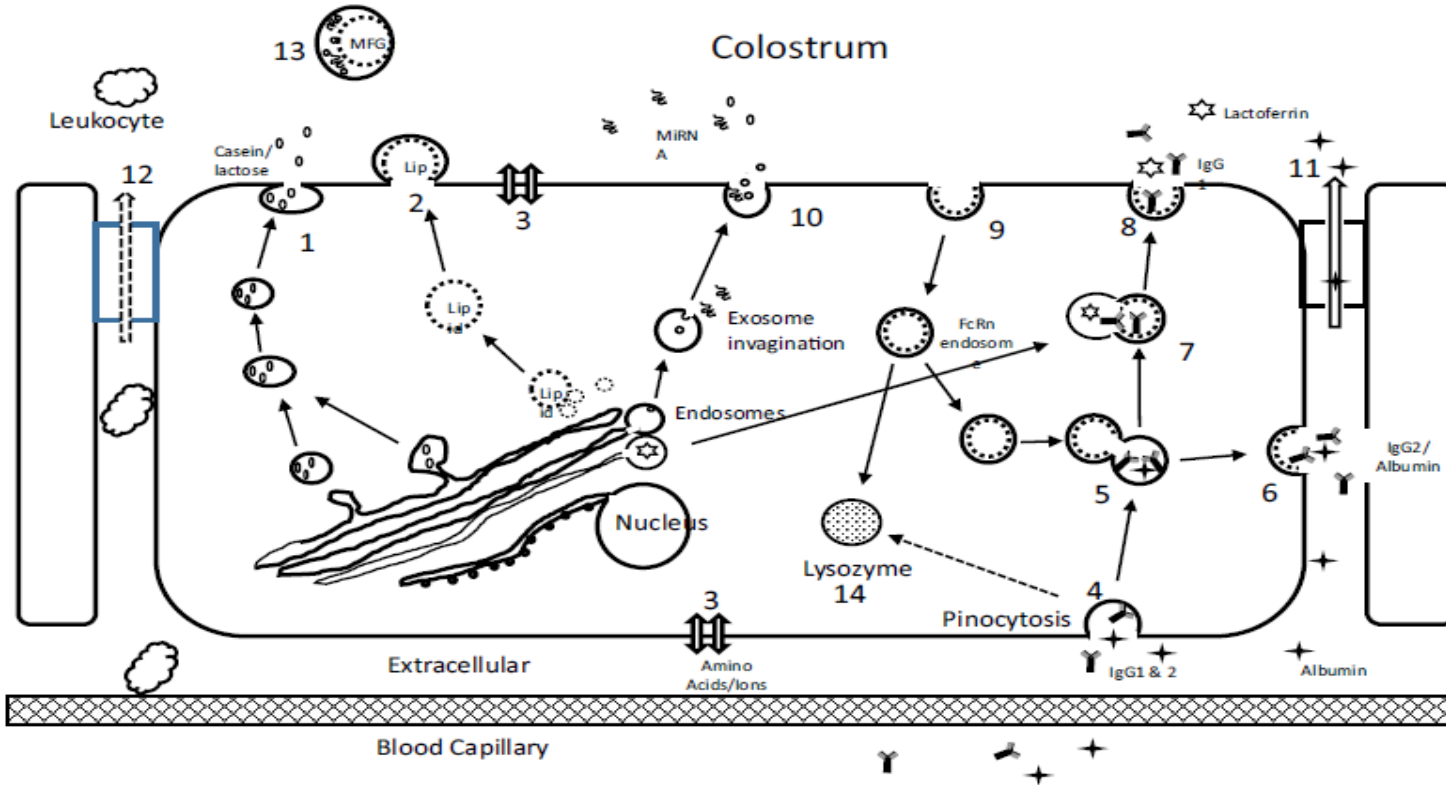
Major structures in the cross-section



Adapted from Dairy Science and Technology: Goff, Hill, and Ferrier <https://books.lib.uoguelph.ca/dairyscienceandtechnologyebook/>

An image showing the macro and microstructure of the bovine mammary gland. (A) The glandular tissue, ducts, glandular cisterns, annular cistern, and teat cistern. (B) A cross-section of an alveolus. (C) A diagram of the anatomy of the teat and its components: teat cistern, ridge of Fürstenberg, teat canal, and teat sphincter muscle. Created with BioRender (<https://www.biorender.com/>) (Accessed on 25-Jan-2026)

Colostrum synthesis



Adapted from Dairy Science and Technology: Goff, Hill, and Ferrier <https://books.lib.uoguelph.ca/dairyscienceandtechnologyebook>; Raumrucker et al. 2022.

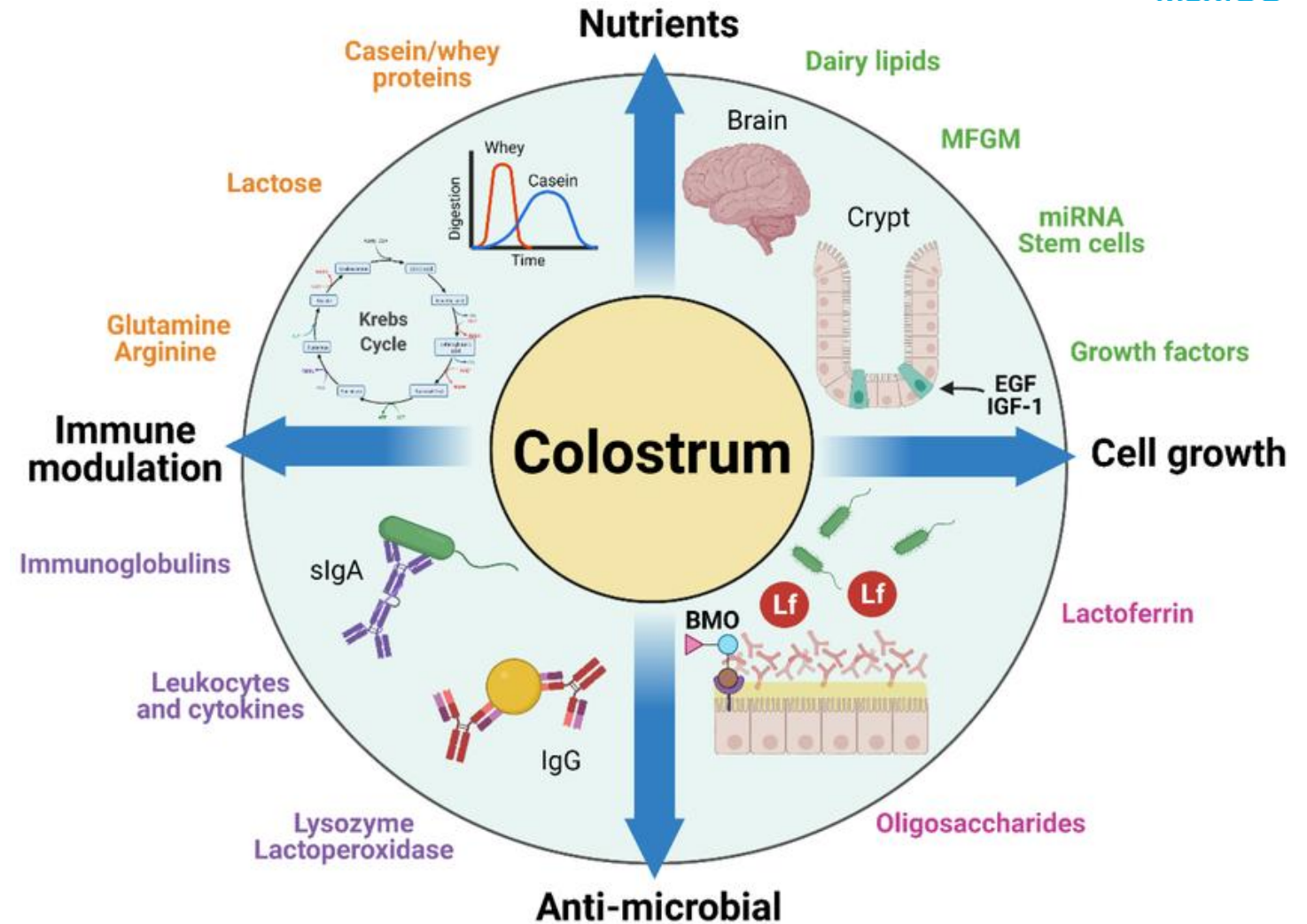
Table 1. Immunoglobulins in bovine and human colostrum and milk¹

Species	Immunoglobulin	Concentration, mg/mL		% of total immunoglobulins	
		Colostrum	Milk	Colostrum	Milk
Bovine	IgG ₁	47.60	0.59	81.0	73.0
	IgG ₂	2.90	0.02	5.0	2.5
	IgA	3.90	0.14	7.0	18.0
	IgM	4.20	0.05	7.0	6.5
Human	IgG	0.43	0.04	2.0	3.0
	IgA	17.35	1.00	90.0	87.0
	IgM	1.59	0.10	8.0	10.0

¹From Butler (1973).

Key bioactive components in colostrum

Definition: Bovine colostrum is produced by cows in the first days after calving and provides nutrition and immunological protection to newborn calves (Hammon et al. 2020).



Other key bioactive components in colostrum

1) Vitamins:

Mean concentrations and physiological roles of vitamins present in the bovine colostrum.

Vitamin	Mean	Physiological Role
Fat-soluble vitamins		
Vitamin A ($\mu\text{g}/100\text{ mL}$)	233–369	Immune function, cell-growth, and vision.
Vitamin E ($\mu\text{g}/100\text{ g}$)	191–530	Antioxidant function.
Vitamin D (IU/100 g fat)	120–181	Ca and P absorption, bone health, and immune function.
Vitamin K ($\mu\text{g}/100\text{ mL}$)	>2	Blood clotting and bone health.
Water-soluble vitamins		
Thiamine (B1) ($\mu\text{g}/100\text{ mL}$)	58–90	Energy metabolism and nervous system.
Riboflavin (B2) ($\mu\text{g}/100\text{ mL}$)	455–610	Energy production and cell growth.
Niacin (B3) ($\mu\text{g}/100\text{ mL}$)	34–96	Redox reactions (synthesis of NAD), energy metabolism.
Pantothenic acid (B5) ($\mu\text{g}/100\text{ mL}$)	224	Acetyl-transfer reactions (synthesis of coenzyme A), energy metabolism.
Pyridoxal (B6) ($\mu\text{g}/100\text{ mL}$)	15.0	
Pyridoxamine (B6) ($\mu\text{g}/100\text{ mL}$)	21.0	Brain development, immune function, and production of hemoglobin.
Pyridoxine (B6) ($\mu\text{g}/100\text{ mL}$)	4.0	
Biotin (B7) ($\mu\text{g}/100\text{ mL}$)	1.0–2.7	Carboxylation reactions, glucose, amino acids, and fatty acids metabolism.
Folate (B9) ($\mu\text{g}/100\text{ mL}$)	0.75–0.8	Single-carbon-transfer reactions (nucleic acids synthesis), DNA, and methionine metabolism.
Cobalamin (B12) ($\mu\text{g}/100\text{ mL}$)	0.2–60	Red blood cell production, neurological function, and DNA synthesis.
Vitamin C ($\mu\text{g}/100\text{ mL}$)	1620–3200	Antioxidant, immune function, skin, and blood vessel integrity.

Values represent the range of mean concentrations and were obtained from refs [7,22,56,143–148].

Other key components in colostrum

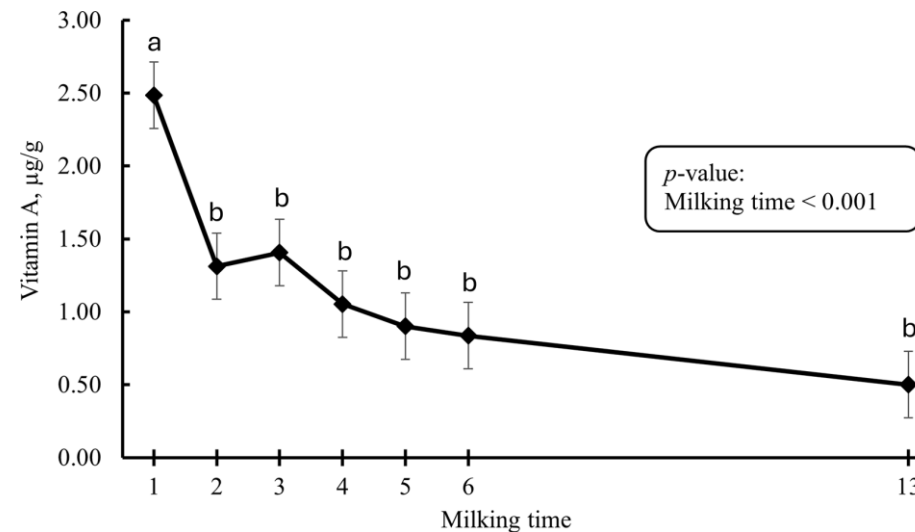
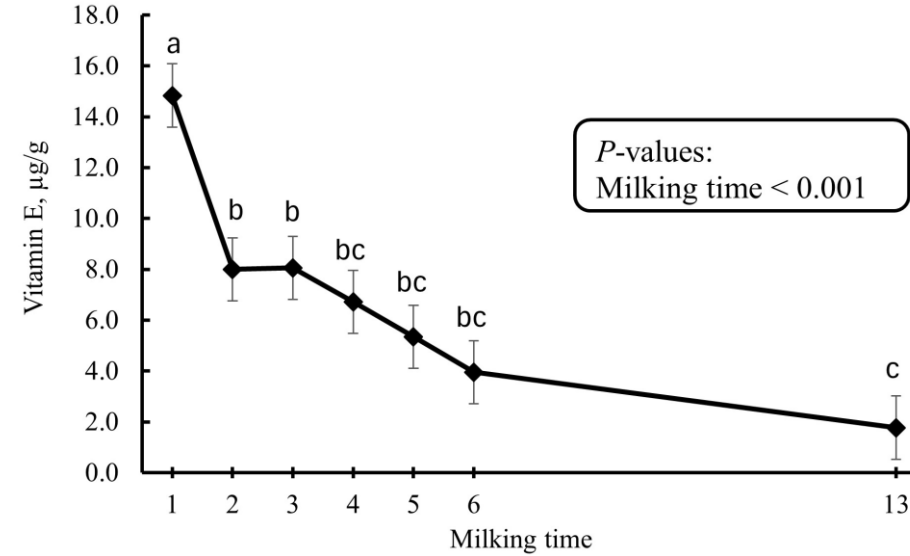
2) Minerals:

- Essential macro minerals like calcium, phosphorus, and magnesium are approximately 2 times more abundant in colostrum than in mature milk.
- Certain micro minerals can be 4 to 10 times greater in colostrum
- *****Note:** Copper is typically low in colostrum and milk.

Nutritional composition of colostrum vs. milk (impact of time)

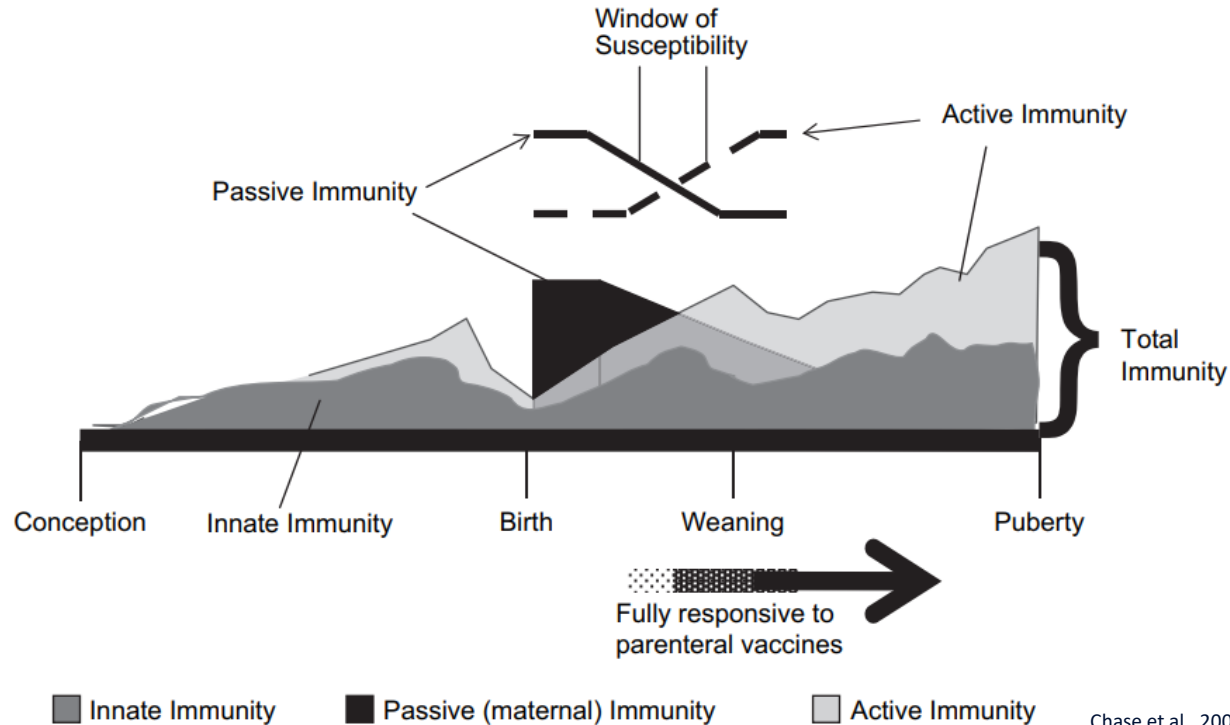
Item	Milking Number			Milk
	1	2	3	
Specific gravity	1.056	1.040	1.035	1.032
Solids, %	23.9	17.9	14.1	12.9
Protein, %	14.0	8.4	5.1	3.1
Casein, %	4.8	4.3	3.8	2.5
IgG, mg/mi	48.0	25.0	15.0	.6
Fat, %	6.7	5.4	3.9	3.7
Lactose, %	2.7	3.9	4.4	5.0
Vitamin A, ug/L	2950	1900	1130	340
Vitamin D, IU/g fat	.9 to 1.8			.4
Riboflavin, ug/ml	4.8	2.7	1.9	1.5
Choline, mg/ml	.70	.34	.23	.13

From: Foley & Otterby, 1978. J. Dairy Sc. 61.1033.



Absorption of colostrum by the calf (passive immunity)

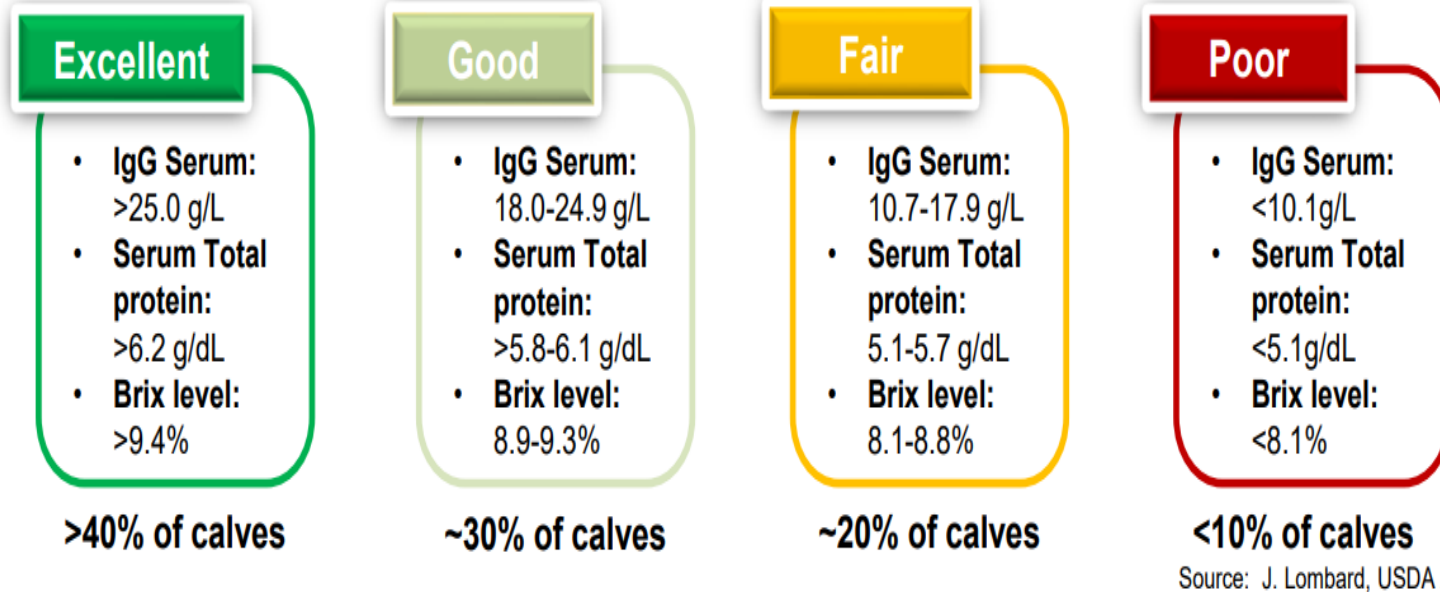
➤ Goals with passive immunity:



- Increase serum IgG antibodies in the calf within 12-24h post birth.
- Minimize the time between passive immunity and active (adaptive) immunity.
 - Management, vaccination programs, nutrition, minimizing stress, etc.

Absorption of colostrum by the calf: Key benchmarks

Transfer of passive immunity guidelines for **dairy heifers**



<https://www.aphis.usda.gov/sites/default/files/colostrum-feeding-passive-immunity-heifer-calves.pdf>

Source: J. Lombard, USDA 2020



Review

Failure of Passive Immune Transfer in Neonatal Beef Calves: A Scoping Review

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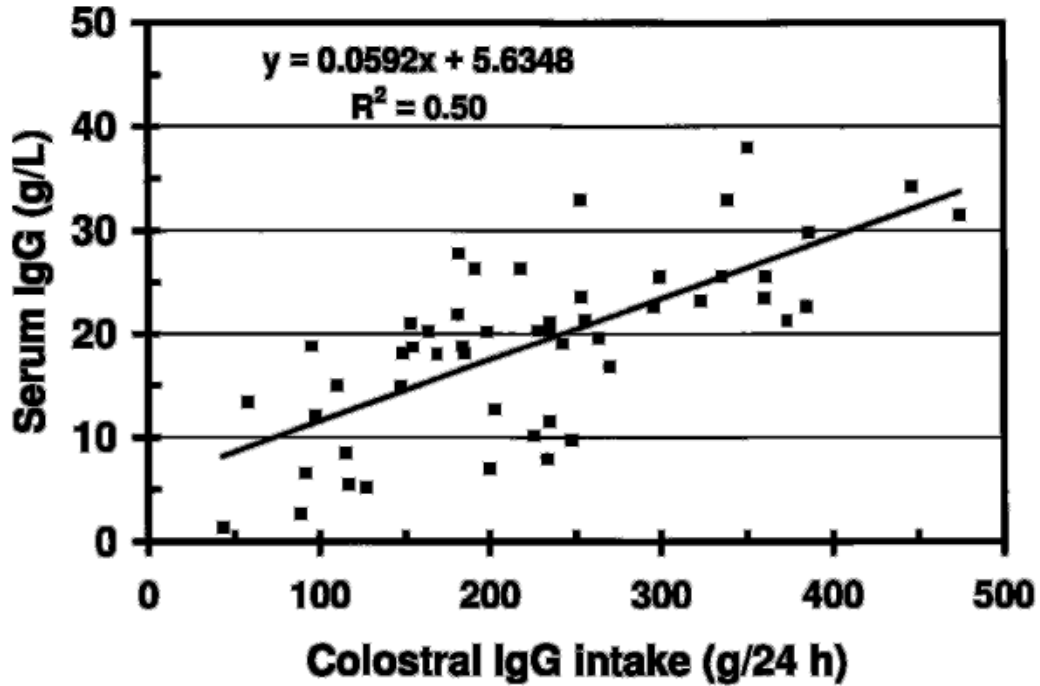
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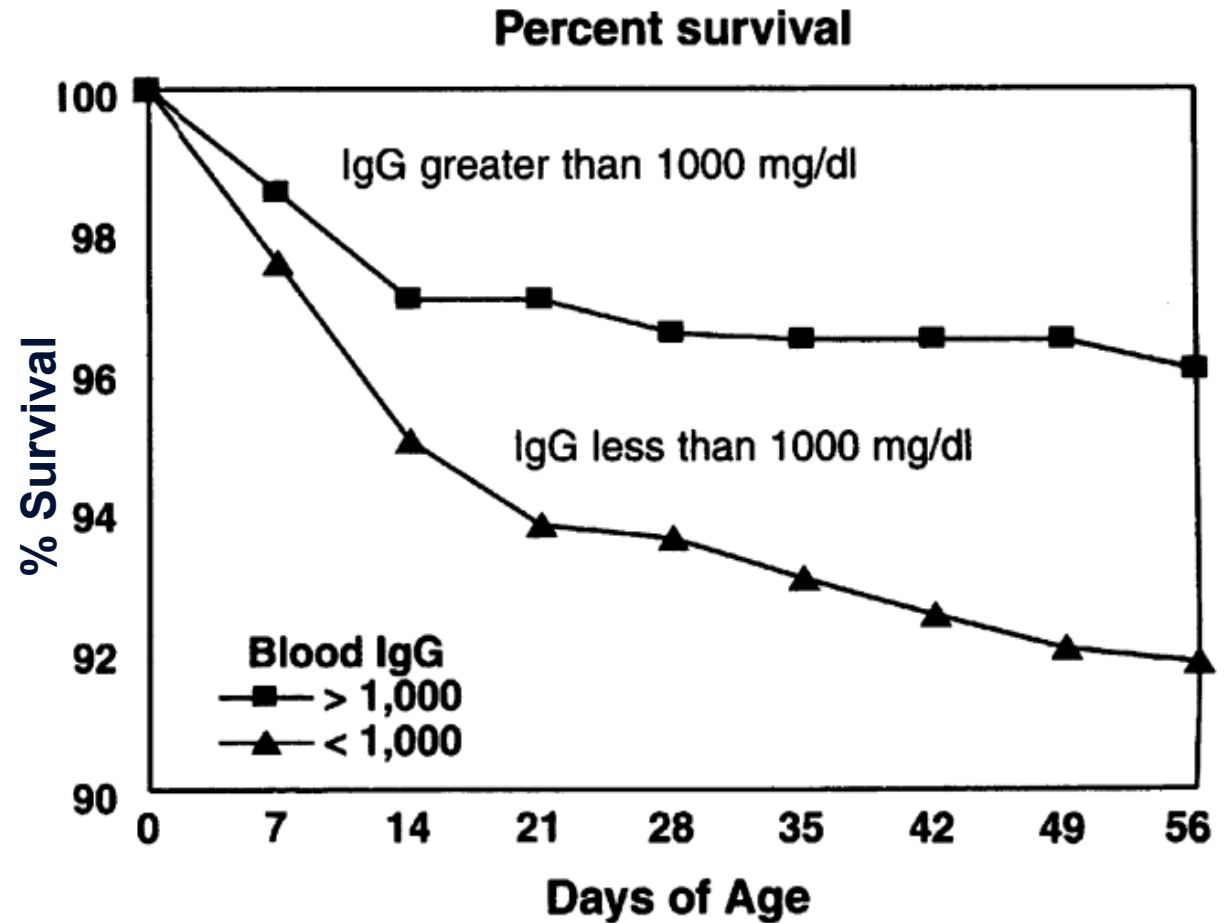
Recent 2025 review - Concluded for **beef calves**:

- Serum IgG concentrations:
 - Above 16 mg/mL → adequate passive transfer.
 - At or above 24 mg/mL → has been increasingly accepted as optimal, based on studies linking it to improved health outcomes.

Calf survival by serum IgG concentrations

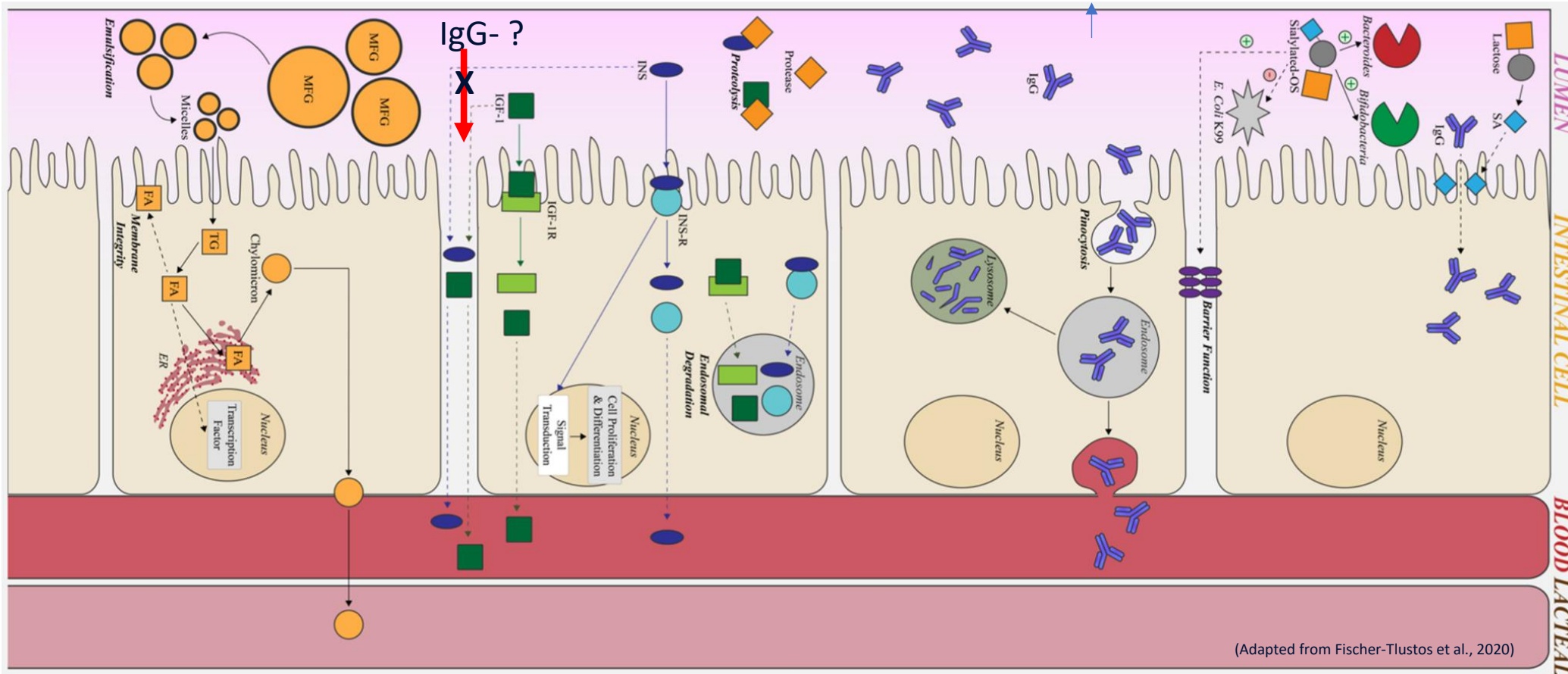


The relationship between colostral IgG intake and serum IgG concentration in calves. [From Hopkins and Quigley, 1997.]



Calf survival by serum IgG concentration. (From National animal health monitoring system. National dairy heifer evaluation project. Dairy herd management practices focusing on preweaned heifers. Ft. Collins, (CO): USDA-APHIS Veterinary Services; 1993.)

A schematic of the transfer of specific bioactive compounds from colostrum in the neonatal calf enterocyte and circulatory system



- After birth, the calf gut is considered “open,” as enterocytes possess the ability to non-selectively absorb large molecules, such as IgG and IgA, by pinocytosis from the intestinal lumen into blood circulation (Fischer et al., 2019).
- Approximately 24 h after birth, “gut closure” takes place: defined as “the cessation of absorption of macromolecules from the gut into blood in neonates” (Lecce and Morgan, 1962; Stott et al., 1979).

Effects of colostrum management on transfer of passive immunity and the potential role of colostral bioactive components on neonatal calf development and metabolism

A.J. Fischer-Tlustos, A. Lopez, K.S. Hare, K.M. Wood, and M.A. Steele

Table 1. Levels of bioactive molecules in colostrum (milking 1) compared with whole milk^a and their proposed functions.

Bioactive compound	Colostrum	Whole milk	Proposed function
IgG (g·L ⁻¹)	94.1	1.2	Passive immunity
Neu5Ac-glycosylated IgG (μM)	~1150	~210	Facilitating intestinal uptake of IgG
Fat (%)	5.7	4.3	Energy, thermoregulation
Fat (g·kg ⁻¹)	62.9	41.8	Energy, thermoregulation
ω-3 FA (%)	0.63	0.35	Immune modulation, antioxidant capacity
IGF-I (μg·L ⁻¹)	310	<2	Intestinal development
Insulin (μg·L ⁻¹)	65	1	Promote postnatal growth, gut development
3'SL (μg·mL ⁻¹)	592.4	41.2	Prebiotic, immune modulation, pathogen inhibition
Nucleotides (μmol·dL ⁻¹)	258.7	15.6	Immune function, gastrointestinal development
5'UMP (μmol·dL ⁻¹)	18.63	2.92	Modulation of immune function
miRNA (total No.)	102	53	Gastrointestinal development, immune modulation

Note: Neu5Ac, 5-N-acteylneuraminic acid; FA, fatty acid; IGF-I, insulin-like growth factor-I; 3'SL, 3'sialyllactose; 5'UMP, uridine 5'monophosphate; miRNA, microRNA.

^aIgG, fat (% and g·kg⁻¹), and 3'SL are reported in [Fischer-Tlustos et al. \(2020a\)](#); Neu5Ac-glycosylated IgG is reported in [Takimori et al. \(2011\)](#); ω-3 FA % is reported in [Hare et al. \(2019a\)](#); IGF-I and insulin concentrations are reported in [Blum and Hammon \(2000\)](#); nucleotide concentrations are reported in [Gill et al. \(2011\)](#); total number of miRNA is reported in [Izumi et al. \(2012\)](#).

Possible reasons for failure of passive transfer

- Factors related to colostrum
 - Quantity/volume
 - IgG concentration
 - Timing of colostrum feeding
 - Method of colostrum feeding (suckling vs bottle/tube feeding)
 - Microbial composition of colostrum
- Factors related to calves
 - Calf sex or twins
 - Calf vigor at birth
 - Month of birth, reproductive technologies used at breeding, calf cortisol and epinephrine concentrations, and nonsteroidal anti-inflammatory drugs after a difficult calving.
 - Calf birth weight
- Factors related to the dam
 - Dam body condition score or udder conformation
 - Dam breed
 - Dam prepartum vaccination
 - Dam parity
 - Calving area, calving difficulty, and non-steroidal anti-inflammatory drugs for dystocia
 - Dam prepartum nutrition

Review

Failure of Passive Immune Transfer in Neonatal Beef Calves: A Scoping Review

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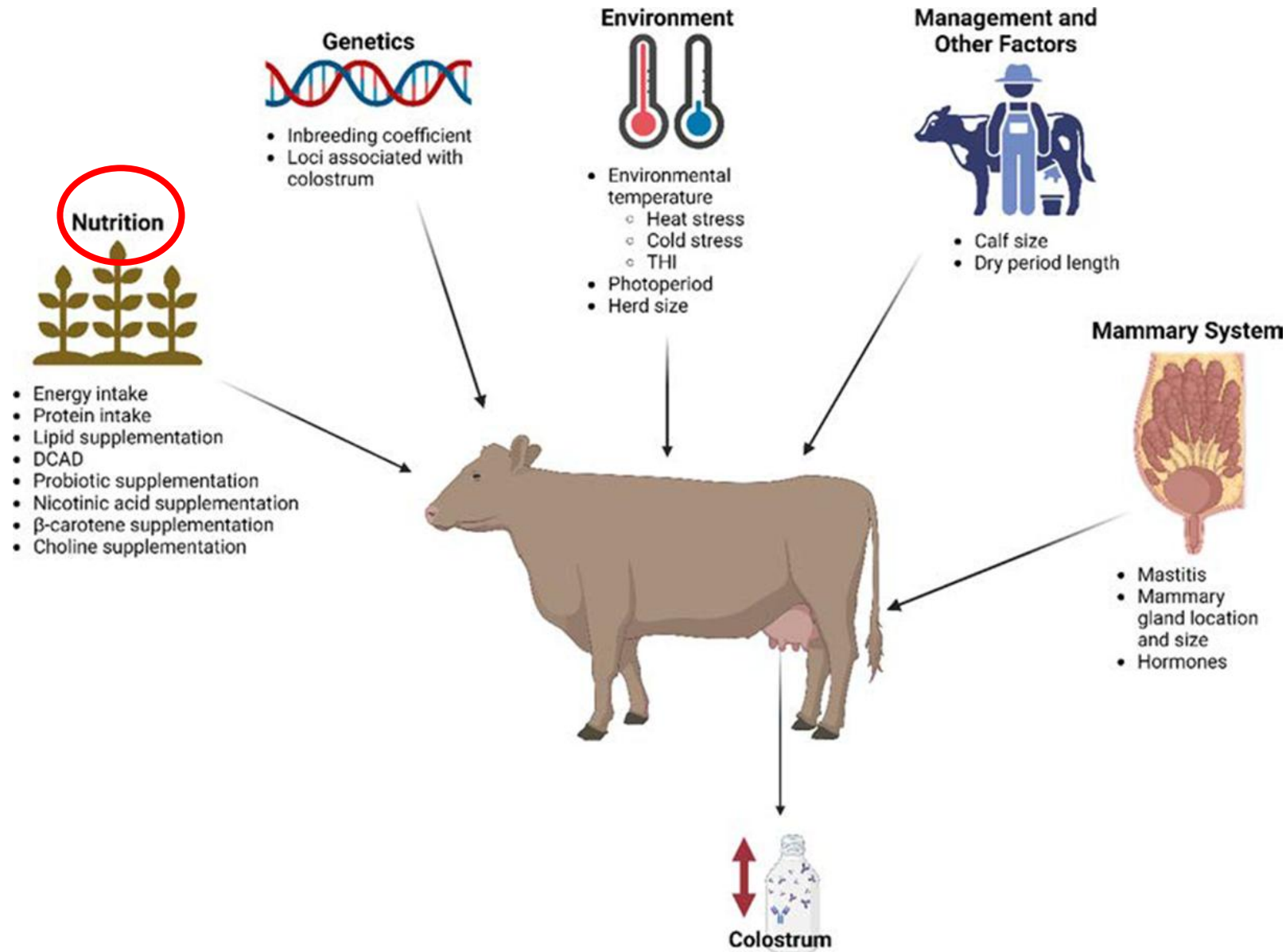
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Factors impacting colostrum production and quality



Nutrition impacts colostrum yield and composition

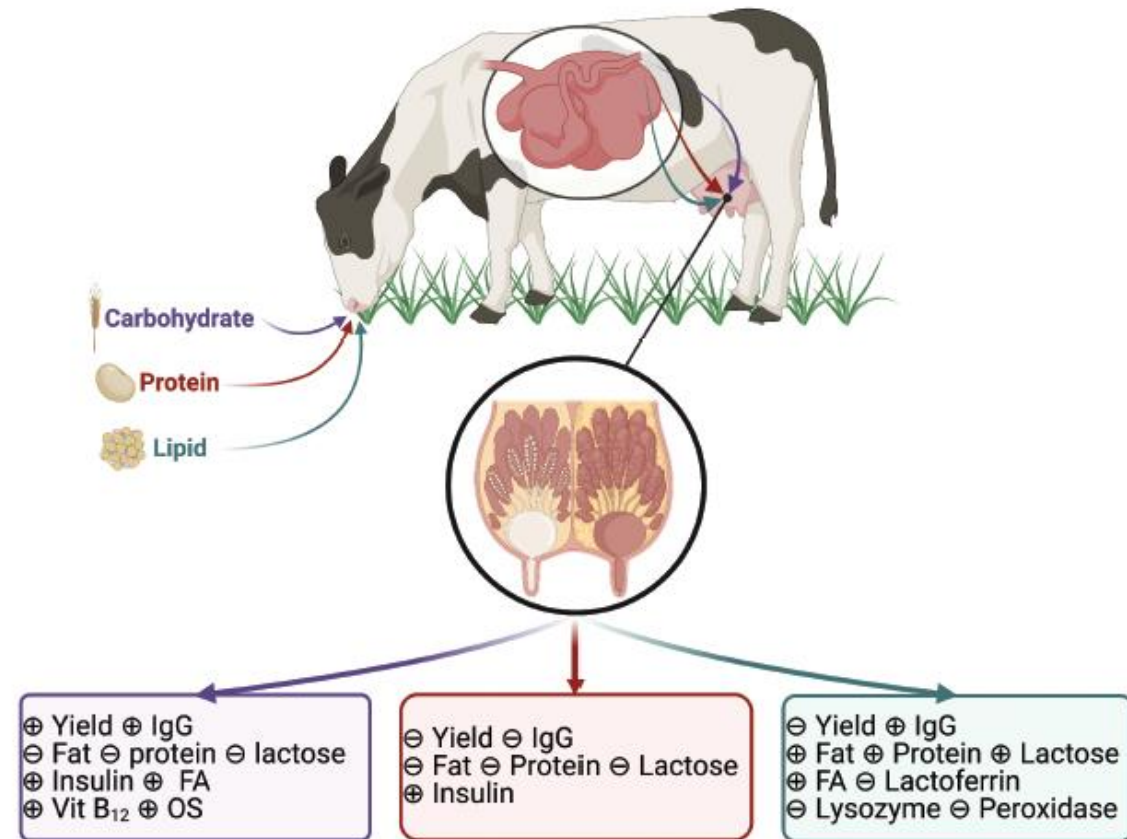
Feature Article

Prepartum nutrient intake and colostrum yield and composition in ruminants

Koryn S. Hare, Amanda J. Fischer-Tlustos, Katharine M. Wood, John P. Cant, and Michael A. Steele

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Hare et al., 2023



Nutritional strategies to improve colostrum synthesis and quality in beef cattle

- **Optimize Late-Gestation Nutrition**

- Nutrition during the final 60 days of pregnancy is the most critical factor for colostrum quality.
- Maintain body condition score (BCS): Aim for a BCS of 5 or 6 for beef cows at calving. Cows with a BCS below 4 often produce lower volumes and poorer quality colostrum.
- Balance energy and protein: High-energy diets in late gestation increase colostrum yield and total antibody (IgG) mass.
- Maintain a total digestible nutrients to crude protein ratio of 8:1 or lower to ensure rumen microbes function efficiently.
- Mineral Supplementation: Supplementing with trace minerals—specifically zinc, manganese, copper, and selenium—improves immunoglobulin concentrations in cows and calves.

Brief summary of the impacts of vitamins, certain trace minerals, and phytochemicals on colostrum quality.

- Vitamins
- Trace minerals
- Phytochemicals

Research summary of impacts of nutrition and feed additives on colostrum quality and calf health.

Vitamin D:

- 1-3 mg/d of supplemental vitamin D (calcidiol) tended to increase colostrum yield, fat protein and total solids (Martinez et al., 2018; Silva et al., 2022; Poindexter et al., 2023) → Vitamin D may have direct effects on epithelial cell proliferation through hormonal control or calcium and substrate availability.

B vitamins (Biotin-B₈, folate-B₉, cobalamin-B₁₂, and nicotinic acid-B₃):

- Increased colostrum IgG concentration (Aragona et al., 2016, 2020).
- Biotin (B₈) altered fatty acid composition (decreased biohydrogenation intermediates and increased certain n-6 FA C18:3, C20:3 and 20:4) in colostrum (Duplessis et al., 2022).

Cobalt:

- Cobalt supplementation has been reported to increase or tended to increase colostrum and milk vitamin B₁₂ and IgA concentrations (Akins et al., 2013; cofactor for methylmalonyl-CoA mutase → gluconeogenesis via propionate and methionine synthase → methyl transfer and protein metabolism).

Vitamin E



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A meta-analysis and meta-regression of the effects of vitamin E supplementation on serum enrichment, udder health, milk yield, and reproductive performance of transition cows

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Dairy cattle:

- The meta-analysis 10 trials showed an effect size of -0.045 ($P = 0.74$) for IgG concentration in colostrum, indicating no effect of vitamin E supplementation or dose on colostrum IgG status.
- Vitamin E supplementation and dose improved vitamin E status in serum of calves but did not impact colostrum quality or IgG concentrations.
- However, supplementing vitamin E improved reproductive performance of transition cows and cow and calf immunity later in life.

Effects of oral vitamin E supplementation during late gestation in beef cattle that calved in late winter and late summer

Roger T. Bass II, DVM, PhD; William S. Swecker Jr, DVM, PhD; Dan E. Eversole, PhD

Effects of maternal natural (*RRR* α -tocopherol acetate) or synthetic (all-*rac* α -tocopherol acetate) vitamin E supplementation on suckling calf performance, colostrum immunoglobulin G, and immune function

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Beef cattle:

- Vitamin E supplementation to beef cows 60 days prior to calving had no impact on calf birth weight, ADG, weaning body weight, calf serum total IgG or cow colostrum total IgG at 24 h post calving.
- Calves nursing cows supplemented with vitamin E had increased circulating concentrations of alpha-tocopherol at 24 h, which appeared to continue throughout maternal supplementation and improved immunity later in life.

Selenium

- Calves born to cows fed selenium-biofortified (3.0 mg/hd/d vs > 27.0 mg/hd/d) alfalfa hay in the last trimester of pregnancy and received colostrum within the first 12 h of age had higher serum ovalbumin (a surrogate protein marker for IgG absorption) concentrations at 24 and 36 h of age compared to control calves → suggests that selenium supplementation to dams can improve passive transfer (Apperson et al., 2018).
- Feeding selenium-biofortified hay to beef cows during the last 8 to 12 weeks of gestation improved selenium status in cows and their offspring, as well as the IgG1 concentrations in colostrum compared to cows receiving control hay (Wallace et al., 2017).

Mechanism:

- The underlying mechanism for improved passive transfer is unknown.
 - Selenium has been postulated to act directly on intestinal epithelial cells to activate pinocytosis (Kamada et al., 2007).
 - Supranutritional concentrations of Se may delay enterocyte replacement by a more mature population of intestinal epithelial cells, which have been shown to be incapable of passive transfer (Broughton et al., 1970; Smeaton et al., 1985).



Article

Effects of Vitamin and Mineral Supplementation During Gestation in Beef Heifers on Immunoglobulin Concentrations in Colostrum and Immune Responses in Naturally and Artificially Reared Calves

Jennifer L. Hurlbert ^{1,*}, Friederike Baumgaertner ^{1,2}, Kerri A. Bochantin-Winders ¹, Isabella M. Jurgens ¹, Kevin K. Sedivec ² and Carl R. Dahlen ^{1,*}

Objective: Investigate the effects of providing a vitamin and mineral supplement to gestating beef heifers on concentrations of immunoglobulins (Ig) in colostrum and calf serum 24 h after feeding maternal colostrum.

- Angus-based heifers (n = 31) were fed a basal diet (Control) or were fed a basal diet plus a vitamin and mineral supplement (VTM) from breeding (Exp. 1) through calving.
- Colostrum was collected at calving, and serum was collected from calves 24 h after colostrum consumption to evaluate passive transfer.

Item	Assurance Levels	
	Min	Max
Minerals		
Ca, g/kg of DM	135.0	162.0
P, g/kg of DM	75.0	-
NaCl, g/kg of DM	180.0	216.0
Mg, g/kg of DM	10.0	-
K, g/kg of DM	10.0	-
Mn, mg/kg of DM	3600.0	-
Co, mg/kg of DM	12.0	-
Cu, mg/kg of DM	1200.0	-
I, mg/kg of DM	60.0	-
Se, mg/kg of DM	27.0	-
Zn, mg/kg of DM	3600.0	-
Vitamins, IU/kg of DM		
A		661,500.0
D		66,150.0
E		661.5

- No treatment impact on [IgG, IgM, or IgA] in colostrum or in calf serum at 24 h.
- Calves born to VTM heifers had greater antibody titers at birth, pasture turn out, and weaning to vaccine components (IBR, BVD-2, and BRSV), respectively.
- **These data indicate that supplementary vitamins and minerals to gestating beef heifers may be a critical factor in programming offspring immune system development.**

Phytogens



OPEN ACCESS

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Mechanisms by which phytogetic extracts enhance livestock reproductive health: current insights and future directions

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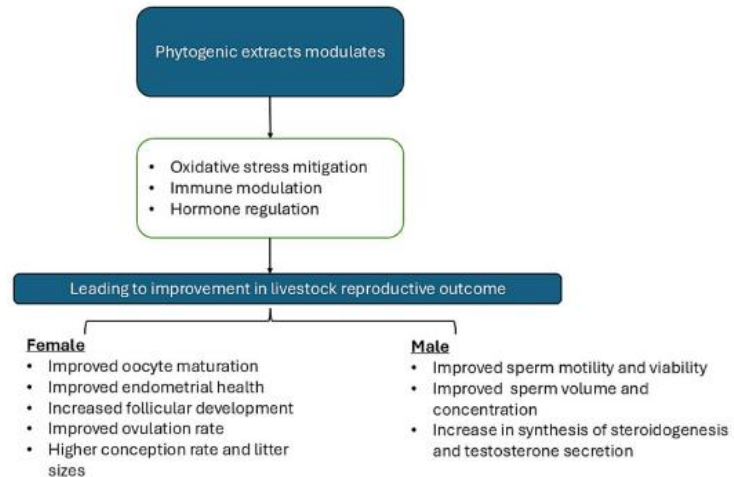


FIGURE 2
Mechanism of action by which phytogetic extracts modulate reproductive outcomes.

TABLE 1 Representative phytogetic extracts that influence reproductive health of livestock.

Health/reproductive condition	Herb used for mitigation	Dosage	Route of administration	Species	Action	References
Delayed puberty	<i>Aegle marmelos</i> and <i>Murraya koenigii</i> supplementation	5 g per day for 9 days	Oral supplementation	Buffalo heifers	Improved estrus induction and ovulation rates	(112)
Poor semen quality	Turmeric, garlic, and moringa extracts	3 g per kg of diet	Oral supplementation	Rabbit bucks	Increased sperm motility and viability	(115, 116)
Infertility	<i>Momordica charantia</i> L. intrauterine administration	1.5 mL orally for 8 weeks	Oral supplementation	Cows	Improved pregnancy rates and fertility outcomes	(117)
Low estrus and conception rates	<i>A. marmelos</i> and <i>M. koenigii</i> supplementation	5 g per day for 9 days	Dietary supplementation	Buffalo heifers	Higher estrus response and better conception rates	(112)
Oxidative stress and inflammation	Various phytogetic extracts	50 mg/kg body weight	Feed additive	Rabbit bucks	Reduced oxidative stress and improved immune function	(115, 116)
Low ovulation rates	β -carotene supplementation	50 mg per day	Dietary supplementation	Goats	Increased progesterone synthesis and higher ovulation rates	(114)
Immune deficiency and low milk yield	Propolis supplementation	5 g per day	Dietary supplementation	Sheep	Improved milk composition and immune response	(80)
Low sperm quality and viability	Ginseng root supplementation	Root extract in diet for 8 weeks	Dietary supplementation	Boars	Enhanced sperm viability and testosterone levels	(77)
Low immunity and poor gut health	<i>Echinacea purpurea</i> feed additive	1% dietary supplementation	Dietary supplementation	Chickens	Boosted immune system and reduced disease susceptibility	(60)



The impact of phytogetic feed additives on ruminant production: A review

N.A. Nastoh^{1*}, M. Waqas^{1,2}, A.A. Çınar¹ and M. Salman¹



Table 1. Effects of phytogetic feed additives (PFA) on ruminant performance

PFA source	Dosage	Study type	Animal species	Diet	Result	References
<i>Foeniculum vulgare</i> seed powder	0.75 and 1.5% of diet	<i>in vivo</i>	male lambs	forage-concentrate 40:60	DMI, LDG, FBW, and FCR ↑ ($P < 0.05$) at 1.5%	Hajalizadeh et al., 2019
<i>Lippia alba</i> hay	30-60-90 g/kg of total DMI	<i>in vivo</i>	Alpine goat	TMR	DMI, acid detergent fibre, feed efficiency ↑ ($P < 0.05$); the intake of total carbohydrates, NDF, and NFC ↓ ($P < 0.001$)	Da Silva et al., 2022
<i>Echinacea purpurea</i> leaf (EP)	4–8-12 g/head/day	<i>in vivo</i>	Ossimi lambs	TMR	BW ↑ 11.82, 13.80, and 12.26% for 4, 8 and 12 g EP, respectively; WG and growth rate ↑ (36.99 and 37.48%), respectively by 8 g EP	Tantawi et al., 2023
Blend of PFA (Digestarom, DSM) and Monensin M	0.5 g/head/day PFA, 0.3 g/head/day monensin	<i>in vivo</i>	Angus steers	TMR	similar DMI and ADG, but ↓ FI as monensin in the beginning phase but performance in the end	Yang et al., 2023
Grape pomace (GP)	5–10% of diet	<i>in vivo</i>	Churra ewe	TMR forage-concentrate 40:60	BBW-FBW and ADG ↓ not significant	Gómez-Cortés et al., 2018
<i>Woodfordia fruticosa</i> , <i>Solanum nigrum</i> , <i>Trigonella foenum-graecum</i>	2–3% of total DMI	<i>in vivo</i>	Jamunapari goat	concentrate and roughage	all nutrients digestibility ↑ ($P < 0.05$); DMI and BWG ↓	Choubey et al., 2015
Anise, clove, and thyme EO	2 ml/head/day	<i>in vivo</i>	Shame goat	TMR	digestibility of ADF, OM, and ether extract ↑ ($P < 0.05$)	El-Essawy et al., 2021
Thyme leaf and celery seeds mixture 1:1	20 g/head/day	<i>in vivo</i>	Barki ewes	concentrate and fodder 60:40	digestibility and nutrient intake ↑ ($P < 0.05$)	Khattab et al., 2020
Rosemary and lemongrass	10 g of each separately/day/h	<i>in vivo</i>	Damascus goat	concentrate and berseem clover	NI ↓ ($P > 0.05$); OM and fibre digestion ↑ ($P < 0.05$)	Kholif et al., 2017
Oregano and carvacrol	50 mg/kg of DM each separately	<i>in vivo</i>	dairy cow	forage and concentrate 60:40	digestibility, N utilisation ↓	Benchaar, 2020
Garlic extract, coriander seed, mesquite pods and oregano	6 ml/head/day orally	<i>in vivo</i>	sheep	TMR	ingestive behaviour and NI ↓ ($P > 0.05$); ND ↑ ($P < 0.05$)	Da Silva et al., 2017
Black rice-purple maize extract 80:20	2-4-6% of diet	<i>in vivo</i>	male dairy cattle	TMR	intake of DM, OM, CP, NDF, ADG, and ADF ↓; EEI ↑ ($P < 0.05$)	Prommachart et al., 2021
Blend of <i>Echinacea</i> , garlic, thyme, caraway and liquorice	35, 20, 15, 15, and 15%, respectively	<i>in vivo</i>	Limousine bulls	roughage and concentrate	daily gain ↑ by 212 g/h/day while feed intake was ↓; protein and fat digestibility ↑ by 1.3 and 2.5%, respectively	Klebanik et al., 2016

EO – essential oil, TMR – total mixed ration, DM – dry matter, DMI – dry matter intake, LDG – live daily gain, FBW – final body weight, FCR – feed conversion ratio, NDF – neutral detergent fibre, NFC – non-fibre carbohydrate, BW – body weight, WG – weight gain, BBW – birth body weight, ADG – average daily gain, BWG – body weight gain, OM – organic matter, NI – nutrient intake, ND – nutrient digestibility, ADF – acid detergent fibre, EEI – ether extract intake; $P < 0.05$ indicates that there is significant effect of PFAs on the given parameters

Phytogens as an alternative to antibiotics

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Ruminant Nutrition



An essential oil blend fed for growth performance and carcass characteristics to feedlot steers

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¹Use of trade names in this publication does not imply endorsement by Colorado State University or criticism of similar products not mentioned.

²Mention of a proprietary product does not constitute a guarantee or warranty of the products by Colorado State University or the authors and does not imply its approval to the exclusion of other products that may also be suitable.

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Objective: Evaluate an essential oil blend fed for growth performance and carcass characteristics to feedlot steers.

Treatments

- 1) Control: no added feed additives
- 2) EO: Essential oil targeted rate of 6 g/hd/d.
- 3) M+T+EO: Monensin, Tylosin and EO
- 4) M+T: Positive control
- 5) M+EO: Monensin and EO (no Tylosin)

- 400 steers total → with 8 weight block replicates per treatment.
- Standard high concentrate finishing diet.


Results

- EO improved receiving cattle weight gains (d 0-56).
- EO improved dressing percentage.
- No impact on liver abscess rates.
- No impact on overall animal performance compared to treatments 3-5.

Phytogens: Pre- and post-calving in beef cattle

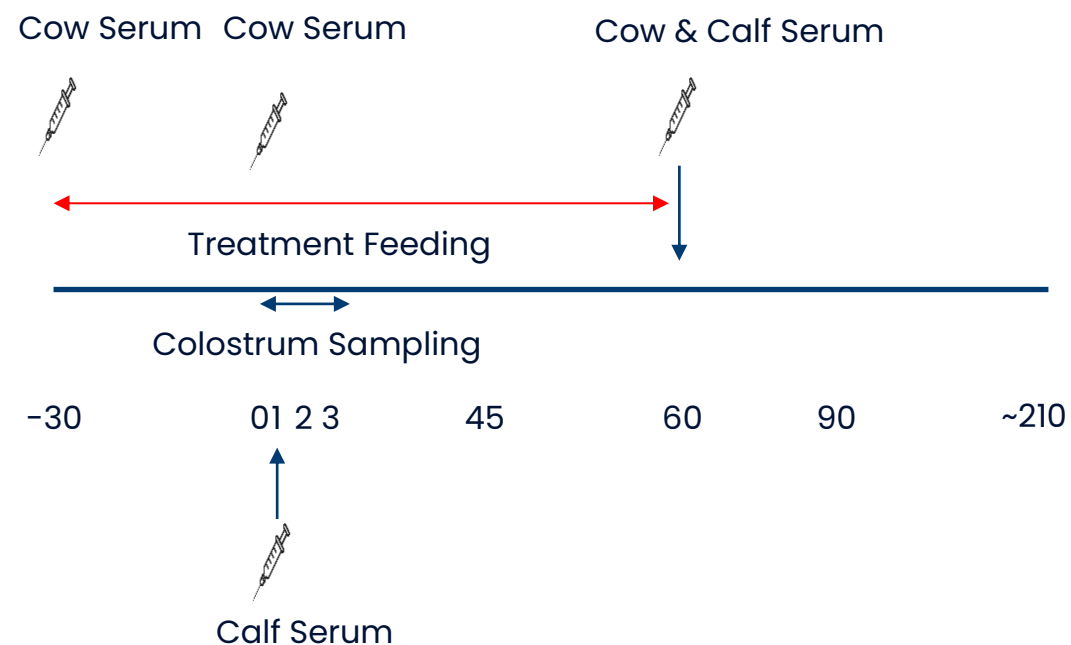


Article
Effects of Botanical Blend of Turmeric, Capsicum, and Pepper Extracts on Colostrum and Milk Yield and Quality, Passive Transfer of Immunity, and Performance of Beef Cow–Calf Pairs

Grace H. Jardon ¹, Madison R. Kovarna ¹, Jeff S. Heldt ² , Emma H. Wall ³ and Ana Clara B. Menezes ^{1,*}

Conducted at South Dakota State University

- 23 Angus-based 3 yr. old cows (532 kg.)
- Group housed in a dry-lot pen
- Corn silage/grass hay/DDGS ration fed @ 2% BW (DMB)
- 3 treatments fed 30 d pre-calving to 60 d post-calving
 - Control: No added FA
 - 250: PHYT06 @ 250 mg/hd/d
 - 500: PHYT06 @ 500 mg/hd/d
 - PHYTO06: formulated blend of turmeric, capsicum, and black pepper extract



Phytogens: Pre- and post-calving in beef cattle

Colostrum composition and volume

Item	Treatments			SEM	P-value	
	CON	PHYT250	PHYT500		Linear	Quadratic
Fat, %	3.29^b	4.23^a	4.17^a	0.29	0.05	0.19
Protein, %	7.80	7.33	8.24	0.34	0.36	0.09
MUN, mg/100g	4.51	5.84	4.58	0.87	0.96	0.21
Other solids, %	4.71	4.60	4.52	0.09	0.16	0.89
Lactose, %	3.66	3.57	3.48	0.10	0.21	0.96
Total colostrum, ml	1441.43	1281.25	1683.75	243.73	0.48	0.33

Phytogens: Pre- and post-calving in beef cattle

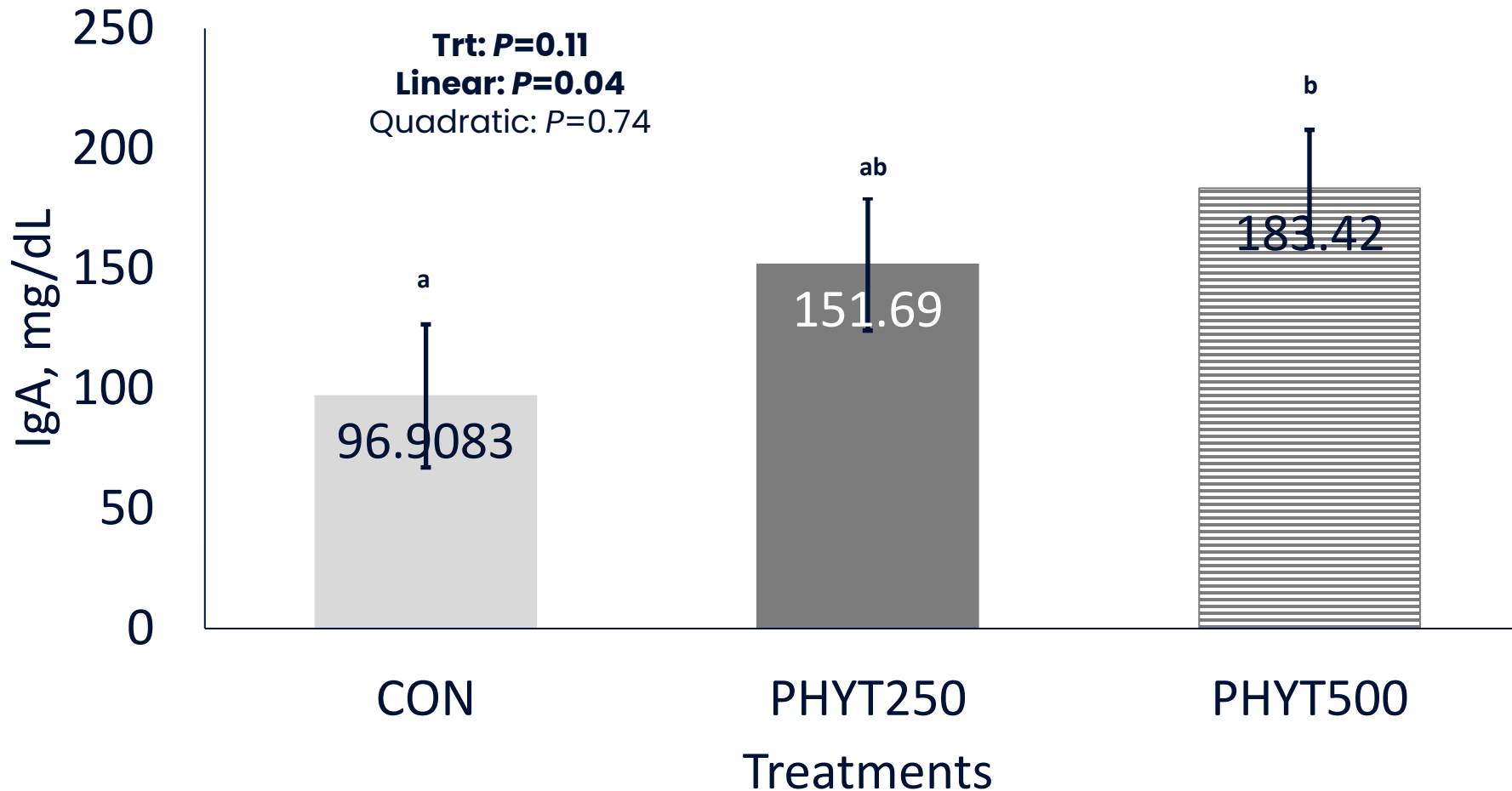


Milk composition and volume

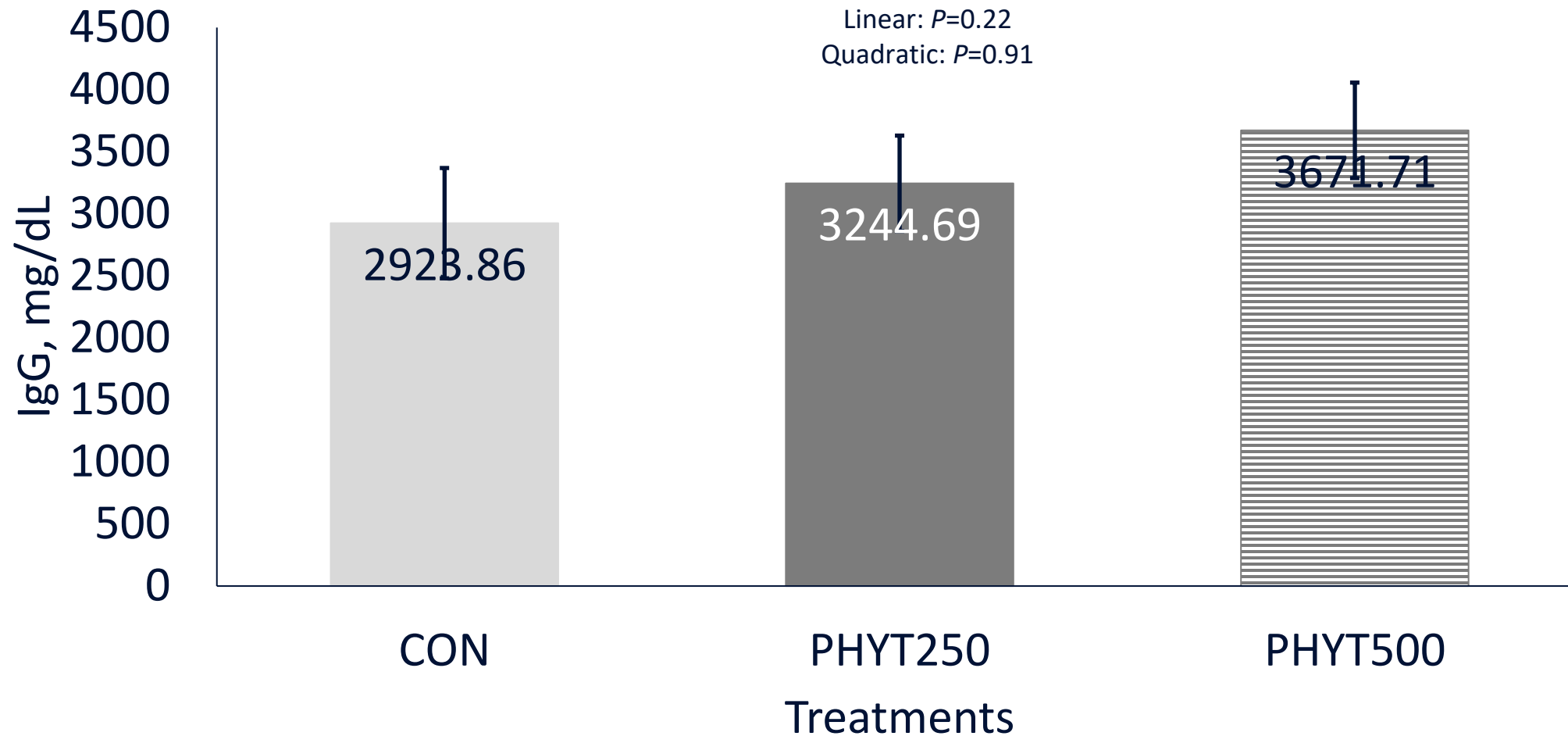
Item	Treatments			SEM	P-value	
	CON	PHYT250	PHYT500		Linear	Quadratic
Fat, %	3.84	4.05	4.71	0.35	0.07	0.56
Protein, %	3.36	3.45	3.36	0.07	0.95	0.29
MUN, mg/100g	16.92	16.23	14.99	0.73	0.06	0.73
Other solids, %	5.27	5.23	5.18	0.11	0.55	0.97
Lactose, %	4.35	4.31	4.28	0.12	0.67	0.96
Total milk, ml	4639.44	5616.67	5564.58	426.86	0.12	0.28

Phytogens: Pre- and post-calving in beef cattle

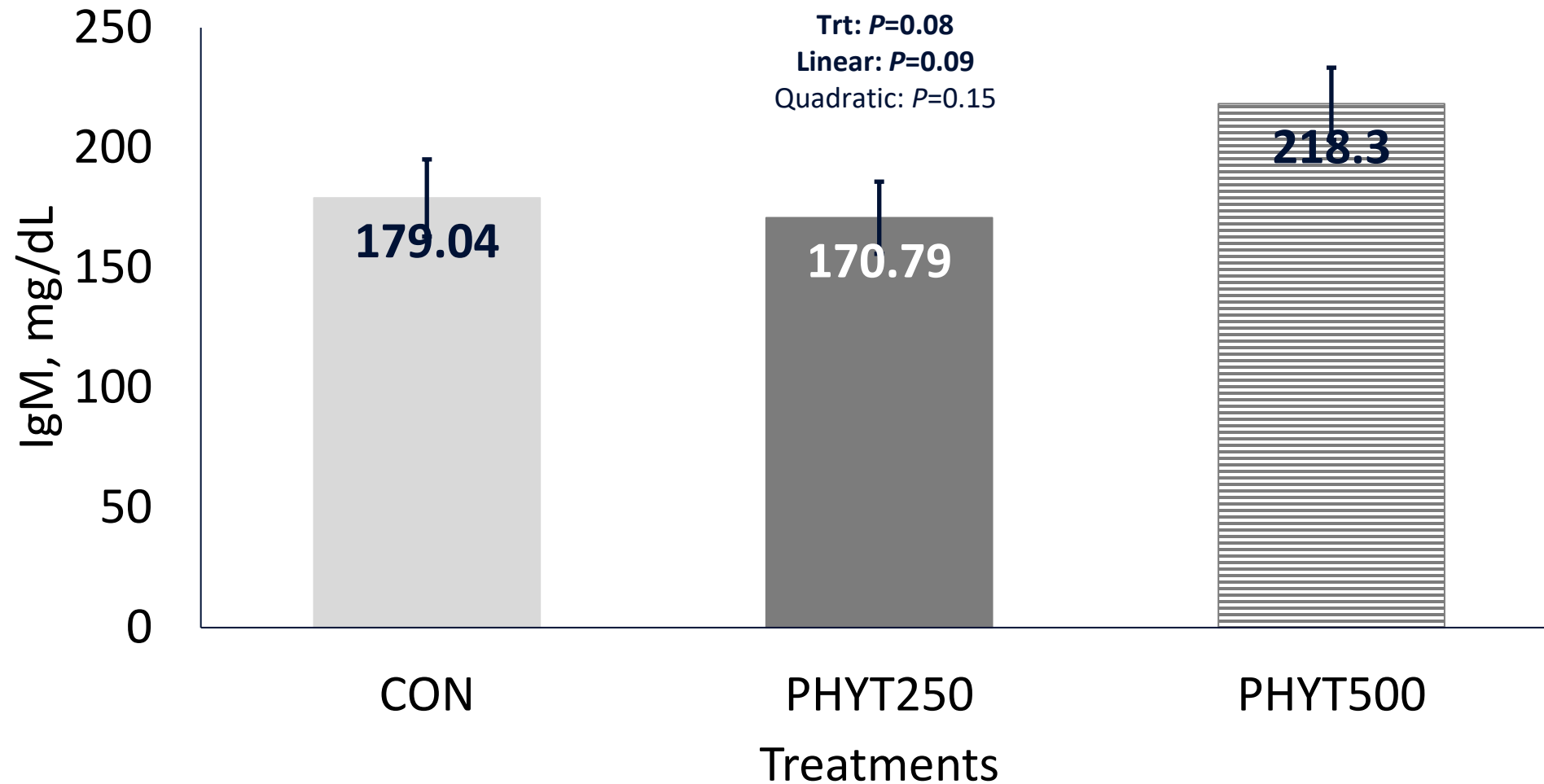
Calf serum IgA 24 hr after birth



Calf serum IgG 24 hr after birth



Colostrum IgM



Summary

- Increased doses of Fytera Lacteco resulted in a linear increase in fat of colostrum and IgA in calf serum.
- Increased doses of Fytera Lacteco tended to linearly increase IgM in colostrum, concentrations of fat in milk as well as total milk.
- A quadratic response was observed for calf ADG ($p = 0.03$), where CON (0.99 ± 0.03 kg/d) was less than PHYT250 (1.10 ± 0.03 kg/d), and intermediate values were observed for PHYT500 (1.01 ± 0.03 kg/d).

Future Opportunities:

- Why the variation in the literature around the impact of minerals, vitamins, and phytochemicals on production, immunity, and colostrum quality?
- Source, quality, composition and external factors (e.g., cattle breed, environmental and dietary factors, etc.).
- Interface between passive, innate, and active immunity.
- IgG, IgA, IgM and other bioactive components?