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Deng Ziyang, Liu Xuezheng, Zhang Dezhi, et al. Effects of IGF-1 on osteoporosis in diabetic rats[J]. J Third Mil Med Univ, 2014, 36 (19):1987-1990.

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## 胰岛素样生长因子-1改善糖尿病大鼠骨质疏松及其



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作者: [邓子阳](#); [刘学政](#); [张德志](#); [左中夫](#); [付云杰](#); [刘万鹏](#)  
辽宁医学院: 人体解剖学教研室, 附属第一医院骨科

Author(s): [Deng Ziyang](#); [Liu Xuezheng](#); [Zhang Dezhi](#); [Zuo Zhongfu](#); [Fu Yunjie](#); [Liu Wanpeng](#)

Department of Human Anatomy, Department of Orthopedics, First Affiliated Hospital, Liaoning Medical University, Jinzhou, Liaoning Province, 121001, China

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摘要:

目的 探讨胰岛素样生长因子-1 (insulin-like growth factor-1, IGF-1) 对糖尿病大鼠骨质疏松的影响及机制。 方法 取30只体质量220~250 g的雄性3月龄SD大鼠, 腹腔注射链脲佐菌素建立糖尿病大鼠模型, 按随机数字表法分为对照组 (正常大鼠腹腔注射PBS)、糖尿病组 (糖尿病大鼠腹腔注射PBS) 及IGF-1治疗组 (糖尿病大鼠腹腔注射IGF-1), 3个月后观察骨源性碱性磷酸酶 (bone alkaline phosphatase, BALP) 含量、胫骨钙磷含量、胫骨灰与胫骨质量之比、骨形态发生蛋白-2 (bone morphogenetic protein-2, BMP-2) 表达及胫骨骨密度。 结果 对照组、糖尿病组及IGF-1组BALP含量分别为 (2.42±0.56)、(1.54±0.41) 及 (2.18±0.62) ng/L, 钙含量分别为 (5.89±1.21)、(5.41±0.75) 及 (5.75±1.05) mol/L, 磷含量分别为 (3.78±0.56)、(3.21±0.47) 及 (3.67±0.41) mol/L, 胫骨灰与胫骨质量比值分别为 (67.21±0.81)%、(63.13±0.63)%及 (65.81±0.21)%。与对照组相比, 糖尿病组BALP含量低, 胫骨BMP-2表达少, 钙磷含量、胫骨灰重与胫骨质量比值、胫骨密度均下降 ( $P<0.05$ )。与糖尿病组相比, IGF-1组BALP含量增加, 胫骨BMP-2表达上调, 胫骨钙磷含量、胫骨灰重与胫骨质量比值、胫骨骨密度均显著提高

( $P < 0.05$ )。结论 IGF-1可增加糖尿病大鼠胫骨钙磷含量、提高胫骨灰重与胫骨质量比值、防止糖尿病大鼠骨质疏松,其机制可能与IGF-1促进骨骼BMP-2表达、提高BALP含量有关。

**Abstract:** Objective To determine the effects and potential mechanisms of insulin-like growth factor-1 (IGF-1) on osteoporosis in diabetic rats. Methods Thirty male SD rats (with an age of 3 months and weight of 220 to 250 g) were randomly assigned into control group (naive rats administered with PBS), diabetic group (diabetic rats received PBS), and IGF-1 group (diabetic rats received IGF-1). After SD diabetic rats were induced by intraperitoneal injection of streptozotocin, PBS or 1 mg/(kg · d) IGF-1 was given to the rats from the corresponding groups for 3 months. Then the tibial bone density was calculated with the aid of X-ray photography, the serum level of bone alkaline phosphatase (BALP) was detected, the contents of tibial calcium and phosphonium were measured for the weight ratio of tibial ash to tibial bone, and the expression of tibial bone morphogenetic protein-2 (BMP-2) was detected by Western blotting and immunohistochemical assay. Results In the control, diabetic and IGF-1 groups, the BALP level was  $2.42 \pm 0.56$ ,  $1.54 \pm 0.41$  and  $2.18 \pm 0.62$  ng/L respectively; the calcium content was  $5.89 \pm 1.21$ ,  $5.41 \pm 0.75$  and  $5.75 \pm 1.05$  mol/L respectively; the phosphonium content was  $3.78 \pm 0.56$ ,  $3.21 \pm 0.47$  and  $3.67 \pm 0.41$  mol/L respectively; the ratio of tibial ash to tibial bone was  $(67.21 \pm 0.81)\%$ ,  $(63.13 \pm 0.63)\%$  and  $(65.81 \pm 0.21)\%$  respectively. The serum level of BALP, the expression of BMP-2, the contents of calcium and phosphonium, the weight ratio of tibial ash to tibial bone, and the tibial bone density were decreased in diabetic group compared with control group ( $P < 0.05$ ). While, the IGF-1 group showed increased BALP level, up-regulated tibial BMP-2, increased contents of tibial calcium and phosphonium, increased weight ratio of tibial ash to tibial bone, and improved tibial bone density compared to diabetic group ( $P < 0.05$ ). Conclusion IGF-1 enhances the tibial contents of tibial calcium and phosphonium, increase weight ratio of tibial ash to tibial bone, and inhibit osteoporosis in diabetic rats. These alterations may result from IGF-1 enhancing the level of BALP and up-regulating BMP-2 in the tibia.

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