

BÖLÜM 1



GEÇİŞ DÖNEMİNDE İMMUN FONKSİYONLARIN DEĞİŞİMİ VE OKSİDATİF STRES

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GİRİŞ

İneklerde geçiş dönemi doğum sürecinin öncesi ve sonrasındaki 3 haftayı kapsayan süreçtir. Bu süreçte ineklerde hormonal, fizyolojik, metabolik ve immünolojik değişimler şekillenmekte, bu değişimlere verilen yanıtlara göre postpartum dönemin başarısı farklılık gösterebilmektedir. Özellikle vücudun patojen mikroorganizmalara karşı oluşturduğu hücresel savunma sistemi geçiş dönemi içerisinde kolostrogenesis, laktogenezis, doğum, postpartum uterusun involüsyonu gibi mekanizmalarda rol almakta, burada görevli hücrelerin metabolizma ile ilişkileri de fonksiyonlarını doğrudan etkilemektedir. Geçiş dönemi içerisindeki kritik kontrol noktalarının belirlenmesi ve bu süreçte ineğe gerekli mineral, iz element, vitamin desteklerinin sağlanması ile immun sistemin fonksiyonel kalması ve dolayısıyla periparturient dönemin başarıyla idaresi sağlanarak ilerleyen süreçlerde oluşabilecek kayıpların önüne geçilebilir.

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KAYNAKLAR

1. Sordillo LM, Shafer-Weaver K, Derosa D. Immunobiology of the mammary gland. *Journal of Dairy Science*. 1997; 80(8):1851-1865.
2. Mehrzad J. Molecular aspects of neutrophils as pivotal circulating cellular innate immune systems to protect mammary gland from pathogens. Kanwar J (ed.) Recent advances in immunology to target cancer, inflammation and infections içinde, InTech, Croatia. 2012 383-422.
3. Mehrzad J, Dosogne H, Meyer E, Heyneman R, Burvenich C. Respiratory burst activity of blood and milk neutrophils in dairy cows during different stages of lactation. *Journal of Dairy Research*. 2001; 68(3):399-415.
4. Bradford B. A difficult time: Transisiton immunity in the dairy cow. Chase C (ed.) Bovine İmmunity Making Immunology and Vaccinology Come Alive içinde. Spain: Servet Editorial- Grupo Asis Biomedica, S.L.; 2022. p. 50-66.
5. Drackley JK. Biology of dairy cows during the transition period: The final frontier?. *Journal ff Dairy Science*. 1999; 82(11), 2259-2273.
6. Goff JP. The monitoring, prevention, and treatment of milk fever and subclinical hypocalcemia in dairy cows. *The Veterinary Journal*. 2008; 76:50-57.
7. Martinez N, Risco CA, Lima FS, et al. Evaluation of peripartal calcium status, energetic profile, and neutrophil function in dairy cows at low or high risk of developing uterine disease. *Journal of Dairy Science*. 2012; 95(12): 7158- 7172.
8. Chapinal NSJ, Leblanc ME, Carson KE, et al. Herd-level association of serum metabolites in the transition period with disease, milk production, and early lactation reproductive performance. *Journal of Dairy Science*. 2012; 95:5676-5682.
9. Neves RC, Leno BM, Curler MD, et al. Association of immediate postpartum plasma calcium concentration with early-lactation clinical diseases, culling, reproduction, and milk production in Holstein cows. *Journal of Dairy Science*. 2018; 101:547-555.
10. Neves RC, Leno BM, Bach KD, et al. Epidemiology of subclinical hypocalcemia in early-lactation Holstein dairy cows: The temporal associations of plasma calcium concentration in the first 4 days in milk with disease and milk production. *Journal of Dairy Science*. 2018b; 101:9321-9331.
11. Yazlık M, Çolakoğlu H, Pekcan M, et al., (2021). Association between metabolic indicators and clinical endometritis during the transition period in Brown Swiss cows. *Medycyna Weterynaryjna*, 2021; 77(5): 238-244.
12. Goff JP, Hohman A, Timms LL. Effect of subclinical and clinical hypocalcemia and dietary cation-anion difference on rumination activity in periparturient dairy cows. *Journal of Dairy Science*. 2020; 103:2591-2601.
13. Miltenburg CL, Duffield TF, Bienzle D, et al. Randomized clinical trial of a calcium supplement for improvement of health in dairy cows in early lactation. *Journal of Dairy Science*. 2016; 99: 6550-6562.
14. Martinez N, Sinedino LDP, Bisinotto RS, et al. Effect of induced subclinical hypocalcemia on physiological responses and neutrophil function in dairy cows. *Journal of Dairy Science*. 2014; 97:874-887.
15. Kimura K, Reinhardt TA, Goff JP. Parturition and hypocalcemia blunts calcium signals in immune cells of dairy cattle. *Journal of Dairy Science*. 2006; 89:2588-2595.
16. Atabai K, Sheppard D, Werb Z. Roles of the innate immune system in mammary gland remodeling during involution. *Journal of Mammary Gland Biology and Neoplasia*. 2007; 12:37-45.

17. Kosteli A, Sugaru E, Haemmerle G, et al. 2010. Weight loss and lipolysis promote a dynamic immune response in murine adipose tissue. *Journal of Clinical Investigation*. 2010; 120:3466–3479
18. Challis JR, Lockwood CJ, Myatt L, et al. Inflammation and pregnancy. *Reproductive Sciences*. 2009; 16:206–215
19. Ametaj BN, Bradford BJ, Bobe G, et al. Strong relationships between mediators of the acute phase response and fatty liver in dairy cows. *Canadian Journal of Animal Science*. 2005; 85:165–175.
20. Mullins CR, Mamedova LK, Brouk MJ, et al. Effects of monensin on metabolic parameters, feeding behavior, and productivity of transition dairy cows. *Journal of Dairy Science*. 2012; 95:1323–1336.
21. Diez-Fraile A, Meyer E, Burvenich C. Sympathoadrenal and immune system activation during the periparturient period and their association with bovine coliform mastitis. A review. *Veterinary Quarterly*. 2003; 25(1): 31-44.
22. Elenkov IJ, Chrousos GP. (2002). Stress hormones, proinflammatory and antiinflammatory cytokines, and autoimmunity. *Annals of the New York Academy of Sciences*. 2002; 966(1): 290-303.
23. Kasproicz DJ, Kohm AP, Berton MT, et al. Stimulation of the B cell receptor, CD86 (B7-2), and the β 2-adrenergic receptor intrinsically modulates the level of IgG1 and IgE produced per B cell. *The Journal of Immunology*. 2000;165(2): 680-690.
24. Madden KS, Sanders VM, Felten DL. Catecholamine influences and sympathetic neural modulation of immune responsiveness. *Annual Review of Pharmacology and Toxicology*. 1995; 35(1):417-448.
25. Shuster DE, Lee EK, Kehrli JM. Bacterial growth, inflammatory cytokine production, and neutrophil recruitment during coliform mastitis in cows within ten days after calving, compared with cows at midlactation. *American Journal of Veterinary Research*, 1996; 57(11):1569- 1575.
26. Roth JA, Kaeberle ML. Effects of in vivo dexamethasone administration on in vitro bovine polymorphonuclear leukocyte function. *Infection and Immunity*, 1981; 33(2):434-441.
27. Aleri JW, Hine BC, Pyman MF, et al. Periparturient immunosuppression and strategies to improve dairy cow health during the periparturient period. *Research in Veterinary Science*. 2016; 108:8-17.
28. Roth JA, Kaeberle ML, Appell LH, et al. Association of increased estradiol and progesterone blood values with altered bovine polymorphonuclear leukocyte 104 function. *American Journal of Veterinary Research*. 1983; 44(2):247-253
29. Comline RS, Hall LW, Lavelle RB, et al. Parturition in the cow: endocrine changes in animals with chronically implanted catheters in the foetal and maternal circulations. *Journal of Endocrinology*. 1974; 63:451-472.
30. Kehrli ME (2015). Immunological dysfunction in periparturient cows: evidence, causes and ramifications. In: *Proc. Florida Nutrition Conference*. 2015:14-29.
31. Goff JP. Major advances in our understanding of nutritional influences on bovine health. *Journal of Dairy Science*. 2006; 89(4):1292-1301.
32. Kimura K, Goff JP, Kehrli ME, et al. Effects of Mastectomy on Composition of Peripheral Blood Mononuclear Cell Populations in Periparturient Dairy Cows. *Journal of Dairy Science*. 2002; 85(6):1437-1444.
33. Kvidera SK, Horst EA, Abuajamieh M, et al. Glucose requirements of an activated immune system in lactating Holstein cows. *Journal of Dairy Science*. 2017; 100:2360–2374.
34. Galvão KN, Flaminio M, Brittin SB, et al. Association between uterine disease and indicators of neutrophil and systemic energy status in lactating Holstein cows. *Journal of Dairy Science*. 2010; 93(7): 2926-2937.

35. Vazquez-Anon M, Bertics S, Luck M, et al. Peripartum liver triglyceride and plasma metabolites in dairy cows. *Journal of Dairy Science*. 1994; 77(6):1521- 1528.
36. Ohtsuka S, Murao K, Imachi H, et al. Prolactin regulatory element binding protein as a potential transcriptional factor for the insulin gene in response to glucose stimulation. *Diabetologia*. 2006; 49(7): 1599-1607.
37. Blondet JJ, Beilman GJ. Glycemic control and prevention of perioperative infection. *Current Opinion in Critical Care*. 2007; 13(4):421-427.
38. Lang CH, Bagby GJ, Spitzer JJ. Glucose kinetics and body temperature after lethal and non-lethal doses of endotoxin. *American Journal of Physiology*. 1985; 248:R471-R478.
39. Vernay MC, Wellnitz O, Kreipe L, et al. Local and systemic response to intramammary lipopolysaccharide challenge during long-term manipulated plasma glucose and insulin concentrations in dairy cows. *Journal of Dairy Science*. 2012; 95:2540-2549
40. Hammon DS, Evjen IM, Dhiman TR, et al. Neutrophil function and energy status in Holstein cows with uterine health disorders. *Veterinary Immunology and Immunopathology*, 2006;113(1-2): 21-29.
41. Scalia D, Lacetera N, Bernabucci U, et al. In vitro effects of nonesterified fatty acids on bovine neutrophils oxidative burst and viability. *Journal of Dairy Science*. 2006; 89(1):147-154.
42. Contreras GA, Sordillo LM.. Lipid mobilization and inflammatory responses during the transition period of dairy cows. *Comparative Immunology, Microbiology and Infectious Diseases*. 2011; 34(3): 281-289.
43. Yazlık MO, Çolakoglu HE, Pekcan M, et al. The evaluation of superoxide dismutase activity, neutrophil function, and metabolic profile in cows with retained placenta. *Theriogenology*. 2019; 128: 40-46.
44. Horst RL, Jorgensen NA. Elevated plasma cortisol during induced and spontaneous hypocalcemia in ruminants. *Journal of Dairy Science*. 1982; 65(12):2332-2337.
45. Burgos RA, Conejeros I, Hidalgo MA, et al. Calcium influx, a new potential therapeutic target in the control of neutrophil-dependent inflammatory diseases in bovines. *Veterinary Immunology and Immunopathology*, 2011; 143(1-2):1-10.
46. Sayeed MM. Exuberant Ca²⁺ signaling in neutrophils: a cause for concern. *Physiology*. 2000; 15(3):130-136
47. Brécharde S, Tschirhart EJ. Regulation of superoxide production in neutrophils: role of calcium influx. *Journal of Leukocyte Biology*. 2008; 84(5):1223-1237.
48. Abuelo A, Hernández J, Benedito JL, et al. The importance of the oxidative status of dairy cattle in the periparturient period: revisiting antioxidant supplementation. *Journal of Animal Physiology and Animal Nutrition*, 2015; 99(6): 1003-1016.
49. Miller JK, Brzezinska-Slebodzinska E, Madsen FC. Oxidative stress, antioxidants, and animal function. *Journal of Dairy Science*. 1993; 76: 2812-2823.
50. Sordillo LM, Aitken SL. Impact of oxidative stress on the health and immune function of dairy cattle. *Veterinary Immunology and Immunopathology*, 2009; 128: 104-109.
51. Asehnoun K, Strassheim D, Mitra S, et al. Involvement of reactive oxygen species in Toll-like receptor 4-dependent activation of NF- κ B. *Journal of Immunology*, 2004;172: 2522-2529.
52. Colakoglu HE, Yazlik MO, Kaya U, et al. MDA and GSH-Px activity in transition dairy cows under seasonal variations and their relationship with reproductive performance. *Journal of Veterinary Research*. 2017; 61(4): 497-502.
53. Lykkesfeldt J, Svendsen O. Oxidants and antioxidants in disease: oxidative stress in farm animals. *The Veterinary Journal*, 2007;173(3): 502-511.
54. Politis I. Reevaluation of vitamin E supplementation of dairy cows: bio- availability, animal health and milk quality. *Animal*. 2012; 6: 1427-1434.

55. Spears JW. Micronutrients and immune function in cattle. *The Proceedings of the Nutrition Society*, 2000; 59: 587–594
56. Bouwstra RJ, Nielen M, Newbold JR, et al. Vitamin E supplementation during the dry period in dairy cattle. Part II: oxidative stress following vitamin E supplementation may increase clinical mastitis incidence post- partum. *Journal of Dairy Science*. 2010b; 93: 5696–5706.
57. Bouwstra RJ, Nielen M, Stegeman JA, et al. Vitamin E supplementation during the dry period in dairy cattle. Part I: adverse effect on incidence of mastitis postpar- tum in a double-blind randomized field trial. *Journal of Dairy Science*. 2010; 93: 5684–5695.
58. Sordillo LM, Raphael W. Significance of metabolic stress, lipid mobilization, and inflammation on transition cow disorders. *Veterinary Clinics of North America Food Animal Practice*. 2013; 29: 267– 278.
59. Schönfeld P, Wojtczak L. Fatty acids as modulators of the cellular production of reactive oxygen species. *Free Radical Biology and Medicine*, 2008; 45: 231–241.