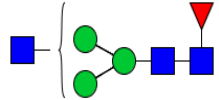
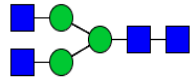
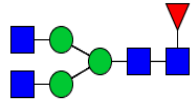
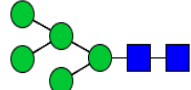


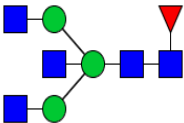
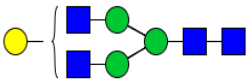
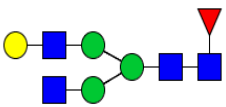
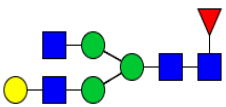
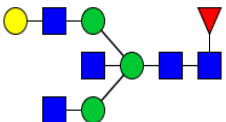
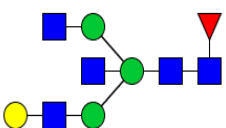
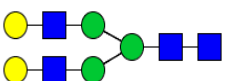
THE ASSOCIATION BETWEEN LOW BACK PAIN AND COMPOSITION OF IgG GLYCOME

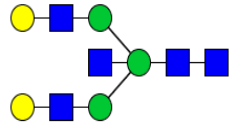
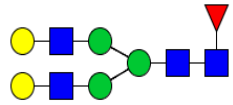
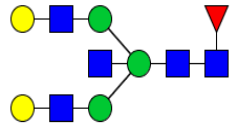
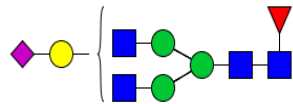
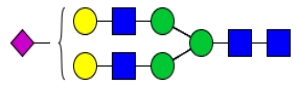
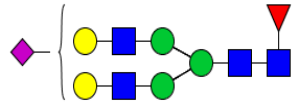
Maxim B. Freidin^{1,#}, Toma Keser^{2,#}, Ivan Gudelj³, Jerko Štambuk³, Dunja Vučenović^{1,4}, Massimo Allegri⁵, Tamara Pavić², Mirna Šimurina², Stella

M. Fabiane¹, Gordan Lauc^{2,3,\$*}, Frances M.K. Williams^{1,\$*}

Supplementary table 1. Structure and description of the studied IgG glycans

GROUP	Edinburgh Code	Zagreb Code	STRUCTURE ^a	DESCRIPTION	FORMULA
Total IgG glycans (neutral + charged)	IGP1	GP1		The percentage of FA1 glycan in total IgG glycans	$GP1 / GP * 100$
	IGP2	GP2		The percentage of A2 glycan in total IgG glycans	$GP2 / GP * 100$
	IGP3	GP4		The percentage of FA2 glycan in total IgG glycans	$GP4 / GP * 100$
	IGP4	GP5		The percentage of M5 glycan in total IgG glycans	$GP5 / GP * 100$

IGP5	GP6		<p>The percentage of FA2B glycan in total IgG glycans</p>	$GP6 / GP^* 100$
IGP6	GP7		<p>The percentage of A2G1 glycan in total IgG glycans</p>	$GP7 / GP^* 100$
IGP7	GP8		<p>The percentage of FA2[6]G1 glycan in total IgG glycans</p>	$GP8 / GP^* 100$
IGP8	GP9		<p>The percentage of FA2[3]G1 glycan in total IgG glycans</p>	$GP9 / GP^* 100$
IGP9	GP10		<p>The percentage of FA2[6]BG1 glycan in total IgG glycans</p>	$GP10 / GP^* 100$
IGP10	GP11		<p>The percentage of FA2[3]BG1 glycan in total IgG glycans</p>	$GP11 / GP^* 100$
IGP11	GP12		<p>The percentage of A2G2 glycan in total IgG glycans</p>	$GP12 / GP^* 100$

	IGP12	GP13		<i>The percentage of A2BG2 glycan in total IgG glycans</i>	$GP13 / GP * 100$
	IGP13	GP14		<i>The percentage of FA2G2 glycan in total IgG glycans</i>	$GP14 / GP * 100$
	IGP14	GP15		<i>The percentage of FA2BG2 glycan in total IgG glycans</i>	$GP15 / GP * 100$
	IGP15	GP16		<i>The percentage of FA2G1S1 glycan in total IgG glycans</i>	$GP16 / GP * 100$
	IGP16	GP17		<i>The percentage of A2G2S1 glycan in total IgG glycans</i>	$GP17 / GP * 100$
	IGP17	GP18		<i>The percentage of FA2G2S1 glycan in total IgG glycans</i>	$GP18 / GP * 100$

	IGP18	GP19		<i>The percentage of FA2BG2S1 glycan in total IgG glycans</i>	$GP19 / GP * 100$
	IGP19	GP20		<i>Structure not determined</i>	$GP20 / GP * 100$
	IGP20	GP21		<i>The percentage of A2G2S2 glycan in total IgG glycans</i>	$GP21 / GP * 100$
	IGP21	GP22		<i>The percentage of A2BG2S2 glycan in total IgG glycans</i>	$GP22 / GP * 100$
	IGP22	GP23		<i>The percentage of FA2G2S2 glycan in total IgG glycans</i>	$GP23 / GP * 100$
	IGP23	GP24		<i>The percentage of FA2BG2S2 glycan in total IgG glycans</i>	$GP24 / GP * 100$
Total IgG glycans - derived parameters	IGP24	FGS/(FG+FGS)		<i>The percentage of sialylation of fucosylated galactosylated structures without bisecting GlcNAc in total IgG glycans</i>	$SUM(GP16 + GP18 + GP23) / SUM(GP16 + GP18 + GP23 + GP8 + GP9 + GP14) * 100$
	IGP25	FBGS/(FBG+FBGS)		<i>The percentage of sialylation of fucosylated galactosylated structures with bisecting GlcNAc</i>	$SUM(GP19 + GP24) / SUM(GP19 + GP24 +$

			<i>in total IgG glycans</i>	$GP10 + GP11 + GP15)^* 100$
IGP26	$FGS/(F+FG+FGS)$		<i>The percentage of sialylation of all fucosylated structures without bisecting GlcNAc in total IgG glycans</i>	$SUM(GP16 + GP18 + GP23) / SUM(GP16 + GP18 + GP23 + GP4 + GP8 + GP9 + GP14)^* 100$
IGP27	$FBGS/(FB+FBG+FBGS)$		<i>The percentage of sialylation of all fucosylated structures with bisecting GlcNAc in total IgG glycans</i>	$SUM(GP19 + GP24) / SUM(GP19 + GP24 + GP6 + GP10 + GP11 + GP15)^* 100$
IGP28	$FG1S1/(FG1+FG1S1)$		<i>The percentage of monosialylation of fucosylated monogalactosylated structures in total IgG glycans</i>	$GP16 / SUM(GP16 + GP8 + GP9)^* 100$
IGP29	$FG2S1/(FG2+FG2S1+FG2S2)$		<i>The percentage of monosialylation of fucosylated digalactosylated structures in total IgG glycans</i>	$GP18 / SUM(GP18 + GP14 + GP23)^* 100$
IGP30	$FG2S2/(FG2+FG2S1+FG2S2)$		<i>The percentage of disialylation of fucosylated digalactosylated structures in total IgG glycans</i>	$GP23 / SUM(GP23 + GP14 + GP18)^* 100$
IGP31	$FBG2S1/(FBG2+FBG2S1+FBG2S2)$		<i>The percentage of monosialylation of fucosylated digalactosylated structures with bisecting GlcNAc in total IgG glycans</i>	$GP19 / SUM(GP19 + GP15 + GP24)^* 100$
IGP32	$FBG2S2/(FBG2+FBG2S1+FBG2S2)$		<i>The percentage of disialylation of fucosylated digalactosylated structures with bisecting GlcNAc in total IgG glycans</i>	$GP24 / SUM(GP24 + GP15 + GP19)^* 100$
IGP33	$F^{total}S1/F^{total}S2$		<i>Ratio of all fucosylated (+/- bisecting GlyNAc) monosialylated and disialylated structures in total IgG glycans</i>	$SUM(GP16 + GP18 + GP19) / SUM(GP23 + GP24)$
IGP34	$FS1/FS2$		<i>Ratio of fucosylated (without bisecting GlcNAc) monosialylated and disialylated structures in total IgG glycans</i>	$SUM(GP16 + GP18) / GP23$
IGP35	$FBS1/FBS2$		<i>Ratio of fucosylated (with bisecting GlcNAc) monosialylated and disialylated structures in total IgG glycans</i>	$GP19 / GP24$
IGP36	FBS^{total}/FS^{total}		<i>Ratio of all fucosylated sialylated structures</i>	$SUM(GP19 + GP24) /$

				<i>with and without bisecting GlcNAc</i>	<i>SUM(GP16 + GP18 + GP23)</i>
	IGP37	FBS1/FS1		<i>Ratio of fucosylated monosialylated structures with and without bisecting GlcNAc</i>	<i>GP19 / SUM(GP16 + GP18)</i>
	IGP38	FBS1/(FS1+FBS1)		<i>The incidence of bisecting GlcNAc in all fucosylated monosialylated structures in total IgG glycans</i>	<i>GP19 / SUM(GP16 + GP18 + GP19)</i>
	IGP39	FBS2/FS2		<i>Ratio of fucosylated disialylated structures with and without bisecting GlcNAc</i>	<i>GP24 / GP23</i>
	IGP40	FBS2/(FS2+FBS2)		<i>The incidence of bisecting GlcNAc in all fucosylated disialylated structures in total IgG glycans</i>	<i>GP24 / SUM(GP23 + GP24)</i>
<i>Neutral IgG glycans</i>	IGP41	GP1 ⁿ		<i>The percentage of FA1 glycan in total neutral IgG glycans (GPⁿ)</i>	<i>GP1 / GPⁿ* 100</i>
	IGP42	GP2 ⁿ		<i>The percentage of A2 glycan in total neutral IgG glycans (GPⁿ)</i>	<i>GP2 / GPⁿ* 100</i>
	IGP43	GP4 ⁿ		<i>The percentage of FA2 glycan in total neutral IgG glycans (GPⁿ)</i>	<i>GP4 / GPⁿ* 100</i>
	IGP44	GP5 ⁿ		<i>The percentage of M5 glycan in total neutral IgG glycans (GPⁿ)</i>	<i>GP5 / GPⁿ* 100</i>
	IGP45	GP6 ⁿ		<i>The percentage of FA2B glycan in total neutral IgG glycans (GPⁿ)</i>	<i>GP6 / GPⁿ* 100</i>
	IGP46	GP7 ⁿ		<i>The percentage of A2G1 glycan in total neutral IgG glycans (GPⁿ)</i>	<i>GP7 / GPⁿ* 100</i>
	IGP47	GP8 ⁿ		<i>The percentage of FA2[6]G1 glycan in total neutral IgG glycans (GPⁿ)</i>	<i>GP8 / GPⁿ* 100</i>
	IGP48	GP9 ⁿ		<i>The percentage of FA2[3]G1 glycan in total neutral IgG glycans (GPⁿ)</i>	<i>GP9 / GPⁿ* 100</i>
	IGP49	GP10 ⁿ		<i>The percentage of FA2[6]BG1 glycan in total neutral IgG glycans (GPⁿ)</i>	<i>GP10 / GPⁿ* 100</i>
	IGP50	GP11 ⁿ		<i>The percentage of FA2[3]BG1 glycan in total neutral IgG glycans (GPⁿ)</i>	<i>GP11 / GPⁿ* 100</i>
	IGP51	GP12 ⁿ		<i>The percentage of A2G2 glycan in total neutral IgG glycans (GPⁿ)</i>	<i>GP12 / GPⁿ* 100</i>
	IGP52	GP13 ⁿ		<i>The percentage of A2BG2 glycan in total</i>	<i>GP13 / GPⁿ* 100</i>

				<i>neutral IgG glycans (GPⁿ)</i>	
	IGP53	GP14 ⁿ		<i>The percentage of FA2G2 glycan in total neutral IgG glycans (GPⁿ)</i>	$GP14 / GP^n * 100$
	IGP54	GP15 ⁿ		<i>The percentage of FA2BG2 glycan in total neutral IgG glycans (GPⁿ)</i>	$GP15 / GP^n * 100$
<i>Neutral IgG glycans - derived parameters</i>	IGP55	G0 ⁿ		<i>The percentage of agalactosylated structures in total neutral IgG glycans</i>	$SUM(GP1^n: GP6^n)$
	IGP56	G1 ⁿ		<i>The percentage of monogalactosylated structures in total neutral IgG glycans</i>	$SUM(GP7^n: GP11^n)$
	IGP57	G2 ⁿ		<i>The percentage of digalactosylated structures in total neutral IgG glycans</i>	$SUM(GP12^n: GP15^n)$
	IGP58	F ^{n total}		<i>The percentage of all fucosylated (+/- bisecting GlcNAc) structures in total neutral IgG glycans</i>	$SUM(GP1^n+ GP4^n+ GP5^n+ GP6^n+ GP8^n+ GP9^n+ GP10^n+ GP11^n+ GP14^n+ GP15^n)$
	IGP59	FG0 ^{n total} /G0 ⁿ		<i>The percentage of fucosylation of agalactosylated structures</i>	$SUM(GP1^n+ GP4^n+ GP5^n+ GP6^n) / G0^n * 100$
	IGP60	FG1 ^{n total} /G1 ⁿ		<i>The percentage of fucosylation of monogalactosylated structures</i>	$SUM(GP8^n+ GP9^n+ GP10^n+ GP11^n) / G1^n * 100$
	IGP61	FG2 ^{n total} /G2 ⁿ		<i>The percentage of fucosylation of digalactosylated structures</i>	$SUM(GP14^n+ GP15^n) / G2^n * 100$
	IGP62	F ⁿ		<i>The percentage of fucosylated (without bisecting GlcNAc) structures in total neutral IgG glycans</i>	$SUM(GP1^n+ GP4^n+ GP5^n+ GP8^n+ GP9^n+ GP14^n)$
	IGP63	FG0 ⁿ /G0 ⁿ		<i>The percentage of fucosylation (without bisecting GlcNAc) of agalactosylated structures</i>	$SUM(GP1^n+ GP4^n+ GP5^n) / G0^n * 100$
	IGP64	FG1 ⁿ /G1 ⁿ		<i>The percentage of fucosylation (without bisecting GlcNAc) of monogalactosylated structures</i>	$SUM(GP8^n+ GP9^n) / G1^n * 100$
	IGP65	FG2 ⁿ /G2 ⁿ		<i>The percentage of fucosylation (without bisecting GlcNAc) of digalactosylated structures</i>	$GP14^n / G2^n * 100$
	IGP66	FB ⁿ		<i>The percentage of fucosylated (with bisecting GlcNAc) structures in total neutral IgG glycans</i>	$SUM(GP6^n+ GP10^n+ GP11^n+ GP15^n)$

IGP67	$FBG0^n/G0^n$		<i>The percentage of fucosylation (with bisecting GlcNAc) of agalactosylated structures</i>	$GP6^n / G0^n * 100$
IGP68	$FBG1^n/G1^n$		<i>The percentage of fucosylation (with bisecting GlcNAc) of monogalactosylated structures</i>	$SUM(GP10^n + GP11^n) / G1^n * 100$
IGP69	$FBG2^n/G2^n$		<i>The percentage of fucosylation (with bisecting GlcNAc) of digalactosylated structures</i>	$GP15^n / G2^n * 100$
IGP70	FB^n/F^n		<i>Ratio of fucosylated structures with and without bisecting GlcNAc</i>	$FB^n / F^n * 100$
IGP71	$FB^n/F^n \text{ total}$		<i>The incidence of bisecting GlcNAc in all fucosylated structures in total neutral IgG glycans</i>	$FB^n / F^n \text{ total} * 100$
IGP72	$F^n/(B^n + FB^n)$		<i>Ratio of fucosylated non-bisecting GlcNAc structures and all structures with bisecting GlcNAc</i>	$F^n/(GP13^n + FB^n)$
IGP73	$B^n/(F^n + FB^n)$		<i>Ratio of structures with bisecting GlcNAc and all fucosylated structures (+/- bisecting GlcNAc)</i>	$GP13^n / (F^n + FB^n) * 1000$
IGP74	$FBG2^n/FG2^n$		<i>Ratio of fucosylated digalactosylated structures with and without bisecting GlcNAc</i>	$GP15^n/GP14^n$
IGP75	$FBG2^n/(FG2^n + FBG2^n)$		<i>The incidence of bisecting GlcNAc in all fucosylated digalactosylated structures in total neutral IgG glycans</i>	$GP15^n/(GP14^n + GP15^n) * 100$
IGP76	$FG2^n/(BG2^n + FBG2^n)$		<i>Ratio of fucosylated digalactosylated non-bisecting GlcNAc structures and all digalactosylated structures with bisecting GlcNAc</i>	$GP14^n/(GP13^n + GP15^n)$
IGP77	$BG2^n/(FG2^n + FBG2^n)$		<i>Ratio of digalactosylated structures with bisecting GlcNAc and all fucosylated digalactosylated structures (+/- bisecting GlcNAc)</i>	$GP15^n/(GP14^n + GP15^n) * 1000$

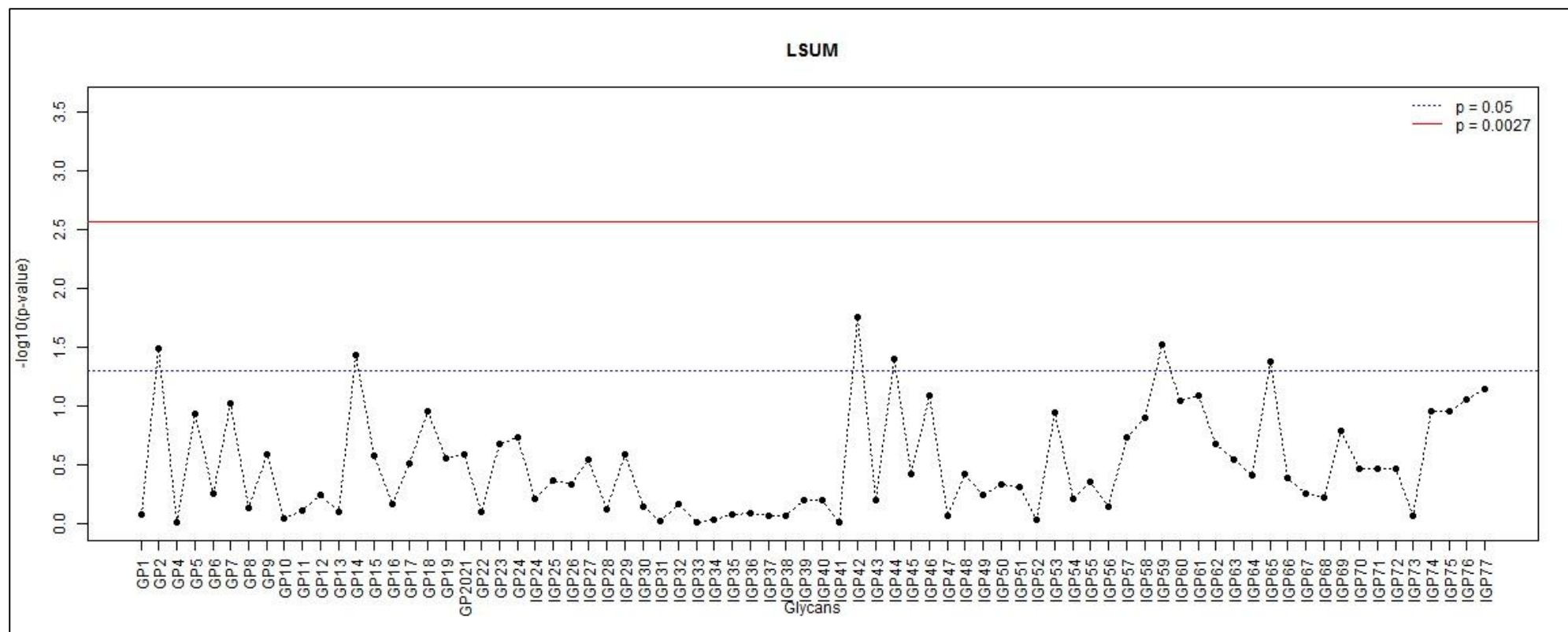
^aSymbol nomenclature for glycan representation was used according to: Varki A, Cummings RD, Esko JD, et al. Symbol nomenclature for glycan representation. Proteomics. 2009;9(24):5398-5399. doi:10.1002/pmic.200900708.

Supplementary Table 2. Correlations between glycan levels and summary scores for lumbar magnetic resonance imaging signs

Glycan	Correlation coefficient*	p-value
GP1	-0.008	0.835
GP2	0.085	0.032
GP4	-0.001	0.974
GP5	0.063	0.115
GP6	0.024	0.549
GP7	0.066	0.096
GP8	-0.014	0.725
GP9	-0.045	0.255
GP10	0.005	0.907
GP11	0.011	0.781
GP12	0.022	0.574
GP13	-0.011	0.781
GP14	-0.083	0.037
GP15	-0.044	0.265
GP16	-0.016	0.681
GP17	0.041	0.306
GP18	-0.064	0.109
GP19	-0.043	0.281
GP2021	0.045	0.258
GP22	-0.011	0.783
GP23	-0.050	0.211
GP24	-0.053	0.183
IGP24	-0.021	0.606
IGP25	-0.031	0.433
IGP26	-0.029	0.462
IGP27	-0.043	0.281
IGP28	0.012	0.755
IGP29	0.045	0.260
IGP30	0.014	0.720
IGP31	0.003	0.938
IGP32	-0.017	0.670
IGP33	0.002	0.962
IGP34	0.004	0.917
IGP35	0.009	0.831
IGP36	0.009	0.819
IGP37	0.008	0.846
IGP38	0.008	0.847
IGP39	0.019	0.634
IGP40	0.019	0.634
IGP41	0.001	0.976
IGP42	0.095	0.017

IGP43	0.020	0.623
IGP44	0.082	0.040
IGP45	0.035	0.381
IGP46	0.069	0.082
IGP47	0.007	0.864
IGP48	-0.035	0.378
IGP49	0.023	0.569
IGP50	0.030	0.459
IGP51	0.027	0.491
IGP52	0.004	0.917
IGP53	-0.063	0.115
IGP54	-0.021	0.607
IGP55	0.031	0.442
IGP56	0.014	0.718
IGP57	-0.053	0.183
IGP58	-0.061	0.126
IGP59	-0.086	0.030
IGP60	-0.067	0.091
IGP61	-0.070	0.081
IGP62	-0.050	0.211
IGP63	-0.043	0.285
IGP64	-0.035	0.383
IGP65	-0.081	0.042
IGP66	0.033	0.406
IGP67	0.023	0.560
IGP68	0.021	0.594
IGP69	0.056	0.162
IGP70	0.038	0.341
IGP71	0.038	0.341
IGP72	-0.038	0.342
IGP73	0.007	0.851
IGP74	0.064	0.111
IGP75	0.064	0.111
IGP76	-0.068	0.087
IGP77	0.072	0.072

* Pearson's correlations were estimated after adjusting glycan levels for age, sex, BMI, and inflammatory disease status.



Supplementary Figure 1. P-values (-log₁₀) for the analysis of correlations between glycan levels and LSUM MRI scores.

P-values correspond to Pearson's correlation coefficients provided in Supplementary table 2.