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MicroRNA-124 reduces caveolar density by targeting caveolin-1 in porcine kidney epithelial PK15 cells

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Abstract Caveolin-1 is the principal component of caveolae, and it is implicated in endocytosis, cholesterol homeostasis, signal transduction and tumorigenesis. MicroRNAs play key regulatory roles in many cellular processes. However, the molecular mechanism by which porcine caveolin-1 is regulated by microRNAs remains unclear. In the present study, we found that miR-124 could directly target caveolin-1 in porcine kidney epithelial cells (PK15). A luciferase reporter assay revealed that miR-124 directly bound to *Cav1* mRNA. Ectopic expression of miR-124 decreased porcine *Cav1* expression at both the mRNA and protein levels. Furthermore, we used transmission electron microscopy to count caveolae in the cytosolic space next to the membrane and we found that the overexpression of miR-124 in PK15 cells reduced the density of the caveolae. Our results suggested that miR-124 reduced caveolar density by targeting caveolin-1 in PK15 cells; therefore, miR-124 could play an important role in the caveolae-mediated endocytosis of pathogens and signal transduction.

Keywords wmiR-124·Caveolin-1·Caveolardensity·PK15cells

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Introduction

Small, noncoding RNAs, approximately 22 nucleotides in length, which are known as microRNAs (miRNAs), play a crucial role in the post-transcriptional regulation of genes involved in fundamental biological processes, including cell differentiation, proliferation, apoptosis and cell signaling [1–4]. In mammals, miRNAs bind to the 3′UTR of target mRNAs, leading to translational repression or mRNA degradation [5, 6]. These miRNAs are predicted to regulate the activity of approximately 30 % of all protein-coding genes [7]. The number of miRNAs that have been identified in humans and pigs is growing, and a total of 2,042 human and 306 porcine mature miRNAs are currently registered in miRBase (release 19, http://www.mirbase.org).

Caveolae, flask-shaped invaginations of the plasma membrane, were first identified in the 1950s as endocytic structures that play important roles in the regulation of many cellular functions, including endocytosis, lipid metabolism and cell signaling [8–10]. Caveolin-1 is a principal component of caveolae membranes; it belongs to a family of three genes including Cav2 and Cav3. Caveolin-1 and caveolin-2 are co-expressed in most cells and co-localized within the plasma membrane and other internal cellular membranes, while caveolin-3 expression is essentially restricted to muscle cells [11, 12]. Previous studies