A comparison between the effects of two cropping methods on Red hartebeest meat quality

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Abstract

Cropping methods that induce the least amount of stress are key in ensuring acceptable meat quality from wild ungulates. The purpose of this study was to compare the effect of day and night cropping on the quality of Red Hartebeest (*Alcelaphus buselaphus*) meat. Ten animals were cropped during the day and ten at night. Emphasis was placed on ultimate pH (pH_u) and rate of pH decline. All pH measurements were adjusted to a standard temperature of 4^oC. There was no significant difference ($p > 0.05$) found between the mean pH_u values for day (5.70 ± 0.056) or night (5.68 ± 0.057) cropped animals. An exponential decay model ($Y = a + b\,e^{(-ct)}$) was fitted to the adjusted pH decline data. Non-linear regression analysis showed no significant difference ($p < 0.05$) in the rate of pH decline for day cropped ($c = -0.19 \pm 0.013$) or night cropped animals ($c = -0.19 \pm 0.013$). The results of this study indicate that there is no significant difference between the effect of day and night cropping on the rate and extent of pH decline of Hartebeest if an experienced cropping team is used.

Introduction

The potential of African ungulates for meat production has long been recognized (Ledger, 1963; Ledger, Sachs & Smith, 1967; Von La Chevallerie, 1972) and during the past 20-25 years the commercial utilization of wildlife has grown tremendously in South Africa (Mostert & Hoffman, 2007). Consumers are becoming increasingly aware of and concerned with the quality of meat products and in South Africa, game meat is often perceived as having a dark, unattractive colour as well as being dry. This may mainly be attributable to either pre-slaughter stress resulting in dark, firm and dry (DFD) meat or to the fact that wild ungulates are more active than domesticated animals so that their meat contains a higher amount of myoglobin and much less intramuscular fat (Hoffman *et al.*, 2005). The former is a problem that could be addressed by minimizing the ante-mortem stress experienced by the animals through proper and efficient cropping methodologies. The plains game species (Springbok, Impala, Blesbok, Hartebeest, etc.) in southern Africa are usually cropped either during the day or at night, using vehicles, helicopters or with the use of boma capture (Hoffman & Wiklund, 2006). Many authors have found night cropping to be the method least stressful to wild animals (Hoffman 2001; Kritzinger, 2002; Lewis *et al.*, 1997; Veary, 1991; Von La Chevallerie & Van Zyl, 1971) and this notion is generally accepted by most game meat producers. Most of the studies quoted were conducted on impala (*Aepyceros melampus)*, or springbok (*Antidorcas marsupialis*), two smaller species whose behaviour (found in herds, tend to stand and face the spotlight) is such that they are suitable for night cropping.

This study was conducted to determine the effect of day and night cropping on the meat quality parameters of Red Hartebeest (*Alcelaphus buselaphus*) meat, since, to our knowledge, this is the first study conducted on Red Hartebeest with regards to cropping methodology.

Materials and methods

For this study twenty Red Hartebeest were cropped at Neudamm Agricultural College in Namibia. Hartebeest are a gregarious species that predominantly occur in small (20-30 animals) harem or bachelor herds. The animals in this study were either cropped during the day or at night by a professional cropping team. At night, animals were spotted and blinded by 1-million candlelight spotlights. All the shots taken were either head or neck shots, with the exception of four animals that were wounded either in the stomach or leg and then shot a second time – this second shot was normally conducted within 60 - 120 seconds of the first. Viscera, stomach and intestines were removed in the field and tagged. Carcasses were then transported to an on-site veterinary laboratory where they were weighed, placed in a cool truck (5 -10^oC) and pH and temperature readings were taken in the *M. longissimus dorsi* (LD) at two to three hour intervals up until 24 hours post-mortem.

The differences between cropping methods (day and night) were, where appropriate, tested separately by means of the null hypothesis (H_o), with H_o:$\mu_1 = \mu_2$ and the alternate hypothesis (H_a) being H_a:$\mu_1 \neq \mu_2$. Significant (P<0.05) differences were found in rate of temperature decline between carcasses so that as a result, pH readings were standardized to 4^{o}C using the formula of Bruce, Scott & Thompson (2001). An exponential decay model ($y = a + b^{-ct}$) was fitted to the pH data and the constants a, b and c analyzed by analysis of variance (ANOVA) using SAS version 8.2 (SAS, 2002).

Results and discussion

The rate and extent of pH decline post-mortem is a generally accepted measure of pre-slaughter stress. The mean ultimate pH (pH_u) values taken at 48 hours post-mortem are depicted in Table I for both cropping methods in this study. Kritzinger (2001) found significant differences ($p \leq 0.05$) in mean pH_u between day and night cropped Impala, with a higher mean pH_u in the day cropped animals. Veary (1991) also found significant differences in pH_u between day and night cropped Springbok, with mean pH values for day cropped animals being consistently higher than those for night cropped animals. This is in contrast to the findings of this investigation, where there were no significant differences between treatments for pH_u.

Table I. Mean pH_u values (LS Mean ± SE) for day and night cropped Hartebeest

			Non-adjusted pH	**P < $\lvert t \rvert$**	**Adjusted pH**	**P < $\lvert t \rvert$**
Treatment	Day	pH_u	5.70 ± 0.056	0.883	5.74 ± 0.056	0.984
	Night	pH_u	5.68 ± 0.057		5.74 ± 0.057	

Rates of pH decline in post-mortem muscle have been estimated by regression of muscle pH values onto time post-mortem. However, the pH decline of post-mortem muscle deviates from a linear regression since it slows as the muscle enters rigor. Because of this slowed decline rate, the natural decline of pH in post-mortem muscle may be best characterized by an exponential decay model, as is the case in this study. Table 2 illustrates the constants for the exponential decay model fitted to the adjusted and non-adjusted pH data.

Table 2. The calculated constants (LSMean ± SE) for the exponential equations fitted to the pH decline under normal temperature conditions and under adjusted standard temperature (4^{o}C) for day (n = 10) and night (n = 10) cropped Hartebeest

$Y = a + be^{-ct}$ Constants	**Treatment**	**Non-adjusted pH**		**Adjusted pH**	
		Mean ± SE	**P < $\lvert t \rvert$**	**Mean ± SE**	**P < $\lvert t \rvert$**
a	Day	5.21 ± 0.358	0.336	5.74 ± 0.038	0.230
	Night	4.75 ± 0.312		5.68 ± 0.036	
b	Day	2.10 ± 0.359	0.846	2.13 ± 0.133	<.0001
	Night	2.19 ± 0.312		1.36 ± 0.128	
c	Day	-0.15 ± 0.016	0.026	-0.19 ± 0.013	0.820
	Night	-0.20 ± 0.014		-0.19 ± 0.013	

The exponential decay model, $y = a + b^{-ct}$, fitted the pH data well with R^2 values for non-adjusted pH ranging from 0.905 to 0.994 and those for adjusted pH ranging from 0.797 to 0.985. The only significant differences between treatments were for constant b ($p < 0.001$) for adjusted pH. Although constant b, when added to constant a, gives an indication of the initial pH value, Table 2 indicates that there were no significant differences in either ultimate pH (constant a) or the rate of pH decline (constant c). This indicates that although treatment may have had a slight effect on initial pH, the effect was not significant and did not influence the ultimate pH or rate of pH decline in any way. This is in contrast to the finding of Kritzinger (2001) and Hoffman (2000) who found that and rate of pH decline (constant c) were higher for day cropped animals than for night cropped animals indicating that day cropped animals experienced more ante mortem stress. This may be attributed to the fact that for these two experiments, the shooters were not members of a professional culling team, as was the case in this investigation, which may have led to the animals experiencing more ante mortem stress. The shots fired in the present investigation were also at a longer distance than the previous research resulting in the Hartebeest being less aware of the hunters.

Conclusions

The results of this study show that there is no significant difference in rate and extent of pH fall post-mortem between day and night cropped Hartebeest. This is in contrast to the findings of other authors who found that night cropping had a significantly better effect on meat quality because of a reduction in stress (Veary, 1991; Hoffman, 2000a, 2000b, 2001a; Kritzinger, 2001; Lewis *et al.*, 1997). These authors concluded that wild ungulates were less active at night and less aware of the hunting vehicles so that they experienced less stress during night cropping than during day cropping. It may be that this effect is species specific so that in the case of Hartebeest, there is no difference in the amount of ante-mortem stress experienced between night and day cropped animals. The effect of day and night cropping on the meat quality of other large antelope is an aspect that requires further research.

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