EVALUATION OF DIFFERENT DEVICES FOR MEASURING PORK COLOR

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INTRODUCTION

Routine measurement of objective pork color in commercial slaughter plants is important for monitoring pork quality. Minolta instruments are considered the gold standard for color measurement [1]. However, the cost of the traditionally used Minolta instruments (CR-400 or CMD 700D) can be quite expensive. Thus, these instruments could be cost prohibitive in both small and large slaughter plants. Previous research has evaluated cost effective instruments designed for paint color assessment [1,2]. Predominantly, these studies have evaluated Nix Sensors, Spectro 1 Sensors, and the Color Muse colorimeter with mixed results. We are unaware of any research assessing the more cost effective Minolta CR-20 Color Reader for pork color which uses a different observer (10°) and only offers the D65 illuminant in comparison to the Minolta CR-400. The purpose of our research was to evaluate the NIX Spectro L (~$480 USD), the Spectro 1 Pro (~$300 USD), and the Minolta CR-20 (~$3200 USD) compared to the Minolta CR-400 (~$11,000 USD) to determine if these more cost effective instruments are viable for use in routine monitoring of pork color under commercial conditions.

MATERIAL AND METHODS

The CR-400 Chroma Meter (CR400; Konica Minolta, Ramsey, NJ, USA) was used as the base instrument to which all other color instruments were compared. The three instruments that were compared to the CR400 were the Nix Spectro L Spectrophotometer (NIX; Nix Sensor Ltd., Hamilton, ON, Canada), the Spectro 1 Pro SCI (SPC; Variable, Inc., Chattanooga, TN, USA), and the CR-20 Color Reader (CR20; Konica Minolta, Ramsey, NJ, USA). All instruments have an 8mm measurement aperture, except the NIX (16mm). All instruments used a 2° observer except the CR20 (10°). Comparisons of the CR400 with the NIX and SPC used the C illuminant, but the comparison between the CR400 and CR20 used the D65 illuminant.

Comparisons were made by using each instrument on the ventral surface of the boneless pork loin under commercial conditions (on the deboning line with moving belt) to determine CIE L*, a*, and b* values [3]. The NIX (n = 138), SPC (n = 120), and CR20 (n = 135) were each compared to the CR400 on different days and in three different commercial facilities. Each loin was scanned using the test instrument and then immediately scanned using the CR400 with care taken to ensure all measurements were in the same exact location of each loin.

RESULTS AND DISCUSSION

The CR20 had the strongest correlation with the CR400, followed by the SPC, and then the NIX for L* (Figure 1). The SPC had the slope closest to 1 followed by the CR20, and then the NIX for L*. All three instruments had a positive bias (average L* higher than the CR400) with the CR20 having the least amount of bias followed by the SPC, and then the NIX. The SPC had the strongest correlation for a*, followed by the CR20, and then the NIX. The SPC had the slope closest to 1 followed by the NIX, and then the CR20 for a*. The NIX had a positive bias (average a* higher than the CR400), but the SPC and CR20 had a negative bias (average a* lower than the CR400) with the SPC having the least amount of bias followed by the NIX, and then the CR20. The SPC had the strongest correlation for b*, followed by the CR20, and then the NIX. The CR20 had the slope closest to 1 followed by the SPC, and then the NIX. The NIX had a negative bias (average b* lower than the CR400), but the SPC and CR20 had a positive bias (average b* higher than the CR400) with the NIX having the least amount of bias followed by the SPC, and then the CR20.

CONCLUSIONS

The NIX, SPC, and CR20 all correlated well compared to the CR400 for L*, a*, and b* although they each had biases that would prevent them from being compared on an absolute value basis. The SPC and CR20 closely aligned with the CR400, more so than the NIX. Each of these instruments are viable for use in internal benchmarking programs or in determining objective color differences between treatments. Although less expensive, the NIX and SPC have limitations in practicality (require Wi-Fi, speed of measurement, etc.) compared to the CR20 that may deem them unacceptable in some commercial situations.

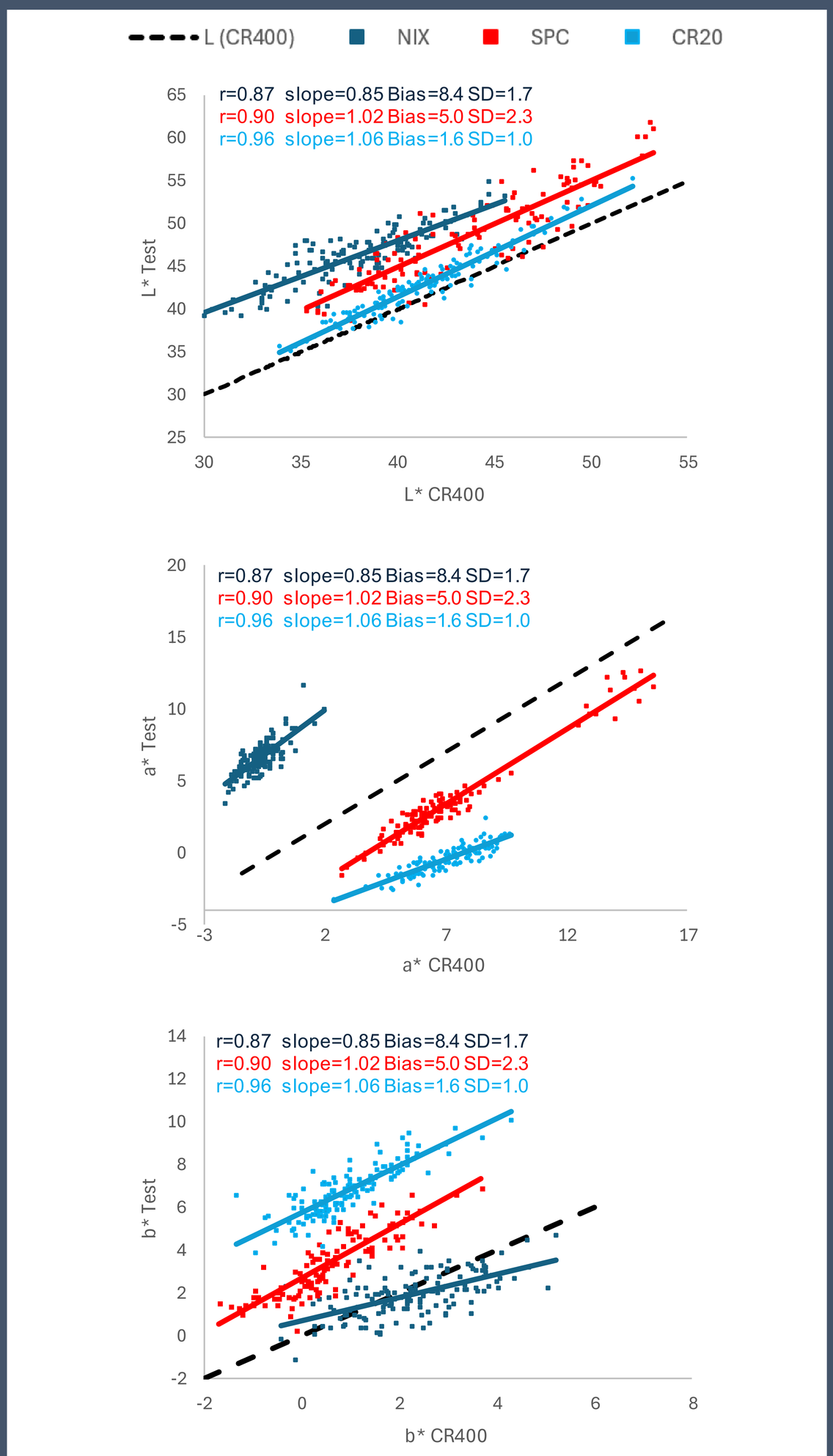

Figure 1. Comparison of the NIX, SPC, and CR20 to the CR400 on Pork Loin L*, a*, and b* Values

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