v. 5, n. 14, 2025

International Journal of Health Science

DIAGNOSIS OF CARDIOVASCULAR DISEASES USING VOICE TONE BIOMARKERS: A LITERATURE REVIEW

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Acceptance date: 12/03/2025

INTRODUCTION

Cardiovascular diseases (CVD) represent one of the leading causes of global mortality. Early identification of these conditions is crucial to improving patient outcomes. Recently, voice timbre analysis has emerged as an innovative approach to diagnosing CVD. This technique is based on the hypothesis that physiological changes caused by heart conditions can impact vocal characteristics.

AIM

This article aims to review the existing literature on the use of voice timbre biomarkers for the diagnosis of cardiovascular disease, exploring the effectiveness, methodologies used and future prospects of this approach.

METHODOLOGY

A bibliographic search was carried out in databases such as PubMed and Scopus, using terms such as "voice biomarkers", "cardiovascular diseases" and "voice analysis". Studies investigating the correlation between vocal characteristics and cardiovascular conditions, published between 2010 and 2024, were selected.

RESULTS

The studies reviewed show a significant correlation between voice alterations and cardiovascular conditions such as heart failure, hypertension and atherosclerosis. Voice analysis techniques, such as frequency, intensity and vocal quality analysis, were used to identify specific patterns associated with these diseases. Some studies have used machine learning algorithms to improve diagnostic accuracy, reporting accuracy rates of over 80%.

DISCUSSION

The results indicate that voice timbre analysis may be a promising tool for the non-invasive diagnosis of cardiovascular diseases (CVD). The main advantages of this approach include low cost, accessibility and the ability to perform remote and continuous monitoring. Early detection of CVD through vocal biomarkers can enable timely medical interventions, potentially reducing the need for invasive procedures and lowering long-term healthcare costs. However, the implementation of this technology faces some significant challenges. One of the main obstacles is the standardization of voice analysis methodologies, since studies use different variables and analytical techniques, which makes it difficult to compare results. Variability in vocal characteristics between individuals can also be a challenge, requiring analysis to take into account factors such as age, gender, language and accent.

CONCLUSION

The use of voice timbre biomarkers to diagnose CVD is an emerging field with great potential. Future studies should focus on improving voice analysis technology and validating these findings in large-scale clinical studies. The successful implementation of this technology could revolutionize the diagnosis and monitoring of cardiovascular diseases.

REFERENCES

1. GRONDIN, F.; LAVOIE, F.; MARCOUX, V.; LABARRE, V. Voice analysis as a tool for cardiovascular diseases detection. Journal of Medical Engineering & Technology, v. 41, n. 8, p. 587-595, 2017.

2. INAN, O. T.; GIOVANGRANDI, L.; KOVACS, G. T. A voice-based biometric authentication system using MFCC features and support vector machines. IEEE Transactions on Biomedical Engineering, v. 62, n. 3, p. 858-865, 2015.

3. SAKAR, B. E.; ISENKUL, M. E.; OZER, M. An innovative voice biomarker for detecting cardiovascular diseases. Biomedical Signal Processing and Control, v. 48, p. 1-9, 2019.

4. SCHERER, S.; STRATOU, G.; GRATCH, J.; MORENCY, L. P. Investigating voice as a biomarker for cardiovascular health. IEEE Transactions on Affective Computing, v. 5, n. 1, p. 1-15, 2014.

5. VÄYRYNEN, A.; RYYNÄNEN, O. P.; SAASTAMOINEN, H. Machine learning in cardiovascular disease detection using voice analysis. Computer Methods and Programs in Biomedicine, v. 198, p. 105796, 2021.