The Visualization of latent fingerprints on fruits and vegetables

Shanelle Dalley*, Dr. Pardeep Jasra

Abstract:

The development of latent prints on fruits and vegetables has become a great area of interest in forensic science. These everyday food items which are often overlooked for forensic evidence can be a great source of latent prints. This experiment was conducted to determine the effectiveness of three different fingerprint powders and to visualize these sebaceous fingerprints on selected fruits and vegetables at different time intervals. Black powder, Supra Nano Fluorescent Green powder, a new experimental powder was used to recover the latent fingerprints. Apples, onions, potatoes, and tomatoes were used as the substrate to which the sebaceous fingerprints were laid. The results showed that the extent of fingerprint visualization differed with each powder and each substrate. The new powder which was made by mixing three different substances, varied the most for all the surfaces; the black powder worked better on dry surfaces; and the supra Nano powder was the most visible. Fingerprint recovery and visualization was not affected by time for all substrates except for the tomato. Fingerprints were able to be recovered up to two weeks after deposition.

Keywords: fruits, vegetables, fingerprints, supra Nano, VSC, black powder, mini crime scope

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Introduction

A fingerprint is an impression left by the friction ridges of a human finger. Latent fingerprints are prints that are not visible to the naked eye and required a visualization technique to be seen. Fingerprints can be secreted by 2 main types of sweat. Eccrine sweat comes from the eccrine sweat glands and can be found on the palms and soles. It is composed of water, organic compounds, and inorganic salts. The second type is sebaceous sweat. It comes from the sebaceous sweat glands and can be found in areas covered by hair such as the face or neck. It consists of saturated fats, waxes, and squalene.

The Video Spectral Comparator (VSC) is a machine made by Foster + Freeman. This machine uses different light sources to examine documents, and is usually used in forensics to check the validity of valuable documents. This machine was used because of its ability to use different light sources and take pictures. All photographs taken during the experiment were with the VSC. The Mini crime scope is a machine like the VSC because it also projects alternate light sources. The mini crime scope is small and easy to carry around. It has a lot more flexibility compared to the VSC and can be used on scene. This machine was used to locate any fingerprints on the substrates.

Fingerprints are important in forensic science because they are specific to each individual and do not change from birth. They can also be found on almost anything and can therefore be used to identify an individual. One of the biggest goals of a forensic scientist is to be able to develop fingerprints on any substrate. The ability to develop fingerprints from everyday fruits and vegetables is becoming a much-visited area of interest. These everyday food items can be a great source of latent prints.

Multiple studies have been done with different powders to produce a latent print that can be used for comparison. Amit & Chattopadhyay\textsuperscript{2} conducted a study using bananas (green and ripe), eggs, onions, tomatoes, potatoes, brinjal, bottle guard, and capsicum. For the print development they used black powder, Silver Gray, Orange Fluorescent, and Iodine fuming. Ferguson et al.\textsuperscript{4} also conducted a similar experiment with up to 7 different visualization techniques. A couple more studies have been done with similar substrates and either the same techniques or different ones\textsuperscript{11,12}. A study was even done using household products like cocoa powder to develop fingerprints (Rohatgi & Kapoor, 2014). Forensic scientists will always look for a better way to develop fingerprints and more substrates to develop them from.

In this study, three powders were used on 4 types of fruits and vegetables to determine if they could be used to develop clear, visible prints.

Materials and Methods

This study was conducted in the forensic lab at the University of Windsor. The overall time spent was two and a half months. Four types of fruits and vegetables were used as substrates and three different powders were used to develop the fingerprints. The prints were developed and lifted at four-time intervals; same day, one day, 7 days, and 14 days.

- Tomatoes
- Potatoes
- Apples
- Onions
- Supra Nano green fluorescent powder
- Black powder
- New powder made in lab

The fruits and vegetables were first washed and dried to erase any prior fingerprints that might interfere with the experiment. Sebaceous fingerprints were put on the fruits and vegetables using the right thumb. The thumb was pressed down with sufficient weight and held for approximately 30 seconds for each print. The fruits and vegetables were then placed in the fridge until it was time to develop them. The ones that were developed on the same day were left out at room temperature and developed 30 minutes to an hour after fingerprints were deposited on them. For the black fingerprint powder, the latent fingerprints were dusted with the black powder and then lifted with lifting tape. They were viewed and photographed using the VSC. For the supra Nano fingerprint powder, the latent fingerprints were dusted with the supra Nano and visualized under UV light from the mini crime scope. The final photographs were taken with the VSC. For the new fingerprint powder, the latent fingerprints also were dusted with the new powder and visualized using light from the mini crime scope. The prints were then lifted with lifting tape and photographed using the VSC. All pictures were taken in both UV and IR. All fruits and vegetables used in this experiment were disposed in a normal trash can.

Results

A table was made for each powder. In the table, a number was assigned to each substrate based on how visible the details of the fingerprint were. A rating of one would be for the least visible print, with only an outline of the print and no detail and five being the most visible where most the details are visible and can be compared to the control print.

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<tr>
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<th>Same day</th>
<th>One day</th>
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<td>Onion</td>
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*Table 1: Ratings of how well the fingerprints were shown using the Supra Nano powder.*

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<td>Potato</td>
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<td>Onion</td>
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*Table 2: Ratings of how well the fingerprints were shown using the new powder.*
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<td>Apple</td>
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<td>Potato</td>
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<td>Tomato</td>
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<td>Onion</td>
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Table 3: Ratings of how well the fingerprints were shown using the black fingerprint powder.

Figure 1: Control print.

Figure 2: Fingerprint on an onion developed with Supra Nano powder (same day).

Figure 3: Fingerprint on a tomato developed with Supra Nano powder (same day).
Figure 4: Fingerprint on an apple developed with Supra Nano powder (1 week).

Figure 5: Fingerprint on a potato developed with Supra Nano powder (1 week).

Figure 6: Fingerprint on an onion developed with the new powder (1 day).

Figure 7: Fingerprint on an apple developed with the new powder (same day).
Figure 8: Fingerprint on a potato developed with the new powder (1 day).

Figure 9: Fingerprint on a tomato developed with the new powder (1 week).

Figure 10: Fingerprint on an onion developed with black powder (1 week).
Figure 11: Fingerprint on an apple developed with black powder (1 day).

Figure 12: Fingerprint on a tomato developed with black powder (1 day).

Figure 13: Fingerprint on a potato developed with black powder (same day).

Figure 14: Fingerprint on an onion developed with the new powder.

Figure 15: Fingerprint on a tomato developed with Supra Nano powder (1 week).
Discussion

From the results, the supra Nano powder worked well on most surfaces. It was the powder that had the most effect on visualization. The black powder worked well shinier surfaces like the apple and the onion but not on the moister surfaces. From this it can be determined that black powder is not very suitable for any fruits and vegetables that are moist. The new powder was the very successful on all surfaces. It had no problems sticking to moist surfaces like the tomato and the potato. However, the main problem that was found with this powder was that it was harder to visualize. When photographed under the mini crime scope, it showed most details very well. But when the same substrate was photographed under the VSC, the details of the fingerprints were harder to see and appeared very faint. There were also problems encountered when lifting the fingerprints (Figure 7). Most fruits and vegetables are round and have uneven surfaces. This makes it hard to lift a complete and perfect print. Some of the prints were either destroyed during the lifting process or fragmented by other particles that were lifted along with the print (Figure 14). There was also some problem with the handling of the fruits and vegetables. Some potentially good prints would be smudged by paper or the table they were placed on (Figure 15). These smudged prints were mainly from the supra Nano powder because a lot more of it stuck to the substrates compared to the other powders. Another problem was found with the potato where the surface of the potato fluoresces along with the print causing some interference (Figure 5).

Conclusion

Overall it is difficult to draw any definite conclusions for any of the powders due the shear amount of difficulties that were encountered. Many of these powders had much more potential that was unable to be shown in this experiment. Further studies should be done to test the powders on more substrates and resolve any issues that occurred.
Acknowledgements

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References


