Supplementary Figures

OMEF Biochip for Evaluating Red Blood Cell Deformability Using Dielectrophoresis as a Diagnostic Tool for Type 2 Diabetes Mellitus

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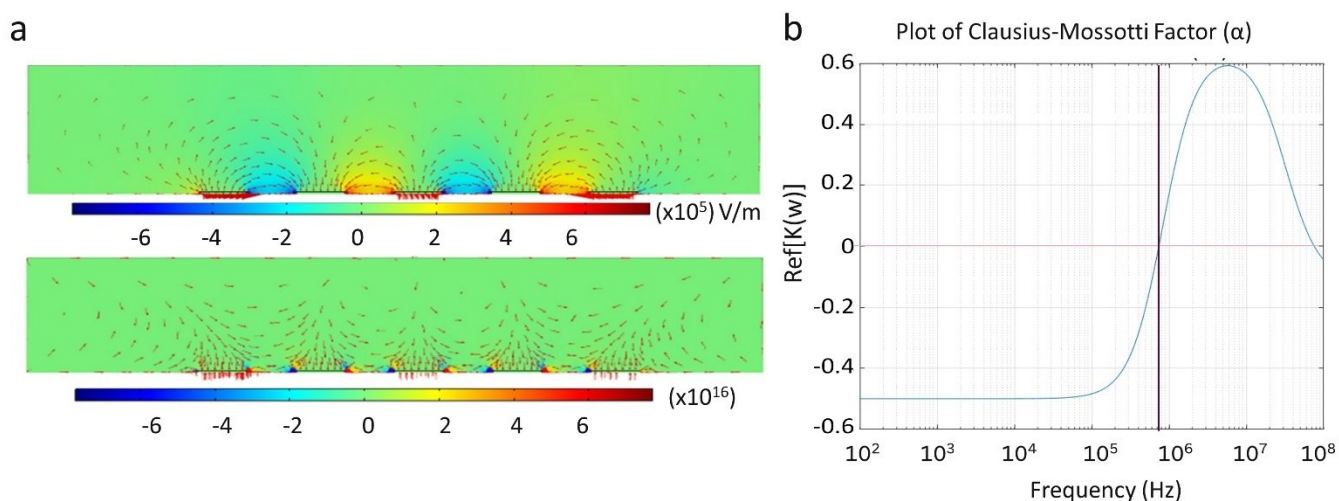[*] *Corresponding Author. E-mail: mohammad.qasaimeh@nyu.edu*

Fig. S1 Optimization of the design of the developed open micro-electro-fluidic OMEF biochip. (a) COMSOL Multiphysics simulations were employed to assess the strength of the electric field for effectively stretching RBCs. (b) Line graph showing calculated Clausius-Mossotti factor α for RBC. Positive DEP (p-DEP) is observed above 1 Mhz.
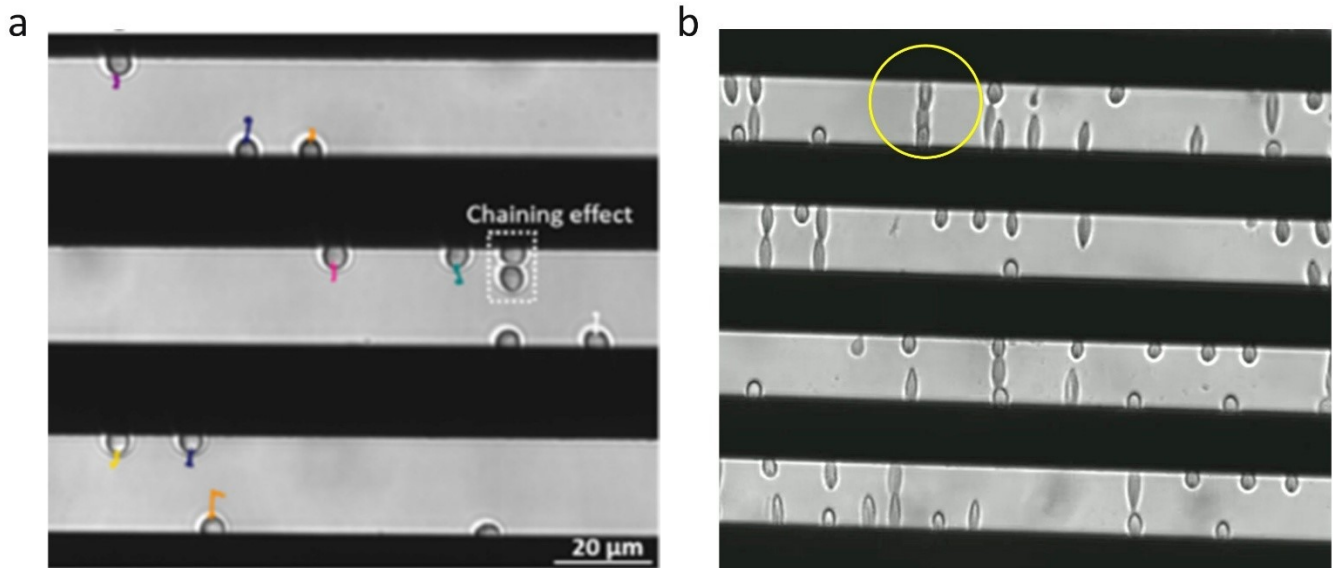
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Fig. S2 Tracking RBC deformation using the semi-automated protocol. (a) Mechanical parameters were averaged across 10-15 RBCs captured on the substrate of the OMEF through DEP. (b) Cells that exhibited "pearl chaining effect", where coinciding axes caused cells to touch each other (yellow circle), were excluded from the analysis.
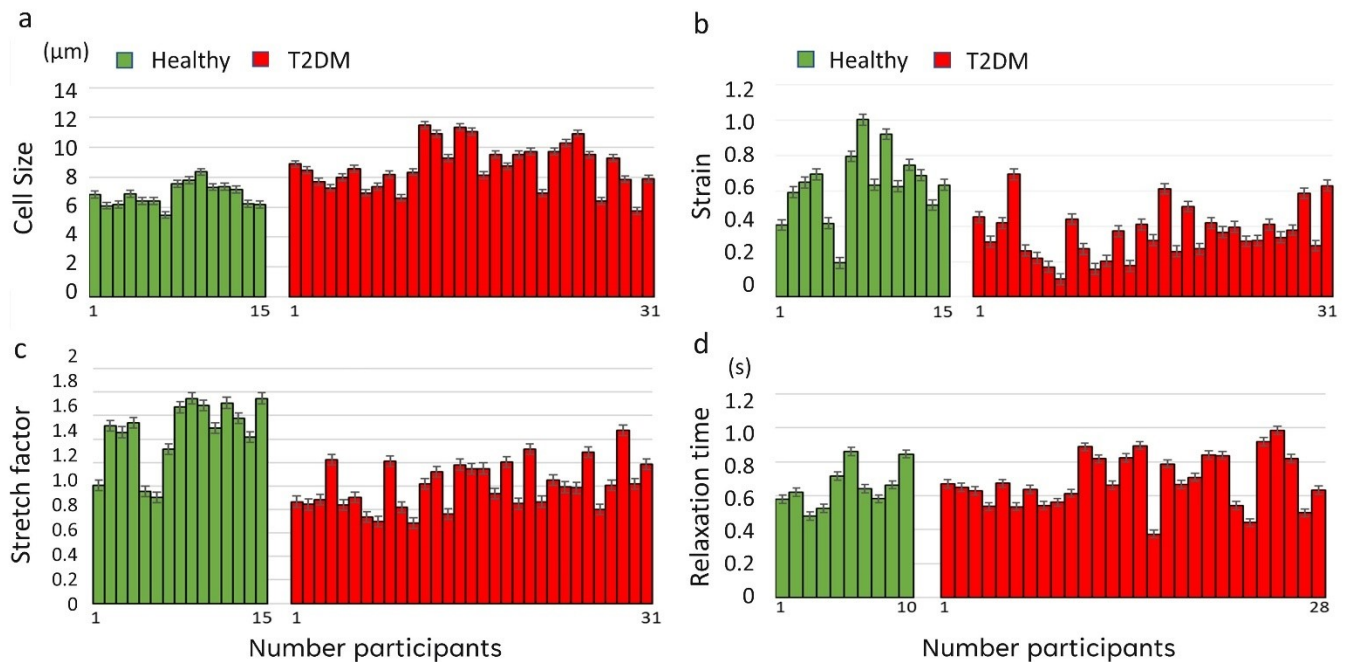

Fig. S3 RBC deformation analysis. Histograms reveal the distribution of (a) cell size, (b) strain, (c) stretch factor, and (d) relaxation time in healthy and diabetic (T2DM) participants. These histograms represent data from RBCs obtained from 15 healthy volunteers and 31 T2DM patients. Error bars indicate the Mean ± Standard Error of the Mean. n = 420 for healthy RBCs and n = 1208 for T2DM RBCs.
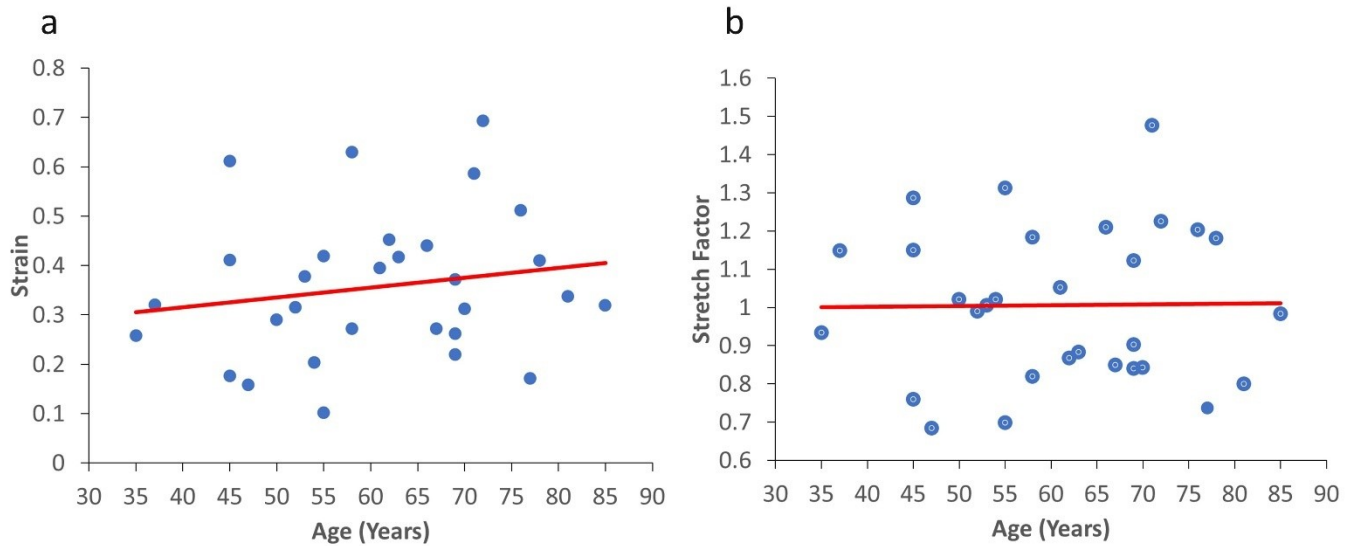
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Fig. S4 Analysis the strain and stretch factor of RBCs across different age groups. The scattered data indicated that (a) the strain equation is y = 0.002x + 0.2364 (R² = 0.0312), and (b) the stretch factor equation is y = 0.0002x + 0.9924 (R² = 0.0002).
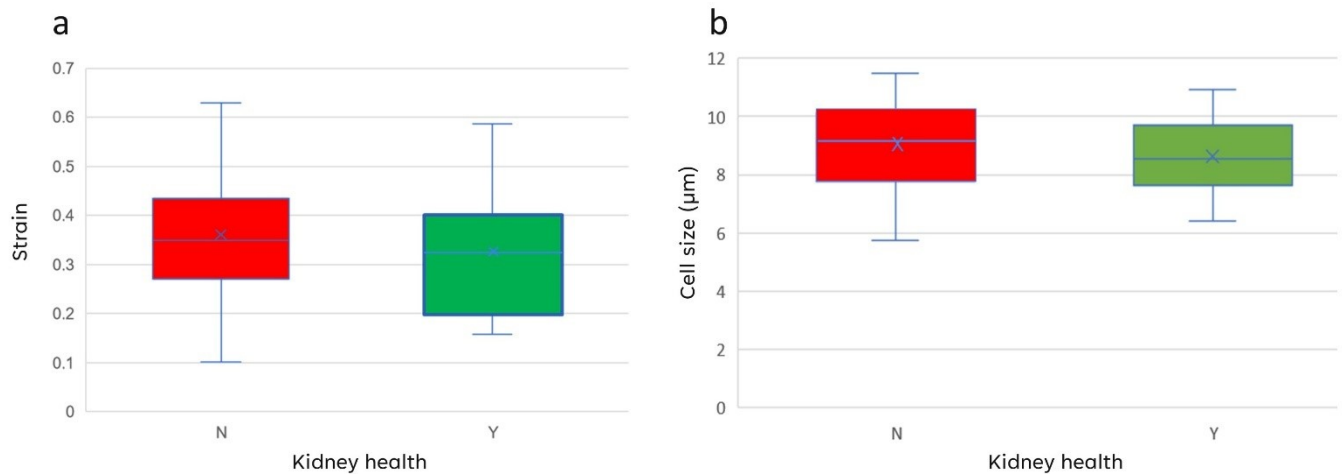

Fig. S5 Analysis of the strain and cell size of RBCs from individuals with and without kidney complications revealed that individuals with kidney complications (N) had a higher average strain value and showed greater variability and spread in cell diameter compared to those with healthy kidneys (Y).

SF3/SF4

Supplementary Figures
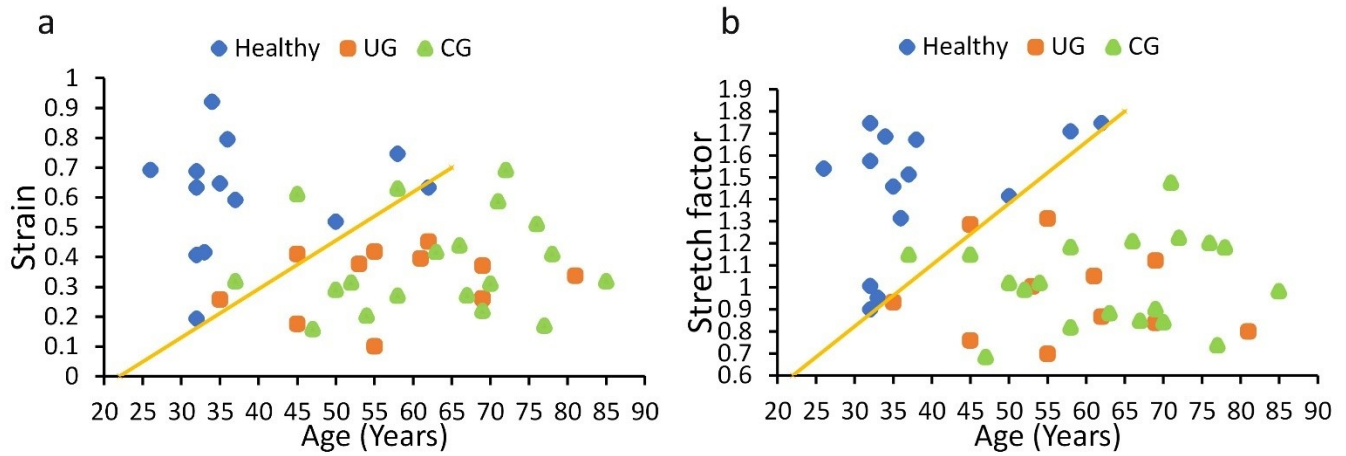

Fig. S6 Analysis of the strain and stretch factor of RBCs from diabetic patients with controlled glycemia (CG, <7%) and uncontrolled glycemia (UC, >7%) in comparison to healthy individuals showed that CG patients exhibited a 15% higher strain than UC patients. Furthermore, both the strain and stretch factors of RBCs from healthy individuals were higher than those of diabetic RBCs.