THE APPEARANCE OF SHAPED BEEF STEAKS (SMARTSHAPE™)

Johanne Taylor[1], Edwina S. Toohey[2], Remy van de Ven[3] and David L. Hopkins[4]

[1]NSW Department of Primary Industries, Head Office, 161 Kite Street, Orange NSW 2800 Australia;

[2]NSW Department of Primary Industries, Cnr Hampden and Cobra Streets, Dubbo NSW 2830 Australia;

[3]NSW Department of Primary Industries, Orange Agricultural Institute, Forest Rd, Orange NSW 2800 Australia; [4]NSW Department of Primary Industries, Centre for Red Meat and Sheep Development, Binni Creek Road, Cowra NSW 2794 Australia.

Abstract – The novel processing technology, SmartShape™, compresses and packages whole meat primals into a form that can then be portioned evenly. A study was conducted to establish the time that beef cuberolls were required to remain in the packaging (chilling time) for the resulting steaks to retain their shape. The minimum time assessed, 12 hours, was found to be adequate with steaks retaining their shape for up to 24 hours after slicing. Steak shape and size did not change until after cooking, when the steaks attained a more natural appearance that was similar to the cooked unshaped equivalent. Further work will be required to establish the minimum chilling time the primal must remain in the packaging and to clarify the effect of resting times and cooking on steak shape.

Key Words – beef cuberoll, shape, portion control

I. INTRODUCTION

Shaped meat products have been available to the retail consumer and the food service industry for generations. These products have undergone extensive processing and can be viewed by the consumer as cheaper, lower quality alternatives to fresh meat [1]. There is a dearth of information about the impact of fresh meat shape on consumer purchase preferences or on the food processing industry. Preferences for steak cross-sectional area have been examined at the retail level [2,3] and for the food service sector [4]. In an older study Hopkins [5] found that shape had no impact on the prices that retailers set for lamb.

There is evidence to suggest that shaped fresh primals that could be sliced evenly into consistent portions (steaks) would be of interest to both the food service and retail sectors. Judge *et al.* [6] stated that uniformity of cut sizes was important to the food service industry because of the need for predictable cooking times, serving sizes and costs. Buyers can specify the weight or the thickness of cuts, but not both, as the weight of a cut is dependent on both circumference and thickness.

In 2008 a novel processing technology for red meat was patented internationally [7]. This technology, registered as SmartShape™, can be used to shape cold-boned primals into an even form and package them so as to retain that form by applying air pressure [8]. Research, using the same technology, involving the shaping of whole hot-boned lamb forequarters with the aid of commercial binder, found that shape retention of the sheep meat after slicing frozen and subsequent cooking was very good [9]. However, the shape retention of fresh meat has not been quantified. This experiment attempted to establish the time period required for SmartShape™ cold-boned beef cuberolls ([10]; HAM 2244) to remain in the packaging between shaping and slicing fresh (chilling time) to ensure that the steaks retained their shape.

II. MATERIALS AND METHODS

Left and right cold-boned cube rolls ([10]; HAM 2244), cut from the m. *longissimus lumborum*, were taken in a commercial abattoir from nine male bovine carcases with an average weight of 350kg (range 292 - 437) and two or fewer permanent incisors. The carcases had been aged overnight at 1 - 5ºC. Each cube roll was split laterally into approximately equal halves with each half being randomly assigned to either the control or the shaping treatment. In this study a sample is defined as half of a cube roll. All samples were similar circumference and length before shaping treatment. The shaped treatment samples were processed for approximately 10 seconds using the SmartShape™ technology and packaged into tubular packaging with a diameter of 95mm (Fig 1). The control samples were placed in plastic bags. The circumference was measured on each

sample and this was repeated for shaped samples after the shaping treatment. The packaged samples were then randomly allocated to a 12, 24 or 48 hour chilling treatment (6 samples per treatment) and kept at 0-1°C for that period. After the allotted chilling time each sample was sliced across the cube roll using a Sunbeam Café Series food slicer into 20mm thick steaks. From this, three steaks were retained, including the second steak in from either end and the steak closest to the middle of the sample. These steaks were laid on a flat surface. The circumference of each steak, along with a long diameter and a short diameter (Fig 2), were recorded immediately on slicing and 2 hours after slicing. The middle steak of each sample was retained for cooking and the circumference and long and short diameter were recorded both immediately before and immediately after cooking in batches of 4 at ~220°C on a Cuisinart Griddler clam grill to a medium degree of doneness. Cooking occurred 12 hours after slicing for the 12 hour chilling treatment samples and 24 hours after slicing for the 24 hour chilling treatment samples. The 48 hour chilling treatment samples were not cooked. A photograph of each steak was taken at each measurement time.

Figure 1. Two halves of the same cube roll. Sample 1 (top) is the untreated control while Sample 2 (bottom) has undergone the SmartShape™ treatment. These were equal length before the treatment of Sample 2.

Linear mixed models were used to analyse the short diameter, longer diameter and circumference averages over steaks within a samples data, with each model fitted using the statistical package ASReml [11]. The models contained fixed effects for treatment (SmartShape™ or control), chilling time (12, 24 or 48 hours), measurement time and interactions between these factors. Random terms in the model were carcase, side within carcase and random error. Random error variation was allowed to differ for the two treatments.

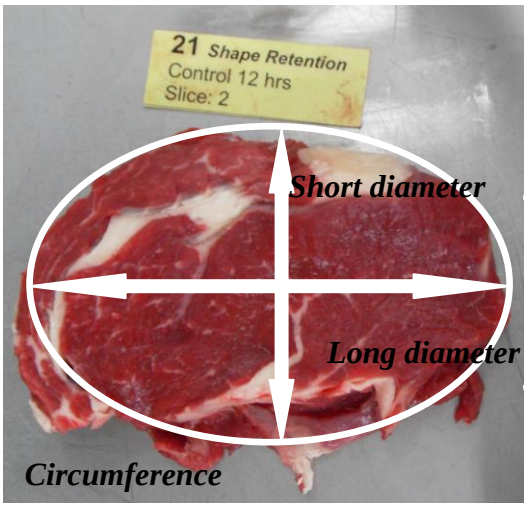

Figure 2. Control sample steak showing short diameter, long diameter and circumference measurements.

III. RESULTS AND DISCUSSION

There were no significant ($P > 0.05$) effects associated with chilling time (12, 24 or 48 hours). As a result all statistical summaries of results are for averages over packaging times.

The predicted means and standard errors for the circumference, averaged over chilling times, for the control and SmartShape™ treatments are presented in Table 1. The circumferences of the shaped sliced steaks were the same as the circumference of the shaped and packaged cuberolls. This shape was maintained while the steaks were raw, even though the steaks had been removed from the restraining packaging. There was a gradual increase in the circumference with resting time seen in the results of both the control and the shaped steaks. Increased distortion in steak shape was observed with increased manual handling, which was avoided in this study. Further study will be required to quantify the relationship between resting time and circumference increases. The circumferences of the control sliced steaks were

significantly ($P < 0.05$) larger than for the control cuberoll (Table 1).

Table 1. Predicted means and standard errors (s.e.) for the circumference (cm) of control and SmartShape™ steaks averaged over chilling times, but at each measurement time.

Treatment	Measure	Mean	*s.e.*	
Control	Pre-treatment	37.9	*0.62*	d
	Post-treatment	n/a		
	Slice steak	39.2	*0.62*	e
	Slice steak + 2 hours	39.7	*0.62*	e
	Pre-cook	40.1	*0.74*	e
	Cook	43.1	*0.74*	f
SmartShape™	Pre-shape treatment	35.2	*0.42*	c
	Post-shape treatment	30.5	*0.37*	a
	Slice steak	31.0	*0.40*	a
	Slice steak + 2 hours	31.4	*0.47*	ab
	Pre-cook	32.8	*0.60*	b
	Cook	35.5	*0.46*	c

Pairwise, means not having a letter in common in the final column are significantly different ($P < 0.05$)

The cooked shaped steak had a circumference similar to that of the source cube roll before shaping whereas for the control steaks the circumference increased significantly with cooking. Shaping reduced the long diameter, while slightly increasing the short diameter of the raw steak. Although there was a significant increase in long diameter with cooking it should be noted that the long diameter did not return to the pre-treatment length. The significant change in shape with cooking, from a defined, almost circular steak (Fig 3) to one with a more natural appearance (Fig 4), is important for consumer acceptance of the shaped steak. Consumers have an overall preference for foods, particularly traditional foods that are perceived as being "natural" or unprocessed [12]. It could therefore be suggested that a product with a more natural appearance, such as the cooked shaped steak, could be more acceptable to them than the unnatural appearance of the uncooked shaped steak. Consumer studies will need to be conducted to confirm the acceptability of the SmartShape™ treated product as Cox *et al.* [12] cautions that there may be a negative backlash from consumers if they find what they believe is a "natural" product has been processed.

Figure 3. Shaped (left) and control (right) steaks from the same cuberoll, after 24 hrs chilling.

Figure 4. The steaks shown in Fig 3 (above) following cooking.

Given that within the food service industry tight portion control is a major way of managing costs and small cost savings per portion accumulate into large savings for a processing business over time [13] it could be suggested that a product which could be sliced into equal portions without trimming could be attractive. Institutional food wastage is of great concern [14,15,16,17]. The estimates of food wastage vary although a study examining four Swedish institutions estimated total waste at 20% of all food delivered, half of which was preparation and serving waste and the other half was plate waste (food taken but not eaten and thrown away) [18]. With potentially 10% of food wasted in preparation, minimising this would reduce costs in production.

IV. CONCLUSION

SmartShape™ is a novel processing technology that can process (or shape) cuberolls of variable circumference and diameter into pieces of consistent circumference and diameter. These shaped cuberolls can then be sliced, after 12 hours chilling, into identical steaks that have the same circumference and diameter as the shaped cuberoll. Subsequent changes to the shape or size of the shaped steak do not occur until after cooking, meaning that the sliced product does not need to be used immediately, but can be left for 24 hours without the loss of shape. Further study will be required to establish the minimum chilling time required between shaping treatment and slicing to ensure shape retention.

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