

# Long-term average spectrum loudness variation in speakers with asthma, asthma and paradoxical vocal fold motion (PVFM) and speakers without breathing problems

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## INTRODUCTION

### Paradoxical vocal fold motion (PVFM) and asthma

- Diseases with similar symptomatology
- PVFM: the diagnosis depends on the visualization of the vocal folds adducted during a shortness of breath or cough attack

### Voice quality and PVFM

- The larynx is related to respiratory, phonatory and swallowing functions. Our hypothesis is that the paradoxical vocal fold dysfunction could also interfere in voice production.

### Long Term Average Spectrum (LTAS)

- Spectrum that represents the intensity in different frequencies ranges
- LTAS correlates to various dimensions of voice quality, representing long-term events related to voice quality (what is recurrent in voice production)
- This acoustic analysis can be influenced by: speakers loudness variation, microphone distance from the mouth, and the soundboard configuration

## PURPOSE

The purpose of this study was to compare the Long Term Average Spectrum (LTAS) intensity measures with and without intensity averaging procedures in three different groups: speakers with asthma, speakers with PVFM and asthma, and speakers without breathing problems

## METHODS

### Subjects:

- 18 women:
  - 6 PVFM
  - 6 PVFM + asthma
  - 6 control (without breathing and voice problems)

### Speech samples:

- 3 repetitions of the "Our Lord" prayer.

### Speech recording procedure:

- 1 - speech signal monitoring
- 2 - soundboard configuration
- 3 - speech recording

### Acoustic analysis:

- LTAS analysis

### Standard averaging intensity procedure

- Proportion mathematical formula

### Statistic analysis:

- Cluster analysis according to a six cluster's division

## RESULTS

### Comparison between standard and non-standard intensity measures

The application of a six cluster's division indicated similar but no identical results between standard and non-standard intensity measures (Charts 1 and 2).

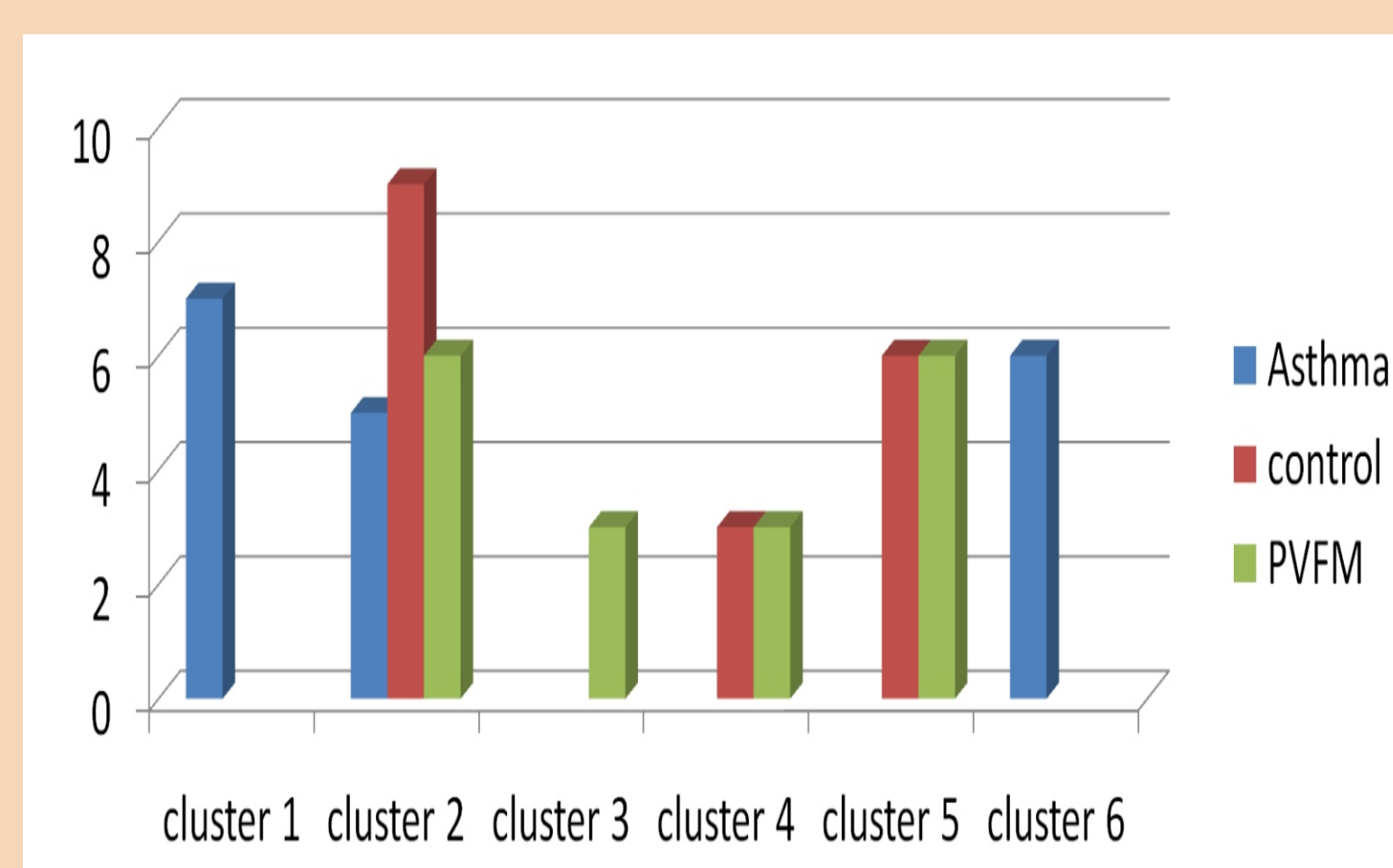


Chart 1 - Cluster analysis of the LTAS intensities measures without standard intensities procedures

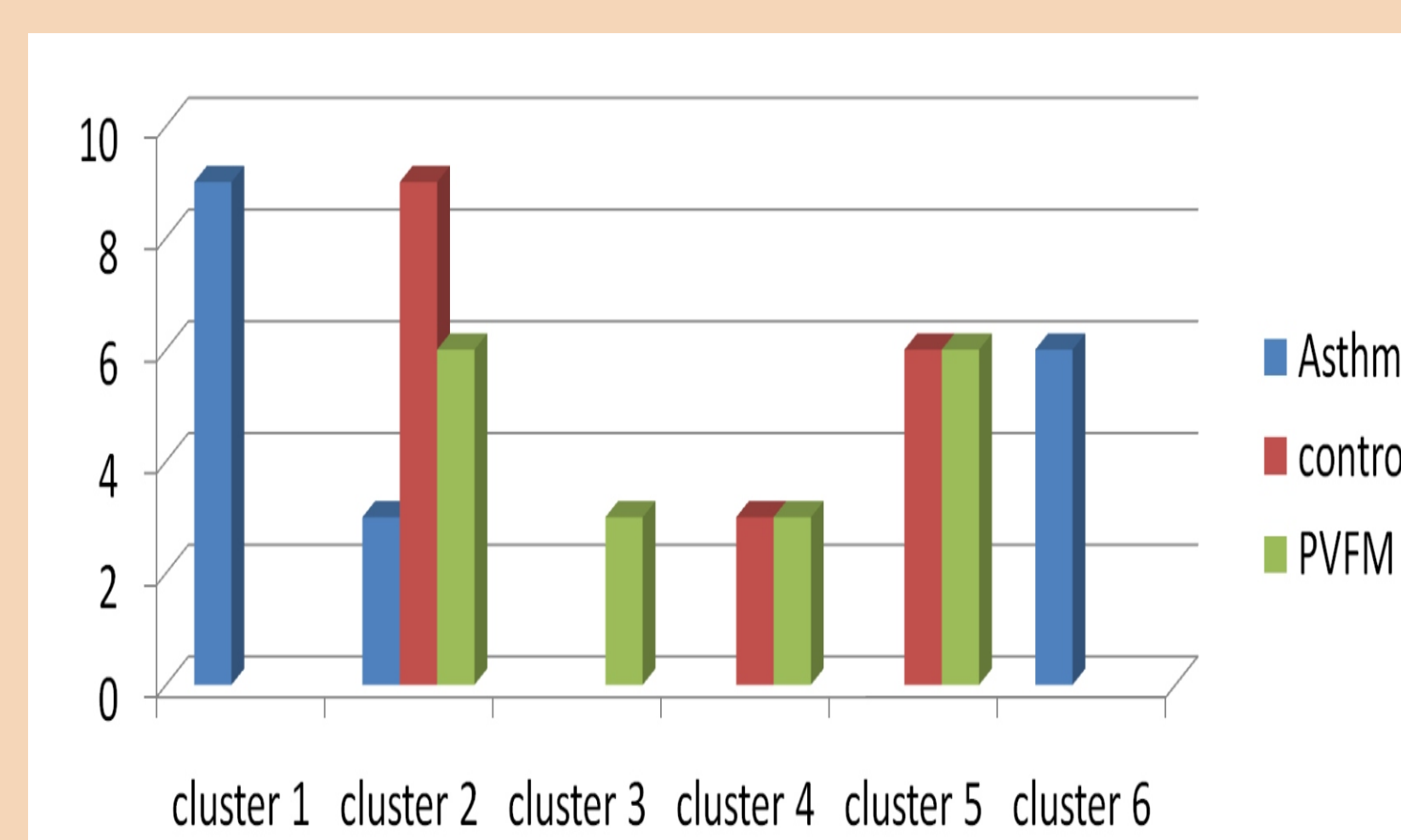


Chart 2 - Cluster analysis of the LTAS intensities measures with standard intensities procedures

### Comparison among PVFM, asthma and control individuals according to standard intensity measures

The analysis of the LTAS among the three groups indicated a tendency of differentiating asthma and the other groups according to cluster's analysis.

The similarity of the clusters that represents the majority of asthma subjects is the lower intensity spectrum slope between 0 and 1 kHz. However, there is a higher intensity between 2 kHz and 5 kHz frequencies, differentiating the first and sixth clusters (Figures 1 and 2).

The patients with PVFM and speakers without breathing problems were distributed in clusters 2 to 5. The spectral slopes of the second and the fifth clusters are represented in figures 3 and 4. The spectral slopes of the third and the fourth clusters were similar to the second and fifth clusters.

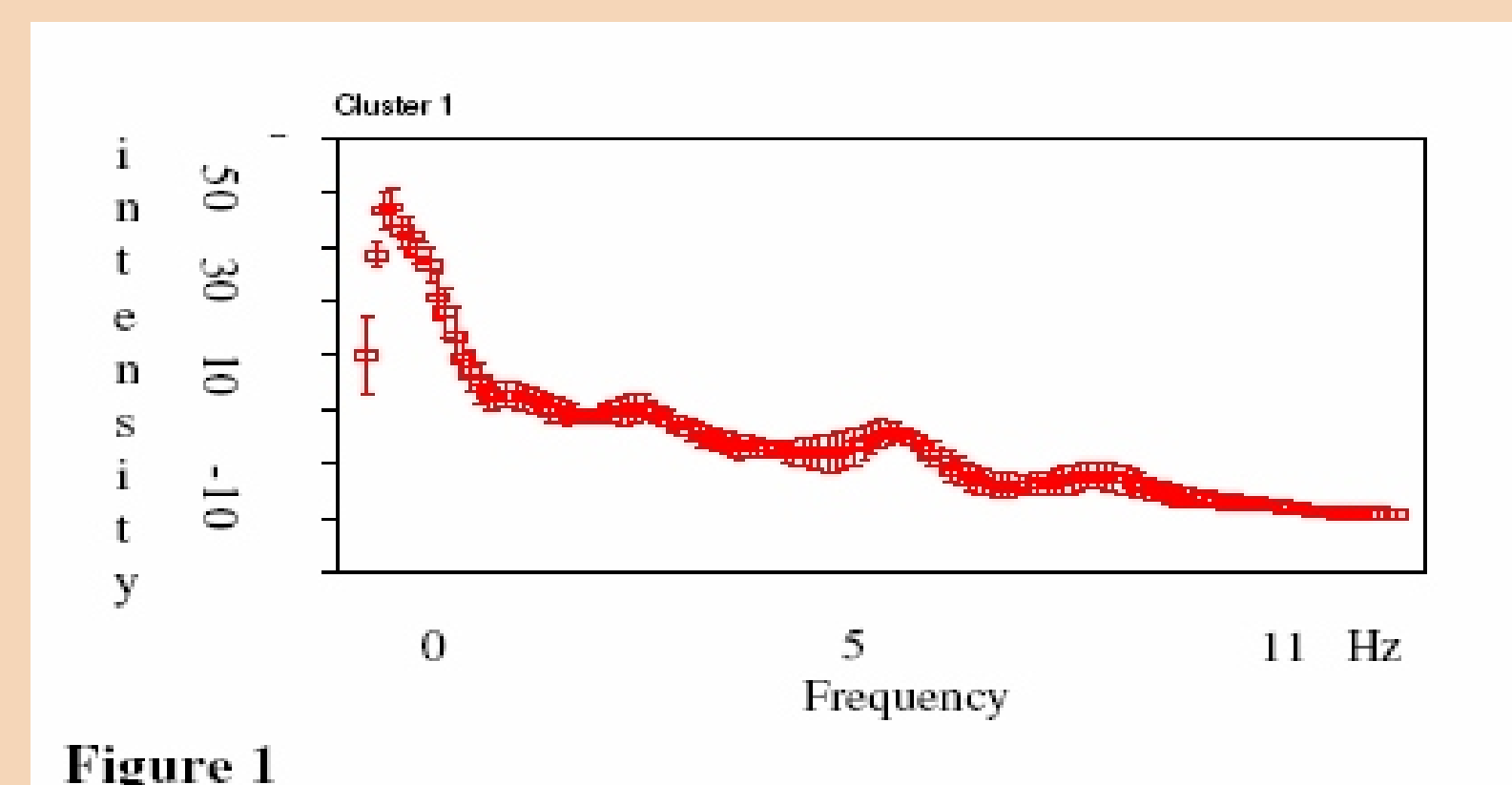


Figure 1

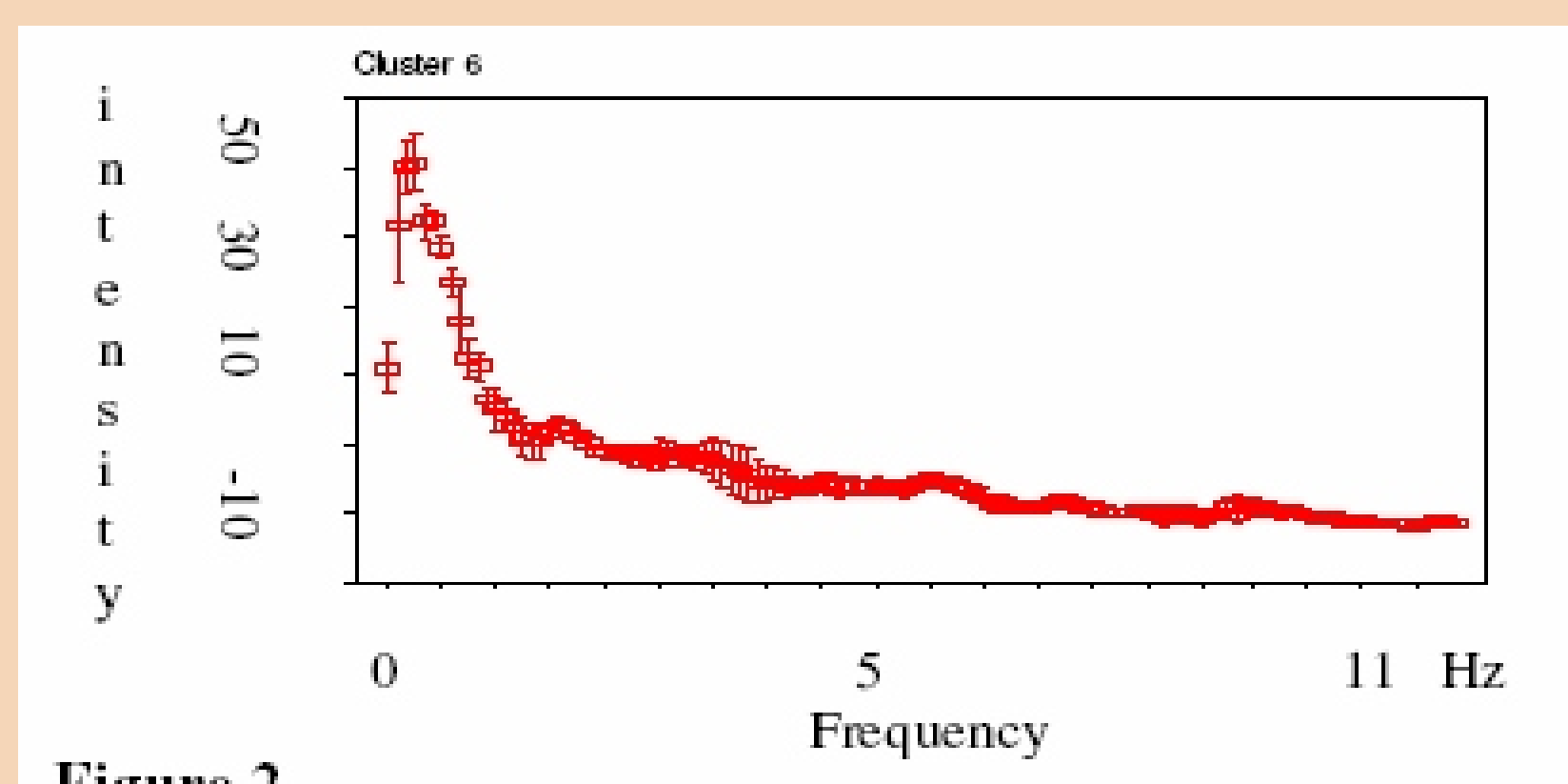


Figure 2

Figures 1 and 2 - First and sixth clusters: mean spectral slopes over the frequency range from 0 to 11 kHz in speech samples obtained by the application of intensity averaging procedures.

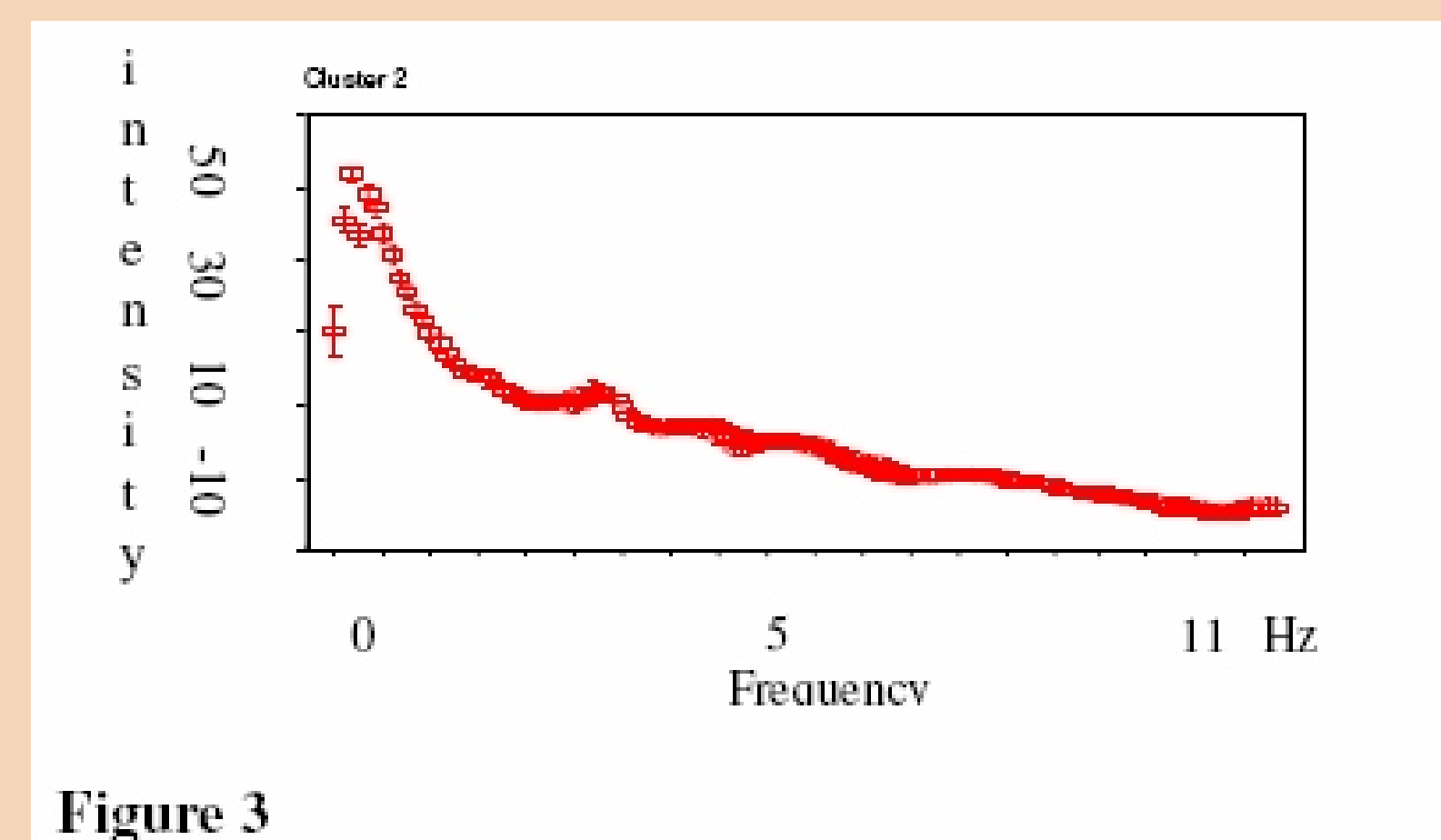


Figure 3

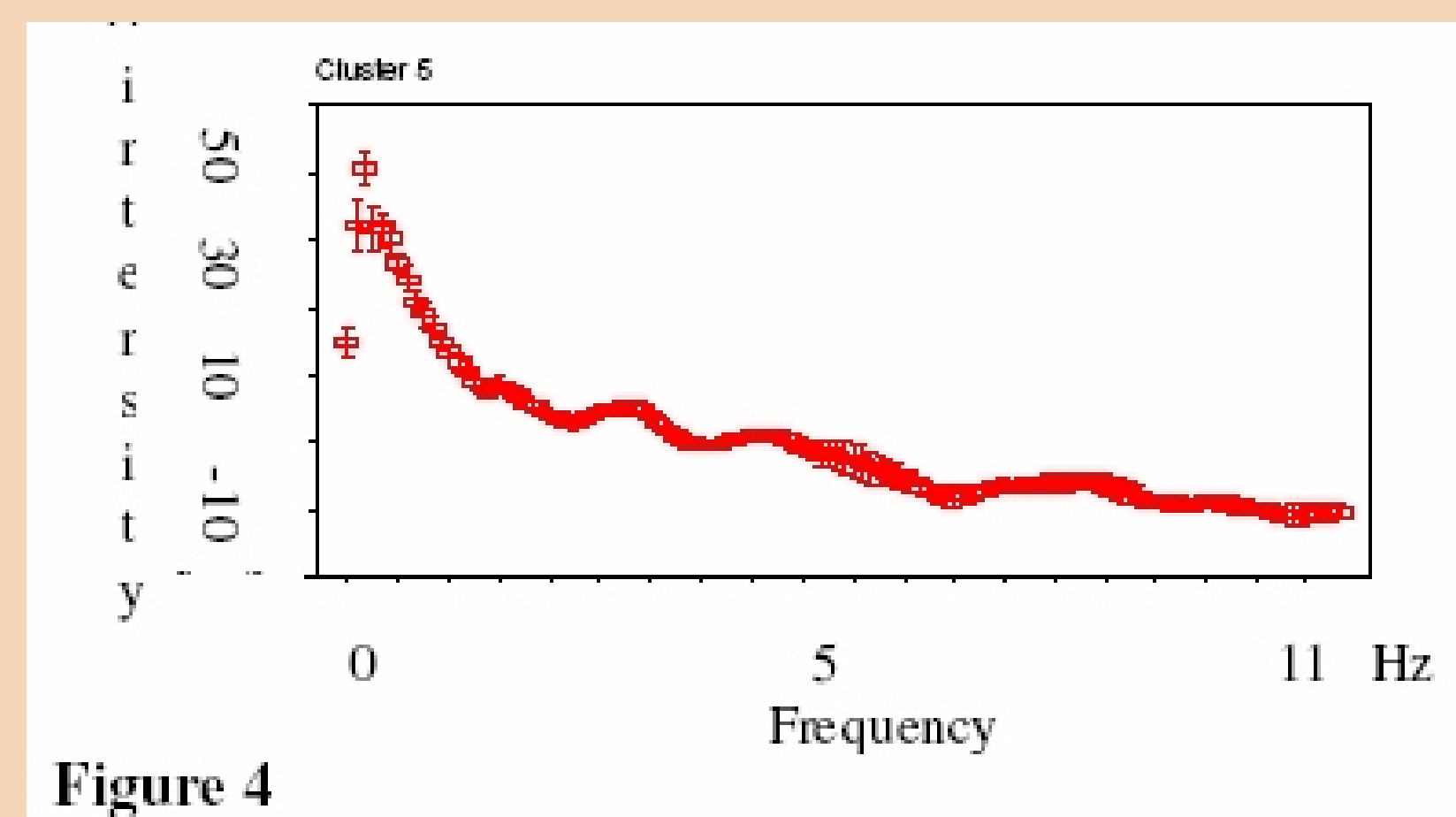


Figure 4

Figures 3 and 4 - Second and fifth clusters: mean spectral slopes over the frequency range from 0 to 11 kHz in speech samples obtained by the application of intensity averaging procedures.

## DISCUSSION AND CONCLUSIONS

Comparison between LTAS intensities measures with and without standard intensities procedures indicated differences in two speech samples. It indicates that loudness variation has an impact in LTAS acoustics analysis.

There was a tendency to separate asthma and PVFM groups according to LTAS analysis. This result indicates that there are specific physiological aspects in those groups related to voice quality.

Voice quality analysis could delineate a physiological mechanism that underlines the dyspnea attacks. LTAS analysis and voice analysis can be a procedure to compose the diagnosis of PVFM.

Further analysis could refine the "delimitations" or physiological aspects of each disease. Aspects related to voice quality such as lung volume and vocal tension should be considered.