SUPPLEMENTARY MATERIAL

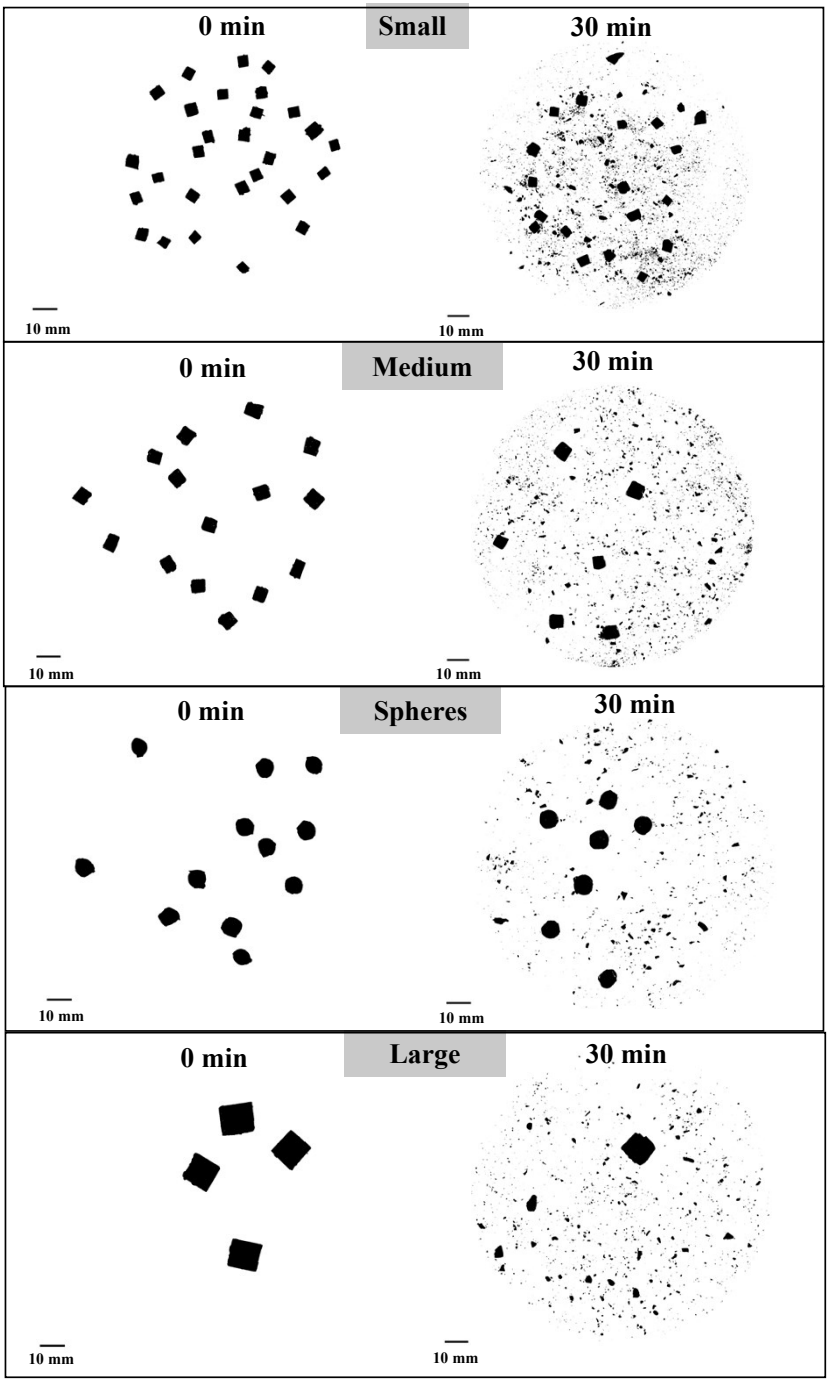
Supplementary Table 1. Median particle area, x_{50}, change (% from initial) and number of particles per gram of solid phase of digesta for small cubes, medium cubes, spheres, and large cubes. Values represent the average (n = 3) ± standard error of the mean. Different letters within each column (abc) and within each row (zyx) are means significantly different within the row or column ($p < 0.05$). Values with no letters within each row or column show no significant differences between means.

Digestion Time (min)	Median Particle Area Change (% from initial)			
	Small	**Medium**	**Spheres**	**Large**
30	87.7 ± 4.3^{a}	80.6 ± 11.2^{a}	77.5 ± 9.0^{a}	97.2 ± 0.6^{a}
60	$18.0 \pm 13.3^{b,y}$	$33.6 \pm 12.0^{b,zy}$	$37.0 \pm 13.1^{ab,zy}$	$77.9 \pm 6.0^{a,z}$
75	$22.0 \pm 8.2^{b,y}$	$6.0 \pm 14.7^{b,y}$	$3.2 \pm 2.9^{b,y}$	$77.1 \pm 5.3^{a,z}$
90	32.3 ± 12.7^{b}	14.8 ± 19.4^{b}	8.9 ± 3.4^{b}	30.7 ± 9.5^{b}
105	5.3 ± 6.6^{b}	19.9 ± 22.0^{b}	12.4 ± 0.2^{b}	20.3 ± 20.2^{b}
120	3.3 ± 6.9^{b}	6.9 ± 7.8^{b}	13.0 ± 2.0^{b}	4.9 ± 9.5^{b}
150	9.7 ± 0.4^{b}	9.1 ± 5.8^{b}	13.6 ± 1.1^{b}	8.6 ± 14.9^{b}
180	17.7 ± 3.0^{b}	10.3 ± 11.6^{b}	19.1 ± 1.2^{b}	14.1 ± 10.0^{b}
Digestion Time (min)	**Number of Particles per Gram**			
	Small	**Medium**	**Spheres**	**Large**
0	16.3 ± 1.4^{b}	7.0 ± 0.3^{b}	5.8 ± 0.1	1.0 ± 0.1^{b}
30	$1802.7 \pm 434.4^{a,z}$	$796 \pm 276.8^{a,y}$	364.8 ± 166.8^{y}	$789.2 \pm 101.2^{a,y}$
60	174.5 ± 4.2^{b}	84.9 ± 9.4^{b}	88.0 ± 52.9	108.8 ± 35.7^{b}
75	111.8 ± 20.7^{b}	67.6 ± 21.0^{b}	34.7 ± 17.2	43.1 ± 2.4^{b}
90	181.7 ± 49.5^{b}	100 ± 17.7^{b}	23.5 ± 7.5	15.8 ± 0.8^{b}
105	61.3 ± 1.0^{b}	124.1 ± 23.4^{b}	20.6 ± 4.0	25.3 ± 13.8^{b}
120	28.2 ± 3.2^{b}	65.4 ± 25.6^{b}	17.9 ± 2.3	9.1 ± 1.9^{b}
150	35.6 ± 6.3^{b}	45.0 ± 12^{b}	20.7 ± 8.5	6.7 ± 2.1^{b}
180	34.1 ± 4.0^{b}	35.4 ± 7.0^{b}	11.5 ± 1.2	10.0 ± 1.8^{b}

Note: the median particle area in the emptied digesta over time was calculated using the following equation:

$$median\ particle\ area\ (x_{50})\ change = \frac{x_{50t} - x_{50initial}}{x_{50initial}}$$

where x_{50t} is the x_{50} measured at each digestion time point and $x_{50initial}$ is the initial x_{50} of each geometry.

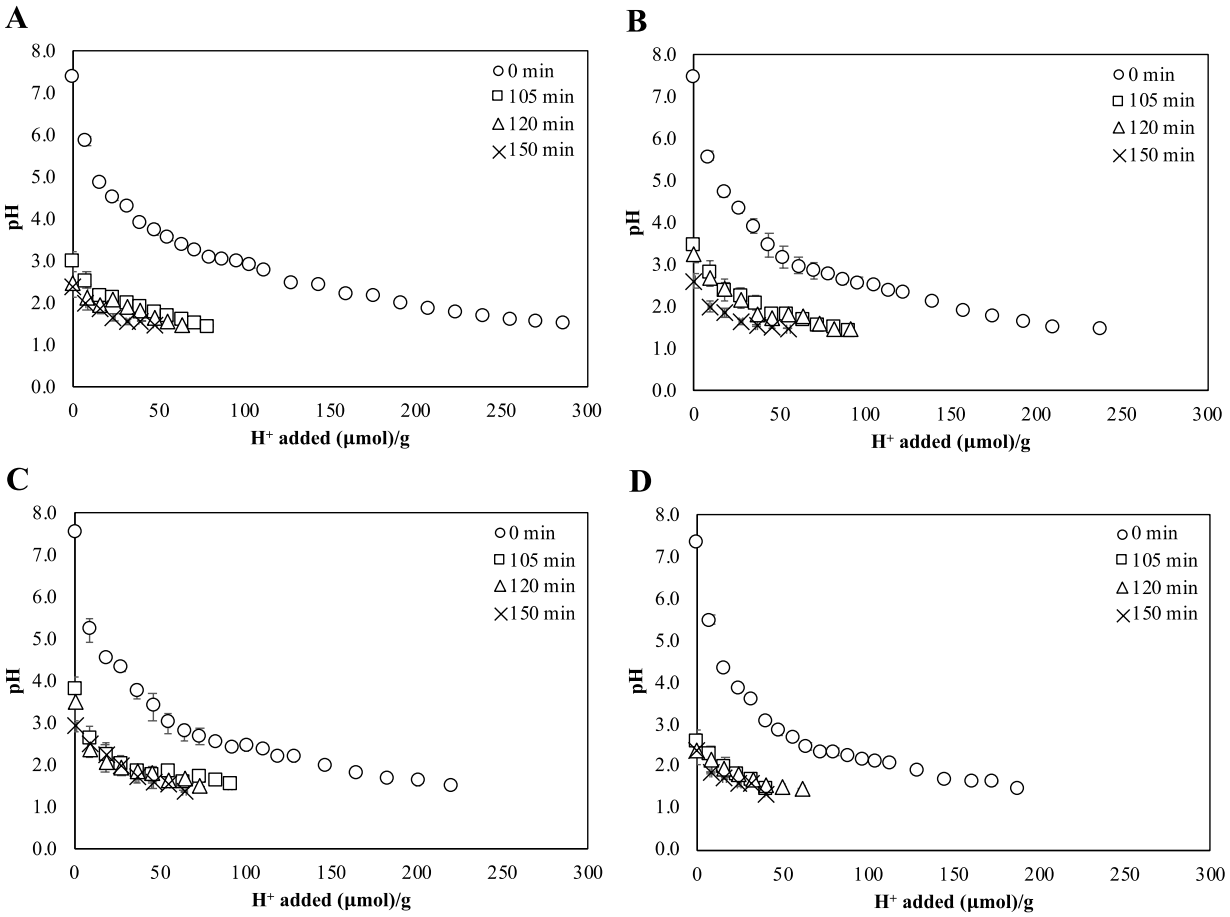


Supplementary Fig. 1 Examples of binary images used for particle size determination of protein gels before and after 30 min of simulated digestion for each of the four geometries.

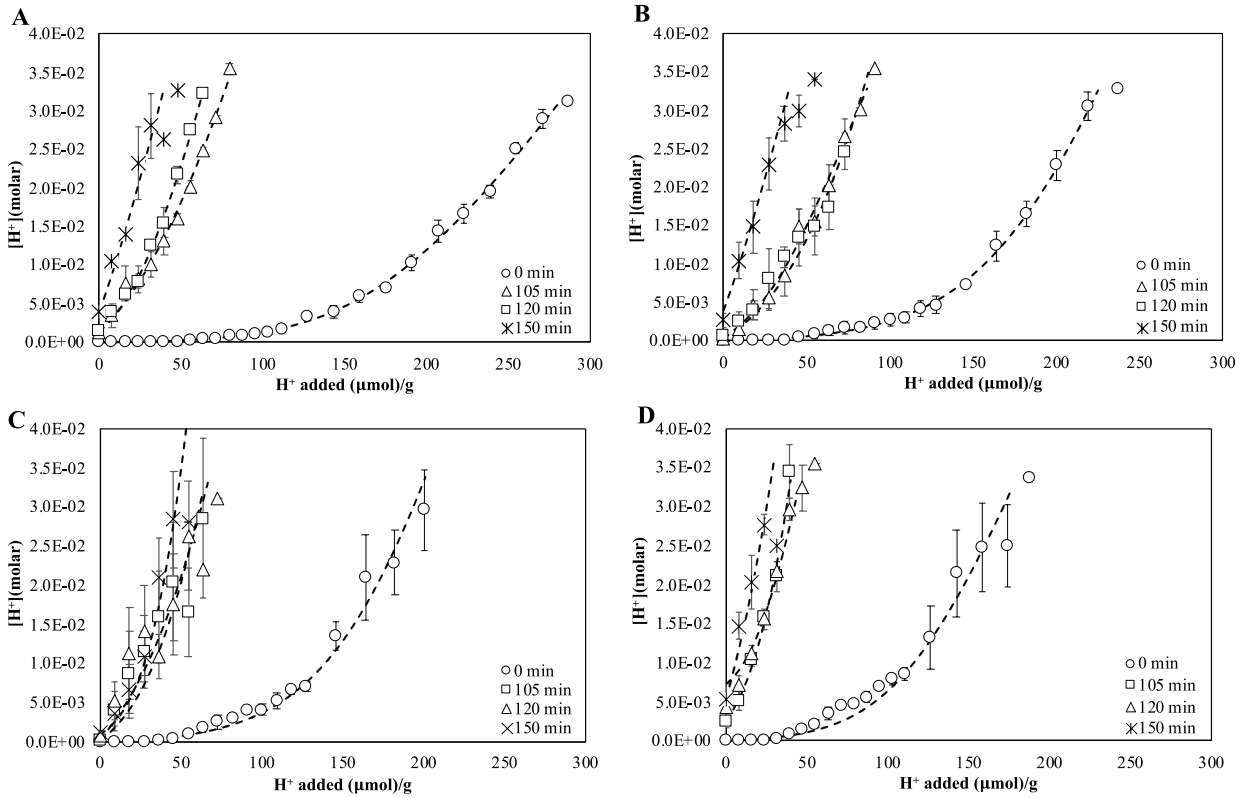
Supplementary Table 2. Particle size distribution parameters (d10, d50, d90, and specific surface area) from the liquid phase of the emptied digesta of all treatments. Values represent the average (n = 2 or 3) ± standard error of the mean.

Digestion time (min)	d10 (µm)			
	Small cubes	Medium cubes	Spheres	Large cubes
60	4.5 ± 0.7	3.6 ± 0.4	3.7 ± 0.3	3.6 ± 0.1
75	N.D.*	2.9 ± 0	2.7 ± 0.1	3.5 ± 0.1
90	3.5 ± 0.7	2.6 ± 0.4	3 ± 0.4	3.2 ± 0.1
105	3.2 ± 0.4	2.8 ± 0.2	3.1 ± 0	3 ± 0.2
120	3.4 ± 0.3	2.9 ± 0.2	2.6 ± 0.1	3 ± 0.2
150	3.9 ± 0.4	2.7 ± 0.3	2.6 ± 0.1	3.1 ± 0.1
180	4.3 ± 0.7	2.8 ± 0.2	2.5 ± 0.1	N.D.*
Digestion time (min)	**d50 (µm)**			
	Small cubes	**Medium cubes**	**Spheres**	**Large cubes**
60	8.3 ± 1.4	6.7 ± 0.7	6.9 ± 0.4	6.7 ± 0.1
75	N.D.*	5.8 ± 0	5.3 ± 0.2	6.5 ± 0.2
90	6.5 ± 1.3	4.7 ± 0.7	6.9 ± 1.6	6.3 ± 0
105	6.1 ± 0.6	5.3 ± 0.3	8.6 ± 0.1	6.6 ± 0
120	6.4 ± 0.7	6.6 ± 1.3	5.8 ± 0.4	6.4 ± 0.1
150	7.4 ± 1.1	7.9 ± 1.8	6.7 ± 0.8	7.4 ± 1.2
180	8.3 ± 2	8.8 ± 3.1	6.4 ± 0.8	N.D.*
Digestion time (min)	**d90 (µm)**			
	Small cubes	**Medium cubes**	**Spheres**	**Large cubes**
60	17.3 ± 2	13.4 ± 2.7	19.9 ± 4.2	16.3 ± 2.4
75	N.D.*	13.4 ± 0.6	10.4 ± 0.9	19.7 ± 7.5
90	12.8 ± 3.2	12.4 ± 3.6	24.2 ± 5.8	28.5 ± 14.6
105	20 ± 7.9	9.7 ± 0.9	62.7 ± 29.7	57.9 ± 6.7
120	12.7 ± 2.8	39.3 ± 28.7	16.0 ± 4.3	42.2 ± 27.2
150	18.3 ± 6.7	46.1 ± 18.8	33.6 ± 17.2	54 ± 40.1
180	24.1 ± 12.5	40.4 ± 23.5	18.8 ± 2.7	N.D.*
Digestion time (min)	**Specific Surface Area (mm^2/g)**			
	Small cubes	**Medium cubes**	**Spheres**	**Large cubes**
60	789 ± 123	985 ± 119	949 ± 46	955 ± 16
75	N.D.*	1133 ± 10	1272 ± 63	999 ± 42
90	1037 ± 213	1413 ± 176	1090 ± 171	1035 ± 11
105	1088 ± 108	1255 ± 90	892 ± 11	991 ± 21
120	1053 ± 108	1091 ± 170	1199 ± 47	1029 ± 17
150	902 ± 115	1078 ± 70	1107 ± 105	970 ± 77
180	818 ± 194	1029 ± 162	1246 ± 82	N.D.*

*N.D. = values not determined since only one replicate was completed due to (1) did not reach obscuration of >5% (for small 75 min), or (2) two of the replicates behaved as outliers (large, 180 min).



Supplementary Fig. 2 Acid titration curve of small cubes (A), medium cubes (B), spheres (C), and large cubes (D) before digestion (time 0 min) and after 105, 120, and 150 min of gastric digestion. Different symbols represent averages (n = 3) and error bars the standard error of the mean. Error bars are included in all treatments but may be too small to be seen in some treatments.



Supplementary Fig. 3 Exponential growth model plots and measured values from buffering capacity analysis of small cubes (A), medium cubes (B), spheres (C), and large cubes (D) before digestion (time 0 min) and after 105, 120, and 150 min of gastric digestion. Symbols represent averages (n = 3) and error bars the standard error of the mean. Dashed lines represent the predicted curves from the empirical model (eqn (4)).