Electronic Supplementary Information (ESI)

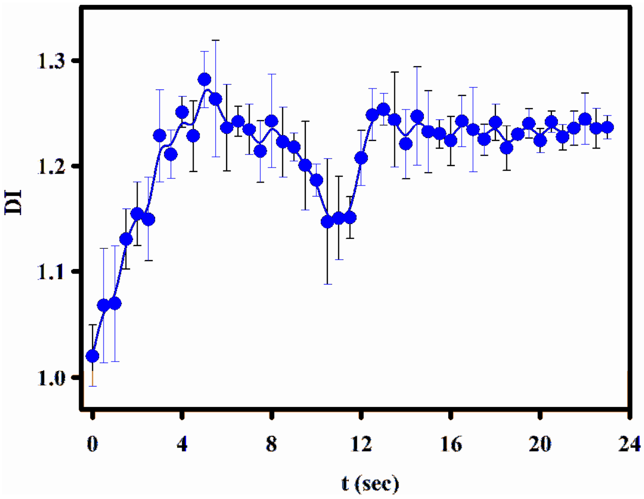

Figure S1: Deformation characteristics of RBCs within a straight channel (H=100 µm, W= 300 µm, L= 2.5 cm) as a function of time. The channel has been fabricated on glass-PDMS substrate by following photolithography followed by soft-lithography technique. Thereafter the channel surface was functionalized with APTES-ConA treatment. Afterwards, we investigate the deformation characteristics of a particular RBC (of haemoglobin content 14 g/dl) at the centre of the channel, L/2 distance away from the inlet reservoir. The images were captured through an inverted microscope (OLYMPUS IX71) using 40X objective lens at a speed of 2 frames per second. During the experimentation, the flow rate of the plasma was kept constant at 5 µl/min. We choose plasma to flow within the channel, as the dynamic imaging of the adhered RBCs would be difficult due to the suspended cells within the blood stream. From the above figure, it is evident that the deformation of RBCs is almost unaltered after ~ 10 seconds, i.e. RBCs achieve its plastic deformation stage; which ensures that our analysis was done for the RBCs at its plastic deformation stage. The error bars were calculated from four sets of repeated experimental results.

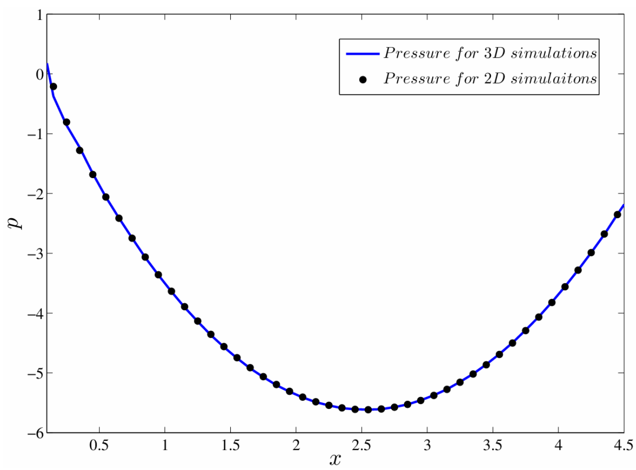

Figure S2: Comparison between pressure from 2-dimensional (2D) and 3-dimensional (3D) simulations, as functions of axial location (x). In 2D simulation channel height and length were $H = 1$ and $L = 5$ respectively. In 3D simulation height, width and length were taken as: $H = 1$, $W = 3$ and $L =$

5, so that the *W*/*H* ratio of 3 as in the experimental set up is maintained. The fluid was considered to be a power law fluid, with power law index n = 0.79 and consistency index, m = 0.104. Other parameters are as follows (kindly refer to the manuscript): ω_0 = 560 rpm, ω = 750 rpm, ρ (density) = 1000 kg/m^3. The other parameters are given by R = 1.339, Re* = 2.23 and the pressure values were plotted along the channel centreline. We have also done simulations for low Re* values, which show exactly similar trends. However, we do not reproduce those results here, for the sake of brevity. This figure demonstrates that, although our simulations in the original manuscript are performed assuming a 2D geometry with $W/H \gg 1$, even for $W/H = 3$, the 2D simulations offer very accurate results. We note that the dominating actuating force in the present study is the centrifugal force. Since, in our 2D simulations, the fluid flow is actuated by centrifugal forcing, in a geometry, which is a 2D analog to the actual 3-dimensional set up, we can conclude that our simulation environment indeed resembles the experimental reality in a qualitative way. Therefore, our use of 2D simulation, to obtain a qualitative picture of the stress distribution in the channel is well justified. In figure S2, we have only compared the values of pressure, since pressure is the primary contributor to the stresses acting on the cells in the present study. As a final note we mention that, all the simulations were performed in COMSOL Multiphysics 4.2.

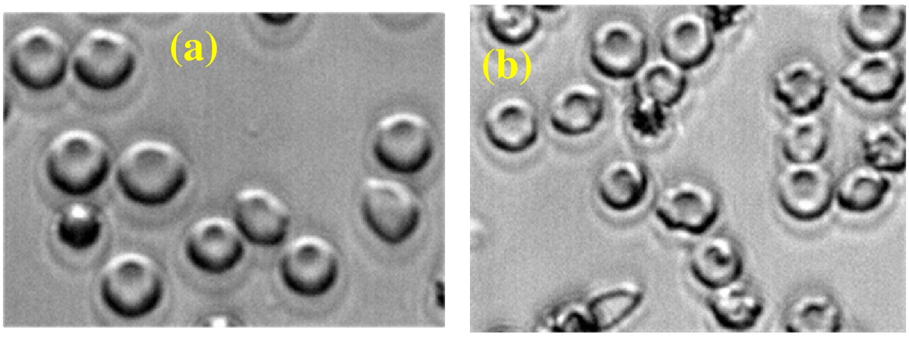

Figure S3: The above figure depicts the images of red blood cells (RBCs) for different haemoglobin contents; **(a)** for haemoglobin content of 16 g/dl and **(b)** for haemoglobin content of 9.2 g/dl. The images were captured through an inverted microscope (OLYMPUS IX71) using 40X objective lens. From the images, the distinction of RBC shape is clearly evident. RBCs having lower haemoglobin contents show some ridges at their outer surfaces, whereas RBCs having higher haemoglobin contents have comparatively smoother membranes.