

Artificial Intelligence-based Prediction of Balance in Postmenopausal Women: A Review of Existing Evidence

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ABSTRACT

Postmenopausal women commonly experience balance impairment due to age-related physiological changes, hormonal decline, reduced muscle strength, decreased bone density, and altered proprioception. These factors significantly increase the risk of falls, fractures, functional dependency, and reduced quality of life. In recent years, Artificial Intelligence (AI) has emerged as an advanced tool in healthcare for predicting balance deficits and identifying fall risk through data-driven approaches. Existing literature highlights the growing application of machine learning algorithms, wearable sensors, motion analysis systems, and computerised assessment tools in evaluating postural stability among postmenopausal women. The purpose of this review-based study is to analyse and summarise existing evidence regarding the role of AI in predicting balance impairment among postmenopausal women and to explore its potential clinical applications in early assessment and fall prevention. A narrative review of previously published literature was conducted using electronic databases, including PubMed, Scopus, Google Scholar, and Web of Science. Relevant review articles and research studies published in the last 10 years (Jan 2016), Artificial Intelligence-Based Prediction of Balance in Postmenopausal Women: A Review of Existing Evidence, focusing on AI-based balance assessment, fall

prediction, and postural control in postmenopausal women, were included. Studies involving machine learning models, wearable technologies, sensor-based assessments, and computerised gait analysis were critically analysed. Existing reviews suggest that AI-based systems demonstrate high accuracy in predicting balance deficits and fall risk in postmenopausal women. Machine learning techniques such as decision trees, support vector machines, neural networks, and deep learning models effectively analyse gait parameters, postural sway, muscle activity, and movement patterns. Wearable sensors and smart technologies further enhance real-time monitoring and early detection of balance impairments. AI-assisted assessment methods were found to be more efficient and sensitive compared to conventional clinical balance tests. AI-based prediction models show promising potential in improving balance assessment and fall risk identification in postmenopausal women. Integration of AI with rehabilitation and physiotherapy practices may support early intervention, personalised treatment planning, and better clinical outcomes. Further large-scale studies are recommended to establish standardised AI-based assessment protocols in this population.

Keywords: Balance prediction, Fall risk, Machine learning, Postural stability, Rehabilitation.

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