



The effect of prolonged repeated moderate intensity exercise on cytokine concentrations in adults

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Purpose

Previous studies showed that exercise-induced changes in plasma cytokine profiles, potential indicators of stress and inflammatory status, depend on exercise duration and intensity. However, studies are generally limited to a single day and insight in the time-course during multiple days of exercise is lacking. Therefore, this study aimed to assess cytokine responses during multiple days of moderate intensity exercise in both men and women.

Methods

50 male (58.9 ± 9.9 years old) and 48 female (50.9 ± 11.2 years old) individuals were monitored on 4 consecutive days at which they walked 30, 40 or 50km per day at a self-determined pace. Blood samples were collected one or two days prior to the start of the exercise (baseline) and at every walking day immediately post-exercise. Blood samples were analysed for IL-6, IL-8, IL-10, IL-1β and TNF-α concentrations.

Results

All cytokine concentrations increased from baseline to post-exercise at day 1 ($p < 0.001$). Thereafter, concentrations decreased from day 1 to day 2 ($p < 0.01$), remaining rather stable during the next days. IL-10 was higher in men than in women after the 1st day of exercise, IL-6 was higher in men after the 2nd day, and IL-1β and TNF-α were higher in men at baseline and during all days.

Table 1. Participant characteristics

	Men (n = 50)	Women (n = 48)	P value
Age (years)	58.9 ± 9.9	50.9 ± 11.2	<.001
Height (cm)	180 ± 6	167 ± 6	<.001
Weight (kg)	88.9 ± 13.3	65.6 ± 8.1	<.001
BMI (kg/m ²)	27.3 ± 3.3	23.5 ± 3.0	<.001
Resting heart rate (bpm)	63 ± 10	64 ± 7	.758
Systolic pressure (mmHg)	142 ± 18	133 ± 21	.036
Diastolic pressure (mmHg)	88 ± 10	82 ± 11	.014
Training distance (km)	812 ± 1072	753 ± 921	.770
Walking 30 km	n = 17	n = 5	
Walking 40 km	n = 20	n = 39	
Walking 50 km	n = 13	n = 4	

Means ± SD are shown. BMI: Body mass index; Training distance: specific walking distance in the year prior to the 4 Days Marches; P Values refers to an unpaired Students t-test between male and female participants

Table 2. Exercise characteristics

		Day 1	Day 2	Day 3	Day 4	A. Sign.
Walking						
Exercise duration (hours:minutes)	Men	7:52 ± 2:32	8:32 ± 1:31	8:23 ± 1:45	8:51 ± 2:03	.001
	Women	8:43 ± 1:04	9:05 ± 1:16	8:41 ± 2:15	9:45 ± 1:32	<.001
	P value	.032	.054	.459	.017	
Speed (km/h)	Men	4.8 ± 0.8	4.6 ± 0.8	4.7 ± 0.7	4.5 ± 0.8	.003
	Women	4.6 ± 0.6	4.4 ± 0.7	4.5 ± 0.6	4.2 ± 0.6	<.001
	P value	.235	.186	.046	.009	
Fluid intake (L)	Men	4.4 ± 1.6	4.4 ± 1.5	4.3 ± 1.3	2.8 ± 1.1	<.001
	Women	4.1 ± 1.7	3.8 ± 1.5	3.6 ± 1.6	2.6 ± 1.0	<.001
	P value	.367	.034	.015	.397	
Physical parameters						
Weight change (kg)	Men	- 1.4 ± 1.0	- 0.8 ± 0.7	-0.5 ± 0.6	-0.9 ± 0.8	<.001
	Women	- 0.3 ± 0.7	-0.3 ± 0.5	-0.3 ± 0.5	-0.5 ± 0.5	.009
	P value	<.001	<.001	.158	.016	
Mean heart rate (bpm)	Men	113 ± 18				
	Women	115 ± 15				
	P value	.512				
Max heart rate (bpm)	Men	124 ± 27				
	Women	129 ± 18				
	P value	.260				
Exercise intensity (%)	Men	67 ± 11				
	Women	67 ± 8				
	P value	.679				

Values are mean values for the 4 walking days. P Values refers to an unpaired Students t test between male and female participants. A. Sign P values refer to an Intra-group Friedman ANOVA test for the effect of days. Weight difference is calculated as post-exercise - pre-exercise, a negative value means weight loss.

Results

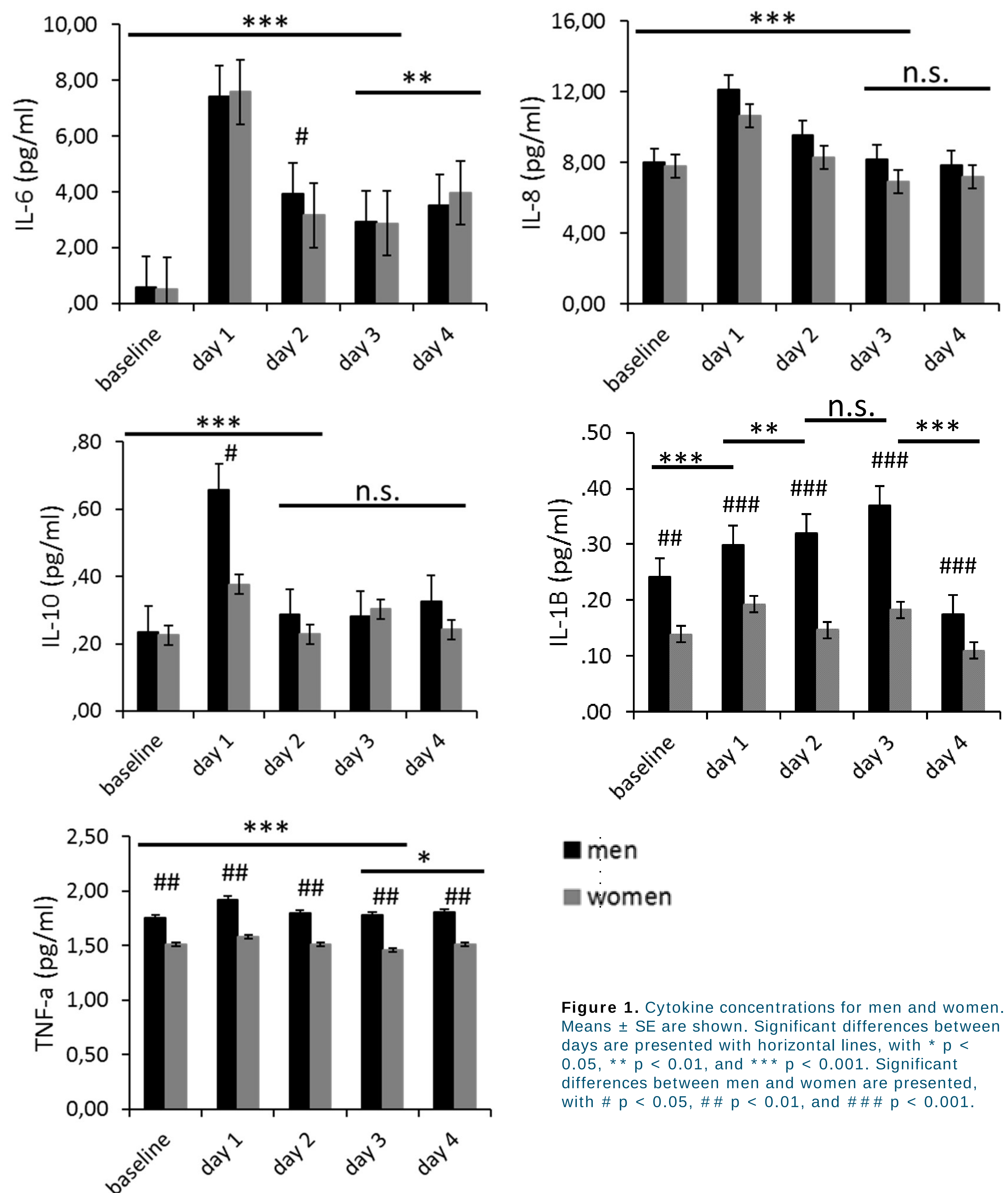


Figure 1. Cytokine concentrations for men and women. Means ± SE are shown. Significant differences between days are presented with horizontal lines, with * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$. Significant differences between men and women are presented, with # $p < 0.05$, ## $p < 0.01$, and ### $p < 0.001$.

Conclusion

Exercise-induced increases of cytokines attenuated on subsequent days, although the same amount of exercise was performed. Men and women showed different baseline levels but similar exercise responses. These results suggest that individuals adapt rapidly to this type of exercise.

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<http://www.wur.nl/en/project/Micronutrients-status-and-exercise-stress-markers-to-monitor-training-load-and-performance-in-athletes.htm>

