B141 Simulating the United Arab Emirates Crime Scene Samples and Generating DNA Profiles From Them Using the RapidHIT™ System

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After attending this presentation, attendees will understand how quickly DNA profiles can be obtained from environmentally challenged samples even by non-scientists.

This presentation will impact the forensic science community by demonstrating that a robust automated system can be used to obtain DNA profiles from samples exposed to detrimental environmental conditions.

The average time needed to obtain a DNA profile from an evidence sample in crime laboratories is approximately 12 hours, which is time-consuming and labor intensive. In contrast, the RapidHIT™ Human DNA Identification System provides a faster method to generate DNA profiles in approximately 90 minutes. The operator only needs to insert the samples in the instrument cartridge. The system then extracts, amplifies, and generates DNA profiles through capillary electrophoresis.

The goal of this research was to test the sensitivity and robustness of the newly introduced "Run Other Samples" instrument protocol of the RapidHIT™ System in generating DNA profiles from simulated crime scene samples. The samples used in this study were blood and saliva, with varying amounts of each deposited on different types of substrates. The blood samples were obtained from one deceased male and one deceased female. The saliva sample was obtained from a living female donor.

The substrates chosen for this study are commonly found in crime scenes in the United Arab Emirates. The substrates used for deposition of saliva samples included cotton swabs, cotton-tipped applicators, stainless steel spoons, plastic spoons and forks, straw, mint-flavored chewing gum, stones covered with soil, the mouth area of water bottles, stamps, envelopes, and oil-based paint. Blood was deposited on substrates that included cotton swabs, cotton-tipped applicators, paper coated with latex-based paint, paper coated with water-color paint, tile, finished wood flooring, unfinished wood blocks, laminated flooring, broken tempered glass, stones covered with soil, pieces of wood covered with soil, denim jeans, synthetic leather, carpet fibers, delicate task wipes, clear plastic bags, and white scarves typically worn by men in the United Arab Emirates. Similar amounts of blood from deceased donors and an approximately similar amount of saliva from a living donor were deposited on each of these items. The substrates containing body fluids were then kept at room temperature for approximately 24 hours. Furthermore, the substrates were environmentally challenged by heat and humidity, factors similar to the weather conditions encountered in the United Arab Emirates.

Each substrate containing one body fluid was either swabbed or cut and deposited in cartridges using the RapidHIT™ System. Autosomal Short Tandem Repeat (STR) loci and the amelogenin gender locus were amplified using the PowerPlex®16 HS multiplex amplification kit chemistry. The generated data were analyzed using GeneMarker® HID Software Version 2.4.0. The DNA profiles were compared for concordance within and between the substrates used in this study.

This study shows that the RapidHIT™ System is capable of producing complete and concordant profiles from blood and saliva samples deposited on simulated crime scene substrates commonly encountered in the United Arab Emirates. The "Run Other Samples" instrument protocol worked effectively to generate DNA profiles from pristine and challenged samples.

Complete profiles were obtained from all of the 87 samples tested. Replicates were not run since full profiles were generated from all 87 samples. The Peak Height Ratios (PHR) and the Relative Fluorescence Units (RFU) values decreased with decreased volumes of blood. The PHR values were above 70% with 1.0µl, 0.5µl, and 0.25µl of blood while PHR values below 70% were observed when 0.125µl and 0.0625µl of blood were amplified.

DNA profiles with all 16 loci were obtained from 1.0µl, 0.5µl, 0.25µl, and 0.125µl of the neat male blood sample. Additionally, 50.0µl, 40.0µl, 30.0µl, 20.0µl, and 10.0µl of saliva directly deposited on the swabs yielded complete DNA profiles. As expected, PHR values decreased when the amount of saliva was reduced.

Various volumes of the blood and saliva samples deposited on different, potentially inhibiting substrates generated complete profiles with excellent peak signals and balanced peak height ratios. Additionally, high heat and humidity similar to that experienced in the United Arab Emirates did not adversely affect the RapidHIT™ System's ability to yield complete profiles on simulated crime scene samples.

United Arab Emirates, RapidHIT™ System, DNA Profiles