

# Comparison of small cigar smoke yields with and without fitment of supplied plastic tip

Ahmad El-Hellani,<sup>1,2</sup> Clifford H. Watson,<sup>3</sup> Michelle Huang,<sup>3</sup> Clark W. Wilson,<sup>1,2</sup> Clint Fleshman,<sup>1,2</sup> Ryan Petitti,<sup>4</sup> Mary Pancake,<sup>4</sup> Chad Bennett,<sup>5</sup> Brittney Keller-Hamilton,<sup>2,6</sup> Jeremy Jones,<sup>7</sup> Hang Tran,<sup>3</sup> Roberto Bravo Cardenas,<sup>3</sup> Darren Mays,<sup>2,6</sup> Wei Ye,<sup>8</sup> Jason Schaff,<sup>8</sup> Robert P. Borthwick,<sup>8</sup> Raymond L. Williamson,<sup>8</sup> Theodore L. Wagener,<sup>2,6</sup> and Marielle C. Brinkman<sup>1,2,\*</sup>

1) College of Public Health, The Ohio State University, Columbus, Ohio, USA; 2) Center for Tobacco Research, The Ohio State University Comprehensive Cancer Center, Columbus, Ohio, USA; 3) Centers for Disease Control and Prevention, Tobacco and Volatiles Branch, Atlanta, Georgia, USA; 4) Center for Design and Manufacturing Excellence, The Ohio State University, Columbus, Ohio, USA; 5) Medicinal Chemistry Shared Resource, Drug Development Institute, The Ohio State University, Columbus, Ohio, USA; 6) Department of Internal Medicine, The Ohio State University, Columbus, Ohio, USA; 7) Produced Better, Alpharetta, Georgia, USA; 8) Center for Tobacco Products, The U.S. Food and Drug Administration, Silver Spring, Maryland, USA

## INTRODUCTION

Machine-generated emissions testing is foundational to understanding the toxicity of tobacco products that produce aerosol or smoke inhaled by the user. In machine-generated emissions testing, products are puffed according to standardized protocols (e.g., Health Canada Intense) or actual human puffing behaviors (i.e., “puff-playback”). The resulting mainstream smoke/aerosol samples are collected, and subjected to chemical and physical analyses, and toxicants are identified and quantified. One limitation to this approach is the availability of smoking machine adaptors that can form a leak-tight sealing with the different tobacco product mouth-ends. Adaptors that can fit cylindrical mouth-ends (e.g., cigars and cigarettes) are commercially available, however, tobacco product mouth-ends that are non-cylindrical like those of electronic cigarettes and plastic-tipped cigar/cigarillos are challenging to seal with available adaptor technology.

## AIMS

- ❖ Introduce a Universal Smoking Machine Adaptor (USMA) that can be used as a leak-tight interface between non-cylindrical tobacco product mouth-ends and smoking machines
- ❖ Show how the USMA allows for more realistic testing of plastic-tipped cigarillos (e.g., Black & Mild)

## METHODS

- We developed and tested a USMA prototype made primarily from industry-standard materials (Figure 1).<sup>1</sup>
- We used the CORESTA cigar adaptor as a comparison adaptor (Figure 2).
- Emissions from Black & Mild cigarillos were generated using the USMA and CORESTA cigar adaptors without the plastic-tip.<sup>2,3</sup>

## METHODS - continued

- Only the USMA allows testing the Black & Mild cigarillo with the plastic tip intact.
- We collected mainstream total particulate matter (TPM) on filter pads and quantified nicotine therein.
- We examined differences in the means (non-parametric Wilcoxon Rank Sum tests) and variability (n=10 replicates) for all measures

## RESULTS

The prototype USMA is a kit that includes rigid plastic parts and four interchangeable flexible ferrules that can be optimized for specific mouth-end sizes and geometries of the tobacco and nicotine products.



**Figure 1.** The rigid and flexible components of the 55 mm diameter (top) and 44 mm diameter (bottom) USMA. (Left to right): back of filter holder, filter pad, base, flexible ferrules, compression plates, and threaded cap.

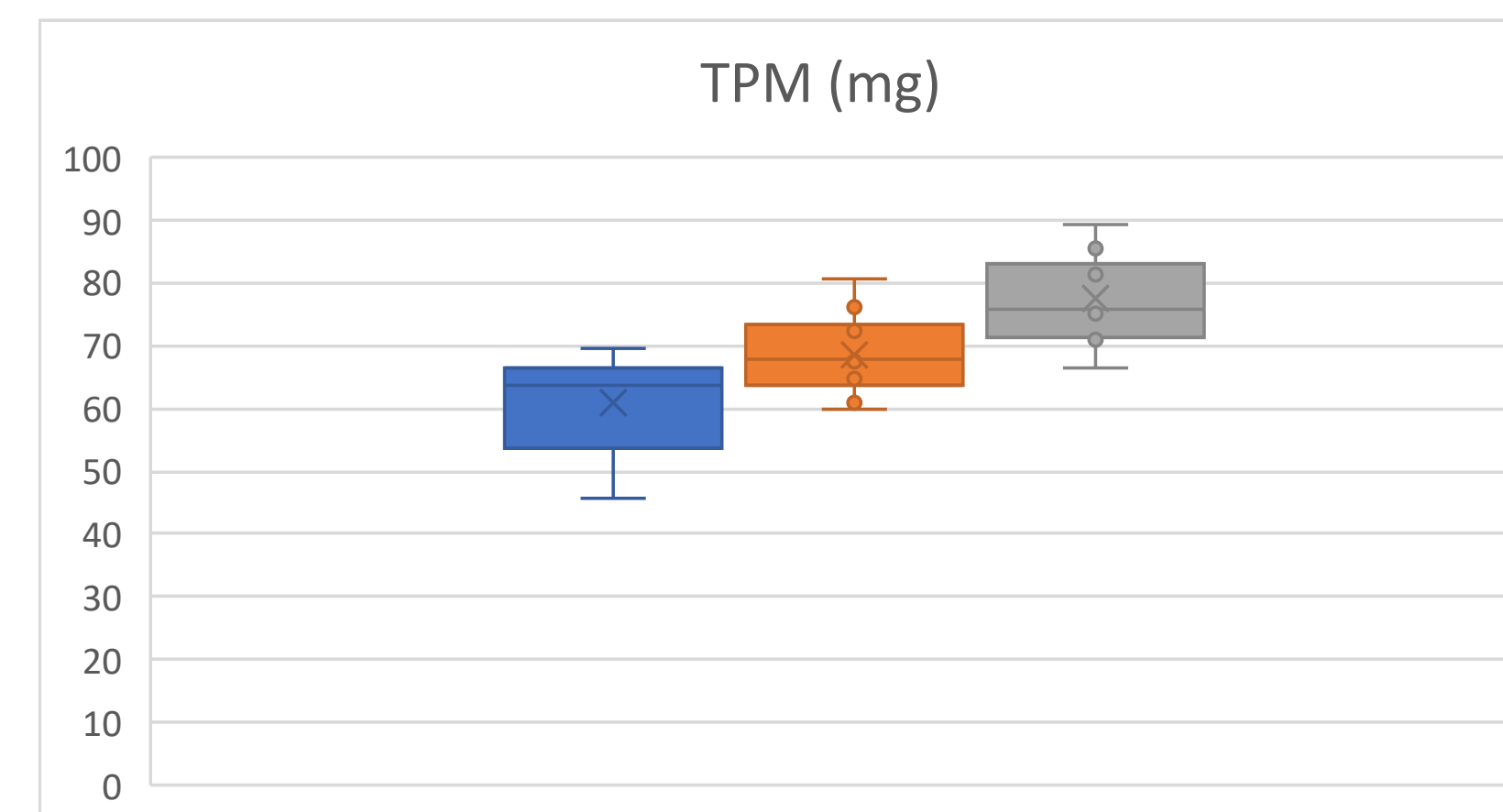
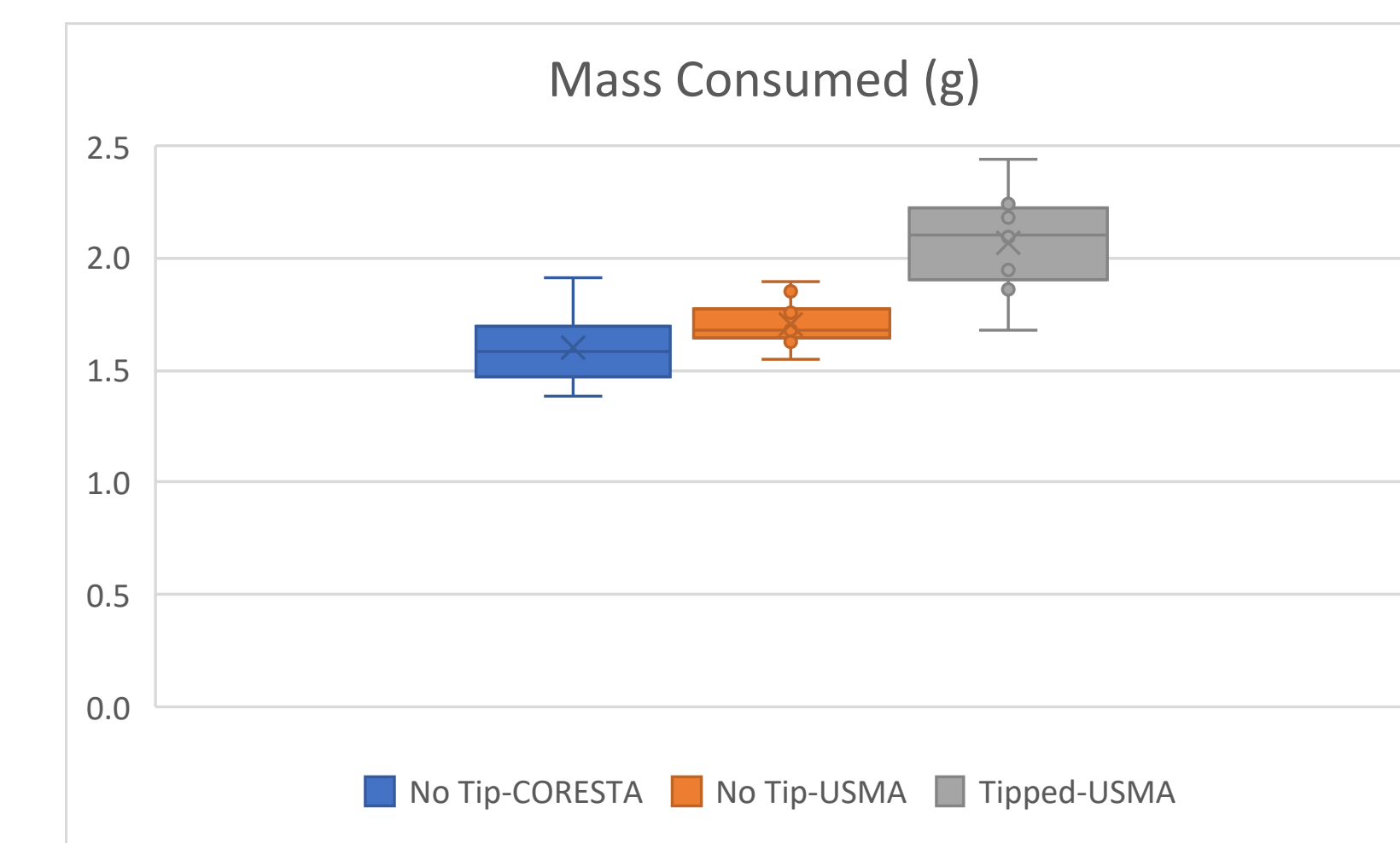


**Figure 2.** The components of the CORESTA cigar adaptor (penny shown for scale)

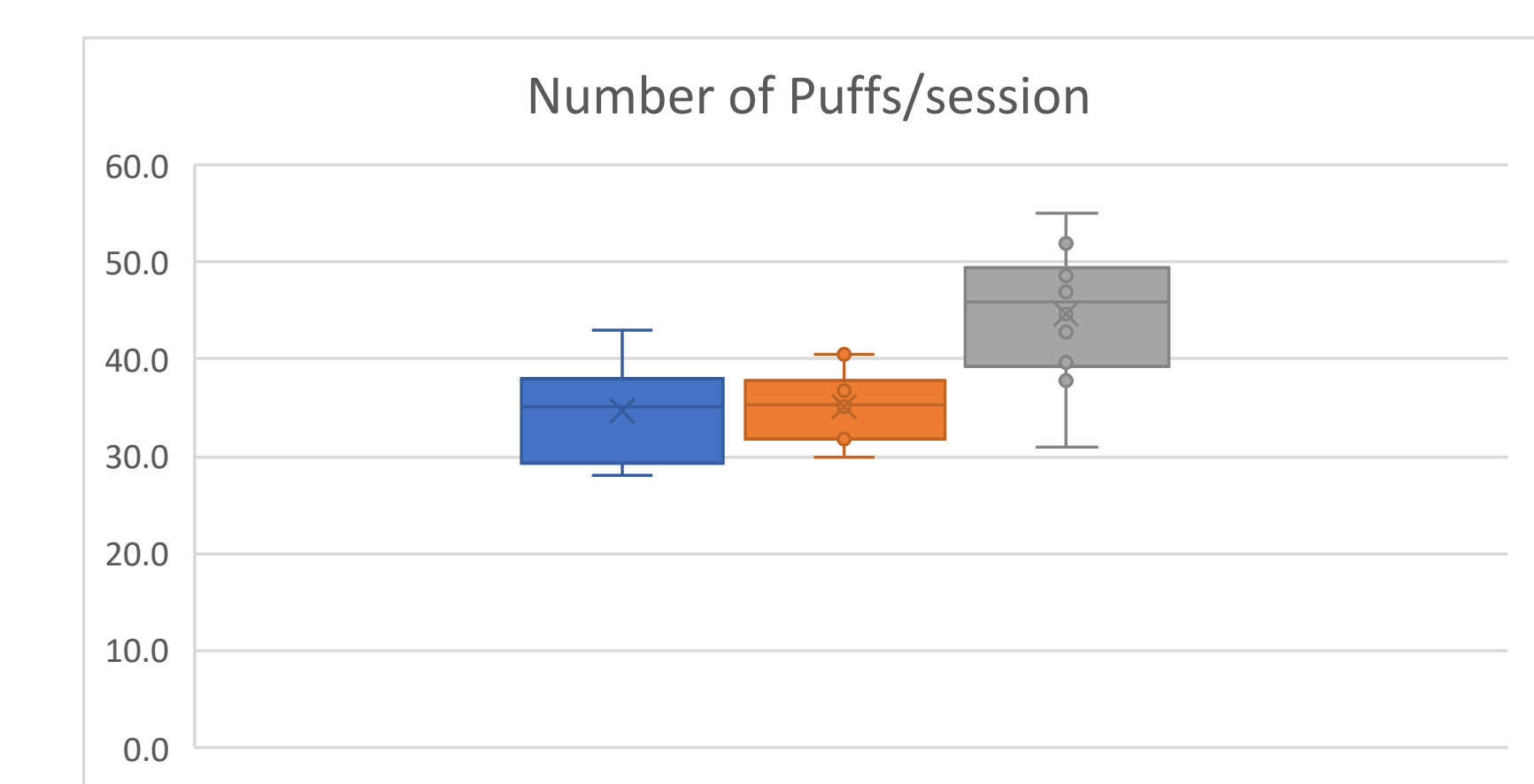
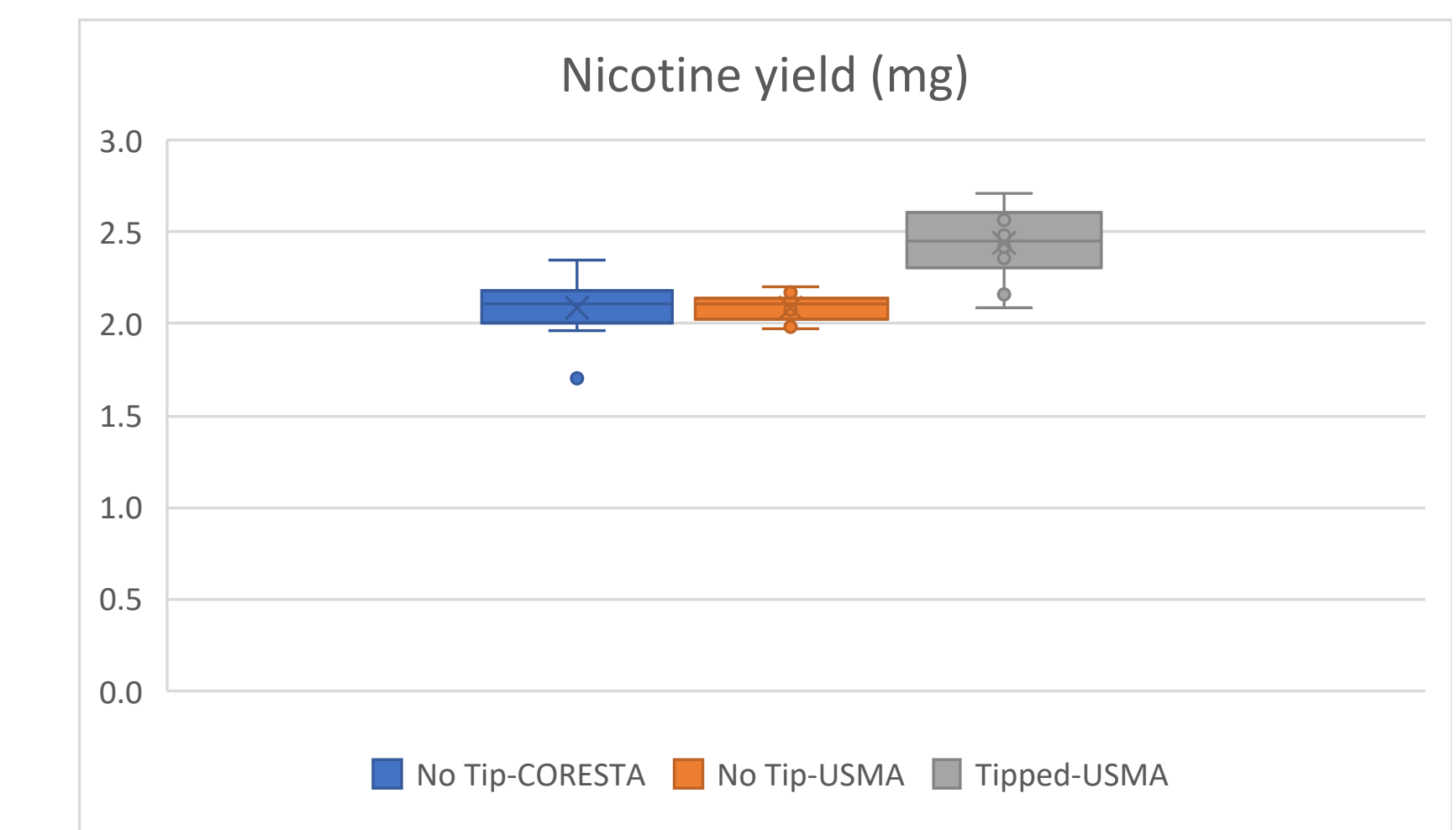
*The USMA is more user-friendly and versatile than the CORESTA adaptor in that it has fewer parts with only 11 components to test all cigars! However, the CORESTA adaptor comprises 9 components, and a single set of components is only capable of testing a range of cylindrical cigars that differ in mouth-end diameter by 1 mm.*

## RESULTS - continued

All measures were statistically significantly higher when the cigarillo was smoked with the plastic tip intact using the USMA compared to tip removed using both adaptors ( $p \leq 0.05$ ).



We saw limited differences in the tobacco mass consumed, TPM yield, nicotine yield, and number of puffs per session between the USMA and the CORESTA adaptors when testing Black & Mild cigarillos without the plastic-tip (Figure 3).



**Figure 3.** Box plots showing the differences between the two adaptors when testing Black & Mild cigarillo with and without the plastic tip.

## CONCLUSIONS

- ❖ The USMA allows testing of plastic-tipped cigarillos without product modification (i.e., removal of the tip)
- ❖ Lower mass consumed, number of puffs/session and mainstream TPM and nicotine are associated with removal of the plastic tip

## BIBLIOGRAPHY

- 1 El-Hellani, ..., Brinkman, Benchmarking a Universal Smoking Machine Adaptor for Tobacco Product Testing. Tobacco Control, 2023, Submitted.
- 2 CRM 64 - Routine Analytical Cigar-Smoking Machine - Specifications, Definitions and Standard Conditions, 2018.
- 3 CRM 65 - Determination of Total and Nicotine-Free Dry Particulate Matter using a Routine Analytical Cigar-Smoking Machine - Determination of Total Particulate Matter and Preparation for Water and Nicotine Measurements, 2019.



**Figure 4.** The CORESTA cigar (left) and USMA (right) adaptors are similar in size.

## ACKNOWLEDGEMENTS

The authors gratefully acknowledge Drs. Ian Tindall and Linda Crumpler from Cerulean for their valuable insights regarding tobacco product smoking and vaping machines.

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the U.S. Department of Health and Human Services or any of its affiliated institutions or agencies. The use of brand names in this manuscript does not constitute an endorsement by either the FDA or CDC. All photos are credited to the authors. This presentation is not a formal dissemination of information by FDA and does not represent Agency position or policy