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

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Abstract

Introduction. Previous study we found that Glut-1 was also expressed on calf muscle ofdiabetic mice models. Exercise was known as one of diabetic modalities therapy but itwas still unclear whether exercise improved Glut-1 expression on diabetic muscle**. Purpose**. This study was aimed to investigate the effect of dynamic eccentricexercise on Glut-1 expression**. Methode**. 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 minutesas dynamic model of eccentric exercise for calf muscle. **Results**. A significant improvement ofGlut-1 expression found optimal at -5 degree of declined treadmill. **Conclusion**. Eccentric exercise improves Glut-1 expression and proposed as an alternative mechanismexplained 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±2 gram of body weight, 10 weeks old were used as experiment unit. Micewere paid from Animal Modeling Group Discussion. Mice were feed and drunk ad libindividually in the 10 cm3 of cage.

Diabetes Models

Diabetes models were obtained with multiple low dose streptozotocin administrationprotocol. Mice were injected 40 mg/ kg BW, 5 consecutive days i.p. Diabetes wasdetermined 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 wasdetermined as the percentage of positive cells which expressed Glut-1 at musclemembrane. Muscle was sliced for immunohisto chemistry staining process withmonoclonal specific anti Glut-1 for mouse. Positive cells were stained brownish atmembrane compared with those negative cells.

Analysis and Ethical Clearance

Data were analyzed statistically with SPSS 17.00 for windows. All protocols wereallowed to perform ethically from Ethic and Animal Welfare Commission Faculty ofVeterinary 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 treadmilldid not influenced Glut-1 expression during downhill running. The analysis were asfollows (table 1 and 2).

Glut-1 was embryonic transporter at almost all cell type in the body. Glut-1 was thandifferentiated in to other Glut type following cell characteristics. Skeletal muscleexpresses Glut-4 at the membrane which characterized as insulin dependent. Glut-4signaling pathways were interrupted under diabetic disturbance. Glut-1 replaced itfunction in order to facilitate glucose uptake through muscle membrane. Fortunately,Glut-1 is insulin independent but also ATP dependent. Glut-1 expression would beinterrupted 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 MAPKand or indirectly through MAPKAP2. Phosporylated Glut-1 actively facilitated glucosetransport through muscle membrane.

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

Decreement	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

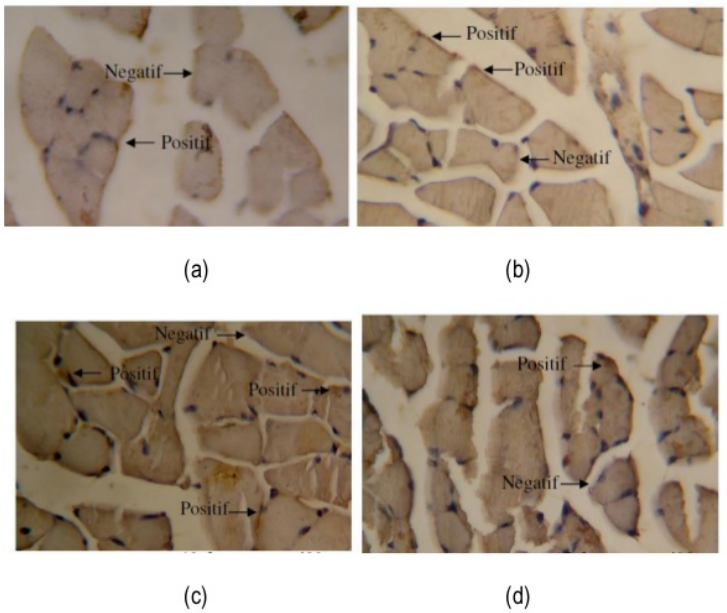

Figure 1. Positive cells of Glut-1 expression on muscle membrane of diabetic mouse models

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 mechanismexplained the benefit of exercise on diabetes therapy.

Acknowledgement

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