

Gender-related Variations in Broca's and Wernicke's Areas in Healthy Adults: A Structural MRI-based Morphometric Analysis

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Language processing is vital for human communication, which majorly relies on Broca's and Wernicke's areas in the left and right hemispheres. Gender-related variations in these regions remain underexplored, particularly in the Sri Lankan population. Thus, this study aimed to investigate this research gap using structural MRI-based morphometric analysis. A retrospective cross-sectional study included 202 healthy adults (97 males, 105 females), aged 18 to 80 years. 3D T1-Weighted structural MRI data obtained from Philips Healthcare and Siemens Healthineers 3.0T MRI scanners were used in the National Hospital of Sri Lanka, Colombo and the University Hospital of General Sir John Kotelawala Defence University, Werahera, under the supervision of the Consultant Neuroradiologist and the Consultant Radiologist. FreeSurfer advanced neuroimaging software package (version-7.4.1) via Windows Subsystem for Linux (WSL) was used for the brain reconstruction process to measure the cortical average thickness, the relative cortical surface area, the relative cortical volume and the cortical mean curvatures for specific boundaries. Statistical analysis was conducted using IBM SPSS Statistics software (version-27.0). Statistically significant gender-related variations were found, with females exhibiting higher Broca average thickness in both hemispheres compared to males ($p = 0.001$, $p = 0.046$). Significant negative correlations with age distributions of the relative cortical volume and the cortical average thickness were observed for Broca and Wernicke areas in both hemispheres. The relative cortical volume of the left Broca area was significantly higher than the right ($p < 0.001$), while the relative cortical volume of the right Wernicke area exceeded the left ($p < 0.001$). Study findings show the measurements of Broca's area was significantly larger in adult females than males. Significant negative correlations with age distribution show age-related brain morphometric changes for both regions. The above results prove that gender influences in anatomical variations in Broca's and Wernicke's areas among healthy adults in Sri Lanka.

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