A2 Efficiency of Human DNA Isolation From Food Bitemarks

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After attending this presentation, attendees will consider the possibility of isolating human DNA from bitten foods.

This presentation will impact the forensic science community with a better understanding of using bitten foods found at crime scene in a criminalistic approach due to the possibility of human DNA isolation and comparison.

Typically, bitemark analysis is used for physical comparison between bitemarks present on physical evidence (human skin or bitten object) and the reference sample (such as suspect's teeth). However, if it is not possible to correctly identify the suspect using this method, it is important to recover salivary DNA. This evidence has been recovered and analyzed from bitten inorganic substrates like cigarette butts and human skin.

On the other hand, there are few studies in which it was possible to isolate human DNA from bitten foods. These attempts have not been successful due to food characteristics. Thus, finding and isolating human DNA from food bitemarks is extremely challenging.

The goal of this research was to analyze the efficiency of human DNA isolation from bitemarks in three different types of foods. The isolated DNA was characterized using PCR for two human housekeeper genes to ensure recovering and isolation of human DNA.

Three volunteers bit into three different foods: cheese, donuts, and apples. The food was kept at room temperature. After 15 hours, the food was placed in a plastic bag and frozen at -15ºC. The day after, the food was submitted to the lab and saliva from each sample was collected using the double swab technique. The DNA was isolated using QIAamp DNA Mini Kit according to the manufacturer's protocol. The DNA was quantified using NanoDrop 2000c. PCR was performed to look for two human housekeeper genes, GAPDH (Glyceraldehide 3-phosphate dehydrogenase, enzyme implicated in glycolysis) and RPL22 (human gene codifies 60S ribosomal protein L22). As positive controls, epithelial cells from two of the volunteers were used.

The results showed the differences in the quantity and quality of DNA isolation between foods. Although the highest DNA concentration was found in the apple and cheese samples, the ratio 260/280, which is commonly used to assess the purity of nucleic acids since proteins absorb light at 280nm, was lowest in apple samples and highest in cheese samples. The DNA concentration from donut samples was the lowest and the ratio 260/280 had an intermediate value. Positive controls showed a high DNA concentration and ratio 260/280.

PCR results were showed in 2.5% agarose gel. In the two positive controls, DNA from cheese samples and donut samples, 1µl DNA was enough to amplify the housekeeper genes. However, DNA from cheese samples demonstrated highest amplification efficiency compare with DNA from donut samples. DNA from apple samples failed to amplify even when using a 5µl sample. These differences were related to the 260/280 ratio because apple samples had the lowest ratio which indicated that the samples were contaminated with proteins. This issue affected PCR efficiency, compromising the appropriate samples amplification.

The findings from this research provide the evidence that it is possible to recover and isolate human DNA from food bitemarks, although the quality of DNA depends on the type of food. These results show the potential importance of bitten food recovered from crime scenes.

Food Bitemarks, DNA Isolation, PCR Efficiency

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