



Structured Light Plethysmography: new method to evaluate expiratory flow limitation in asthmatic children

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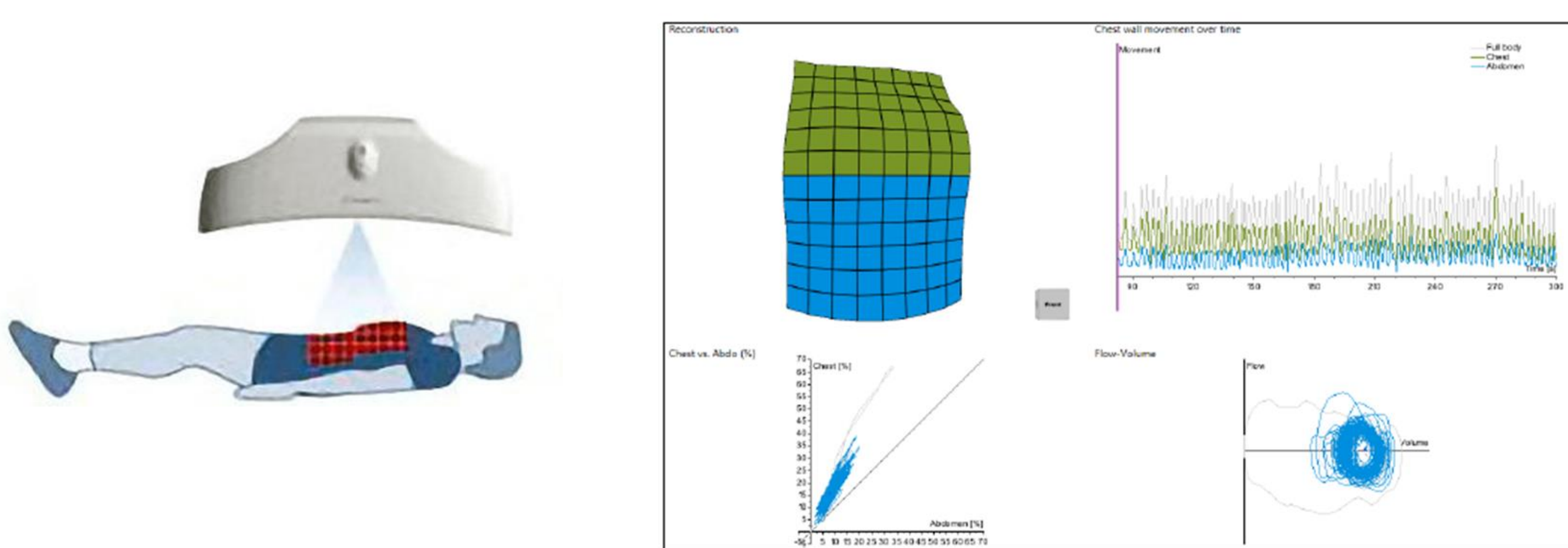
BACKGROUND INFORMATION

Structured Light Plethysmography (SLP) is a new non-invasive method that captures and records real-time functional images of chest movement, allowing a better understanding of patient respiratory function. The system measures breathing motion using a grid of light, tracked by a digital vision system of 2 high-speed cameras. Chest movement during breathing is analyzed and displayed in terms of regional movement parameters as well as a 3D-reconstruction.



In addition to showing the breathing pattern of the patient on a volume-time graph and in a dynamic 3D-representation, the tidal breathing flow/volume graph is available for immediate identification of inspiratory or expiratory flow limitation. The regional subdivision are also available with both graphical curves and numerical parameters, that can easily show and identify respiratory-related issues or abnormal contribution to the tidal volume of the different regions of the chest.

It doesn't require patient collaboration like spirometry; so it could be an alternative to evaluate pre-school children.

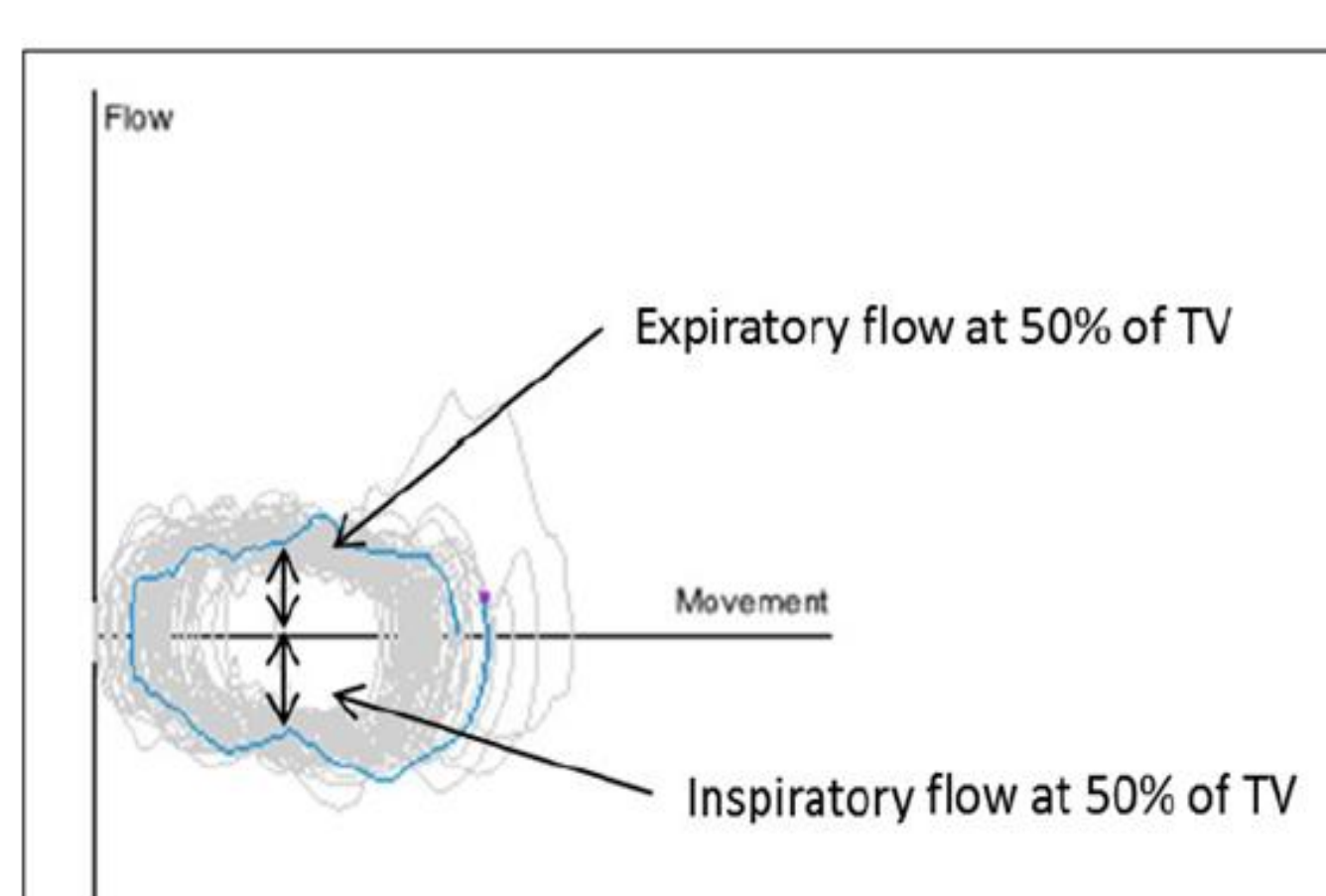


METHODS

- We evaluated asthmatic children aged between 3 to 15 years
- We divided patients in two groups: children with well-controlled asthma (GroupA), and children evaluated during asthma exacerbation(GroupB);
- every patient underwent SLP evaluation, and when it was possible also a spirometry was collected.



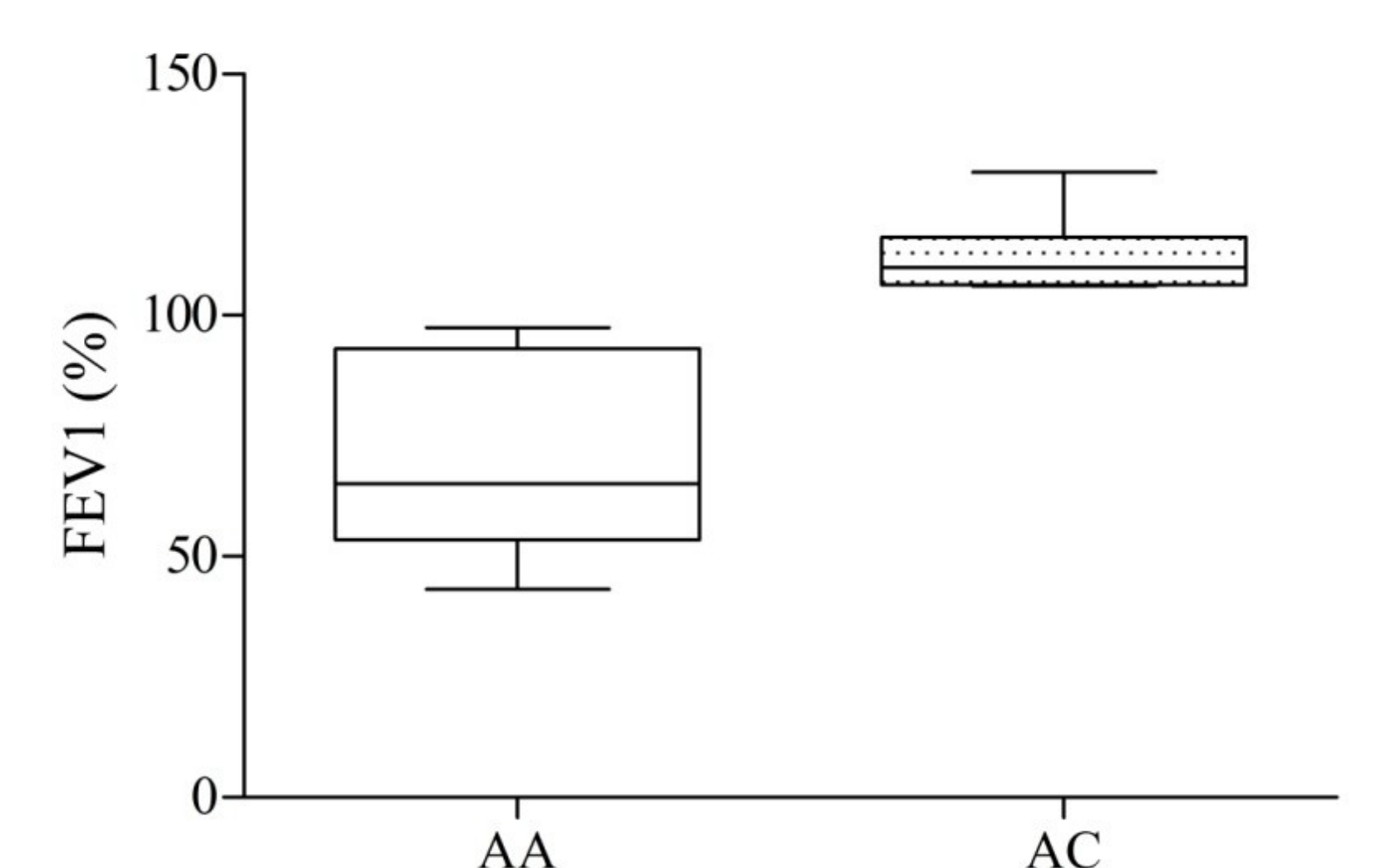
- IE50: the ratio of inspiratory flow at 50% of tidal volume (VT) to expiratory flow at 50% of VT, where VT is taken to be the exhaled chest wall movement, and flow is taken to be the time-derivative of chest wall movement. Increased value of IE50 suggests expiratory flow limitation.



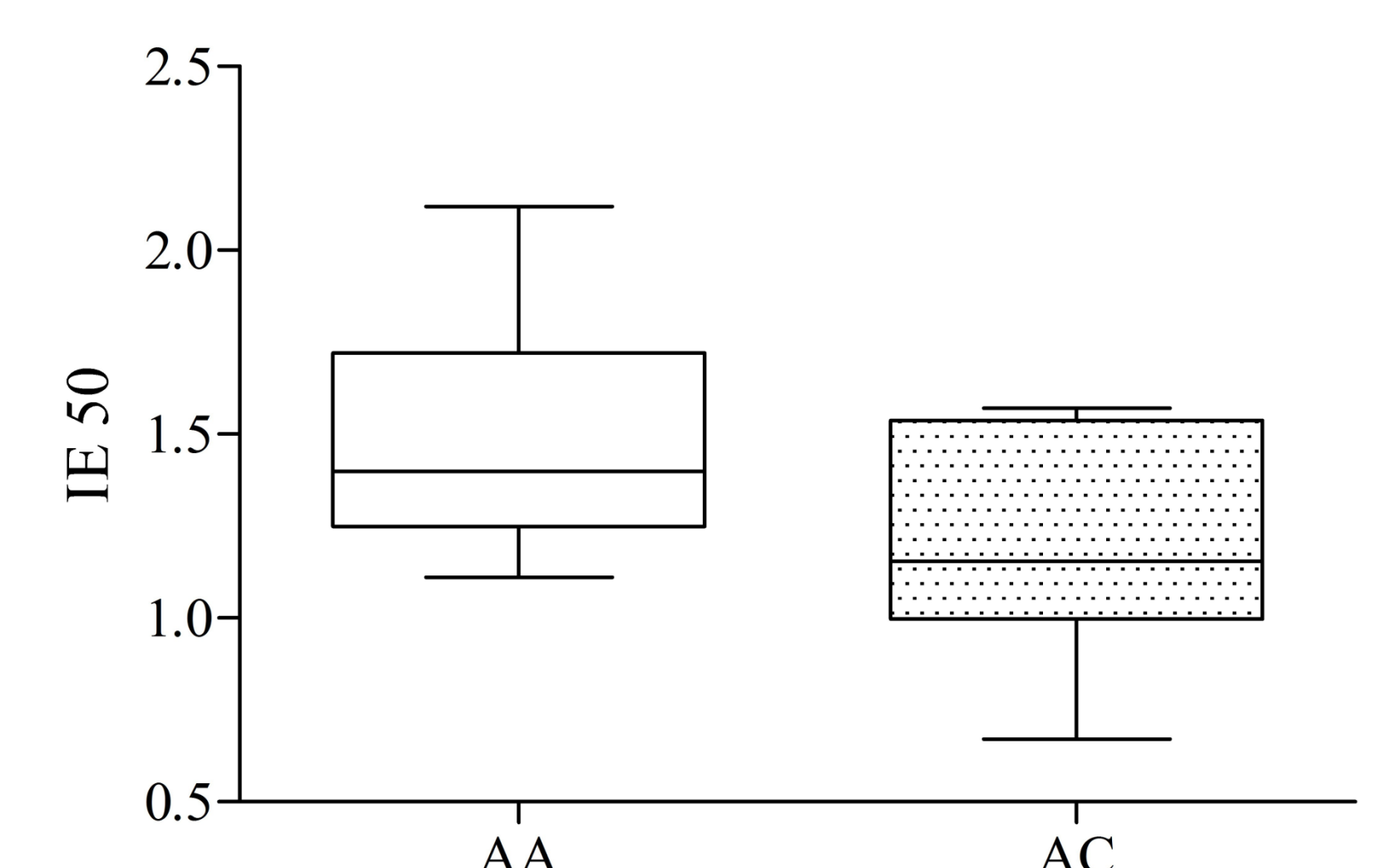
RESULTS

- We evaluate 27 asthmatic children: 10 with well-controlled asthma (GroupA), 17 during asthma exacerbation (GroupB)
- The median age was $7,9 \pm 3,36$; 6 patients were preschool children ($3,33 \pm 0,52$)
- All patients underwent SLP evaluation
- Preschool children were not able to perform a spirometry

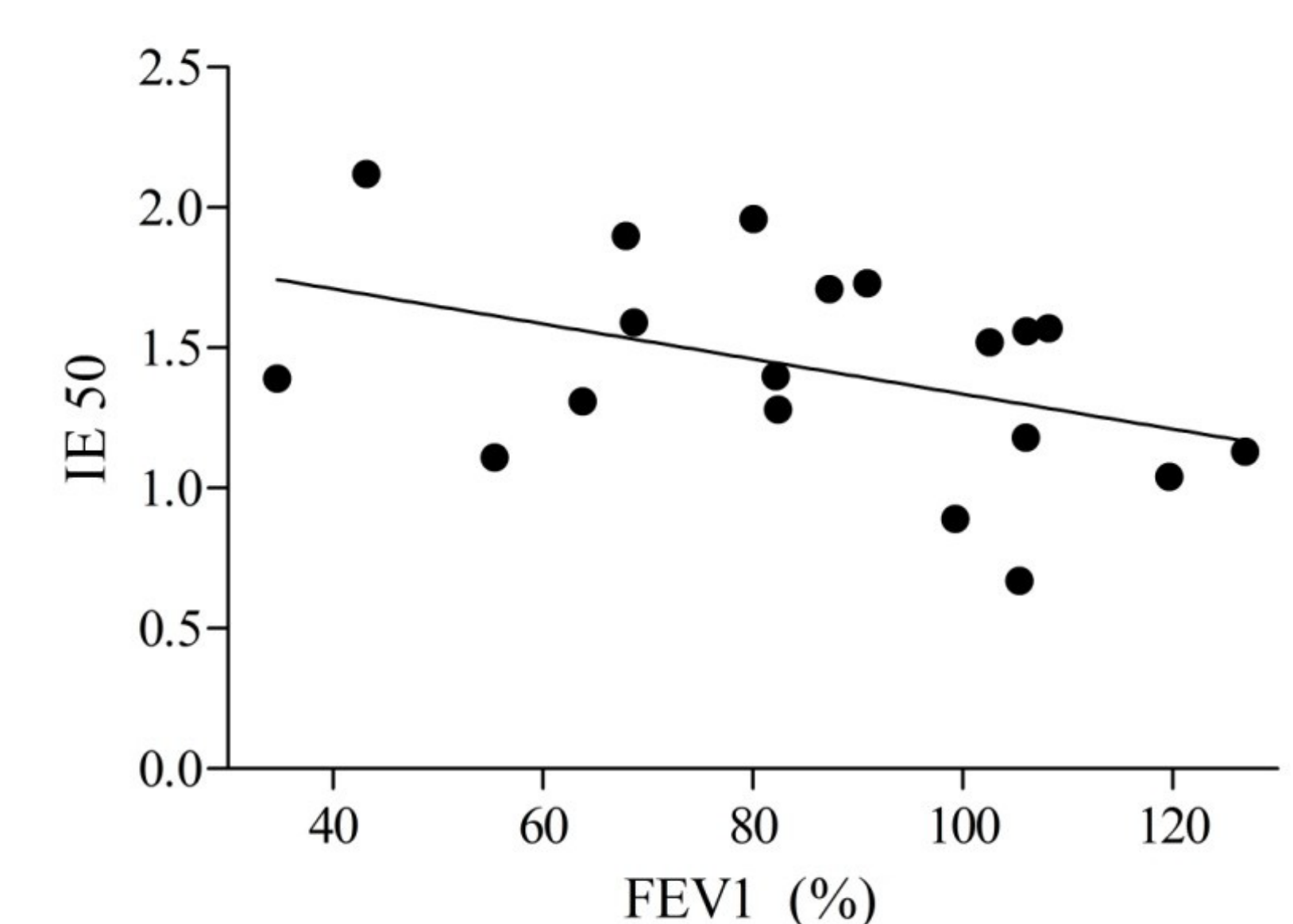
- GroupA showed greater value of FEV1 [median(LQ-UQ)% pred] [106.1(103.3-116.8) vs 69.7(57.50-82.35), $p=0.0002$] at spirometry;



- Similarly SLP evaluations shown IE50 lower in GroupA [1.16(0.99-1.54) vs 1.40(1.25-1.72), $p=0.026$]



- The linear regression between FEV1 and IE50 was not significant; maybe due to small study population ($r = -0,42$; $p = 0,072$)



CONCLUSIONS

- IE50 showed expiratory flow limitation in children during asthma exacerbation and a difference with well-controlled asthma children;
- This data are coherent with spirometric data collected;
- SLP is non-invasive and doesn't need collaboration so it could represent a way to study the degree of obstruction in pre-school asthmatic children.