



Effects of physical exercise on butyrylcholinesterase in obese adolescents

Isabela M.W. Silva¹, Neiva Leite², Dellyana Boberg¹, Thais J. Chaves¹, Gerusa M. Eisfeld², Gisele M. Eisfeld², Gleyse F. Bono¹, Ricardo L.R. Souza¹ and Lupe Furtado-Alle¹

¹Department of Genetics, Universidade Federal de Paraná, Curitiba, PR, Brazil.

²Department of Physical Education, Universidade Federal de Paraná, Curitiba, PR, Brazil.

Abstract

The aim of the present study was to evaluate the effect of a 12 week program of physical exercise (PE) on butyrylcholinesterase (BChE) in obese adolescents. This study compared obese adolescents (N = 54) before and after PE, regarding the relative intensity (RI) and activity of different molecular forms (G1, G2, G4 and G1-ALB) of BChE found in plasma. Waist circumference (WC) and lipid profile were also assessed before and after PE. It was shown that before PE, mean plasma BChE activity was significantly higher in obese than in non-obese adolescents and that it was significantly reduced after PE, becoming similar to that found in non-obese adolescents. Lipid profile and WC also changed in response to PE. These results are consistent with studies that found a correlation between BChE and lipid metabolism and suggest that PE may have led to a physiological regularization of plasma BChE activity. Although mean BChE activity of each isoform was significantly reduced by PE, their RI did not change. This is in accordance with a previous suggestion that this proportion is maintained under factors such as obesity, and may therefore be important for BChE functions.

Key words: BChE activity; physical exercise, obesity.

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Butyrylcholinesterase (BChE; EC 3.1.1.8) is coded by *BCHE* gene (3q26.1-q26.2), synthesized in the liver and distributed to several parts of the organism. Plasmatic BChE is found in four possible homomeric forms (G1 monomers, G2 dimers, G3 trimers and G4 tetramers) or heteromeric forms formed in association with other proteins, such as albumin, G1-Alb (Masson, 1989).

Several studies verified that BChE has a role in lipid metabolism (Kutty *et al.*, 1977), and is correlated with weight (Chautard-Freire-Maia *et al.*, 1991; Li *et al.*, 2008) and body mass index (Alcântara *et al.*, 2001, 2003; Souza *et al.*, 2005; Furtado-Alle *et al.*, 2008). It is also known that plasma BChE activity is positively correlated with obesity (Kutty, 1980; Chautard-Freire-Maia *et al.*, 1991; Furtado-Alle *et al.*, 2008).

The aim of this study was to compare the relative intensity (RI) of BChE isoforms revealed as bands (G1, G1-Alb, G2 and G4) in obese adolescents before and after 12 weeks of physical exercise (PE), and to search for a correlation between RI of BChE isoform bands, plasma BChE activity and PE.

The sample comprised 54 obese adolescents (BMI above percentile 95 and mean age 12.6 ± 2.01), these being

participants of a 12 week program of physical exercise. Aerobic exercise consisted of 50 to 100 min activity during the first four weeks. Intensity was set at 35%-55% of VO_2 peak, and was increased to 55%-75% during the next eight weeks. Plasma was sampled at baseline and after terminating the program. A sample of non-obese adolescents (N = 45; mean age 13.3 ± 2.15) was used to measure plasma BChE activity.

The detection and analysis of BChE bands in plasma was made according to Boberg *et al.* (2010). Samples without any detectable BChE band were excluded from the analysis. Plasma BChE activity was measured according to Dietz *et al.* (1972), as modified by Evans and Wroe (1978). This study was approved by the Ethics Committee of Biological Sciences Sector from Federal University of Parana (05/2009).

Mean plasma BChE activity was significantly reduced after the 12 weeks program (before: 7.66 ± 2.64 KU/L, after: 5.89 ± 2.34 KU/L; $t = 2.96$, $p = 0.008$). Accompanying BChE activity, waist circumference (WC; before: 97.41 ± 11.20 cm, after: 94.62 ± 10.51 cm, $t = 3.6$ and $p = 0.03$), LDL-cholesterol (LDL-C; before: 94.45 ± 20.83 mg/dL, after: 86.00 ± 16.37 mg/dL, $t = 2.77$ and $p = 0.012$) and triglycerides (TG; before: 114.30 ± 57.14 mg/dL, after: 82.75 ± 42.66 mg/dL, $t = 3.1$ and $p = 0.006$) also showed significant reduction with PE,

Table 1 - Means (M) \pm Standard Deviations (SD) of relative intensity (RI) and activity of BChE bands in obese adolescents (n = 34) before and after a 12 week program of physical exercise.

	Relative Intensity			Activity (KU/L)			
	M \pm DP		<i>t</i> -test (p)	M \pm DP		<i>t</i> -test (p)	Means ratio (B/A)
	Before	After		Before	After		
G4	0.68 \pm 0.19	0.72 \pm 0.19	1.23 (0.23)	5.35 \pm 3.00	4.29 \pm 2.29	2.48 (0.02)	1.25
G2	0.13 \pm 0.09	0.10 \pm 0.08	1.51 (0.14)	0.99 \pm 0.65	0.59 \pm 0.36	3.19 (0.003)	1.68
G1-alb	0.10 \pm 0.09	0.10 \pm 0.09	0.49 (0.62)	0.69 \pm 0.44	0.42 \pm 0.43	2.29 (0.03)	1.64
G1	0.09 \pm 0.08	0.08 \pm 0.07	0.23 (0.82)	0.77 \pm 0.64	0.49 \pm 0.40	2.52 (0.02)	1.57

B = Before physical exercise, A = after physical exercise.

while HDL cholesterol (HDL-C) showed a significant increase (before: 42.54 \pm 8.33 mg/dL, after: 49.05 \pm 8.61 mg/dL; *t* = -4.53 and *p* = 0.0002). These changes in BChE activity, WC and lipid profile (LDL-C, TG and HDL-C) are consistent with an already described association between BChE and lipid metabolism. Considering that mean BChE activity in obese adolescents after the program was similar to that seen in non-obese adolescents (5.0 \pm 0.11 KU/L, *t* = 1.5 and *p* = 0.13), and that mean BChE activity of each band was significantly reduced by PE (Table 1), the 12 weeks of PE may have led to a physiological regularization of plasmatic BChE activity. This contrasts with the lack of significance between means of RI of BChE isoform bands before and after the program (Table 1).

Boberg *et al.* (2010) had reported that higher plasma BChE activity is found in obese persons, the RI of each isoform is nonetheless maintained, independent of obesity. Our present data are in accordance with the observation made by Boberg *et al.* (2010), showing that, although mean BChE activity (total and related to each band, Table 1) decreased in response to PE, the RI of each band was maintained. This indicates that this proportionality is regulated and may therefore be important for BChE functions.

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