Sample-to-answer LabDisk for point-of-care analysis of total cholesterol from whole blood

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Summary

A centrifugal microfluidic **LabDisk** for **total cholesterol [TC]** determination **from whole blood** and a **processing device** have been developed. Centrifugal microfluidic sample-to-answer processing features **direct sampling from the fingertip**, **aliquoting** (for analysis of an additional parameter), **blood plasma separation,** rehydration of **prestored reagents**, and real-time **absorbance measurement** of enzymatic reactions. **Time to result for fluidic processing and readout is 7 min** with room for optimization to less than 4 minutes. It was demonstrated that the TC assay can be integrated into LabDisk based multiparameter analysis of whole blood.

Sample-to-answer LabDisk

A whole blood sample is taken from the fingertip applying a LabDisk integrated 40 µL end-to-end capillary shown in figure 1. The centrifugal device shown in figure 2 is used to control micro-fluidic processing of the sample. Lab Disk integrated cuvettes are used for absorptiometric detection of TC concentration (figure 4).

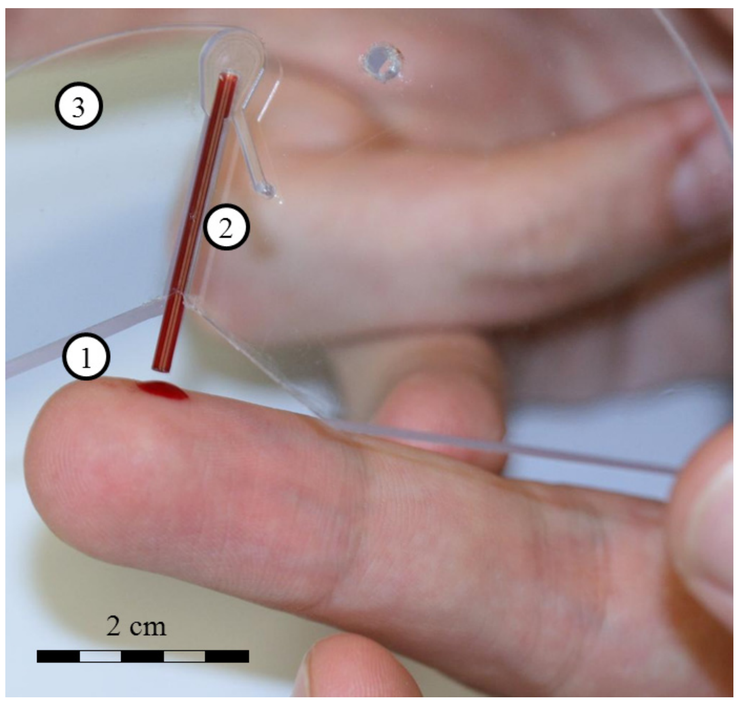

Figure 1: Image of the sample collection process from a punctured site on the fingertip (1) via an end-to-end capillary (2), which is integrated in the LabDisk (3).

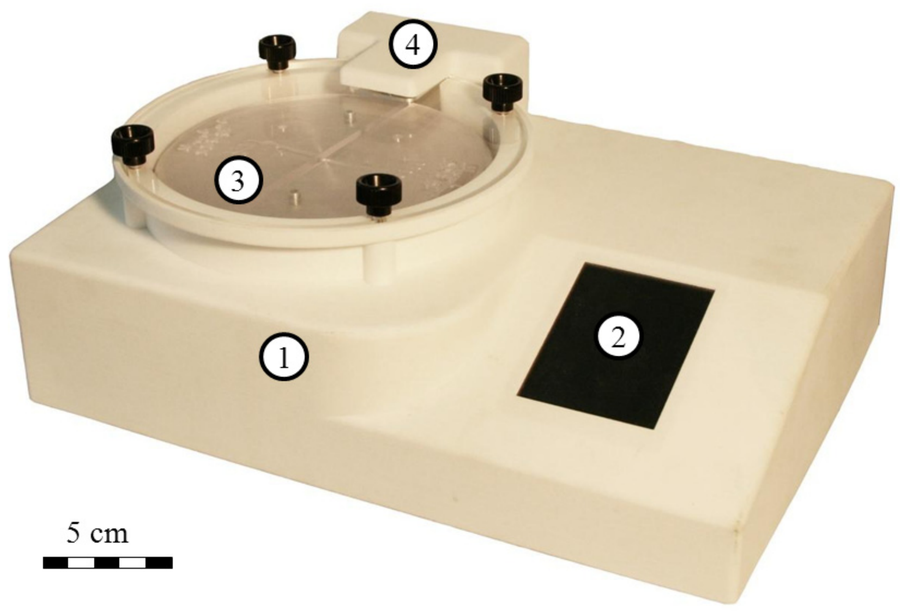

Figure 2: Centrifugal processing device prototype (1) with an integrated touch-panel to operate the device and display results (2). After sample collection the LabDisk (3) is placed onto the rotor, where the sample is processed. The TC concentration is determined with an integrated absorptiometry unit (4).

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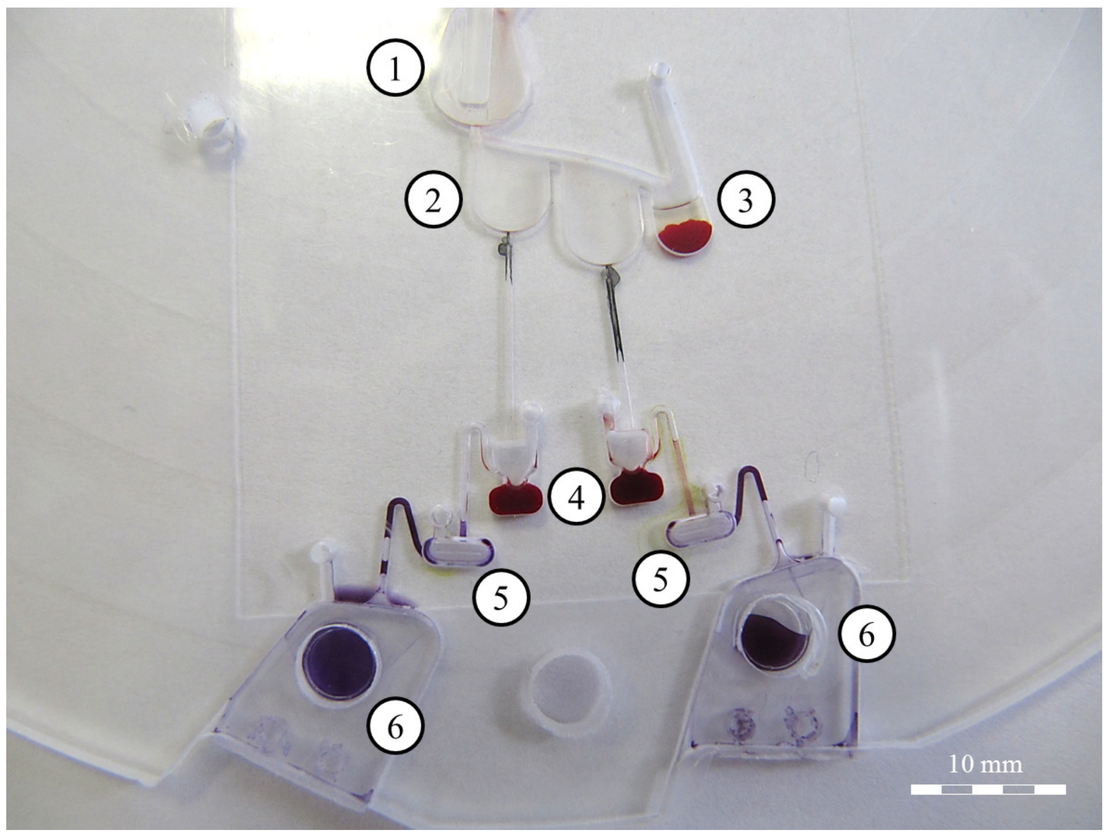

Figure 3: Image of the LabDisk with sample collection chamber (1), aliquoting structure (2), overspill chamber (3), blood plasma separation structures (4), reaction chambers (5) with prestored reagents and integrated cuvettes for absorptiometric detection of TC concentration (6).

Results

sample	c_{LDX} [mM]	$c_{LabDisk}$ [mM]
1	1 6.01	1 6.00
2	2 4.74	2 4.79
3	3 3.81	3a 4.17
		3b 3.66
		3c 3.60

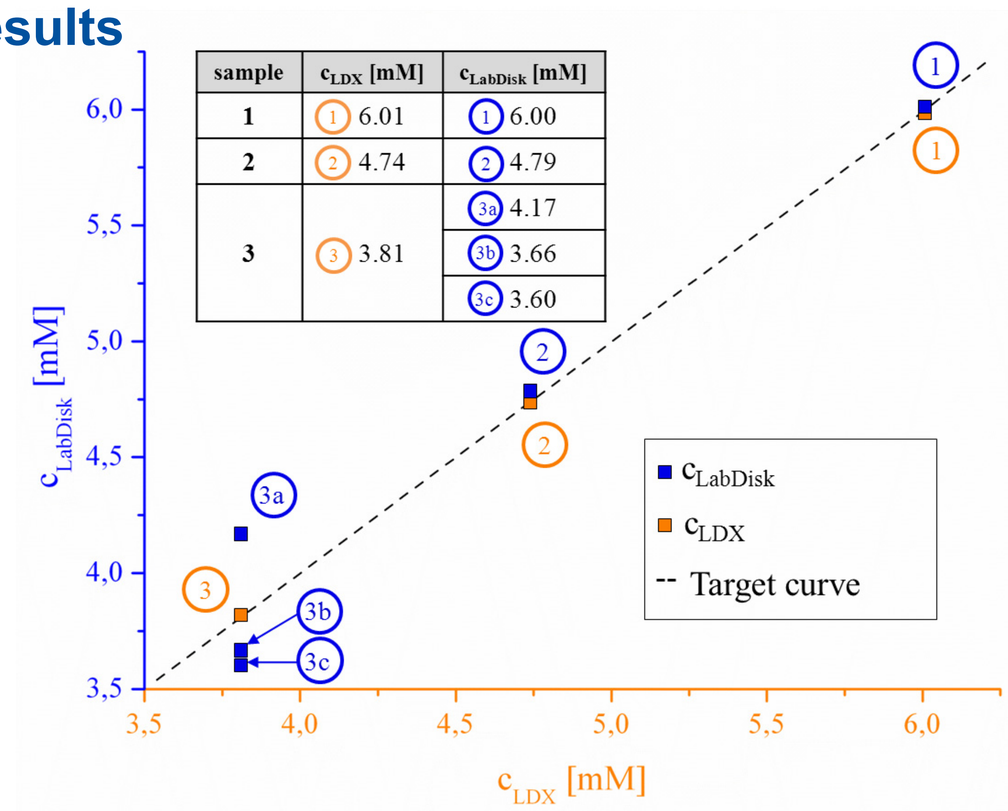

Figure 4: Variance comparison of the TC concentrations of the LabDisk to the TC concentrations determined with the LDX reference system using the same samples, whereas LDX results are shown on the X-axis, LabDisk results on the Y-axis. The dashed line shows the target curve for each concentration. Samples #1 & #2 show comparable results to the reference system, sample #3 varies around the reference result with a CV of 6.3 %.

Conclusions

Results are in line with common testing systems. Only 40 µL of sample is required. Time to result is 7 minutes (with room for optimization). The centrifugal microfluidic is designed to integrate multiparameter analysis like the detection of HDL-cholesterol and TG without affecting the time to result.

Acknowledgements

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