ABSTRACT

The high number of pneumonia cases in children makes chest X-ray examination for its diagnosis very important. Therefore, radiation dose optimization for children must be improved because children are more sensitive to ionizing radiation produced during the examination. Lung phantoms can be used as substitute objects for children's lungs in radiation dose optimization and education. Phantoms available on the market are generally expensive. This study aims to design and fabricate a lung phantom that represent cases of pneumonia in children at a more affordable price. The basic materials used for phantom fabrication are polymethyl methacrylate (PMMA), polyurethane (PU) foam, and calcium carbonate which mimicking soft tissue, lungs and ribs, respectively. While pneumonia that occur in children are represented by glycerine, ethylene glycol, and cooking oil. Phantom validation was carried out by comparing the parameters of computed tomography (CT) number, signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) produced by phantom images and patient images. The results of the research showed the CT number, SNR and CNR values of each liquid, namely glycerin (-16.51 HU; -0.25; 13.96), ethylene glycol (-245.19 HU; -0.63; 9.18) and cooking oil (-267.48 HU; -1.78; 10.59). Based on the results, it shows that glycerin can be used to represent pneumonia at a low-density consolidation level, while cooking oil and ethylene glycol can represent pneumonia at the ground glass opacity (GGO) stage such as Covid-19. The SNR and CNR values of the phantom images were respectively (-0.25; 13.96) for glycerin, (-0.63; 9.18) for ethylene glycol and (-1.78; 10.59) for cooking oil. Compared to patient images that have SNR and CNR (0.91; 19.64) the quality of the fabricated phantom images shows quite high similarity. Based on the results, it can be concluded that the developed paediatric chest phantom can represent pneumonia cases in patients. In addition, the materials used in the phantom fabrication, it has a cheaper price so that it can overcome the limitations of educational institutions in dose optimization and educational purposes.

Keywords**:** *Pneumonia, Chest Phantom, CT Thorax, Radiodiagnostics, Image Quality*