

ABSTRACT

Computed Tomography (CT) simulators play an important role in radiotherapy by providing anatomical images and tissue density information in the form of CT Numbers. A linear relationship between CT Number and Relative Electron Density (RED) is required to ensure the accuracy of tissue density conversion in the Treatment Planning System (TPS). This study aimed to evaluate the linearity of CT Number with respect to RED in Canon and Toshiba Aquilion CT simulators and to compare their linearity characteristics. The study was conducted using a Catphan 503 phantom at the Radiotherapy Department of Dr. Sardjito Hospital. CT Number values were obtained by measuring the region of interest (ROI) of air, PMP, LDPE, water, polystyrene, acrylic, Delrin, and Teflon inserts. Linearity analysis was performed using linear regression between CT Number and RED, with the coefficient of determination (R^2) used as the evaluation parameter. The results showed that most materials in both CT simulators produced CT Number values within the Catphan phantom reference range, except for Delrin and Teflon, which were below the recommended range. Linear regression analysis yielded R^2 values of 0.9979 for the Toshiba Aquilion CT simulator and 0.9978 for the Canon CT simulator. These values met the linearity tolerance criterion recommended by BAPETEN ($R^2 \geq 0.99$). The difference in R^2 values between the two CT simulators was very small, indicating comparable linearity performance. The findings demonstrate that both the Canon and Toshiba Aquilion CT simulators exhibit excellent CT Number linearity with respect to RED and are suitable for supporting radiotherapy treatment planning.

Keywords: CT number, Relative Electron Density, CT simulator, Catphan 503, linearity.