Effects of a resistance physical exercises program on Nrf2 and NF-κB expression in hemodialysis patients

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INTRODUCTION

Oxidative stress and inflammation are important cardiovascular risk factors in patients with chronic kidney disease (CKD) on hemodialysis (HD). Recently, nuclear factor-erythroid 2-related factor 2 (Nrf2) has emerged as a factor that plays a significant role in cellular protection against oxidative stress and inflammation, that coordinate the expression of inflammatory genes, such as κB nuclear factor (NF-κB) as well as the expression of genes encoding phase II detoxifying enzymes and antioxidant enzymes. Studies have shown that Nrf2 expression can be modulated by several factors, such as bioactive compounds and physical exercise. In fact, exercise in CKD patients can bring many benefits; however, there are no studies correlating physical activity and Nrf2 expression in CKD patients.

OBJECTIVES

The aim this study was to evaluate the effects of resistance exercise on NRF2 and NF-κB expression in HD patients.

METHODS

This study included 37 patients on regular HD program. The group that performed the exercise was composed of 24 patients (54.5% women, age 45.7 ± 15.2 years and time on dialysis, 65.7 ± 45.5 months) and, the control group consisted of 13 patients (61.5% women, age 42.5 ± 13.5 years and time on dialysis, 70.1 ± 49.9 months). Blood samples were obtained after 12h fasting and the peripheral blood mononuclear cells were isolated before and after three months intradialytic exercises. The program of exercises (performed with elastic bands and leggings in both lower limbs), it was supervised, 3 times per week (36 sessions).

Quantitative Real-Time PCR analysis was performed using 7500 Real-Time PCR System (Applied Biosystems) to evaluate the levels of mRNA expression encoding Nrf2 and NF-κB. Nitric oxide (NO) and superoxide dismutase (SOD), catalase (CAT) and glutathione peroxidase (GPx) plasma levels were measured using the enzyme immunometric assay.

RESULTS

After 3 months of resistance exercises program, there was a trend to increase the Nrf2 expression and decrease NF-κB expression. There was also a significant reduction of SOD (44.3U/mL to 27.4U/mL) and CAT (33.3U/mL to 23.5U/mL) plasma levels in exercise group, but in contrast, the GPx showed a trend to increase. The NO levels were significantly reduced in control group (p=0.03) (Table 1).

Table 1. Biochemical parameters of HD patients before and after a resistance exercise program

Parameters	Exercise Group		Control Group	
	Before	After	Before	After
Nrf2	0.97±0.78	1.82±0.72*	1.29 0.89	1.08 0.67
NF-κB	0.74±0.38	0.76±0.35	0.88 0.36	0.98 0.12
NO(μM)	17.34±6.44	15.29±6.56	15.19 5.80	11.62 4.44*
SOD(U/mL)	44.36±3.84	27.50±2.39**	45.12 6.19	31.95 4.68
CAT(U/mL)	33.25±13.58	23.52±11.48*	31,02 5.78	33,04 19.05
GPX(U/mL)	28.94±4.86	36.78±12.30	26.06 5.32	20.62 7.78

*p<.05; **p<.0001

CONCLUSION

These data suggest that resistance exercises program during 3 months seems to be able to alter important transcription factors, due to improvement in the Nrf2 activation and reduction of NF-κB expression. In addition, the resistance exercises can alter the oxidative damage and preserve NO levels in CKD patients undergoing HD.

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