ABSTRACT

The accuracy of dose assessment (dosimetry) in electron beam radiotherapy highly depends on the calibration factor of the detector used. The IAEA TRS-398 protocol recommends using a plane-parallel ionization chamber with a direct calibration from a Secondary Standard Dosimetry Laboratory (SSDL) as the reference detector. However, cylindrical (Farmer) ionization chambers are frequently utilized in clinical environments despite lacking direct calibration factors for specific electron energies. This study aims to determine and analyze the absorbed dose-to-water calibration factor $\left(N_{D,w,Q_0}\right)$ *of a cylindrical Farmer detector (IBA FC65-G) through the cross-calibration method against a reference plane-parallel detector (IBA PPC40) using a clinical 8 MeV electron beam from an Elekta Linear Accelerator (Linac) at RSUP Dr. Kariadi. Measurements were performed inside a water phantom at the reference depth* $\left(Z_{ref}\right)$ *by applying essential dosimeter correction factors, including temperature and pressure* (k_{TP})*, polarity* $\left(k_{pol}\right)$*, and ion recombination* (k_s)*. The results revealed that the calculated value for the Farmer detector through cross-calibration was 47.6351 mGy/nC, while the official manufacturer certificate value was 47.4357 mGy/nC. Comparative analysis showed a very small deviation of only 0.42036%, which is well within the acceptable clinical tolerance limit of* $\pm 2\%$ *established by international protocols. In conclusion, this cross-calibration method demonstrates high precision and accuracy, confirming that the cross-calibrated Farmer detector is valid and safe for clinical dosimetry procedures in patient radiotherapy.*

Keywords: *Cross-calibration, Farmer Detector, 8 MeV Electron, TRS-398, Absorbed Dose to Water*