BÖLÜM

9 PROBİYOTİK, PARABİYOTİK VE POSTBİYOTİKLER

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GİRİŞ

Evcil hayvanların mide-bağırsak sistemi, bakteri, protozoa, mantar, arke ve virüslerden oluşan yoğun ve karmaşık mikrobiyal toplulukları barındırır. Son 30 yılda sindirim ekosistemlerinin mikrobiyal bileşim ve fonksiyonel çeşitliliğinin karakterizasyonuna yönelik araştırmalar bağırsak mikrobiyotasının hayvan beslenmesi ve sağlığı konusunda öneminin daha iyi anlaşılmasına yol açmıştır. Gastrointestinal sistemin mikrobiyal toplulukları, otçul hayvanlarda özellikle önemli olan bitki polimerlerinin sindirimi ve fermantasyonu, vitaminlerin sentezi, toksik bileşiklerin toksik olmayan kalıntılara biyolojik dönüşümü, bağışıklık sisteminin uyarılması, bağırsak peristaltizminin ve bağırsak mukoza bütünlüğünün korunması ve patojenlerin kolonizasyonuna karşı bariyer olması gibi önemli görevlere sahiptirler. Besleme uygulamaları, hayvan diyetlerinin bileşimi ve çiftlik yönetimi gibi parametreler bağırsak mikrobiyotasının kompozisyonunu ve fonksiyonlarını sonuç olarak da hayvanların verimliliğini ve sağlığını etkileyebilir. Bu bağlamda, gastrointestinal sistemin mikrobiyal ekosisteminin manipülasyonu yoluyla hayvan sağlığı, refahı ve üretkenliğini arttımak için yem takviyelerinin kullanılması büyük ilgi görmektedir.

PROBİYOTİKLERİN TARİHÇESİ, TANIMI VE SINIFLANDIRILMASI

Probiyotiklerin Tarihçesi

Fermente gıdalar, bakteriler ve sağlık arasındaki bağlantı mikrobiyoloji disiplininin kurulmasıyla başlamıştır. 1680 yılında *Van Leeuwenhoeck*, yeni yaptığı mikroskobu kullanarak biranın fermente edilmesindeki maya hücrelerini gözlemlemiştir. 1700'lerin sonlarında modern kimyanın kurucusu *Lavoisier,* şekerlerin alkol ve karbondioksite dönüşüm sürecini "alkolik fermantasyon olayını" kimyadaki en sıra dışı olaylardan biri olarak tanımlamıştır. 1840'larda *Theodor Schwann* ve *Charles Cagniard-Latour*, mayanın büyümesi ile alkolik fermantasyon süreci arasında olası bir ilişki olduğunu bildirmişlerdir. Laktik asit fermantasyonunun mikroorganizmalar tarafından başlatıldığı sonucuna ulaşan kişi büyük Fransız kimyager *Louis Pasteur'dur*. *Pasteur*, başlangıçta fermantasyonu 'havasız solunum' olarak tanımlamış ve

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rointestinal sistemde stabil kalarak etkili olurlar.

Daha Düşük Antimikrobiyal Direnç Riski: Parabiyotik ve postbiyotiklerin cansız olmaları, antimikrobiyal direnç genlerinin yatay olarak başka hücrelere aktarılma riskini azaltır. Bu, özellikle antibiyotik direncinin önemli bir sorun haline geldiği günümüzde, önemli bir avantajdır.

KAYNAKLAR

Abd El-Ghany WA. Paraprobiotics and postbiotics: Contemporary and promising natural antibiotics alternatives and their applications in the poultry field. Open Veterinary Journal, 2020; 10(3): 323-30.

Abd El-Hack ME, El-Saadony MT, Shafi ME, Qattan SY, Batiha GE, Khafaga, AF. Probiotics in poultry feed. J Anim Physiol Anim Nutr. 2020;104(6):1835–50.

Acar Y, Sökülmez Kaya P. Postbiyotikler ve sağlık üzerine etkileri: Sistematik derleme (Postbiotics and their effects on health: Systematic review). J Lit Pharm Sci. 2021; 10(2): 276-84.

Alagawany M, Abd El-Hack ME, Farag MR, Sachan S, Karthik K, Dhama K. The use of probiotics as eco-friendly alternatives for antibiotics in poultry nutrition. Environ. Sci Pollut Res. 2018; 25: 10611–18.

Alawneh JI, Barreto MO, Moore RJ, Soust M, Al-Harbi H, James AS, et al. Systematic review of an intervention: The use of probiotics to improve health and productivity of calves. Pre Vet Med. 2020; 183: 105147.

Anee IJ, Alam S, Begum RA, Shahjahan RM, Khandaker AM. The role of probiotics on animal health and nutrition. Jo-BAZ. 2021; 82: 52.

Arkadiusz H, Paulina K, Rafał P. Antioxidative activity of probiotics. Arch Med Sci. 2021; 17 (3): 792–04.

Arsène MMJ, Davares AKL, Andreevna SL, Vladimirovich EA, Carime BZ, Marouf R, et al. The use of probiotics in animal feeding for safe production and as potential alternatives to antibiotics. Veterinary World. 2021; 14(2): 319-28.

Artun Y, Ender U. Meta-analysis to predict the effects of probiotics on meat quality of broiler. J Anim Physiol Anim Nutr. 2024; 1-8.

Atılgan C, Karabıyıklı Çiçek Ş. Hayvanların beslenmesinde probiyotik ve prebiyotiklerin önemi ve sağlık üzerine etkileri. GBAD. 2021; 10(2): 24-5.

Aydın F. Su ürünleri yetiştiriciliğinde postbiyotik ve paraprobiyotiklerin yeri. Mar Life Sci. 2023; 5(1): 26-36.

Azita F, Fatemeh R. The antioxidant activity of Lactic acid bacteria and probiotics. J Food Safe & Hyg. 2020; 6(4): 168-82.

Bajagai YS, Klieve AV, Dart PJ, Bryden WL. Probiotics in animal nutrition—production, impact and regulation. In: Makkar HPS, editor. FAO animal production and health paper No. 179. Food and Agriculture Organization of the United Nation, Rome, Italy; 2016.

Bąkowski M, Kiczorowska B. Probiotic microorganisms and herbs in ruminant nutrition as natural modulators of health and production efficiency. Ann Anim Sci. 2021; 21(1): 3-28.

Barreto MO, Soust M, Moore RJ, Olchowy TW, Alawneh JI. Systematic review and meta-analysis of probiotic use on inflammatory biomarkers and disease prevention in cattle. Pre Vet Med. 2021; 194: 105433.

Beegum F, Chandran A. Postbiotics: A developing notion to application. International Journal of Advanced Biochemistry Research. 2024; 8(9): 148-53.

Begum J, Buyamayum B, Lingaraju MC, Dev K, Biswas A. Probiotics: Role in immunomodulation and consequent effects. Letters in Animal Biology. 2021; 1(1): 01-06.

Bhogoju S, Nahashon S. Recent Advances in probiotic application in animal health and nutrition. Agriculture. 2022; 12(2): 304

Binda S, Hill C, Johansen E, Obis D, Pot B, Sanders ME, et al. Criteria to qualify microorganisms as "probiotic" in foods and dietary supplements. Front Microbiol. 2020; 11:1662

Burçak E, Yalçın S. Buzağı beslemede probiyotiklerin kullanımı: The use of probiotics in calf nutrition. Lalahan Hay Araşt Enst Derg. 2013; 53(2); 101-14.

Butel MJ. Probiotics, gut microbiota and health. Med Mal Infect. 2014; 44(1): 1-8.

Chaucheyras-Durand F, Durand H. Probiotics in animal nutrition and health. Beneficial microbes. 2010; 1(1): 3-9

Cuevas-González PF, Liceaga AM, Aguilar-Toalá JE. Postbiotics and paraprobiotics: From concepts to applications. Food Res Int. 2020; 136: 109502.

Devadharshini K, Devamugilan C. Probiotics in Ruminants: A comprehensive review of health, production and future frontiers. Chron Aquat Sci. 2024; 1(10): 182-193.

Dışhan A, Gönülalan Z, Dokuzcu D. Mevcut postbiyotik sınıfları ve sağlık etkileşimleri: Current classes of postbiotics and their health interactions. Bes Diy Derg. 2022; 50(1): 83-91

European Food Safety Authority (EFSA), Panel on Additives and Products or Substances used in Animal Feed (EFSA FEEDAP Panel). Safety and efficacy of Probiomix B (Lactobacillus plantarum KKP/593/p and Lactobacillus rhamnosus KKP 825) as a feed additive for chickens for fattening. EFSA J. 2016; 14(2): 4397.

European Food Safety Authority (EFSA), Panel on Biological Hazards (EFSA BIOHAZ Panel). Scientific opinion on the maintenance of the list of QPS biological agents intentionally added to food and feed (2013 update). EFSA J. 2013; 11(11): 108.

Ezema C. Probiotics in animal production. J Vet Med Anim Health. 2013: 5(11): 308-16.

Feng T, Wang J. Oxidative stress tolerance and antioxidant capacity of lactic acid bacteria as probiotic: a systematic review. Gut Microbes. 2020; 12(1); 1801944.

Gaggìa F, Mattarelli P, Biavati B. Probiotics and prebiotics in animal feeding for safe food production. Int J of Food Microb. 2010; 141: 15-28.

Ghimire S, Subedi K, Zhang X, Wu C. Efficacy of *Bacillus subtilis* probiotic in preventing necrotic enteritis in broilers: a systematic review and meta-analysis. Avian Pathology. 2024; 53(6): 451–6.

Gogineni VK, Morrow LE, Gregory PJ, Malesker MA. Probiotics: History and evolution. J Anc Dis Prev Rem. 2013; 1(2): 1-7.

Hashem NM, Gonzalez-Bulnes A. The Use of Probiotics for Management and improvement of reproductive eubiosis

and function. Nutrients. 2022; 14(4): 902.

Hill C, Guarner F, Reid G, Gibson GR, Merenstein DJ, Pot B, et al. Expert consensus document. The International Scientific Association for Probiotics and Prebiotics consensus statement on the scope and appropriate use of the term probiotic. Nat Rev Gastroenterol Hepatol. 2014; 11(8): 506-14.

Hosseini SH, Farhangfar A, Moradi M, Dalir-Naghadeh B. Beyond probiotics: Exploring the potential of postbiotics and parabiotics in veterinary medicine. Research in Veterinary Science. 2024; 167: 105133.

Izuddin WI, Humam AM, Loh TC, Foo HL, Samsudin AA. Dietary Postbiotic Lactobacillus plantarum improves serum and ruminal antioxidant activity and upregulates hepatic antioxidant enzymes and ruminal barrier function in post-weaning lambs. Antioxidants. 2020; 9(3): 250-63.

Izuddin WI, Loh TC, Foo HL, Samsudin AA, Humam AM. Postbiotic L. plantarum RG14 improves ruminal epithelium growth, immune status and upregulates the intestinal barrier function in post-weaning lambs. Sci Rep. 2019; 9: 9938-48.

Izuddin WI, Loh TC, Samsudin AA, Foo HL, Humam AM, Shazali N. Effects of postbiotic supplementation on growth performance, ruminal fermentation and microbial profile, blood metabolite and GHR, IGF-1 and MCT-1 gene expression in post-weaning lambs. BMC Vet Res. 2019; 15: 315-25.

Izuddin WI, Loh TC, Samsudin AA, Foo HL. In vitro study of postbiotics from Lactobacillus plantarum RG14 on rumen fermentation and microbial population. R Bras Zootec. 2018; 47: e20170255.

Jha R, Das R, Oak S, Mishra P. Probiotics (direct-fed microbials) in poultry nutrition and their effects on nutrient utilization, growth and laying performance, and gut health: A systematic review. Animals. 2020; 10(10); 1863.

Kadam JH, Pawar RS, Din MFM, Zambare V. Advances on Probiotics Utilization in Poultry Health and Nutrition. In : Vasudeo Zambare, Mohd Fadhil Md. Din, Puja Gupta and Bhupendra Gopalbhai Prajapati, editors. Advances in Probiotics for Health and Nutrition. 2023; DOI: http://dx.doi.org/10.5772/intechopen.113738

Kareem KY, Loh TC, Foo HL, Akit H, Samsudin AA. Effects of dietary postbiotic and inulin on growth performance, IGF1 and GHR mRNA expression, faecal microbiota and volatile fatty acids in broilers. BMC Vet Res. 2016; 12: 163.

Kareem KY, Loh TC, Foo HL, Asmara SA, Akit H. Influence of postbiotic RG14 and inulin combination on cecal microbiota, organic acid concentration, and cytokine expression in broiler chickens. Poult Sci. 2017: 96; 966-75.

Kober AKMH, Riaz Rajoka MS, Mehwish HM, Villena J, Kitazawa H. Immunomodulation potential of probiotics: A novel strategy for improving livestock health, immunity, and productivity. Microorganisms. 2022; 10(2): 388.

Kulkarni NA, Chethan HS, Srivastava R, Gabbur AB. Role of probiotics in ruminant nutrition as natural modulators of health and productivity of animals in tropical countries: an overview. Tropical Animal Health and Production. 2022; 54(2): 110.

Lee NK, Park YS, Kang DK, Paik HD. Paraprobiotics: definition, manufacturing methods, and functionality. Food Science and Biotechnology. 2023; 32(14); 1981-91.

Li HY, Zhou DD, Gan RY, Huang SY, Zhao CN, Shang A, et al. Effects and mechanisms of probiotics, prebiotics, synbiotics, and postbiotics on metabolic diseases targeting gut microbiota. Nutrients. 2021: 13(9): 3211.

Liu C, Ma N, Feng Y, Zhou M, Li H, Zhang X, Ma X. From probiotics to postbiotics: Concepts and applications. Animal Research and One Health. 2023; 1(1): 92-114.

Loh TC, Choe DW, Foo HL, Sazili AQ, Bejo MH. Effects of feeding differentpostbiotic metabolite combinations produced by Lactobacillus plantarum strains on egg quality and production performance, faecal parameters and plasma cholesterol in laying hens. BMC Vet Res. 2014; 10: 149.

Markowiak P, Śliżewska K. The role of probiotics, prebiotics and synbiotics in animal nutrition. Gut Pathog. 2018; 10: 21.

Martyniak A, Medyńska-Przeczek A, Wedrychowicz A, Skoczeń S, Tomasik PJ. Prebiotics, probiotics, synbiotics, paraprobiotics and postbiotic compounds in IBD. Biomolecules. 2021; 11(12): 1903.

Melara EG, Avellaneda MC, Valdivié M, García-Hernández Y, Aroche R, Martínez Y. Probiotics: Symbiotic relationship with the animal host. Animals. 2022; 12(6): 719.

Nalla K, Manda NK, Dhillon HS, Kanade SR, Rokana N, Hess M, et al. Impact of probiotics on dairy production efficiency. Front Microbiol. 2022; 13: 805963.

Naveen Kango and Suresh Nath Prebiotics, Probiotics and Postbiotics: The changing paradigm of functional foods. Journal of Dietary Supplement 2024; 21(5): 709-35.

Ncho CM, Kim SH, Rang SA, Lee SS. A meta-analysis of probiotic interventions to mitigate ruminal methane emissions in cattle: implications for sustainable livestock farming. Animal. 2024; 18(6): 101180.

Oelschlaeger TA. Mechanisms of probiotic actions. International Journal of Medical Microbiology. 2010; 300(1): 57–62.

Parkinson, TJ, Merrall M, Fenwick SG. A case of bovine mastitis caused by Bacillus cereus. New Zealand Veterinary Journal. 1999; 47(4): 151-52.

Rabetafika HN, Razafindralambo A, Ebenso B, Razafindralambo HL. Probiotics as antibiotic alternatives for human and animal applications. Encyclopedia 2023; 3(2): 561-81.

Rakesh C, Sachin K, Prashant R G, Vinay VV and Banakar PS. A review on probiotics for animals and their mode of action. The Pharma Innovation Journal 2023; 12(2): 500-06.

Reuben RC, Elghandour MM, Alqaisi O, Cone JW, Márquez O, Salem AZ. Influence of microbial probiotics on ruminant health and nutrition: Sources, mode of action and implications. J Sci Food Agric. 2022; 102: 1319-40.

Reuben RC, Sarkar SL, Roy PC, Anwar A, Hossain MA, Jahid IK. Prebiotics, probiotics and postbiotics for sustainable poultry production. World's Poultry Science Journal. 2021; 77(4): 825-82.

Ruiz Sella SR, Bueno T, de Oliveira AA, Karp SG, Soccol CR. Bacillus subtilis natto as a potential probiotic in animal nutrition. Critical Reviews in Biotechnology. 2021; 41(3): 355-69.

Saha S. Fukuyama K, Debnath M, Namai F, Nishiyama K, Kitazawa H. Recent Advances in the use of probiotics to improve meat quality of small ruminants. Microorganisms 2023; 11(7): 1652.

Sánchez B, Delgado S, Blanco-Míguez A, Lourenço A, Gueimonde M, Margolles A. Probiotics, gut microbiota, and their influence on host health and disease. Mol Nutr Food

Res. 2017; 61(1): 1600240
Sharma RK, Chauhan K, Pathak AK, Khan N. Postbiotics for animal health and performance. Intas Polivet. 2020; 21(2); 288-94.
Siciliano RA, Reale A, Mazzeo MF, Morandi S, Silvetti T, Brasca M. Paraprobiotics: A new perspective for functional foods and nutraceuticals. Nutrients. 2021; 13: 1225.
Simon O. Microorganisms as feed additives-probiotics. Adv Pork Prod. 2005; 16:161–7.
Tatar B, Öztürk Hİ. Probiyotiklerin ötesinde fonksiyonel bileşen konseptleri: Postbiyotikler ve paraprobiyotikler. Turkish Journal of Agriculture. Food Science and Technology. 2022; 10(9): 1747-55.
Teame T, Wang A, Xie M, Zhang Z, Yang Y, Ding Q, et al. Paraprobiotics and postbiotics of probiotic lactobacilli, their positive effects on the host and action mechanisms: A review. Front Nutr. 2020; 7: 570344.
Thorakkattu P, Khanashyam AC, Shah K, Babu KS, Mundanat AS, Deliephan A, et al. Postbiotics: Current trends in food and pharmaceutical industry. Foods 2022; 11(19): 3094.
Tootiaie S, Moharrami M, Mojgani N. Honeybee Gut: Reservoir of Probiotic Bacteria. In: Mojgani N, Dadar M, editors. Probiotic Bacteria and Postbiotic Metabolites: Role in Animal and Human Health. Singapore: Springer Singapore; 2021; p. 221–36.
Uyeno Y, Shigemori S, Shimosato T. Effect of probiotics/prebiotics on cattle health and productivity. Microbes and Environments. 2015; 30(2): 126-32.
Wang Y, Wu Y, Wang Y, Xu H, Mei X, Yu D, et al. Antioxidant properties of probiotic bacteria. Nutrients, 2017; 9(5): 521.
Yeşilyurt N, Yılmaz B, Ağagündüz D, Capasso R. Involvement of probiotics and postbiotics in the immune system modulation. Biologics. 2021; 1(2): 89-110.