

# The effect of asthma on cardiorespiratory endurance (CRE) in children

## Background

A beneficial effect of climate therapy at moderate and high altitudes on asthma symptoms has been suggested<sup>1,2</sup>. The impact of asthma on aerobic fitness in children is controversial as some studies showed a negative influence<sup>3</sup>, whereas others did not<sup>4</sup>. In this study we investigated the effect of a one week stay at moderate altitude (900 m) in the Alps on exercise induced bronchoconstriction (EIB) and cardiorespiratory endurance (CRE) in a group of asthmatic children participating to a summer asthma camp.

## Methods

Asthmatic children from an urban area (Udine, north-east of Italy) performed spirometry (Spirolab, MIR, IT) before and 10 minutes after a 20-m shuttle run test (20mSRT) on the 1<sup>st</sup> and 7<sup>th</sup> day of the asthma camp. The 20mSRT is a field test widely used to measure aerobic fitness by predicting maximum oxygen uptake (VO<sub>2</sub>max) and performance. The child runs between two lines set 20 m apart at a incremental pace dictated by a recording emitting tones at appropriate intervals. The test score achieved by the subject is the number of 20 m shuttles completed before the subject either withdrew voluntarily from the test, or failed to be within 3 m of the end lines on two consecutive tones. Spirometry z-scores were derived from GLI-2012 equations<sup>5</sup> and percentiles of 20mSRT performances were assigned according to De Miguel-Etayo<sup>6</sup> for children aged 7-9 years and to Tomkinson<sup>7</sup> for older subjects. A repeatable flow-volume curve at each testing point was required. EIB was defined as a FEV1 decrease ≥10% after the 20mSRT.

## Results

Twenty-four participants (mean age 11.8y, ranging from 7,4 to 16,3 years, 10 female and 14 males) were included in the final analysis. 17 patients had well controlled asthma, 6 partially controlled and 1 uncontrolled asthma, according to the GINA 2017 guidelines.

	Day 1	Day 7
FEV1 z-score pre-exercise	0.10 (0.95)	0.21 (0.96)
FVC z-score pre-exercise	0.09 (0.96)	0.49 (0.94)
FEV1/FVC z-score pre-exercise	-0.02 (1.01)	-0.50 (0.84)
Frequency of EIB	14 (58%)	8 (33%)
Frequency of 20mSRT performance <25° percentile (pc)	11 (45%)	4 (16%)
Positive EIB among those with 20mSRT performance <25° pc	9/11	1/4

Table 1

Spirometry z-scores (GLI-2012), exercise induced bronchoconstriction (EIB) and 20-m shuttle run test (20mSRT) results in 24 asthmatic children at the start and end of the asthma camp in the Alps. Mean (SD) values reported unless otherwise specified.

Sex	Age in years	Exercise induced FEV1 decrease % day 1	20mSRT result quartile day 1	Exercise induced FEV1 decrease % day 7	20mSRT result quartile day 7
M	12,5	8	5° - 25°	1	50° - 75°
F	11,3	<b>28</b>	5° - 25°	<b>11</b>	25° - 50°
M	13,5	3	25° - 50°	2	75° - 95°
M	8,8	<b>12</b>	<5°	<b>20</b>	50° - 75°
M	12,3	<b>34</b>	5° - 25°	<b>10</b>	50° - 75°
M	13,5	2	5° - 25°	-7	5° - 25°
M	11,6	3	75° - 95°	-2	25° - 50°
M	16,3	<b>11</b>	5° - 25°	-1	5° - 25°
M	12,8	9	50° - 75°	-1	75° - 95°
F	12,0	<b>13</b>	5° - 25°	0	5° - 25°
F	11,3	<b>29</b>	5° - 25°	<b>17</b>	25° - 50°
M	8,8	6	25° - 50°	-2	25° - 50°
M	7,4	<b>10</b>	50° - 75°	4	75° - 95°
F	8,1	<b>12</b>	<5°	<b>32</b>	5° - 25°
F	12,3	-5	5° - 25°	4	75° - 95°
F	14,5	3	75° - 95°	1	75° - 95°
M	9,0	<b>46</b>	5° - 25°	<b>37</b>	25° - 50°
F	11,1	<b>18</b>	50° - 75°	<b>35</b>	50° - 75°
M	12,4	<b>34</b>	50° - 75°	0	75° - 95°
F	10,3	1	25° - 50°	0	50° - 75°
M	8,7	<b>10</b>	50° - 75°	4	> 95°
M	13,9	<b>23</b>	25° - 50°	<b>19</b>	50° - 75°
F	11,9	0	25° - 50°	-3	75° - 95°
F	9,9	<b>15</b>	50° - 75°	0	50° - 75°

Table 2

Summary of patients characteristics, percentage of FEV1 volume decrease post-exercise and 20mSRT quartile at day 1 and day 7 of the asthma camp. In bold FEV1% decrease in patients with EIB. Green boxes show an improvement in the 20mSRT quartile between day 1 and 7

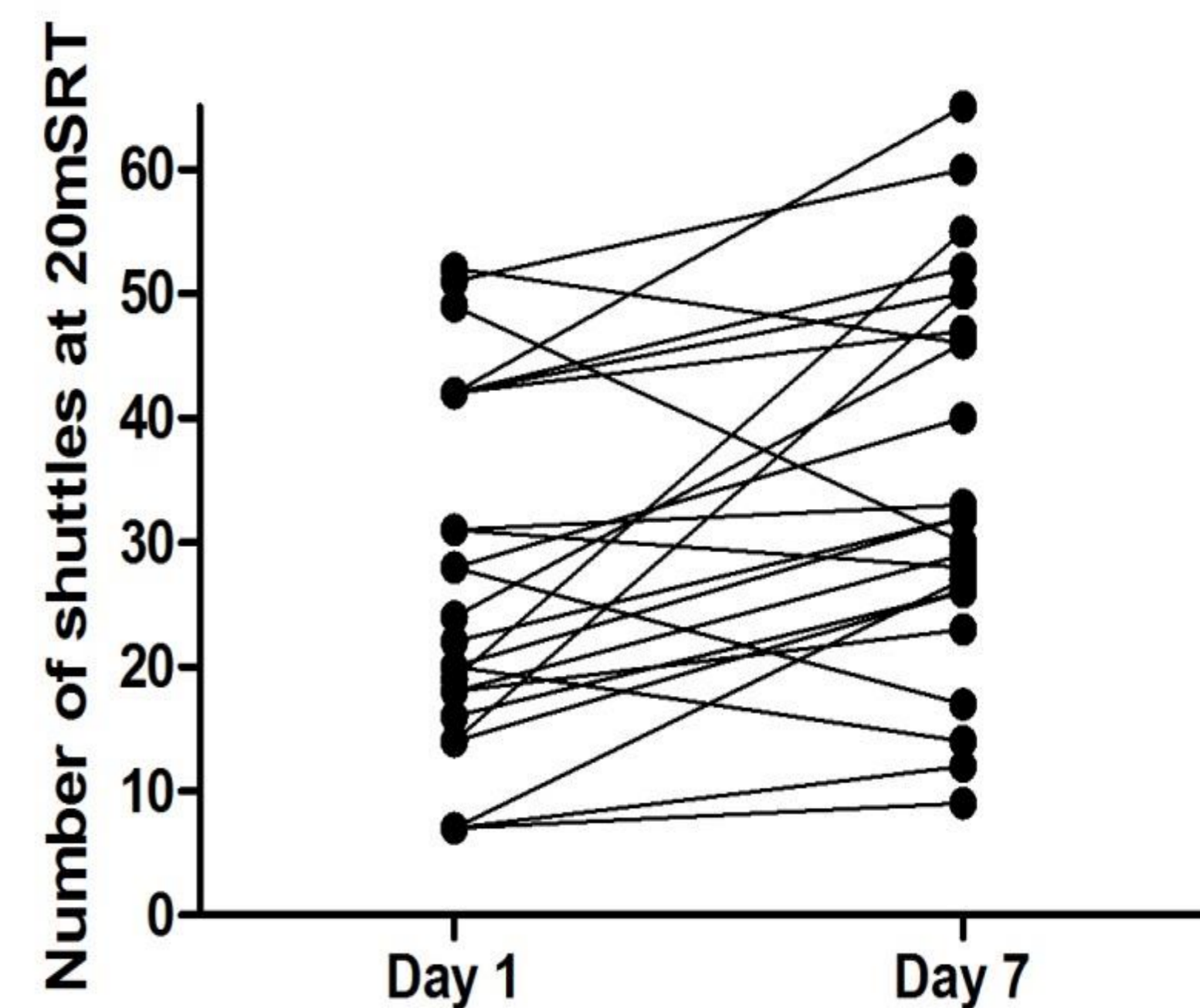


Figure 1

On Y axis number of shuttles performed by each patient at the 20m-SRT, on the X axis the time. Each point represents a patients. Continues lines identify the same patient during time.

## Conclusions

Asthma seemed to have a negative impact on cardio-respiratory endurance before the camp. The asthma camp at moderate altitude improved both frequency of exercise induce bronchoconstriction and the cardio-respiratory fitness in our cohort of asthmatic children.

### REFERENCES

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