GLOBAL PORK QUALITY BENCHMARKING – PIC® COMPASS™

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I. INTRODUCTION

Pork quality attributes are generally measured by independent companies as a means of meeting customer and consumer expectations and demands. Various factors can impact the development of overall pork quality as influenced by plant operations [1,2]. Global swine genetics company, PIC®, sought to provide a means of assessing pork quality where all measurements are standardised across processing plants. Ultimately, this benchmark data termed PIC® Compass™, provides an independent reference for companies to assess how comparable and competitive their overall pork quality performance is on a national or global basis. Collecting this benchmarking information can be an effective tool for driving and implementing process improvements aimed at strengthening pork quality attributes.

II. MATERIALS AND METHODS

Thus far, data have been collected from 19 commercial pork processing facilities in North America and Europe. Data includes *post-mortem* chilling rates, *post-mortem* pH evaluation, and subjective Japanese Colour Score (JCS) and firmness evaluation. Carcass temperature decline was recorded using HOBO data loggers (Onset Computer Corporation, Bourne, MA, USA) equipped with probes placed in the deep ham (*semimembranosus*), loin (at the last rib), and shoulder (between 2nd and 3rd ribs; Onset Computer Corporation, Bourne, MA, USA). An additional ambient probe (Onset Computer Corporation, Bourne, MA, USA) was placed hanging below the carcass to obtain ambient temperatures throughout the chilling process. Probes were randomly placed in carcasses on the slaughter floor before chilling with measurements logged every minute thereafter for approximately 20 h. Chilling data were collected on a minimum of 12 carcasses across multiple days at each processing plant to account for variation. Ham (*semimembranosus*) and loin (last rib) pH were measured at two different time points: initial pH (pHi) was collected immediately before chilling on the slaughter floor and ultimate pH (pHu) was collected approximately 20 h *post-mortem* on the cut floor. Subjective loin quality measurements were collected on boneless loins. The JCS (1 to 6; 1 = Pale and 6 = Dark) was measured on the ventral surface of the loin. Firmness score (1 to 5; 1 = soft and 5 = very firm) was determined by bending the loin. For pH and subjective loin quality measurements, a minimum of 275 measurements were taken across multiple days at each processing plant. All data were kept strictly confidential with reports containing anonymised data where a customer could only recognise their own data. Data were analysed in SAS using the PROC GLM procedure.

III. RESULTS AND DISCUSSION

All plants in this study used CO_2 stunning, whereas animal handling systems prior to stunning were somewhat variable. Additionally, *post-mortem* chilling rates were variable across processing facility and chilling capabilities. Stunning and *peri-mortem* handling are the last processes affecting the stress levels of the living pig, and therefore, pork quality. Alternately, carcass chilling is one of the first *post-mortem* processes that impacts the development of pork quality, with chilling system variation resulting in differences across muscles [3]. Differences in both pHi and pHu were observed in the present benchmark data (Table 1). Initial pH values can be indicative of poor animal handling or stressed pigs before slaughter when values fall below 6.00 due to rapid *post-mortem* pH decline [1]. Alternately, pHu values below 5.60 can be an indicator of poor carcass chilling and can result in more PSE-like (pale, soft, and exudative) or even intermediary RSE-like (red, soft, and exudative) pork with lower water-holding capacity and product unacceptable for many consumers [2,4]. Colour and firmness scores aligned with differences observed in carcass chilling and resulting pHu values.

Table 1 PIC® Compass™ – *Post-mortem* pH, Colour, and Firmness

Trait	Average	Minimum	Maximum	SD
Ham pHi	6.58	6.49	6.83	0.08
Loin pHi	6.66	6.56	6.74	0.04
Ham pHu	5.75	5.62	5.91	0.08
Loin pHu	5.67	5.55	5.84	0.08
JCS Average Score	3.41	3.15	3.82	0.20
Firmness Score	2.47	1.67	2.98	0.35

When comparing benchmark data across regions, additional pork quality differences were observed (Table 2). Higher pHu values ($P < 0.05$) for the loin were observed in North American plants compared to European plants. Further, North American plants tended to have darker colour ($P < 0.10$) and had higher firmness ($P < 0.05$) scores, likely resulting from differences in chilling systems. Overall, while the present benchmark data were variable in *post-mortem* pH, colour, and firmness, these data confirm that good animal handling coupled with adequate carcass chilling systems at the processing facility are necessary to develop and maintain pork quality.

Table 2 PIC® Compass™ – Comparison of Pork Quality Between Regions

Trait	Europe	North America	P-value	Pooled SEM
No. of plants	7	12	-	-
Time of pHi, min PM	32.6	37.2	0.10	1.80
Ham pHi	6.60	6.57	0.54	0.03
Loin pHi	6.65	6.67	0.50	0.01
Ham pHu	5.71	5.78	0.06	0.02
Loin pHu	5.60	5.71	0.002	0.02
JCS Average Score	3.29	3.47	0.07	0.06
Firmness Score	2.19	2.64	0.005	0.09

IV. CONCLUSION

Pork quality is influenced by several factors and global variation was observed based on processing capabilities and techniques. To date, PIC® is not aware of any benchmarking data related to attributes that impact the quality of pork as influenced by plant operations on a global scale. Factors such as animal handling, transportation length, time in lairage, and rate and extent of carcass chilling are critical in the development of pork quality attributes. These data enable processing plants to assess competitiveness and implement changes as needed to produce high-quality pork that meets demands for various markets.

REFERENCES

1. Berg, E. (2006). Critical points affecting fresh pork quality within the packing plant. http://porkgateway.org/resource/critical-points-affecting-fresh-pork-quality-within-the-packing-plant/
2. Lonergan, S. (2012). Pork Quality: pH decline and pork quality. http://porkgateway.org/resource/pork-quality-ph-decline-and-pork-quality/
3. Blakely, A., Prusa, K., Fedler, C. A., Sherrard, G. B., Steadham, E. M., Stalder, K. J., Lorenzen, C. L., Huff-Lonergan, E., Lonergan, S. M. (2019). The effect of rapid chilling on pork carcasses during the early postmortem period on fresh pork quality. Meat and Muscle Biology 3:424-432.
4. Buege, D. (2006). Variation in pork lean quality. https://porkgateway.org/resource/variation-in-pork-lean-quality/