



昆明小鼠胃肠道钙离子跨膜吸收途径相关基因表达模式分析

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Expression Patterns Analysis of Calcium Ion Trans-Membranous Absorption Related Genes in Gastrointestinal Tract of *Kunming* Mice

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摘要 本研究旨在分析钙离子(Ca²⁺)跨膜吸收途径相关基因在昆明小鼠胃肠道中的表达模式。选取12只8周龄、平均体重(30.71±2.93)g的雌性昆明小鼠,取胃、十二指肠、空肠、回肠、盲肠和结肠组织样品,利用实时定量PCR法检测维生素D依赖性钙结合蛋白(CaBP-D9k)、瞬时性受体电位通道香草酸受体6(TRPV6)和维生素D受体(VDR)mRNA表达量。结果表明:1)CaBP-D9k、TRPV6和VDR mRNA在胃内属低水平表达,而在盲肠内表达量较高;2)随着小肠的延伸,CaBP-D9k、VDR mRNA表达量逐渐降低,而TRPV6 mRNA则在回肠内高水平表达;3)CaBP-D9k (P<0.05)、VDR (P<0.05)、TRPV6 mRNA的表达量(P>0.05)随着大肠肠段的延伸而不同程度地下降。结果提示,CaBP-D9k、TRPV6和VDR mRNA表达量与胃肠道Ca²⁺跨膜吸收能力存在关联性。

关键词: 胃肠道 钙离子跨膜吸收 维生素D依赖性钙结合蛋白 瞬时性受体电位通道香草酸受体6 维生素D受体 昆明小鼠

Abstract: This study was conducted to analyze the expression patterns of calcium ion trans-membranous absorption related genes in gastrointestinal tract of *Kunming* mice. A total of 12 female *Kunming* mice aged 8 weeks with an average body weight of (30.71±2.93) g were used as experimental animals. Tissues of stomach, duodenum, jejunum, ileum, cecum and colon were collected for the analysis of vitamin D-dependent 9 ku calcium-binding protein (CaBP-D9k), transient receptor potential vanilloid receptor 6 (TRPV6), and vitamin D receptor (VDR) mRNA expression levels by RT-qPCR. The results showed as follows: 1) CaBP-D9k, TRPV6 and VDR mRNA expressed in stomach at a low level, but in cecum at a high level; 2) with the extension of small intestine, expression levels of CaBP-D9k and VDR mRNA were gradually reduced, while TRPV6 mRNA expressed in ileum at a high level; 3) with the extension of large intestine, expression levels of CaBP-D9k (P<0.05), VDR (P<0.05) and TRPV6 mRNA (P>0.05) were also gradually reduced at different levels. These results indicate that expression levels of CaBP-D9k, VDR and TRPV6 mRNA are associated with the capability of Ca²⁺ trans-membranous absorption in gastrointestinal tract.

Keywords: gastrointestinal tract, Ca²⁺ trans-membranous absorption, vitamin D-dependent 9 ku calcium-binding protein, transient receptor potential vanilloid receptor 6, vitamin D receptor, *Kunming* mice

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- [1] WU W X, LIU J X, XU G Z, et al. Calcium homeostasis, acid-base balance, and health status in periparturient Holstein cows fed diets with low cation-anion difference[J]. *Livestock Science*, 2008, 117(1): 7-14.
- [2] P REZ AV, PICOTTO G, CARPENTIERI A R, et al. Minireview on regulation of intestinal calcium absorption. Emphasis on molecular mechanism: transcellular pathway[J]. *Digestion*, 2008, 77(1): 22-34.
- [3] MARTIN-TERESO J, VERSTEGEN M W. A novel model to explain dietary factors affecting hypocalcaemia in dairy cattle[J]. *Nutrition Research Reviews*, 2011, 24(2): 228-143.
- [4] BRONNER F, PANSU D, STEIN W D. An analysis of intestinal calcium transport across the rat intestine[J]. *The American Journal of Physiology*, 1986, 250(5): G561-G569.
- [5] BRONNER F. Mechanisms of intestinal calcium absorption[J]. *Journal of Cellular Biochemistry*, 2003, 88(2): 387-393.
- [6] BOUILLON R, VAN CROMPHAUT S, CARMELIET G. Intestinal calcium absorption: molecular vitamin D mediated mechanisms[J]. *Journal of Cellular Biochemistry*, 2003, 88(2): 332-339.
- [7] HOENDEROP J G, NILIUS B, BINDELS R J. Calcium absorption across epithelia[J]. *Physiological Reviews*, 2005, 85(1): 373-422.
- [8] WILKENS M R, MROCHEN N, BREVES G, et al. Gastrointestinal calcium absorption in sheep is mostly insensitive to an alimentary induced change of calcium homeostasis[J]. *Comparative Biochemistry and Physiology Part B: Biochemistry and Molecular Biology*, 2011, 158(3): 199-207.
- [9] BALESARIA S, SANGHA S, WALTERS J R. Human duodenum responses to vitamin D metabolites of *TRPV6* and other genes involved in calcium absorption[J]. *American Journal of Physiology: Gastrointestinal and Liver Physiology*, 2009, 297(6): G1193-G1197.
- [10] BRONNER F. Recent developments in intestinal calcium absorption[J]. *Nutrition Reviews*, 2009, 67(2): 109-113.
- [11] 那键. 雌激素、维生素D₃对雌性大鼠成骨细胞增殖及钙通道*TRPV5/TRPV6*表达的影响. 博士学位论文. 长春: 吉林大学, 2009: 47-65.
- [12] WILKENS M R, KUNERT-KEIL C, BRINKMEIER H, et al. Expression of calcium channel *TRPV6* in ovine epithelial tissue[J]. *The Veterinary Journal*, 2009, 182(2): 294-300.
- [13] LIEBEN L, BENN B S, AJIBADE D, et al. *TRPV6* mediates intestinal calcium absorption during calcium restriction and contributes to bone homeostasis[J]. *Bone*, 2010, 47(2): 301-308.
- [14] WILLEMS E, VANDESOMPELE L L J. Standardization of real-time PCR gene expression data from independent biological replicates[J]. *Analytical Biochemistry*, 2008, 379(1): 127-129.
- [15] SU A I, WILTSHIRE T, BATALOV S, et al. A gene atlas of the mouse and human protein-encoding transcriptomes[J]. *Proceedings of the National Academy of Sciences*, 2004, 101(16): 6062-6067.
- [16] SUZUKI Y, LANDOWSKI C P, HEDIGER M A. Mechanisms and regulation of epithelial Ca²⁺ absorption in health and disease[J]. *Annual Review of Physiology*, 2008, 70: 257-271.
- [17] KHANAL R C, NEMERE I. Regulation of intestinal calcium transport[J]. *Annual Review of Nutrition*, 2008, 28: 179-196.
- [18] SIDLER-LAUFF K, BOOS A, KRAENZLIN M, et al. Influence of different calcium supplies and a single vitamin D injection on vitamin D receptor calbindin D9k immunoreactivities in the gastrointestinal tract of goat kids[J]. *Journal of Animal Science*, 2010, 88(11): 3598-3610.
- [19] NIJENHUIS T, HOENDEROP J G, VAN DER KEMP A W, et al. Localization and regulation of the epithelial Ca²⁺ channel *TRPV6* in the kidney[J]. *Journal of the American Society of Nephrology*, 2003, 14(11): 2731-2740.
- [20] SPREKELER N, MULLER T, KOWALEWSKI M P, et al. Expression patterns of intestinal calcium transport factors and *ex-vivo* absorption of calcium in horses[J]. *BMC Veterinary Research*, 2011, 7(1): 65-76.
- [21] WALTERS J R, BALESARIA S, CHAVELE K M, et al. Calcium channel *TRPV6* expression in human duodenum: different relationships to the vitamin D system and aging in men and women[J]. *Journal of Bone and Mineral Research*, 2006, 21(11): 1770-1777.
- [22] KARBACH U, FELDMEIER H. The cecum is the site with the highest calcium absorption in rat intestine[J]. *Digestive Diseases and Sciences*, 1993, 38(10): 1815-1824.
- [23] WASSERMAN R H. Vitamin D and the dual processes of intestinal calcium absorption[J]. *The Journal of Nutrition*, 2004, 134(11): 3137-3139.
- [24] WALI R K, BAUM C L, SITRIN M D, et al. 1,25(OH)₂ vitamin D₃ stimulates membrane phosphoinositide turnover, activates protein kinase C, and increases cytosolic calcium in rat colonic epithelium[J]. *The Journal of Clinical Investigation*, 1990, 85(4): 1296-1303.

[1] 尹清强^{1,2}, 李小飞¹, 常娟¹, 郑秋红¹, 杨玉荣¹, 左瑞. 微生态制剂对哺乳和断奶仔猪生产性能的影响及作用机理研究[J]. *动物营养学报*, 2011, 23(6): 622-630

张庆丽^{1,2}, 谭支良², 贺志雄², 张恩平^{1*}, 孙志洪^{2,3*}. 营养限制对断奶羔羊血浆和胃肠道上皮组织抗氧化能力的影响[J]. *动物营养学报*, 2010, 22(