# Deodorant as a Potential Source of DNA Profiles for References in Criminal Investigations

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## Abstract

In forensic contexts, identifying personal items from suspects or victims that frequently yield single-source profiles would simplify the collection of objects for obtaining reference samples. This study investigates if solid deodorant sticks are a good source of biological material for the generation of a DNA profile. The current study tests the following null hypotheses: (1) single-source DNA profiles will not be obtained from solid deodorant and (2) DNA quantity will not predict the completeness of a profile. For nine consecutive days, two participants were each given deodorant decontaminated by exposure to UV light to use once in the morning after showering. The deodorants were wet swabbed each day after usage using sterile technique; one swab was used per deodorant, per day. The deodorants were swabbed on the exposed deodorant stick and the inside of its plastic cap.

Samples were extracted utilizing the QIAamp DNA Mini Kit (QIAGEN Hilden, Germany). Samples were further processed through DNA analysis workflow utilizing Applied Biosystems™ (Carlsbad, CA) products: samples were quantified with Quantifiler™ Trio DNA Quantification Kit on a 7500 Real-Time PCR System; samples were amplified using Globalfiler™ Amplification Kit on a ProFlex™ PCR System and analyzed on a 3500xL Genetic Analyzer.

DNA quantification results ranged from 0 to 1.7 ng/µL; most samples yielded no detectable DNA profiles. Two samples had only one allele consistent with the deodorant user. In a third sample, 11 out of 34 alleles detected were consistent with the user. The first null hypothesis can be partially rejected as consistent alleles were present, but no full profiles were obtained. Based on the data, the second hypothesis can be rejected as there's no relationship between quantification and DNA profiling results. In conclusion, solid deodorant is not a good source for generating single-source profiles that could be useful as references in criminal investigation.

## Introduction

- As DNA amplification technology increases in sensitivity, detecting transfer DNA and obtaining mixed DNA profiles from swabbed items becomes increasingly common during forensic investigations.
- Identifying objects through systematic research that serve as good reservoirs of high quality and quantity DNA for producing individualizing reference profiles will have a positive impact in the field of forensic science.
- Solid deodorant may serve as a good source for obtaining DNA reference samples because it is not usually shared and the surface that contacts a user's skin is sheltered from the external environment by a plastic cap.
- Spencer (2008) conducted a similar study in which the following methods and findings were presented:
  - Ten participants were given two deodorants each; the first was used for one day and the second was used for three consecutive days.
  - The surface of the deodorant stick and the outside plastic container were swabbed.
  - User profiles were not obtained from the deodorant stick, but extraneous alleles were detected.
  - The exterior surface of the deodorant produced mixed profiles, including that of the user.
- The current study investigates whether solid deodorant could be a suitable source of DNA for references in criminal investigations by utilizing current forensic genetics technologies.
  - $H_0$1: Single source DNA profiles will not be obtained from solid deodorant.
  - $H_0$2: DNA quantity will not predict the completeness of a profile.

## Materials & Methods

- Samples
  - 2 participants were chosen to use separate deodorant sticks over the course of 9 consecutive days.
  - Each deodorant was decontaminated by exposure to UVR before distributing to the participants at the start of the experiment.
  - The exposed deodorant and plastic cap were swabbed to monitor the success of the decontamination procedures.
  - Deodorants were stored in Ziplock bags throughout the duration of the experiment except during participant application or non-participant swabbing. After each non-participant swabbing, the deodorants were placed in a new Ziplock bag.
- Sampling Procedure:
  - For 9 consecutive days, the two participants applied their designated deodorant after showering for a period of five seconds per armpit each morning.
  - After use, deodorants were placed into Ziplock bags until sampled.
  - At 9:00 am each day, the deodorants were wet-swabbed on two surfaces: (1) the exposed deodorant and (2) the inner surface of the deodorant cap.
  - A total of 9 samples per participant were obtained.
  - Samples were purified from the swabs utilizing the QIAamp DNA Minikit (QIAGEN, Venlo, Netherlands) as per manufacturer's instructions for buccal swabs (spin protocol).
- DNA Quantification:
  - Samples were quantified with Quantifiler™ Trio DNA Quantification Kit on a 7500 Real-Time PCR System.
- DNA Amplification:
  - Samples were amplified using Globalfiler™ Amplification Kit on a ProFlex™ PCR System and analyzed on a 3500xL Genetic Analyzer.

## Results

| Samples (User 1) | DNA Quantity (ng/µl) | Samples (User 2) | DNA Quantity (ng/µl) |
|---|---|---|---|
| 1A1 | 0 | 1S1 | 1.74 |
| 1A2 | 0 | 1S2 | 0 |
| 1A3 | 0 | 1S3 | 0 |
| 1A4 | 0.5 | 1S4 | 0 |
| 1A5 | 0 | 1S5 | 0 |
| 1A6 | 1.4 | 1S6 | 0 |
| 1A7 | 0 | 1S7 | 0 |
| 1A8 | 0 | 1S8 | 0 |
| 1A9 | 0 | 1S9 | 0 |

**Table 1**: Sample names for users 1 and 2; quantification information. Highlighted samples are those that contained detectable DNA.

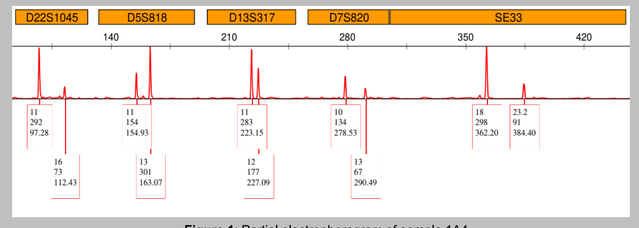


**Figure 1**: Partial electropherogram of sample 1A4.

| Locus | User 1 Alleles | Unknown Alleles |
|---|---|---|
| D22S1045 | 11,16 | - |
| D5S818 | 11 | 13 |
| D13S317 | - | 11,12 |
| D7S820 | 10 | 13 |
| SE33 | 23.2 | 18 |

**Table 2**: Key to Figure 1.

## Discussion & Conclusions

- DNA quantification results ranged from 0 to 1.7 ng/µL.
- Most samples yielded no detectable DNA.
  - This is a surprising result because the deodorants came into direct contact with the participant's skin, so the transfer of biological material should have been inevitable.
- Two samples (Samples 1A6 and 1S1) contained one single allele consistent with the deodorant user.
- In a third sample (Sample 1A4), 11 out of 34 alleles detected were consistent with the user.
  - Figure 1 shows part of the electropherogram of sample 1A4 displaying 5 loci with 5 alleles consistent with User 1 as well as 5 alleles from an unknown contributor.
  - The extraneous alleles could be explained by transfer DNA being deposited by individuals who utilized the same facilities as User 1.
- The first null hypothesis can be partially rejected as consistent alleles were present, but no full profiles were obtained.
- Based on the data, the second null hypothesis can be rejected as there is no relationship between quantification and DNA profiling results.
  - While there were samples that yielded DNA, the amount of DNA did not predict the completeness of the profile.
- In conclusion, solid deodorant is not a good source for generating single-source DNA profiles which could be useful as references in criminal investigations.
  - The present study adds to the literature regarding recommended sources for DNA reference profiles.
  - These findings are consistent with those found in the Spencer (2008) study.

## References

Spencer, Tara N. Obtaining DNA Profiles form Epithelial Cells Deposited on Deodorant Sticks (Unpublished Master's Thesis). 2008. John Jay College of Criminal Justice, New York, NY.

## Acknowledgements

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