A COMPARISON BETWEEN THE USE OF SCOLINE (SUCCINYLDICHOLINE CHLORIDE) AND KILLING BY MEANS OF A HEAD SHOT ON THE PHYSICAL MEAT QUALITY ATTRIBUTES OF BUFFALO (*SYNCERUS CAFFER*)

Louwrens C. Hoffman

Department of Animal Sciences, University of Stellenbsoch, P Bag X1, Matieland, 7602, SOUTH AFRICA

Key words: Slaughter methodology, game meat, stress, pH, colour, drip loss, PSE

Background

De Vos *et al.* (1983) described in detail the procedures used in the large-scale population control of buffalo (and elephant and hippo) in the Kruger National Park. The method consists of darting the buffalo with an excess dosage of succinyldicholine chloride (SDC) as an immobilizing euthanizing agent which blocks the passage of signals from nerve to muscle, resulting in paralysis. Paralysis of the diaphragm and intercostals muscles sets in almost simultaneously with general skeletal paralysis. Hence hypoxia sets in quickly and brain activity decreases simultaneously in proportion to the degree of hypoxaemia. De Vos and co-workers rejected alternative central immobilizing agents like etorphine hydrochloride (M99), Fentanyl and phencyclidine hydrochloride (Sernalyn) as these drugs are stable and leave residues in the meat. The utilisation of the meat, by means of human consumption, normally forms an integral part of a population control program. As noted by Button *et al.* (1981) SDC is ideally suited for game cropping operations because:

1. SDC acts extremely rapidly and animals are immobilized and appear dead within 4 min after injection. This rapid immobilization prevents game moving far from the site of cropping and minimizes deleterious changes in meat quality associated with prolonged chasing, eg glycogen depletion. De Vos *et al.* (1983) noted that the mean distance between the two carcases furthest apart in a buffalo group culled was on average 88.5m.
2. SDC is highly soluble in water and can be made up in concentrated solutions, allowing suitably small volumes to be injected from a helicopter using projectile darts.
3. Residues of SDC in meat are apparently considered acceptable by public health authorities. Cooking and digestion also destroy SDC. Should humans absorb a few molecules after ingestion, they would be degraded within a matter of minutes by plasma pseudocholinesterase to metabolites that normally occur in the body – succinic acid and choline.

A second alternative considered by de Vos and his co-workers was shooting the buffalo with a high-powered rifle. However, this method was not regarded as suitable in a National Park as wounded animals could behave aggressively towards tourist vehicles. Furthermore the animals could come to associate man with danger thereby destroying the amicable relationship between animal and man. De Vos *et al.* (1983) noted that on the few occasions when the rifle method was attempted, the results were nearly disastrous, despite the fact that the shooters were regarded as being exceptionally good marksmen. Some animals were invariably wounded, understandably as buffalo represent a relatively small and fast moving target. Dutton (1978) regarded shooting from vehicles as the major flaw in the buffalo culling operation carried out in Marromeu in Mozambique.

De Vos *et al.* (1983) conceded that the SDC method is not entirely without stress and distress inducing phases. Hattingh and co-workers (1984) investigated this aspect by comparing the blood composition parameters of buffalo (and elephant) that were either shot, herded and shot or killed by an overdose of SDC. Their results showed statistically significant differences in a number of variables including plasma ACTH and cortisol concentrations. These changes were attributed to stress induced by a combination of herding and darting with SDC and asphyxia. A study by Button and Mülders (1983) showed that this response could largely be ascribed to conscious perception of asphyxia in conscious animals with resulting fear.

Objectives

The above-mentioned studies did not investigate the effect of the culling methodologies on the meat quality of the animals. In our investigations, the effects of shooting or using SDC on the muscle pH decline, muscle colour and water binding capacity (drip loss) were measured.

Methods

The buffalo were all part of a group that tested positive for TB and were thus to be culled. The capture methodology and the TB test period (3 days) during which phase the buffalo are confined in a boma, all cause the buffalo to be under a high level of stress. Buffalo testing TB positive are transported to a holding boma where they are kept for a minimum of six days so as to allow the metabolic breakdown of all the drugs utilised, prior to being culled. In the holding boma the animals have free access to water and hay, and after 3-4 days they do start consuming hay. The animals were then either shot with a high calibre rifle or killed with an overdose of scoline. The animals shot were divided into two groups: A which were stressed over a long period (3 days capture boma + 9 days holding boma) and B = which were stressed over a shorter period (3 days capture boma + 6 days holding boma). The animals in treatment C were subjected to the same stress conditions as treatment B (3 days capture boma + 6 days boma), except that they were killed with scoline.

Results and Discussion

Buffalo are notoriously difficult to kill due to the way that they lift their heads to challenge any person approaching. The head is either lifted high, which necessitates placing the bullet in a trajectory 1-2 mm above the snout or the head is lowered, which requires the bullet to go through the thick horn boss. The rifleman shooting the first group of buffalo (Treatment A) was either inexperienced or used too light a bullet load resulting in 3-4 shots being required to kill the animals. The animals from Treatment B

were killed with a single shot. The animals killed with scoline dropped within 1-2 mins of the administration of the drug. However they were still conscious 5-8 mins after drug administration (this is the period that it took to shoot all six animals). When all the animals were down, the rifleman moved into the holding pen and gave each animal (for all the treatments) an additional brain shot from close proximity to ensure that the animals were dead. Thereafter the muscle pH were taken and an exponential function ($y = a + b\ e^{(ct)}$) was fitted to the rate of pH decline with time as depicted in Table 1. What is interesting from the data in Table 1 is that the buffalo killed with scoline had a rate of pH decline three times faster than the buffalo shot with a rifle. The period of stress did not influence the pH decline between treatments A and B.

The CIElab colour parameters and drip losses of the *M. longissimus* of the buffalo from this investigation are summarised in Table 2. The muscle colour of the buffalo that were culled with scoline was paler (higher L* value) than that from the animals that were shot. Interestingly the animals that were wounded (Treatment A) also had a lighter muscle colour (though not significantly so) than those animals that were killed with a single bullet. These results clearly indicate that the acute ante mortem stress caused by the use of scoline (resulting in asphyxia as discussed) also causes the meat to show attributes associated with PSE meat. This is borne out further by the drip loss monitored; the muscle from these animals had a higher drip loss.

Conclusions

It can be concluded that the muscles of animals culled with succinyldicholine chloride show more negative physical meat quality attributes than when the animals are shot.

References

Button, C., Bertschinger, H.J. & Mülders, M.S.G. 1981. Haemodynamic and neurological responses of ventilated and apnoeic calves to succinyldicholine. *J SA Vet. Assoc.* 52: 283-288.

Button, C. & Mülders, M.S.G. 1983. Responses of unanaesthetised and pentobarbitone-anaesthetised sheep to a lethal dose of succinyldicholine. *J SA Vet. Assoc.* 54: 63-64.

De Vos, V., Bengis, R.G. & Coetzee, H.J. 1983. Population control of large mammals in the Kruger National Park. In Management of large mammals in African conservation areas. Haum Educational Publishers. P213-231.

Dutton, P. 1978. Marromeu – slaughter or wise harvest? *African wildlife* 32: 29-30.

Hattingh, J., Wright, P.G., De Vos, V., McNairan, I.S., Ganhao, M.F., Silove, M., Wolverson, G. & Cornelius, S.T. 1984. Blood composition in culled elephants and buffaloes. *J SA Vet. Assoc.* 55: 157-164.

Table 1: The calculated constants (LSMean ± std err) for the exponential equations fitted to the pH decline of buffalo subjected to different ante-mortem stress periods and killing methods

Treatment	Period stressed (days)	Killing method	$y = a + be^{cK}$		
			a	b	c
A	12	Shot	$5.503^{a} \pm 0.0225$	$1.193^{a} \pm 0.0610$	$-0.302^{a} \pm 0.0714$
B	9	Shot	$5.318^{b} \pm 0.0225$	$1.543^{b} \pm 0.0610$	$-0.220^{a} \pm 0.0714$
C	9	Scoline	$5.393^{c} \pm 0.0205$	$1.674^{b} \pm 0.0557$	$-0.722^{b} \pm 0.0652$

^{abc} – letters in the same column with same superscript do not differ significantly ($p>0.05$)

Table 2:The physical characteristics of buffalo *M. longissimus dorsi* exposed to different ante mortem stress factors

Physical Parameter		Treatment		
		A	B	C
CIElab	L*	$33.69^{ab} \pm 0.786$	$32.96^{a} \pm 0.786$	$35.59^{b} \pm 0.642$
	a*	$2.77^{a} \pm 0.366$	$3.68^{ab} \pm 0.366$	$3.90^{b} \pm 0.298$
	b*	8.09 ± 0.566	8.91 ± 0.566	8.36 ± 0.463
Drip loss (%)		$2.13^{a} \pm 0.457$	$1.33^{a} \pm 0.452$	$3.80^{b} \pm 0.369$

^{ab} – letters in the same row with same superscript do not differ significantly ($p>0.05$)