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iSWAB-DNA: The Sample Collection Device for High-Quality DNA Resilient to Challenging Transportation Conditions

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Introduction.

Cold chain transportation has been the standard practice for maintaining the integrity of biological samples during transportation. It is costly and labor-intensive. The iSWAB-DNA device from Mawi DNA Technologies contains innovative non-toxic stabilization buffer and maintains the integrity of the sample at ambient or challenging temperatures. This allows for more flexibility on sample collection and sample transportation in diverse environments. Extensive testing has been conducted on the iSWAB-DNA devices to simulate challenging shipping conditions, ensuring the preservation of high-quality samples throughout the transportation process.

Methods.

Samples collections:

Buccal swabs samples were collected in iSWAB-DNA devices from ten donors according to the respective standard instructions for use (IFU). All collected samples were mixed at 12 rpm for 24 hours to simulate the movement during transportation.

Challenging temperature changes:

Forty-two samples collected in iSWAB -DSC, iSWAB-DNA-250 and iSWAB-DNA-1200 were exposed to three freeze (-20°C) and thaw cycles (50°C) to stimulate challenging transportation temperatures. Freezing or thawing occurred in 3-hour phases. DNA from all samples were extracted using QIAamp Blood DNA Kit (Qiagen, Cat #51185) after overnight mixing (Baseline) and after freeze-thaw cycles (Freeze-Thaw).

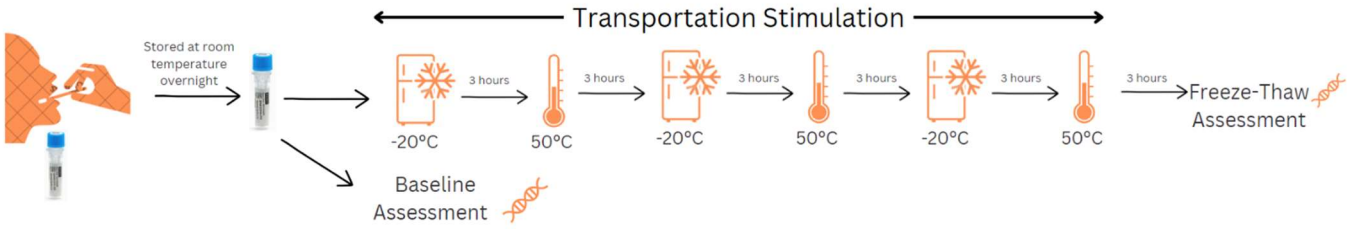

Figure 1: The challenging temperature changes with three consecutive freeze (-20 °C) and thaw (50 °C) cycles. Samples were extracted, quantified, and qualified before the stimulation (Baseline) and after (Freeze-Thaw).

DNA quantification and qualification:

DNA quantity and quality were measured using Nanodrop One Microvolume UV-Vis Spectrophotometer (Thermo Fisher Scientific Cat. # ND-ONE-W4). TapeStation 4150 System with Agilent Genomic DNA ScreenTapes (Agilent, Cat. # 5067-5365) was used for determining the integrity of DNA.

Results and Discussion:

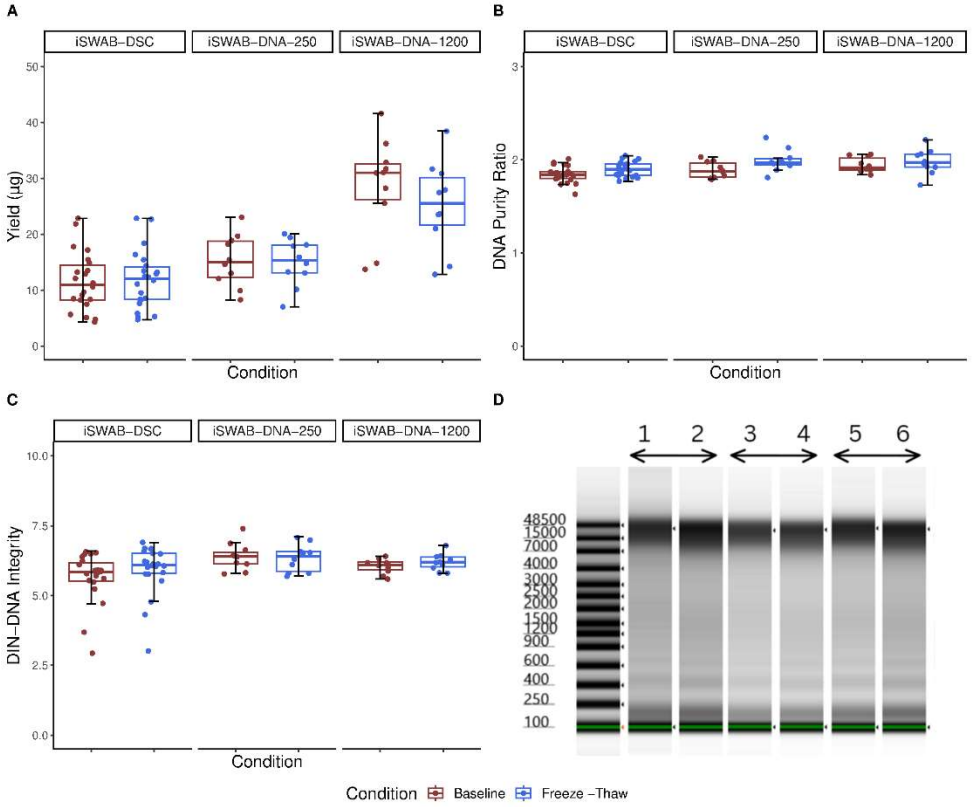

Figure 2: DNA yield, purity, and quality remain stable after three cycles of freezing (-20°C) and thawing (50°C) in iSWAB-DNA devices. A, DNA yield was calculated based on the volume of devices (iSWAB-DSC, iSWAB-DNA-250). B, DNA purity ratio (A260/A280). C, DNA Integrity. D, Side-by-side gel image (Tape Station system) of DNA extracted from three samples before (1, 3, 5) and after three freeze-thaw cycles (2, 4, 6).

To assess the effect of challenging temperature changes, post-collection iSWAB-DNA devices were subjected to three consecutive freezing (-20°C) and thawing (50°C) cycles. All samples after freeze-thaw showed no significant change in the DNA yield, purity, and DNA integrity compared to the baseline (Figure 3A-C). Purified DNA had a high molecular weight and showed negligible degradation after extreme storage conditions (Figure 3D). Overall, the quantity and quality of DNA were not affected by the challenging temperature changes.

Conclusion

The evidence presented here indicates the versatility of storage or transportation conditions for iSWAB-DNA devices to produce high-quality genomic DNA suitable for downstream applications. The resilience of challenging temperature changes provides customers with greater flexibility in sample collection and transportation.