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BIOIMPEDANCE SPECTROSCOPY – MODERN APPLICATIONS

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Bioimpedance spectroscopy (BIS) is a non-invasive method for measuring fluid volume in tissues. The tissue impedance response parameters change depending on the frequencies of the applied signal. Measuring these responses provides information about the composition, structure and health status of the tissue.

The aim of this work is to present modern applications of BIS and future trends. Solutions corresponding to the above topic published in years 2020-2022 were reviewed, and those the most innovative, introducing new solutions. In this work, the focus was on presenting the modern applications with the use of BIS in: breast cancer-related lymphedema (BCRL), classification of lung tissue in identifying pulmonary nodules, fluid volume assessment in heart failure patients and analytical model for blood glucose detection.

In PubMed database a phrase “bioimpedance spectroscopy AND applications AND reviews” obtained 12 publications. Narrowing the search area to years 2019-2022, 5 results left, therefore there is a strong need for creating new overviews of modern BIS uses. Earlier systematic reviews did not focus on the description of specific applications, but only indicated the fields of interest and technical aspects of performing measurements, which, although equally important, do not present the latest solutions in the described area. BIS is commonly used as a tool for the early detection of edema of a different kind. Currently work is being done on the use of the BIS method in the detection of BCRL. The concept of bioimpedance detecting swelling before it is visible, by volume change, is innovative and has the potential to enhance the early diagnosis of BCRL. Special attention should be also paid to research which conducting on the feasibility of designing a real-time, safe, and smart system to localize the invisible/impalpable pulmonary nodules by the bioimpedance spectrum of the lung tissue. There are also works, based on the mathematical relationship between blood glucose concentration and its electrical impedance, prove that BIS could be presented as a suitable method for developing noninvasive glucose measuring systems. These are just some of the applications that have affected on the motivation of taking up the topic.

A review of modern solutions and studies conducted with the use of bioimpedance spectroscopy allows to systematize the knowledge in this area and allows seeing the direction in which the field is developing and the research are carried out.