Feasibility study boning carcasses with a higher temperature.

Effect of higher carcass temperature during boning on meat quality.

Theo J. Verkleij[1] Bert Lambooij[2], Henny Reimert[2]
[1]TNO Quality of Life, P.O. Box 360, 3700 AJ Zeist, the Netherlands, [1] Corresponding author
[2]Animal Science Group, division Animal Production, P.O. Box 65, 8200 AB Lelystad, the Netherlands.

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Introduction

In the meat industry manual handling like boning, carried out at low temperatures at high speed and time pressure can cause musculoskeletal disorders like repetitive strain injury (r.s.i.) injuries to joints, muscles and nerves in wrists, elbow, arm, shoulder and neck. Boning at a higher temperature (+15ºC) is expected to give a positive contribution towards suppressing musculoskeletal disorder in general and r.s.i. in particular On the other hand, boning at a higher temperature is expected to have an effect on the meat quality like color, tenderness and water holding capacity. Adjusting handling conditions for employers in order to reduce r.s.i. injuries is therefore only acceptable, if the meat quality is not negatively affected.
The aim of this study was to measure the effects on meat quality boning veal at a higher temperature.

Materials and method

50 Carcasses of veal from 1 farm were slaughtered in succession and divided into two groups to chill. Carcasses were cooled overnight at two set-temperatures (+ 11ºC and +5ºC). The next morning the *m.longissumus lumborum* (LL) and the *m. semi membranosus* (SM) were obtained for the measurements of temperature and pH. Color was measured triple, 30 minutes after boning on a new slice between the 3rd and 4th lumbar vertebra with a Minolta CM 525i, D65 light, 10º observer, 30 mm opening and 25 mm surface.
A new slice was used to determine the water holding capacity (WHC) according to the method of Kaufmann.
A third slice at 1 cm thickness was trimmed, individually packed to determine the drip loss after 5 days of cooled storage at 4ºC according to the modified method of Lundström en Malmfors (1985).
A fourth slice at 5 thickness was trimmed and vacuum packed to determine after 5 days the cooking loss. The meat was heated in water of 75ºC during 1 hour and cooled during 30 minutes in tap water. Weighing the meat before and after heating, cooling and dipping gave represents the cooking loss. Subsequently the tenderness is measured from 6 strips (10 by 10 mm) according to the Warner Bratzler method.
The microbiological count per cm^2 was carried out and with a predictive model the effect of the two temperatures on the shelf life was determined. Besides the measurements on meat quality, the effects of boning at different temperatures towards the contribution of suppressing musculoskeletal disorder were also recorded. To prevent a day-effect, a second research-day was carried out.

Results & Discussion

The results of pH-measurement and temperature are given in table 1. As can be seen, those values are according to values which can be expected in veal. (Eikelenboom and Smulders 1986, Den Hertog c.s. 1997, Klont cs. 1999). The differences were not significant. Before starting the experiment, the measured temperature was between +4/+6 ºC and +9/+11 ºC. After boning, the intended temperature (+5ºC and +11ºC) wasn't reached anymore, due to storage for a longer period in a cooled area before boning.

Table 1: pH and temperature of veal 1 night after slaughter and cooling at 2 different temperatures.

	day 1		day 1		day 2		day2	
Carcass temperature	*m longissumus l.*		*m semi-membranosus*		*m longissumus l.*		*m semi-membranosus*	
	pH	Temp.	pH	Temp.	pH	Temp.	pH	Temp.
Low mean value	**5,58**	**3,80**	**5,46**	**5,09**	**5,53**	**3,49**	**5,45**	**5,23**
standard error	0,08	0,58	0,04	0,36	0,09	1,12	0,04	0,52
Higher mean value	**5,55**	**8,21**	**5,46**	**8,79**	**5,49**	**8,02**	**5,45**	**9,17**
standard error	0,09	0,79	0,04	1,38	0,06	0,35	0,04	1,38

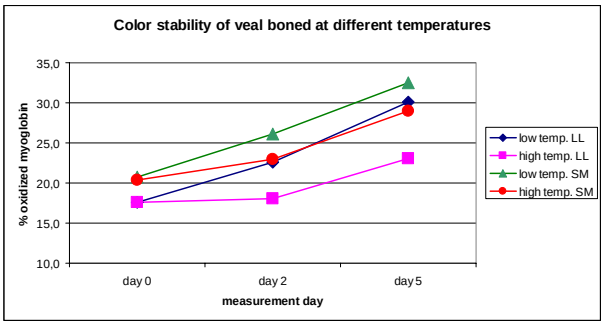

Figure 1: color stability of boned veal at different temperatures

During storage, the L* value on day 0 till day 5 increased from 49 towards 56. The a* value increased from 11.5 to 13.0 for the *LL* and from 12.4 towards 15.4 for the *S.M.*
Although small differences were noticed, there was no significance (st.error 95%). The color stability (% oxidized myolgobin) showed a difference between the cold or warmer boned meat (fig. 1). The warmer boned veal showed a slightly more stable color.

Results in table 2 showed the *m longissumus l* showed a lower water holding capacity, less driploss, and a lower cooking loss compared to the *m semi-membranosus*.

Table 2: Results of physical measurements of veal after different boning temperatures.

day 1 boning temp.		***m longissumus l.***				***m semi-membranosus***			
			loss				loss		
		WHC [mg]	drip- [%]	cooking- [%]	tenderness [N]	WHC [mg]	drip – [%]	cooking- [%]	tenderness [N]
low	mean	**0,012**	**1,6**	**18,0**	**47,3**	**0,039**	**3,0**	**28,4**	**42,4**
	st.error	0,003	0,6	3,5	7,0	0,011	0,7	2,3	7,6
higher	mean	**0,008**	**1,6**	**22,1**	**47,4**	**0,035**	**3,8**	**25,5**	**47,0**
	st.error	0,002	0,4	3,3	10,8	0,006	0,7	2,9	12,4
day 2		***m longissumus l.***				***m semi-membranosus***			
low	mean	**0,011**	**1,6**	**18,6**	**50,9**	**0,041**	**3,6**	**28,4**	**43,1**
	st.error	0,004	0,4	3,0	10,7	0,009	0,5	2,3	7,7
higher	mean	**0,009**	**2,3**	**21,1**	**37,2**	**0,035**	**4,0**	**27,8**	**55,8**
	st.error	0,002	0,6	2,3	9,9	0,008	0,7	2,6	5,6

The microbiological count of both cold and warm boned veal meat varied from 90 colony forming units (cfu)/cm^2 till 3700 cfu/cm^2 after 1 night chilling. Due to the variation in cfu/cm^2 a predictive model is used to estimate the effect on shelf life of the veal. The shelf life will not shorten. The contamination effect is determined to be the key factor for determining the shelf life.
Effect on boning at different temperatures towards the contribution of suppressing musculoskeletal disorder showed by hindquarters from veal a slight reduction in workforce, boning shoulders however, didn't show a reduction in workforce, although it was marked the boning is easier. Due to a higher temperature, the contamination of the boning place is somewhat higher.

Conclusion

Boning veal carcasses at a 5ºC higher temperature can be considered due to a small reduction in work force showed at hindquarters. Concerning meat quality, a positive effect was a better color stability, whether the other characteristics were not affected.
Contamination was negatively affected on the place, but the shelf life will not be shortened if cooled subsequently afterwards.

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