Sous vide cooking improves the eating quality of spent buffalo (bubalus bubalis) meat

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I. INTRODUCTION

Tenderness is an important factor that influences overall consumer satisfaction, repeat buying decisions, and willingness to pay a premium price [1]. In South Asia, a large proportion of meat comes from spent animals, especially buffalo (Bubalus bubalis) [2]. Sous vide is a French cooking technique where meat in a vacuum-sealed bag is cooked under water at temperatures ranging from 50 °C to 85 °C for between 2 to 18 hours [3]. Improving the tenderness of meat from spent animals can impact consumer acceptance and provide an affordable animal protein source to cater for the growing protein demands in developing countries. This study assessed the effect of controlled time-temperature conditions in sous vide cooking on eating characteristics of buffalo meat.

II. MATERIALS AND METHODS

36 muscle samples (18 each of bicep femoris (BF) and semitendinosus (ST)) were obtained from randomly selected female spent buffalo carcasses (Bubalus Bubalis) aged > 60 months. The study comprised 6 treatments; a 3×2 factorial arrangement of treatments was applied according to a completely randomized block design with 3 specific cooking conditions, i.e., $55 \,^{\circ}C$ for 8 h ($55^{\circ}C$ -8H), $65 \,^{\circ}C$ for 5 h ($65^{\circ}C$ -5H), and 95 $^{\circ}C$ for 45 min ($95^{\circ}C$ -45M) and 2 muscle types, BF and ST with 3 batches as replications. BF and ST was cut to yield 2.5 cm thick steaks ($250 \text{ g} \pm 10 \text{ g}$). Each steak was vacuum packed in impermeable bags and cooked in a water bath. At the cessation of cooking, the samples were cooled in an ice bath and kept overnight at 4-5 $^{\circ}C$. Tenderness was measured by WBSF texture analyzer, color by using Minolta colorimeter, cooking loss & cooking yield were recorded accordingly after removing cooked steaks from the vacuum bags. Samples were also analyzed for myofibrillar fragmentation index (MFI) and total collagen content (TCC). Samples were assessed for sensory analysis using 9- point hedonic scale after searing steaks on the hot plate. Data was analyzed using the mixed procedure of SAS (version 9.4). The Tukey-Kramer test was applied to compare means.

III. RESULTS AND DISCUSSION

The findings illustrated variation in mean WBSF values between cooking conditions (p < 0.001) for both muscles, and no difference in tenderness (p = 0.19) was observed among the muscles while analyzing muscle type as illustrated in table 1. However, findings of color were found to be significant in color parameters except C in meat type and L* among 65°C-5H and 95°C-45M. The mean total collagen content & MFI values showed differences in cooked meat between the cooking conditions and the muscles (p < 0.001) while cooking loss and cooking yield showed less significance (p = 0.022) illustrated in figure 1. Sensory evaluation results demonstrated that the sensory panelists liked meat from 55°C-8H cooking for all the sensory traits, followed by 65°C-5H and 95°C-45M.

Table 1: Effect of cooking temperature and muscle type on tenderness & color (a*, C, L*, b* & H) of cooked BF and ST steaks.

Cooking Conditions	WBSF	a *	С	L*	b*	н
55°C-8H	$28.6^{\circ} \pm 3.64$	$9.9^{\circ} \pm 0.37$	$14.8^{\circ} \pm 0.32$	$51.3^{a} \pm 0.29$	$10.8^{\mathtt{a}} \pm 0.13$	$47.9^{a} \pm 0.89$
65°C-5H	$41.9^{b} \pm 3.64$	$11.2^b\pm0.37$	$16.5^{b} \pm 0.32$	$44.7^{b} \pm 0.29$	$12.1^b\pm0.13$	$46.9^{b} \pm 0.89$
95°C-45M	$55.9^{a} \pm 3.64$	$10.7^{a}\pm0.37$	$15.4^{\mathtt{a}} \pm 0.32$	$44.7^{b} \pm 0.29$	$10.9^{\text{ac}}\pm0.13$	45.5° ± 0.89
P value	< 0.001	<.0001	< .0001	< .0001	< .0001	< .0001
Muscle type						
BF	42.5 ± 3.63	$10.9^{b} \pm 0.37$	15.5 ± 0.32	$45.3^{a} \pm 0.24$	$10.9^{a} \pm 0.12$	$44.7^{a} \pm 0.87$
ST	41.8 ± 3.63	$10.2^{a} \pm 0.37$	15.6 ± 0.32	48.5 ^b ± 0.24	$11.7^{b} \pm 0.12$	$48.7^{b} \pm 0.87$
P value	0.19	<.0001	0.66	< .0001	< .0001	< .0001

L* (Lightness), a* (redness), b* (Yellowness), C (Chroma), H (hue)

WBSF: Warner Bratzler's shear force; BF: bicep femoris; ST: semitendinosus



Figure 1. Effect of cooking conditions and muscle type on cooking loss, cooking yield, total collagen content & myofibrillar fragmentation index (MFI). While Figure 2 illustrate the effect of cooking temperature on sensory parameters

IV. CONCLUSION

This study has shown that cooking at constant low temperatures and time significantly improved the tenderness of the two muscles while preserving the organoleptic characteristics. low-value cuts can be utilized as steaks which can be available at a lower price. The findings of this study may also apply in the development of ready-to-cook and eat buffalo meat products.

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