Selection of DBS card for anti-SARS-CoV-2 antibody detection

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Introduction

Dried Blood Spot (DBS) technology is well recognized as a cost effective, simple and reliable alternative to conventional liquid sampling methods for a wide range of applications. During the current pandemic, serological testing is emerging as a powerful solution to improve our understanding of COVID-19 exposure, transmission and immune response in patients previously infected with SARS-CoV-2. However, in the midst of the pandemic restrictions, large-scale testing is limited by the need for trained healthcare workers and quarantines with many patients advised to stay home. Ahlstrom-Munksjö Specimen Collection Cards allowing capillary blood self-sampling and simplified transport to laboratories for analysis could provide a reliable alternative. In this study, both DBS and liquid serum samples were tested using one serological assay to evaluate the usability of DBS with Ahlstrom-Munksjö BioSample collection cards for the detection of anti-SARS-CoV-2 antibodies.

Materials and method

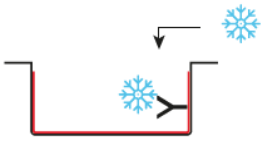
SARS-CoV-2 S IgG ELISA semi-quantitative CE-IVD kit was used for serum and DBS analysis. Specific reagents used in the assay and procedure are summarized in the Assay Procedure. During the first stage, diluted samples are incubated in ELISA microplate wells with immobilized recombinant viral protein (antigen) - SARS-CoV-2 surface glycoprotein S. In case of a positive sample, virus-specific antibodies (IgG) will bind with the antigens. Bounded specific IgG antibodies are determined using enzyme-labelled antibodies (HRP, horseradish peroxidase) against the human IgG. Horseradish peroxidase catalyzes the color reaction when TMB substrate is added. The concentration of antibodies in the samples are determined by measuring the optical density using a spectrophotometer.

The correlation between extracts of DBS from capillary blood and serum from capillary blood was determined by analyzing 95 patient samples (n) in total. All patient samples were tested in duplicate. The test results (relative values – RV) are calculated by dividing the OD average by the calculated limit value of the test.
Interpretation of the results:

- If RV ≥ 1.0 – the result is positive
- If the RV is 0.8-1.0 – the result is marginal, and the sample must be repeated
- If RV < 0.8 – the result is negative

Assay Procedure

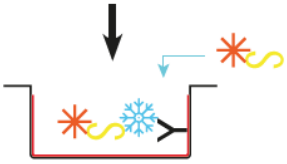
Add **100 µl** of positive, negative, blank controls and diluted patient samples into ELISA microplate wells



Incubate at +37°C for 1h

Wash the microplate 4 x by adding **350 µl** of ready to use wash solution

Add **100 µl** of enzyme conjugate



Incubate at +37°C for 1h then wash 4 times with 350µl of wash solution

Add **100 µl** of enzyme substrate solution

Incubate at room temperature for 10 min

Add **50 µl** of STOP solution

Read absorbance at 450 nm immediately after adding the STOP solution

Results

For the qualitative result interpretation, the total agreement was calculated excluding the borderline results.

DBS cards	BioSample	Competitor
Patient samples (n)	44	64
Pearson correlation	0.978	0.963
Total agreement (w/o BRDL)	0,952	0,871

For quantitative result interpretation, Pearson's correlation coefficient (r) and linear regression graphs with coefficient of determination (r^2) were plotted.

***Table 1**- Qualitative and quantitative results*

An excellent correlation of IgG antibody quantity was observed between extracts of DBS from capillary blood and liquid serum from capillary blood with Ahlstrom-Munksjö BioSample cards: r = 0,978; Total agreement (w/o Brdl) = 95,2%; r^2 = 0,957. And the lowest correlation was observed with the competitor's cards: r= 0,963; Total agreement (w/o Brdl)= 87,1%; r^2 = 0,928.

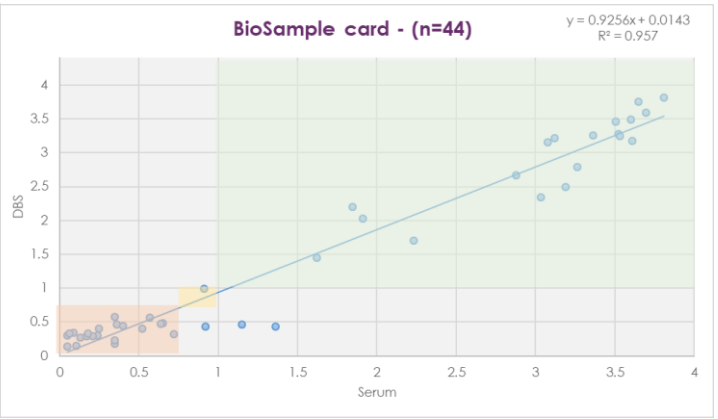


Figure 1- *Correlation between DBS and liquid serum for competitor's card*

Figure 2- *Correlation between DBS and liquid serum for BioSample card*

Conclusions

Our results clearly demonstrate that DBS technology is a reliable and feasible alternative to liquid sampling for serological assessment in COVID-19. Ahlstrom-Munksjö BioSample cards can be used in combination with "SARS-CoV-2 S IgG ELISA" IVD kit for semi-quantitative analysis of IgG antibodies against SARS-CoV-2 Spike protein. This method will be particularly useful in large-scale disease surveillance and longitudinal research of immune response in COVID-19.

Literature cited: 1. SARS-CoV-2 S IgG ELISA IMUNODIAGNOSTIKA IFU – Product EI-2020-9499 G

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