SHORT COMMUNICATION

RECORDS OF PHARMACEUTICAL AND BIOMEDICAL SCIENCES

The effect of leucine supplementation on the skeletal muscles of streptozotocin (STZ) diabetic rats

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Abstract

Skeletal muscle atrophy is one of the serious and less studied diabetic complications.Leucine an essential amino acid that is transported into most mammalian cells by System L. The current study was conducted to assess the effect of leucine on diabetic skeletal muscles. Forty male Wister rats were allocated into four groups; control, Leucine-treated group was subjected to daily oral supplement of Leucine (1.35 g/kg) for 8 weeks, STZ-diabetic group was treated with single intravenous injection of STZ (45 mg/kg) and STZ-diabetic group supplemented with leucine (1.35 g/kg) for 8 weeks. Body weight and histopathological analysis of soleus muscle were evaluated. There was a significant increase in body weight of leucine group at $p< 0.05$. Leucine supplementation attenuated loss of soleus muscle mass observed in STZ diabetic rats. These findings may suggest protective effect of leucine against diabetic muscle loss.

Keywords: Diabetes mellitus, atrophy, soleus muscle, body weight.

1. Introduction

Skeletal muscle atrophy or myopathy is one of serious and less studied diabetic complications (Zhang *et al.*, 2014). The maintenance of normal mass and size of skeletal muscle is critical for locomotion, heat production and the control of intermediary metabolism (Wu *et al.*, 2011).

Number of clinical studies have demonstrated that intake of leucine supplements can successfully enhance protein synthesis in skeletal muscles (Rieu *et al.*, 2006; Koopman *et al.*, 2008; Churchward-Venne *et al.*, 2014). It is well-known that leucine, which is an

essential BCAA has unique capacity to improve the rate of whole mixed protein synthesis in skeletal muscles. The protein synthetic effect of leucine is facilitated by insulin bioavailability (Anthony *et al.*, 2001).

2. Results

2.1. Effect of leucine supplementation on body weight:

Leucine supplementation increased the body weight of rats either control or STZ-diabetic rats. Statistical analysis using one-way ANOVA showed that the body weight of STZ-diabetic rats was significantly decreased compared to control group ($p<0.05$, Fig.1). On the other hand, supplementation with leucine (1.3g/kg) for eight weeks has increased the body weight of control rats significantly ($p<0.05$, Fig.1). Leucine supplementation also increased the body weight of STZ-diabetic rats, but non-significantly compared to control (Fig. 1).

2.2. Histopathological results:

Histopathological investigation of H&E stained sections of soleus muscles of STZ-diabetic rats showed reduction of the mean cross-sectional area due to muscle mass reduction. Leucine supplemented rats showed an increase in mean cross-sectional area (Fig. 2).

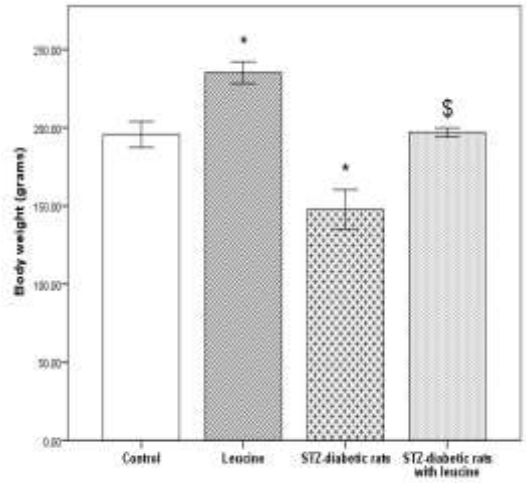

Figure 1. Effect of leucine supplementation on body weight. Data are expressed as mean ± ER. Data are analyzed by one-way ANOVA followed by Bonferroni test at $p<0.05$.* different from control group. $ different from diabetic group.

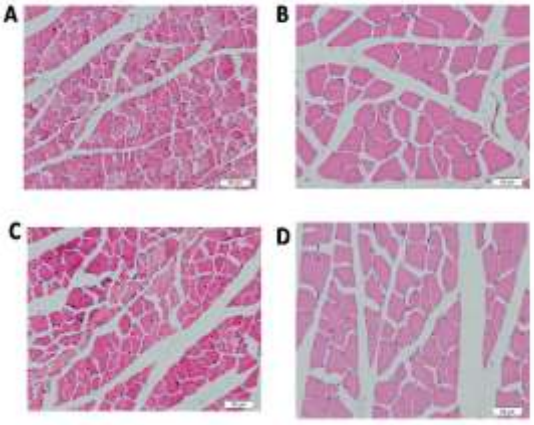

Figure 2. Photomicrograph of rat soleus muscles. A: control group, B: leucine-supplemented group , C: STZ-diabetic group D: STZ-diabetic group supplemented with leucine. H&E.20 scale bar 50 µm.

3. Discussion

Many studies have been done to discover its mechanism of action in β-cells diminution (Deeds *et al.*, 2011). These studies found out that STZ is delivered to the cell by GLUT2 glucose transporter causing alkylation of DNA and finally death of pancreatic β-cells (Lenzen, 2008). Myopathy or skeletal muscle atrophy is one of the serious and less studied diabetic complications. The preservation of healthy skeletal muscle is vital for locomotion, production of heat and management of cellular metabolism (Wu *et al.*, 2011). Leucine has therapeutic effect on atrophied skeletal muscles (Kelleher *et al.*, 2013). It was evident in this study that leucine supplementation can overcome the atrophy by increased the mean cross-sectional area in rat soleus muscles as an example of slow skeletal muscle fibers. It was previously shown that augmentation of intramyocellular lipids (IMCL), which

is one of pathophysiological causes of diabetic myopathy is appeared to be muscle specific to soleus muscle more than other muscles (Perseghin *et al.*, 2003; Bernroider *et al.*, 2005). The current study proved also that leucine can increase the body weight through recovery of muscle mass. As a result, leucine can be used as asupplementary drug in diabetic patients.

4. References

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