Supplementary Table S1. Description of structures for UPLC results of IgG glycan peaks

Glycan peak	Structures of glycan peak	Graphic peak composition	Glycan peak	Structures of glycan peak	Graphic peak composition
GP1	FA1		GP13	A2BG2	
GP2	A2		GP14	FA2G2	
GP3	A2B		GP15	FA2BG2	
GP4	FA2		GP16	FA2G1S1	
GP5	M5		GP17	A2G2S1	
GP6	FA2B		GP18	FA2G2S1	
GP7	A2G1		GP19	FA2BG2S1	
GP8	FA2[6]G1		GP20	FA2FG2S1	
GP9	FA2[3]G1		GP21	A2G2S2	
GP10	FA2[6]BG1		GP22	A2BG2S2	
GP11	FA2[3]BG1		GP23	FA2G2S2	
GP12	A2G2		GP24	FA2BG2S2	
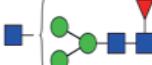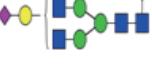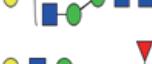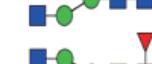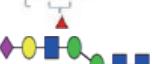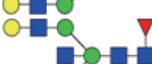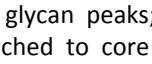
Note. UPLC, ultra-performance liquid chromatography; IgG, immunoglobulin G; GP, glycan peaks; F, represents a fucose attached to core N-acetylglucosami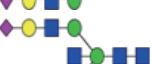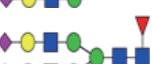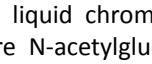ne; M, represents mannoses attached to core N-acetylglucosamine; A, represents N-acetylglucosamine attached to core triple mannose; B, represents bisected N-acetylglucosamine linked to core triple mannose; G, represents galactose; *[3]G1* and *[6]G1* represent galactose attached to α1–3 and α1–6 mannose respectively; *S* represents N-acetylneuraminic acid attached to galactose; blue square represents N-acetylglucosamine; red triangle represents fucose; green circle represents mannose; yellow circle represents galactose; purple square represents N-acetylneuraminic acid.

Supplementary Table S2. Description of structures and calculation formula of derived glycan traits

Derived glycan traits	Structures of derived glycan traits	Calculation formula
FGS / (FG + FGS)	Sialylation of fucosylated galactosylated structures without bisecting GlcNAc	SUM (GP16 + GP18 + GP23) / SUM (GP16 + GP18 + GP23 + GP8 + GP9 + GP14) × 100
FBGS / (FBG + FBGS)	Sialylation of fucosylated galactosylated structures with bisecting GlcNAc	SUM (GP19 + GP24) / SUM (GP19 + GP24 + GP10 + GP11 + GP15) × 100
FGS / (F + FG + FGS)	Sialylation of all fucosylated structures without bisecting GlcNAc	SUM (GP16 + GP18 + GP23) / SUM (GP16 + GP18 + GP23 + GP4 + GP8 + GP9 + GP14) × 100
FBGS / (FB + FBG + FBGS)	Sialylation of all fucosylated structures with bisecting GlcNAc	SUM (GP19 + GP24) / SUM (GP19 + GP24 + GP6 + GP10 + GP11 + GP15) × 100
FG1S1 / (FG1 + FG1S1)	Monosialylation of fucosylated monogalactosylated structures	GP16 / SUM (GP16 + GP8 + GP9) × 100
FG2S1 / (FG2 + FG2S1 + FG2S2)	Monosialylation of fucosylated digalactosylated structures	GP18 / SUM (GP18 + GP14 + GP23) × 100
FG2S2 / (FG2 + FG2S1 + FG2S2)	Disialylation of fucosylated digalactosylated structures	GP23 / SUM (GP23 + GP14 + GP18) × 100
FBG2S1 / (FBG2 + FBG2S1 + FBG2S2)	Monosialylation of fucosylated digalactosylated structures with bisecting GlcNAc	GP19 / SUM (GP19 + GP15 + GP24) × 100
FBG2S2 / (FBG2 + FBG2S1 + FBG2S2)	Disialylation of fucosylated digalactosylated structures with bisecting GlcNAc	GP24 / SUM (GP24 + GP15 + GP19) × 100
$F^{total}S1 / F^{total}S2$	Ratio of all fucosylated monosialylated and disialylated structures	SUM (GP16 + GP18 + GP19) / SUM (GP23 + GP24)
FS1 / FS2	Ratio of fucosylated (without bisecting GlcNAc) monosialylated and disialylated structures	SUM (GP16 + GP18) / GP23
FBS1 / FBS2	Ratio of fucosylated (with bisecting GlcNAc) monosialylated and disialylated structures	GP19 / GP24
FBS^{total} / FS^{total}	Ratio of all fucosylated sialylated structures with and without bisecting GlcNAc	SUM (GP19 + GP24) / SUM (GP16 + GP18 + GP23)
FBS1 / FS1	Fucosylated monosialylated structures with and without bisecting GlcNAc	GP19 / SUM (GP16 + GP18)
FBS1 / (FS1 + FBS1)	Bisecting GlcNAc in all fucosylated monosialylated structures	GP19 / SUM (GP16 + GP18 + GP19)
FBS2 / FS2	Ratio of fucosylated disialylated structures with and without bisecting GlcNAc	GP24 / GP23
FBS2 / (FS2 + FBS2)	Bisecting GlcNAc in all fucosylated disialylated structures	GP24 / SUM (GP23 + GP24)
$GP1^n$	GP1 in total neutral glycan fraction	$GP1 / GP^n × 100$
$GP2^n$	GP2 in total neutral glycan fraction	$GP2 / GP^n × 100$
$GP4^n$	GP4 in total neutral glycan fraction	$GP4 / GP^n × 100$
$GP5^n$	GP5 in total neutral glycan fraction	$GP5 / GP^n × 100$
$GP6^n$	GP6 in total neutral glycan fraction	$GP6 / GP^n × 100$
$GP7^n$	GP7 in total neutral glycan fraction	$GP7 / GP^n × 100$
$GP8^n$	GP8 in total neutral glycan fraction	$GP8 / GP^n × 100$
$GP9^n$	GP9 in total neutral glycan fraction	$GP9 / GP^n × 100$
$GP10^n$	GP10 in total neutral glycan fraction	$GP10 / GP^n × 100$
$GP11^n$	GP11 in total neutral glycan fraction	$GP11 / GP^n × 100$
$GP12^n$	GP12 in total neutral glycan fraction	$GP12 / GP^n × 100$
$GP13^n$	GP13 in total neutral glycan fraction	$GP13 / GP^n × 100$
$GP14^n$	GP14 in total neutral glycan fraction	$GP14 / GP^n × 100$
$GP15^n$	GP15 in total neutral glycan fraction	$GP15 / GP^n × 100$
$G0^n$	G0 in total neutral glycan fraction	$SUM (GP1^n: GP4^n + GP6^n)$
$G1^n$	G1 in total neutral glycan fraction	$SUM (GP7^n: GP11^n)$
$G2^n$	G2 in total neutral glycan fraction	$SUM (GP12^n: GP15^n)$
$F^{n\ total}$	All fucosylated structures in total neutral glycan fraction	$SUM (GP1^n + GP4^n + GP6^n + GP8^n + GP9^n + GP10^n + GP11^n + GP14^n + GP15^n)$

Continued

Derived glycan traits	Structures of derived glycan traits	Calculation formula
$FG0^{n\ total} / G0^n$	Fucosylation in agalactosylated structures	$SUM (GP1^n + GP4^n + GP6^n) / G0^n \times 100$
$FG1^{n\ total} / G1^n$	Fucosylation in monogalactosylated structures	$SUM (GP8^n + GP9^n + GP10^n + GP11^n) / G1^n \times 100$
$FG2^{n\ total} / G2^n$	Fucosylation in digalactosylated structures	$SUM (GP14^n + GP15) / G2^n \times 100$
F^n	Fucosylation (without bisecting GlcNAc) in total neutral glycan fraction	$SUM (GP1^n + GP4^n + GP8^n + GP9^n + GP14^n)$
$FG0^n / G0^n$	Fucosylation (without bisecting GlcNAc) in agalactosylated structures	$SUM (GP1^n + GP4^n) / G0^n \times 100$
$FG1^n / G1^n$	Fucosylation (without bisecting GlcNAc) in monogalactosylated structures	$SUM (GP8^n + GP9^n) / G1^n \times 100$
$FG2^n / G2^n$	Fucosylation (without bisecting GlcNAc) in digalactosylated structures	$GP14^n / G2^n \times 100$
FB^n	Fucosylation (with bisecting GlcNAc) structures in total neutral glycan fraction	$SUM (GP6^n + GP10^n + GP11^n + GP15^n)$
$FBG0^n / G0^n$	Fucosylation (with bisecting GlcNAc) of agalactosylated structures	$GP6^n / G0^n \times 100$
$FBG1^n / G1^n$	Fucosylation (with bisecting GlcNAc) of monogalactosylated structures	$SUM (GP10^n + GP11^n) / G1^n \times 100$
$FBG2^n / G2^n$	Fucosylation (with bisecting GlcNAc) of digalactosylated structures	$GP15^n / G2^n \times 100$
FB^n / F^n	Ratio of fucosylated structures with and without bisecting GlcNAc	$FB^n / F^n \times 100$
$FB^n / F^{n\ total}$	Bisecting GlcNAc in all fucosylated structures in total neutral glycan fraction	$FB^n / F^n\ total \times 100$
$F^n / (B^n + FB^n)$	Ratio of fucosylated non–bisecting GlcNAc structures and all structures with bisecting GlcNAc	$F^n / (GP13^n + FB^n)$
$B^n / (F^n + FB^n)$	Ratio of structures with bisecting GlcNAc and all fucosylated structures (with and without bisecting GlcNAc)	$GP13^n / (F^n + FB^n) \times 1,000$
$FBG2^n / FG2^n$	Ratio of fucosylated digalactosylated structures with and without bisecting GlcNAc	$GP15^n / GP14^n$
$FBG2^n / (FG2^n + FBG2^n)$	Bisecting GlcNAc in all fucosylated digalactosylated structures in total neutral glycan fraction	$GP15^n / (GP14^n + GP15^n) \times 100$
$FG2^n / (BG2^n + FBG2^n)$	Fucosylated digalactosylated without bisecting GlcNAc structures in all digalactosylated structures	$GP14^n / (GP13^n + GP15^n)$
$BG2^n / (FG2^n + FBG2^n)$	Digalactosylated structures with bisecting GlcNAc in all fucosylated digalactosylated structures (with and without bisecting GlcNAc)	$GP13^n / (GP14^n + GP15^n) \times 1,000$

Note. F, a fucose attached to core N-acetylglucosamine; B, bisected N-acetylglucosamine linked to core triple mannose; G, galactose; S, N-acetylneuraminic acid attached to galactose; ^{n}, neutral glycans.

Supplementary Table S3. Initial glycan peaks levels in the whole study population of nested case-control study

Initial glycans	Incident IS	Control	P^*	$q^{\#}$
GP1	0.09 (0.06–0.16)	0.10 (0.06–0.15)	0.92289	0.92289
GP2	0.47 (0.32–0.72)	0.54 (0.34–0.74)	0.29690	0.41915
GP3	0.14 (0.08–0.25)	0.14 (0.06–0.24)	0.50532	0.60638
GP4	27.91 (24.37–33.50)	26.28 (22.06–30.47)	0.00538[*]	0.02356[#]
GP5	0.25 (0.18–0.33)	0.23 (0.17–0.28)	0.29391	0.41915
GP6	5.83 (4.73–6.84)	5.27 (4.54–6.39)	0.12498	0.27268
GP7	0.23 (0.14–0.39)	0.27 (0.16–0.45)	0.14670	0.29340
GP8	18.07 (16.66–19.25)	18.48 (16.72–20.15)	0.35356	0.47141
GP9	8.92 (6.37–9.99)	8.51 (7.52–10.29)	0.66243	0.75706
GP10	3.86 (3.47–4.71)	3.98 (3.39–4.58)	0.80409	0.87719
GP11	0.39 (0.27–0.52)	0.46 (0.35–0.65)	0.01306[*]	0.04478[#]
GP12	0.44 (0.31–0.73)	0.56 (0.40–0.83)	0.02977[*]	0.07939
GP13	0.59 (0.37–0.76)	0.60 (0.43–0.83)	0.39073	0.49355
GP14	15.76 (13.06–18.50)	13.79 (16.21–18.45)	0.20918	0.35859
GP15	1.31 (1.13–1.69)	1.36 (1.19–1.65)	0.89766	0.92289
GP16	2.51 (2.14–2.99)	2.75 (2.40–3.11)	0.02277[*]	0.06831
GP17	0.62 (0.48–0.76)	0.67 (0.53–0.84)	0.25641	0.41026
GP18	8.03 (5.87–9.68)	8.58 (6.60–10.89)	0.07599	0.18238
GP19	1.22 (0.90–1.47)	1.44 (1.04–1.73)	0.00589[*]	0.02356[#]
GP20	0.07 (0.04–0.10)	0.08 (0.05–0.11)	0.17033	0.31446
GP21	0.21 (0.12–0.36)	0.31 (0.18–0.45)	0.00228[*]	0.01368[#]
GP22	0.04 (0.03–0.07)	0.08 (0.03–0.14)	0.00077[*]	0.00924[#]
GP23	0.59 (0.35–0.98)	0.84 (0.53–1.22)	0.00195[*]	0.01368[#]
GP24	0.49 (0.32–1.00)	0.93 (0.48–1.37)	0.00014[*]	0.00336[#]

Note. Data were expressed median (25th–75th percentile); IS, ischemic stroke; GP, glycan peaks.
[*]$P < 0.05$. [#]$q < 0.05$: significant after correction for FDR (false discovery rate).

Supplementary Table S4. Sex-specific initial glycan peaks levels in nested case-control study

Initial glycans	Men				Women			
	Incident IS	Control	P^*	$q^\#$	Incident IS	Control	P^*	$q^\#$
GP1	0.09 (0.06–0.16)	0.08 (0.05–0.12)	0.53245	0.61419	0.10 (0.05–0.15)	0.10 (0.07–0.17)	0.36758	0.80236
GP2	0.51 (0.32–0.74)	0.54 (0.35–0.73)	0.81231	0.82950	0.47 (0.31–0.69)	0.61 (0.34–0.75)	0.17711	0.80236
GP3	0.18 (0.09–0.29)	0.12 (0.05–0.17)	0.02494*	0.05679	0.13 (0.07–0.22)	0.22 (0.10–0.29)	0.07032	0.80236
GP4	26.64 (24.54–31.37)	22.65 (20.42–26.22)	0.00001*	0.00008#	31.87 (23.14–35.61)	30.47 (27.15–32.94)	0.88539	0.92388
GP5	0.26 (0.18–0.33)	0.21 (0.16–0.26)	0.08585	0.13736	0.25 (0.20–0.30)	0.25 (0.20–0.35)	0.60091	0.90137
GP6	5.70 (4.91–6.49)	5.12 (4.17–6.16)	0.28842	0.38115	5.96 (4.59–7.07)	5.58 (4.76–7.13)	0.82898	0.92388
GP7	0.30 (0.15–0.40)	0.28 (0.18–0.46)	0.30174	0.38114	0.22 (0.12–0.33)	0.23 (0.15–0.40)	0.30960	0.80236
GP8	18.05 (16.40–19.16)	17.72 (16.16–19.84)	0.82950	0.82950	18.07 (16.94–19.16)	18.95 (17.42–20.32)	0.09597	0.80236
GP9	8.38 (6.28–9.88)	8.71 (7.65–10.37)	0.24399	0.34445	9.09 (7.41–10.03)	8.30 (6.80–10.26)	0.59025	0.90137
GP10	3.90 (3.35–4.70)	4.02 (3.43–4.58)	0.53742	0.61419	3.85 (3.50–5.07)	3.85 (3.05–4.70)	0.33709	0.80236
GP11	0.41 (0.29–0.52)	0.49 (0.37–0.72)	0.00765*	0.02295#	0.38 (0.30–0.50)	0.43 (0.32–0.55)	0.57133	0.90137
GP12	0.51 (0.35–0.76)	0.66 (0.48–1.03)	0.02393*	0.05679	0.39 (0.25–0.61)	0.47 (0.34–0.61)	0.30100	0.80236
GP13	0.64 (0.41–0.77)	0.63 (0.45–0.92)	0.66266	0.72290	0.51 (0.35–0.72)	0.52 (0.40–0.78)	0.40118	0.80236
GP14	16.06 (14.85–18.51)	17.54 (15.13–18.98)	0.05330	0.09487	15.04 (11.94–18.36)	14.36 (12.59–16.84)	0.84204	0.92388
GP15	1.35 (1.03–1.81)	1.46 (1.29–1.71)	0.24162	0.34446	1.28 (1.07–1.58)	1.20 (1.01–1.40)	0.12404	0.80236
GP16	2.56 (2.16–2.96)	2.77 (2.41–3.40)	0.02603*	0.05679	2.51 (2.14–3.02)	2.68 (2.34–2.97)	0.37326	0.80236
GP17	0.68 (0.49–0.80)	0.74 (0.60–0.91)	0.05534	0.09487	0.58 (0.48–0.72)	0.60 (0.47–0.69)	0.73488	0.92388
GP18	7.90 (6.31–9.68)	9.82 (8.01–12.46)	0.00218*	0.00747#	7.77 (5.44–9.93)	7.59 (5.97–8.54)	0.55485	0.90136
GP19	1.22 (0.88–1.48)	1.55 (1.34–1.77)	0.00004*	0.00019#	1.25 (0.94–1.48)	1.20 (0.72–1.54)	0.40055	0.80236
GP20	0.07 (0.04–0.10)	0.10 (0.04–0.12)	0.04731*	0.09462	0.07 (0.05–0.10)	0.06 (0.05–0.09)	0.84481	0.92388
GP21	0.22 (0.12–0.38)	0.38 (0.28–0.57)	0.00002*	0.00012#	0.21 (0.11–0.34)	0.22 (0.12–0.29)	0.87464	0.92388
GP22	0.05 (0.03–0.08)	0.12 (0.06–0.20)	0.00001*	0.00008#	0.04 (0.03–0.07)	0.05 (0.02–0.09)	0.26127	0.80236
GP23	0.56 (0.35–1.09)	1.02 (0.68–1.68)	0.00008*	0.00032#	0.59 (0.36–0.90)	0.68 (0.38–0.87)	0.94823	0.94823
GP24	0.53 (0.35–1.11)	1.14 (0.79–1.62)	0.00001*	0.00008#	0.46 (0.31–0.90)	0.60 (0.33–0.99)	0.66626	0.92388

Note. Data were expressed median (25th–75th percentile); IS, ischemic stroke; GP, glycan peaks. $^*P < 0.05$. $^\#q < 0.05$: significant after correction for FDR (false discovery rate).

Supplementary Table S5. Sex-specific derive glycan traits levels in nested case-control study

Derive glycans	Men				Women			
	Incident IS	Control	P^*	$q^\#$	Incident IS	Control	P^*	$q^\#$
FGS/(FG + FGS)	21.58 (17.18–24.75)	24.82 (20.35–28.44)	0.01024*	0.03253#	19.92 (16.46–23.58)	20.47 (16.83–22.67)	0.54249	0.79174
FBGS/(FBG + FBGS)	22.28 (15.51–32.00)	31.46 (23.82–37.07)	0.00045*	0.00347#	22.06 (17.79–29.09)	23.24 (16.82–31.50)	0.74667	0.86864
FGS/(F + FG + FGS)	13.84 (10.47–16.80)	17.36 (14.10–20.75)	0.00103*	0.00556#	13.09 (9.45–16.37)	13.09 (11.09–14.74)	0.36087	0.63734
FBGS/(FB + FBG + FBGS)	13.21 (8.81–19.06)	19.22 (14.63–25.69)	0.00008*	0.00072#	12.33 (9.45–17.34)	13.58 (8.84–18.63)	0.79154	0.89048
FG1S1/(FG1 + FG1S1)	8.36 (6.87–10.13)	9.18 (8.01–11.79)	0.02131*	0.05479	7.89 (6.97–9.79)	8.92 (7.67–9.99)	0.16845	0.62776
FG2S1/(FG2 + FG2S1 + FG2S2)	31.99 (28.02–36.49)	35.12 (31.17–38.62)	0.01811*	0.05147	32.52 (28.71–34.62)	32.50 (28.72–35.54)	0.97411	0.98890
FG2S2/(FG2 + FG2S1 + FG2S2)	2.42 (1.46–4.26)	3.40 (2.68–5.14)	0.00121*	0.00594#	2.54 (1.70–4.02)	3.11 (1.43–3.89)	0.85649	0.92501
FBG2S1/(FBG2 + FBG2S1 + FBG2S2)	36.07 (31.29–41.18)	36.53 (33.98–39.56)	0.80038	0.86441	39.16 (34.44–45.11)	37.95 (32.40–42.82)	0.74219	0.86864
FBG2S2/(FBG2 + FBG2S1 + FBG2S2)	19.40 (11.83–28.99)	26.39 (20.92–32.73)	0.00002*	0.00036#	14.76 (10.66–23.97)	19.94 (12.67–27.05)	0.22264	0.62776
$F^{total}S1/F^{total}S2$	9.61 (5.97–14.64)	6.57 (5.06–8.69)	0.00007*	0.00072#	10.47 (6.26–14.49)	8.74 (6.72–13.80)	0.66629	0.83674
FS1/FS2	17.82 (11.06–29.02)	12.92 (9.23–17.11)	0.00059*	0.00354#	17.29 (10.68–23.77)	15.40 (11.99–25.66)	0.95193	0.98890
FBS1/FBS2	1.88 (1.38–3.14)	1.41 (1.09–1.71)	0.00002*	0.00036#	2.55 (1.58–3.30)	1.96 (1.48–3.32)	0.32103	0.62775
FBS^{total}/FS^{total}	0.16 (0.12–0.21)	0.19 (0.16–0.23)	0.00059*	0.00354#	0.17 (0.11–0.22)	0.16 (0.11–0.22)	0.53805	0.79174
FBS1/FS1	0.11 (0.08–0.14)	0.12 (0.10–0.16)	0.05678	0.12264	0.12 (0.09–0.16)	0.11 (0.09–0.14)	0.20666	0.62776
FBS1/FS1 + FBS1	0.09 (0.07–0.12)	0.10 (0.09–0.14)	0.06318	0.13030	0.11 (0.08–0.14)	0.10 (0.08–0.12)	0.21982	0.62776
FBS2/FS2	0.89 (0.62–1.28)	1.10 (0.84–1.33)	0.02100*	0.05479	0.79 (0.65–1.09)	1.02 (0.65–1.27)	0.53814	0.79174
FBS2/(FS2 + FBS2)	0.47 (0.38–0.56)	0.52 (0.46–0.57)	0.04908*	0.12047	0.44 (0.39–0.52)	0.50 (0.39–0.56)	0.53904	0.79174
$GP1^n$	0.09 (0.07–0.20)	0.11 (0.07–0.16)	0.64278	0.73851	0.11 (0.06–0.18)	0.12 (0.08–0.20)	0.63293	0.81376
$GP2^n$	0.59 (0.38–0.89)	0.66 (0.43–0.88)	0.50054	0.60065	0.54 (0.36–0.77)	0.68 (0.40–0.89)	0.17490	0.62776
$GP4^n$	32.55 (29.13–37.07)	27.71 (25.51–31.73)	0.00003*	0.00041#	36.88 (27.52–41.70)	35.13 (31.34–37.73)	0.56569	0.79915
$GP5^n$	0.31 (0.21–0.39)	0.26 (0.19–0.31)	0.24623	0.39107	0.28 (0.23–0.34)	0.29 (0.23–0.39)	0.45536	0.76842
$GP6^n$	6.70 (5.83–7.69)	6.12 (5.30–7.39)	0.22027	0.36044	6.85 (5.56–8.00)	6.30 (5.47–8.23)	0.60676	0.79914
$GP7^n$	0.34 (0.18–0.50)	0.36 (0.22–0.54)	0.15588	0.28058	0.25 (0.14–0.36)	0.28 (0.17–0.45)	0.26776	0.62776
$GP8^n$	20.93 (19.55–23.35)	22.14 (20.06–23.57)	0.25676	0.39614	21.02 (18.93–22.51)	21.99 (20.31–23.25)	0.08556	0.62776
$GP9^n$	9.88 (7.14–11.46)	10.60 (9.55–12.43)	0.01181*	0.03543#	10.54 (8.69–11.55)	9.72 (7.85–11.44)	0.29290	0.62776
$GP10^n$	4.63 (3.92–5.50)	4.91 (4.29–5.72)	0.12410	0.23108	4.55 (4.06–5.68)	4.44 (3.51–5.45)	0.20555	0.62776
$GP11^n$	0.46 (0.31–0.60)	0.61 (0.45–0.82)	0.00139*	0.00626#	0.47 (0.35–0.57)	0.49 (0.36–0.62)	0.75604	0.86864
$GP12^n$	0.59 (0.43–0.93)	0.80 (0.60–1.25)	0.00659*	0.02224#	0.45 (0.29–0.70)	0.53 (0.38–0.74)	0.36588	0.63734

Continued

Derive glycans	Men				Women			
	Incident IS	Control	P^*	$q^\#$	Incident IS	Control	P^*	$q^\#$
$GP13^n$	0.76 (0.44–0.97)	0.79 (0.55–1.10)	0.35647	0.46949	0.55 (0.40–0.85)	0.61 (0.45–0.89)	0.33248	0.62776
$GP14^n$	19.06 (15.87–22.04)	22.00 (17.94–24.04)	0.00491*	0.01768#	16.72 (13.35–22.43)	16.63 (14.41–19.71)	0.96386	0.98890
$GP15^n$	1.62 (1.21–2.14)	1.85 (1.59–2.17)	0.05250	0.12264	1.53 (1.20–1.94)	1.39 (1.15–1.67)	0.12482	0.62776
$G0^n$	39.81 (36.45–44.64)	35.43 (32.44–39.42)	0.00002*	0.00036#	43.89 (34.54–49.25)	42.01 (39.49–47.09)	0.84456	0.92501
$G1^n$	36.38 (33.12–39.88)	39.15 (36.88–40.78)	0.00165*	0.00685#	36.78 (33.66–39.91)	36.74 (34.84–38.86)	0.98890	0.98890
$G2^n$	22.03 (18.32–25.91)	25.96 (21.39–28.36)	0.00180*	0.00694#	19.87 (15.37–25.34)	19.10 (16.49–22.71)	0.71465	0.86864
$F^{n\,total}$	96.92 (96.19–97.85)	96.87 (95.94–97.56)	0.17436	0.29423	97.50 (96.98–98.14)	97.15 (96.61–97.84)	0.09055	0.62776
$FG0^{n\,total}/G0^n$	98.40 (97.78–98.95)	98.31 (98.60–99.50)	0.10451	0.20156	98.78 (98.27–99.10)	98.50 (97.85–98.88)	0.19258	0.62776
$FG1^{n\,total}/G1^n$	99.11 (98.62–99.52)	99.05 (98.60–99.43)	0.31759	0.46351	99.32 (99.07–99.61)	99.22 (98.87–99.52)	0.20389	0.62776
$FG2^{n\,total}/G2^n$	93.52 (92.42–94.99)	93.21 (91.72–94.47)	0.16577	0.28876	94.06 (93.36–95.44)	93.58 (92.48–94.80)	0.11383	0.79174
F^n	82.88 (81.56–85.69)	82.93 (80.58–85.59)	0.33667	0.46949	83.54 (82.34–85.73)	84.32 (81.60–86.26)	0.52525	0.79915
$FG0^n/G0^n$	81.58 (79.77–83.54)	80.41 (77.86–83.42)	0.05466	0.12264	82.35 (80.01–84.19)	82.26 (80.13–85.63)	0.60676	0.62776
$FG1^n/G1^n$	84.16 (82.80–87.17)	84.59 (82.26–86.46)	0.28216	0.42324	84.81 (83.71–86.66)	85.09 (83.44–88.06)	0.19898	0.79915
$FG2^n/G2^n$	85.71 (84.19–87.91)	85.70 (83.33–87.08)	0.45936	0.56788	85.94 (84.80–88.42)	86.82 (84.33–88.19)	0.60029	0.62776
FB^n	13.85 (11.86–14.98)	13.97 (12.04–15.53)	0.52184	0.61259	13.71 (12.31–14.84)	13.19 (11.25–15.47)	0.13337	0.62776
$FBG0^n/G0^n$	16.78 (14.86–18.41)	17.86 (15.07–19.31)	0.06515	0.13030	16.61 (14.45–18.75)	16.34 (13.13–17.91)	0.31430	0.62776
$FBG1^n/G1^n$	14.72 (12.14–16.05)	14.33 (12.84–15.86)	0.94717	0.98359	14.25 (12.61–15.51)	14.34 (11.04–15.63)	0.15728	0.62776
$FBG2^n/G2^n$	7.57 (6.34–8.82)	7.50 (6.57–8.45)	0.69743	0.78461	7.58 (6.78–8.59)	7.20 (6.17–8.63)	0.10361	0.62776
FB^n/F^n	16.74 (13.92–18.25)	16.83 (14.02–19.48)	0.46272	0.56788	16.43 (14.55–18.11)	15.63 (13.09–18.96)	0.27178	0.62776
$FB^n/F^{n\,total}$	14.34 (12.22–15.44)	14.41 (12.29–16.29)	0.46272	0.56788	14.11 (12.70–15.33)	13.52 (11.57–15.94)	0.27178	0.62776
$F^n/(B^n + FB^n)$	5.74 (5.23–6.88)	5.63 (4.82–6.76)	0.35359	0.46949	5.82 (5.33–6.63)	6.15 (5.04–7.15)	0.32787	0.62776
$B^n/(F^n + FB^n)$	7.88 (4.51–9.96)	8.08 (5.64–11.28)	0.35647	0.46949	5.69 (4.04–8.69)	6.26 (4.60–9.17)	0.33713	0.62776
$FBG2^n/FG2^n$	0.09 (0.07–0.11)	0.09 (0.08–0.10)	0.97632	0.99251	0.09 (0.08–0.10)	0.08 (0.07–0.10)	0.09598	0.62776
$FBG2^n/(FG2^n + FBG2^n)$	8.20 (6.75–9.68)	8.18 (7.17–9.23)	0.99251	0.99251	7.97 (7.34–9.16)	7.60 (6.69–9.08)	0.09598	0.62776
$FG2^n/(BG2^n + FBG2^n)$	7.51 (6.73–9.74)	7.77 (6.74–9.29)	0.94717	0.98359	7.93 (6.96–8.90)	8.41 (7.05–9.59)	0.25983	0.62776
$BG2^n/(FG2^n + FBG2^n)$	35.97 (23.84–48.16)	34.19 (23.01–45.88)	0.78248	0.86232	33.78 (24.20–42.73)	35.75 (27.10–46.79)	0.28410	0.62776

Note. Data were expressed median (25th–75th percentile); *IS* ischemic stroke. * represents $P < 0.05$. $^\#$ represents $q < 0.05$: significant after correction for FDR (false discovery rate).

Supplementary Table S6. Associations of initial glycan peaks and ischemic stroke in sex-specific analysis (after adjusting for age, waist and hip circumference, obesity, diabetes, hypertension, and dyslipidemia)

Initial glycans	Incident IS *vs.* control (men)			Incident IS *vs.* control (women)		
	OR (95% CI)	P[*]	q[#]	OR (95% CI)	P[*]	q[#]
GP1	2.07 (0.42–10.18)	0.37218	0.50995	0.60 (0.12–3.04)	0.54082	0.86531
GP2	0.53 (0.13–2.11)	0.36630	0.50995	0.81 (0.16–4.09)	0.80073	0.94287
GP3	3.03 (0.84–10.96)	0.09149	0.24397	0.42 (0.10–1.82)	0.24799	0.73508
GP4	1.16 (1.05–1.29)	0.00396[*]	0.02356[#]	1.01 (0.91–1.11)	0.90359	0.94287
GP5	3.32 (0.52–21.32)	0.20537	0.37914	0.37 (0.03–4.43)	0.42893	0.74085
GP6	1.13 (0.81–1.58)	0.46818	0.59139	1.24 (0.79–1.92)	0.36580	0.73508
GP7	0.37 (0.06–2.20)	0.27572	0.44115	0.39 (0.06–2.53)	0.32465	0.73508
GP8	0.99 (0.82–1.20)	0.93209	0.93209	0.80 (0.64–1.00)	0.05127	0.71088
GP9	0.70 (0.55–0.90)	0.00491[*]	0.02356[#]	0.98 (0.78–1.22)	0.82305	0.94287
GP10	0.67 (0.42–1.09)	0.10535	0.25284	1.47 (0.78–2.74)	0.23071	0.73508
GP11	0.29 (0.05–1.94)	0.20402	0.37914	0.54 (0.04–7.82)	0.64983	0.91740
GP12	0.26 (0.07–0.95)	0.04082[*]	0.12246	0.73 (0.07–7.56)	0.78904	0.94287
GP13	1.43 (0.41–5.01)	0.57682	0.65922	0.42 (0.06–2.76)	0.36754	0.73508
GP14	1.04 (0.89–1.21)	0.62048	0.67689	0.98 (0.83–1.16)	0.83265	0.94287
GP15	0.94 (0.29–2.98)	0.91178	0.93209	4.06 (0.56–29.63)	0.16662	0.73508
GP16	0.58 (0.29–1.18)	0.13407	0.29251	0.78 (0.30–2.06)	0.62133	0.91740
GP17	0.74 (0.29–1.91)	0.53150	0.63780	14.54 (0.90–234.80)	0.05924	0.71088
GP18	0.94 (0.83–1.08)	0.38246	0.50995	1.12 (0.90–1.41)	0.30969	0.73508
GP19	0.33 (0.13–0.85)	0.02092[*]	0.07172	1.84 (0.61–5.58)	0.27867	0.73508
GP20	0.01 (0.01–62.90)	0.25526	0.43759	1.02 (0.09–10.99)	0.99036	0.99036
GP21	0.02 (0.01–0.27)	0.00292[*]	0.02357[#]	2.34 (0.43–12.61)	0.32450	0.73508
GP22	0.01 (0.01–0.02)	0.00403[*]	0.02357[#]	0.50 (0.09–2.83)	0.43216	0.74084
GP23	0.32 (0.13–0.78)	0.01231[*]	0.04924[#]	1.97 (0.48–8.02)	0.34477	0.73508
GP24	0.21 (0.09–0.54)	0.00108[*]	0.02357[#]	0.92 (0.31–2.79)	0.88869	0.94287

Note. IS, ischemic stroke; *CI* confidence interval; GP, glycan peaks. [*]$P < 0.05$. [#]$q < 0.05$: significant after correction for FDR (false discovery rate).

Supplementary Table S7. Associations of derive glycan traits and ischemic stroke in sex-specific analysis (after adjusting for age, waist and hip circumference, obesity, diabetes, hypertension, and dyslipidemia)

Derive glycans	Incident IS vs. control (men)			Incident IS vs. control (women)		
	OR (95% CI)	P^*	$q^\#$	OR (95% CI)	P^*	$q^\#$
FGS/(FG + FGS)	1.97 (0.90–1.05)	0.47035	0.58821	1.06 (0.96–1.17)	0.25252	0.66608
FBGS/(FBG + FBGS)	0.97 (0.93–1.01)	0.14862	0.32101	1.00 (0.95–1.06)	0.90261	0.98529
FGS/(F + FG + FGS)	0.93 (0.84–1.02)	0.10578	0.32101	1.08 (0.94–1.24)	0.29246	0.66608
FBGS/(FB + FBG + FBGS)	0.94 (0.88–0.99)	0.04614^*	0.20763	1.01 (0.93–1.09)	0.84370	0.98529
FG1S1/(FG1 + FG1S1)	0.90 (0.76–1.08)	0.26753	0.42478	0.98 (0.79–1.21)	0.85245	0.98529
FG2S1/(FG2 + FG2S1 + FG2S2)	0.97 (0.91–1.05)	0.44277	0.58821	1.05 (0.96–1.13)	0.29063	0.66608
FG2S2/(FG2 + FG2S1 + FG2S2)	0.72 (0.55–0.94)	0.01443^*	0.09740	1.18 (0.85–1.65)	0.32829	0.66608
FBG2S1/(FBG2 + FBG2S1 + FBG2S2)	1.00 (0.93–1.07)	0.93178	0.93999	1.03 (0.97–1.10)	0.35771	0.66608
FBG2S2/(FBG2 + FBG2S1 + FBG2S2)	0.92 (0.87–0.97)	0.00236^*	$0.03186^\#$	0.98 (0.92–1.04)	0.43883	0.76441
$F^{total}S1/F^{total}S2$	1.31 (1.10–1.55)	0.00217^*	$0.03186^\#$	0.98 (0.92–1.05)	0.58689	0.90459
FS1/FS2	1.14 (1.05–1.25)	0.00323^*	$0.03488^\#$	0.98 (0.94–1.03)	0.40807	0.73452
FBS1/FBS2	1.40 (0.95–2.05)	0.08864	0.30780	1.00 (0.76–1.29)	0.96764	0.98529
FBS^{total}/FS^{total}	0.02 (0.00–0.61)	0.02354	0.14124	2.14 (0.12–37.37)	0.60306	0.90459
FBS1/FS1	0.09 (0.00–1.82)	0.11599	0.32101	6.51 (0.22–189.84)	0.27634	0.66608
FBS1/FS1 + FBS1	0.08 (0.00–2.17)	0.13119	0.32101	7.82 (0.18–338.24)	0.28483	0.66608
FBS2/FS2	0.46 (0.17–1.27)	0.13610	0.32101	0.51 (0.14–1.91)	0.31653	0.66608
FBS2/(FS2 + FBS2)	0.04 (0.00–3.17)	0.14456	0.32101	0.07 (0.00–13.69)	0.32787	0.66608
GP1^n	1.85 (0.36–9.48)	0.46240	0.58821	0.78 (0.16–3.76)	0.75293	0.98529
GP2^n	0.49 (0.15–1.66)	0.25350	0.42478	0.92 (0.23–3.66)	0.90194	0.98529
GP4^n	1.14 (1.04–1.25)	0.00579^*	0.05211	1.00 (0.93–1.09)	0.93899	0.98529
GP5^n	2.86 (0.43–19.18)	0.27843	0.42478	0.13 (0.00–9.62)	0.35189	0.66608
GP6^n	1.04 (0.77–1.41)	0.80101	0.84157	1.26 (0.84–1.91)	0.26759	0.66608
GP7^n	0.40 (0.08–1.96)	0.25918	0.42478	0.98 (0.09–11.24)	0.98529	0.98529
GP8^n	0.93 (0.79–1.08)	0.34361	0.48828	0.84 (0.69–1.03)	0.09674	0.65695
GP9^n	0.65 (0.51–0.84)	0.00970^*	0.07482	1.01 (0.84–1.22)	0.90422	0.98529
GP10^n	0.62 (0.40–0.95)	0.02857	0.14634	1.48 (0.87–2.51)	0.14599	0.65695
GP11^n	0.27 (0.05–1.42)	0.13398	0.32101	1.14 (0.31–4.15)	0.84676	0.98529
GP12^n	0.29 (0.09–0.89)	0.02981^*	0.14634	2.31 (0.57–9.41)	0.24438	0.66608
GP13^n	1.23 (0.43–3.50)	0.69777	0.77130	0.58 (0.12–2.68)	0.48008	0.81013
GP14^n	0.99 (0.88–1.10)	0.79650	0.84157	0.99 (0.87–1.13)	0.90839	0.98529
GP15^n	0.75 (0.30–1.84)	0.52458	0.62949	3.46 (0.69–17.42)	0.13259	0.65695
G0^n	1.12 (1.03–1.22)	0.00075^*	$0.02025^\#$	1.02 (0.94–1.11)	0.61997	0.90482
G1^n	0.74 (0.63–0.87)	0.00036^*	$0.01944^\#$	0.94 (0.83–1.07)	0.35238	0.66608
G2^n	0.97 (0.88–1.07)	0.55739	0.64580	1.01 (0.90–1.15)	0.81987	0.98529
$F^{n\ total}$	1.18 (0.87–1.61)	0.28319	0.42478	1.01 (0.63–1.62)	0.95728	0.98529
$FG0^{n\ total}/G0^n$	1.54 (0.96–2.51)	0.08202	0.30780	1.04 (0.59–1.80)	0.90425	0.98529
$FG1^{n\ total}/G1^n$	1.26 (0.79–2.00)	0.32894	0.48007	0.90 (0.36–2.26)	0.82569	0.98529
$FG2^{n\ total}/G2^n$	1.16 (0.95–1.41)	0.14570	0.32101	1.00 (0.78–1.27)	0.96609	0.98529
F^n	1.10 (0.96–1.25)	0.17171	0.35662	0.86 (0.68–1.08)	0.19000	0.66608

Continued

Derive glycans	Incident IS *vs.* control (men)			Incident IS *vs.* control (women)		
	OR (95% CI)	P^*	$q^\#$	OR (95% CI)	P^*	$q^\#$
$FG0^n/G0^n$	1.11 (0.99–1.24)	0.06739	0.27992	0.92 (0.77–1.08)	0.29939	0.66608
$FG1^n/G1^n$	1.08 (0.94–1.24)	0.27107	0.42478	0.80 (0.64–1.00)	0.04944	0.65695
$FG2^n/G2^n$	1.10 (0.97–1.26)	0.14237	0.32101	0.91 (0.74–1.11)	0.34349	0.66608
FB^n	0.89 (0.75–1.07)	0.22285	0.41496	1.24 (0.95–1.64)	0.11803	0.65695
$FBG0^n/G0^n$	0.89 (0.79–1.02)	0.09120	0.30780	1.13 (0.93–1.38)	0.21865	0.66608
$FBG1^n/G1^n$	0.94 (0.81–1.11)	0.47929	0.58821	1.27 (1.00–1.60)	0.05105	0.65695
$FBG2^n/G2^n$	0.94 (0.68–1.03)	0.69989	0.77130	1.48 (0.97–2.28)	0.07214	0.65695
FB^n/F^n	0.92 (0.82–1.04)	0.18069	0.36138	1.16 (0.95–1.41)	0.13681	0.65695
$FB^n/F^{n\ total}$	0.90 (0.76–1.06)	0.19347	0.37312	1.23 (0.95–1.60)	0.12297	0.65695
$F^n/(B^n+FB^n)$	1.20 (0.87–1.65)	0.26277	0.42478	0.65 (0.39–1.06)	0.08252	0.65695
$B^n/(F^n+FB^n)$	1.01 (0.92–1.11)	0.81041	0.84157	0.95 (0.82–1.10)	0.50541	0.82703
$FBG2^n/FG2^n$	0.15 (0.00–18.16)	0.43812	0.58821	0.80 (0.64–1.01)	0.05737	0.65695
$FBG2^n/(FG2^n+FBG2^n)$	0.90 (0.68–1.20)	0.47565	0.58821	1.43 (0.96–2.13)	0.07703	0.65695
$FG2^n/(BG2^n+FBG2^n)$	1.05 (0.89–1.23)	0.56209	0.64580	0.95 (0.75–1.19)	0.63963	0.90894
$BG2^n/(FG2^n+FBG2^n)$	1.00 (0.98–1.02)	0.93999	0.93999	0.99 (0.96–1.02)	0.54538	0.86619

Note. IS, ischemic stroke; *CI*, confidence interval. $^*P < 0.05$. $^\#q < 0.05$: significant after correction for FDR (false discovery rate).

Supplementary Table S8. Initial glycan peaks after dimension reduction screening and false discrimination rates of 5-fold cross-validation in the three methods

Items	Stepwise regression	Ridge regression	Lasso regression
Initial glycan peaks			
GP4	0.147	0.144	0.018
GP9	−0.349	−0.393	−0.047
GP21	–	–	–
GP22	−18.174	−12.879	−0.994
GP23	–	–	–
GP24	–	–	−0.172
False discrimination rates	0.267	0.267	0.286

Note. GP, glycan peaks; –, the initial glycans were not included in the model.
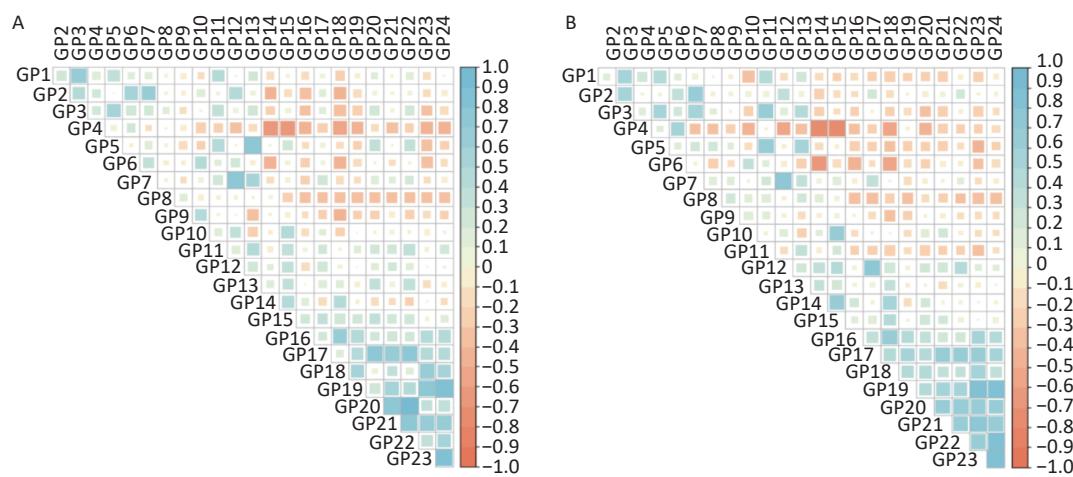
Supplementary Figure S1. The correlation coefficients of independent IgG N-glycan peaks in (A) men and (B) women. The positive correlations are represented by blue, while negative correlations are represented by red.