ABSTRACT

Ultrasonography (USG) is a non-invasive medical imaging modality that utilizes high-frequency sound waves to visualize internal body structures. One of the key factors influencing USG image quality is the frequency of the transducer used. Higher frequencies generally produce better image resolution but have lower tissue penetration, whereas lower frequencies offer greater penetration depth at the expense of reduced image sharpness. This study aims to evaluate the impact of frequency variation on the image quality of ultrasonography devices, focusing on parameters such as image uniformity, distance measurement accuracy, spatial resolution, image contrast, and dead zone. The evaluation was conducted using a CIRS phantom model 040GSE and a GE Logiq E USG system at frequencies of 1.5 MHz, 2.5 MHz, 3 MHz, and 4.5 MHz. The assessments for image uniformity, gray scale, and dead zone were based on direct visual observation, while measurements of parameters such as vertical and horizontal distance, as well as axial and lateral resolution, were performed manually using the caliper tools on the USG machine. The results indicate that higher frequencies provide better axial and lateral resolution at shallow depths but exhibit reduced penetration capability into deeper regions of the phantom. Conversely, lower frequencies show better penetration but with diminished resolution. All measured values across the evaluated image quality parameters remained within acceptable tolerance limits. The observed reduction in visualization depth at higher frequencies is likely attributed to increased wave attenuation. This study emphasizes that selecting the appropriate frequency setting should be based on the clinical imaging requirements to ensure optimal image quality.

Keywords: *Ultrasonography, frequency, image quality, penetration, phantom.*