Aerobic exercise training counteracts insulin resistance induced by low sodium diet by increasing insulin signaling in muscle

Paula Ramos Pinto¹, V. Del Bianco¹, A.P. Garcia Bochi¹, G. Silva Ferreira¹, M. da Silva Trevisani¹, L. Gomes Rodrigues¹, E.R. Nakandakare¹, M. Okamoto², U. Fabres Machado², S. Catanozi¹, M. Passarelli^{1,3}.

¹Faculdade de Medicina da Universidade de São Paulo, Laboratório de Lípidos LIM10 - Hospital das Clínicas HCFMUSP, São Paulo, Brazil.
²Instituto de Ciências Biomédicas- Universidade de São Paulo ICB-USP, Departamento de Fisiologia e Biofísica, São Paulo, Brazil.
³Universidade Nove de Julho, Programa de Pós-Graduação em Medicina, São Paulo, Brazil.

e-mail: paularamos@usp.br

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Introduction

Low sodium diet contributes to reduce cardiovascular disease. However some studies have demonstrated severe metabolic alterations such as plasma hyperlipidemia, insulin resistance, activation of renin-angiotensin-aldosterone and sympathetic systems induced by sodium restriction diet.

Aim

To investigate the effect of aerobic exercise training (AET) in the insulin-resistance induced by low-sodium (LS) diet in LDLRKO mice focusing in the insulin-signaling in skeletal muscle.

Methods

Three-month old LDLRKO mice were fed a chow normal sodium (1,27%-NaCl; NS) or a LS (0,15%-NaCl; LS) diet, and concomitantly kept sedentary (S-NS or S-LS) or submitted to AET (T; T-NS or T-LS) in treadmill (1h/day, 15 m/min, 5-times week) during 3 months. Exercise capacity, body weight, blood pressure, plasma cholesterol, triglycerides, fasting glucose and glucose decay rate by the insulin tolerance test (ITT) were determined. GLUT4, total and phosphorylated AKT in whole gastrocnemius extract were analyzed by immunoblot. Comparisons were done by 2-way ANOVA. This study was approved by The Ethical Committee - CEUA Faculdade de Medicina da Universidade de São Paulo (Nº 071/16)

Conclusion

AET prevents the LS diet-induced insulin resistance in LDLRKO mice by enhancing total and phosphorylated AKT and GLUT4 content in skeletal muscle.

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Results

TABLE 1. Body weight, plasma lipids and glucose, blood pressure and exercise capacity in LDLRKO mice after experimental protocol.

	S-NS	T-NS	S-LS	T-LS	<i>p</i>		
	(n = 4-13)	(n = 5-12)	(n = 4-14)	(n = 4-12)	Interaction	Diet	Exercise
Body Weight (g)	26.1±2.5	25.5±2.1	27.0±2.9	27.2±2.5	0.6077	0.0669	0.7408
TC (mg/dL)	271±103	304±91	254±96	292±83	0.9534	0.7721	0.4723
TG (mg/dL)	101±9	100±27	152±36	130±51	0.5252	0.0284	0.4911
Glucose (mg/dL)	101±16	113±15	115±19	124±23	0.7374	0.0224	0.0477
BP (mmHg)	106±6	106±6	103±8	103±5	0.9777	0.0924	0.8010
EC (sec)	1097±236	1995±464	1053±244	1866±593	0.7095	0.4495	<0.0001

Data expressed as mean SD; TC = total cholesterol; TG = triglycerides; BP = blood pressure, EC = exercise capacity.

Insulin tolerance test (ITT)

* *p* < 0.005

GLUT4 , total AKT and phosphorylated protein level in gastrocnemius muscle

Representative figures