

GİRİŞ

Lezzet, hayvanlarda iştah belirtisine ve hayvanların görme, koku, dokunma ve tatma duyularında reaksiyona neden olan yemin fiziksel ve kimyasal özellikleri tarafından belirlenir. Tat, ağza alınan materyalin dildeki tat tomurcuklarında yer alan reseptör hücreleriyle kimyasal etkileşime girmesiyle oluşan bir duyumdur.

Tatlı, tuzlu, ekşi, acı ve umami olmak üzere beş temel tat vardır. Acı tat sıklıkla yemde toksinlerin varlığıyla ilişkilidir, ekşi bir tat bozulmuş yemi işaret edebilir. Genel olarak sodyum veya minerallerin varlığı tuzlu bir tat verir. En yaygın doğal tatlı tat karbonhidratların varlığına işaret eden şekerlerin tadı iken; en sık rastlanan umami tat proteinlerin varlığına işaret eden L-glutamatın tadıdır.

HAYVANLARDA TAT TERCİHLERİ

Tatlı: Buzağı dilinin farklı tatlı uyarılarına (glisin, ksilitol, sodyum sakarin, mono ve disakkaritler gibi) karşı elektrofizyolojik olarak tepki verdiği görülmüş; sığırlarda tatlı tadın dilin arka bölgesinden algılandığı doğrulanmıştır. Şekerli tat sığırlar-

da tüketme isteği yaratırken; koyunlarda bu etki görülmemektedir. Kedilerin işlevsel bir tat alma duyusu olmasına rağmen; tatlı tat reseptörlerinden yoksundurlar ve sakkaroz gibi tatlı bileşiklerini genellikle tercih etmezler.

Tuzlu: Tuzlu tat tercihi, vücudun sodyum ve mineral ihtiyaçlarından etkilenebilir. Sütle besleme döneminde tuz verilmeyen buzağılar, aynı dönemde tuza erişimi olan buzağılara kıyasla sodyum tuzunu daha fazla tercih etmektedir. Süt ineklerinin merasına tuz uygulanmasıyla süt verimi, süt yağı içeriği, canlı ağırlık artışı ve otlamada geçirilen sürenin arttığı görülmüştür. Köpeklerin tuzlu tadı tercih ettiği ortaya konmuştur.

Ekşi: Yemdeki asitlerin varlığıyla ilişkili olan ekşi tat, geviş getiren hayvanlar arasında en az ilgi gören tattır. Silaja düşük miktarlarda laktik ve asetik asit eklenmesi koyunlarda tüketimi arttırmıştır. Koyunlar aynı zamanda düşük dozda malonik ve bütirik asitle desteklenmiş samanı da tercih etmektedir. Tam tersine, sığırlar yüksek dozda uçucu yağ asitlerinin varlığı nedeniyle silaj tüketimini azaltır. Bu da geviş getiren hayvanların yoğunluğu düşük olduğunda daha fazla ekşi yem tüketebileceğini düşündürmektedir. Koyunlarda asetik asit

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Tablo 9. Diğer lezzet arttırıcılar ve köpek mamasında önerilen miktarları

Lezzet Arttırıcı	Önerilen Miktar
Zeolitler (klinoptilolit)	Kuru mama ağırlığının % 0.01-4'ü
Tarhun esansiyel yağı	Kuru mama ağırlığının %0.001-0.005'i
Amonyaklı glisirizin	Pet mamalarındaki sükroz içeriğine göre değişir

Son yıllarda köpekleri aile bireyi gibi görme ve insanlaştırma çabaları neticesi barbekü, dana yah-nisi, kraker, pizza, sosis, yumurta, rosto dana eti, fıstık ezmesi, jöle ve patates gibi insan beslenme-sinde sıkça kullanılan aromalar ve tatlar köpeklere de uyarlanmaya çalışılmaktadır.

Hayvan Yemlerinde Kullanılmasına İzin Verilen Lezzet Arttırıcı Yem Katkı Maddeleri

Avrupa Birliğinde halihazırda ruhsatlı ve T.C. Tarım ve Orman Bakanlığınca kullanımına izin verilen lezzet arttırıcı yem katkı maddelerine aşağıdaki adresten ulaşılabilir.

<https://ec.europa.eu/food/food-feed-portal/screen/home>

KAYNAKLAR

- Ahmad M. Effects of flavouring additives on feed intake and immune function of newly received feedlot cattle. MSC Thesis, University of Saskatchewan, Saskatoon, 2022.
- Atwood SB, Provenza FD, Wiedmeier RD, Banner RE. Changes in preferences of gestating heifers fed untreated or ammoniated straw in different flavors. *J Anim Sci* 2001; 79: 3027-33.
- Bachmanov AA, Beauchamp GK. Taste receptor genes. *Annual Review of Nutrition* 2007; 27: 389-414.
- Bauer JE. Facilitative and functional fats in diets of cats and dogs. *Journal of the American Veterinary Medical Association* 2006; 229: 680-4.
- Baumont R. Palatability and feeding behaviour in ruminants. A review. *Annales De Zootechnie* 1996; 45: 385-400.
- Bergström A, Frantz L, Schmidt R, Ersmark E, Lebrasseur O, Girdland-Flink L, Skoglund P. Origins and genetic legacy of prehistoric dogs. *Science* 2020; 370: 557-64.
- Blanch M, Carro MD, Ranilla MJ, Viso A, Vázquez-Añón M, Bach A. Influence of a mixture of cinnamaldehyde and garlic oil on rumen fermentation, feeding behavior and performance of lactating dairy cows. *Anim Feed Sci Technol* 2016; 219: 313-23.
- Boya UO, Dotson MJ, Hyatt EM. A comparison of dog food choice criteria across dog owner segments: An exploratory study. *International Journal of Consumer Studies* 2015; 39: 74-82.
- Broderick GA, Luchini ND, Reynal SM, Varga GA, Ishler VA. Effect on production of replacing dietary starch with sucrose in lactating dairy cows. *Journal of Dairy Science* 2008; 91: 4801-10.
- Cannas A, Mereu A, Decandia M, Molle G. Role of sensorial perceptions in feed selection and intake by domestic herbivores. *Italian J Anim Sci* 2009; 8: 243-51.
- Carlotto SB, Olivo CJ, Viégas J, Stiles DA, Gabbi AM, Brustolin KD, Charão PS, Rossarolla G, Ziech M, Pereira LET, Scaravelli LF. Performance and behavior of dairy calves fed diets containing milk and citric flavor agents. *Ciência e Agrotecnologia* 2007; 3: 889-95.
- Catanese F, Distel RA, Provenza FD, Villalba JJ. Early experience with diverse foods increases intake of nonfamiliar flavors and feeds in sheep. *J Anim Sci* 2012; 90: 2763-73.
- Chen M, Chen X, Nsor-Atindana J, Masamba KG, Ma J, Zhong F. Optimization of key aroma compounds for dog food attractant. *Anim Feed Sci Technol* 2017; 225: 173-81.
- Chen J, Lei Y, Zhang Y, He S, Liu L, Dong X. Beyond sweetness: The high-intensity sweeteners and farm animals. *Anim Feed Sci Technol* 2020; 267: 114571.
- Craig JM. Additives in pet food: are they safe? *Journal of Small Animal Practice* 2021; 1-12.
- De Rosa G, Moio L, Napolitano F, Grasso F, Gubitosi L, Bordini A. Influence of flavor on goat feeding preferences. *Journal of Chemical Ecology* 2002; 28: 269-81.
- Dhakal J, Aldrich CG. Use of medium chain fatty acids to mitigate Salmonella Typhimurium (ATCC 14028) on Dry Pet Food Kibbles. *Journal of Food Protection* 2020; 83: 1505-11.
- Di Donfrancesco B, Koppel K, Swaney-Stueve M, Chambers E. Consumer acceptance of dry dog food variations. *Animals* 2014; 4: 313-30.
- Distel RA, Iglesias RMR, Arroquy J, Merino J. A note on increased intake in lambs through diversity in food flavor. *Applied Animal Behaviour Science* 2007; 105: 232-7.
- European Commission, Directorate-General for Health and Food Safety, (2021). European Union register of feed additives pursuant to Regulation (EC) No 1831/2003. Annex I, List of additives (Çıkış tarihi 21.09.2021), Publications Office of the European Union.
- Fadel HHM, Lotfy SN, Asker MMS, Mahmoud MG, Al-Okbi SY. Nutty-like flavour production by *Corynebacterium glutamicum* 1220T from enzymatic soybean hydrolysate. Effect of encapsulation and storage on the nutty flavouring quality. *Journal of Advanced Research* 2018; 10: 31-8.
- Fahim NH, Kholif AE, Azzaz HH. Fennel and ginger improved nutrient digestibility and milk yield and quality in early lactating Egyptian buffaloes. *Annals of Animal Science* 2022; 22: 255-70.
- Fathi MH, A. Riasi A, Allahresani A. The effect of vanilla calf

- starter on performance of Holstein calves. *J Anim Feed Sci* 2009; 18: 412-9.
- Favreau A, Baumont R, Ferreira G, Dumont B, Ginane C. Do sheep use umami and bitter tastes as cues of post-ingestive consequences when selecting their diet? *Applied Animal Behaviour Science* 2010; 125: 115-23.
- Favreau-Peigné A, Baumont R, Ginane C. Food sensory characteristics: Their unconsidered roles in the feeding behaviour of domestic ruminants. *Animal* 2013; 7: 806-13.
- Ferrell F. Preference for sugars and nonnutritive sweeteners in young beagles. *Neuroscience and Biobehavioral Reviews* 1984; 8: 199-203.
- Folador JF, Karr-Lilienthal LK, Parsons CM, Bauer LL, Utterback PL, Schasteen CS, Bechtel PJ, Fahey GC. Jr. Fish meals, fish components, and fish protein hydrolysates as potential ingredients in pet foods. *J Anim Sci* 2006; 84: 2752-65.
- Fuller MF. *The Encyclopedia of Farm Animal Nutrition*. Oxon, UK: CABI Publishing, 2004.
- Geddes RF, Biourge V, Chang Y, Syme HM, Elliott J. The effect of moderate dietary protein and phosphate restriction on calcium-phosphate homeostasis in healthy older cats. *J Vet Int Med* 2016; 30: 1690-702.
- Gherardi S, Black J. Effect of palatability on voluntary feed intake by sheep. Identification of chemicals that alter the palatability of a forage. *Australian Journal of Agricultural Research* 1991; 42: 571-84.
- Glaser D, Wanner M, Tinti J, Nofre C. Gustatory responses of pigs to various natural and artificial compounds known to be sweet in man. *Food Chem* 2000; 68: 375-85.
- Ginane C, Baumont R, Favreau-Peigné A. Perception and hedonic value of basic tastes in domestic ruminants. *Physiology and Behavior* 2011; 104: 666-74.
- Goatcher WD, Church DC. Taste responses in ruminants. I. Reactions of sheep to sugars, saccharin, ethanol and salt. *J Anim Sci* 1970; 30: 777-83.
- Han X, Chen C, Zhang X, Wei Y, Tang S, Wang J, Tan Z, Xu L. Effects of dietary stevioside supplementation on feed intake, digestion, ruminal fermentation, and blood metabolites of goats. *Animals* 2019; 9: 32.
- Harper MT, Oh J, Giallongo F, Lopes JC, Weeks HL, Faugeron J, Hristov AN. Short communication: Preference for flavored concentrate premixes by dairy cows. *J Dairy Sci* 2016; 99: 6585-9.
- Havekes CD, Duffield TF, Carpenter AJ, DeVries TJ. Effects of molassesbased liquid feed supplementation to a highst-rav dry cow diet on feed intake, health, and performance of dairy cows across the transition period. *J Dairy Sci* 2020; 103: 5070-89.
- Hellekant G, Hård af Segerstad C, Roberts T. Sweet taste in the calf: III. Behavioral responses to sweeteners. *Physiology and Behavior* 1994; 56: 555-62.
- Hellekant G, Roberts T, Elmer D, Cragin T, Danilova V. Responses of single chorda tympani taste fibers of the calf (*Bos taurus*). *Chemical Senses* 2010; 35: 383-94.
- Hof C. Use of sweeteners in animal nutrition. *Lohmann Information* 1999; 2: 10-4.
- Jongwe C, Thakur SS, Kaur J, Mahesh MS. Effect of replacing groundnut cake with guar meal (*Cyamopsis tetragonoloba*) in concentrate mixture with and without added sweetener and flavour on production performance of Sahiwal cows. *Indian J Anim Nutr* 2014; 31: 138-42.
- Kalam SM, Savsani HH, Chavda MR, Odedra MD, Deendayal, Naliyapara HP, Patel SD, Belim SY. Flavoured additives in ruminant nutrition: A review. *Indian Journal of Animal Nutrition* 2023; 40: 1-8.
- Khan MA, Bach A, Weary DM, Von Keyserlingk MAG. Invited review: Transitioning from milk to solid feed in dairy heifers. *J Dairy Sci* 2016; 99: 885-902.
- Koppel K. Sensory analysis of pet foods. *J Sci Food Agric* 2014; 94: 2148-53.
- Laflamme DP, Abood SK, Fascetti AJ, Fleeman LM, Freeman LM, Michel KE, Buer C, Kemp BL, Doren JR, Willoughby KN. Pet feeding practices of dog and cat owners in the United States and Australia. *Journal of the American Veterinary Medical Association* 2008; 232: 687-94.
- Lejonklev J, Løkke MM, Larsen MK, Mortensen G, Petersen MA, Weisbjerg MR. Transfer of terpenes from essential oils into cow milk. *J Dairy Sci* 2013; 96: 4235-41.
- Li X, Li W, Wang H, Cao J, Maehashi K, Huang L, Bachmanov AA, Reed DR, Legrand-Defretin V, Beauchamp GK 2005. Pseudogenization of a sweet-receptor gene accounts for cats' indifference toward sugar. *PLoS Genetics* 2005; 1: 27-35.
- Longo MA, Sanroman MA. Production of food aroma compounds: Microbial and enzymatic methodologies. *Food Technology and Biotechnology* 2006; 44(3): 335-53.
- Luscombe-Marsh ND, Smeets AJ, Westerterp-Plantenga MS. Taste sensitivity for monosodium glutamate and an increased liking of dietary protein. *British Journal of Nutrition* 2008; 99: 904-8.
- Martínez-Alvarez O, Chamorro S, Brenes A. Protein hydrolysates from animal processing by-products as a source of bioactive molecules with interest in animal feeding: A review. *Food Research International* 2015; 73: 204-12.
- McMeniman JP, Rivera JD, Schlegel P, Rounds W, Galyean ML. Effects of an artificial sweetener on health, performance, and dietary preference of feedlot cattle. *J Anim Sci* 2006; 84: 2491-500.
- Montoro C, Ipharraguerre I, Bach A. Effect of flavoring a starter in a same manner as a milk replacer on intake and performance of calves. *Anim Feed Sci Technol* 2011; 164: 130-4.
- Moran AW, Al-Rammahi M, Zhang C, Bravo D, Calsamiglia S, Shirazi-Beechey SP. Sweet taste receptor expression in ruminant intestine and its activation by artificial sweeteners to regulate glucose absorption. *J Dairy Sci* 2014; 97: 4955-72.
- Morand-Fehr P, Ben Ayed M, Hervieu J, Lescoat P. Relationship between palatability and rate of intake in goats. In: Lindberg JE, Gonda HL, Ledin I. (eds.). *Recent advances in small ruminant nutrition*. Zaragoza; CIHEAM, 1997, p. 121-3.
- Mottram DS. Flavor compounds formed during the Maillard reaction. In *ACS Symposium Series* (543) *Thermally Generated Flavors*; Parliament TH, Morello MJ, McGorrian RJ, Eds, Washington, DC, USA: American Chemical Society, 1994; pp. 104-26.
- Murphy LA, Coleman AE. Xylitol toxicosis in dogs. *Veterinary Clinics of North America Small Animal Practice* 2012; 42: 307-12.
- Mwangi F, Dallasheh A, Kalyesubula M, Reicher N, Sabastian

- C, Mabeesh SJ. Diet preference, feed efficiency and expression of the sodium-dependent glucose transporter isoform1 and sweet taste receptors in the jejunum of lambs supplemented with different flavours. *Animals* 2023; 13: 1417.
- Nadeem H. Basics of feed flavoring agents for poultry, ruminants. A look at how higher palatability improves animal performance. *Feed Strategy* May 10, 2023.
- Naveen P, Chouraddi R, Anil, Akash, Anand VM, Yadav S, Singh AK, Nair PM, Gujjalkar P, Jigyasha, Durge A. Different taste enhancing feed additives in livestock feeding- a review. *Multilogic in Science* 2022; 12: 322-9.
- Neumann NJ, Fasshauer M. Added flavors: Potential contributors to body weight gain and obesity? *BMC Med* 2022; 20: 417.
- Oh J, Harper M, Giallongo F, Bravo DM, Wall EH, Hristov AN. Effects of rumen-protected Capsicum oleoresin on productivity and responses to a glucose tolerance test in lactating dairy cows. *J Dairy Sci* 2017; 100: 1888-901.
- Panakkal EJ, Kitiborwornkul N, Sriariyanun M, Ratanapompinyo J, Yasurin P, Asavasanti S. Production of food flavouring agents by enzymatic reaction and microbial fermentation. *Applied Science and Engineering Progress* 2021; 14(3): 297-312.
- Pandi K, Ranjan A. Taste matters: Unraveling the significance of feed additives in enhancing feed palatability. *Feed Additive* 9 August 2023.
- Pepino MY, Bourne C. Non-nutritive sweeteners, energy balance, and glucose homeostasis. *Current Opinion in Clinical Nutrition & Metabolic Care* 2011; 14: 391-5.
- Ponce CH, Brown MS, Silva JS, Schlegel P, Rounds W, Hallford DM. Effects of a dietary sweetener on growth performance and health of stressed beef calves and on diet digestibility and plasma and urinary metabolite concentrations of healthy calves. *J Anim Sci* 2014; 92: 1630-8.
- Samant SS, Crandall PG, Jarma Arroyo SE, Seo HS. Dry pet food flavor enhancers and their impact on palatability: A Review. *Foods* 2021; 10: 2599.
- Shah MA, Friedman EJ, Bahaa AO, Murphy MR. Effect of liquid flavor supplementation of the diet on dairy cows in the transition period. *J Dairy Sci* 2004; 87: 1872-7.
- Sharma A, Sharma P, Singh J, Singh S, Nain L. Prospecting the potential of agro residues as substrate for microbial flavor production. *Frontiers in Sustainable Food Systems* 2020; 4(18).
- Summers SC, Stockman J, Larsen JA, Zhang L, Rodriguez AS. Evaluation of phosphorus, calcium, and magnesium content in commercially available foods formulated for healthy cats. *J Vet Int Med* 2020; 34: 266-73.
- Steiner T. *Phytogenics in Animal Nutrition, Natural Concepts to Optimize Gut Health and Performance*. Nottingham, NG11 0AX, United Kingdom: Nottingham University Press, 2009.
- Thomas LC, Wright TC, Formusiak A, Cant JP, Osborne VR. Use of flavored drinking water in calves and lactating dairy cattle. *J Dairy Sci* 2007; 90: 3831-7.
- Törres CL, Hickenbottom SJ, Rogers QR. Palatability affects the percentage of metabolizable energy as protein selected by adult beagles. *J Nutr* 2003; 133: 3516-22.
- Valentin D, Chrea C, Nguyen DH. *Taste-Odour Interactions in Sweet Taste Perception. Optimising Sweet Taste in Foods*. Cambridge, UK: Woodhead Publishing Ltd; 2006.
- Villalba JJ, Bach A, Ipharraguerre IR. Feeding behavior and performance of lambs are influenced by flavor diversity. *J Anim Sci* 2011; 89: 2571-81.
- Yang WZ, Ametaj BN, Benchaar C, He ML, Beauchemin KA. Cinnamaldehyde in feedlot cattle diets: Intake, growth performance, carcass characteristics, and blood metabolites. *J Anim Sci* 2010; 88: 1082-92.
- Zhang W, He H, Gong L, Lai W, Dong B, Zhang L. Effects of sweetener sucralose on diet preference, growth performance and hematological and biochemical parameters of weaned piglets. *Asian-Australasian J Anim Sci* 2019; 33: 802-11.
- Zhu L, Wang G, Dong B, Peng C, Tian Y, Gong L. Effects of sweetener neotame on diet preference, performance and hematological and biochemical parameters of weaned piglets. *Anim Feed Sci Technol* 2016; 214: 86-94.