

绵羊 *ILK* 基因的克隆及其在毛囊生长期的表达

杨剑波^{1,2,3}, 甘尚权^{2,3}, 杨永林^{2,3}, 张红琳⁴, 宋天增⁵, 冯静⁵, 杨井泉^{2,3}, 高磊^{2,3}, 石国庆^{1,2,3}, 沈敏^{2,3}

1. 石河子大学动物科技学院, 石河子 832000 2. 新疆农垦科学院畜牧兽医研究所, 石河子 832000 3. 新疆兵团绵羊繁育生物技术重点实验室, 石河子 832000 4. 南京晓庄学院生物化工与环境工程学院, 南京 211171 5. 西藏自治区农牧科学院畜牧兽医研究所, 拉萨850009

YANG Jian-Bo^{1,2,3}, GAN Shang-Quan^{2,3}, YANG Yong-Lin^{2,3}, ZHANG Hong-Lin⁴, SONG Tian-Zeng⁵, FENG Jing⁵, YANG Jing-Quan^{2,3}, GAO Lei^{2,3}, SHI Guo-Qing^{1,2,3}, SHEN Min^{2,3}

1. College of Animal Science and Technology, Shihezi University, Shihezi 832000, China 2. Animal Husbandry and Veterinary Institute, Xinjiang Academy of Agricultural and Reclamation Science, Shihezi 832000, China 3. Key Lab of Sheep Breeding and Reproduction, Xinjiang Agroeclimation Academy of Sciences, Shihezi 832000, China 4. School of Biochemical and Environmental Engineering, Nanjing Xiaozhuang College, Nanjing 211171, China 5. Institute of Animal Husbandry and Veterinary, Tibet Academy of Agriculture and Animal Science, Lhasa 850009, China

- 摘要
- 参考文献
- 相关文章

Download: PDF (598KB) HTML (331KB) Export: BibTeX or EndNote (RIS) Supplementary data

摘要 整合素连接激酶(ILK)是一种支架蛋白,在毛囊发育过程中发挥重要作用。文章利用PCR技术,首次获得绵羊*ILK*基因的编码区全长序列,并进行了生物信息学分析;同时对该基因的组织表达谱及其在不同绵羊品种毛囊生长期皮肤组织中的表达变化进行了研究。结果表明,绵羊*ILK*基因ORF全长1 359 bp,编码452个氨基酸。ILK蛋白结构经预测含有3个锚定重复序列和1个激酶结构域,并存在多个磷酸化位点和蛋白激酶C的磷酸化位点。半定量RT-PCR结果显示该基因在绵羊心脏、肝脏、脾脏、肺脏、肾脏、骨骼肌、皮肤和小肠组织中均有表达,皮肤、脾脏和肝脏中表达量较高;实时荧光定量PCR结果表明在3~5月份(毛囊生长起始期),*ILK*基因在中国美利奴超细型和哈萨克羊皮肤组织中的表达水平较高并均呈逐月上升趋势;在6~10月份(毛囊生长期),中国美利奴超细型皮肤*ILK*基因表达水平高于同期的哈萨克羊。分析认为*ILK*可能在调控绵羊次级毛囊生长发育过程中起一定作用。

关键词: 整合素连接激酶 基因克隆 毛囊 绵羊

Abstract: Integrin linked kinase (ILK) is a scaffold protein, which plays important roles in hair follicle development. The cDNA sequence of novel *ILK* gene in sheep was cloned by PCR method and analyzed by bioinformatics. Tissue expression profiling in eight tissues and temporal profiling at different wool follicle anagen stages in skin was analyzed. The results showed that the whole open reading frame (ORF) of *ILK* gene was 1 359 bp in length, which encoded 452 amino acids. Bioinformatic analysis indicated that the secondary structure of *ILK* gene was mainly made up of three ankyrin repeats and a kinase domain, and there were multiple phosphorylation and Protein Kinase C sites in this gene. The RT-PCR result confirmed that *ILK* mRNA was expressed in heart, liver, spleen, lung, skeletal muscle, skin, and small intestine, and the expression level was much higher in skin, spleen, and liver than others. The q-PCR analysis demonstrated that the expression level of *ILK* was significantly increased from March to May (early follicle anagen initiation) in both sheep breeds, Chinese Merino and Kazakh sheep, and there were certain differences from June to October between the two breeds. The above results indicated that *ILK* gene may play key roles in regulating secondary follicle growth.

Keywords: integrin-linked kinase, gene cloning, hair follicle, sheep

收稿日期: 2012-01-14; 出版日期: 2012-06-25

基金资助:

转基因生物新品种培育重大专项(编号: 2009ZX08008-001B; 2011ZX08008-001), 国家高技术研究发展计划项目(863计划)(编号: 2008AA101011), 兵团种质资源创新与功能基因发掘及利用专项(编号: 2012BB044), 973计划前期研究专项(编号: 2009CB125907)和国家自然科学基金项目(编号: 30960249)资助

通讯作者 石国庆 Email: nkkxyxms@163.com


引用本文:

杨剑波, 甘尚权, 沈敏等. 绵羊*ILK*基因的克隆及其在毛囊生长期的表达[J] 遗传, 2012, V34(6): 719-726

YANG Jian-Bo, GAN Shang-Quan, YANG Yong-Lin, ZHANG Hong-Lin, SONG Tian-Zeng, FENG Jing, YANG Jing-Quan, GAO Lei, SHI Guo-Qing, SHEN Min. Cloning and expression in follicle anagen of *ILK* gene in sheep[J] HEREDITAS, 2012, V34(6): 719-726

链接本文:

http://www.chinagene.cn/Jwk_yc/CN/10.3724/SP.J.1005.2012.00719 或 http://www.chinagene.cn/Jwk_yc/CN/Y2012/V34/I6/719

- [1] Hannigan GE, Leung-Hagsteijn C, Fitz-Gibbon L, Coppolino MG, Radeva G, Filmus J, Bell JC, Dedhar S. Regulation of cell adhesion and anchorage-dependent growth by a new β 1-integrin-linked protein kinase. *Nature*, 1996, 379(6560): 91-96.
- [2] Delcommenne M, Tan C, Gray V, Rue L, Woodgett J, Dedhar S. Phosphoinositide-3-OH kinase-dependent regulation of glycogen synthase kinase 3 and protein kinase B/AKT by the integrin-linked kinase. *Proc Natl Acad Sci USA*, 1998, 95(19): 11211-11216. 

Service

- ▶ 把本文推荐给朋友
- ▶ 加入我的书架
- ▶ 加入引用管理器
- ▶ Email Alert
- ▶ RSS

作者相关文章

- ▶ 杨剑波
- ▶ 甘尚权
- ▶ 沈敏
- ▶ 石国庆

- [3] Novak A, Hsu SC, Leung-Hagesteijn C, Radeva G, Papkoff J, Montesano R, Roskelley C, Grosschedl R, Dedhar S. Cell adhesion and integrin-linked kinase regulate the LEF-1 and β -catenin signaling pathways. *Proc Natl Acad Sci USA*, 1998, 95(8): 4374-4379. [crossref](#)
- [4] Haase M, Gmach CC, Eke I, Hehlhans S, Baretton GB, Cordes N. Expression of integrin-linked kinase is increased in differentiated cells. *J Histochem Cytochem*, 2008, 56(9): 819-829. [crossref](#)
- [5] Takanami I. Increased expression of integrin-linked kinase is associated with shorter survival in non-small cell lung cancer. *BMC Cancer*, 2005, 5: 1. [crossref](#)
- [6] Nakrieko KA, Welch I, Dupuis H, Bryce D, Pajak A, St Arnaud R, Dedhar S, D'Souza SJ, Dagnino L. Impaired hair follicle morphogenesis and polarized keratinocyte movement upon conditional inactivation of integrin-linked kinase in the epidermis. *Mol Biol Cell*, 2008, 19(4): 1462-1473. [crossref](#)
- [7] Xie W, Li FG, Kudlow JE, Wu CY. Expression of the integrin-linked kinase (ILK) in mouse skin. *Am J Pathol*, 1998, 153(2): 367-372. [crossref](#)
- [8] Lorenz K, Grashoff C, Torka R, Sakai T, Langbein L, Bloch W, Aumailley M, Fassler R. Integrin-linked kinase is required for epidermal and hair follicle morphogenesis. *J Cell Biol*, 2007, 177(3): 501-513. [crossref](#)
- [9] Wickstrom SA, Lange A, Hess MW, Polleux J, Spatz JP, Kruger M, Pfaller K, Lambacher A, Bloch W, Mann M, Huber LA, Fassler R. Integrin-linked kinase controls microtubule dynamics required for plasma membrane targeting of caveolae. *Dev Cell*, 2010, 19(4): 574-588. [crossref](#)
- [10] Vi L, de Lasa C, DiGuglielmo GM, Dagnino L. Integrin-linked kinase is required for TGF- β 1 induction of dermal myofibroblast differentiation. *J Invest Dermatol*, 2011, 131(3): 586-593. [crossref](#)
- [11] 赵伯阳, 汪代华, 徐刚毅, 赵文伯, 郑程莉. 山羊CAST基因II型转录本的克隆及在山羊不同组织中的表达. *遗传*, 2011, 33(4): 358-364. [浏览](#)
- [12] Livak KJ, Schmittgen TD. Analysis of relative gene expression data using real-time quantitative PCR and the 2^{-Delta Delta C(T)} Method. *Methods*, 2001, 25(4): 402-408.
- [13] Legate KR, Montanez E, Kudlacek O, Fassler R. ILK, PINCH and parvin: the tIPP of integrin signalling. *Nat Rev Mol Cell Biol*, 2006, 7(1): 20-31. [crossref](#)
- [14] Grashoff C. The role of Integrin-linked kinase *in vivo* and *in vitro*
- [15] Degree thesis]. The Ludwig-Maximilian University, 2007.
- [16] Hannigan G, Troussard AA, Dedhar S. Integrin-linked kinase: a cancer therapeutic target unique among its ILK. *Nat Rev Cancer*, 2005, 5(1): 51-63. [crossref](#)
- [17] Chiswell BP, Zhang R, Murphy JW, Boggon TJ, Calder-wood DA. The structural basis of integrin-linked kinase-PINCH interactions. *Proc Natl Acad Sci USA*, 2008, 105(52): 20677-20682. [crossref](#)
- [18] Lange A, Wickstrom SA, Jakobson M, Zent R, Sainio K, Fassler R. Integrin-linked kinase is an adaptor with essential functions during mouse development. *Nature*, 2009, 461 (7266): 1002-1006.
- [19] 赵有璋. 羊生产学 (第二版). 北京: 中国农业出版社, 2003: 32-36. [crossref](#)
- [20] Nakrieko KA, Rudkouskaya A, Irvine TS, D'Souza SJ, Dagnino L. Targeted inactivation of integrin-linked kinase in hair follicle stem cells reveals an important modulatory role in skin repair after injury. *Mol Biol Cell*, 2011, 22(14): 2532-2540. [crossref](#)
- [1] 高磊. 绵羊发情周期不同组织CRY1 mRNA转录水平相对定量研究[J]. *遗传*, 2013,35(1): 0-0
- [2] 杨小亮 白大章 邱巍 董慧琴 李大全 陈芳 马润林 Hugh T Blair 高剑峰. 以绵羊MHC区段BAC克隆酶切片段为探针杂交筛选绵羊混合组织cDNA文库[J]. *遗传*, 2012,34(7): 887-894
- [3] 李洪涛 何新 周志勇 赵松华 张文祥 刘钢 赵宗胜 贾斌. *Slc7a11*基因在不同被毛颜色哈萨克羊皮肤组织中的表达分析[J]. *遗传*, 2012,34(10): 1314-1319
- [4] 林佳丽 沈良才 潘登科 张瑾. 猪 *Gli1*基因的克隆、表达谱分析及脂肪组织特异性表达载体的构建[J]. *遗传*, 2012,34(10): 1291-1297
- [5] 李玉坤, 王学敏, 高洪文, 仁爱琴, 王赞, 孙桂枝. 东方山羊豆 *Cu/ZnSOD*基因的克隆及表达分析[J]. *遗传*, 2012,34(1): 95-101
- [6] 王建起, 曹文广. 绵羊多胎主效基因研究进展[J]. *遗传*, 2011,33(9): 953-961
- [7] 刘伍限, 贾斌, 石国庆, 任建功, 刘卡, 马润林. 绵羊 *FGF5*基因的克隆、表达及RNA干扰[J]. *遗传*, 2011,33(9): 982-988
- [8] 王遵宝, 赵宗胜, 余鹏, 吴洪宾, 班谦, 梁耀伟, 郑炜. 绵羊皮肤源EST-SSR标记的功能注释及染色体电子定位[J]. *遗传*, 2011,33(7): 731-737
- [9] 苏建民, 许文兵, 李艳艳, 王丽君, 王勇胜, 张涌. 转基因克隆牛胎盘中印迹基因 *PEG10*的DNA甲基化水平[J]. *遗传*, 2011,33(5): 533-538
- [10] 帅建军, 熊飞, 彭日荷, 姚泉洪, 熊爱生. 多氯联苯的生物修复[J]. *遗传*, 2011,33(3): 219-227
- [11] 焦莎莎, 刘卡, 李刚, 高剑峰, 马润林. 绵羊MHC区段3个预测基因的验证与表达分析[J]. *遗传*, 2011,33(12): 1353-1358
- [12] 吴江鸿, 闫祖威, 胡斯乐, 张文广, 李金泉. *Hoxc13*在毛囊发育中的作用[J]. *遗传*, 2010,32(7): 656-662
- [13] 王继英, 俞英, 冯利霞, 王怀中, 张勤. 利用改进的酚-氯仿法从猪毛囊中提取基因组DNA[J]. *遗传*, 2010,32(7): 752-756
- [14] 尹佟明. 林木基因组及功能基因克隆研究概述[J]. *遗传*, 2010,32(7): 677-684
- [15] 林荆, 付凤玲, 蒋伟, 牟禹, 雍太明, 李晚忱. 垫状卷柏海藻糖-6-磷酸合成酶基因的克隆及功能分析[J]. *遗传*, 2010,32(5): 498-504