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CORRELATION BETWEEN BOWEL SOUNDS VERSUS CLINICAL AND ENDOSCOPIC DATA : AI-POWERED ANALYSIS

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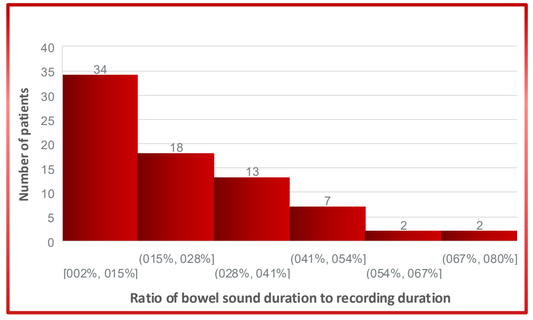
Bowel sound analysis holds promise as a non-invasive, cost-effective alternative to conventional diagnostic methods. However, standardized recording and interpretation methods are lacking. Our study aims to address this gap by investigating the correlations between bowel sounds and clinical/endoscopic data in patients.

We conducted a single-center, observational, cross-sectional study at the Mongi Slim Hospital's Gastroenterology Department. The study included patients scheduled for colonoscopy who had followed a residue-free diet for at least three days and ingested a bowel prep the day before the examination. We collected the patients' medical and surgical history, their digestive complaints, and performed a bariatric assessment. Bowel sounds were then recorded for 5 minutes using a modified version of the *Littman® CORE Digital stethoscope* and were then analyzed using AI programs to extract acoustic features. Afterwards, these features were compared with clinical and endoscopic data to establish correlations.

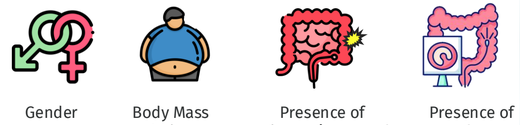
We included 95 patients in our study (mean age = 56.32 years, sex ratio M/F = 1.02). Colonoscopy was performed in 83 patients (87.37%) and was total in 62 patients (74.70%). At least one endoscopic anomaly was present in 47 patients (54.63%). The most common finding was polyps in 27 patients, representing 57.45% of patients with an endoscopic anomaly. We labeled 33,837 bowel sounds from the 95 recordings of the included patients, with an average of 356.18 bowel sound labels per recording. The mean ratio of bowel sound duration to recording duration was 22.75%, corresponding to 68 seconds of bowel sounds out of the 5 minutes recorded.



In the analytical study, we found that gender was correlated with the RMS* and Envelope** features, with p-values of 0.021 and 0.032, respectively, suggesting that men tend to have an increased overall amplitude of the signal, while women exhibit a greater variability of amplitude over time. Difficulty passing gas was also correlated with RMS and Envelope with p-values of 0.039 and 0.032, respectively, implying that patients having trouble passing gas produce sounds with lower average amplitude and increased variability over the course of the signal. Difficulty passing gas was also correlated with Spectral Contrast with a p-value of 0.036. This means that in these patients, the spectral energy is evenly distributed across frequencies and there are no major frequency variations over the course of the signal. The presence of an endoscopic anomaly was also correlated with RMS and Envelope with p-values of 0.027 and 0.024, respectively, suggesting that in the presence of an endoscopic anomaly, the average amplitude of the signal would be lower, and the amplitude of the sounds would be more variable over the course of the signal.

*Root Mean Square (RMS) : Estimation of the average amplitude of the signal
**Enveloppe : Estimation of the amplitude variability of the signal

RMS & Envelope correlated with



We also found that the presence of polyp(s) was correlated with RMS and Envelope with p-values of 0.041 and 0.042, respectively, indicating that in the presence of polyp(s), the average signal amplitude is lower, and the amplitude of the sounds is more variable over the course of the signal.

Although conducted under experimental conditions, since we used a controlled diet and bowel prep, this study demonstrated promising correlation between bowel sounds and both clinical data and endoscopic findings in patients, particularly the amplitude of bowel sounds and its variations over time. Further studies are needed to verify these correlations under more real-life conditions.

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