

YEMLER VE HAYVAN BESLEMEDE ORGANİK ASİTLER

BÖLÜM 10

DOI: 10.37609/akya.3801.c301

Ramazan TOSUN ¹
Ali İhsan ATALAY ²

| 1. GİRİŞ

Hayvancılık sektöründe hayvansal ürünün miktar ve kalitesi ile hayvan refahını artırmak için birçok yem katkı maddeleri kullanılmaktadır. Uzun yıllardır en fazla kullanılan katkı maddesi antibiyotikler olmuştur (1). Ancak hayvansal ürünlerde kalıntı bırakması ve bakterilerin çapraz direnç geliştirmesi nedeniyle 2006 yılında başta Avrupa Birliği ülkeleri olmak üzere birçok ülkede ve Türkiye’de büyümeyi uyarıcı ve gelişimi tetikleyen antibiyotiklerin kullanımı yasaklanmıştır. Antibiyotiklerin yasaklanmasının ardından hayvanlar üzerinde oluşabilecek stres faktörü, hayvansal ürün kaybı gibi ekonomik ve üretimin sürekliliğine zarar verebilecek olumsuz etkilere karşı antibiyotiklerin yerini doldurabilecek alternatif doğal, güvenilir ve kalıntı bırakmayan ürünler araştırılmaya başlanmıştır (2). Bu amaçla enzimler, organik asitler, probiyotikler, prebiyotikler, simbiyotikler, esansiyel yağlar, tıbbi ve aromatik bitkiler, bitki ekstraktları gibi birçok ürünler hayvan beslemede antibiyotiklere alternatif olarak kullanımının araştırılması hız kazanmıştır. Bu araştırmalarda antibiyotiklere alternatif katkı maddesi olarak en çok üzerinde araştırılan ürünlerden biri de organik asitler olmuştur (3). Çünkü organik asitler, hem hayvan sağlığını hem de beslenme verimliliğini artırmaya yardımcı olması açısından hayvan beslemede önemli bir role sahiptir. Bu asitler, özellikle ruminantların sindirim süreçlerinde ve genel metabolizmalarında

¹ Dr. Öğr. Üyesi, Iğdır Üniversitesi, Ziraat Fakültesi, Zootečni Bölümü, ramazantosun68@gmail.com, ORCID iD: 0000-0002-8209-6362

² Doç. Dr., Iğdır Üniversitesi, Ziraat Fakültesi, Zootečni Bölümü, alihsanatalay66@hotmail.com, ORCID iD: 0000-0002-7379-9082

KAYNAKLAR

1. Islam MZ, Khandaker ZH, Chowdhury SD, et al. Effect of citric acid and acetic acid on the performance of broilers. *Journal of the Bangladesh Agricultural University*. 2008; 6(2), 315–320. doi: 10.3329/jbau.v6i2.4828
2. Yaşar S, Okutan İ, Tosun R. Testing novel eubiotic additives: its health and performance effects in commercially raised farm animals. *Journal of the Institute of Science & Technology*. 2017;7(4), 297–308.
3. İpçak HH, Özüretmen S, Özleş H, et al. Hayvan beslemede doğal koruyucular ve etki mekanizmaları. *Hayvansal Üretim*. 2017; 58(1), 57–65.
4. Van Immerseel F, Russell JB, Flythe MD, et al. The use of organic acids to combat *Salmonella* in poultry: A mechanistic explanation of the efficacy. *Avian Pathology*. 2006; 35(3), 182–188. doi: 10.1080/03079450600711045
5. Gül M, Tekce E. Organik asitler: organik asitler ve hayvan beslemede kullanım alanları. *Türkiye Klinikleri*. 2017; 3(1), 57–63.
6. Şenköylü N, Nır I. *Kanatlılar için sindirimi destekleyen yem katkı maddeleri*. Tekirdağ; Tekirdağ Üniversitesi Yayınevi; 2000.
7. Ricke SC. Perspectives on the use of organic acids and short chain fatty acids as antimicrobials. *Poultry Science*. 2003; 82: 632–639. doi: 10.1093/ps/82.4.632
8. Çelikkilek, A. *Broyler yemlerine organik asit katılmasının besi performansı ve ince bağırsak mikrobiyolojisi üzerine etkileri*. Bursa: Uludağ Üniversitesi Doktora Tezi; 2008.
9. Russell JB, Diez-Gonzales F. The effects of fermentation acids on bacterial growth. *Advances in Microbial Physiology*, 1998; 39, 205–234. doi: 10.1016/s0065-2911(08)60017-x
10. Kholif AE, Gouda GA, Olafadehan OA, et al. Acidifiers and organic acids in livestock nutrition and health. Alagawany M, Sallam, SM. El-Hack MEA (ed.) *Organic feed additives for livestock*. London: Academic Press; 2025. p. 43–56.
11. Elghandour MMY, Kholif AE, Salem AZM, et al. Sustainable anaerobic rumen methane and carbon dioxide productions from prickly pear cactus flour by organic acid salts addition. *Journal of Cleaner Production*. 2016; 139, 1362–1369. doi: 10.1016/j.jclepro.2016.08.075
12. El-Zaiat HM, Kholif AE, Mohamed DA, et al. Enhancing lactational performance of Holstein dairy cows under commercial production: malic acid as an option. *Journal of the Science of Food and Agriculture*. 2019; 99(2), 885–892. doi: 10.1002/jsfa.9259
13. Üstündağ AÖ, Özdoğan M. Kanatlı beslemede alterbiyotik kullanımı: probiyotikler, prebiyotikler, organik asitler ve bakteriyosinler. *Türkiye Klinikleri Veteriner Bilimleri-Farmakoloji ve Toksikoloji Özel Dergisi*. 2017; 3(3), 1–16.
14. Theron MM, Lues JFR. *Organic acids and food preservation*. Boca Raton: CRC Press; 2011.
15. Pearlin BV, Muthuvel S, Govidasamy P, et al. Role of acidifiers in livestock nutrition and health: A review. *Journal of Animal Physiology and Animal Nutrition*. 2020; 104(2), 558–569. doi: 10.1111/jpn.13282
16. Dibner JJ, Buttin P. Use of organic acids as a model to study the impact of gut microflora on nutrition and metabolism. *Journal of Applied Poultry Research*. 2002; 11, 453–63. doi: 10.1093/japr/11.4.453
17. Cornils B, Lappe P. Dicarboxylic acids, aliphatic. *Ullmann's Encyclopedia of Industrial Chemistry*. 2012; 11, 287–304
18. Kıyıcı O, Güçlü BK, Kara K, et al. The effectiveness of DL-malic acid on fattening performance and rumen parameters in beef cattle rations containing high concentrated feed and dry forage. *Journal of The Faculty of Veterinary Medicine Erciyes University*. 2023; 20(3), 169–177. doi: 10.32707/ercivet.1389149

19. Rathnayake D, Mun HS, Dilawar MA. Time for a paradigm shift in animal nutrition metabolic pathway: Dietary inclusion of organic acids on the production parameters, nutrient digestibility, and meat quality traits of swine and broilers. *Life*. 2021; 11(6), 476. doi: 10.3390/life11060476
20. Gheller LS, Ghizzi LG, Marques JA, et al. Effects of organic acid-based products added to total mixed ration on performance and ruminal fermentation of dairy cows. *Animal Feed Science and Technology*. 2020; 261, 114406. doi: 10.1016/j.anifeedsci.2020.114406
21. Gouda GA, Kholif AE, Hamdon HA, et al. Utilization of waste date palm leaves biomass ensiled with malic or lactic acids in diets of Farafra ewes under tropical conditions. *Animals*. 2022; 12(11), 1432. doi: 10.3390/ani12111432
22. Pal K, Patra AK, Sahoo A, et al. Effects of nitrate and fumarate in tree leaves-based diets on nutrient utilization, rumen fermentation, microbial protein supply and blood profiles in sheep. *Livestock science*. 2015; 172, 5-15. doi: 10.1016/j.livsci.2014.12.008
23. Fontoura ABP, Javaid A, De La Maza-Escolà VS, et al. Heat stress develops with increased total-tract gut permeability, and dietary organic acid and pure botanical supplementation partly restores lactation performance in Holstein dairy cows. *Journal of Dairy Science*. 2023; 105(9), 7842-7860. doi: 10.3168/jds.2022-21820
24. Liu Q, Wang C, Yang WZ, et al. Effects of malic acid on rumen fermentation, urinary excretion of purine derivatives and feed digestibility in steers. *Animal*. 2009; 3(1), 32-39. doi: 10.1017/S1751731108003364
25. da Silva Dias MS, Ghizzi LG, Marques JA, et al. Effects of organic acids in total mixed ration and feeding frequency on productive performance of dairy cows. *Journal of Dairy Science*. 2021; 104(5), 5405-5416. doi: 10.3168/jds.2020-19419
26. Vyas D, Beauchemin KA, Koenig KM. Using organic acids to control subacute ruminal acidosis and fermentation in feedlot cattle fed a high-grain diet. *Journal of Animal Science*. 2015; 93(8):3950-3958. doi: 10.2527/jas.2015-9009
27. Houari C, Mimoune N, Ait-Issad N, et al. Impact of a feed additive (acidifier and toxin-binder) in milk production in dairy cattle. *Veterinarska Stanica*. 2024; 55(3), 267-278.
28. Van Zijderveld SM, Fonken B, Dijkstra J, et al. Effects of a combination of feed additives on methane production, diet digestibility, and animal performance in lactating dairy cows. *Journal of Dairy Science*. 2011; 94(3), 1445-1454. doi: 10.3168/jds.2010-3635
29. Sun YY, Li J, Meng QS, et al. Effects of butyric acid supplementation of acidified milk on digestive function and weaning stress of cattle calves. *Livestock Science*. 2019; 225, 78-84. doi: 10.1016/j.livsci.2019.04.021
30. Guilloteau P, Zabielski R, David JC, et al. Sodium-butyrate as a growth promoter in milk replacer formula for young calves. *Journal of Dairy Science*. 2009; 92(3), 1038-1049. doi: 10.3168/jds.2008-1213
31. Patel JR, Patil SS, Pawar MM. Effect of malic acid supplementation on haemato-biochemical and reproductive parameters of lactating kankrej cows. *Journal of Krishi Vigyan*. 2024; 12(3), 490-496.
32. Abdelrahman MM, Alhidary I, Albaadani HH, et al. (2019). Effect of palm kernel meal and malic acid on rumen characteristics of growing Naemi lambs fed total mixed ration. *Animals*. 2019; 9(7), 408. doi: 10.3390/ani9070408
33. Toprak NN, Öztürk H, Dikmen BY, et al. Effects of malate supplementation to the concentrate feed on performance, rumen fermentation and carcass yield of lambs fed forage at restricted and ad-libitum level. *Ankara Üniversitesi Veteriner Fakültesi Dergisi*. 2018; 66(1), 73-81.
34. Abas I, Kutay HC, Kahraman R, et al. Effects of organic acid and bacterial direct-fed microbial on fattening performance of Kivircik-Male yearling lambs. *Pakistan Journal of Nutrition*. 2007; 6(2), 149-154. doi: 10.3923/pjn.2007.149.154

35. Cao YN, Sun YR, Tang YM, et al. Effect of high oxalic acid intake on growth performance and digestion, blood parameters, rumen fermentation and microbial community in sheep. *Small Ruminant Research*. 2024; 237, 107324. doi: 10.1016/j.smallrumres.2024.107324
36. Saadi AM, Almallah OD, Mustafa MW. The effects of dietary addition of acetic acid on milk yield and composition in Awassi ewes at an early stage of lactation. *Food Research*. 2023; 7(4), 122-126. doi: 10.26656/fr.2017.7(4).202
37. Li W, Cui Z, Jiang Y, et al. Dietary guanidine acetic acid improves ruminal antioxidant capacity and alters rumen fermentation and microflora in rapid-growing lambs. *Antioxidants*. 2023; 12(3), 772. doi: 10.3390/antiox12030772
38. Carrillo-Muro O, Rivera-Villegas A, Hernandez-Briano P, et al. Effect of dietary calcium propionate inclusion period on the growth performance, carcass characteristics, and meat quality of feedlot ram lambs. *Agriculture*. 2023; 13(8), 1577. doi: 10.3390/agriculture13081577
39. Francis FL, Ribeiro TLM, LaFleur D, et al. Encapsulated butyric acid and zinc as a feed additive for lambs abruptly transitioned to a grain-based diet. *Biology*. 2024; 13(6), 457. doi: 10.3390/biology13060457.
40. Meng M, Li X, Huo R, et al. Effects of dietary disodium fumarate supplementation on muscle quality, chemical composition, oxidative stress and lipid metabolism of Hu sheep induced by high concentrate diet. *Meat Science*. 2023; 201, 109176. doi: 10.1016/j.meatsci.2023.109176
41. Giorgino A, Raspa F, Valle E, et al. Effect of dietary organic acids and botanicals on metabolic status and milk parameters in mid-late lactating goats. *Animals*. 2023; 13(5), 797. doi: 10.3390/ani13050797
42. Elewa AE, Ali ME, Fahmy SE, et al. Impact of malic acid supplementation on the performance, rumen fermentation, biochemical parameters and antioxidant status in lambs. *Egyptian Journal of Veterinary Sciences*. 2024; 1–10.
43. Dong H, Tan J, Li S, et al. Effect of fumarate and live yeast on methane emissions, rumen fermentation, blood metabolites, and lactation performance in dairy goats. *bioRxiv*. doi: 10.1101/2024.08.00.
44. Kopecky J, Hrnčár C, Weis J. Effect of organic acids supplement on performance of broiler chickens. *Animal Sciences & Biotechnologies*. 2012; 45, 51–54.
45. Emami NK, Daneshmand A, Naeini SZ, et al. Effects of commercial organic acid blends on male broilers challenged with *E. coli* K88: performance, microbiology, intestinal morphology, and immune response. *Poultry Science*. 2017; 96(9), 3254–3263. doi: 10.3382/ps/pex106
46. Yang X, Xin H, Yang C, et al. Impact of essential oils and organic acids on the growth performance, digestive functions and immunity of broiler chickens. *Animal Nutrition*. 2018; 4(4), 388–393. doi: 10.1016/j.aninu.2018.04.005
47. Gao YY, Zhang XL, Xu LH, et al. Encapsulated blends of essential oils and organic acids improved performance, intestinal morphology, cecal microflora, and jejunal enzyme activity of broilers. *Czech Journal of Animal Science*. 2019; 64, 189–198. doi: 10.17221/172/2018-CJAS
48. Ding J, He S, Xiong Y, et al. Effects of dietary supplementation of fumaric acid on growth performance, blood hematological and biochemical profile of broiler chickens exposed to chronic heat stress. *Brazilian Journal of Poultry Science*. 2020; 22(1), eRBCA-2019-1147. doi: 10.1590/1806-9061-2019-1147
49. He S, Ding J, Xiong Y, et al. Effects of dietary fumaric acid on growth performance, meat quality, nutrient composition and oxidative status of breast muscle in broilers under chronic heat stress. *European Poultry Science*. 2020; 84. doi: 10.1399/eps.2020.300.
50. He S, Yin Q, Xiong Y, et al. Effects of dietary fumaric acid on the growth performance, immune response, relative weight and antioxidant status of immune organs in broilers exposed to chronic heat stress. *Czech Journal of Animal Science*. 2020; 65, 104–113. doi: 10.17221/13/2020-CJAS

51. Nguyen DH, Lee KY, Mohammadigheisar M, et al. Evaluation of the blend of organic acids and medium-chain fatty acids in matrix coating as antibiotic growth promoter alternative on growth performance, nutrient digestibility, blood profiles, excreta microflora, and carcass quality in broilers. *Poultry Science*. 2018; 97(12), 4351–4358. doi: 10.3382/ps/pey339
52. Mustafa A, Bai S, Zeng Q, et al. Effect of organic acids on growth performance, intestinal morphology, and immunity of broiler chickens with and without coccidial challenge. *AMB Express*. 2021; 11, 1–18. doi: 10.1186/s13568-021-01299-1.
53. Ma J, Wang J, Mahfuz S, et al. Supplementation of mixed organic acids improves growth performance, meat quality, gut morphology and volatile fatty acids of broiler chicken. *Animals*. 2021; 11(11), 3020. doi: 10.3390/ani11113020.
54. Ogunola KM, Jegede AV, Fafiolu AO, et al. Responses of broiler chickens to diets of different nutritional planes supplemented with or without organic acids. *Veterinary Medicine and Science*. 2025; 11(3), e70332. doi: 0.1002/vms3.70332
55. Islam Z, Sultan A, Khan S, et al. Effects of an organic acids blend and coated essential oils on broiler growth performance, blood biochemical profile, gut health, and nutrient digestibility. *Italian Journal of Animal Science*. 2024; 23(1), 152–163. doi: 10.1080/1828051X.2023.2297562
56. Dai D, Qiu K, Zhang HJ, et al. Organic acids as alternatives for antibiotic growth promoters alter the intestinal structure and microbiota and improve the growth performance in broilers. *Frontiers in Microbiology*. 2021; 11, 618144. doi: 10.3389/fmicb.2020.618144
57. Waghmare S, Gupta M, Bhiram KB, et al. Effects of organic acid blends on the growth performance, intestinal morphology, microbiota, and serum lipid parameters of broiler chickens. *Poultry Science*. 2025; 104(1), 104546. doi: 10.1016/j.psj.2024.104546
58. Salem FM, Abd El-Dayem AA. Formic and propionic acids' effectiveness on laying hens' productivity and egg quality, utilization of nutrients and some blood profiles during the early production phase. *Tropical Animal Health and Production*. 2025; 57, 63. doi: 10.1007/s11250-025-04276-z.
59. Birilie E, Mekuriaw Y, Animut G. Effect of dietary organic acids supplementation on laying performance, egg quality traits and economic efficiency of commercial layer hens. *Uttar Pradesh Journal of Zoology*. 2025; 46(9), 409–419.
60. Wei-Qian H, Wen-Hui Z, Yue-Yi L, et al. Effects of compound organic acidifiers on production performance, egg quality, serum biochemical indexes, and economic benefits of laying hens in late laying period. *Feed Research*. 2024; 47(8).
61. Zhang M, Zou XT, Li H, et al. Effect of dietary γ -aminobutyric acid on laying performance, egg quality, immune activity and endocrine hormone in heat-stressed Roman hens. *Animal Science Journal*. 2012; 83(2), 141–147. doi: 10.1111/j.1740-0929.2011.00939.x
62. Abbas G, Sohail HK, Habib-Ur R. Effects of formic acid administration in the drinking water on production performance, egg quality and immune system in layers during hot season. *Avian Biology Research*. 2013; 6(3), 227–232. doi: 10.3184/175815513X13740707043279
63. Bouassi T, Libanio D, Mesa MD, et al. Supplementation with liquid whey and ACIDAL® ML in drinking water affect gut pH and microflora and productive performance in laying hens. *British Poultry Science*. 2021; 62(1), 138–146. doi: 10.1080/00071668.2020.1824291
64. Srisongkram U, Permpoonpattana P, Rattanawut J. Effects of mixed organic acids supplementation in laying hen diet on production performance, egg quality and ileal bacterial populations.
65. Ebeid TA, Al-Homidan IH. Organic acids and their potential role for modulating the gastrointestinal tract, antioxidative status, immune response, and performance in poultry. *World's Poultry Science Journal*. 2022; 78(1), 83–101. doi: 10.1080/00439339.2022.1988803

66. Smulikowska S, Czerwiński J, Mieczkowska A, et al. The effect of fat-coated organic acid salts and a feed enzyme on growth performance, nutrient utilization, microflora activity, and morphology of the small intestine in broiler chickens. *Journal of Animal and Feed Sciences*. 2009; 18(3), 478–489. doi: 10.22358/jafs/66422/2009
67. Tugnoli B, Giovagnoni G, Piva A, et al. 2020. From acidifiers to intestinal health enhancers: How organic acids can improve growth efficiency of pigs. *Animals*. 2020;10:134. doi: 10.3390/ani10010134.
68. Kara K, Aktug C, Guclu BK, et al. Effect of formic acid on *in vitro* ruminal fermentation and methane emission. *Turkish Journal of Food Agriculture and Science*. 2015; 3, 856–860. doi: 10.24925/turjaf.v3i11.856-860.491