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Reply to Arnemo and Kreeger: "Commentary on 'Influence of Ambient Temperature and Confinement on the Chemical Immobilization of Fallow Deer (*Dama dama*)'"

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We thank Arnemo and Kreeger (2017) for an opportunity to expound on the techniques we used in our study on the immobilization of fallow deer (*Dama dama*; Costa et al. 2017). Arnemo and Kreeger commented on dart placement and impact, ambient temperatures, the doses of drugs we used, factors affecting drugging, and the conclusions of our work. The aim of our study was to evaluate the influence of climatic and environmental conditions on chemical immobilization of fallow deer based on physiological parameters, and the duration and quality of immobilization. Group A deer, living free, were captured in winter with 1 mg/kg of xylazine and 1 mg/kg of tiletamine/zolazepam. Group B deer were captured in spring with 2 mg/kg of xylazine and 1.5 mg/kg of tiletamine/zolazepam, after being grouped in a pen. The choice to increase the dosage in the latter group was made because of an initial evident lack of pharmacological effects.

Heart rates remained constant throughout monitoring in both groups. Respiratory rate and oxygen saturation were lower in Group B. Body temperature and blood lactate concentration were significantly higher in Group B. Induction and immobilization quality were best in Group A. General anesthesia was not achieved in either group. Induction time and duration of recumbency were approximately 8 and 50 min, for Group A and Group B, respectively.

Environmental conditions of capture, high temperatures, and muscular stress probably contributed to the need to increase the dosage of anesthetic for chemical immobilization of the deer (Costa et al. 2017).

In our study, we used only optimal dart hits (i.e., in the thigh muscles). We used an 11-mm barrel for 3-mL darts and a 13-mm barrel for 5-mL darts in all the animals. As all were in good body condition, we detected no differences (Arnemo et al. 2011; Bergvall et al. 2015). We did not find any hemorrhage or tissue trauma in any animals because we darted the animals from a short distance (20–30 m) and needed a lower velocity and a weaker propulsive energy (5–6 atm). As for drug volumes, we used different volumes with different darts, but both dart types worked excellently. On other occasions, we used 1 mg/kg of a 10% solution of xylazine (a higher concentration) to obtain a lower volume of drug, with the same results.

As "winter and spring" immobilizations, in both seasons we darted all subjects in 1 day, there was no snow in winter and no excessive sunshine in spring, as we worked within a wooded area. The difference of temperature was 10 C, an important difference when working in Sicily. We started with the minimum suggested drug amounts, and then increased the dosage because we thought that the struggling animals needed higher concentrations.

The deer in Group B showed nervous behavior because they had been gathered in an enclosure before immobilization. Body temperatures and blood lactate concentrations were significantly higher in Group B, an effect likely associated with environmental conditions of capture (high temperature), increased muscular exertion, limited space, and fear. These factors contributed to the need for an increased dosage of anesthetics to immobilize the deer (Bibby and Grimble 1988). Trapping conditions did not affect the dose of anesthetic drugs used in white-tailed deer (*Odocoileus virginianus*; Boesch et al. 2011) but those animals were not free to move into their trap.

However, they showed significantly higher lactate levels compared to those caught in the wild.

Having presented the environmental conditions, the dosage and volumes of drugs used, the size and the power of darts, and the inoculation site, we feel that our study is repeatable, and that the need for different dosages was probably caused by stress and environmental temperatures at the time of capture.

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