Supplementary Material

Enhancing bioaccessibility of plant protein by probiotics: an *in vitro* study

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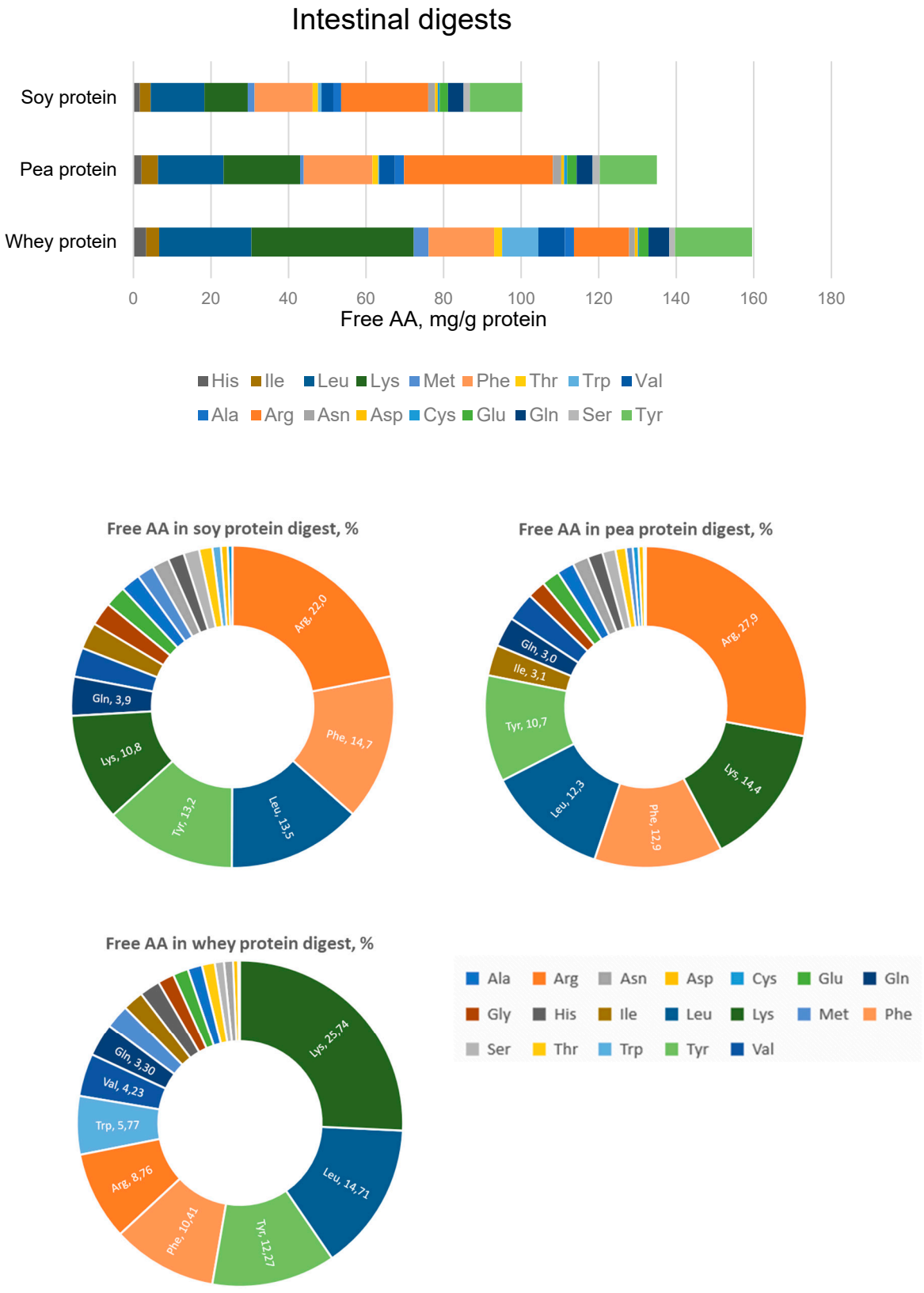
Supplementary table 1. Soluble protein measured at the beginning and after the *in vitro* digestion of soy, pea and whey protein ingredients. Values are mean (standard deviation, SD).

Treatment	Baseline (mg)	After digestion (mg)	Change, Δ (mg)	After digestion, relative to control
	Soy protein			
Control	430.9 (25.5)	428.5 (27.1)	-2.4 (3.6)	1.00 (0.06)
B420	395.0 (25.2)	714.4 (20.5) †****	+319.5 (40.4) ****	1.67 (0.05) ****
BI-04	376.1 (53.9)	421.0 (65.2)	+44.9 (22.2)	0.98 (0.15)
NCFM	430.6 (62.4)	473.1 (87.7)	+42.5 (27.7)	1.10 (0.20)
HN001	428.9 (40.5)	448.2 (61.9)	+19.3 (77.2)	1.05 (0.14)
Lpc-37	431.5 (52.7)	449.1 (58.6)	+17.6 (28.4)	1.05 (0.14)
Lp-115	434.8 (81.2)	453.4 (66.7)	+18.5 (18.2)	1.06 (0.16)
LI-23	522.0 (74.8)	649.4 (90.6) †***	+127.4 (54.7) **	1.52 (0.21) **
	Pea protein			
Control	96.8 (17.8)	319.3 (27.3) †	+222.6 (29.3)	1.00 (0.09)
B420	85.5 (9.3)	312.4 (44.6) †	+226.9 (52.0)	0.98 (0.14)
BI-04	109.5 (15.4)	429.9 (55.5) †****	+320.5 (48.2) *	1.35 (0.17) **
NCFM	101.3 (25.3)	419.1 (14.6) †***	+317.8 (26.8) [a]	1.31 (0.05) **
HN001	85.6 (18.0)	322.7 (16.9) †	+237.1 (33.5)	1.01 (0.05)
Lpc-37	94.1 (24.5)	355.9 (43.6) †	+261.7 (65.8)	1.11 (0.14)
Lp-115	87.4 (23.9)	395.8 (9.1) †**	+308.4 (31.8) [a]	1.24 (0.03) *
LI-23	107.1 (7.0)	473.9 (19.0) †****	+366.8 (25.7) **	1.48 (0.06) ****
	Whey protein			
Control	937.9 (70.3)	933.8 (96.7)	-4.1 (26.7)	1.00 (0.10)
B420	974.5 (74.0)	1052 (60.4)	+77.2 (33.0)	1.13 (0.06)
BI-04	848.7 (9.1)	924.6 (106.5)	+75.9 (111.7)	0.99 (0.11)
NCFM	959.7 (124.5)	941.1 (111.9)	-18.6 (15.2)	1.01 (0.12)
HN001	959.0 (117.6)	948.7 (147.2)	-10.3 (49.9)	1.02 (0.16)
Lpc-37	1056.3 (138.5)	1076.1 (112.5)	+19.9 (33.8)	1.15 (0.12)
Lp-115	978.2 (43.7)	960.6 (77.1)	-17.5 (41.3)	1.03 (0.08)
LI-23	878.4 (91.1)	873.5 (84.6)	-4.9 (12.9)	0.94 (0.09)

† Significantly different from the baseline;
* $p<0.05$, ** $p<0.01$, *** $p<0.001$, **** $p<0.0001$, significantly different from the control;
[a] $0.05 \leq p < 0.1$, a tendency towards a difference from the control.

B420 = *Bifidobacterium animalis* subsp. *lactis* B420; BI-04 = *B. animalis* subsp. *lactis* BI-04; NCFM = *Lactobacillus acidophilus* NCFM; HN001 = *Lacticaseibacillus rhamnosus* HN001; Lpc-37 = *Lacticaseibacillus paracasei* subsp. *paracasei* Lpc-37; Lp-115 = *Lactiplantibacillus plantarum* Lp-115; and LI-23 = *Lactococcus lactis* subsp. *lactis* LI-23.



Supplementary figure 1. Profiles of free amino acids (AA) released from whey, soy and pea protein after the *in vitro* digestion. Essential amino acids (EAA): histidine (His), isoleucine (Ile), leucine (Leu), lysine (Lys), methionine (Met), phenylalanine (Phe), threonine (Thr) and valine (Val)

Supplementary table 2. The absolute values of free amino acids at the beginning (baseline) and after the simulated digestion of soy and pea protein by treatment. The table shows mean (mg/g protein) followed by standard deviation in brackets.

		Soy protein		Pea protein	
Amino acid	Treatment	Baseline (mg/g protein)	After digestion (mg/g protein)	Baseline (mg/g protein)	After digestion (mg/g protein)
Alanine	Control	0.29 (0.09)	2.03 (0.70) ***	0.33 (0.02)	2.38 (0.15) ***
	B420	0.35 (0.00)	3.13 (0.21) ***	0.35 (0.01)	2.63 (0.02) ***
	BI-04	0.47 (0.19)	2.82 (0.37) ***	0.36 (0.01)	2.83 (0.27) ***
	NCFM	0.47 (0.11)	3.53 (0.27) ***	0.40 (0.07)	2.60 (0.27) ***
	HN001	0.43 (0.14)	3.38 (0.55) ***	0.45 (0.10)	2.65 (0.30) ***
	Lpc-37	0.41 (0.10)	2.92 (0.43) ***	0.49 (0.02)	2.80 (0.21) ***
	Lp-115	0.33 (0.08)	2.24 (0.74) ***	0.38 (0.01)	2.45 (0.06) ***
	LI-23	0.35 (0.02)	2.88 (0.21) ***	0.42 (0.07)	2.73 (0.24) ***
Arginine	Control	3.46 (0.56)	22.45 (5.96) ***	2.10 (0.36)	38.36 (1.14) ***
	B420	3.79 (0.03)	27.64 (2.99) ***	2.52 (0.06)	39.96 (0.16) ***
	BI-04	4.36 (0.89)	31.16 (8.01) ***	2.28 (0.47)	34.88 (10.55) ***
	NCFM	4.47 (0.53)	27.23 (4.38) ***	2.94 (0.49)	39.50 (2.21) ***
	HN001	4.34 (0.66)	27.00 (6.06) ***	3.16 (0.88)	39.83 (2.64) ***
	Lpc-37	4.06 (0.44)	24.43 (2.25) ***	3.47 (0.53)	40.79 (2.18) ***
	Lp-115	3.60 (0.40)	24.66 (3.25) ***	2.66 (0.29)	40.27 (2.26) ***
	LI-23	3.98 (0.24)	26.87 (1.86) ***	2.90 (0.44)	41.76 (0.77) ***
Asparagine	Control	0.31 (0.06)	1.75 (0.41) ***	0.35 (0.01)	2.19 (0.09) ***
	B420	0.23 (0.02)	2.33 (0.30) ***	0.28 (0.02)	2.16 (0.21) ***
	BI-04	0.37 (0.16)	2.20 (0.27) ***	0.31 (0.03)	2.33 (0.15) ***
	NCFM	0.42 (0.09)	2.92 (0.35) ***	0.39 (0.10)	2.36 (0.20) ***
	HN001	0.38 (0.10)	2.76 (0.62) ***	0.48 (0.11)	2.47 (0.34) ***
	Lpc-37	0.37 (0.08)	2.28 (0.38) ***	0.53 (0.04)	2.61 (0.20) ***
	Lp-115	0.35 (0.05)	1.93 (0.43) ***	0.37 (0.00)	2.23 (0.06) ***
	LI-23	0.30 (0.07)	2.15 (0.15) ***	0.44 (0.09)	2.52 (0.27) ***
Aspartic acid	Control	0.14 (0.05)	0.68 (0.02) ***	0.14 (0.01)	0.71 (0.01) ***
	B420	0.16 (0.00)	0.94 (0.05) **	0.15 (0.01)	0.74 (0.02) ***
	BI-04	0.19 (0.04)	0.94 (0.03) ***	0.17 (0.04)	0.81 (0.15) ***

		Soy protein		Pea protein	
Amino acid	Treatment	Baseline (mg/g protein)	After digestion (mg/g protein)	Baseline (mg/g protein)	After digestion (mg/g protein)
	NCFM	0.26 (0.06)	1.21 (0.09)	0.19 (0.08)	0.88 (0.28) ***
	HN001	0.24 (0.04)	1.12 (0.12)	0.22 (0.09)	1.01 (0.35)
	Lpc-37	0.24 (0.05)	1.00 (0.23) ***	0.27 (0.00)	1.22 (0.04)
	Lp-115	0.24 (0.05)	1.02 (0.06) **	0.18 (0.05)	0.64 (0.30) ***
	LI-23	0.15 (0.02)	0.71 (0.19) ***	0.22 (0.07)	0.89 (0.47) ***
Cystine	Control	0.08 (0.00)	0.51 (0.18) ***	0.08 (0.00)	0.80 (0.04) ***
	B420	0.08 (0.00)	0.65 (0.03) ***	0.09 (0.00)	0.64 (0.05) ***
	BI-04	0.13 (0.08)	0.80 (0.25) ***	0.13 (0.08)	0.74 (0.18) ***
	NCFM	0.08 (0.00)	0.89 (0.09) *	0.16 (0.07)	0.83 (0.22) ***
	HN001	0.08 (0.00)	0.89 (0.08) *	0.18 (0.09)	1.02 (0.23) *
	Lpc-37	0.12 (0.08)	0.84 (0.21) ***	0.24 (0.00)	1.17 (0.04)
	Lp-115	0.12 (0.08)	0.52 (0.36) ***	0.17 (0.05)	0.89 (0.24) ***
	LI-23	0.08 (0.00)	0.62 (0.03) ***	0.17 (0.08)	0.96 (0.24) ***
Glutamic acid	Control	0.40 (0.13)	2.16 (0.27) ***	0.47 (0.01)	2.46 (0.04) ***
	B420	0.27 (0.00)	2.24 (0.14) ***	0.28 (0.02)	2.06 (0.06) ***
	BI-04	0.35 (0.10)	2.27 (0.12) ***	0.34 (0.11)	2.14 (0.24) ***
	NCFM	0.55 (0.09)	3.00 (0.15) ***	0.45 (0.15)	2.57 (0.33) ***
	HN001	0.51 (0.08)	2.79 (0.48) ***	0.55 (0.11)	2.76 (0.46) ***
	Lpc-37	0.50 (0.09)	2.52 (0.44) ***	0.61 (0.00)	3.03 (0.09) ***
	Lp-115	0.54 (0.03)	2.42 (0.27) ***	0.39 (0.12)	1.88 (0.77) ***
	LI-23	0.38 (0.08)	2.23 (0.03) ***	0.53 (0.09)	2.40 (1.01) ***
Glutamine	Control	0.63 (0.24)	4.03 (0.68) ***	0.58 (0.03)	4.13 (0.30) ***
	B420	0.82 (0.03)	5.84 (0.59) ***	0.62 (0.01)	4.77 (0.30) ***
	BI-04	1.25 (0.72)	5.33 (0.65) ***	0.63 (0.02)	5.57 (0.91) ***
	NCFM	1.24 (0.35)	7.02 (0.75) ***	0.86 (0.25)	4.67 (0.72) ***
	HN001	1.12 (0.43)	6.69 (1.27) ***	1.09 (0.39)	4.78 (0.98) ***
	Lpc-37	1.02 (0.31)	6.07 (1.11) ***	1.25 (0.15)	5.24 (0.60) ***
	Lp-115	0.76 (0.27)	5.07 (0.76) ***	0.74 (0.03)	4.45 (0.10) ***
	LI-23	0.85 (0.07)	5.47 (0.48) ***	0.94 (0.28)	5.14 (0.68) ***

		Soy protein		Pea protein	
Amino acid	Treatment	Baseline (mg/g protein)	After digestion (mg/g protein)	Baseline (mg/g protein)	After digestion (mg/g protein)
Glycine	Control	0.16 (0.01)	2.39 (0.23) ***	0.16 (0.00)	2.50 (0.07) ***
	B420	0.10 (0.00)	2.52 (0.15) ***	0.10 (0.00)	2.75 (0.18) ***
	BI-04	0.13 (0.03)	2.43 (0.30) ***	0.12 (0.03)	2.45 (0.30) ***
	NCFM	0.18 (0.06)	2.77 (0.02) ***	0.16 (0.05)	2.71 (0.16) ***
	HN001	0.17 (0.05)	2.77 (0.22) ***	0.19 (0.04)	2.76 (0.13) ***
	Lpc-37	0.17 (0.05)	2.39 (0.39) ***	0.21 (0.01)	2.85 (0.02) ***
	Lp-115	0.19 (0.01)	2.27 (0.35) ***	0.15 (0.02)	2.51 (0.04) ***
	LI-23	0.13 (0.02)	2.53 (0.11) ***	0.17 (0.05)	2.73 (0.21) ***
Histidine	Control	0.33 (0.03)	1.66 (0.27) ***	0.38 (0.01)	2.09 (0.08) ***
	B420	0.24 (0.04)	2.28 (0.44) ***	0.30 (0.05)	2.10 (0.42) ***
	BI-04	0.38 (0.18)	2.21 (0.43) ***	0.36 (0.06)	2.38 (0.14) ***
	NCFM	0.44 (0.09)	2.39 (0.16) ***	0.40 (0.13)	2.29 (0.24) ***
	HN001	0.42 (0.09)	2.33 (0.24) ***	0.51 (0.10)	2.38 (0.34) ***
	Lpc-37	0.41 (0.07)	2.17 (0.31) ***	0.55 (0.03)	2.50 (0.15) ***
	Lp-115	0.41 (0.02)	2.01 (0.29) ***	0.42 (0.04)	2.25 (0.10) ***
	LI-23	0.30 (0.09)	1.94 (0.15) ***	0.46 (0.09)	2.41 (0.24) ***
Isoleucine	Control	0.24 (0.08)	2.79 (1.24) ***	0.32 (0.02)	4.26 (0.36) ***
	B420	0.31 (0.00)	5.09 (0.32) ***	0.38 (0.01)	4.75 (0.16) ***
	BI-04	0.47 (0.25)	4.76 (0.33) ***	0.38 (0.02)	5.07 (0.26) ***
	NCFM	0.47 (0.13)	5.52 (0.43) ***	0.44 (0.08)	4.58 (0.58) ***
	HN001	0.44 (0.17)	5.23 (0.94) ***	0.51 (0.15)	4.73 (0.77) ***
	Lpc-37	0.39 (0.10)	4.65 (0.77) ***	0.56 (0.07)	4.99 (0.54) ***
	Lp-115	0.31 (0.06)	3.46 (1.54) ***	0.40 (0.02)	4.53 (0.23) ***
	LI-23	0.31 (0.01)	4.68 (0.34) ***	0.44 (0.08)	4.99 (0.34) ***
Leucine	Control	1.98 (0.86)	13.84 (2.32) ***	1.10 (0.09)	16.90 (1.04) ***
	B420	2.48 (0.04)	19.64 (1.10) ***	1.28 (0.02)	16.82 (0.31) ***
	BI-04	3.08 (1.09)	18.37 (1.24) ***	1.22 (0.18)	18.30 (1.42) ***
	NCFM	3.29 (0.52)	20.94 (1.27) ***	1.47 (0.22)	17.23 (0.86) ***
	HN001	3.10 (0.79)	20.30 (3.07) ***	1.66 (0.47)	18.04 (1.95) ***

		Soy protein		Pea protein	
Amino acid	Treatment	Baseline (mg/g protein)	After digestion (mg/g protein)	Baseline (mg/g protein)	After digestion (mg/g protein)
	Lpc-37	2.82 (0.52)	18.41 (2.01) ***	1.79 (0.29)	18.54 (1.56) ***
	Lp-115	2.04 (0.78)	15.68 (3.39) ***	1.33 (0.03)	17.80 (1.13) ***
	LI-23	2.64 (0.22)	18.98 (1.27) ***	1.47 (0.21)	19.12 (0.65) ***
Lysine	Control	1.67 (0.54)	11.21 (2.76) ***	0.80 (0.10)	19.74 (0.91) ***
	B420	1.95 (0.07)	14.80 (2.15) ***	0.82 (0.03)	19.98 (0.37) ***
	BI-04	2.28 (0.50)	16.29 (3.60) ***	0.81 (0.06)	17.60 (4.59) ***
	NCFM	2.32 (0.26)	15.08 (1.95) ***	1.08 (0.20)	20.18 (1.05) ***
	HN001	2.23 (0.34)	15.04 (3.36) ***	1.22 (0.34)	20.65 (1.53) ***
	Lpc-37	2.12 (0.22)	13.57 (1.51) ***	1.36 (0.15)	21.29 (1.26) ***
	Lp-115	1.75 (0.47)	12.35 (2.02) ***	0.97 (0.11)	20.40 (1.10) ***
	LI-23	2.06 (0.15)	14.64 (1.41) ***	1.09 (0.22)	21.47 (0.83) ***
Methionine	Control	0.29 (0.09)	1.75 (0.23) ***	0.09 (0.00)	0.94 (0.03) **
	B420	0.32 (0.00)	2.43 (0.15) ***	0.09 (0.00)	0.94 (0.04) **
	BI-04	0.44 (0.13)	1.96 (0.61) ***	0.13 (0.06)	1.51 (0.93)
	NCFM	0.48 (0.10)	2.64 (0.20) ***	0.13 (0.07)	1.09 (0.17)
	HN001	0.45 (0.11)	2.59 (0.33) ***	0.16 (0.07)	1.20 (0.27)
	Lpc-37	0.43 (0.08)	2.37 (0.31) ***	0.20 (0.00)	1.32 (0.08) *
	Lp-115	0.36 (0.09)	2.19 (0.28) ***	0.12 (0.06)	1.09 (0.12)
	LI-23	0.36 (0.04)	2.28 (0.12) ***	0.16 (0.06)	1.17 (0.20)
Phenylalanine	Control	2.12 (0.59)	14.97 (1.28) ***	1.02 (0.07)	17.74 (0.61) ***
	B420	2.49 (0.03)	19.25 (0.79) ***	1.14 (0.02)	17.60 (0.21) ***
	BI-04	3.12 (1.17)	18.40 (0.82) ***	1.10 (0.13)	18.57 (0.77) ***
	NCFM	3.00 (0.34)	19.51 (1.04) ***	1.30 (0.16)	17.66 (0.75) ***
	HN001	2.90 (0.57)	19.18 (2.34) ***	1.44 (0.36)	18.37 (1.54) ***
	Lpc-37	2.63 (0.33)	17.76 (1.43) ***	1.54 (0.23)	18.72 (1.39) ***
	Lp-115	2.16 (0.47)	16.17 (1.96) ***	1.23 (0.02)	18.59 (1.24) ***
	LI-23	2.62 (0.18)	18.76 (1.13) ***	1.30 (0.14)	19.38 (0.48) ***
Serine	Control	0.29 (0.07)	1.60 (0.33) ***	0.28 (0.01)	1.81 (0.08) ***
	B420	0.24 (0.00)	2.03 (0.17) ***	0.20 (0.01)	1.71 (0.06) ***

		Soy protein		Pea protein	
Amino acid	Treatment	Baseline (mg/g protein)	After digestion (mg/g protein)	Baseline (mg/g protein)	After digestion (mg/g protein)
	Bl-04	0.34 (0.10)	1.88 (0.15) ***	0.23 (0.04)	1.83 (0.20) ***
	NCFM	0.39 (0.09)	2.45 (0.23) ***	0.28 (0.07)	1.86 (0.14) ***
	HN001	0.36 (0.10)	2.38 (0.38) ***	0.34 (0.08)	1.98 (0.22) ***
	Lpc-37	0.35 (0.08)	1.99 (0.30) ***	0.37 (0.01)	2.10 (0.09) ***
	Lp-115	0.32 (0.06)	1.72 (0.35) ***	0.27 (0.02)	1.71 (0.05) ***
	Ll-23	0.29 (0.04)	1.89 (0.09) ***	0.31 (0.06)	1.98 (0.26) ***
Threonine	Control	0.24 (0.07)	1.37 (0.32) *	0.23 (0.01)	1.45 (0.06) ***
	B420	0.22 (0.01)	2.02 (0.22) ***	0.17 (0.00)	1.48 (0.08) ***
	Bl-04	0.33 (0.10)	1.79 (0.21) ***	0.22 (0.07)	1.74 (0.35) ***
	NCFM	0.35 (0.07)	2.35 (0.22) ***	0.24 (0.06)	1.57 (0.16) ***
	HN001	0.35 (0.07)	2.27 (0.34) ***	0.29 (0.05)	1.69 (0.28) ***
	Lpc-37	0.34 (0.05)	1.93 (0.36) ***	0.32 (0.01)	1.78 (0.15) ***
	Lp-115	0.31 (0.06)	1.64 (0.32) ***	0.26 (0.04)	1.51 (0.12) ***
	Ll-23	0.26 (0.04)	1.82 (0.12) ***	0.27 (0.05)	1.65 (0.25) ***
Tryptophan	Control	0.08 (0.00)	0.90 (0.55)	0.08 (0.00)	0.30 (0.00) ***
	B420	0.23 (0.13)	2.46 (1.87) ***	0.11 (0.03)	0.82 (0.45)
	Bl-04	0.32 (0.26)	1.63 (1.66) *	0.16 (0.05)	1.65 (0.95)
	NCFM	0.22 (0.13)	1.92 (0.98) ***	0.08 (0.00)	0.56 (0.45)***
	HN001	0.28 (0.06)	2.27 (0.65) ***	0.11 (0.06)	0.44 (0.24) ***
	Lpc-37	0.27 (0.07)	2.05 (0.66) ***	0.11 (0.06)	0.44 (0.24) ***
	Lp-115	0.23 (0.01)	1.44 (0.44) **	0.13 (0.09)	0.80 (0.50) ***
	Ll-23	0.11 (0.06)	1.14 (0.73) ***	0.09 (0.02)	0.49 (0.23) ***
Tyrosine	Control	1.80 (0.39)	13.53 (1.87) ***	1.06 (0.08)	14.75 (0.57) ***
	B420	2.09 (0.04)	18.45 (0.80) ***	1.16 (0.01)	15.37 (0.17) ***
	Bl-04	2.67 (1.08)	16.84 (1.53) ***	1.15 (0.09)	16.73 (1.35) ***
	NCFM	2.48 (0.26)	18.43 (1.15) ***	1.29 (0.14)	14.99 (0.91) ***
	HN001	2.41 (0.44)	18.09 (2.35) ***	1.39 (0.27)	15.34 (1.26) ***
	Lpc-37	2.19 (0.26)	16.70 (1.34) ***	1.48 (0.17)	15.55 (1.15) ***
	Lp-115	1.82 (0.28)	14.46 (2.33) ***	1.27 (0.02)	15.43 (0.92) ***

		Soy protein		Pea protein	
Amino acid	Treatment	Baseline (mg/g protein)	After digestion (mg/g protein)	Baseline (mg/g protein)	After digestion (mg/g protein)
	LI-23	2.19 (0.15)	17.75 (1.00) ***	1.30 (0.10)	16.05 (0.42) ***
Valine	Control	0.35 (0.11)	3.06 (1.31) ***	0.33 (0.01)	4.01 (0.31) ***
	B420	0.43 (0.01)	5.54 (0.36) ***	0.37 (0.01)	4.53 (0.17) ***
	BI-04	0.64 (0.33)	4.99 (0.52) ***	0.39 (0.01)	5.09 (0.56) ***
	NCFM	0.68 (0.19)	5.93 (0.41) ***	0.48 (0.13)	4.48 (0.51) ***
	HN001	0.61 (0.24)	5.65 (0.97) ***	0.59 (0.20)	4.57 (0.67) ***
	Lpc-37	0.56 (0.16)	5.14 (0.87) ***	0.67 (0.08)	4.79 (0.43) ***
	Lp-115	0.42 (0.10)	3.78 (1.67) ***	0.43 (0.03)	4.26 (0.12) ***
	LI-23	0.44 (0.03)	5.05 (0.36) ***	0.51 (0.14)	4.73 (0.43) ***
Total EAA	Control	7.30 (2.36)	51.56 (9.33) ***	4.35 (0.30)	67.43 (3.24) ***
	B420	8.66 (0.33)	73.52 (7.29) ***	4.66 (0.06)	69.02 (1.57) ***
	BI-04	11.07 (3.93)	70.40 (6.97) ***	4.76 (0.16)	71.91 (2.48) ***
	NCFM	11.25 (1.59)	76.27 (5.55) ***	5.61 (0.91)	69.63 (4.50) ***
	HN001	10.79 (2.31)	74.86 (10.84) ***	6.49 (1.77)	72.06 (7.53) ***
	Lpc-37	9.97 (1.42)	68.05 (5.03) ***	7.11 (0.91)	74.38 (5.75) ***
	Lp-115	7.99 (2.06)	58.71 (10.86) ***	5.29 (0.24)	71.23 (2.87) ***
	LI-23	9.11 (0.76)	69.28 (4.77) ***	5.79 (0.95)	75.41 (2.57) ***
Total BCAA	Control	2.57 (1.05)	19.69 (4.83) ***	1.76 (0.12)	25.17 (1.69) ***
	B420	3.22 (0.06)	30.28 (1.77) ***	2.03 (0.04)	26.09 (0.61) ***
	BI-04	4.20 (1.67)	28.12 (2.04) ***	1.99 (0.19)	28.45 (2.17) ***
	NCFM	4.44 (0.84)	32.40 (2.10) ***	2.39 (0.42)	26.29 (1.91) ***
	HN001	4.15 (1.20)	31.18 (4.98) ***	2.76 (0.81)	27.34 (3.39) ***
	Lpc-37	3.77 (0.77)	28.20 (3.64) ***	3.03 (0.44)	28.32 (2.54) ***
	Lp-115	2.78 (0.94)	22.92 (6.59) ***	2.16 (0.01)	26.59 (1.45) ***
	LI-23	3.39 (0.26)	28.71 (1.91) ***	2.42 (0.43)	28.84 (1.35) ***
Total AA	Control	14.85 (3.95)	102.70 (14.63) ***	9.90 (0.78)	137.51 (5.29) ***
	B420	16.80 (0.45)	139.28 (12.68) ***	10.40 (0.13)	141.80 (2.03) ***
	BI-04	21.32 (6.92)	137.07 (13.25) ***	10.49 (0.41)	142.20 (9.06) ***
	NCFM	21.78 (3.18)	145.73 (12.33) ***	12.74 (2.05)	142.60 (9.44) ***

		Soy protein		Pea protein	
Amino acid	Treatment	Baseline (mg/g protein)	After digestion (mg/g protein)	Baseline (mg/g protein)	After digestion (mg/g protein)
	HN001	20.82 (4.34)	142.74 (22.46) ***	14.55 (3.89)	146.67 (14.40) ***
	Lpc-37	19.40 (2.79)	129.19 (9.16) ***	16.04 (1.82)	151.73 (10.28) ***
	Lp-115	16.26 (3.32)	115.02 (13.97) ***	11.87 (0.58)	143.70 (5.17) ***
	LI-23	17.79 (1.41)	132.37 (8.17) ***	13.19 (2.18)	152.57 (5.66) ***

*p<0.05, **p<0.01, and ***p<0.001, significant difference in terms of absolute change in amino acid concentration from baseline to after digestion within treatment. The data were log-transformed and analyzed using a robust linear model that is not affected by the heavy-tailed distribution of the data (outliers). p-values are corrected for false discovery rate (FDR) using Benjamini-Hochberg method.

B420 = *Bifidobacterium animalis* subsp. *lactis* B420; BI-04 = *B. animalis* subsp. *lactis* BI-04; NCFM = *Lactobacillus acidophilus* NCFM; HN001 = *Lacticaseibacillus rhamnosus* HN001; Lpc-37 = *Lacticaseibacillus paracasei* subsp. *paracasei* Lpc-37; Lp-115 = *Lactiplantibacillus plantarum* Lp-115; and LI-23 = *Lactococcus lactis* subsp. *lactis* LI-23.

Supplementary table 3. Comparison of probiotic **soy protein** digests to control digests in terms of absolute change in free amino acid content in the soluble phase from baseline to after digestion. The comparisons are reported as ratios against the control treatment where a ratio of 1.0 denotes no difference, ratio < 1 less than control and ratio > 1 higher than control. Standard error of the estimate is reported in parentheses.

Amino acid	B420	Bl-04	NCFM	HN001	Lpc-37	Lp-115	Ll-23
Alanine	1.42 (0.16) **	1.20 (0.14)	1.55 (0.18) ***	1.55 (0.18) ***	1.30 (0.15) *	1.10 (0.13)	1.29 (0.15) *
Arginine	1.13 (0.13)	1.12 (0.13)	1.09 (0.12)	1.08 (0.12)	0.96 (0.11)	1.02 (0.12)	1.08 (0.12)
Asparagine	1.37 (0.16) *	1.18 (0.14)	1.61 (0.18) ***	1.64 (0.19) ***	1.24 (0.14)	1.09 (0.12)	1.20 (0.14)
Aspartic acid	1.43 (0.16) **	1.39 (0.16) **	1.76 (0.20) ***	1.62 (0.18) ***	1.34 (0.15) *	1.44 (0.17) **	0.91 (0.10)
Cystine	1.14 (0.13)	1.23 (0.14)	1.63 (0.19) ***	1.64 (0.19) ***	1.43 (0.16) **	0.46 (0.05) ***	1.08 (0.12)
Glutamic acid	1.12 (0.13)	1.09 (0.12)	1.40 (0.16) **	1.36 (0.16) *	1.11 (0.13)	1.07 (0.12)	1.06 (0.12)
Glutamine	1.51 (0.17) **	1.23 (0.14)	1.74 (0.20) ***	1.72 (0.20) ***	1.57 (0.18) ***	1.30 (0.15) *	1.39 (0.16) **
Glycine	1.09 (0.12)	1.05 (0.12)	1.16 (0.13)	1.17 (0.13)	1.00 (0.11)	0.95 (0.11)	1.08 (0.12)
Histidine[a]	1.55 (0.18) ***	1.35 (0.15) *	1.42 (0.16) **	1.39 (0.16) **	1.30 (0.15) *	1.20 (0.14)	1.19 (0.14)
Isoleucine[a,b]	1.66 (0.19) ***	1.49 (0.17) **	1.75 (0.20) ***	1.69 (0.19) ***	1.52 (0.17) **	1.24 (0.14)	1.51 (0.17) **
Leucine[a,b]	1.46 (0.17) **	1.30 (0.15) *	1.50 (0.17) **	1.47 (0.17) **	1.33 (0.15) *	1.16 (0.13)	1.39 (0.16) **
Lysine[a]	1.40 (0.16) **	1.42 (0.16) **	1.38 (0.16) **	1.42 (0.16) **	1.22 (0.14)	1.09 (0.12)	1.33 (0.15) *
Methionine[a]	1.44 (0.16) **	1.18 (0.13)	1.48 (0.17) **	1.46 (0.17) **	1.33 (0.15) *	1.24 (0.14)	1.32 (0.15) *
Phenylalanine[a]	1.31 (0.15) *	1.19 (0.14)	1.29 (0.15) *	1.26 (0.14)	1.18 (0.13)	1.09 (0.12)	1.26 (0.14)
Serine	1.30 (0.15) *	1.13 (0.13)	1.48 (0.17) **	1.49 (0.17) **	1.19 (0.14)	1.07 (0.12)	1.17 (0.13)
Threonine[a]	1.50 (0.17) **	1.23 (0.14)	1.67 (0.19) ***	1.66 (0.19) ***	1.39 (0.16) **	1.16 (0.13)	1.31 (0.15) *
Tryptophan[a]	3.17 (0.38) ***	0.85 (0.10)	1.55 (0.18) **	2.30 (0.27) ***	2.07 (0.25) ***	1.34 (0.16) *	1.39 (0.17) *
Tyrosine	1.41 (0.16) **	1.22 (0.14)	1.37 (0.16) *	1.34 (0.15) *	1.24 (0.14)	1.11 (0.13)	1.34 (0.15) *
Valine[a,b]	1.70 (0.19) ***	1.44 (0.16) **	1.75 (0.20) ***	1.69 (0.19) ***	1.56 (0.18) ***	1.27 (0.15)	1.53 (0.17) **
total EAA[a]	1.51 (0.17) **	1.39 (0.16) **	1.52 (0.17) **	1.51 (0.17) **	1.36 (0.16) *	1.22 (0.14)	1.41 (0.16) **
total BCAA[b]	1.56 (0.18) ***	1.38 (0.16) **	1.61 (0.18) ***	1.57 (0.18) ***	1.42 (0.16) **	1.22 (0.14)	1.46 (0.17) **
Total AA	1.42 (0.16) **	1.34 (0.15) *	1.43 (0.16) **	1.43 (0.16) **	1.27 (0.15)	1.14 (0.13)	1.33 (0.15) *

[a] EAA, essential amino acid; [b] BCAA, branched chain amino acid. Statistically significant different to control digestion without probiotic; * $p<0.05$, ** $p<0.01$, *** $p<0.001$.

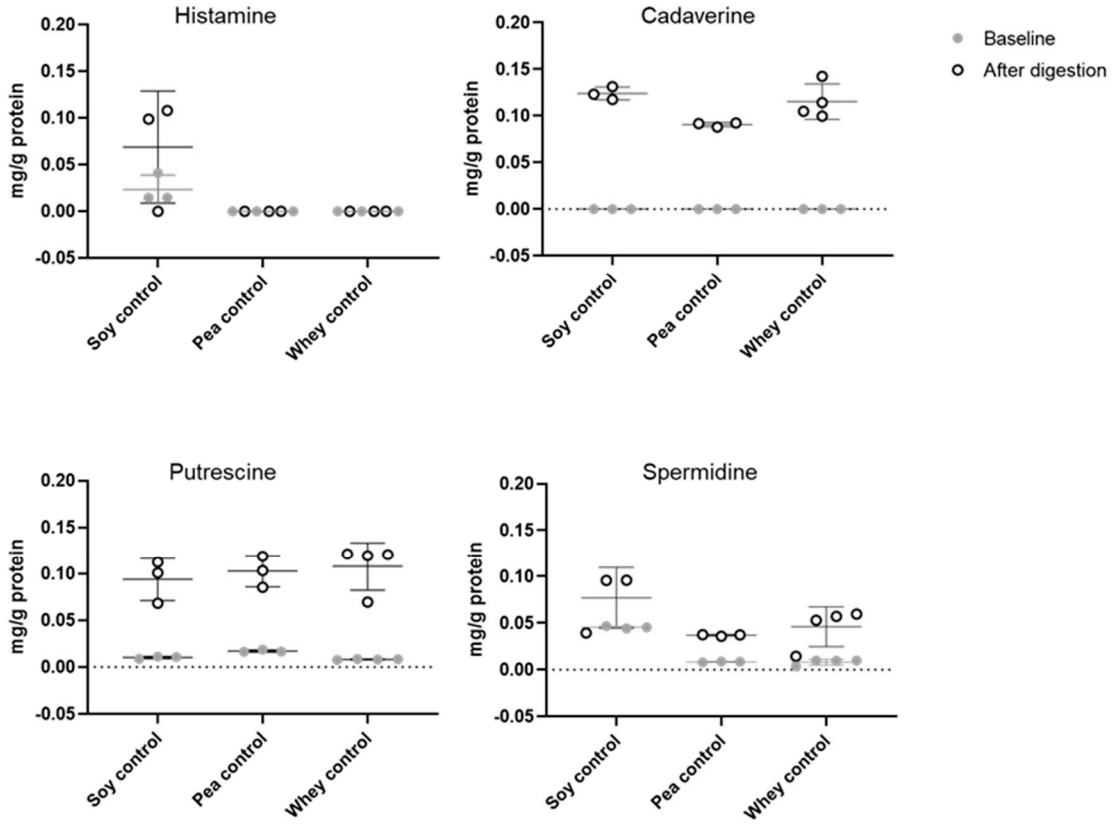
B420 = *Bifidobacterium animalis* subsp. *lactis* B420; Bl-04 = *B. animalis* subsp. *lactis* Bl-04; NCFM = *Lactobacillus acidophilus* NCFM; HN001 = *Lacticaseibacillus rhamnosus* HN001; Lpc-37 = *Lacticaseibacillus paracasei* subsp. *paracasei* Lpc-37; Lp-115 = *Lactiplantibacillus plantarum* Lp-115; and Ll-23 = *Lactococcus lactis* subsp. *lactis* Ll-23.

Supplementary table 4. Comparison of probiotic **pea protein** digests to control digests in terms of absolute change in free amino acid content from baseline to after digestion. The comparisons are reported as ratios against the control treatment where a ratio of 1.0 denotes no difference, ratio < 1 less than control and ratio > 1 higher than control. Standard error of the estimate is reported in parentheses.

Amino acid	B420	Bl-04	NCFM	HN001	Lpc-37	Lp-115	Ll-23
Alanine	1.11 (0.08)	1.18 (0.09)	1.05 (0.08)	1.07 (0.08)	1.13 (0.08)	1.01 (0.08)	1.12 (0.08)
Arginine	1.03 (0.08)	1.02 (0.08)	1.01 (0.08)	1.01 (0.08)	1.03 (0.08)	1.04 (0.08)	1.07 (0.07)
Asparagine	1.04 (0.08)	1.10 (0.08)	1.07 (0.08)	1.09 (0.08)	1.14 (0.08)	1.01 (0.08)	1.13 (0.08)
Aspartic acid	1.04 (0.08)	1.11 (0.08)	1.24 (0.09)	1.59 (0.12) ***	1.67 (0.12) ***	0.88 (0.07)	0.97 (0.07)
Cystine	0.76 (0.06) **	0.85 (0.06)	0.89 (0.07)	1.23 (0.09)	1.30 (0.10) *	0.90 (0.07)	1.08 (0.08)
Glutamic acid	0.90 (0.07)	0.92 (0.07)	1.09 (0.08)	1.14 (0.09)	1.22 (0.09)	0.90 (0.07)	1.03 (0.07)
Glutamine	1.17 (0.09)	1.36 (0.10) **	1.06 (0.08)	1.03 (0.08)	1.16 (0.09)	1.05 (0.08)	1.17 (0.08)
Glycine	1.13 (0.08)	1.03 (0.08)	1.09 (0.08)	1.10 (0.08)	1.13 (0.08)	1.01 (0.08)	1.09 (0.08)
Histidine[a]	1.14 (0.08)	1.18 (0.09)	1.11 (0.08)	1.11 (0.08)	1.14 (0.09)	1.07 (0.08)	1.14 (0.08)
Isoleucine[a,b]	1.12 (0.08)	1.20 (0.09)	1.07 (0.08)	1.08 (0.08)	1.15 (0.09)	1.06 (0.08)	1.16 (0.08)
Leucine[a,b]	0.98 (0.07)	1.07 (0.08)	1.00 (0.07)	1.04 (0.08)	1.06 (0.08)	1.04 (0.08)	1.12 (0.08)
Lysine[a]	1.01 (0.08)	0.98 (0.07)	1.01 (0.08)	1.03 (0.08)	1.05 (0.08)	1.03 (0.08)	1.08 (0.08)
Methionine[a]	1.00 (0.07)	1.08 (0.08)	1.16 (0.09)	1.26 (0.09) *	1.31 (0.10) **	1.14 (0.09)	1.19 (0.08)
Phenylalanine[a]	0.98 (0.07)	1.04 (0.08)	0.98 (0.07)	1.01 (0.08)	1.03 (0.08)	1.04 (0.08)	1.08 (0.08)
Serine	0.99 (0.07)	1.06 (0.08)	1.03 (0.08)	1.07 (0.08)	1.13 (0.08)	0.94 (0.07)	1.10 (0.08)
Threonine[a]	1.06 (0.08)	1.20 (0.09)	1.10 (0.08)	1.14 (0.09)	1.18 (0.09)	1.02 (0.08)	1.12 (0.08)
Tryptophan[a]	4.04 (0.31) ***	4.56 (0.35) ***	1.04 (0.08)	1.04 (0.08)	1.04 (0.08)	3.12 (0.24) ***	1.61 (0.12) ***
Tyrosine	1.04 (0.08)	1.13 (0.08)	1.00 (0.07)	1.02 (0.08)	1.03 (0.08)	1.03 (0.08)	1.08 (0.08)
Valine[a,b]	1.13 (0.08)	1.25 (0.09)	1.08 (0.08)	1.08 (0.08)	1.13 (0.08)	1.04 (0.08)	1.15 (0.08)
Total EAA[a]	1.02 (0.08)	1.06 (0.08)	1.01 (0.08)	1.04 (0.08)	1.07 (0.08)	1.05 (0.08)	1.10 (0.08)
Total BCAA[b]	1.03 (0.08)	1.12 (0.08)	1.02 (0.08)	1.05 (0.08)	1.09 (0.08)	1.04 (0.08)	1.13 (0.08)
Total AA	1.03 (0.08)	1.03 (0.08)	1.02 (0.08)	1.03 (0.08)	1.06 (0.08)	1.03 (0.08)	1.09 (0.08)

[a] EAA, essential amino acid; [b] BCAA, branched chain amino acid. Statistically significant different to control digestion without probiotic; *p<0.05, **p<0.01, ***p<0.001.

B420 = *Bifidobacterium animalis* subsp. *lactis* B420; Bl-04 = *B. animalis* subsp. *lactis* Bl-04; NCFM = *Lactobacillus acidophilus* NCFM; HN001 = *Lacticaseibacillus rhamnosus* HN001; Lpc-37 = *Lacticaseibacillus paracasei* subsp. *paracasei* Lpc-37; Lp-115 = *Lactiplantibacillus plantarum* Lp-115; and Ll-23 = *Lactococcus lactis* subsp. *lactis* Ll-23.



Supplementary figure 2. Concentration of biogenic amines (mg/g protein) in samples collected at the beginning and after the *in vitro* digestion of soy, pea and whey protein.

Supplementary table 5**.** Probiotic counts as log10 colony forming units (CFU) at baseline and after *in vitro* digestion of soy, pea and whey protein. Values are mean (standard deviation, SD).

Treatment	Baseline (log10 CFU)	After digestion (log10 CFU)	Change, Δ (log10 CFU)
	Soy protein		
B420	8.6 (0.19)	8.3 (0.19)	-0.30 (0.02)
Bl-04	8.9 (0.21)	8.5 (0.18)	-0.33 (0.03)
NCFM	8.6 (0.08)	5.5 (0.07)	-3.1 (0.04)
HN001	8.8 (0.08)	5.6 (0.15)	-3.2 (0.07)
Lpc-37	8.8 (0.28)	5.3 (0.16)	-3.5 (0.32)
Lp-115	9.0 (0.14)	6.4 (0.18)	-2.6 (0.16)
Ll-23	9.0 (0.06)	4.5 (0.06)	-4.5 (0.02)
	Pea protein		
B420	8.8 (0.20)	8.5 (0.14)	-0.27 (0.08)
Bl-04	8.9 (0.09)	8.7 (0.10)	-0.29 (0.03)
NCFM	8.1 (0.10)	5.4 (0.07)	-2.6 (0.08)
HN001	8.8 (0.32)	5.6 (0.11)	-3.2 (0.26)
Lpc-37	8.8 (0.11)	4.8 (0.09)	-4.0 (0.10)
Lp-115	8.8 (0.25)	6.2 (0.42)	-2.7 (0.18)
Ll-23	8.5 (0.36)	5.4 (0.27)	-3.1 (0.16)
	Whey protein		
B420	8.7 (0.23)	8.3 (0.19)	-0.35 (0.05)
Bl-04	8.6 (0.00)	7.7 (0.06)	-0.86 (0.06)
NCFM	8.4 (0.16)	4.3 (0.09)	-4.1 (0.15)
HN001	8.6 (0.01)	4.7 (0.24)	-3.9 (0.25)
Lpc-37	8.7 (0.22)	4.3 (0.17)	-4.4 (0.06)
Lp-115	8.8 (0.12)	4.6 (0.12)	-4.2 (0.11)
Ll-23	8.7 (0.09)	0.0 (0.0)	-8.7 (0.09)

B420 = *Bifidobacterium animalis* subsp. *lactis* B420; Bl-04 = *B. animalis* subsp. *lactis* Bl-04; NCFM = *Lactobacillus acidophilus* NCFM; HN001 = *Lacticaseibacillus rhamnosus* HN001; Lpc-37 = *Lacticaseibacillus paracasei* subsp. *paracasei* Lpc-37; Lp-115 = *Lactiplantibacillus plantarum* Lp-115; and Ll-23 = *Lactococcus lactis* subsp. *lactis* Ll-23.