

BÖLÜM 2



GEÇİŞ DÖNEMİNDE ENERJİ DENGESİ VE POSTPARTUM SÜRECE ETKİSİ

Hatice Esra ÇOLAKOĞLU¹

Murat Onur YAZLIK²

GEÇİŞ DÖNEMİNDE ENERJİ İHTİYACI VE POSTPARTUM SÜRECE ETKİLERİ

Geçiş dönemi, ineklerde doğumdan önceki ve sonraki 3 haftayı kapsayan dönemdir. Doğuma yakın süreçte yaşanan endokrin değişimler, laktasyona hazırlık, artan enerji, vitamin, mineral ve protein ihtiyacı ile kuru madde alımının azalması sonucunda oluşan negatif enerji dengesi ve bağışıklık sisteminin baskılanması ile geçiş döneminde inekler metabolik, enfeksiyöz ve reproduktif hastalıklara karşı daha yüksek risk altındadır. Geçiş dönemi sırasında yaşanan tüm sağlık sorunları, ineğin üreme ve süt verim performanslarını olumsuz etkilemekte, dolayısıyla da ekonomik kayıplara neden olmaktadır, bu nedenle geçiş dönemi ineğin yaşamındaki en önemli dönemlerden biridir (1, 2). Bu dönemde negatif enerji dengesine bağlı olarak oluşabilecek sorunları önlemek, kayıpları en aza indirmek ve fertilitiyi arttırmak için geçiş dönemi sürü sevk-i-daresi ile beslenmesine önem verilmelidir.

Süt ineklerinde beslenmeden kazanılan enerji ile yaşama, laktasyon, kolostrum ile gebelik için kaybedilen enerji arasında oluşan fark 'Enerji Den-

¹ Doç. Dr., Ankara Üniversitesi Veteriner Fakültesi, Doğum ve Jinekoloji AD., canatan@ankara.edu.tr

² Doç. Dr., Ankara Üniversitesi Veteriner Fakültesi, Doğum ve Jinekoloji AD., yazlik@ankara.edu.tr

alınan besinlerin öncelikle süt verimine yönlendirilmesi ve geçiş döneminde yaşanan endokrinolojik ve fizyolojik değişiklikler, reproduktif parametreler ile genel sağlık üzerine olumsuz etki etmekte, bunların sonucunda da ciddi ekonomik kayıplar oluşmaktadır. Bu dönemde negatif enerji dengesine bağlı olarak oluşabilecek sorunları önlemek, kayıpları en aza indirmek, fertliliteyi arttırmak için geçiş dönemi sürü sevk-idaresi, beslenmesine önem verilmelidir. Geçiş döneminde metabolik hastalıklar, NED ve VKS değişimi izlenerek saptanan aksaklıklar zamanında giderilmelidir.

KAYNAKLAR

1. Alaçam E. Sütçü ineklerde geçiş dönemi ve önemli sorunları. *Türkiye Klinikleri Journal of Veterinary Science*. 2011;2(2): 85-95.
2. Singh AK, Bhakat C, Mandal DK, et. al. Factors associated with negative energy balance and its effect on behavior and production performance of dairy cows: A review. *Iranian Journal of Applied Animal Science*. 2021;11(4): 641-653.
3. Grummer RR, Rastani RR. Why reevaluate dry period length? *Journal of Dairy Science*. 2004;87: 77-85.
4. Nakada K. How to improve reproductive efficacy from now in Japan? Find out the factors of late lactation to predict postpartum reproductive diseases. *Journal of Reproduction and Development*. 2006;52: 177-183.
5. Nigussie, T. A review on the role of energy balance on reproduction of dairy cow. *Journal of Dairy Research and Technology*. 2018;1(3): 1-8.
6. Carpenter BB, Sprott LR. Determining pregnancy in cattle. *AgriLife Extension Service*. 2008;B-1077.
7. House WA, Bell AW. Mineral accretion in the fetus and adnexa during late gestation in *Holstein* cows. *Journal of Dairy Science*. 1993;76: 2999-3010
8. Bell AW, Slepets R, Ehrhardt RA. Growth and accretion of energy and protein in the gravid uterus during late pregnancy in *Holstein* cows. *Journal of Dairy Science*. 1995;78: 1954-61.
9. Moran J. *Tropical dairy farming: feeding management for small holder dairy farmers in the humid tropics*. Landlinks Press, 2005;51-59.
10. Maciel SMA, Amimo J, Martins M, et al. Factors influencing reproductive performance of cows from different Nguni ecotypes in southern Mozambique. *Tropical Animal Health and Production*. 2012;44: 435-444.
11. Yalew B, Lobago F, Gusho G. Calf survival and reproductive performance of *Holstein-Friesian* cows in central Ethiopia. *Tropical Animal Health and Production*. 2011;43: 359-365.
12. Atashi H, Zamiri MJ, Sayyadenjad MB, et al. Trends in reproductive performance of *Holstein* dairy cows in Iran. *Tropical Animal Health and Production*. 2012;44: 2001-2006.
13. Drackley JK. Biology of dairy cow during the transition period: The final frontier? *Journal of Dairy Science*. 1999;82: 2259-2273.
14. Arslan C, Tufan T. Geçiş dönemindeki süt ineklerinin beslenmesi I. Bu dönemde görülen fizyolojik, hormonal, metabolik ve immunolojik değişiklikler ile beslenme ihtiyaçları. *Kafkas Üniversitesi Veteriner Fakültesi Dergisi*. 2010;16: 151-158.
15. Salasel B, Mokhtari A, Taktaz T. Prevalence, risk factors for and impact of subclinical endometritis in repeat breeder dairy cows. *Theriogenology*. 2010;74: 1271-1278.

16. LeBlanc SJ. Monitoring metabolic health of dairy cattle in the transition period. *Journal of Reproduction and Development*. 2010;56: 29-35
17. Schirmann K, Chapinal N, Weary DM, et al. Short-term effects of regrouping on behavior of prepartum dairy cows. *Journal of Dairy Science*. 2011;94: 2312-2319.
18. Ingvarstén KL. Feeding and management related diseases in the transition cow. Physiological adaptations around calving and strategies to reduce feeding-related diseases. *Animal Feed Science and Technology*. 2006;126: 175-213.
19. Encinias AM, Lardy G. *Body condition scoring I: Managing your cow herd through body condition scoring*. [Online]: [<http://www.ext.nodak.edu.extpubs/ansci/beef/as1026w.htm>]. [Accessed: 29.9.2022].
20. Rehage J, Kaske M. Interactions between milk yield and production diseases in dairy cows. *Übersichten zur Tierernährung*. 2004;32: 203-219.
21. Wathes DC, Cheng Z, Bourne N, et al. Differences between primiparous and multiparous dairy cows in the inter-relationships between metabolic traits, milk yield and body condition score in the periparturient period. *Domestic Animal Endocrinology*. 2007a;33: 203-225
22. Wathes DC, Fenwick M, Cheng Z, et al. Influence of negative energy balance on cyclicity and fertility in the high producing dairy cow. *Theriogenology*. 2007b; 68: 232-241.
23. Remppis S, Steingass H, Gruber L, et al. Effects of energy intake on performance, mobilization and retention of body tissue and metabolic parameters in dairy cows with special regard to effects of prepartum nutrition on lactation—A review. *Asian-Australasian Journal of Animal Sciences*. 2011;24: 540-572.
24. Bisinotto RS, Greco LF, Ribeiro ES, et al. Influence of nutrition and metabolism on fertility of dairy cows. *Animal Reproduction*. 2012;9: 260-272.
25. Hayırlı A, Çolak A. İneklerin kuru ve geçiş dönemlerinde sevk-idare ve besleme stratejileri: postpartum süreçte metabolik profil, sağlık durumu ve fertiliteye etkisi. *Türkiye Klinikleri Journal of Veterinary Science*. 2011;2: 1-35.
26. Młynek K, Strączek I, Głowińska B. The occurrence of a negative energy balance in Holstein-Friesian and Simmental cows and Its Association with the Time of Resumption of Reproductive Activity. *Metabolites*. 2022;12(5): 448.
27. Swartz TH, Moallem U, Kamer H, et al. Characterization of the liver proteome in dairy cows experiencing negative energy balance at early lactation. *Journal of Proteomics*. 2021;246:104308.
28. Butler WR Nutritional interactions with reproductive performance in dairy cattle. *Animal Reproduction Science*. 2000;60-61: 449-57.
29. Garnsworthy PC, Lock A, Mann GE et al. Nutrition, metabolism and fertility in dairy cows: 1. Dietary energy source and ovarian function. *Journal of Dairy Science*. 2008;91: 3814-3823
30. Crowe MA. Review article: Resumption of ovarian cyclicity in postpartum beef and dairy cows. *Reproduction in Domestic Animals*. 2008;43: 20-28.
31. Amanuel B, Ulfina G. Combating negative effect of negative energy balance in dairy cows: comprehensive review. *Approaches in Poultry, Dairy & Veterinary Scienc*. 2019; 6(2).
32. Song Y, Wang Z, Zhao C, et al. Effect of negative energy balance on plasma metabolites, minerals, hormones, cytokines and ovarian follicular growth rate in Holstein dairy cows. *Journal of Veterinary Research*. 2021;65(3): 361-368.
33. Leroy JLMR, Opsomer G, Van Soom A, et al. Reduced fertility in high yielding dairy cows: are the oocyte and embryo in danger? Part I: The importance of negative energy balance and altered corpus luteum function to the reduction of oocyte and embryo quality in high yielding dairy cows. Review. *Reproduction in Domestic Animals*. 2008;43: 612-622.
34. Triwutanon S, Rukkwamsuk T. Factors associated with negative energy balance in periparturient dairy cows raised under tropical climate of Thailand—A mini-review. *Journal of Advanced Veterinary and Animal Research*. 2021;8(3): 378.

35. Civiero M, Cabezas-Garcia EH, Ribeiro-Filho HMN, et al. Relationships between energy balance during early lactation and cow performance, blood metabolites, and fertility: A meta-analysis of individual cow data. *Journal of Dairy Science*. 2021;104(6): 7233-7251.
36. Horst EA, Kvidera SK, Baumgard LH. Invited review: The influence of immune activation on transition cow health and performance—A critical evaluation of traditional dogmas. *Journal of Dairy Science*. 2021;104(8):8380-8410.
37. Pérez-Báez J, Risco CA, Chebel RC, et al. Association of dry matter intake and energy balance prepartum and postpartum with health disorders postpartum: Part II. Ketosis and clinical mastitis. *Journal of Dairy Science*. 2019;102(10): 9151-9164.
38. Churakov M, Karlsson J, Rasmussen AE, et al. Milk fatty acids as indicators of negative energy balance of dairy cows in early lactation. *Animal*. 2021;15(7):100253.
39. Esposito G, Irons PC, Webb EC, et al. Interactions between negative energy balance, metabolic diseases, uterine health and immune response in transition dairy cows. *Animal Reproduction Science*. 2014;30;144(3-4): 60-71.
40. 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.
41. LeBlanc SJ, Duffield T, Leslie K, et al. Defining and diagnosing postpartum clinical endometritis and its impact on reproductive performance in dairy cows. *Journal of Dairy Science*. 2002;85: 2223-2236.
42. Macrae, A. Assessment of energy balance in dairy cattle. *Livestock*. 2019;24(5): 229-235.
43. Mulligan FJ, O'Grady L, Rice DA, et al. A herd health approach to dairy cow nutrition and production diseases of the transition cow. *Animal Reproduction Science*. 2006;96: 331-353.
44. Singh AK, Bhakat C. The relationship between body condition score and milk production, udder health and reduced negative energy balance during initial lactation period: A review. *Iranian Journal of Applied Animal Science*. 2022;12(1), 1-9.
45. Santos JEP, Rutigliano HM, SA Filho MF. Risk factors for resumption of postpartum cyclicity and embryonic survival in lactating dairy cows. *Animal Reproduction Science*. 2009;110: 207-221.
46. Roche JR, Kay JK, Friggens NC, et al. Assessing and managing body condition score for the prevention of metabolic disease in dairy cows. *Veterinary Clinics of North America: Food Animal Practice*. 2013;29: 323-336.
47. Montiel F, Ahuja C. Body condition and suckling as factors influencing the duration of postpartum anestrus in cattle. *Animal Reproduction Science*. 2005;85: 1-26.
48. Wathes DC, Clempson AM, Pollott GE. Associations between lipid metabolism and fertility in the dairy cow. *Reproduction, Fertility and Development*. 2013;25: 48-61.
49. Souissi W, Bouraoui R. Relationship between body condition score, milk yield, reproduction, and biochemical parameters in dairy cows. *Lactation in Farm Animals-Biology, Physiological Basis, Nutritional Requirements, and Modelization*. 2019. P. 3-14.
50. Edmonson AJ, Lean IJ, Weaver LD, et al. A body condition scoring chart for *Holstein* dairy cows. *Journal of Dairy Science*. 1989;72: 68-78.
51. Jones C, Heinrichs J. Manual for body condition scoring excel spreadsheet series. DAS 03-60. The Pennsylvania State Univ., University Park. 2008.
52. Rodenburg J. Body condition scoring of dairy cattle. [Online] <http://www.omafra.gov.on.ca/english/livestock/dairy/facts/00-109.htm> [Accessed:16th June 2022]
53. Elanco Animal Health. Body condition scoring in Dairy Cattle, Bulletin, AI 8478, California. 2009.
54. Encinias AM, Lardy G. Body condition scoring I: Managing your cow herd through body condition scoring. [Online] <http://www.ext.nodak.edu.extpubs/ansci/beef/as1026w.htm>

- [Accessed: 16th June 2022]
55. Ferguson JD, Azzaro G, Licitra G. Body condition using digital images. *Journal of Dairy Science*. 2006;89: 3833-3841.
 56. Bewley JM, Schutz MM. Review: an interdisciplinary review of body condition scoring for dairy cattle. *The Professional Animal Scientist*. 2008;24: 507-529.
 57. Grant R, Keown J. Feeding dairy cattle for proper body condition score. Cooperative Extension; G92-1070-A, Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln. 1992.
 58. Serin G. Sütçü ineklerde beden kondisyon skorunun reproduktif performans üzerine etkisi. *Kafkas Üniversitesi Veteriner Fakültesi Dergisi*. 2004;10: 221-225
 59. Butler WR Smith RD. Interrelationship between energy balance and postpartum reproductive function in dairy cattle. *Journal of Dairy Science*. 1989;72: 767-783
 60. Ruegg PL. Body condition scoring in dairy cows relationship with production, reproduction, nutrition and health. *The Compendium North American Edition*. 1991;13: 1309-1313.
 61. Silke V, Diskin MG, Kenny, DA, et al. Extent, pattern and factors associated with late embryonic loss in dairy cows. *Animal Reproduction Science*. 2002;71: 1-12.
 62. Overton TR, Waldron MR. Nutritional management of transition dairy cows: Strategies to optimize metabolic health. *Journal of Dairy Science*. 2004;87, 105-119.
 63. Hoffman PC, Funk DA. Applied dynamics of dairy replacement growth and management. *Journal of Dairy Science*. 1992;76: 3179-3187.
 64. Coffey MP, Hickey J, Brotherstone S. Genetic aspects of growth of *Holstein-Friesian* dairy cows from birth to maturity. *Journal of Dairy Science*. 2006;89: 322.
 65. Roche JR, Berry DP, Lee JM, et al. Describing the body condition score change between successive calvings: a novel strategy generalizable to diverse cohorts. *Journal of Dairy Science*. 2007;90: 43784396
 66. Patton J, Kenny DA, McNamara, S, et al. Relationships among milk production, energy balance, plasma analytes, and reproduction in *Holstein-Friesian* cows. *Journal of Dairy Science*. 2007;90: 649.
 67. Wathes DC, Cheng Z, Chowdhury W, et al. Negative energy balance alters global gene expression and immune responses in the uterus of postpartum dairy cows. *Physiological Genomics*. 2009;39: 1-13.
 68. Piccione G, Messina V, Marafioti S, et al. Changes of some haematochemical parameters in dairy cows during late gestation, postpartum, lactation and dry periods. *Veterinarija ir Zootechnika*. 2012;58: 59-64.
 69. Duffield TF, Leblanc S, Bagg R, et al. Effect of a monensin controlled release capsule on metabolic parameters in transition dairy cows. *Journal of Dairy Science*. 2003;86: 1171-1176
 70. Quiroz-Rocha GF, Leblanc SJ, Duffield T, et al. Reference limits for biochemical and hematological analytes of dairy cows one week before and one week after parturition. *Canadian Veterinary Journal*. 2009;50: 383-388.
 71. Quiroz-Rocha GF, Leblanc SJ, Duffield T, et al. Short communication: Effect of sampling time relative to the first daily feeding on interpretation of serum fatty acid and beta-hydroxybutyrate concentrations in dairy cattle. *Journal of Dairy Science*. 2010;93: 2030-2033.
 72. Ospina PA, Nydam DV, Stokol T, et al. Associations of elevated nonesterified fatty acids and β -hydroxybutyrate concentrations with early lactation reproductive performance and milk production in transition dairy cattle in the northeastern United States. *Journal of Dairy Science*. 2010;93: 1596-1603.
 73. Ospina PA, Nydam DV, Stokol T, et al. Evaluation of nonesterified fatty acids and beta-hydroxybutyrate in transition dairy cattle in the northeastern United States: Critical thresholds for prediction of clinical disease. *Journal of Dairy Science*. 2010;93: 546-554.
 74. Nydam DV, Ospina PA, Mcart JA, et al. Monitoring negative energy balance in transition

- dairy cows for herd results. Tri-State Dairy Nutrition Conference, 2013; April 23-24.
75. Gonzalez FD, Muino R, Pereira V, et al. Relationship among blood indicators of lipomobilization and hepatic function during early lactation in high-yielding dairy cows. *Journal of Veterinary Science*. 2011;12: 251-255.
 76. Xu W, Vervoort J, Saccenti E, et al. Relationship between energy balance and metabolic profiles in plasma and milk of dairy cows in early lactation. *Journal of Dairy Science*. 2020;103(5): 4795-4805.
 77. Block SS, Butler WR, Ehrhardt RA, et al. Decreased concentration of plasma leptin in periparturient dairy is by negative energy balance. *Journal of Endocrinology*. 2001;171: 339-348.
 78. Reynolds CK, Aikman PC, Lupoli B, et al. Splanchnic metabolism of dairy cows during the transition from late gestation through early lactation. *Journal of Dairy Science*. 2003;86: 1201-1217.
 79. Adewuyi AA, Gruys E, Van Eedenbug FJCM. Non esterified fatty acids (NEFA) in dairy cattle. A review. *Veterinary Quarterly*. 2005;27: 117-126.
 80. Soares RAN, Vargas G, Muniz MMM, et al. Differential gene expression in dairy cows under negative energy balance and ketosis: A systematic review and meta-analysis. *Journal of Dairy Science*. 2021;104(1): 602-615.
 81. Rukkamsuk T. A field study on negative energy balance in periparturient dairy cows kept in small holder farms: effect on milk production and reproduction. *African Journal of Agricultural Research*. 2010;5: 3157-3163.
 82. LeBlanc SJ. Interactions of metabolism, inflammation, and reproductive tract health in the postpartum period in dairy cattle. *Reproduction in Domestic Animals*. 2012;47: 18-30.
 83. Garverick HA, Harris MN, Vogel-Bluel R, et al. Concentrations of nonesterified fatty acids and glucose in blood of periparturient dairy cows are indicative of pregnancy success at first insemination. *Journal of Dairy Science*. 2013;96: 181-188.
 84. Hammon DS, Evjen IM, Dhiman TR. Neutrophil function and energy status in *Holstein* cows with uterine health disorders. *Veterinary Immunology and Immunopathology*. 2006;113: 21-29.
 85. Roche JR, Burke CR, Crookenden MA, et al. Fertility and the transition dairy cow. *Reproduction, Fertility and Development*. 2018;30(1): 85-100.
 86. Sahal M, Deniz A, Vural R, et al. Evaluation of the effect of different doses of butaphosphan and cyanocobalamin combination in dairy cattle with subclinical ketosis. *Kafkas Üniversitesi Veteriner Fakültesi Dergisi*. 2017;23(3): 349-356.
 87. Oetzel GR. Monitoring and testing dairy herds for metabolic disease. *Veterinary Clinics of North America Food Animal Practice*. 2004;20: 651-674.
 88. Esposito G, Raffrenato E, Lukamba SD, et al. Characterization of metabolic and inflammatory profiles of transition dairy cows fed an energy-restricted diet. *Journal of Animal Science*. 2020;98(1): 1- 15.
 89. Serbest U, Çınar, M, Hayirli A. Sütçü ineklerde negatif enerji dengesi ve metabolik indikatörleri. *Kafkas Üniversitesi Veteriner Fakültesi Dergisi*. 2012;18: 705-711
 90. Samarutel J, Ling K, Jaakson H, et al. Effect of body condition score at parturition on the production performance, fertility and culling in primiparous Estonian *Holstein* cows. *Veterinarija Ir Zootehnika*. 2006;36: 69-74.
 91. Chapinal N, Veira DM, Weary DM, et al. *Technical Note: Validation of a System for Monitoring Individual Feeding and Drinking Behavior and Intake in Group-Housed Cattle*. *Journal of Dairy Science*. 2007; 90: 5732-5736.
 92. Chagas LM, Bass JJ, Blache D. Invited review: New perspectives on the roles of nutrition

- and metabolic priorities in the subfertility of high-producing dairy cows. *Journal of Dairy Science*. 2007;90: 4022.
93. Putnam DN, Henderson HO. The effect of pregnancy on the body weight of dairy cows. *Journal of Dairy Science*. 1946;29: 657-661
94. Van Straten M, Shpigel NY, Frige M. Associations among patterns in daily body weight, body condition scoring, and reproductive performance in high-producing dairy cows. *Journal of Dairy Science*. 2009;92: 4375-4385.