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The study of fat, Protein, and production levels of milk in Holstein dairy cows treated with arginine

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Abstract

In this study, 73 non-pregnant and clinically healthy and lactating Holstein cows without any clinical signs, and with a mean parity of 3.2 ± 1.4, days in milk at the beginning of study 110 ± 20 days, body condition scour (BCS) of about 3.2 ± 0.3, and milk production rate of 48± 10 kg were selected and randomly placed in two treatment and control groups. In the treatment group (n=36), arginine (155 µmol / kg body weight) was injected once every 8 hours a day for 6 days, and in the control group (n=37) saline solution (0.11 ml/kg body weight, once every 8 hours a day) was injected for 6 days. The results showed that there was no difference between the treatment and the controle group in terms of milk production (38.5 and 36 kg, P=0.3), fat (3.7 and 3.8%, P=0.8) and protein (3.1 and 3.1%, P=0.5) levels. It was concluded from this study that the use of arginine after the peak of milk production could not increase the fat, protein, and production levels of milk.

Keywords: Arginine, Amino Acid, Holstein Cow, Milk Production, Milk Fat and protein

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Refrences

Azarbayejani, R., & Mohammadsadegh, M. (2021). Glucose, insulin, and cortisol concentrations and glucose tolerance test in Holstein cows with inactive ovaries. *Tropical Animal Health and Production*, *53*(1), 41. doi.org/10.1007/s11250-020-02448-7

Burton, J. L., McBride, B. W., Block, E., Glimm, D. R., & Kennelly, J. J. (1994). A review of bovine growth hormone. *Canadian Journal of Animal Science*, *74*(2), 167-201. doi: 10.4141/cjas94-027.

Chiofalo, V., Baldi, A., Savoini, G., Polidori, F., Dell'Orto, V., & Politis, I. (1999). Response of dairy ewes in late lactation to recombinant bovine somatotropin. *Small Ruminant Research*, *34*(2), 119-125. doi: 10.1016/S0921-4488(99)00061-9.

Chew, B. P., Eisenman, J. R., & Tanaka, T. S. (1984). Arginine infusion stimulates prolactin, growth hormone, insulin, and subsequent lactation in pregnant dairy cows. *Journal of Dairy Science*, *67*(11), 2507-2518.

Clark, J. H. (1975). Lactational responses to postruminal administration of proteins and amino acids. *Journal of Dairy Science*, *58*(8), 1178-1197.

Davis, S. L. (1972). Plasma levels of prolactin, growth hormone, and insulin in sheep following the infusion of arginine, leucine and phenylalanine. *Endocrinology*, *91*(2), 549-555.

Ding, L., Shen, Y., Wang, Y., Zhou, G., Zhang, X., Wang, M., ... & Zhang, J. (2019). Jugular arginine supplementation increases lactation performance and nitrogen utilization efficiency in lactating dairy cows. *Journal of animal science and biotechnology*, *10*(1), 1-10. https://doi.org/10.1186/s40104-018-0311-8

Disenhaus, C., Jammes, H., Hervieu, J., Ternois, F., & Sauvant, D. (1995). Effects of recombinant bovine somatotropin on goat milk yield, composition and plasma metabolites. *Small Ruminant Research*, *15*(2), 139-148.. doi:10.1016/0921-4488(94)00019-4

Gow, C. B., Ranawana, S. S. E., Kellaway, R. C., & McDowell, G. H. (1979). Responses to post-ruminal infusions of casein and arginine, and to dietary protein supplements in lactating goats. *British Journal of Nutrition*, *41*(2), 371-382.

Hayashi, A. A., Nones, K., Roy, N. C., McNabb, W. C., Mackenzie, D. S., Pacheco, D., & McCoard, S. (2009). Initiation and elongation steps of mRNA translation are involved in the increase in milk protein yield caused by growth hormone administration during lactation. *Journal of Dairy Science*, *92*(5), 1889-1899.doi: 10.3168/jds.2008-1334 PMID: 19389947.

Hertelendy, F., Machlin, L., & Kipnis, D. M. (1969). Further studies on the regulation of insulin and growth hormone secretion in the sheep. *Endocrinology*, *84*(2), 192-199.

Hertelendy, F., Machlin, L. J., Takahashi, Y., & Kipnis, D. M. (1968). Insulin release from sheep pancreas in vitro. *Journal of Endocrinology*, *41*(4), 605-606.

Hertelendy, F., Takahashi, K., Machlin, L. J., & Kipnis, D. M. (1970). Growth hormone and insulin secretory responses to arginine in the sheep, pig, and cow. *General and comparative endocrinology*, *14*(1), 72-77.

Lassala, A., Bazer, F. W., Cudd, T. A., Li, P., Li, X., Satterfield, M. C., ... & Wu, G. (2009). Intravenous administration of L-citrulline to pregnant ewes is more effective than L-arginine for increasing arginine availability in the fetus. *The Journal of Nutrition*, *139*(4), 660-665.

McATEE, J. W., & TRENKLE, A. (1971). Effects of feeding, fasting, glucose or arginine on plasma prolactin levels in the bovine. *Endocrinology*, *89*(3), 730-734.

McAtee, J. W., and A. Trenkle. 1971. Metabolic regulation of plasma insulin levels in cattle. J. Anim. Sci. 33:438.

Mepham, T. B. (1982). Amino acid utilization by lactating mammary gland. *Journal of dairy science*, *65*(2), 287-298. doi.org/10.3168/jds.S0022-0302(82)82191-7

Moncada, S., & Higgs, A. (1993). The L-arginine-nitric oxide pathway. *New England journal of medicine*, *329*(27), 2002-2012.

National Research council (2001). Nutritional Requirement of Dairy cows.Seventh Revised Edition.ISBN: 978-0-309-06997-7.doi.org/10.17226/9825.

Oliveira, L. H., Nascimento, A. B., Monteiro Jr, P. L. J., Guardieiro, M. M., Wiltbank, M. C., & Sartori, R. (2016). Development of insulin resistance in dairy cows by 150 days of lactation does not alter oocyte quality in smaller follicles. *Journal of dairy science*, *99*(11), 9174-9183.doi.org/10.3168/jds.2015-10547.

Sallam, S. M. A., Nasser, M. E. A., & Yousef, M. I. (2005). Effect of recombinant bovine somatotropin on sheep milk production, composition and some hemato-biochemical components. *Small Ruminant Research*, *56*(1-3), 165-171.

Seifert, E. L., Estey, C., Xuan, J. Y., & Harper, M. E. (2010). Electron transport chain-dependent and-independent mechanisms of mitochondrial H2O2 emission during long-chain fatty acid oxidation. *Journal of Biological Chemistry*, *285*(8), 5748-5758..DOI 10.1074/jbc.M109.026203

Squires, E. J. (2003). Endocrine manipulation of reproduction. In *Applied animal endocrinology* (pp. 154-191). Wallingford UK: CABI Publishing.

Vicini, J. L., Clark, J. H., Hurley, W. L., & Bahr, J. M. (1988). Effects of abomasal or intravenous administration of arginine on milk production, milk composition, and concentrations of somatotropin and insulin in plasma of dairy cows. *Journal of dairy science*, *71*(3), 658-665.

Wang, M., Xu, B., Wang, H., Bu, D., Wang, J., & Loor, J. J. (2014). Effects of arginine concentration on the in vitro expression of casein and mTOR pathway related genes in mammary epithelial cells from dairy cattle. *PLoS One*, *9*(5), e95985..

Zheng, P., Song, Y., Tian, Y., Zhang, H., Yu, B., He, J., ... & Chen, D. (2018). Dietary arginine supplementation affects intestinal function by enhancing antioxidant capacity of a nitric oxide–independent pathway in low-birth-weight piglets. *The Journal of nutrition*, *148*(11), 1751-1759. doi:https://doi.org/10.1093/jn/nxy198.

Zheng, P., Yu, B., He, J., Tian, G., Luo, Y., Mao, X., ... & Chen, D. (2013). Protective effects of dietary arginine supplementation against oxidative stress in weaned piglets. *British journal of nutrition*, *109*(12), 2253-2260.