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Effects of ingested nanocellulose and nanochitosan materials on carbohydrate digestion and absorption in an in vitro small intestinal epithelium model

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Supplementary Figures



Supplementary Figure 1. Toxicological assessment of glucose-free media formulations at different pyruvate concentrations. a. TEER, b. LDH c. Viability. d. ROS production.



Supplementary Figure 2. Effects of cellulose and chitosan nanomaterials on absorption of glucose from starch. a. Apical chamber glucose absorption over time, b. Glucose utilization by cells over time c. Cell glucose utilization rate over time. d. Glucose translocation rate over time.

Maltose Hydrolysis in Stored Apical Digesta-Media Samples



Supplementary Figure 3. **Spontaneous hydrolysis of maltose in stored samples over time.** Immediately following digestion, 100% of glucose is in the form of maltose. At the time digestas of starch were applied to cells, 48 h after digestion, 90% of glucose remains in the form of maltose.



Supplementary Figure 4. Effects of cellulose and chitosan nanomaterials on absorption of glucose from glucose-spiked digestas. a. Apical chamber glucose absorption over time, b. Glucose utilization by cells over time c. Cell glucose utilization rate over time. d. Glucose translocation rate over time.



Supplementary Figure 5. Glucose absorption mechanisms. Schematic representation of a small intestinal enterocyte (features not to scale) showing the primary enzymes, transporters and signaling pathways thought to be involved in absorption of glucose, as well as .

Supplementary Tables

Material	Cellulose Nanocrystals (CNC) ^{1,2}	Cellulose Nanofiber (CNF) ^{1,2}	Chitosan nanoparticles (Chnp) ^{3,4}
Density ρ_p (g/cm ³)	1.572 ± 0.021	1.3120 ± 0.0185	1.587±0.009
$SSA(m^2/g)$	93	34	23.66±0.32
d _{BET} (nm)	N/D	N/D	159.8±2.3
Length (nm)	270 ± 90	6710 ± 5611	N/D
Diameter (nm)	25 ± 9	64 ± 29	N/D
Aspect Ratio	11.5 ± 3.2	107.6 ± 54.5	N/D
Zeta potential (ζ, mV)	-27.4 ± 1.21	-7.43 ± 3.25	$+20.8 \pm 3.01$
Hydrodynamic size-diameter(nm)	N/D	N/D	175.8 ± 37.4
Endotoxin (EU/mg)	1.47	<lod< th=""><th><lod< th=""></lod<></th></lod<>	<lod< th=""></lod<>
Sterility (CFU/g)	0	0	0

Supplmentary Table 1. Material characterization

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- Guo, Z. *et al.* Physicochemical and Morphological Transformations of Chitosan Nanoparticles across the Gastrointestinal Tract and Cellular Toxicity in an in Vitro Model of the Small Intestinal Epithelium. *J. Agric. Food Chem.* (2019). doi:10.1021/acs.jafc.9b05506