

Lactate measurement in pig blood at exsanguination as predictor for meat quality

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I. INTRODUCTION

The lactate content in pork is an important factor affecting meat quality [1], particularly in terms of its water holding capacity, tenderness, juiciness, and flavor. Lactate is produced during glycolysis, which is the breakdown of glucose in muscle cells. In living animals, lactate levels are typically low. However, after slaughter, muscle glycogen is converted into lactate, causing a decrease in pH, a process known as postmortem glycolysis. The rate and extent of postmortem glycolysis can impact meat quality attributes, by promoting the breakdown of connective tissue, activates enzymes responsible for tenderization, by affecting the water-holding capacity and affecting biochemical processes that contribute to meat flavor development during cooking. High levels of lactate have negative effects causing pale, soft, exudative meat. To manage lactate levels, factors such as pre-slaughter handling, animal genetics, stress reduction before slaughter, and post-slaughter processing techniques are important considerations for pork producers. In earlier research there has also been relation noted between the lactate content in blood at exsanguination and the final pork quality [1]. A positive relation between preslaughter conditions and blood lactate levels at exsanguination were also noted [2]. This indicates that measuring lactate level at exsanguination can become a novel quantified way to relate the preslaughter factors with the final meat quality.

This study aims to explore the relation between the lactate levels at exsanguination with the final meat quality parameters in a commercial slaughterhouse in the Netherlands.

II. MATERIALS AND METHODS

The study involves data from a trial carried out in May 2023 at a slaughterhouse owned by Vion Food, the Netherlands. A total of 80 pigs were slaughtered, and blood samples were taken immediately after stunning and sticking. These samples were measured with a hand-held lactate analyser (Lactate Scout 4, EFK Diagnostics, United Kingdom). After exsanguination, various meat quality parameters were measured, including drip loss, pH at 45 minutes, 3 hours, 6 hours, and 24 hours, as well as Minolta L, a, b colour values. All measurements were then correlated with the blood lactate values at exsanguination through correlation analysis, and correlation plots were created for visual simplification. Out of the 80 pigs, complete data from all measurements were available for 74, thus the analysis presented is based on 74 samples. All analyses were performed using MATLAB (MathWorks, Natick, MA, USA).

III. RESULTS AND DISCUSSION

Correlations of several meat quality parameters are plotted against the lactate values of blood during exsanguination (Figure 1). The lactate values show a slight positive correlation with drip loss and a negative correlation with pH at 45 minutes, 3 hours, and 6 hours. pH at 24 hours shows almost zero correlation with lactate value. Furthermore, lactate values exhibit a slight positive correlation with Lab colour values. Drip loss shows a positive correlation with the Lab values. pH at 45 minutes has a positive correlation with pH at 3 hours and 6 hours. pH shows almost no correlation with Lab values. Additionally, drip loss, pH at 45 minutes, 3 hours, and 6 hours shows almost zero correlation with pH at 24 hours. An earlier study [1] also reports a

positive correlation between lactate and drip loss and a negative correlation between lactate and pH. Based on such correlations, the earlier study suggested that lactate at exsanguination is predictive of the rate of early post-mortem metabolism.

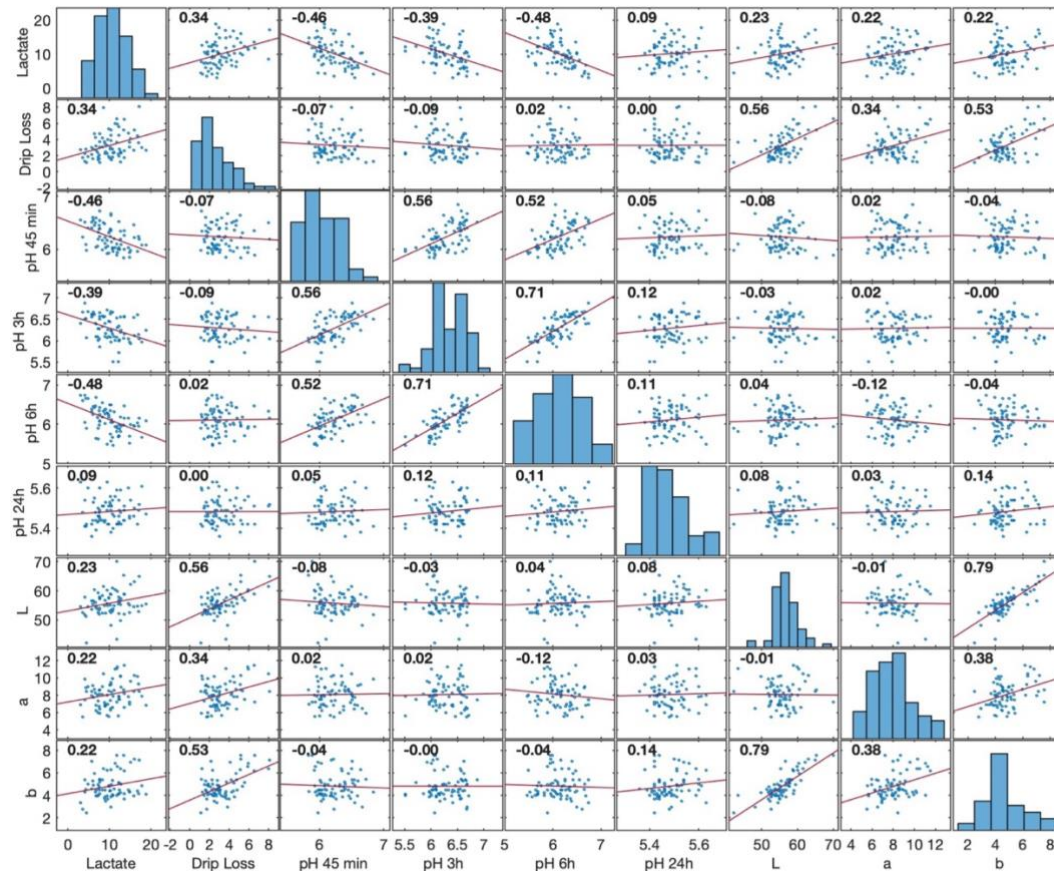


Figure 1: A summary of correlation plots between blood lactate levels at exsanguination and different meat quality parameters.

IV. CONCLUSION

This study explored the correlation of lactate values of blood at exsanguination and several of the meat quality parameters at a commercial slaughterhouse in the Netherlands. The results suggested that like earlier reported results [1], the lactate values at exsanguination carried correlation with meat quality parameters such as drip loss and pH. With drip loss, lactate carried positive correlation while with pH a negative correlation. Some positive correlation with Minolta Lab values was also note for lactate. Overall, the blood lactate values at exsanguination are found to be correlated to meat quality parameters. An in-line blood lactate measurement system during exsanguination can allow tracking the lactate values for individual animal allowing a better track of meat quality as well as animal welfare.

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