EFFECT OF PROGENY ON BEEF QUALITY OF REPRESENTATIVE BULLS WAGYU KUROGE BREED IN TROPICAL CONDITIONS

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I. INTRODUCTION

The inclusion of different breeds, such as the Wagyu Kuroge breed, has been a strategy to improve the quality of the country's beef and meet the needs of more demanding consumers. Wagyu cattle originate from native Japanese breeds and intense marbling tends to be their most notable characteristic [1]. However, different climatic conditions generate physiological and metabolic changes in animals, which can affect beef production in terms of yield, composition and beef quality attributes [2]. In this way, it is suggested that progenies of bulls from the main families of the Wagyu Kuroge breed, raised in tropical conditions, influence the physicochemical characteristics of the beef. Therefore, the aim of this study was to evaluate the influence of the progeny of representative Wagyu Kuroge bulls on the characteristics of tenderness and fat deposition when raised in tropical conditions.

II. MATERIALS AND METHODS

Forty progenies of representative bulls from the main Wagyu Kuroge lines (100% Tajima, Hiroshima, Itozakura, High % Tajima) were used, with 10 progenies from each line. The progenies were castrated, confined (initial mean weight of 450 kg) and maintained on the same diet for 666 days during the finishing phase, and harvested at an average age of 40 months. The criteria for slaughtering the animals were age and final weight. The final mean weight was 732.18 kg, 789.29 kg, 709.75 kg and 784.48 kg for 100% Tajima, Hiroshima, Itozakura and Alto % Tajima, respectively. During boning, after 48 hours, the *Longissimus thoracis* muscle was analyzed for pH, subcutaneous fat thickness and marbling score (Japan Meat Grading Association). Samples of the *Longissimus thoracis* muscle were collected for the analysis of shear force (aged for 2 and 14 days at 0 to 2ºC) and sarcomere length. The procedures for the analysis of shear force were performed according to AMSA (2016), and the sarcomere length was performed according to Battaglia et al. (2016). The lineage effect for all variables was analyzed considering a completely randomized experimental design. Data was submitted to analysis of variance (ANOVA) using the MIXED procedure of the SAS® and the mean results were compared using the Tukey test with a significance level when $P \leq 0.05$.

III. RESULTS AND DISCUSSION

The results are shown in Table 1. For pH values, the lineage did not differ ($P = 0.127$), and the values are within the normal range. Regarding shear force in aged for 2 days samples ($P = 0.299$) and in aged for 14 days samples ($P = 0.314$) there was no difference among treatments, however in aged samples the 100% Tajima, Itozakura and Hiroshima progenies are classified as very tender according to the Ranking of Beef Muscles for Tenderness [5], however, regardless of the lineage, the beef of the progenies stood out for presented a high degree of tenderness.

In relation to the marbling score, there was a difference ($P = 0.008$), where the 100% Tajima and Hiroshima progenies presented higher values when compared to the other lines, corroborating the finding in the literature, which shows that this characteristic is correlated mainly with predisposing genetic factors, either between breeds or between strains [6;7]. As for subcutaneous fat thickness,

there was a difference (P = 0.044), with progenies of the Hiroshima line showed lower values when compared to the others, but all the progenies, regardless of the lineage, revealed values higher than those required for the gourmet market and suitable for the Japanese standard [1;6;8].
There was no difference in sarcomere length (P = 0.093), but the values obtained are in accordance with the literature for beefs considered to be tender, which was confirmed by the values found for shear force, and explained by an adequate decline in pH and appropriate thickness of subcutaneous fat to prevent cold shortening [9].

Table 1 – Influence of the progeny of representative bulls from the main families of the Wagyu Kuroge breed on beef physicochemical characteristics

Variable	Lineage				Pr > F	
	100% Tajima	Itozakura	Alto % Tajima	Hiroshima	SEM	P-value
48h carcass pH	5.53	5.55	5.56	5.33	0.054	0.127
Subcutaneous fat thickness, mm	29.96[a]	29.98[a]	27.36[a]	12.84[b]	4.109	0.044
Marbling score	6.67[a]	4.89[b]	4.92[b]	7.92[a]	0.735	0.008
Shear Force (aged for 2 days), N	46.93	48.60	55.97	41.42	0.306	0.299
Shear Force (aged for 14 days), N	34.88	37.65	43.76	37.16	0.147	0.314
Sarcomere length, µm	2.00	2.17	2.08	2.17	0.180	0.093

[a-b] Averages with different superscripts differ in the rows by the F test

IV. CONCLUSION

Subcutaneous fat thickness and intramuscular fat deposition were influenced by the genetics of the progenies; however, important attributes for beef quality, such as beef tenderness, were not influenced by this factor. Therefore, all the lineage of Wagyu Kuroge progenies raised in tropical conditions have a high-quality final product, giving them an advantage in gourmet markets.

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REFERENCES

1. Motoyama, M.; Sasaki, K.; Watanabe, A. (2016) Wagyu and the factors contributing to its beef quality: A Japanese industry overview. Meat Science 120:10-18.
2. Gonzalez-Rivas, P.A.; Chauhan, S.S.; Ha, M.; Fegan, N.; Dunshea, F.R.; Warner, R.D. (2020) Effects of heat stress on animal physiology, metabolism, and meat quality: A review. Meat Science 162:108025
3. American Meat Science Association (2016). Research Guidelines for Cookery, Sensory Evaluation, and Instrumental Tenderness Measurements of Meat (2. ed. pp. 105), 2016, Champaign, Illinois.
4. Battaglia, C.; Vilella, G.F.; Bernardo, A.P.S.; Gomes, C.L.; Biase, A.G.; Albertini, T.Z.; Pflanzer, S.B. (2019) Comparison of methods for measuring shear force and sarcomere length and their relationship with sensorial tenderness of longissimus muscle in beef. Journal of Texture Studies 51(2):1-11.
5. Calkins, C.R.; Sullivan, G. (2020) Ranking of Beef Muscles for Tenderness. National Cattlemen's Beef Association 91:1-6.
6. Calles, J.A.E.; Gaskins, C.T.; Busboom, J.R.; Duckett, S.K.; Cronrath, J.D.; Reeves, J.J. (2000) Sire variation in fatty acid composition of crossbred Wagyu steers and heifers. Meat Science 56(1): 23-29.
7. Fu, X.; Yang, Q.; Wang, B.; Zhao, J.; Zhu, M.; Parish, S.M.; Du, M. (2018) Reduced satellite cell density and myogenesis in Wagyu compared with Angus cattle as a possible explanation of its high marbling. Animal 12(5):990-997.
8. Schumacher, M.; DelCurto-Wyffels, H.; Thomson, J.; Boles, J. (2022) Fat deposition and fat effects on meat quality - A review. Animals 12(12):1550.
9. Ertbjerg, P.; Puolanne, E. (2017) Muscle structure, sarcomere length and influences on meat quality: A review. Meat Science 132: 139-152.