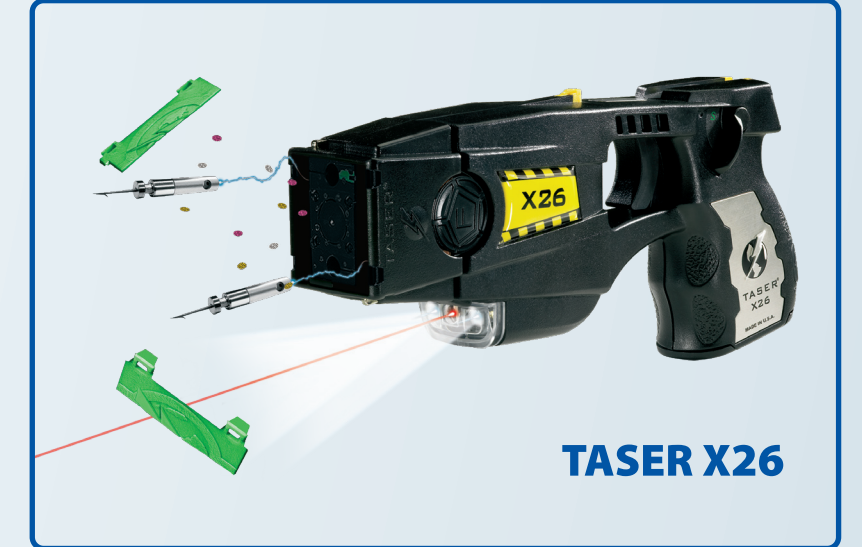


## Introduction

The mechanisms of death in many arrest-related deaths are unclear. Some authors have opined that deaths may be related to a metabolic acidosis.

In this study, we compared markers of acidosis during several simulated use of force encounters.



## Methods

This was a prospective study of human subjects. The subjects were a convenience sample of law enforcements officers receiving a training exposure. Subjects were randomized to one of five groups:

- 1) a 150 meter sprint, simulating flight,
- 2) 45 seconds of hitting and kicking a heavy bag, simulating physical combat,
- 3) a 10-second TASER X26 exposure,
- 4) a K-9 training exercise of approximately 30 seconds, and
- 5) an oleoresin capsicum (O.C.) exposure to the face.

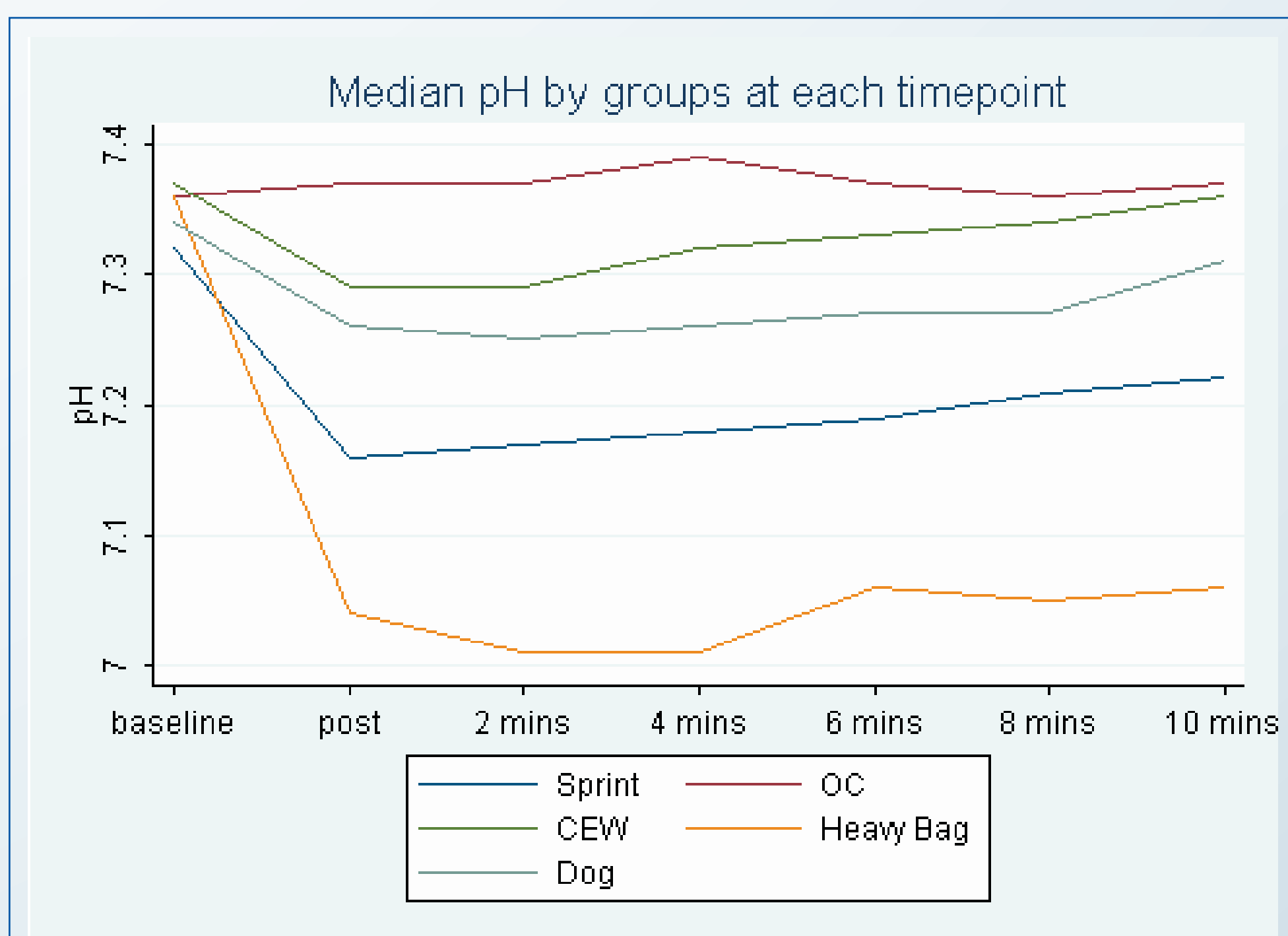


Subjects had an intravenous catheter placed by a physician or paramedic prior to the test. Baseline pH and lactate were drawn at that time. Subjects then participated in their assigned task. pH and lactate were drawn immediately after the task and every 2 minutes for 10 minutes.

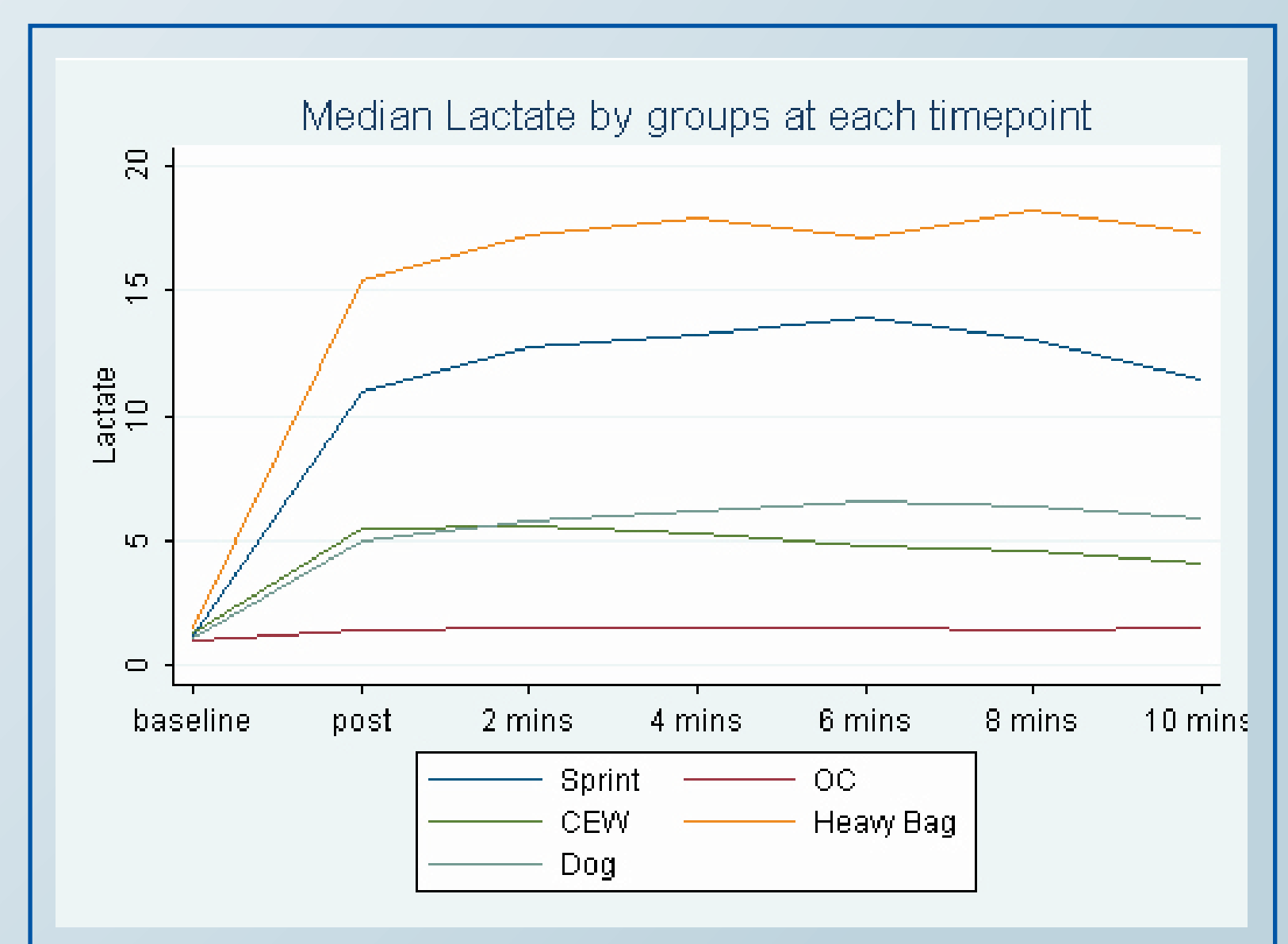
## Results

The median pH at baseline was 7.36 (range 7.28 to 7.44). There was no difference between the groups ( $p=0.23$ ). The median post-task pH was lowest for the heavy bag group at 7.01 (range 6.94 to 7.18, IQR 6.99 to 7.05), followed by the sprint group at 7.16 (range 7.05 to 7.31, IQR 7.13 to 7.31). The K-9 group was next at 7.26 (range 7.30 to 7.40, IQR 7.22 to 7.31), followed by the TASER group at 7.29 (range 7.24 to 7.35, IQR 7.26 to 7.33), and lastly the oleoresin capsicum group at 7.37 (range 7.33 to 7.40, IQR 7.38 to 7.39) ( $p<0.001$ ). These differences persisted over the subsequent 6 measured time points.

The median lactate at baseline was 1.15 (range 0.61 to 3.55, IQR 0.75 to 2.35). There was no difference between the groups ( $p=0.07$ ). The median post-task lactate was highest for the heavy bag group at 14.71 (range 8.9 to 18.7, IQR 13.7 to 17.40), followed by the sprint group at 10.98 (range 3.3 to 14.6, IQR 7.4 to 13.2). The TASER group was next at 5.49 (range 1.3 to 7.2, IQR 4.3 to 5.9), followed by the K-9 group at 5.01 (range 1.5 to 9.6, IQR 3.5 to 7.0). The oleoresin capsicum group was lowest at 1.39 (range 0.6 to 2.4, IQR 1.3 to 1.7) ( $p<0.001$ ). These differences persisted over the subsequent 6 measure time points.



pH Graph



Lactate Graph

## Conclusions

The comparison of use of force encounters demonstrated that the simulated combat was one of the most activating of acidosis. The simulated combat also lowered the pH the most out of all the tasks.

These results combined suggest that fighting with LEOs may be the most detrimental from a physiologic standpoint. The authors recommend further study in this area to assist LEOs in determining the best tactics and devices to utilize in arrest scenarios that have higher likelihood of being associated with an ARD.