Effects of Osteopontin in Preadipocyte Differentiation

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Introduction

- Obesity is caused by increased adipose tissue mass with increased size and numbers of adipocytes. This can lead to many complications including diabetes-associated insulin resistance [1].
- Browning of the white adipose tissue is beneficial in the prevention of obesity and metabolic diseases [2].
- Adipocyte regulations are affected by osteopontin (OPN) which is a cytokine secreted primarily from bones [3].
- OPN mediates various biological functions such as cell survival and plays a role in inflammation [4]. However, effect of OPN on adipogenesis is unclear.

Specific Aims

- In this study, we investigated the effects of osteopontin on adipogenesis using 3T3-L1 preadipocytes (Fig. 1).

Fig. 1. Effect of osteopontin on adipogenesis.

Methods

Table. 1. Experimental Group.

Time	OPN Dose (nM)			
2 hour	0	1	10	100
2 day	0	1	10	100

- Preadipocytes were stimulated with 0, 1, 10 and 100 nM OPN for either 2 hours or 2 days (Table. 1).
- Proteins were assessed by Western blot analysis. Immunoreactive proteins were visualized by exposure to X-ray film. Protein bands were shown by image scanning. GAPDH was used as a control.

Results

- OPN treatment increased UCP-1, and PRDM16 expressions compared to the control (Fig. 2, 3).
- OPN treatment significantly decreased the size of lipid droplets, especially in the 2 hour treatment group (Fig. 4).

Fig. 2. Expression of proteins with various concentrations of OPN in 3T3-L1 preadipocytes (2 hours).

Fig. 3. Expression of proteins with various concentrations of OPN in 3T3-L1 preadipocytes (2 days).

Fig. 4. After OPN treatment in each group, Oil Red O staining was conducted to detect the lipid droplets in 3T3-L1 preadipocytes.

Discussion

- OPN induced activation of brown adipogenesis marker proteins from white adipocytes.
- OPN may promote the maturation of preadipocytes into brown adipocytes (Fig. 5).
- These results suggest that physical exercise may help treat obesity by turning white adipocytes into brown adipocytes by OPN.

Fig. 5. Regulation of adipogenesis by osteopontin in 3T3-L1 preadipocytes.

References

- Kahn et al., Mechanisms linking obesity to insulin resistance and type 2 diabetes, *Nature*, 2006.
- Whittle et al., Using brown adipose tissue to treat obesity – the central issue, *Trends Mol Med*, 2011.
- Zhong et al., Osteopontin-induced brown adipogenesis from white preadipocytes through a PI3K-AKT dependent signaling, *Biochem Biophys Res Commun*, 2015.
- Lund et al., The role of osteopontin in inflammatory processes, *J Cell Commun Signal*, 2009.

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