

# APCHI-ERGOFUTURE-PEI-IAIFI 2014

"With new mind set and widen horizon to catch the future: Physiology is the basic science for human life"  
UDAYANA UNIVERSITY, DENPASAR – BALI – INDONESIA  
OCTOBER 22-25, 2014



# Programme Book

# BALI 2014



# Programme Book

Joint International Conference

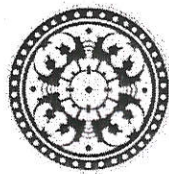
**APCHI-ERGOFUTURE-PEI-IAIFI 2014**

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## Dynamic Eccentric Exercise Improve Glut-1 Expression on Calf Muscle of Diabetic Mice Models

Purwanto B, Gadis M, Wardhani T

Physiology Department Faculty of Medicine, Campus A Airlangga University  
Jl. Prof Moestopo 47 Surabaya. Email: [bpaifo@gmail.com](mailto:bpaifo@gmail.com)

### Abstract

**Introduction.** Previous study we found that Glut-1 was also expressed on calf muscle of diabetic mice models. Exercise was known as one of diabetic modalities therapy but it was still unclear whether exercise improved Glut-1 expression on diabetic muscle. **Purpose.** This study was aimed to investigate the effect of dynamic eccentric exercise on Glut-1 expression. **Method.** Multiple low dose of streptozotocin administration was used to induce diabetes at mice. Diabetic mice were run on treadmill with negative inclination (downhill) for 21 minutes as a dynamic model of eccentric exercise for calf muscle. **Results.** A significant improvement of Glut-1 expression was found optimal at -5 degree of declined treadmill. **Conclusion.** Eccentric exercise improves Glut-1 expression and proposed as an alternative mechanism explained the benefit of exercise on diabetes therapy

**Keywords:** eccentric, downhill, Glut-1, diabetes, exercise

### Introduction

Previous study we found Glut-1 expressed on calf muscle membrane of diabetic mice models. Glut-1 replaced Glut-4 function to facilitate glucose uptake through muscle membrane. Fortunately, it was established that exercise improve glucose uptake toward various mechanism. It is unclear whether exercise also could improve Glut-1 on diabetic mice models. This study was aimed to investigate the effect of dynamic eccentric exercise on Glut-1 expression.

### Material and Method

#### Experiment unit

Male mice,  $25 \pm 2$  gram of body weight, 10 weeks old were used as experiment unit. Mice were paid from Animal Modeling Group Discussion. Mice were feed and drunk ad lib individually in the 10 cm<sup>3</sup> of cage.

## **Diabetes Models**

Diabetes models were obtained with multiple low dose streptozotocin administration protocol. Mice were injected 40 mg/ kg BW, 5 consecutive days i.p. Diabetes was determined up to 300 mg/dl of blood glucose level a week after streptozotocin injection.

## **Examination**

Blood glucose was measured using colorimetric in mg/ dl. Glut-1 expression was determined as the percentage of positive cells which expressed Glut-1 at muscle membrane. Muscle was sliced for immunohistochemistry staining process with monoclonal specific anti Glut-1 for mouse. Positive cells were stained brownish at membrane compared with those negative cells.

## **Analysis and Ethical Clearance**

Data were analyzed statistically with SPSS 17.00 for windows. All protocols were allowed to perform ethically from Ethic and Animal Welfare Commission Faculty of Veterinary Airlangga University

## **Result and Discussion**

The expression of Glut-1 on the membrane of calf muscles were as follows (fig.1). Positive cells were significantly improved at exercised mice. The decrement of treadmill did not influenced Glut-1 expression during downhill running. The analysis were as follows (table 1 and 2).

Glut-1 was embryonic transporter at almost all cell type in the body. Glut-1 was then differentiated in to other Glut type following cell characteristics. Skeletal muscle expresses Glut-4 at the membrane which characterized as insulin dependent. Glut-4 signaling pathways were interrupted under diabetic disturbance. Glut-1 replaced its function in order to facilitate glucose uptake through muscle membrane. Fortunately, Glut-1 is insulin independent but also ATP dependent. Glut-1 expression would be interrupted under ATP excessive status.

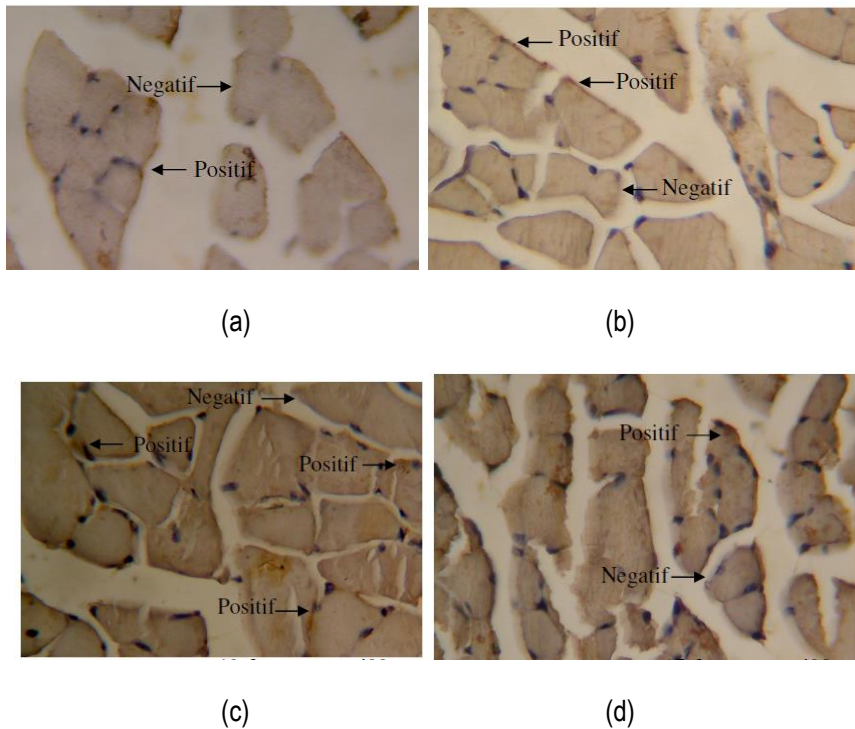
Eccentric exercise (such as downhill running) stimulated MAPK signaling activities. P38MAPK was widely found at skeletal muscle. Glut-1 was directly activated by p38 MAPK and or indirectly through MAPKAP2. Phosphorylated Glut-1 actively facilitated glucose transport through muscle membrane.

**Table 1.** Positive cells of Glut-1 expression (%)

Decrement	N	Mean	Std. Deviation
0	7	.3471	.27518
5	7	2.1629	.99232
10	7	2.1486	.98652
15	7	2.3286	1.42834

**Table 2.** Comparison of decrement influenced to Glut-1 expression

Mean Difference				
I) Groups	(J) Groups	(I-J)	Std. Error	Sig.
0	5	-1.81571*	.38921	.010
	10	-1.80143*	.38710	.010
	15	-1.80143*	.54979	.038
5	10	.01429	.52887	1.00
	15	-.16571	.65736	.994
10	15	-.18000	.65611	.992



**Figure 1.** Positive cells of Glut-1 expression on muscle membrane of diabetic mouse models

- a. 0 decrement 400x
- b. 5 decrement 400x
- c. 10 decrement 400x
- d. 11 decrement 400x

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## Conclusion

Eccentric exercise improves Glut-1 expression and proposed as an alternative mechanism explained the benefit of exercise on diabetes therapy.

## Acknowledgement

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