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PEDIATRIC ALLERGY AND IMMUNOLOGY

Letter to the Editor

Exhaled Breath Temperature: a key feature to discriminate asthmatic children

Editor,

The skilful research team supervised by Prof. Popov reports their interesting integrated measurement systems (PAI-08-L-0222) able to accumulate the thermal energy released during the accumulation of multiple exhalations and conveying each single breath over a thermal block into a thermically isolated chamber. The system transduces the temperature of the thermal block by a high precision thermal sensor. A fitting procedure allows to model the acquired temperature values in relation to the initial temperature of the air in the thermal chamber. This work definitely confirms our findings about the information content of the plateau of exhalation in comparison to the rate of temperature increase. Such information is a key feature to discriminate asthmatic from non-asthmatic children.

The cumulative curve acquired from the measurement device proposed by Popov et al., even if quite different from our single breath signal method, can be fitted by the same exponential model we adopted (Fig. 1), demonstrating the effectiveness of our approach:

$$T(t) = T_{\mathrm{p}} + (T_0 - T_{\mathrm{p}}) * \exp(-t/\mathrm{tau}).$$

We really appreciate this novel approach and we definitely agree that the fluid-dynamics and sensory integration in cheap and reliable thermal system have the highest potential impact. Measurements with an optimum stability and repeatability, as well as high amplitude signals and fast sensor responses, can hardly be handled if the sampling device is not designed to control and optimize all factors capable of influencing sensor responses. Often, little attention is paid to the project and realization of fluidic systems which also play an important role in the sampling process.

On the basis of our conclusions, from a technical point of view, the lack of established sampling and measurement procedures for exhaled breath temperature analysis can play a key role to increase the discrimination capabilities. It is challenging to develop a device capable of discriminating between different asthma levels.

The simplicity and the elegance of the breath temperature methodology are fascinating thanks

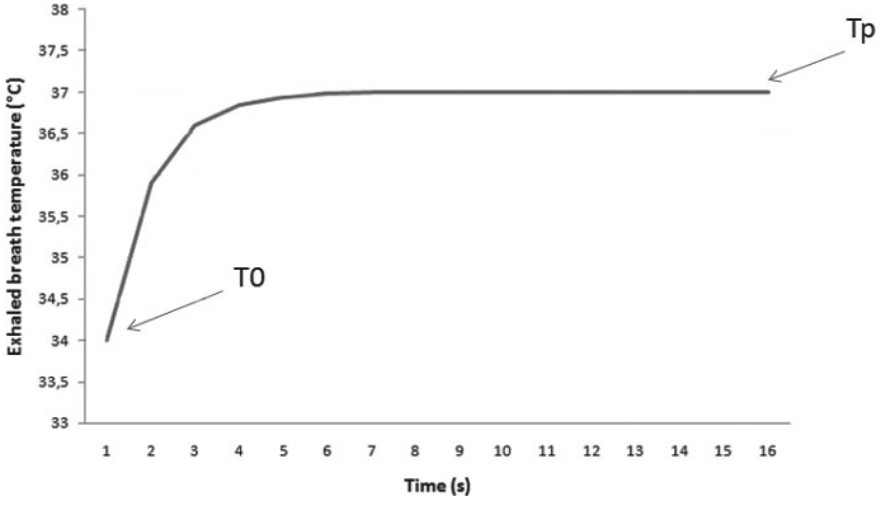

Fig. 1. Exponential fitting of the exhaled breath temperature $T(t)$.

because of its non-invasive approach to patients, as well as real time results. Anyway, in our opinion, there is an insufficient understanding of the underlying phenomena, as well as the lack of a reliable sampling procedure that could hinder a finer discrimination among patients. Considering that Popov et al. reinforced our findings by using a different sampling techniques, we can argue that both the single breath dynamic sampling and cumulative sampling within a canister are effective methods. The former involves the measurement of temperature during a single breath, the latter entails collecting series of total breaths revealing the increase of temperature within the chamber containing the breaths collected from patients. The collection of multiple breaths should allow samples to be obtained that are more representative of a subject's condition. Nevertheless, the single breath dynamic sampling can be repeated over several breaths extracting means and trends. At the present time, neither system can guarantee better results and, therefore, further extended development and validation are warranted to develop a standardized sampling protocol, to enhance the resolution of the system and to allow the development of portable diagnostic devices.

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