**CONCLUSION**

In conclusion, we introduced AttnSleep, a novel attention-based deep learning model designed for automatic sleep stage classification using single-channel EEG data. By incorporating a multi-resolution CNN for feature extraction and adaptive feature recalibration (AFR), AttnSleep effectively captures both low and high-frequency components, enhancing the representation of EEG signals. The temporal context encoder, leveraging multi-head attention with causal convolutions, further captures the temporal dependencies crucial for accurate sleep stage classification. Our extensive experiments on three public datasets demonstrated that AttnSleep outperforms state-of-the-art methods, achieving superior accuracy across various evaluation metrics. Additionally, the class-aware loss function addressed data imbalance issues without increasing computational overhead. The promising results underscore the potential of AttnSleep as a powerful tool for sleep stage classification, facilitating improved sleep monitoring and contributing to better understanding and management of sleep disorders. Future work may explore the integration of additional physiological signals and real-time deployment of the model in clinical settings