

THE EFFECTS OF A 12-WEEK JUMP ROPE EXERCISE PROGRAM ON ABDOMINAL ADIPOSITY, VASOACTIVE SUBSTANCES, INFLAMMATION & VASCULAR FUNCTION IN PREHYPERTENSIVE ADOLESCENT GIRLS

Ronald J. Headid III, Elizabeth J. Pekas, Steven D. Scott, Michael D. Shukis, Jeonghwa Shin, Jiwon Shin, and Song-Young Park

University of Nebraska at Omaha, School of Health and Kinesiology, Omaha, NE



Vascular Research Lab

BACKGROUND

- High blood pressure and abdominal obesity have been known to be associated with poor cardiovascular health in many populations, including children and adolescents.
- We have previously demonstrated that combined resistance and aerobic exercise (CRAE) training can be useful as a therapeutic treatment to improve high blood pressure, arterial stiffness, insulin resistance, and central adiposity in obese prehypertensive adolescent girls.
- CRAE training may not be the most optimal or easily accessible intervention, thus we sought to examine other exercise interventions, specifically jump rope (JR) training, and its effects on overall health and cardiovascular measurements. JR training was selected because it is an easily accessible exercise modality.

PURPOSE

- To examine the effects of a jump rope exercise program on central adiposity and percent body fat, nitric oxide (NO) bioavailability, and levels of endothelin-1 (ET-1), c-reactive protein (CRP), arterial stiffness, and blood pressure (BP) in adolescent girls with prehypertension

METHODS

- 40 sedentary adolescent females (15±1 yrs) who were prehypertensive (SBP > 120 mmHg or DBP > 80 mmHg) with abdominal obesity (waist > 80 cm) were randomly assigned to a 12-week JR program or a sedentary control group
- The exercise group performed JR training 5 days a week for 12 weeks
- The sedentary control group came to the lab at the same frequency as the JR exercise group, but did not participate in exercise
- Venous blood samples, vascular function measurements, waist circumference, and body composition were taken before and after 12 weeks at the same time in the morning (± 1 hour) after an overnight fast
- A 2 x 2 repeated measures ANOVA was used. A probability of type I error less than 5% was considered significant ($p < 0.05$). Paired t-tests were used for *post hoc* comparisons.

METHODS

Table 1. Jump rope exercise program

Order	Exercise	Duration	Week	Intensity	Frequency
Warm-up	Static stretching	5 min			
	Walking				
	Jogging				
Main exercise	1 line 2 jump	40 min	1 - 4	40-50% HRR	5 times/week
	Jumping feet together			(RPE 11-12)	
	Running jumping		50-60% HRR		
	Open side jump		(RPE 13-14)		
	Open back and forth jump		60-70% HRR		
	Rock paper scissor jump		(RPE 15-16)		
Cool-down	Static stretching	5 min			
	Walking				
	Jogging				

RESULTS

Table 2. Participant characteristics and body composition parameters before and after a 12-week period of control (n=20) and exercise intervention (n=20)

	Control (n = 20)		Exercise (n = 20)	
	Pre	Post	Pre	Post
Age, y	15 ± 1	-	15 ± 1	-
Tanner stage	2 - 3	-	2 - 3	-
Height, cm	161 ± 3	162 ± 4	160 ± 3	161 ± 3
Body mass, kg	68 ± 8.4	70 ± 8.9*	69 ± 9.4	66 ± 7.3*†
BMI, kg/m ²	25 ± 2	26 ± 2	26 ± 3	25 ± 2
Body fat, %	32.7 ± 3.2	33.5 ± 3.7	33.8 ± 3.6	30.2 ± 3.1*†
Lean body mass, kg	43.7 ± 4.2	44.5 ± 3.6	44.9 ± 4.5	46.8 ± 4.2*†
Waist circumference, cm	85.3 ± 4	85.7 ± 4	86.4 ± 4	83.3 ± 5*†
Heart rate, bpm	69 ± 2	68 ± 3	67 ± 3	64 ± 2*†
Systolic BP, mmHg	126 ± 4.2	127 ± 5.3	126 ± 3.3	120 ± 2.1*†
Diastolic BP, mmHg	82 ± 2.2	84 ± 1.9	82 ± 0.4	80 ± 2

Values are Mean ± SD

* $p < 0.05$ different than Pre, † $p < 0.05$ different than Control

RESULTS

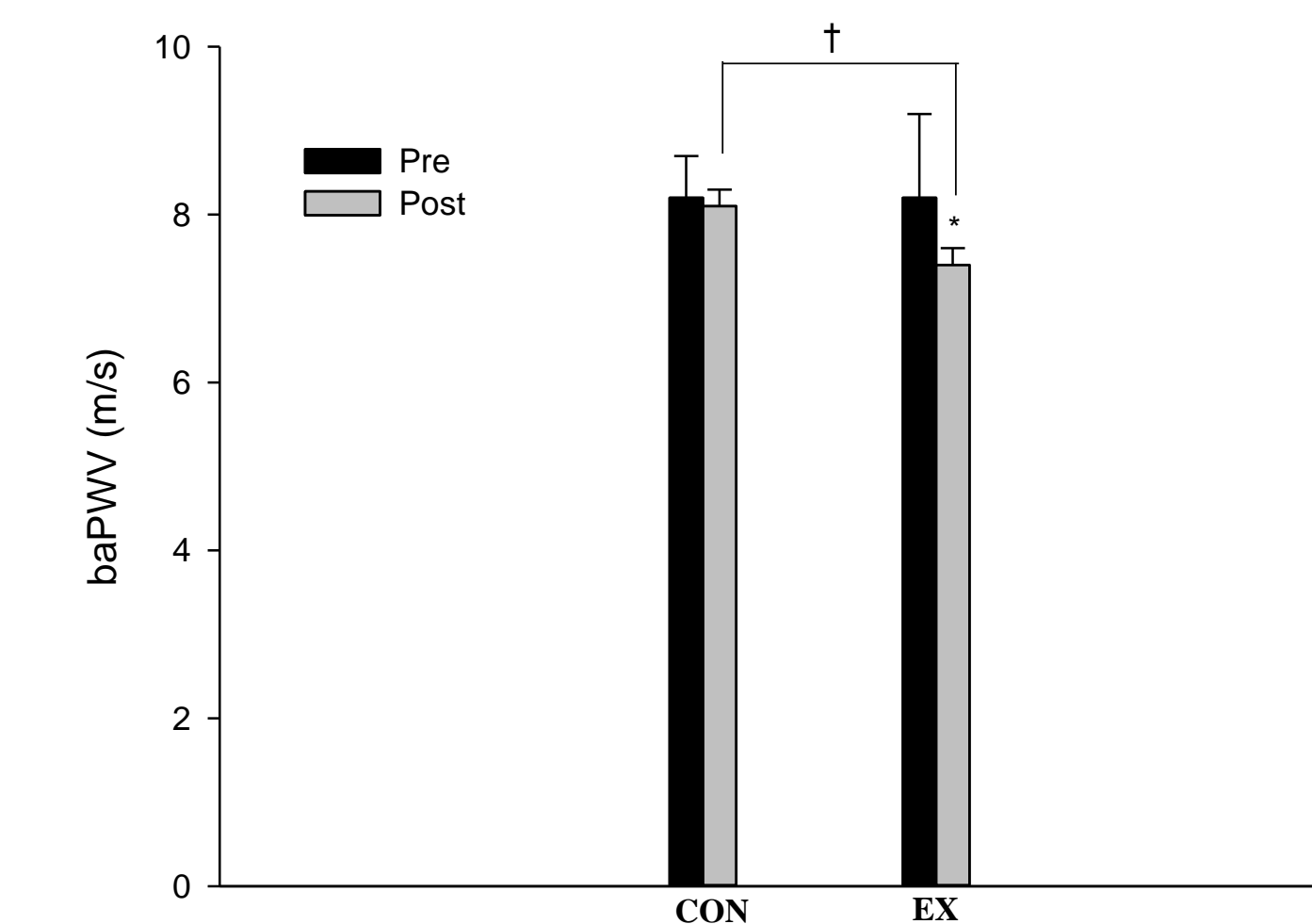


Figure 1. Brachial-to-ankle pulse wave velocity (m/s) pre- and post-exercise intervention between the control (CON) and the exercise (EX) groups. Values are presented as Mean ± SEM. * $p < 0.05$ vs. Pre, † $p < 0.05$ vs. CON

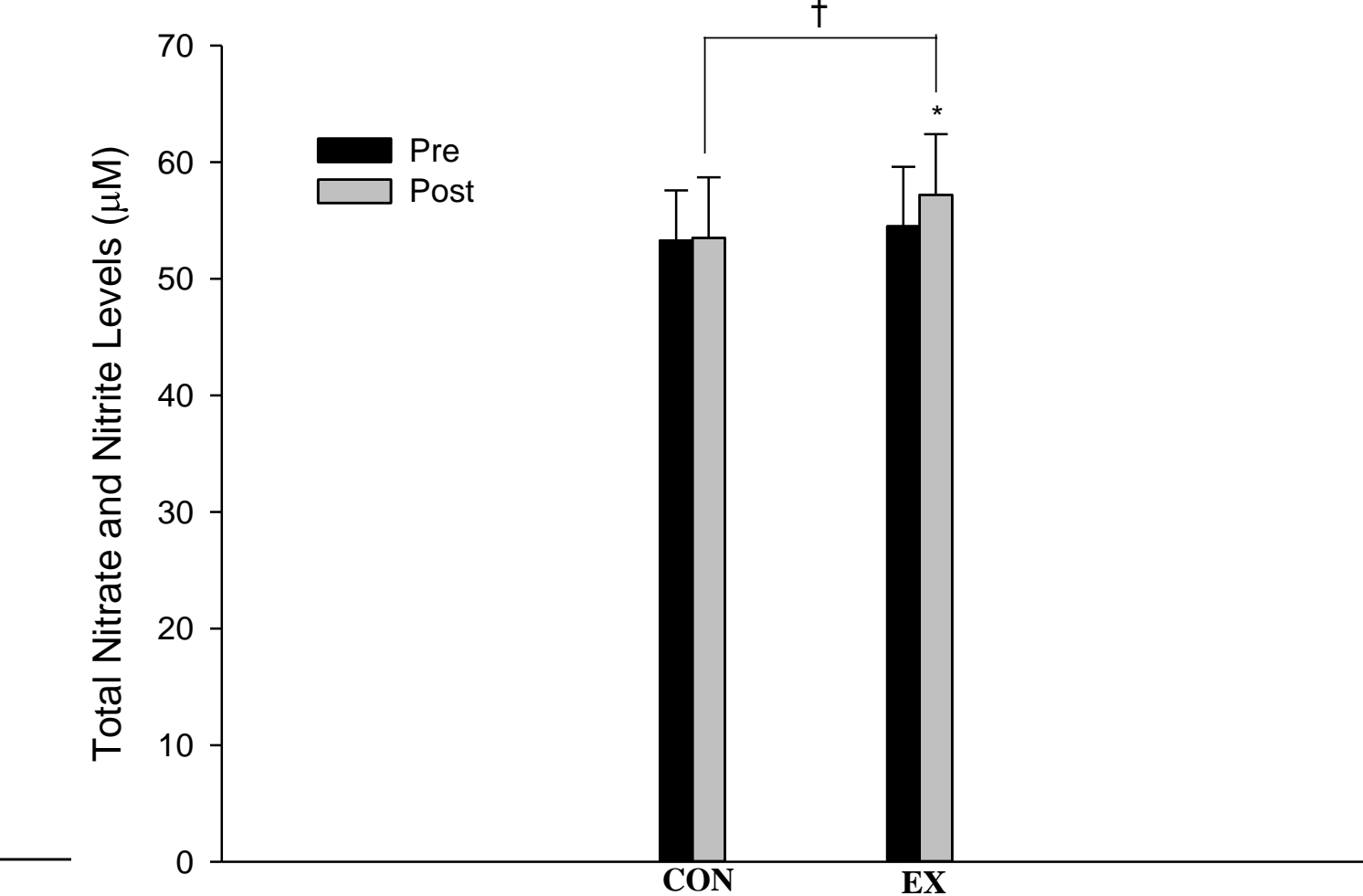


Figure 2. Total nitrate and nitrite levels (μmol) pre- and post-exercise intervention between the control (CON) and the exercise (EX) groups.

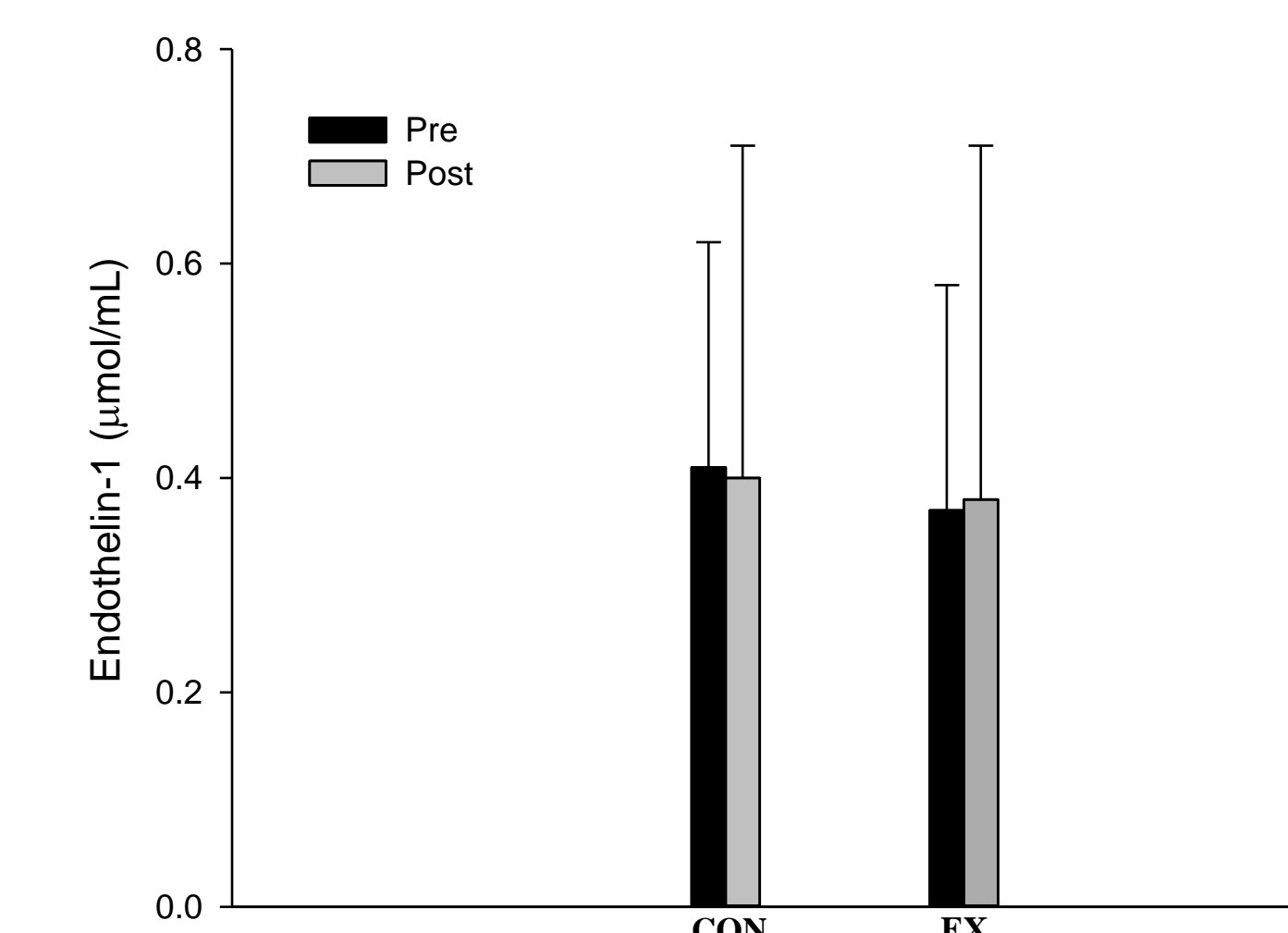


Figure 3. Total endothelin-1 levels (μmol/mL) pre- and post-exercise intervention between the control (CON) and the exercise (EX) groups.

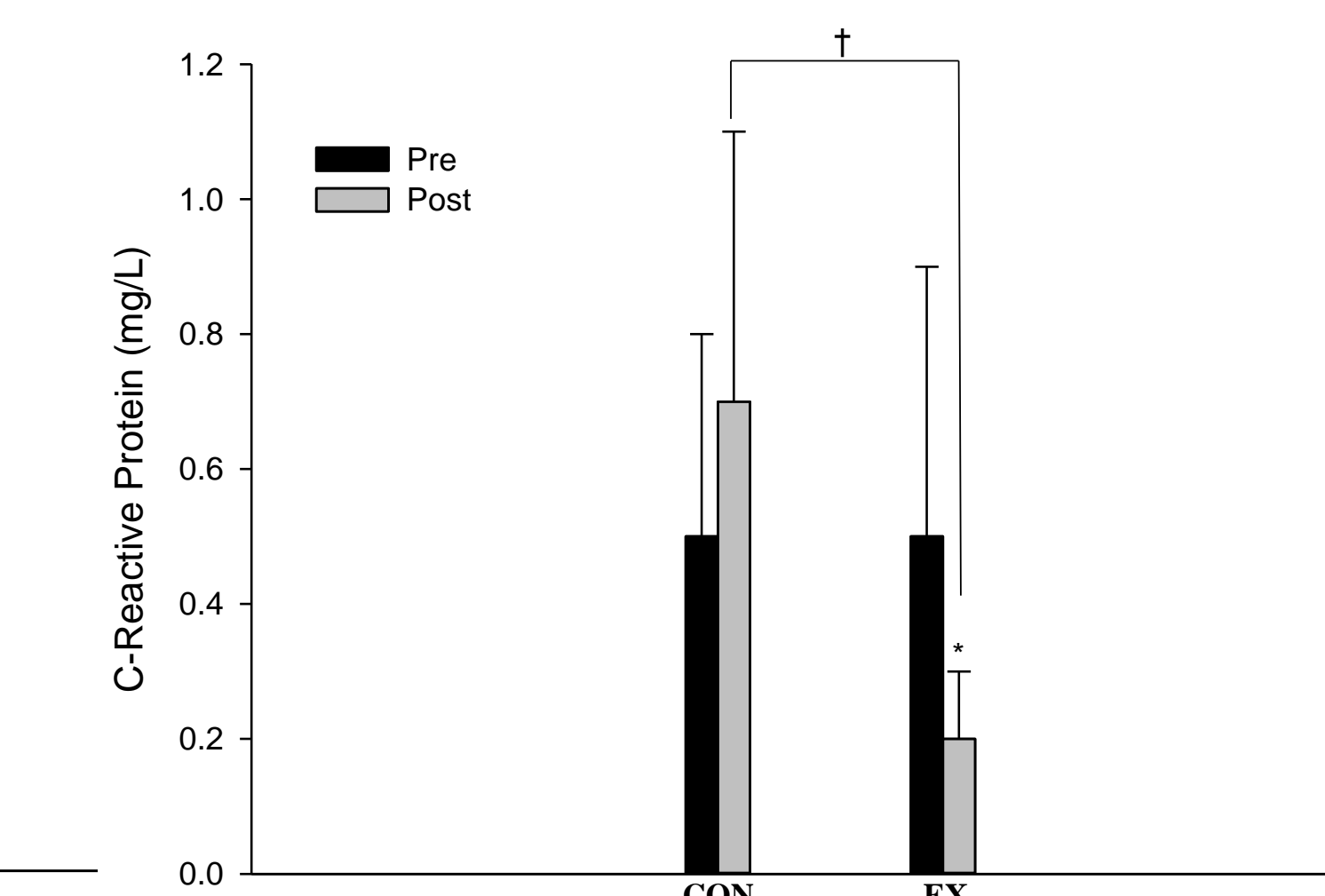


Figure 4. Total C-reactive protein levels (mg/L) pre- and post-exercise intervention between the control (CON) and the exercise (EX) groups.

CONCLUSIONS

- Our findings suggest that a 12-week jump rope exercise program can be a beneficial nonpharmacological exercise modality to improve cardiovascular health in adolescent girls with prehypertension.

This project was funded by the University Committee on Research and Creative Activity (UCRCA) and the NASA Nebraska Space Grant (#NNX15A109H).