**Figure S1.** Hydrolysis of human $\alpha$-1 acid glycoprotein (A) and porcine mucin (B) by $\alpha$-L-fucosidases. HPLC chromatograms (Dionex system) of the standard compound L-fucose (chromatograms 1A and 1B). Control, reaction mixture with human $\alpha$-1 acid glycoprotein (chromatogram 2A) or porcine mucin (chromatogram 2B) and without enzyme. Reactions mixtures with human $\alpha$-1 acid glycoprotein as substrate and $\alpha$-L-fucosidases Fuc18, Fuc39 and Fuc19A (chromatograms 3A-5A). Reactions mixture with porcine mucin as substrate and $\alpha$-L-fucosidase Fuc2358 (chromatogram 3B).
| Fuc2358 | Fuc1821 | Fuc1584 | Fuc35A | Fuc144 | Fuc584 | Fuc1327 | Fuc19A | Fuc11 | Fuc19B | Fuc29 | Fuc193 | Fuc30 | Fuc35B | Fuc39 | Fuc21 | Fuc14 | Fuc29 | Fuc28 | Fuc499 |
|---------|---------|---------|--------|--------|--------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 100.00  | 24.63   | 100.00  | 97.94  | 26.99  | 31.53  | 31.99   | 31.31  | 31.31  | 25.92  | 27.42  | 26.97  | 29.56  | 28.68  | 23.71  | 21.31  | 21.97  | 20.20  | 23.20  | 23.85  | 24.05  | 23.45  |
| 24.63   | 100.00  | 96.00   | 26.99  | 31.53  | 31.99  | 31.31  | 31.31  | 25.92  | 27.42  | 26.97  | 29.56  | 28.68  | 23.71  | 21.31  | 21.97  | 20.20  | 23.20  | 23.85  | 24.05  | 23.45  |
| 24.38   | 97.94   | 100.00  | 27.71  | 31.29  | 32.24  | 31.57  | 31.57  | 25.92  | 27.42  | 26.97  | 29.56  | 28.68  | 23.71  | 21.31  | 21.97  | 20.20  | 23.20  | 23.85  | 24.05  | 23.45  |
| 24.35   | 26.99   | 96.00   | 100.00 | 32.27  | 34.51  | 33.17  | 32.92  | 26.94  | 32.56  | 31.69  | 32.47  | 31.47  | 30.18  | 19.68  | 22.50  | 21.04  | 17.38  | 17.79  | 19.24  | 18.65  | 18.65  |
| 27.45   | 31.53   | 31.29   | 32.27  | 100.00 | 38.15  | 36.16  | 36.16  | 28.32  | 30.36  | 29.82  | 28.53  | 31.15  | 31.74  | 26.69  | 20.34  | 24.21  | 18.26  | 24.43  | 25.28  | 23.23  | 22.66  |
| 27.72   | 31.99   | 32.24   | 34.51  | 38.15  | 100.00 | 69.68  | 69.91  | 28.46  | 27.25  | 29.09  | 28.05  | 32.18  | 29.15  | 26.94  | 23.50  | 25.64  | 20.61  | 24.65  | 26.40  | 24.93  | 24.93  |
| 28.42   | 31.31   | 31.57   | 32.92  | 36.16  | 69.91  | 97.00  | 100.00 | 27.23  | 26.72  | 27.84  | 26.55  | 30.21  | 28.54  | 24.52  | 21.91  | 24.65  | 20.16  | 22.31  | 22.99  | 22.10  | 21.27  |
| 28.42   | 31.31   | 31.57   | 32.92  | 36.16  | 69.91  | 97.00  | 100.00 | 27.23  | 26.72  | 27.84  | 26.55  | 30.21  | 28.54  | 24.52  | 21.91  | 24.65  | 20.16  | 22.31  | 22.99  | 22.10  | 21.27  |
| 27.45   | 31.53   | 31.29   | 32.27  | 100.00 | 38.15  | 36.16  | 36.16  | 28.32  | 30.36  | 29.82  | 28.53  | 31.15  | 31.74  | 26.69  | 20.34  | 24.21  | 18.26  | 24.43  | 25.28  | 23.23  | 22.66  |
| 100.00  | 24.63   | 100.00  | 97.94  | 26.99  | 31.53  | 31.99  | 31.31  | 31.31  | 25.92  | 27.42  | 26.97  | 29.56  | 28.68  | 23.71  | 21.31  | 21.97  | 20.20  | 23.20  | 23.85  | 24.05  | 23.45  |
| 24.63   | 100.00  | 96.00   | 26.99  | 31.53  | 31.99  | 31.31  | 31.31  | 25.92  | 27.42  | 26.97  | 29.56  | 28.68  | 23.71  | 21.31  | 21.97  | 20.20  | 23.20  | 23.85  | 24.05  | 23.45  |
| 24.38   | 97.94   | 100.00  | 27.71  | 31.29  | 32.24  | 31.57  | 31.57  | 25.92  | 27.42  | 26.97  | 29.56  | 28.68  | 23.71  | 21.31  | 21.97  | 20.20  | 23.20  | 23.85  | 24.05  | 23.45  |
| 24.35   | 26.99   | 96.00   | 100.00 | 32.27  | 34.51  | 33.17  | 32.92  | 26.94  | 32.56  | 31.69  | 32.47  | 31.47  | 30.18  | 19.68  | 22.50  | 21.04  | 17.38  | 17.79  | 19.24  | 18.65  | 18.65  |
| 27.45   | 31.53   | 31.29   | 32.27  | 100.00 | 38.15  | 36.16  | 36.16  | 28.32  | 30.36  | 29.82  | 28.53  | 31.15  | 31.74  | 26.69  | 20.34  | 24.21  | 18.26  | 24.43  | 25.28  | 23.23  | 22.66  |

**TABLE S1.** Percent amino acid identity matrix of the α-L-fucosidases GH29 found in infant gut microbial metagenome

Fuc499

Fuc28 |
| Fuc21 |
| Fuc39 |
| Fuc28 |
| Fuc499 |

α-L-fucosidases with amino acid identity above 69% are labeled with the same color.
| Name        | Sequence                                      |
|-------------|-----------------------------------------------|
| Fuc18BamHI  | 5’-TTTTGGATCTCTGTCAGAGTGTTTCGGGCAC           |
| Fuc18HindIII| 5’-TTTTAAGCTTCTATCGACACCAAATTTCCG            |
| Fuc19ABamHI | 5’-TTTTGGATCCACACACATTTGTACATAAAC            |
| Fuc19APstl  | 5’-TTTCTGCAGTCACCTTCTTTTTGTTTTCGG           |
| Fuc30BamHI  | 5’-TTTTGGATCCAAACTAAGTCGTTGACCC            |
| Fuc30HindIII| 5’-TTTTAAGCTTTCTCCTCTCACAATATAC            |
| Fuc35ABamHI | 5’-TTTTGGATCCACTACCGAAGACATTTGCA            |
| Fuc35APstl  | 5’-TTTTCTGCAGTCAGAAATATTCTACTTTTAGC         |
| Fuc35BBamHI | 5’-TTTTGGATCCACAGAAATAATTGTATGTC            |
| Fuc35BHindIII| 5’-TTTTTAAGCTTTTATATTTGCCGAAAGACTTTA       |
| Fuc39BamHI  | 5’-TTTTGGATCCCTCTGACCAGCAAAGAAAC           |
| Fuc39HindIII| 5’-TTTTAAGCTTTCAAGGAGCTACGGTCAC           |
| Fuc193BamHI | 5’-TTTTGGATCCACACATATTGTCCAAAATCAATA       |
| Fuc193HindIII| 5’-TTTTAAGCTTTCTACTCCAAATATAGTTCTA       |
| Fuc1584BamHI| 5’-TTTTGGATCCCAAATCTCGGAAAAAGCATTTG       |
| Fuc1584Pstl | 5’-TTTTCTGCAGTATTGTGGCTCTACTACCTCAG        |
| Fuc2358Sphl | 5’-TTTTGCATCGCATGATAAGCCTTGAAAGAGATTG    |
| Fuc2358HindIII| 5’-TTTTAAGCTTTCTAAAGCTGATGCGCAAAAC       |
| Fuc5372BamHI| 5’-CTGGGATCCCAAGATACCCCTGCAAAATGAGACC    |
| Fuc5372HindIII| 5’-ATTAGCTTTGGCTGCAGGTCGACCCTAGCTAGG      |