Wild boar captured in a large corral-style trap or hunted: preliminary comparison of meat quality traits

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Abstract

The management and numerical control of wild boars mainly depend on hunting practices, even if other alternative strategies such as the use of traps and cages can be adopted. There is little information available on the quality of captured wild boar meat. The aim of this study was to evaluate the meat quality of wild boars captured with a large corral-style trap compared to still hunting and collective hunting methods. *Longissimus dorsi* samples were collected from 60 wild boars, 20 of which were obtained by trapping, 20 by still hunting, and 20 by collective hunting. The animals considered were 32 males and 28 females, weighing between 42 and 68 kg. Muscle pH has been recorded at 1, 24, and 48 hours *post-mortem*. Furthermore, after 24 hours, color, drip loss, cooking loss, and Warner-Bratzler shear force were also evaluated. Trapping with large enclosures such as corral-style traps, if properly managed, does not seem to adversely affect the quality traits of wild boar meat, which were found to be like those obtained by the still hunting method.

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Introduction

The wild boar population in Europe is constantly growing due to its high fertility rate and remarkable ability to adapt to different conditions and environments. The rise of these wild ungulates is increasingly causing economic, environmental, and public health issues (Massei *et al.*, 2015; Croft *et al.*, 2020; Johann *et al.*, 2020). Wild boars may represent a reservoir for several pathogens, and they can therefore be involved in the diffusion and transmission of diseases to both humans and domestic animals (Fredriksson-Ahomaa, 2019; Altissimi *et al.*, 2023). Recently, the major concern related to wild boar is its role in the diffusion of African swine fever to pigs, which can lead to devastating socio-economic impacts in many countries (Sauter-Louis *et al.*, 2021; Ladoşi *et al.*, 2023). Perform a strong reduction of wild boar population not only in restricted and outbreak border areas was recommended (Reichold *et al*., 2022). It is, therefore, necessary to carry out proper control and containment of these wild animals, traditionally performed by hunters, while other strategies such as traps, cages, or enclosures are now also authorized. This approach could generate a large amount of meat available on the market, but its quality may be different according to the pre- and post-harvesting methods adopted. Wild boar meat quality can be affected by several factors, such as environmental, animal-related, animal welfare, hunting method, and *post-mortem* procedures (Ranucci *et al.*, 2021; Tomljanović *et al.*, 2022; Fabijanić *et al.*, 2023).

The effects of trapping on wild boar welfare are reported in the literature (Fahlman *et al*., 2020; Westhoff *et al.*, 2022), but the impacts on meat quality, to our knowledge, are not yet reported.

The aim of this study was to evaluate the meat quality parameters of wild boars captured with a corral-style trap compared to still hunting (SH) and collective hunting (CH) methods.

Materials and Methods

The trial was conducted from October 2021 to October 2022 in the Umbria region (Central Italy) on 60 wild boars, of which 20 were obtained by CH, 20 by SH, and 20 by trapping (T). Hunted animals were collected from the northern area of Umbria (Gubbio, Valfabbrica, and Gualdo Tadino), while trapped wild boars were obtained from a corral trap located in a private hunting reserve in the same area. CH is a traditional wild boar hunting method performed during hunting seasons, where wild boar is chased by dogs and run towards shooters in fixed positions, thus the shot accuracy could lead to a wounded animal; SH is performed without dogs, only with a few hunters in hidden shooting spots waiting for animals that are generally unaware of the event until their death. T is an efficient technique that could be used in addition to hunting as a tool to control and regulate the wild boar density population (Torres-Blas *et al.*, 2020). There are several types of traps: cages, enclosures, and traps of different sizes. In this study, a large corral-style trap has been used (30×20 m) (Figure 1). The trap was baited with corn and consisted of a release mechanism that closed the gate when the animals reached the feeding area (located in the middle of the trap). To facilitate culling procedures, animals were led into a smaller cage, allowing them to calm down before stunning (performed with a captive bolt pistol) and bleeding.

The animals considered were 32 males and 28 females, weighing between 42 kg and 68 kg. After culling, all wild boars were promptly transported to a collection center, eviscerated, and refrigerated without skinning at 5±1°C. After 24 hours, portions (10×10 cm) of *Longissimus dorsi* were collected and quickly transferred to the laboratory of the Department of Veterinary Medicine of the University of Perugia for physicochemical determinations. pH was measured at 1 hour directly on the field and at 24 and 48 hours *post-mortem* in the laboratory using a pH meter equipped with an insertion electrode (Crison 20, Barcelona, Spain). Furthermore, at 24 hours *post-mortem,* color, drip loss, cooking loss, and Warner-Bratzler shear force (WBSF) were evaluated. Meat color was performed in triplicate on the surface of the muscle and oxygenated for 30 minutes at 4°C with a Minolta Chromameter (Cromameter CR400, Osaka, Japan), calibrated on a standard white tile. Lightness (L*), redness (a*), yellowness (b*), chroma (C), and hue angle (H) were determined in line with the CIE Lab System (CIE, 1986). For the drip loss determination, meat samples (4.5×4.5×2.5 cm) were initially weighed (Ohaus Adventurer Pro balance weight, Parsippany, NJ, USA) (average weight: 54.60±2.15 g), placed in a plastic box with a grid parallel to the fiber direction, refrigerated for 24 hours at 5°C, and weighed again after drying it with absorbent paper. The determination of cooking loss was carried out by placing each meat sample (6.0×6.0×2.5 cm; average weight of 84.22±2.01 g) in a plastic bag, cooking it in a water bath at 80°C for 1 hour, finally cooling it under running tap water for 30 min., and weighing again to calculate the water loss after drying it with absorbent paper. The water-bath-cooked samples were used for WBSF by sampling 3 cylindrical cores (Ø 1.25 cm^2) parallel to muscle fibers. The Warner-Bratzler device was mounted on a texturometer (Perten, TVT6700, Perten Instrument, Segeltorp, Sweden) to evaluate the shear force of the muscle cutting perpendicularly to the fibers. Data were collected in an Excel sheet, and statistical analyses were performed by the Microsoft Excel statistical tool (Microsoft, Redmond, WA, USA). A one-way analysis of variance model was performed by considering as a fixed factor the harvesting method (T, SH, and CH), while gender (male and female) was deleted from the model as not significant in previous statistical analyses. The difference in the mean values was evaluated by the Tukey test, with significance set at $p<0.05$. The correlation among the different quality indices considered was also performed using Pearson's correlation test ($p<0.05$).

Results

The results of pH measurements recorded at 1, 24, and 48 hours *post-mortem* are reported in Figure 2. Regarding pH determinations at 1 hour, there were no significant differences between T and SH, while CH resulted significantly different, with lower values as compared to the other groups. At 24 hours, the analogy between T and SH was confirmed, with a physiological decrease in pH values in both groups. At the same time, CH measurements significantly differed from the other 2 groups, and higher values were recorded. pH determinations at 48 hours were in line with those previously obtained at 24 hours, where T was lower than CH, while at this time SH did not show any statistical difference between T and CH. Concerning the meat color (Table 1), no difference in the L* values was detected between T and SH, while CH showed lower values than the other groups. Regarding b* and H values, the T group

Figure 1. Large corral-style trap.

Table 1. Color mean values. Different letters in the same column indicate statistical differences ($p<0.05$).

	L*	a*	b*	C	H
T	39.45 b	19.18	9.24 b	21.39	64.23 a
SH	38.01 b	18.68	8.27 ab	20.53	65.48. ab
CH	34.55 a	18.39	7.26 a	19.82	68.89 b
SEM	0.903	0.675	0.443	0.730	1.128
p	>0.001	0.705	0.010	0.323	0.014

L*, lightness; a*, redness; b*, yellowness; C, chroma; H, hue angle; T, trapping; SH, still hunting; CH, collective hunting; SEM, standard error of the means recorded similar measurements to SH and higher values compared to CH. No significant differences were found between the 3 experimental groups for the a* and C indices. As shown in Table 2, meat from the T group showed a higher percentage of water loss compared to both SH and CH. However, cooking loss determinations did not reveal any statistical differences between the 3 groups. WBSF was evaluated, but no significant differences between groups were found. Significant correlations were recorded between L* value and pH at 24 and 48 hours ($p<0.05$) with an inverse correlation (-0.604 and -0.547 between L* value and pH at 24 and 48 hours, respectively) and between L* value and drip loss ($p<0.05$) with a partial positive correlation (0.301).

Discussion

Results regarding pH measurements highlight a physiological decrease in pH values over time in wild boars' meat obtained by both T and SH methods. A different trend was observed in meat samples achieved by CH, where abnormal acidification over time was detected, with values lower at 1-hour *post-mortem* than T and SH but higher at 24 and 48 hours *post-mortem*. pH is one of the most considered parameters to assess the effect of animal stress on meat quality and, therefore, on its shelf life. Abnormalities in pH drop could be related to different chronic and acute stress conditions, but these studies have been mainly performed on pigs or other livestock. In the literature, several values are reported as optimal, and different thresholds were set to indicate quality defects such as pale soft exudative and dark firm dry (DFD) for pork (Boler *et al.*, 2010; Faucitano *et al.*, 2010; Fabijanić *et al.*, 2023), whereas scarce literature regarding wild boar meat is available. Viganò *et al.* (2019) considered a classification system for game meat quality based on pH values, where meat samples with pH<5.8 are considered good quality, 5.8<pH<6.2 as intermediate-DFD, and pH>6.2 as DFD. Taking as reference this categorization, in the T group, average pH values at 24 hours were above 5.8, while the SH groups had an average value slightly over 5.8 (5.85), but not significantly different from T. Indeed, CH could be defined as intermediate-DFD (pH=5.99). It is known that *ante-mortem* stress adversely affects *post-mortem* pH decreases (Stanisz *et al.*, 2019) due to the complete or rapid consumption of muscular glycogen content, which leads to abnormal acidification. Taking into consideration that stress is minimal in SH since the animals are not conscious of the hunting until death, the results of T indicate a minimal stress of the trapped animals. Large-size traps, such as corral traps, allow to catch many wild boars simultaneously, and it has been shown that the stress level (measured with serum cortisol levels) is lower in animals caught in groups of at least 5 wild boars rather than a single individual in small cages (Westhoff *et al.*, 2022). Instead, CH has a higher final pH, and it can be assumed that more stress is generated for the animal by this kind of hunting technique. The pH decrease is also related to the meat color change in water holding capacity. Meat color plays a crucial role in consumer perception and choice. Game meat is usually distinguished by a darker color, although it is affected by several factors such as the concentration of myoglobin and its different forms, physical activity, muscle type, kind of muscle fiber, *ante-mortem* stress, age, and diet (Suman and Joseph, 2013; Pedrazzoli *et al.*, 2017; Tomasevic *et al.*, 2018). L* index showed that meat samples from the T and SH groups were brighter than those from the CH group, which is in line with the pH values recorded. Moreover, L* index outcomes for T and SH are typical for game meat and similar to other authors' findings (Kasprzyk *et al.,* 2019; Palazzo *et al.*, 2021). The lower L* values of CH confirm the possible intermediate-DFD condition. No statistical difference between experimental groups was noticed regarding a* values, probably due to the more relevant influence of the content of myoglobin in the muscle than other environmental and stress factors (Fernández-López *et al.*, 2000). Meat obtained from trapped wild boars reported higher b* values, which could be attributable to environmental conditions. Indeed, T samples were obtained using a single corral trap located in a private hunting reserve where corn meal-based bait was used to attract the animals inside the traps, while SH and CH animals were hunted in different areas with disparate floristic compositions of pasture and forest. The different diets may have affected the b* index (Pedrazzoli *et al.*, 2017).

Drip loss determinations underline a higher percentage of water loss in T samples compared to SH and CH, resulting in another contribution to the definition of the low presence of DFD meat among this group. Animal gender did not significantly influ-

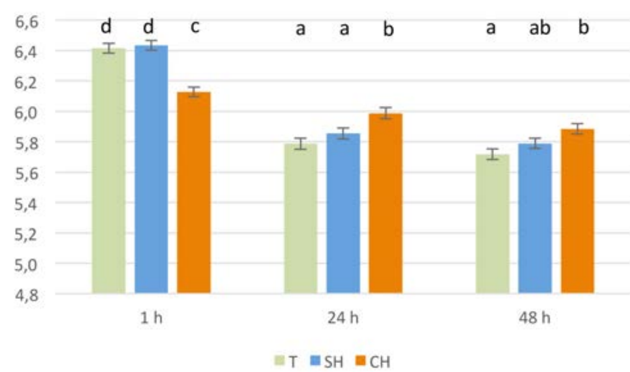

Figure 2. Mean values and standard deviation (bars) of pH at 1, 24 and 48 hours *post-mortem.* Different letters (a, b, c, d) indicate statistical differences between mean values ($p<0.05$). T, trapping; SH, still hunting; CH, collective hunting.

Table 2. Mean values of drip loss, cooking loss and Warner-Bratzler shear force. Different letters in the same column indicate statistical differences between mean values for different experimental groups ($p<0.05$).

	Drip loss (%)	Cooking loss (%)	WBSF (N/cm²)
T	1.72 b	32.03	55.84
SH	1.25 a	33.09	56.32
CH	1.02 a	33.00	53.45
SEM	0.142	0.854	2.363
p	0.004	0.620	0.782

WBSF, Warner-Bratzler shear force; T, trapping; SH, still hunting; CH, collective hunting; SEM, standard error of the means, ence the drip loss values, contrary to the findings of Ludwiczak *et al.* (2020), where drip loss was higher in the meat of males than females. Regarding cooking loss, no statistical differences were noticed, and the values obtained in this study are similar to those of Cifuni *et al.* (2014). Instead, Borilova *et al.* (2016) reported higher cooking loss values, but for shoulder and hind leg muscles. Fabijanić *et al.* (2023) noticed sex-related differences, as males' meat cooking loss was higher than females' one. Concerning WBSF measurements, no significant differences were found between experimental groups, and the values achieved are in line with those of Florek *et al.* (2017). It is important to remember that other *post-mortem* activities performed by hunters, such as bleeding, evisceration, and refrigeration, could surely have influenced meat quality (Stella *et al.*, 2018; Ranucci *et al.*, 2021).

Conclusions

This survey highlights that large corral-style traps do not seem to adversely affect the quality parameters of wild boar meat that are similar to those obtained by the best practice of still hunting. Regarding quality indices observed, meat obtained by collective hunting appeared intermediate-DFD and could pose a risk for higher spoilage and pathogen microbial growth. The meat quality of trapped wild boars detected could therefore contribute to establishing a consistent, self-sustaining boar meat chain. Further studies are needed to evaluate the effects of other types of traps on the quality characteristics of wild boar meat and different animal welfare indicators.

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