Some Traits of Fallow Deer and Wild Boar Meat as Affected by Hunting Withdrawal: First Results

Amici A.[1], Meo Zilio D. [2],
Ficco A. [2], Primi R. [1], Serrani F. [1], Failla S. [2], Contò M. [2]

[1] Department of Science and Technology for Agriculture, Forestry, Nature and Energy (DAFNE), Tuscia University, Via De Lellis, Viterbo, Italy

[2] Center for Research and Experimentation in Agriculture, department of Meat Production and Genetic Improvement (CRA-PCM), Rome, Italy

Abstract— ***Killing conditions may imply risk for safety and uncertainty in post-mortem meat processes. Objective of this paper was the evaluation of influence of hunting technique on main meat quality traits in wild boar (Sus scrofa) and fallow deer (Dama dama). Since last decade, the number of wild ungulates showed an increase both in Europe and in Italy. This induced an increase in culling rates and venison availability for consumers and the market. Meat from hunted wild ungulates undergoes several steps from the field to the consumer, implying a possible decline in meat quality and uncertainty in post-mortem processing steps. 25 wild boars and 14 fallow deer were investigated. They were hunted in different ways: dog drive hunting and still hunting, that imply a stressful escape or not. Still hunted animals provided meat with higher water loss: + 1,7 % and + 2,6 % thawing and cooking loss, respectively. The hunting technique seems neither to have any relevant effect on water loss nor on colour features. Anyway, meat from dog drive hunted animals showed paler and yellower than the other (L* 38.62 vs 31.74 P<0.05; b 12.65 vs 9.65 P<0.05). Outcomes confirm stress as source of abnormalities in meat quality. These anomalies might result discordant as a function of the species taken into account.***

Keywords—**ungulates, meat, stress**

I. INTRODUCTION

Number of wild ungulates is supposed to steady increase both in Europe and in Italy in the incoming decade [1]. That induced an increase in culling rates and venison availability for consumers and market [2]. Quality of cervid and wild boar meat from different feeding and farming conditions [3] [4] have been studied over the last two decades. At present, there is a lack of available data on intra-specific variability, species, gender, age, technique of shooting, post-mortem processing of free ranging animals [3].

Therefore, the aim of this study was to investigate the effects of hunting technique and slaughtering process on the main meat quality traits in wild boar (*Sus scrofa*) and fallow deer (*Dama dama*).

MATERIALS AND METHODS

A. Hunting technique Wild boars and fallow deer were sampled in wild conditions according to Italian rules on hunting. The two techniques utilised in this paper for harvesting samples are dog drive hunting (D) and still hunting (S). The first imply the use of dogs to drive the animals toward the hunters, represent the traditional hunting technique for wild boar in Italy, and also entails a stressful and often long lasting escape of the animal. The second technique utilised consists in waiting for game in favourable site (by usually standing on a tree or a tower), is often utilised in containment programs to maintain a balanced eco-system [3], and implies the unconsciousness of shooting for the animal. All the animals were ear tagged and a format was filled with the most relevant harvesting data: date and time of shooting, time of bleeding (in the field), note on the effect of shooting, time of arrival at slaughterhouse. Shooting and jugulation were performed by skilled personnel.

B. Animals

Although sampling has been planned in order to be balanced for groups it was very difficult to obtain this

requisite in field conditions. The main reasons were the population structure (males vs. females, adults vs young, etc.) and the employment of different hunting techniques. 25 wild boars and 14 fallow deer were used for 21 females (F) and 18 males (M) in all. The animals were grouped into two classes according to the age: young (12 heads ≤ 15 months) and adults (27 heads within 20 and 40 months) following the experimental design showed in Table 1.

C. Culling period

Animals were collected between October and February, when the weather conditions were generally good (not rainy) and without snow cover. Environmental and weather conditions were recorded in two weather stations located in the hunting areas.

D. Sampling areas

Animals were harvested in the National Preserve of Castelporziano (Roma), during a containment program to reduce animals overabundance, and in the hunting district of Viterbo Province, two areas of Central Italy.

E. Data collection

Before slaughtering, the following data were individually recorded: species, age, sex, weight (partially blooded), carcass weight and physiological state (e.g. pregnancy). All the animals were slaughtered within two hours after shooting. Carcasses were dissected and a portion of left side *longissimus dorsi* muscle (LD) of nearly 300 g, between the 2nd and the 4th rib, was taken and frozen at -20 °C according to a twofold timing scheme: freezing *ante rigor mortis*, no later than 8 hours *post mortem* (Pre), and freezing *post rigor mortis*, within 8 and 20 hours *post mortem* (Post), after having been chilled at + 2 °C. All the samples were vacuum packed in plastic bag before freezing. Since the animals were hunted in different areas and conditions, it was impossible to register body condition scores and digestive tract content.

F. Sample analysis

Individual meat samples were thawed out and submitted to the following physical and chemical measures: pH, colour, thawing loss, cooking loss, shear force on cooked meat and percentage of chemical components (dry matter, ash, fat, protein).

- pH by a pH meter "Hanna" Hi 98240 with a probe;
- Colour: colour indices (lightness L*, red a*, and yellow b*) were determined on raw meat by using D65 illuminant after 1 h of oxygen exposition by a reflectance spectrophotometer Minolta CM-2006d [5]
- Taw loss and cooking loss: according to [6]
- Warner-Blatzer shear force on cooked meat (SF) was determined in four 1 x 1cm cross section strips using an INSTRON 5543 texturometer. A 50-kg compression load cell and a crosshead speed of 100 mm/min were used.
- Chemical composition (dry matter, fat, protein, ash) [7]

E. Statistical analysis

Statistical analysis was performed by GLM procedure of SAS [8], adopting a model including species, sex, time of freezing, hunting technique and interactions between the main factors.

	Technique				Total
Wild boars					
Number	D		S		
	16		9		
	Pre	Post	Pre	Post	
	9	7	5	4	
Total					25
Fallow deer					
Number	D		S		
	9		5		
	Pre	Post	Pre	Post	
	5	4	2	3	
Total					14
Grand total					39

Table 1: Experimental design of trial
D: drive hunted; S: still hunted,; Pre: frozen by 8 hours; Post: frozen within 8 and 20 hours

II. RESULTS

No differences resulted from chemical analysis neither for hunting technique nor for sex, (dry matter 25.41±1.31 %; ash 1.27±0.18 %; fat 2.3±1.11 %; protein: 21.4±0.89 %), except for dry matter (24.64±0.98 % vs 25.60 ± 1,47%, P < 0.05 for males and females respectively). As for fat, females showed a trend to be fattier than males (2.97 v. 2.27 %, P < 0.1). Such tendency seems to be reflected in a slightly higher toughness of cooked male meat (SF) when compared to the female one (4.64±1.6 kg vs 3.66±1.27 kg, P=0.053).

No differences emerged from comparison between the age classes.

Main selected factors are shown in Table 2, while significant interactions are reported in Fig 1-3.

Wild boars showed a higher water loss than fallow deer. With regard to the hunting technique, still hunted wild boars were characterized by higher moisture loss than those belonging to D group both as thawing and cooking loss (Fig. 1). Analysis of freezing time data highlights a not trivial water loss in meat frozen *post rigor mortis* for still hunted animals (Fig. 3).

Meat of fallow deer is less bright and redder (L* 30.22 vs 40.14; a* 12.72 vs 8.04, P<0.01)

Dog drive hunted wild boars resulted generally paler than fallow deer. Hunting technique shows to have a direct and meaningful influence on colour parameters. In fact, L* and b* values resulted to be higher on dog drive hunted wild boars, probably for the stress generated by this method. Fallow deer showed a similar trend, even though differences are not significant (Fig. 2).

Different freezing timing did not affect fallow deer meat characteristics whilst, Post treatment deeply influenced meat water loss (Fig. 3).

No differences lie in pH and tenderness for all factors taken into account. An exception was deer meat which showed a tendency to be more tender (P = 0.076).

	Specie		Hunt		Time		M	RMSE
	W	F	D	S	Pre	Post		
pH	5.63	5.67	5.63	5.67	5.68	5.62*	5.65	0.081
Tl %	10.81	7.86*	8.34	10.36	8.26	10.44	9.38	2.779
Cl %.	31.37	28.00*	28.07	31.31*	29.76	29.61	29.64	2.963
SF kg	4.72	3.58	4.03	4.27	4.00	4.29	4.35	1.384
L*	40.14	30.22**	38.62	31.74*	33.87	36.49	38.10	6.656
a*	8.04	12.72**	10.78	10.58	11.69	9.07	9.66	3.750
b*	12.01	10.69	13.05	9.65*	11.83	10.87	12.2	3.183

Table 2: Effects of species, hunting techniques and ageing times on physical quality of LD (w = wild boars; F = fallow deer; D = drive; S = still; M = means; T l = thawing loss; C l.= cooking loss SF=share force). Note: * p<0.05; **P<0.01; *** p<0.001

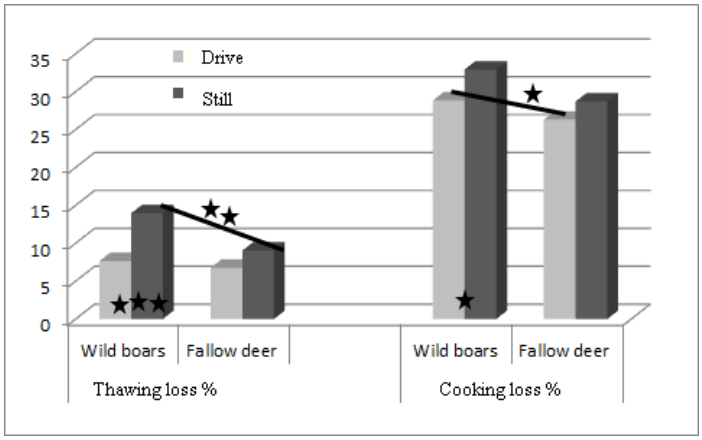

Fig. 1: Water loss as affected by species and hunting technique (Note: * p<0.05; **P<0.01; *** p<0.001)

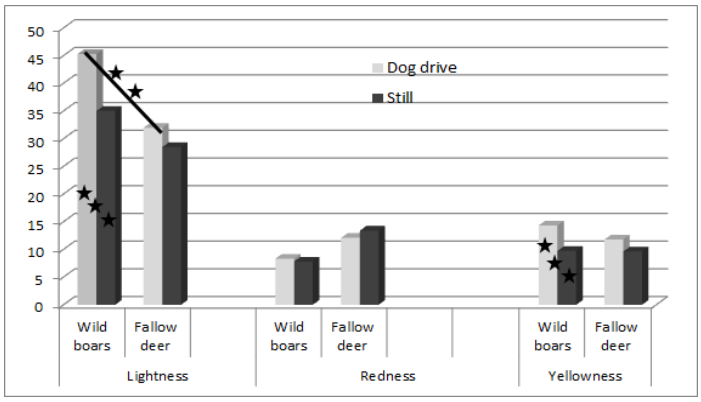

Fig. 2: Colour as affected by species and hunting techniques

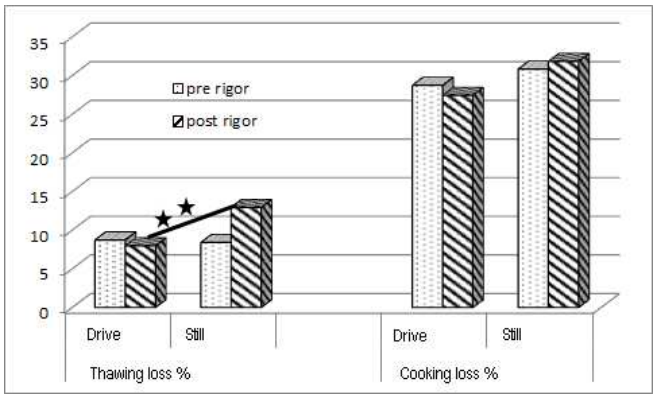

Fig. 3: Water loss as affected by hunting techniques and ageing times

III. DISCUSSION

The results showed that meat from S treatment animals underwent higher thawing and cooking losses than D treatment. Though stress is well known to be highly correlated with WHC reduction (Pears et al., 2009), the effect of S treatment might be due to the dehydration of animals during their escape. Therefore, the result of stress induced by hunting technique resulted to be hidden by the animal physiological condition. As for meat colour, findings are consistent with previous studies on the connection between colour stability and stress [9] and can be explained by stress-induced protein denaturation. The higher water loss in meat frozen post rigor mortis confirms its higher maturation. This last statement is strengthened by the tendency to lower pH and higher tenderness, though not statistically important [10]

IV. CONCLUSION

Not standard post hunting meat processing may affect final quality of meat. The stress induced by the course and incomplete bleeding in hunted game could cause a lowering in meat colour stability and a worsening in meat quality. Anyway, these results highline controversial effects. Outcomes point out the need of further studies and confirm the stress as the cause of a number of abnormalities in meat post-mortem processes. These anomalies might result discordant as a function of the species.

AKNOWLEDGMENTS

The experiment has been possible thanks to the collaboration in field activity and sample and data collection of the National Preserve of Castelporziano (General Secretariat of the President of Italian Republic-Roma) and the Viterbo Province Administration.

REFERENCES

1. Milner, J.M., Bonenfant, C., Mysterud, A., Gaillard, J-M., Csányi, S., Stenseth, N.C., 2006. Temporal and spatial development of red deer harvesting in Europe: biological and cultural factors. J. Appl. Ecol. 43:721-734

2. Ramanzin M., Amici A., Casoli C., Esposito L., Lupi P., Marsico G., Mattiello S., Olivieri O., Ponzetta M.P., Russo C., Trabalza Marinucci M. (2010) Meat from wild ungulates: ensuring quality and hygiene of an increasing resource. Ital J Anim Sci 9(4):318-331

3. Skewes, O., Morales, R., González, F., Lui, J., Hofbauer, P., Paulsen, P., 2008. Carcass and meat quality traits of wild boar (Sus scrofa s. L.) with 2n=36 karyotype compared to those of phenotypically similar crossbreeds (2n=37 and 2n=38) raised under same farming conditions. 1. Carcass quantity and meat dressing. Meat Sci. 80:1200-1204.

4. Volpelli, L.A., Valusso, R., Morgante, M., Piasentier, E., 2003. Meat quality in male fallow deer (Dama dama): effects of age and supplementary feeding. Meat Sci. 65:555-562

5. Cassens R.G., Demeyer D., Eiklenboom G., Honikel K.O., Johansson G., Nielsen T., Renerre M., Richardson I. Sakata R., (1995). Recommendation of a reference method for assessment of meat colour. In: Proceedings of the 41st ICOMST, San Antonio, Texas, 1995, C86, 410-411.

6. Honikel, K. O. (1998). Reference methods for the assessment of physical characteristics of meat. Meat Science, 49, 447–457.

7. AOAC (1990). Official methods of analysis of the AOAC, 15th ed., Ed. Ass. Off. Analyt. Chemists, Washington

8. SAS (1985). SAS user's guide statistics. Ed. Cary (NC) SAS Institute Inc. USA.

9. Pearce K.L., Rosenvold K., Andersen H. J., Hopkins D. L. (2011). Water distribution and mobility in meat during the conversion of muscle to meat and
ageing and the impacts on fresh meat quality attributes — A review. Meat Science 89, 111–124.

10. Silva J.A, Patarata L., Martins C. (1999). Influence of ultimate pH on bovine meat tenderness during ageing, Meat Science 53, 453–459.