



# Readings of complex electrical bio-impedance spectroscopy on the human rectum

Carlos Augusto González Correa  
Brenda Lucia Arturo Áreas  
Victoria Eugenia Aguirre Cardona

University of Caldas  
Manizales/Caldas



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DO ESTADO DE  
SANTA CATARINA

# Introduction

# Materials and methods

# Results

# Discussion

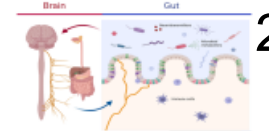
# Conclusions

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### Introduction


Brain Gut



Communication pathways of the gut-brain axis

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### Materials and methods



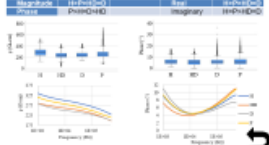
A novel like tetrapole measurement probe

- The equipment used in the conduct of the BioSpectra, in order to qualify the measurement of all five capacitance components (R<sub>1</sub>, R<sub>2</sub>, Z and H<sub>1</sub>).
- The device was calibrated using various resistors with a tolerance of 1%. For the study, a current of 180  $\mu$ A was applied across 300 frequencies, spaced logarithmically within the range of 1 to 100 kHz.
- The probe was calibrated, and impedance data were correlated to resistivity based on measurements of laboratory calibration using a Franklin LF 11 conductivity probe, following the method described by Saitani et al. (2004).

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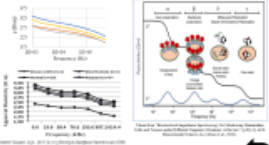
### Results

Results of statistical comparison analysis of disease groups (E: Healthy; H: Rheumatoid; D: Diabetes; P: Polyp)



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### Discussion



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### Conclusions

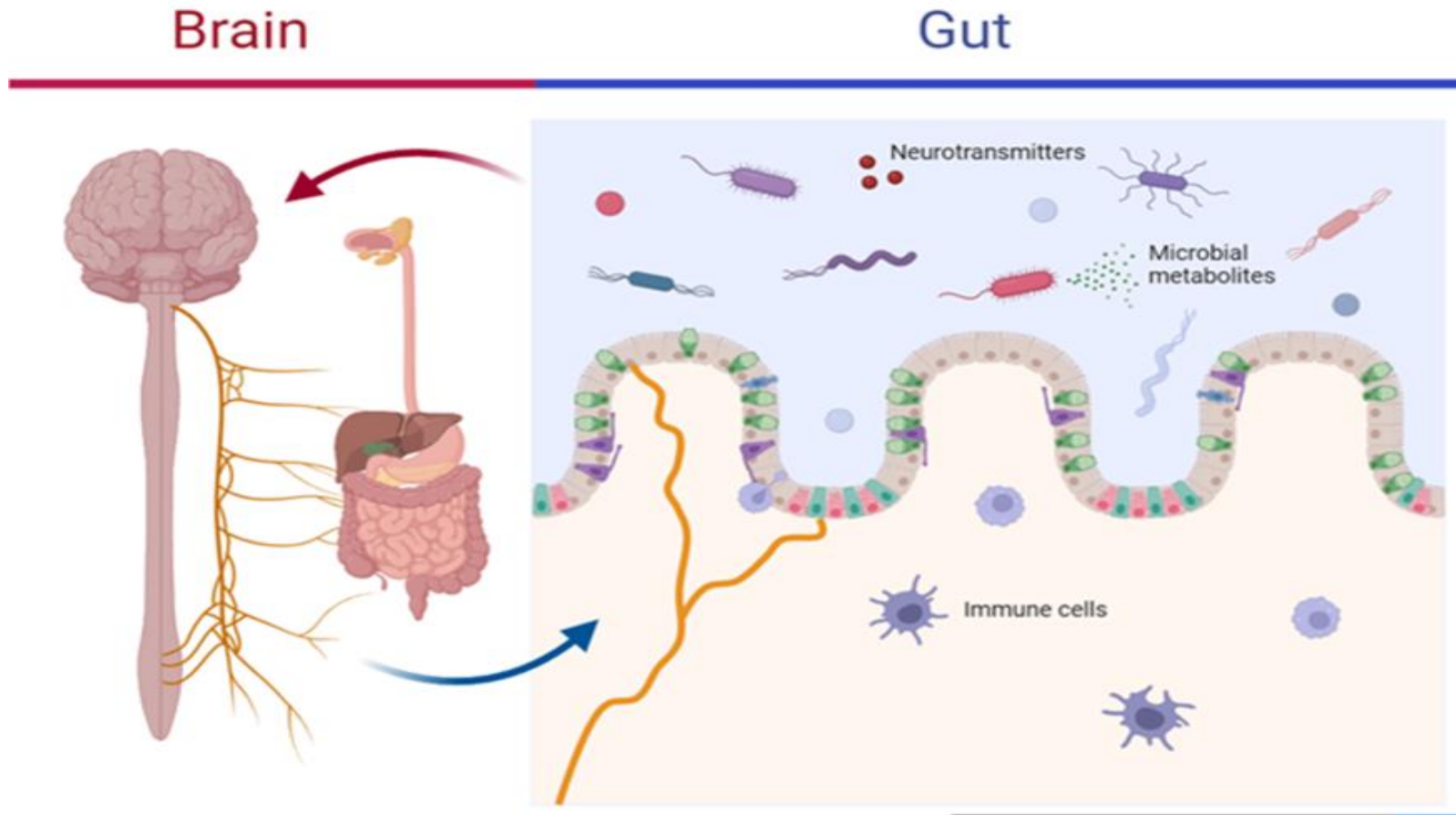
- Based on the data obtained on this, the impedance of abdominal tissue appears to exhibit non-linearities, and its magnitude decreases in the presence of disease.
- Despite the limitations of this study, including the small number of patients, the results suggest that it may be possible to detect occlusive disease by means of EIS in the intestine, even in apparently normal tissue, under the concept of the capacitance field effect.
- Future studies will require a larger sample size to increase statistical power. Additionally, tests such as REX, CT scan should be employed to assess the ability of this technique to solve the presence of IBC.

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### References

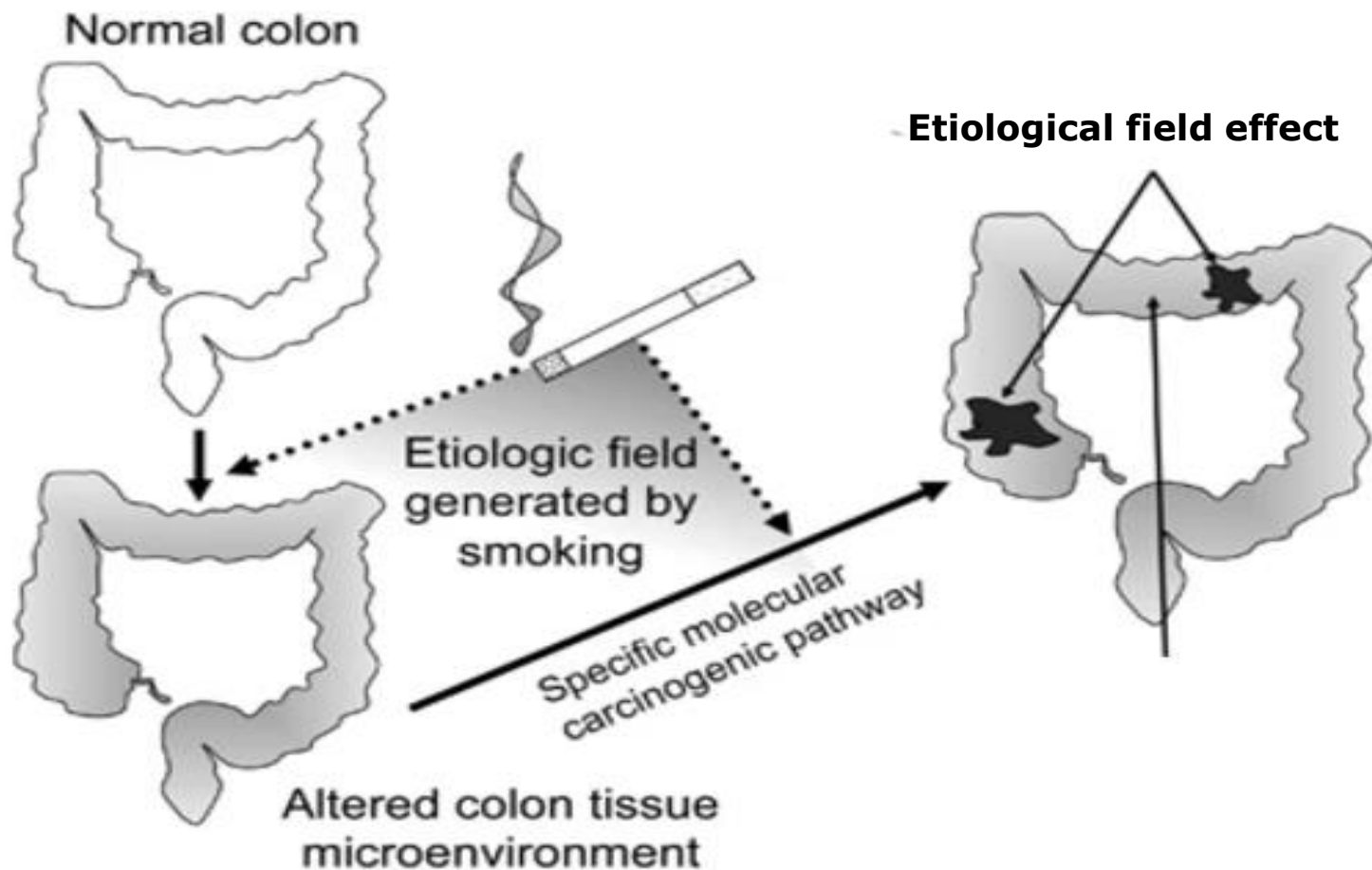
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# Introduction

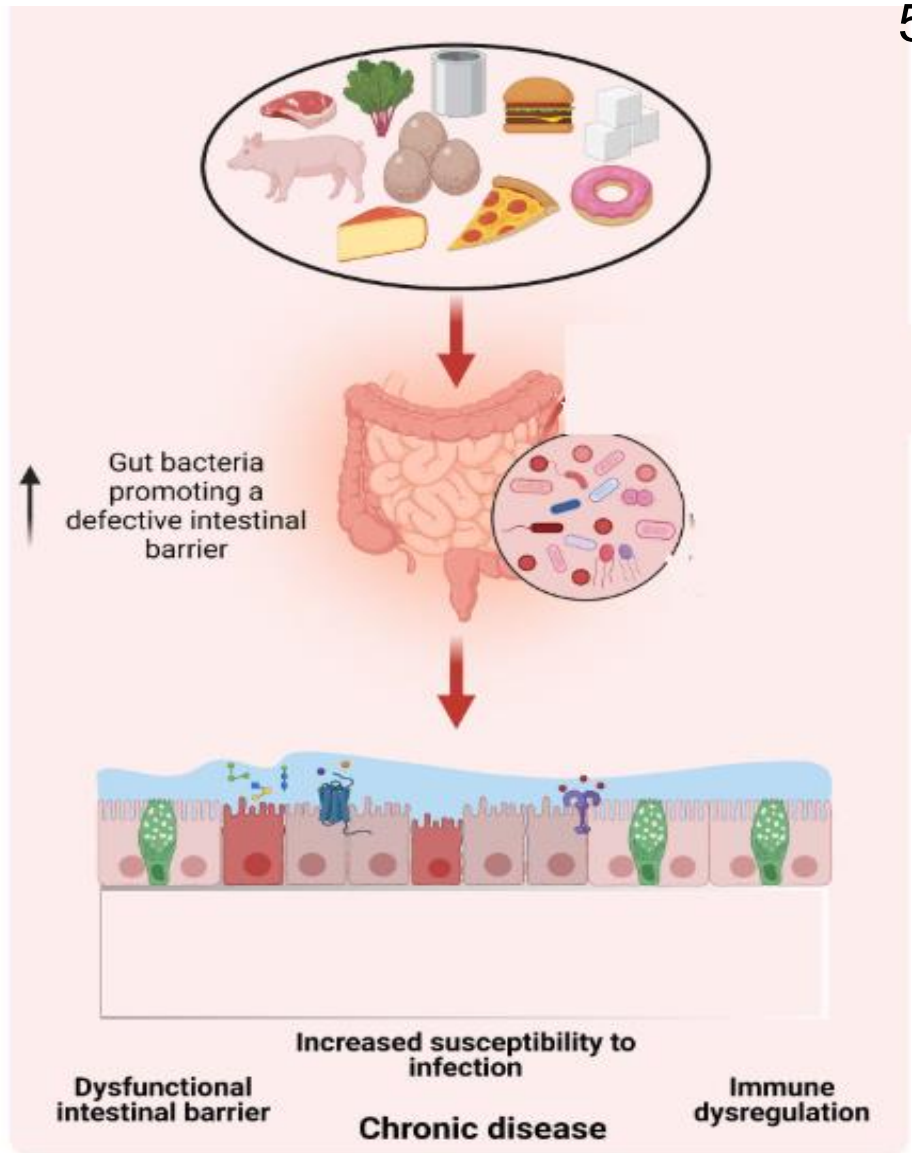
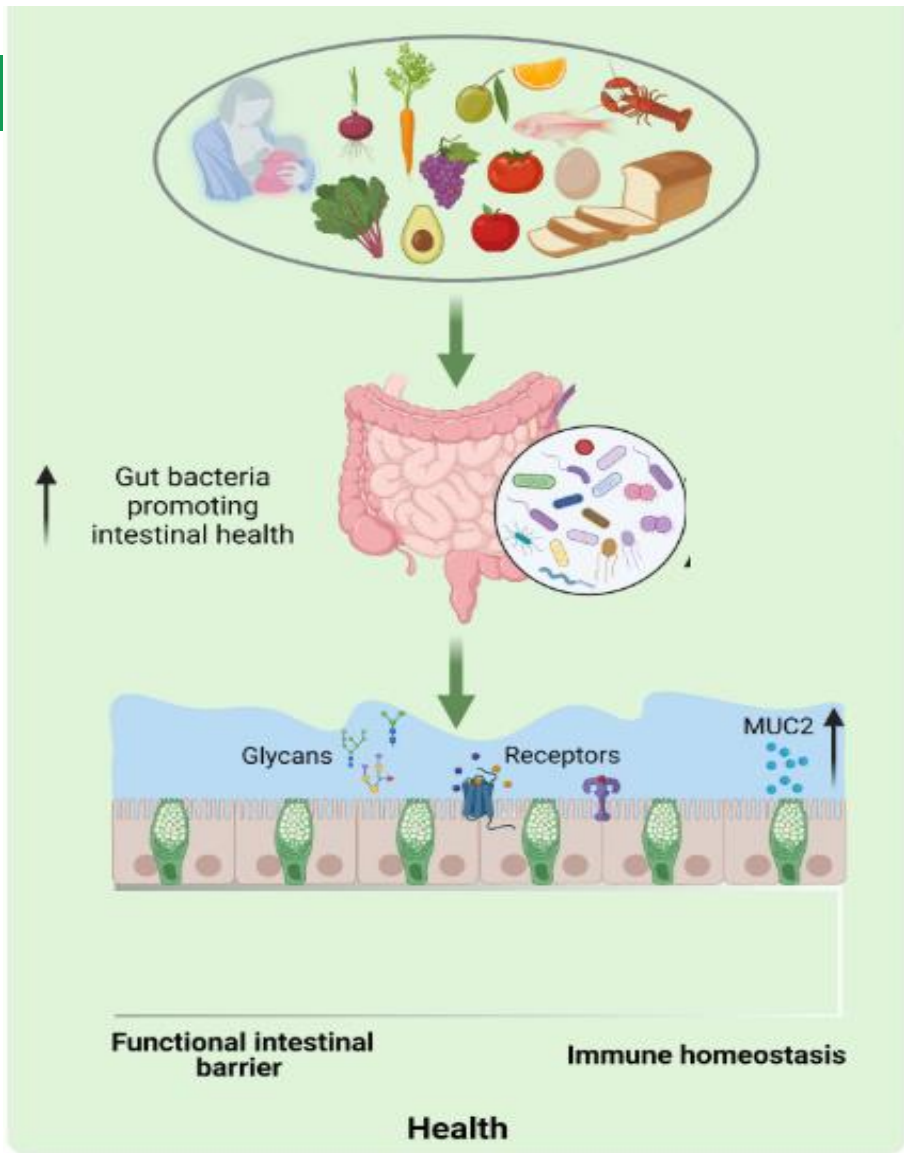


## Communication pathways of the gut-microbiota-brain axis

American Society for Microbiology. SThe Gut Microbiome and Drug Addiction: An Emerging Link: <https://asm.org/articles/2023/april/the-gut-microbiome-and-drug-addiction-an-emerging>

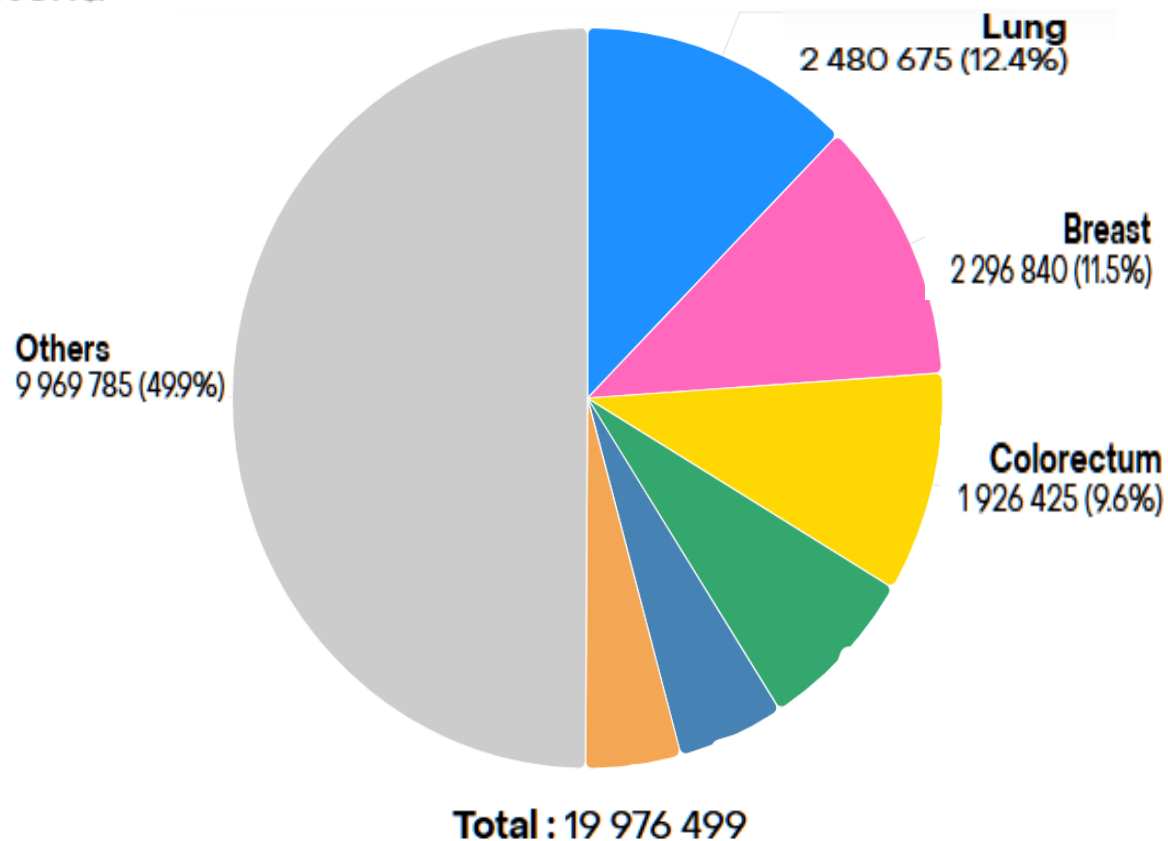


Lochhead P *et al.* Etiologic field effect: reappraisal of the field effect concept in cancer predisposition and progression. *Mod Pathol.* 2015 Jan;28(1):14-29. doi: 10.1038/modpathol.2014.81. Epub 2014 Jun 13. PMID: 24925058; PMCID: PMC4265316. <https://pubmed.ncbi.nlm.nih.gov/24925058/>



Diet, microbiota, and the mucus layer: The guardians of our health. Francesco Suriano<sup>1\*</sup>, Elisabeth E. L. Nyström<sup>2</sup>, Domenico Sergi<sup>3</sup> and Jenny K. Gustafsson<sup>4</sup>

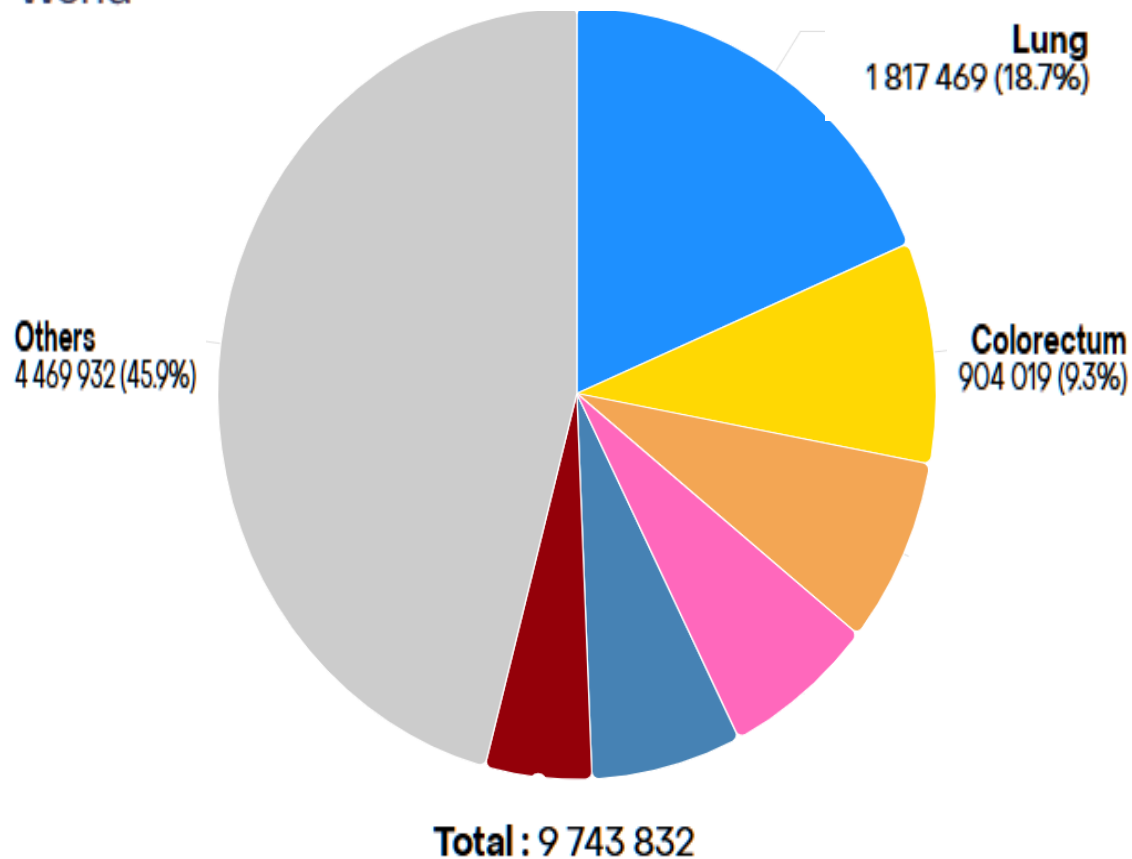
## Absolute numbers, Incidence, Both sexes, in 2022 World



**GLOBOCAN 2022.**

<https://gco.iarc.fr/today/data/factsheets/cancers/8-Colon-fact-sheet.pdf>

## Absolute numbers, Mortality, Both sexes, in 2022 World



**GLOBOCAN 2022.**

<https://gco.iarc.fr/today/data/factsheets/cancers/8-Colon-fact-sheet.pdf>

# Detecting colorectal cancer using electrical impedance spectroscopy: an ex vivo feasibility study

Angela Pathiraja<sup>1</sup>, Paul Ziprin, Arsam Shiraz, Reza Mirnezami, Andrew Tizzard, Brian Brown, Andreas Demosthenous, Richard Bayford

Affiliations + expand

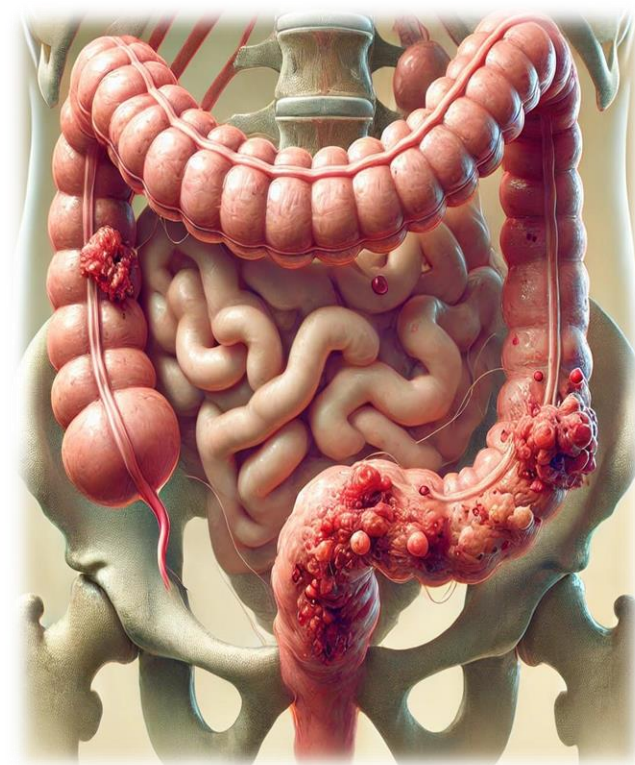
PMID: 28333038 DOI: [10.1088/1361-6579/aa68ce](https://doi.org/10.1088/1361-6579/aa68ce)

P-226

Rectal Bioelectrical impedance (REBI) as a possible screening tool for colorectal cancer (CRC)

[C. Gonzalez-Correa](#),<sup>1</sup> [D. Miranda-Mercado](#),<sup>2</sup> [E. Mulett-Vasquez](#),<sup>1</sup> [M. Osorio-Chica](#),<sup>1</sup> and [C. Dussan-Lubert](#)<sup>1</sup>

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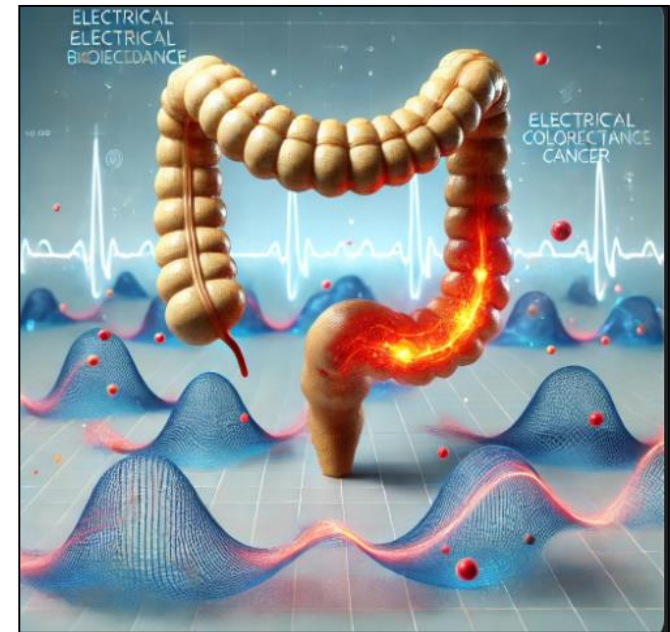
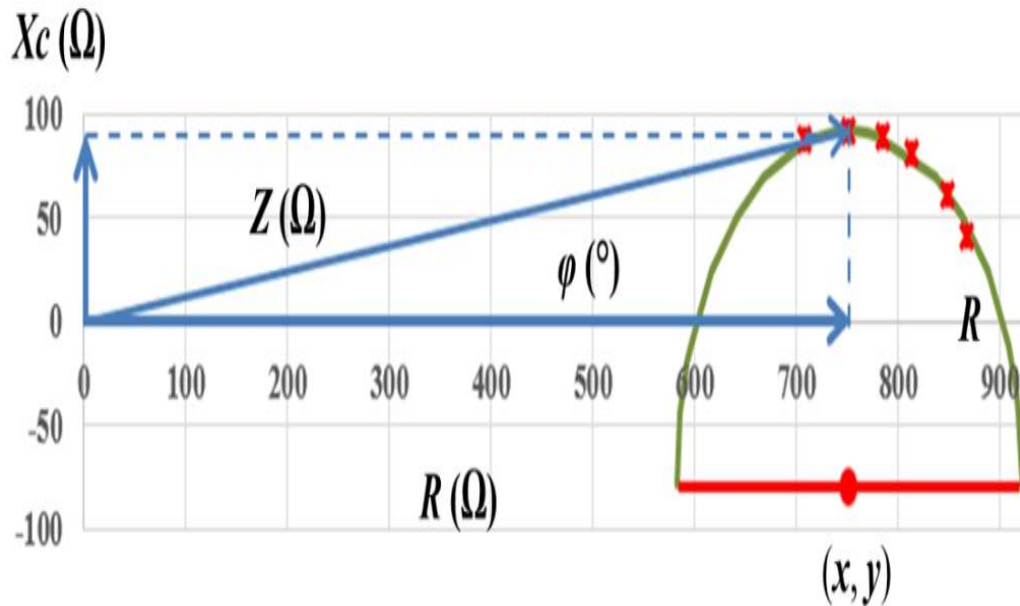
**II Latin American Conference on Bioimpedance** pp 68–71 | [Cite as](#)

## *In vivo* Electrical-Impedance Spectroscopy (EIS) Readings in the Human Rectum

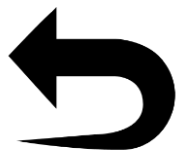
[Mulett-Vasquez Edelberto](#), [Gonzalez-Correa Carlos-Augusto](#), [Miranda-Mercado David-Alejandro](#), [Osorio-Chica Mauricio](#) & [Dussan-Lubert Carmen](#)



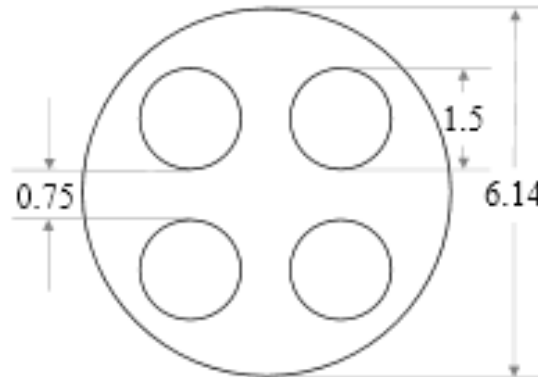
# Electrical bioimpedance



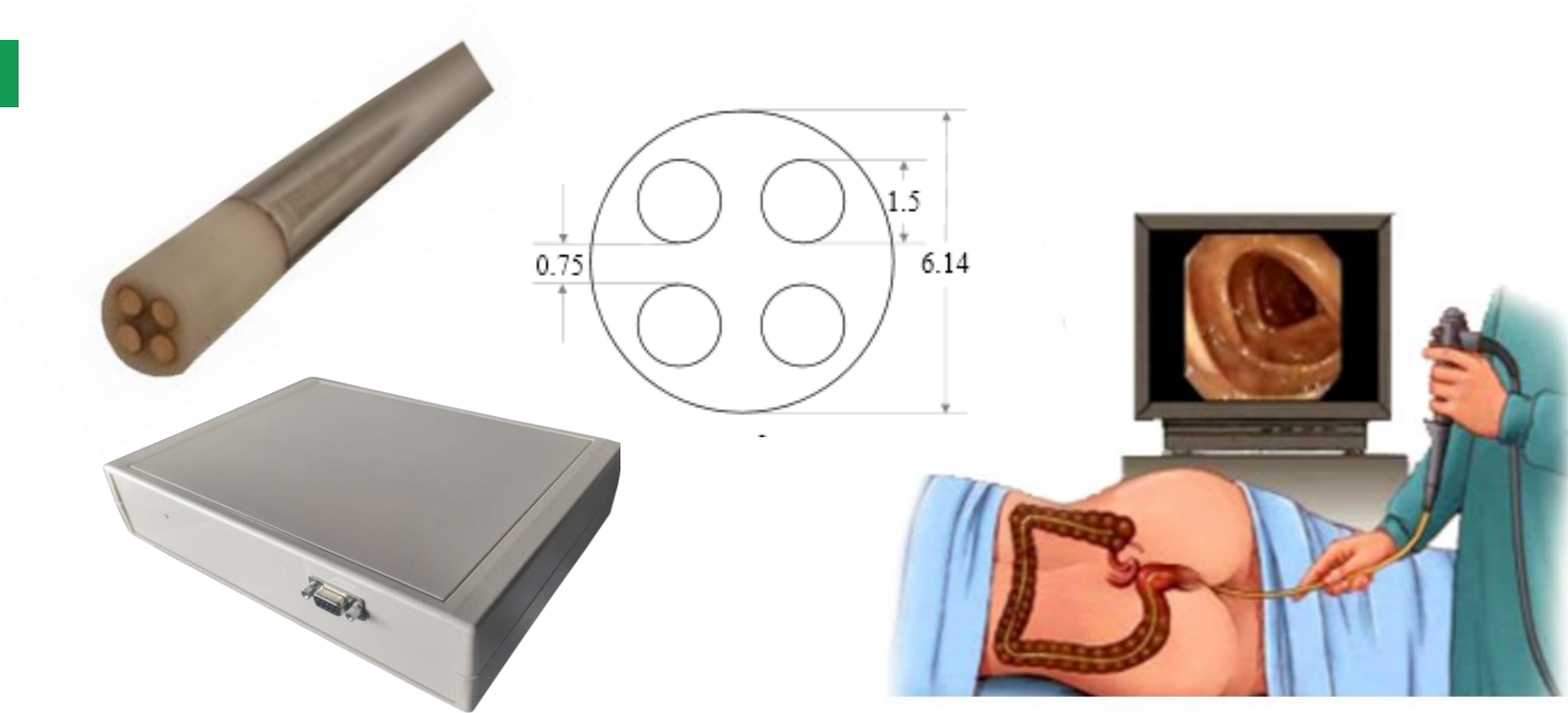
This paper presents the results of measuring all four components of EBIS: real, imaginary, magnitude, and phase, on *in vivo* human rectal tissue from 20 patients undergoing total colonoscopy. A statistical analysis was conducted to determine whether significant differences exist in the electrical behavior corresponding to each diagnosis made during colonoscopy.



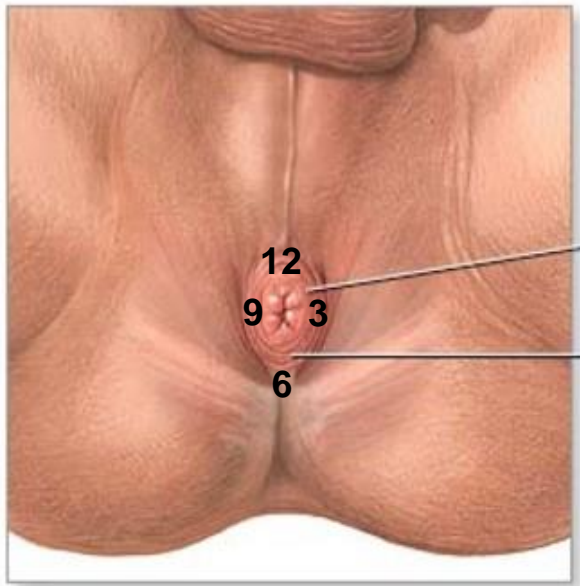
# Materials and methods



- A pencil like tetrapolar measurement probe
- The equipment used is an evolution of the BioZspectra, en-hanced to enable the measurement of all four impedance components ( $R$ ,  $X$ ,  $Z$  and  $\emptyset$ ).
- The device was calibrated using resistors with a tolerance of 0.1%. For the study, a current of  $100 \mu\text{A}$  was applied across 100 frequencies, spaced loga-rithmically within the range of 1 to 500 kHz.
- The probe was calibrated, and impedance data were converted to resistivity based on measurements of electrolytic solutions using a Handylab LF 12 conductivity meter, following the method de-scribed by Jaimes *et al* 2024.



- Four groups: 1) healthy patients, 2) hemorrhoids, 3) diverticula, and 4) polyps.
- The analysis was performed using SPSS v26 software.
  - To select the appropriate statistical test, the normality of the data and the homogeneity of variances between the groups were evaluated.



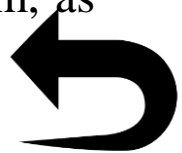
ADAM.



This project received approval from the Ethics Committee of the University of Caldas (Minutes No. 09, Communication ID CBCS-034, dated May 20, 2020).



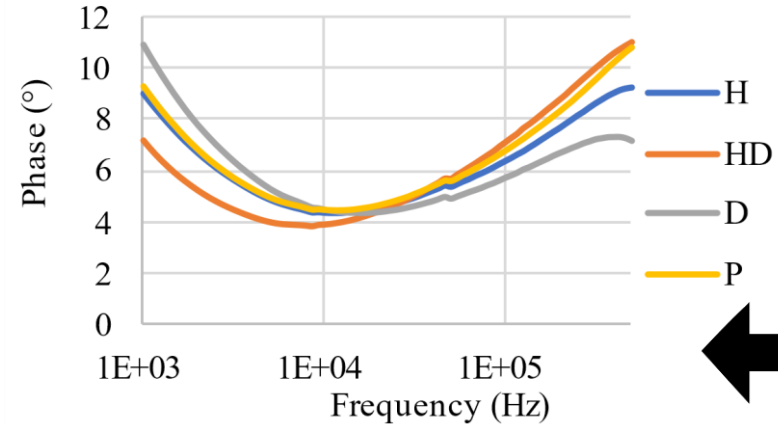
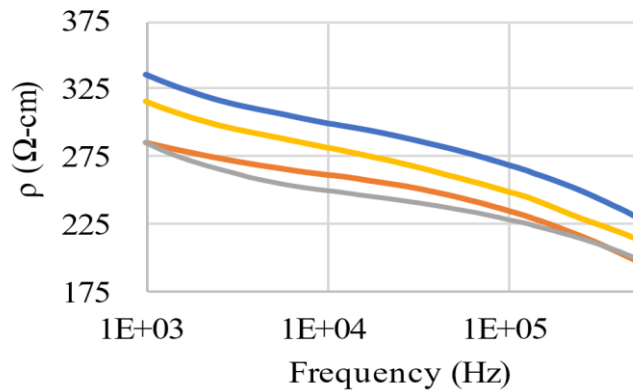
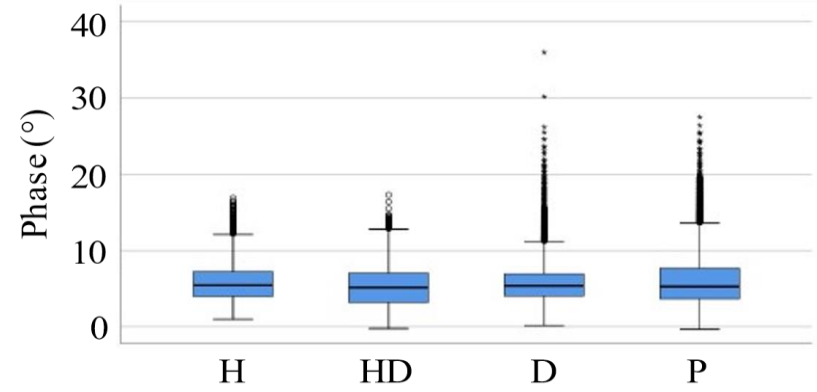
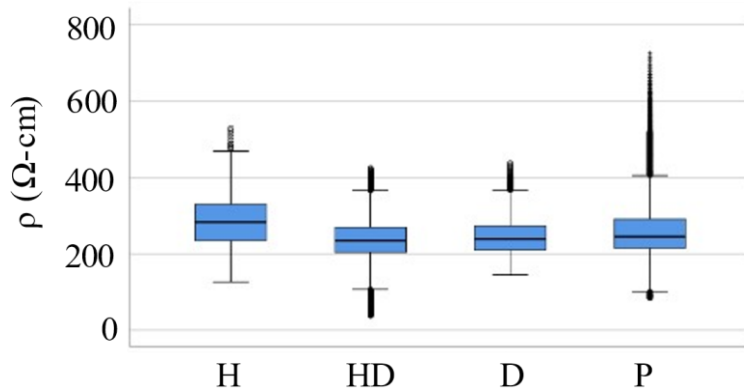
- It is also endorsed by the University Hospital SES of Caldas and Oncosalud IPS.
- Patients with a prior diagnosis of CRC and those who declined to participate or did not sign the informed consent form were excluded from the study.
- A total of 20 participants were analyzed, comprising 12 women and 8 men, aged between 29 and 86 years.
- The measurement procedure consists of inserting a probe in the lower rectum, placing the tip on the wall of the tissue in 4 quadrants, taking 3 readings in each of them, as done by Gonzalez-Correa et al. 2019.



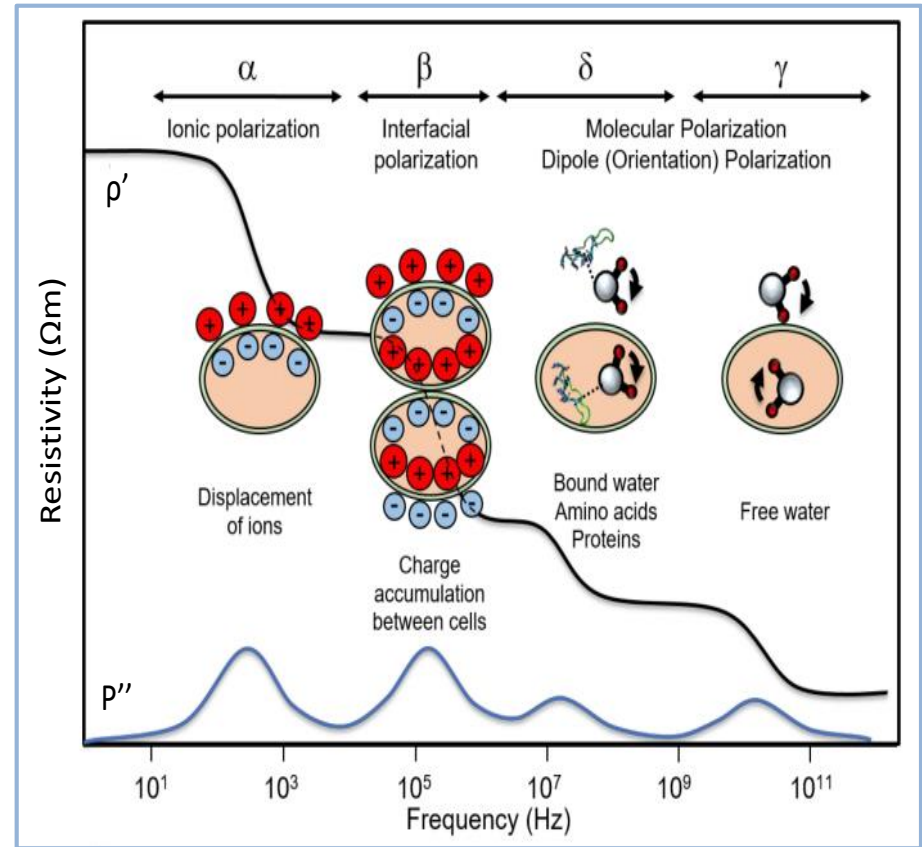
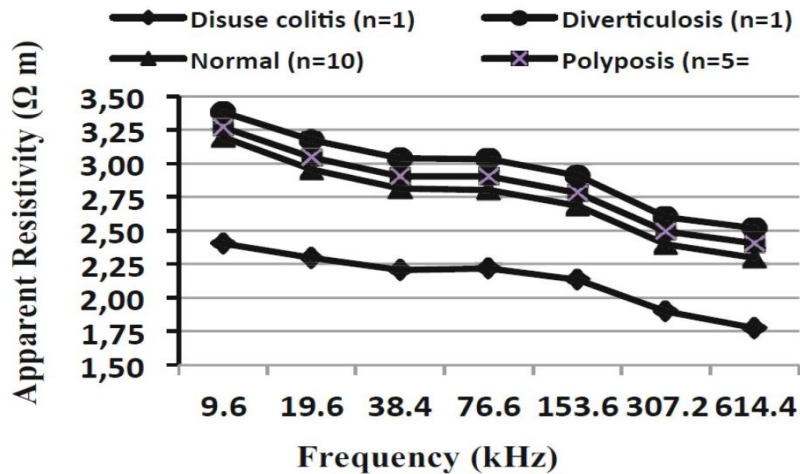
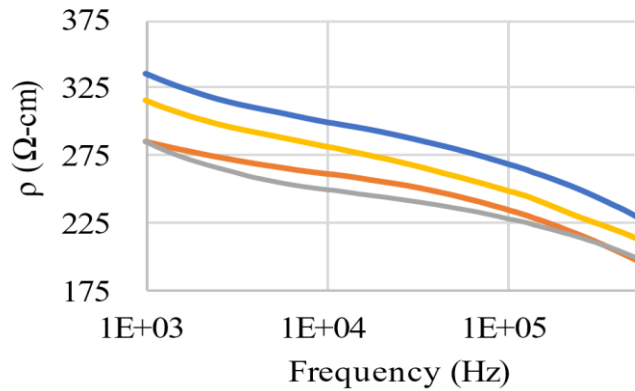
# Results

Results of statistical comparison analysis of disease groups (H: Healthy; HD: Hemorrhoids; D: Diverticula; P: Polyps)

Magnitude	H>P>HD=D	Real	H>P>HD=D
Phase	P>H=D>HD	Imaginary	H=P>HD=D



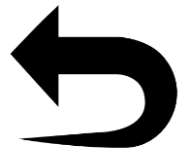
# Discussion



Taken from “Bioelectrical Impedance Spectroscopy for Monitoring Mammalian Cells and Tissues under Different Frequency Domains: A Review” (p.D), by ACS Measurement Science Au, (Abasi et al., 2022).

Mulett-Vásquez *et al.*, 2016. In vivo Electrical-Impedance Spectroscopy (EIS) Readings in the Human Rectum. Fuente:

[https://link.springer.com/chapter/10.1007/978-981-287-928-8\\_18](https://link.springer.com/chapter/10.1007/978-981-287-928-8_18)



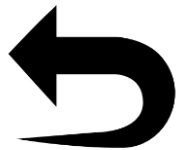
# Conclusions

1. Based on the data obtained so far, the impedance of colorectal tissue appears to exhibit two dispersions, and its magnitude decreases in the presence of disease.



2. Despite the limitations of this study, including the small number of patients, the results suggest that it may be possible to detect colon diseases by measuring EBIS in the rectum, even in apparently normal tissue, under the concept of the carcinogenic field effect.

3. Future studies will require a larger sample size to increase statistical power. Additionally, tests such as ROC curves should be explored to assess the ability of this technique to infer the presence of CRC.



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# 5<sup>TH</sup> CLABI

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FLORIANOPOLIS - BRAZIL - 2024

