**Increased diet viscosity by oat β-glucans decreases the passage rate of liquids in the stomach and affects digesta physicochemical properties in growing pigs**

M. Schop1,2,A. J. M. Jansman2, S. de Vries1 and W. J. J. Gerrits1

*1 Animal Nutrition Group, Wageningen University & Research, 6700 AH Wageningen, the Netherlands*

*2 Animal Nutrition Department, Wageningen Livestock Research, 6700 AH Wageningen, the Netherlands*

***animal* journal**

Supplementary data

**Supplementary table S1.** The mean retention time (min) of digesta solids (TiO2) and liquids (Cr-EDTA) in the stomach and small intestine of growing pigs fed dietary treatments consisting of five incremental levels of β-glucans (BG: 0, 2.5, 5. 7.5 and 10%).

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Dietary β-glucan level (% of diet) | | | | | | | | | |
|  |  | 0 | | 2.5 | | 5 | | 7.5 | | 10 | |
| Segment | Parameter | Mean | SD | Mean | SD | Mean | SD | Mean | SD | Mean | SD |
| Stomach | Obs1 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
|  | Solids | 153 | 31 | 105 | 22 | 116 | 39 | 108 | 42 | 136 | 50 |
|  | Liquids | 52 | 12 | 43 | 26 | 66 | 16 | 75 | 36 | 104 | 41 |
| Proximal small intestine2 | Obs1 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
|  | Solids | 24 | 8 | 19 | 7 | 17 | 10 | 20 | 10 | 23 | 14 |
|  | Liquids | 24 | 12 | 22 | 8 | 19 | 8 | 17 | 7 | 26 | 16 |
| Distal small intestine2 | Obs1 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
|  | Solids | 81 | 5 | 111 | 37 | 104 | 17 | 69 | 20 | 82 | 15 |
|  | Liquids | 91 | 6 | 128 | 38 | 112 | 18 | 79 | 17 | 88 | 11 |

1 number of observations.

2 Division based on total length of small intestine.

**Supplementary table S2.** The digestibility of starch and crude protein in the stomach and small intestine of growing pigs fed dietary treatments consisting of five incremental levels of β-glucans (BG: 0, 2.5, 5. 7.5 and 10%).

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Dietary β-glucan level (% of diet) | | | | | | | | | |
|  |  | 0 | | 2.5 | | 5 | | 7.5 | | 10 | |
| Segment | Parameter | Mean | SD | Mean | SD | Mean | SD | Mean | SD | Mean | SD |
| Stomach | Obs1 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
|  | Solids | 0.30 | 0.22 | -0.34 | 0.25 | -0.25 | 0.24 | -0.63 | 0.24 | -0.39 | 0.24 |
|  | Liquids | 0.14 | 0.09 | 0.09 | 0.19 | -0.10 | 0.11 | -0.22 | 0.10 | -0.04 | 0.11 |
| Proximal small intestine2 | Obs1 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
|  | Solids | 0.85 | 0.11 | 0.91 | 0.07 | 0.88 | 0.05 | 0.90 | 0.11 | 0.79 | 0.29 |
|  | Liquids | 0.14 | 0.28 | 0.12 | 0.18 | 0.09 | 0.22 | 0.26 | 0.40 | 0.18 | 0.37 |
| Distal small intestine2 | Obs1 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
|  | Solids | 0.97 | 0.02 | 0.97 | 0.01 | 0.97 | 0.01 | 0.96 | 0.02 | 0.94 | 0.03 |
|  | Liquids | 0.55 | 0.19 | 0.60 | 0.10 | 0.60 | 0.06 | 0.50 | 0.19 | 0.55 | 0.08 |

1 number of observations.

2 Division based on total length of small intestine.

**Supplementary table S3.** Physicochemical properties of digesta (viscosity: *,* , visco451, water-binding capacity: **WBC**) in various segments of the gastrointestinal tract of growing pigs fed dietary treatments consisting of five incremental levels of β-glucans (BG: 0, 2.5, 5. 7.5 and 10%).

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Dietary β-glucan level (% of diet) | | | | | | | | | |
|  |  | 0 | | 2.5 | | 5 | | 7.5 | | 10 | |
| Segment | Parameter | MEAN | SD | MEAN | SD | MEAN | SD | MEAN | SD | MEAN | SD |
| Stomach | Obs2 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
|  |  | 752 | 519 | 173 | 139 | 185 | 88 | 54 | 53 | 45 | 23 |
|  |  | 0.12 | 0.04 | 0.14 | 0.03 | 0.14 | 0.03 | 0.23 | 0.08 | 0.37 | 0.04 |
|  | visco45 | 29.1 | 20.8 | 6.3 | 4.9 | 7.0 | 3.5 | 2.5 | 1.9 | 3.8 | 1.6 |
|  | WBC | 1.2 | 0.2 | 1.0 | 0.5 | 1.2 | 0.5 | 1.0 | 0.2 | 1.1 | 0.2 |
| Proximal small intestine2 | Obs2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
|  |  | 47 | 62 | 24 | 21 | 24 | 26 | 19 | 24 | 29 | 21 |
|  |  | 0.41 | 0.38 | 0.12 | 0.05 | 0.19 | 0.13 | 0.27 | 0.08 | 0.30 | 0.08 |
|  | visco45 | 1.9 | 2.2 | 0.9 | 0.8 | 1.3 | 1.5 | 1.0 | 1.0 | 1.8 | 1.2 |
|  | WBC2 | 1.8 | 1.2 | 1.6 | 0.8 | 2.7 | 2.4 | 1.3 | . | 1.0 | . |
| Distal small intestine2 | Obs2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
|  |  | 177 | 184 | 58 | 41 | 59 | 38 | 63 | 95 | 94 | 78 |
|  |  | 0.16 | 0.03 | 0.20 | 0.03 | 0.20 | 0.04 | 0.27 | 0.09 | 0.20 | 0.07 |
|  | visco45 | 7.7 | 8.2 | 2.6 | 1.5 | 2.7 | 1.4 | 2.6 | 3.2 | 4.8 | 4.0 |
|  | WBC | 2.1 | 0.4 | 2.2 | 0.3 | 2.0 | 0.3 | 3.2 | 1.4 | 2.9 | 0.4 |
| Caecum | Obs2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
|  |  | 34 | 18 | 25 | 5 | 26 | 10 | 24 | 17 | 40 | 25 |
|  |  | 0.13 | 0.06 | 0.19 | 0.06 | 0.23 | 0.05 | 0.20 | 0.11 | 0.25 | 0.11 |
|  | visco45 | 1.2 | 0.6 | 1.1 | 0.3 | 1.4 | 0.5 | 1.2 | 0.8 | 2.2 | 1.0 |
|  | WBC | 3.4 | 0.6 | 3.0 | 0.5 | 3.7 | 1.2 | 3.0 | 0.5 | 3.1 | 1.0 |
| Proximal colon3 | Obs2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
|  |  | 30 | 15 | 39 | 9 | 56 | 5 | 50 | 22 | 47 | 9 |
|  |  | 0.22 | 0.04 | 0.26 | 0.04 | 0.18 | 0.07 | 0.21 | 0.08 | 0.27 | 0.07 |
|  | visco45 | 1.5 | 0.8 | 2.3 | 0.8 | 2.6 | 0.7 | 2.3 | 0.9 | 2.9 | 0.6 |
|  | WBC | 2.9 | 0.5 | 2.5 | 0.6 | 3.0 | 0.5 | 2.9 | 0.7 | 2.7 | 1.2 |
| Distal colon3 | Obs2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
|  |  | 30 | 30 | 25 | 20 | 81 | 57 | 81 | 50 | 51 | 23 |
|  |  | 0.33 | 0.26 | 0.36 | 0.16 | 0.23 | 0.13 | 0.33 | 0.13 | 0.32 | 0.09 |
|  | visco45 | 1.9 | 1.3 | 2.7 | 3.5 | 4.0 | 2.9 | 6.1 | 3.4 | 3.8 | 1.9 |

1 Derived from dynamic viscosity by using a power-law function: , where = viscosity (Pa×s), = shear rate (/s), = power law index, = consistency constant (Pa×s).

2 number of observations, except for WBC in proximal small intestine (obs= 2 for BG0, 3 for BG2.5, 4 for BG5, 1 for BG7.5 and 1 for BG10).

3 Division based on total length of small intestine, and colon, respectively.