Purpose: To propose a method for consistently evaluating a color liquid-crystal display (LCD) as well as a monochrome LCD using commercially available color cameras with different spectral sensitivities.

Methods: Three single-lens reflex digital cameras with different spectral sensitivities were utilized as color cameras for evaluating the LCDs in this study. We used part of the dcraw.c code (open-source Dave Coffin™s RAW converter) to obtain unprocessed red (R), green (G), and blue (B) signals from the camera raw data (unprocessed image data). The RGB signals of the camera raw data were transformed to grayscale signals that corresponded to the luminance of LCDs by employing a weighting factor for each color. The weighting factors were determined based on the ratio of measured luminance of RGB test patterns displayed on a color LCD to compensate for differences in the spectral sensitivity of the RGB signals between the cameras. Resolution and noise properties of LCDs were evaluated in terms of modulation transfer function (MTF) and Wiener spectrum (WS), respectively.

Results: When the RGB signals were utilized without the weighting factors for compensation of differences in the spectral sensitivity of cameras, the MTFs and the WSs were different between the cameras, in particular in the color LCD. On the other hand, the MTFs and WSs of the color LCD and the monochrome LCD corresponded well between the cameras by applying the weighting factors based on the luminance to RGB signals.

Conclusions: Image quality of a color LCD as well as a monochrome LCD could be evaluated consistently even when color cameras with different spectral sensitivities were used. The proposed method can be applied to the evaluation of image quality, quality control, and quality assurance of LCDs for medical use.