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Beyond Words: Acoustic Biomarkers of Depression Across Languages

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Objective: Depression is a global mental health concern, with diagnosis often relying on subjective assessments. Recent advances suggest that acoustic biomarkers, features such as pitch, tone, and rhythm, may provide objective indicators of depressive states. This scoping review aims to synthesise evidence on acoustic biomarkers of depression across languages, highlighting their association and the methodological trends. **Methods:** A scoping review was conducted following PRISMA-ScR guidelines, we searched PubMed, Scopus, ProQuest, and Google Scholar for studies published between 2015 and 2025. Eligible studies analysed acoustic features of speech in clinically diagnosed depressed individuals. Two reviewers independently screened and charted data on participant characteristics, speech parameters and their association with depression as well as the analytical approaches. Extracted information was thematically mapped to identify common biomarkers, and methodological heterogeneity. **Results:** Eighteen studies across eight languages (Hungarian, Portuguese, Italian, English, Dutch, Spanish, Japanese and Mandarin) met the inclusion criteria, with participants ranging in age from 17 to 79 years. Most studies compared individuals with clinically diagnosed depression to healthy controls. Speech samples were derived from both reading tasks and spontaneous speech, sourced either from existing corpora or collected within the study. Acoustic findings were categorised into four domains: vocal fold source features, vocal tract filter features, prosodic features, and language-related markers. Among these, prosodic features were the most extensively investigated, with fundamental frequency (F0), intensity, and speech rate consistently showing negative associations with depression severity. **Conclusions:** Acoustic biomarkers show promise as objective indicators of depression, particularly prosodic features such as pitch, intensity, and speech rate. However, variability in study designs, linguistic contexts, and analytical approaches limits cross-study comparability and generalisability. Future research should prioritise standardised methodologies, multilingual datasets, and culturally informed frameworks to enhance the diagnostic validity and clinical applicability of acoustic markers in diverse populations.

Keywords: Acoustic biomarkers; depression; scoping review; speech