

Article

# Lipidomics of Brain Tissues in Rats Fed Human Milk from Chinese Mothers or Commercial Infant Formula

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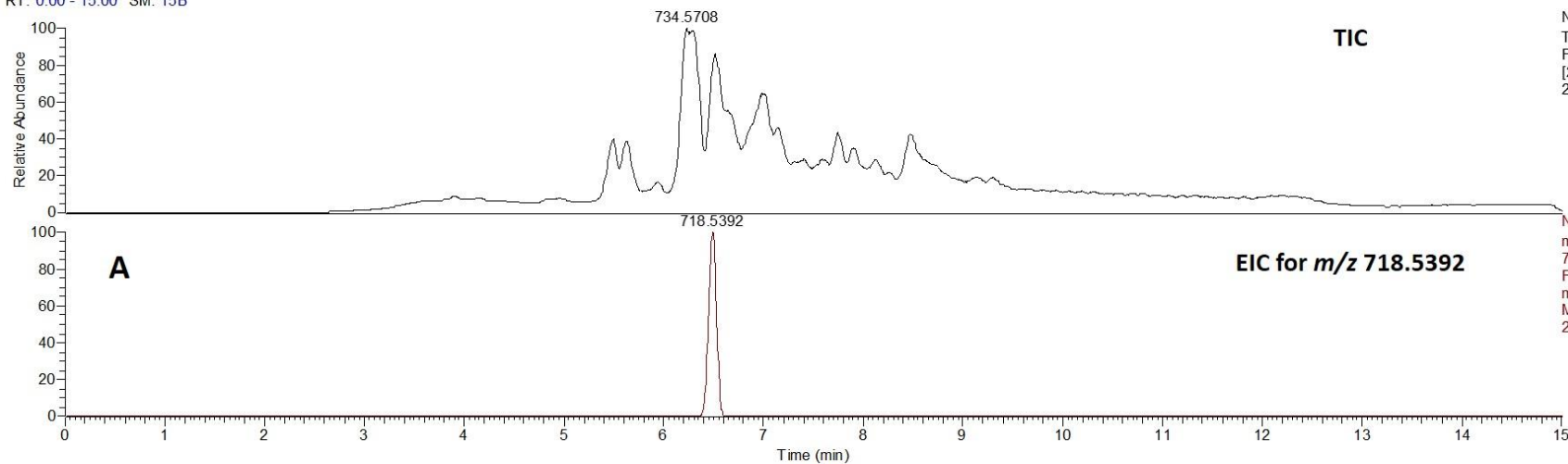
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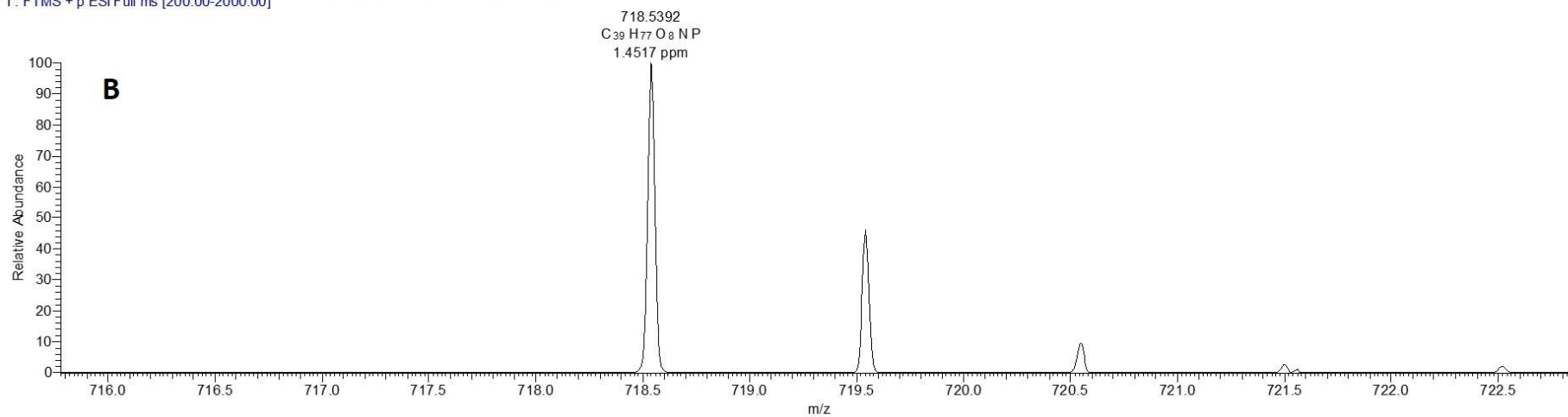
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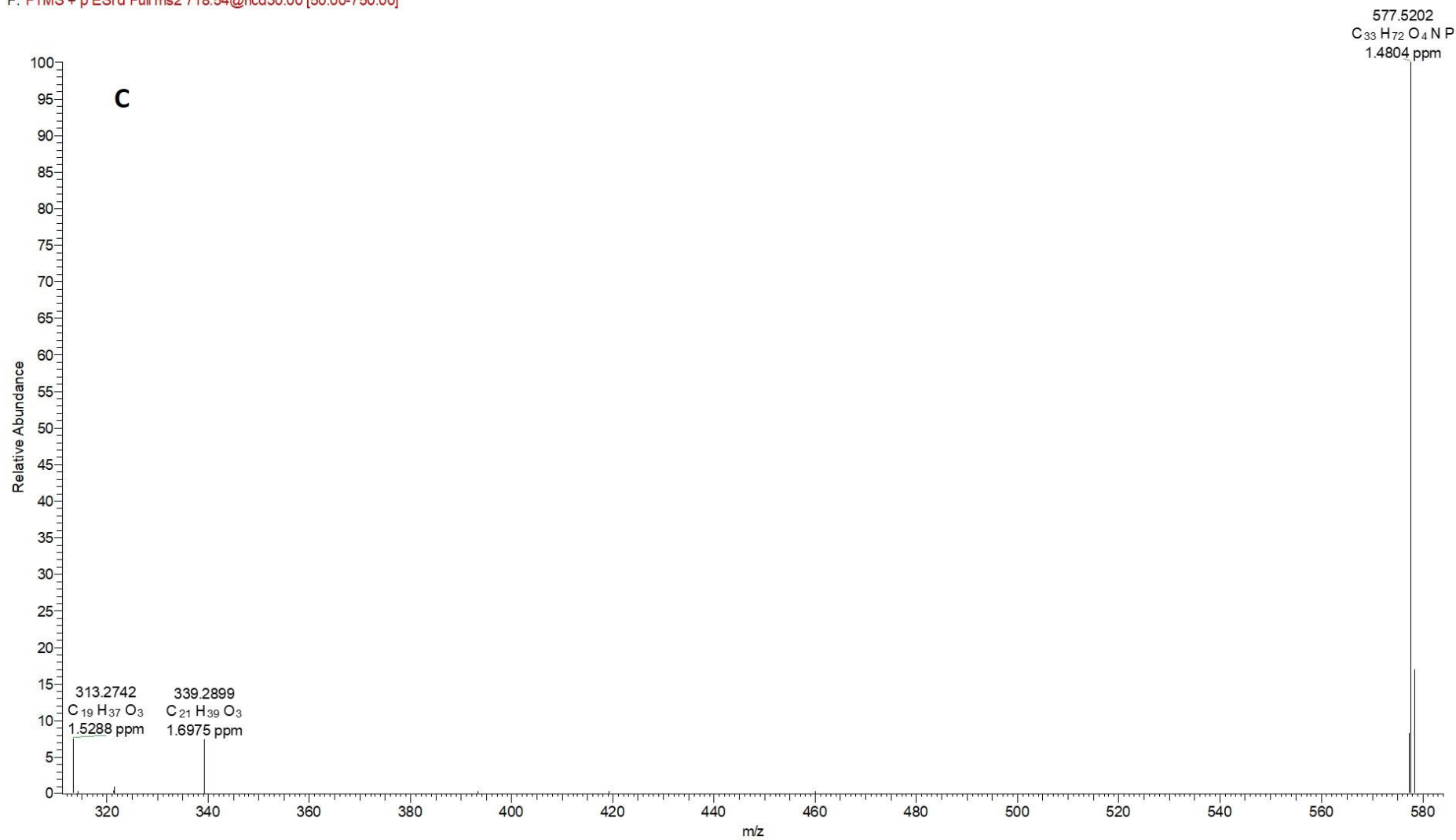
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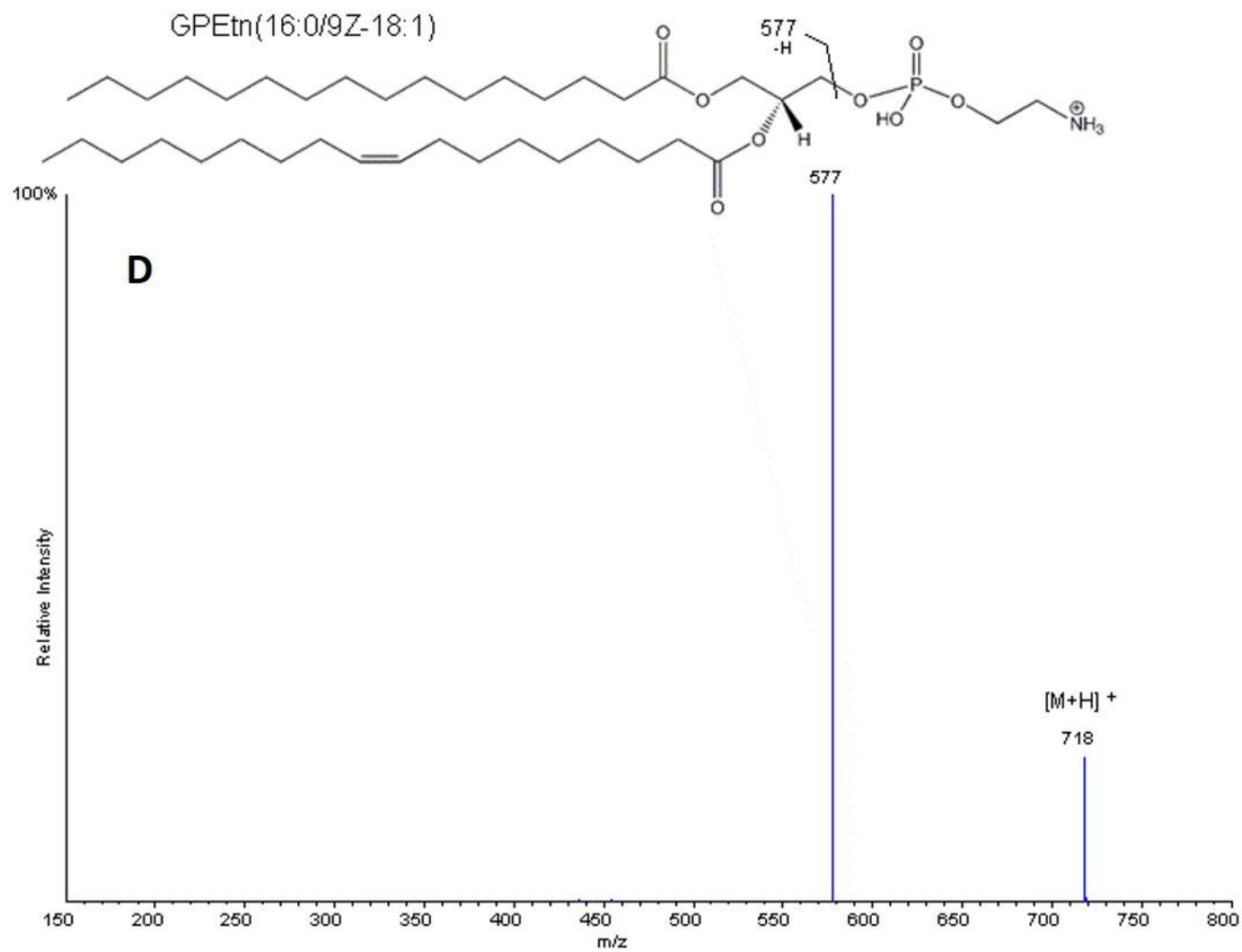
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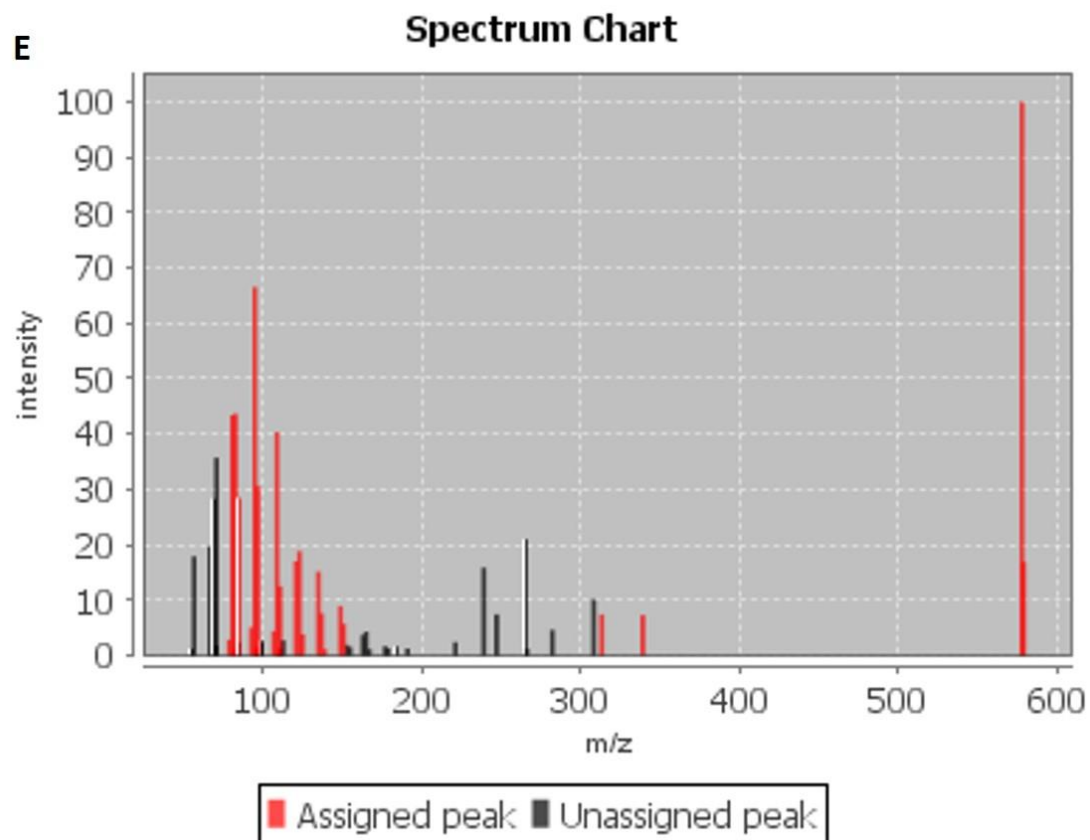
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**Figure S1.** Identification of PE(16:0/18:1)+H where (A) shows an EIC corresponding to the parent ion  $m/z$  718.5392, (B) shows elemental composition of  $m/z$  718.5392 corresponding to the molecular formula of PE(16:0/18:1)+H, (C) shows the ddMS2 spectrum for  $m/z$  718.54 @ CE of 30 eV, (D) shows principal product ions of an analytical standard of PE(16:0/18:1)+H from the LipidMaps database, and (E) shows the theoretical mass spectrum of MS2 product ions of  $m/z$  718.5392.

**Table S1.** Tentative product/fragment ions of PE(16:0/18:1)+H and their corresponding observed  $m/z$  values generated by LipidSearch™.

Observed $m/z$	Tentative product/fragment ions
79.0548	C <sub>6</sub> H <sub>7</sub>
81.0705	C <sub>6</sub> H <sub>9</sub>
83.0862	C <sub>6</sub> H <sub>11</sub>
85.1018	C <sub>6</sub> H <sub>13</sub>
93.0704	C <sub>7</sub> H <sub>9</sub>
95.0861	C <sub>7</sub> H <sub>11</sub>
97.1017	C <sub>7</sub> H <sub>13</sub>
107.086	C <sub>8</sub> H <sub>11</sub>
109.1016	C <sub>8</sub> H <sub>13</sub>
111.1172	C <sub>8</sub> H <sub>15</sub>
121.1015	C <sub>9</sub> H <sub>13</sub>
123.1171	C <sub>9</sub> H <sub>15</sub>
125.1328	C <sub>9</sub> H <sub>17</sub>
135.117	C <sub>10</sub> H <sub>15</sub>
137.1325	C <sub>10</sub> H <sub>17</sub>
139.1483	C <sub>10</sub> H <sub>19</sub>
149.1327	C <sub>11</sub> H <sub>17</sub>
151.1484	C <sub>11</sub> H <sub>19</sub>
313.2741	(16:0)-OH
339.2897	(18:1)-OH
577.5199	NL[PE]

NL[PE] refers to the neutral loss of  $m/z$  141 diagnostic of PE

**Table S2.** Putative combinations of fatty acids and adducts corresponding to PE(34:1) and their m-scores generated by LipidSearch™.

<b>Lipid ion</b>	<b>m-score*</b>
PE(16:0/18:1)+H	29.8
PE(18:1/16:0)+H	29.8
PE(10:0/24:1)+H	15.1
PE(12:0/22:1)+H	15.1
PE(14:0/20:1)+H	15.1
PE(15:1/19:0)+H	15.1
PE(16:1/18:0)+H	15.1
PE(17:1/17:0)+H	15.1
PE(18:0/16:1)+H	15.1
PE(19:1/15:0)+H	15.1
PE(20:0/14:1)+H	15.1
PE(20:1/14:0)+H	15.1
PE(22:1/12:0)+H	15.1
PE(24:1/10:0)+H	15.1
PE(26:1/8:0)+H	15.1
PE(16:0e/19:4)+Li	15.1
PE(16:0p/19:3)+Li	15.1
PE(16:1e/19:3)+Li	15.1
PE(16:1p/19:2)+Li	15.1
PE(18:0p/17:3)+Li	15.1

\*The score calculated based on the number of matches with product ion peaks in the spectrum.

**Table S3.** List of 163 lipid species identified in the current study by LipidSearch software (based on ddMS<sup>2</sup>) and matched with the final data matrix (XCMS) in positive and negative ionisation modes, with average normalised peak intensities  $\pm$  SE in brain samples from rats fed human milk or infant formula ( $n=12$ ).

Lipid Ion	<i>m/z</i>	RT (secs)	Ion Formula	Class	Fatty Acid	Average peak intensity $\pm$ SE	
						Human milk	Infant formula
<b>Positive ionisation mode</b>							
<b>Ceramides</b>							
Cer(d18:1/16:0)+H	538.5194	381.28	C <sub>34</sub> H <sub>68</sub> O <sub>3</sub> N	Cer	(d18:1/16:0)	23390237 $\pm$ 849340	22968114 $\pm$ 849277
Cer(d18:2/18:0)+H	564.535	386.52	C <sub>36</sub> H <sub>70</sub> O <sub>3</sub> N	Cer	(d18:2/18:0)	70383939 $\pm$ 3456659	71824796 $\pm$ 3092380
Cer(d18:1/18:0)+H	566.5507	427.14	C <sub>36</sub> H <sub>72</sub> O <sub>3</sub> N	Cer	(d18:1/18:0)	471871680 $\pm$ 27081731	468352547 $\pm$ 18724515
Cer(d20:1/18:0)+H	594.582	472	C <sub>38</sub> H <sub>76</sub> O <sub>3</sub> N	Cer	(d20:1/18:0)	46137740 $\pm$ 1586564	41710459 $\pm$ 2727779
Cer(d18:1/22:0)+H	622.6133	515.04	C <sub>40</sub> H <sub>80</sub> O <sub>3</sub> N	Cer	(d18:1/22:0)	7542913 $\pm$ 384422	6753847 $\pm$ 453905
Cer(d18:1/24:1)+H	648.6289	512.34	C <sub>42</sub> H <sub>82</sub> O <sub>3</sub> N	Cer	(d18:1/24:1)	47623616 $\pm$ 2526683	43930662 $\pm$ 2659910
Cer(d18:1/24:0)+H	650.6446	555.02	C <sub>42</sub> H <sub>84</sub> O <sub>3</sub> N	Cer	(d18:1/24:0)	7193849 $\pm$ 424658	6287841 $\pm$ 405475
CerG1(d18:1/18:0)+H	728.6035	386.54	C <sub>42</sub> H <sub>82</sub> O <sub>8</sub> N	CerG1	(d18:1/18:0)	47372243 $\pm$ 1804599	42712717 $\pm$ 2622198
CerG1(d18:1/18:0+O)+H	744.5984	375.48	C <sub>42</sub> H <sub>82</sub> O <sub>9</sub> N	CerG1	(d18:1/18:0+O)	21766753 $\pm$ 1159251	17850453 $\pm$ 1365347
CerG1(d18:1/20:0+O)+H	772.6297	417.6	C <sub>44</sub> H <sub>86</sub> O <sub>9</sub> N	CerG1	(d18:1/20:0+O)	21766753 $\pm$ 1159251	17850453 $\pm$ 1365347



CerG1(d38:1)+H	756.6348	431	C <sub>44</sub> H <sub>86</sub> O <sub>8</sub> N	CerG1	(d38:1)	23059911 ± 1296903	19095985 ± 1694169
CerG1(d18:1/22:1)+H	782.6504	464.2	C <sub>46</sub> H <sub>88</sub> O <sub>8</sub> N	CerG1	(d18:1/22:1)	14325563 ± 647307	11579016 ± 920522
CerG1(d18:1/22:0)+H	784.6661	472.5	C <sub>46</sub> H <sub>90</sub> O <sub>8</sub> N	CerG1	(d18:1/22:0)	32200872 ± 1694967	26462477 ± 2670847
CerG1(d40:0+O)+H	802.6767	480.66	C <sub>46</sub> H <sub>92</sub> O <sub>9</sub> N	CerG1	(d40:0+O)	22680879 ± 1843054	17708949 ± 2024657
CerG1(d18:1/24:2)+H	808.6661	462.38	C <sub>48</sub> H <sub>90</sub> O <sub>8</sub> N	CerG1	(d18:1/24:2)	12171501 ± 575191	9687452 ± 811384
CerG1(d18:2/24:1)+H	808.6661	433.88	C <sub>48</sub> H <sub>90</sub> O <sub>8</sub> N	CerG1	(d18:2/24:1)	5069266 ± 242880	4440493 ± 374297
CerG1(d18:1/24:1)+H	810.6817	472.22	C <sub>48</sub> H <sub>92</sub> O <sub>8</sub> N	CerG1	(d18:1/24:1)	166696157 ± 8407145	135403339 ± 13946084
CerG1(d42:1)+H	812.6974	516.16	C <sub>48</sub> H <sub>94</sub> O <sub>8</sub> N	CerG1	(d42:1)	121747728 ± 7099915	104824272 ± 9976147
CerG1(d18:0/24:1)+H	812.6974	485.84	C <sub>48</sub> H <sub>94</sub> O <sub>8</sub> N	CerG1	(d18:0/24:1)	7223754 ± 374450	5339250 ± 655133
CerG1(d18:0/24:0)+H	814.713	530.82	C <sub>48</sub> H <sub>96</sub> O <sub>8</sub> N	CerG1	(d18:0/24:0)	11089637 ± 495319	8292721 ± 894933
CerG1(d42:0+O)+H	830.708	521.86	C <sub>48</sub> H <sub>96</sub> O <sub>9</sub> N	CerG1	(d42:0+O)	56064641 ± 2745368	41254337 ± 3995143
CerG1(d18:1/26:1)+H	838.713	512.7	C <sub>50</sub> H <sub>96</sub> O <sub>8</sub> N	CerG1	(d18:1/26:1)	10855874 ± 673048	9145632 ± 793104
CerG1(d44:1)+H	840.7287	554.86	C <sub>50</sub> H <sub>98</sub> O <sub>8</sub> N	CerG1	(d44:1)	7331391 ± 511900	6021735 ± 514105
<b>Diacylglycerol</b>							
DG(18:0/16:0)+NH <sub>4</sub>	614.5718	502.76	C <sub>37</sub> H <sub>76</sub> O <sub>5</sub> N	DG	(18:0/16:0)	14683932 ± 442610	13057723 ± 589684
DG(18:0/18:1)+NH <sub>4</sub>	640.5875	506.04	C <sub>39</sub> H <sub>78</sub> O <sub>5</sub> N	DG	(18:0/18:1)	10987111 ± 849163	9072100 ± 1031855

DG(18:0/18:0)+NH <sub>4</sub>	642.6031	541.98	C <sub>39</sub> H <sub>80</sub> O <sub>5</sub> N	DG	(18:0/18:0)	38458623 ± 1660750	35287483 ± 1280747
DG(18:0/20:4)+NH <sub>4</sub>	662.5718	461.2	C <sub>41</sub> H <sub>76</sub> O <sub>5</sub> N	DG	(18:0/20:4)	27261396 ± 2594638	24747622 ± 2644507
<b>Phosphatidylethanolamine</b>							
PE(16:0p/16:0)+H	676.5276	407.82	C <sub>37</sub> H <sub>75</sub> O <sub>7</sub> NP	PE	(16:0p/16:0)	5297000 ± 223815	4618677 ± 232877
PE(16:0p/18:1)+H	702.5432	412.7	C <sub>39</sub> H <sub>77</sub> O <sub>7</sub> NP	PE	(16:0p/18:1)	229567636 ± 9557431	198310814 ± 13014100
PE(18:0p/16:0)+H	704.5589	451.78	C <sub>39</sub> H <sub>79</sub> O <sub>7</sub> NP	PE	(18:0p/16:0)	13159539 ± 550477	11404356 ± 658703
PE(16:0e/18:1)+H	704.5589	417.32	C <sub>39</sub> H <sub>79</sub> O <sub>7</sub> NP	PE	(16:0e/18:1)	31287163 ± 900958	26701141 ± 1669861
PE(16:0/18:1)+H	718.5381	387.28	C <sub>39</sub> H <sub>77</sub> O <sub>8</sub> NP	PE	(16:0/18:1)	92758254 ± 2504884	87335358 ± 3773007
PE(18:0/16:0)+H	720.5538	426.64	C <sub>39</sub> H <sub>79</sub> O <sub>8</sub> NP	PE	(18:0/16:0)	16058191 ± 694886	14978929 ± 715916
PE(16:0p/20:4)+H	724.5276	367.12	C <sub>41</sub> H <sub>75</sub> O <sub>7</sub> NP	PE	(16:0p/20:4)	103670452 ± 5357121	100137061 ± 4827411
PE(18:1p/18:1)+H	728.5589	414.84	C <sub>41</sub> H <sub>79</sub> O <sub>7</sub> NP	PE	(18:1p/18:1)	303861858 ± 11694492	261609275 ± 19165290
PE(18:0p/18:1)+H	730.5745	452.26	C <sub>41</sub> H <sub>81</sub> O <sub>7</sub> NP	PE	(18:0p/18:1)	197605140 ± 10075566	162970118 ± 12751155
PE(18:0e/18:1)+H	732.5902	462.42	C <sub>41</sub> H <sub>83</sub> O <sub>7</sub> NP	PE	(18:0e/18:1)	25168614 ± 1166438	19952740 ± 1647797
PE(16:0/20:4)+H	740.5225	345.86	C <sub>41</sub> H <sub>75</sub> O <sub>8</sub> NP	PE	(16:0/20:4)	44849131 ± 2441902	45055266 ± 2221239
PE(18:0/18:1)+H	746.5694	431.88	C <sub>41</sub> H <sub>81</sub> O <sub>8</sub> NP	PE	(18:0/18:1)	129706948 ± 4988478	111512912 ± 6619286
PE(16:0p/22:6)+H	748.5276	353.7	C <sub>43</sub> H <sub>75</sub> O <sub>7</sub> NP	PE	(16:0p/22:6)	164904737 ± 9020185	154992902 ± 7949434

PE(18:1p/20:1)+H	756.5902	452.3	C <sub>43</sub> H <sub>83</sub> O <sub>7</sub> NP	PE	(18:1p/20:1)	49049516 ± 3583071	36536204 ± 3374387
PE(18:0p/20:1)+H	758.6058	491.34	C <sub>43</sub> H <sub>85</sub> O <sub>7</sub> NP	PE	(18:0p/20:1)	33159888 ± 1940875	26517580 ± 2609547
PE(16:0/22:6)+H	764.5225	335.18	C <sub>43</sub> H <sub>75</sub> O <sub>8</sub> NP	PE	(16:0/22:6)	240338921 ± 11822540	236126020 ± 12061883
PE(18:1/20:4)+H	766.5381	350.64	C <sub>43</sub> H <sub>77</sub> O <sub>8</sub> NP	PE	(18:1/20:4)	50382385 ± 2540264	47897491 ± 2319392
PE(18:0/20:3)+H	770.5694	408.54	C <sub>43</sub> H <sub>81</sub> O <sub>8</sub> NP	PE	(18:0/20:3)	8264646 ± 392065	7540929 ± 447905
PE(18:1p/22:6)+H	774.5432	356.76	C <sub>45</sub> H <sub>77</sub> O <sub>7</sub> NP	PE	(18:1p/22:6)	60366085 ± 3482997	55840385 ± 2930860
PE(18:0/20:1)+H	774.6007	470.12	C <sub>43</sub> H <sub>85</sub> O <sub>8</sub> NP	PE	(18:0/20:1)	12210565 ± 694558	9356541 ± 923806
PE(18:0p/22:6)+H	776.5589	399.84	C <sub>45</sub> H <sub>79</sub> O <sub>7</sub> NP	PE	(18:0p/22:6)	471166520 ± 16679831	449560071 ± 21016084
PE(18:1/22:6)+H	790.5381	337.32	C <sub>45</sub> H <sub>77</sub> O <sub>8</sub> NP	PE	(18:1/22:6)	57122632 ± 3073425	55167080 ± 2665150
PE(18:0/22:6)+H	792.5538	380.92	C <sub>45</sub> H <sub>79</sub> O <sub>8</sub> NP	PE	(18:0/22:6)	740366682 ± 20173629	710290814 ± 27968280
PE(18:0/22:5)+H	794.5694	404	C <sub>45</sub> H <sub>81</sub> O <sub>8</sub> NP	PE	(18:0/22:5)	27531820 ± 1259669	23731642 ± 1059150
PE(18:0/22:4)+H	796.5851	421.82	C <sub>45</sub> H <sub>83</sub> O <sub>8</sub> NP	PE	(18:0/22:4)	105666250 ± 3876693	98916103 ± 4576959
<b>Sphingomyelins</b>							
SM(d34:1)+H	703.5749	325.24	C <sub>39</sub> H <sub>80</sub> O <sub>6</sub> N <sub>2</sub> P	SM	(d34:1)	50764155 ± 2154145	49620160 ± 3589264
SM(d36:2)+H	729.5905	327.32	C <sub>41</sub> H <sub>82</sub> O <sub>6</sub> N <sub>2</sub> P	SM	(d36:2)	53108203 ± 1908169	49520389 ± 2910627
SM(d36:1)+H	731.6062	370.2	C <sub>41</sub> H <sub>84</sub> O <sub>6</sub> N <sub>2</sub> P	SM	(d36:1)	595682085 ± 14313611	568798967 ± 25111132

SM(d36:0)+H	733.6218	386.58	C <sub>41</sub> H <sub>86</sub> O <sub>6</sub> N <sub>2</sub> P	SM	(d36:0)	18506329 ± 702414	16668164 ± 830403
SM(d38:1)+H	759.6375	413.62	C <sub>43</sub> H <sub>88</sub> O <sub>6</sub> N <sub>2</sub> P	SM	(d38:1)	95973869 ± 3355740	87308842 ± 5576838
SM(d40:2)+H	785.6531	416.98	C <sub>45</sub> H <sub>90</sub> O <sub>6</sub> N <sub>2</sub> P	SM	(d40:2)	6802675 ± 417663	5215207 ± 495856
SM(d40:1)+H	787.6688	461	C <sub>45</sub> H <sub>92</sub> O <sub>6</sub> N <sub>2</sub> P	SM	(d40:1)	17145771 ± 1023207	14014343 ± 1328073
SM(d42:2)+H	813.6844	455.84	C <sub>47</sub> H <sub>94</sub> O <sub>6</sub> N <sub>2</sub> P	SM	(d42:2)	54735931 ± 3364245	44368485 ± 4268536
SM(d42:1)+H	815.7001	503.46	C <sub>47</sub> H <sub>96</sub> O <sub>6</sub> N <sub>2</sub> P	SM	(d42:1)	17883630 ± 971659	15212062 ± 1275012
<b>Phosphatidylcholine</b>							
PC(30:0)+H	706.5381	328.84	C <sub>38</sub> H <sub>77</sub> O <sub>8</sub> NP	PC	(30:0)	268743924 ± 8859790	256007242 ± 13918027
PC(32:1e)+H	718.5745	395.32	C <sub>40</sub> H <sub>81</sub> O <sub>7</sub> NP	PC	(32:1e)	26293990 ± 1075666	25697721 ± 1125782
PC(31:0)+H	720.5538	348.6	C <sub>39</sub> H <sub>79</sub> O <sub>8</sub> NP	PC	(31:0)	18534715 ± 1118875	18851214 ± 1063688
PC(32:0e)+H	720.5902	397.54	C <sub>40</sub> H <sub>83</sub> O <sub>7</sub> NP	PC	(32:0e)	38882741 ± 1825303	35659901 ± 1668226
PC(32:1)+H	732.5538	331.72	C <sub>40</sub> H <sub>79</sub> O <sub>8</sub> NP	PC	(32:1)	251701301 ± 20931185	212956463 ± 11679169
PC(32:0)+H	734.5694	371.66	C <sub>40</sub> H <sub>81</sub> O <sub>8</sub> NP	PC	(32:0)	3244692833 ± 94953762	3187938505 ± 100957320
PC(33:1)+H	746.5694	354.24	C <sub>41</sub> H <sub>81</sub> O <sub>8</sub> NP	PC	(33:1)	16886949 ± 817511	16347720 ± 877657
PC(34:1e)+H	746.6058	402.26	C <sub>42</sub> H <sub>85</sub> O <sub>7</sub> NP	PC	(34:1e)	240570825 ± 9683638	203695792 ± 14676231
PC(33:0)+H	748.5851	393.22	C <sub>41</sub> H <sub>83</sub> O <sub>8</sub> NP	PC	(33:0)	26432770 ± 810261	26836742 ± 1395662

PC(34:0e)+H	748.6215	443.12	C <sub>42</sub> H <sub>87</sub> O <sub>7</sub> NP	PC	(34:0e)	10409157 ± 443582	9174314 ± 546908
PC(34:1)+H	760.5851	375.36	C <sub>42</sub> H <sub>83</sub> O <sub>8</sub> NP	PC	(34:1)	4739634496 ± 141951176	4599586978 ± 148321696
PC(34:0)+H	762.6007	415.52	C <sub>42</sub> H <sub>85</sub> O <sub>8</sub> NP	PC	(34:0)	820034285 ± 30492265	760280516 ± 36554903
PC(34:2)+H	758.5694	342	C <sub>42</sub> H <sub>81</sub> O <sub>8</sub> NP	PC	(34:2)	126887348 ± 8463306	142243771 ± 9037323
PC(36:2p)+H	770.6058	397.12	C <sub>44</sub> H <sub>85</sub> O <sub>7</sub> NP	PC	(36:2p)	19167159 ± 856519	16758444 ± 1223754
PC(36:2e)+H	772.6215	406.2	C <sub>44</sub> H <sub>87</sub> O <sub>7</sub> NP	PC	(36:2e)	42520517 ± 1420102	36506460 ± 2722413
PC(35:1)+H	774.6007	395.3	C <sub>43</sub> H <sub>85</sub> O <sub>8</sub> NP	PC	(35:1)	46644505 ± 1241858	44110089 ± 2605718
PC(36:1e)+H	774.6371	444.94	C <sub>44</sub> H <sub>89</sub> O <sub>7</sub> NP	PC	(36:1e)	23954908 ± 1318883	20255337 ± 1738660
PC(36:4)+H	782.5694	335.8	C <sub>44</sub> H <sub>81</sub> O <sub>8</sub> NP	PC	(36:4)	1044886321 ± 53040058	1041344788 ± 49769789
PC(36:3)+H	784.5851	347.92	C <sub>44</sub> H <sub>83</sub> O <sub>8</sub> NP	PC	(36:3)	22507124 ± 1136685	25113913 ± 1624553
PC(36:2)+H	786.6007	379.78	C <sub>44</sub> H <sub>85</sub> O <sub>8</sub> NP	PC	(36:2)	414842931 ± 25380771	386298512 ± 24150022
PC(36:1)+H	788.6164	418.98	C <sub>44</sub> H <sub>87</sub> O <sub>8</sub> NP	PC	(36:1)	1585506946 ± 52130483	1388590719 ± 78159047
PC(36:0)+H	790.632	458.34	C <sub>44</sub> H <sub>89</sub> O <sub>8</sub> NP	PC	(36:0)	13729129 ± 664620	11278022 ± 808573
PC(37:4)+H	796.5851	356.72	C <sub>45</sub> H <sub>83</sub> O <sub>8</sub> NP	PC	(37:4)	5036477 ± 318402	5163877 ± 310847
PC(38:6)+H	806.5694	325.1	C <sub>46</sub> H <sub>81</sub> O <sub>8</sub> NP	PC	(16:0/22:6)	728839570 ± 44568585	708650922 ± 84262687
PC(38:5)+H	808.5851	352.3	C <sub>46</sub> H <sub>83</sub> O <sub>8</sub> NP	PC	(38:5)	216968566 ± 13381802	204598735 ± 9959614

PC(38:4)+H	810.6007	384.86	C <sub>46</sub> H <sub>85</sub> O <sub>8</sub> NP	PC	(38:4)	684023657 ± 21587197	663037581 ± 24328338
PC(38:3)+H	812.6164	395.72	C <sub>46</sub> H <sub>87</sub> O <sub>8</sub> NP	PC	(38:3)	24989121 ± 1013201	23418016 ± 1113299
PC(38:2)+H	814.632	418.78	C <sub>46</sub> H <sub>89</sub> O <sub>8</sub> NP	PC	(38:2)	42225775 ± 1550380	35738330 ± 2619357
PC(38:1)+H	816.6477	461.9	C <sub>46</sub> H <sub>91</sub> O <sub>8</sub> NP	PC	(38:1)	62456377 ± 3339235	47281498 ± 4307697
PC(40:7)+H	832.5851	328.16	C <sub>48</sub> H <sub>83</sub> O <sub>8</sub> NP	PC	(40:7)	355461192 ± 10797655	325922338 ± 17770318
PC(40:6)+H	834.6007	366.18	C <sub>48</sub> H <sub>85</sub> O <sub>8</sub> NP	PC	(40:6)	255127030 ± 10697665	232849482 ± 12389867
PC(40:5)+H	836.6164	377.5	C <sub>48</sub> H <sub>87</sub> O <sub>8</sub> NP	PC	(40:5)	27630236 ± 536462	26569780 ± 1463193
PC(40:4)+H	838.632	402.94	C <sub>48</sub> H <sub>89</sub> O <sub>8</sub> NP	PC	(40:4)	53960384 ± 2131427	47504750 ± 2775447
PC(40:2)+H	842.6633	461.36	C <sub>48</sub> H <sub>93</sub> O <sub>8</sub> NP	PC	(40:2)	17655500 ± 1140947	12829565 ± 1345492
PC(40:1)+H	844.679	502.7	C <sub>48</sub> H <sub>95</sub> O <sub>8</sub> NP	PC	(40:1)	35394473 ± 2489364	26074984 ± 2441450
PC(42:10)+H	854.5694	288.94	C <sub>50</sub> H <sub>81</sub> O <sub>8</sub> NP	PC	(42:10)	4732431 ± 303338	4470863 ± 281836
PC(42:8)+H	858.6007	329.24	C <sub>50</sub> H <sub>85</sub> O <sub>8</sub> NP	PC	(42:8)	12192990 ± 352407	11197324 ± 634872
PC(41:1)+H	858.6946	524.56	C <sub>49</sub> H <sub>97</sub> O <sub>8</sub> NP	PC	(41:1)	6367321 ± 496274	4569069 ± 460865
PC(42:7)+H	860.6164	367.12	C <sub>50</sub> H <sub>87</sub> O <sub>8</sub> NP	PC	(42:7)	7249447 ± 302313	6141924 ± 371527
PC(42:1)+H	872.7103	539.62	C <sub>50</sub> H <sub>99</sub> O <sub>8</sub> NP	PC	(42:1)	22880015 ± 1745326	17619307 ± 1691091
<b>Phosphatidylserine</b>							

PS(18:1/18:1)+H	788.5436	339.7	C <sub>42</sub> H <sub>79</sub> O <sub>10</sub> NP	PS	(18:1/18:1)	30550480 ± 1191362	28036407 ± 1829513
PS(18:0/18:1)+H	790.5593	379.78	C <sub>42</sub> H <sub>81</sub> O <sub>10</sub> NP	PS	(18:0/18:1)	176364612 ± 6595837	157774854 ± 9710268
PS(18:0/22:6)+H	836.5436	325.3	C <sub>46</sub> H <sub>79</sub> O <sub>10</sub> NP	PS	(18:0/22:6)	375426076 ± 12434005	338561370 ± 20017339
PS(18:0/22:5)+H	838.5593	356.36	C <sub>46</sub> H <sub>81</sub> O <sub>10</sub> NP	PS	(18:0/22:5)	14585049 ± 752127	13074054 ± 628191
PS(18:0/22:4)+H	840.5749	372.04	C <sub>46</sub> H <sub>83</sub> O <sub>10</sub> NP	PS	(18:0/22:4)	43962289 ± 1111539	41412780 ± 1930131
PS(22:4/22:6)+H	884.5436	286.62	C <sub>50</sub> H <sub>79</sub> O <sub>10</sub> NP	PS	(22:4/22:6)	5942725 ± 276206	5433577 ± 350357
<b>Phosphatidylinositol</b>							
PI(16:0/20:4)+NH <sub>4</sub>	876.5597	292.92	C <sub>45</sub> H <sub>83</sub> O <sub>13</sub> NP	PI	(16:0/20:4)	8898107 ± 423108	8397330 ± 426502
PI(18:1/20:4)+NH <sub>4</sub>	902.5753	292.34	C <sub>47</sub> H <sub>85</sub> O <sub>13</sub> NP	PI	(18:1/20:4)	5297353 ± 270342	5002631 ± 278596
PI(18:0/20:4)+NH <sub>4</sub>	904.591	333.18	C <sub>47</sub> H <sub>87</sub> O <sub>13</sub> NP	PI	(18:0/20:4)	69548865 ± 2528047	63415266 ± 2948773
<b>Negative ionisation mode</b>							
<b>Lysophosphatidylethanolamine</b>							
LPE(18:0)-H	480.3096	146.28	C <sub>23</sub> H <sub>47</sub> O <sub>7</sub> NP	LPE	(18:0)	12494183 ± 340750	11719958 ± 827898
LPE(22:6)-H	524.2783	39.9	C <sub>27</sub> H <sub>43</sub> O <sub>7</sub> NP	LPE	(22:6)	5259986 ± 627249	4603514 ± 406515
<b>Phosphatidylethanolamine</b>							
PE(16:0p/16:0)-H	674.513	407.16	C <sub>37</sub> H <sub>73</sub> O <sub>7</sub> NP	PE	(16:0p/16:0)	6051977 ± 175405	5426539 ± 313374

PE(16:0/18:1)-H	716.5236	388.48	C <sub>39</sub> H <sub>75</sub> O <sub>8</sub> NP	PE	(16:0/18:1)	71714002 ± 939916	63409138 ± 4916605
PE(16:0p/20:4)-H	722.513	365.36	C <sub>41</sub> H <sub>73</sub> O <sub>7</sub> NP	PE	(16:0p/20:4)	110292352 ± 2987477	102374043 ± 9190520
PE(16:0e/20:4)-H	724.5287	374.5	C <sub>41</sub> H <sub>75</sub> O <sub>7</sub> NP	PE	(16:0e/20:4)	11655518 ± 644457	10540862 ± 1043294
PE(18:1p/18:1)-H	726.5443	413.9	C <sub>41</sub> H <sub>77</sub> O <sub>7</sub> NP	PE	(18:1p/18:1)	262311977 ± 6282014	221888578 ± 15989372
PE(18:0e/18:1)-H	730.5756	462.84	C <sub>41</sub> H <sub>81</sub> O <sub>7</sub> NP	PE	(18:0e/18:1)	30283301 ± 1190623	25295601 ± 1800753
PE(16:0/20:4)-H	738.5079	346.74	C <sub>41</sub> H <sub>73</sub> O <sub>8</sub> NP	PE	(16:0/20:4)	76434748 ± 1463504	72329402 ± 6337640
PE(36:4)-H	738.5079	648.66	C <sub>41</sub> H <sub>73</sub> O <sub>8</sub> NP	PE	(36:4)	7909748 ± 263045	7228706 ± 703078
PE(18:1/18:2)-H	740.5236	357.3	C <sub>41</sub> H <sub>75</sub> O <sub>8</sub> NP	PE	(18:1/18:2)	4996178 ± 226106	5160839 ± 509008
PE(18:1/18:1)-H	742.5392	390.42	C <sub>41</sub> H <sub>77</sub> O <sub>8</sub> NP	PE	(18:1/18:1)	78948705 ± 2011445	68797773 ± 5024460
PE(18:0/18:1)-H	744.5549	432.34	C <sub>41</sub> H <sub>79</sub> O <sub>8</sub> NP	PE	(18:0/18:1)	188602257 ± 3737102	167059069 ± 8136023
PE(16:0p/22:6)-H	746.513	352.54	C <sub>43</sub> H <sub>73</sub> O <sub>7</sub> NP	PE	(16:0p/22:6)	246605868 ± 4823285	223580365 ± 18516416
PE(16:0e/22:6)-H	748.5287	360.68	C <sub>43</sub> H <sub>75</sub> O <sub>7</sub> NP	PE	(16:0e/22:6)	115638837 ± 4557845	98423945 ± 9333402
PE(18:0p/20:4)-H	750.5443	404.2	C <sub>43</sub> H <sub>77</sub> O <sub>7</sub> NP	PE	(18:0p/20:4)	236589276 ± 4787893	230355851 ± 13192881
PE(18:0p/22:6)-H	774.5443	399.22	C <sub>45</sub> H <sub>77</sub> O <sub>7</sub> NP	PE	(18:0p/22:6)	398871100 ± 4386945	375275344 ± 21898034
PE(18:0p/22:5)-H	776.56	427.14	C <sub>45</sub> H <sub>79</sub> O <sub>7</sub> NP	PE	(18:0p/22:5)	17622931 ± 298452	15081144 ± 802522
PE(18:2/22:6)-H	786.5079	305.98	C <sub>45</sub> H <sub>73</sub> O <sub>8</sub> NP	PE	(18:2/22:6)	6504750 ± 166953	7173665 ± 668375



PE(18:0/22:4)-H	794.5705	421.2	C <sub>45</sub> H <sub>81</sub> O <sub>8</sub> NP	PE	(18:0/22:4)	94628112 ± 1727373	89680729 ± 5515864
PE(20:0p/22:6)-H	802.5756	441.24	C <sub>47</sub> H <sub>81</sub> O <sub>7</sub> NP	PE	(20:0p/22:6)	6115589 ± 68271	6084246 ± 315391
PE(24:4/18:0)-H	822.6018	454.5	C <sub>47</sub> H <sub>85</sub> O <sub>8</sub> NP	PE	(24:4/18:0)	5908148 ± 167841	5458527 ± 318142
<b>Sphingomyelins</b>							
SM(d18:1/16:0)+HCOO	747.5658	322.54	C <sub>40</sub> H <sub>80</sub> O <sub>8</sub> N <sub>2</sub> P	SM	(d18:1/16:0)	4065172 ± 148097	3640179 ± 359766
SM(d40:1)+HCOO	831.6597	459.7	C <sub>46</sub> H <sub>92</sub> O <sub>8</sub> N <sub>2</sub> P	SM	(d40:1)	7962239 ± 259331	6836804 ± 452914
SM(d22:1/20:1)+HCOO	857.6753	453.9	C <sub>48</sub> H <sub>94</sub> O <sub>8</sub> N <sub>2</sub> P	SM	(d22:1/20:1)	36205637 ± 1083919	30604632 ± 2069913
SM(d20:0/16:0)+HCOO	777.6127	387.04	C <sub>42</sub> H <sub>86</sub> O <sub>8</sub> N <sub>2</sub> P	SM	(d20:0/16:0)	4408764 ± 207855	3661766 ± 324815
<b>Phosphatidylglycerol</b>							
PG(16:0/18:1)-H	747.5182	338.68	C <sub>40</sub> H <sub>76</sub> O <sub>10</sub> P	PG	(16:0/18:1)	14084177 ± 247181	12263540 ± 855537
PG(16:0/20:4)-H	769.5025	303.64	C <sub>42</sub> H <sub>74</sub> O <sub>10</sub> P	PG	(16:0/20:4)	5698291 ± 183472	5835813 ± 496346
PG(18:0/20:4)-H	797.5338	342.54	C <sub>44</sub> H <sub>78</sub> O <sub>10</sub> P	PG	(18:0/20:4)	5135325 ± 184218	5000016 ± 398882
PG(22:6/22:6)-H	865.5025	240	C <sub>50</sub> H <sub>74</sub> O <sub>10</sub> P	PG	(22:6/22:6)	6903407 ± 189824	6730357 ± 587273
<b>Phosphatidylserine</b>							
PS(16:0/18:1)-H	760.5134	335.86	C <sub>40</sub> H <sub>75</sub> O <sub>10</sub> NP	PS	(16:0/18:1)	15280841 ± 417463	13030588 ± 1218442
PS(18:1/18:1)-H	786.5291	339.52	C <sub>42</sub> H <sub>77</sub> O <sub>10</sub> NP	PS	(18:1/18:1)	56504806 ± 1816231	48170540 ± 4657692

PS(18:0/18:1)-H	788.5447	378.52	C <sub>42</sub> H <sub>79</sub> O <sub>10</sub> NP	PS	(18:0/18:1)	179935107 ± 4777208	146475633 ± 14424381
PS(16:0/22:6)-H	806.4978	289.64	C <sub>44</sub> H <sub>73</sub> O <sub>10</sub> NP	PS	(16:0/22:6)	12223520 ± 1267910	11634111 ± 1510563
PS(18:0/20:4)-H	810.5291	341.86	C <sub>44</sub> H <sub>77</sub> O <sub>10</sub> NP	PS	(18:0/20:4)	70437615 ± 1779938	61959944 ± 5499022
PS(18:0/20:1)-H	816.576	416.52	C <sub>44</sub> H <sub>83</sub> O <sub>10</sub> NP	PS	(18:0/20:1)	20056213 ± 1772407	16461965 ± 1616123
PS(39:0)-H	832.6073	416.14	C <sub>45</sub> H <sub>87</sub> O <sub>10</sub> NP	PS	(39:0)	390765053 ± 5688384	345313606 ± 24611362
PS(18:0/22:4)-H	838.5604	368.92	C <sub>46</sub> H <sub>81</sub> O <sub>10</sub> NP	PS	(18:0/22:4)	56403819 ± 1940755	49839291 ± 4875249
PS(41:5)-H	850.5604	322.78	C <sub>47</sub> H <sub>81</sub> O <sub>10</sub> NP	PS	(41:5)	114752816 ± 1422025	101645443 ± 9385382
PS(43:7)-H	874.5604	298.64	C <sub>49</sub> H <sub>81</sub> O <sub>10</sub> NP	PS	(43:7)	4076522 ± 124030	4097940 ± 403580
PS(22:6/22:6)-H	878.4978	250.3	C <sub>50</sub> H <sub>73</sub> O <sub>10</sub> NP	PS	(22:6/22:6)	8076274 ± 183712	7356860 ± 667546
PS(24:4/22:6)-H	910.5604	319.4	C <sub>52</sub> H <sub>81</sub> O <sub>10</sub> NP	PS	(24:4/22:6)	5874390 ± 413455	4849389 ± 459667
<b>Phosphatidylcholine</b>							
PC(16:0p/16:0)+HCOO	762.5654	393.48	C <sub>41</sub> H <sub>81</sub> O <sub>9</sub> NP	PC	(16:0p/16:0)	5187291 ± 223598	4226922 ± 331095
PC(16:0e/16:0)+HCOO	764.5811	399.68	C <sub>41</sub> H <sub>83</sub> O <sub>9</sub> NP	PC	(16:0e/16:0)	6041154 ± 164798	5466009 ± 372591
PC(16:0e/18:1)+HCOO	790.5967	397.34	C <sub>43</sub> H <sub>85</sub> O <sub>9</sub> NP	PC	(16:0e/18:1)	57151889 ± 1035177	48568590 ± 3669999
PC(16:0/18:2)+HCOO	802.5604	341.62	C <sub>43</sub> H <sub>81</sub> O <sub>10</sub> NP	PC	(16:0/18:2)	39072481 ± 888473	41522110 ± 4006069
PC(16:0/18:1)+HCOO	804.576	375.38	C <sub>43</sub> H <sub>83</sub> O <sub>10</sub> NP	PC	(16:0/18:1)	638646014 ± 10246996	575723044 ± 52073044

PC(17:0/18:1)+HCOO	818.5917	397.02	C <sub>44</sub> H <sub>85</sub> O <sub>10</sub> NP	PC	(17:0/18:1)	8980789 ± 96651	8347490 ± 583352
PC(18:0e/18:1)+HCOO	818.628	446.74	C <sub>45</sub> H <sub>89</sub> O <sub>9</sub> NP	PC	(18:0e/18:1)	14698371 ± 480618	11817529 ± 967529
PC(18:1/22:0)+HCOO	888.6699	503.1	C <sub>49</sub> H <sub>95</sub> O <sub>10</sub> NP	PC	(18:1/22:0)	17114970 ± 574342	13970786 ± 884417
<b>Phosphatidylinositol</b>							
PI(18:1/18:1)-H	861.5499	328.02	C <sub>45</sub> H <sub>82</sub> O <sub>13</sub> P	PI	(18:1/18:1)	4748030 ± 298152	3372502 ± 402950
PI(18:1/20:4)-H	883.5342	298.78	C <sub>47</sub> H <sub>80</sub> O <sub>13</sub> P	PI	(18:1/20:4)	51384029 ± 1561335	48346716 ± 4255545
PI(18:0/20:4)-H	885.5499	327.28	C <sub>47</sub> H <sub>82</sub> O <sub>13</sub> P	PI	(18:0/20:4)	540882579 ± 15367450	473655304 ± 53326862

*m/z* denotes mass-to-charge ratios of the features used for identification; RT denotes retention time in seconds.

**Table S4.** Lipid species that were significantly different in the brain of rats fed human milk or infant formula ( $n = 12$ ) based on percentage contribution to respective class.

Lipid species	Human milk vs Infant formula	Lipid species	Human milk vs Infant formula
<b>Positive ionization mode</b>		<b>Negative ionization mode</b>	
CerG1(d18:0/24:0)+H	Human milk > Infant formula	PC(16:0p/16:0)+HCOO	Human milk > Infant formula
CerG1(d18:0/24:1)+H	Human milk > Infant formula	PC(18:0e/18:1)+HCOO	Human milk > Infant formula
CerG1(d18:1/22:1)+H	Human milk > Infant formula	PC(18:1/22:0)+HCOO	Human milk > Infant formula
CerG1(d18:1/24:2)+H	Human milk > Infant formula	PE(18:0/18:1)-H	Human milk > Infant formula
CerG1(d42:0+O)+H	Human milk > Infant formula	PE(18:0p/22:5)-H	Human milk > Infant formula
PC(34:1e)+H	Human milk > Infant formula	PG(16:0/18:1)-H	Human milk > Infant formula
PC(36:0)+H	Human milk > Infant formula	PI(18:1/18:1)-H	Human milk > Infant formula
PC(36:1)+H	Human milk > Infant formula	PS(18:0/18:1)-H	Human milk > Infant formula
PC(38:1)+H	Human milk > Infant formula	PC(16:0/18:2)+HCOO	Human milk < Infant formula
PC(40:1)+H	Human milk > Infant formula	PE(16:0/20:4)-H	Human milk < Infant formula
PC(40:2)+H	Human milk > Infant formula	PE(18:0p/20:4)-H	Human milk < Infant formula
PC(40:4)+H	Human milk > Infant formula	PE(18:1/18:2)-H	Human milk < Infant formula
PC(41:1)+H	Human milk > Infant formula	PE(18:2/22:6)-H	Human milk < Infant formula
PC(42:1)+H	Human milk > Infant formula	PG(16:0/20:4)-H	Human milk < Infant formula
PC(42:7)+H	Human milk > Infant formula	PS(43:7)-H	Human milk < Infant formula
PE(18:0/18:1)+H	Human milk > Infant formula		
PE(18:0/20:1)+H	Human milk > Infant formula		
PE(18:0e/18:1)+H	Human milk > Infant formula		
PE(18:0p/16:0)+H	Human milk > Infant formula		
PE(18:0p/18:1)+H	Human milk > Infant formula		
PE(18:1p/20:1)+H	Human milk > Infant formula		
SM(d40:2)+H	Human milk > Infant formula		
Cer(d18:2/18:0)+H	Human milk < Infant formula		
PC(34:2)+H	Human milk < Infant formula		
PC(36:3)+H	Human milk < Infant formula		
PE(16:0/20:4)+H	Human milk < Infant formula		

Significance tested by Fisher's LSD ( $\alpha = 0.05$ ).

**Table S5.** Nutritional composition analysis of human milk and infant formula samples.

<b>Test/Reference</b>	<b>Unit of measurement</b>	<b>Human milk</b>	<b>Infant formula</b>
Total solids ISO 6731/IDF 21:2010	g/100g	11.2	12.9
Fat ISO 7208/IDF 22:2008	g/100g	1.88	3.67
Protein ISO 8968-2/IDF 20-2:2001	g/100g	1.10	1.46
Carbohydrate 1.2.8. FSANZ calculation	g/100g	8.10	7.40
Energy 1.2.8. FSANZ calculation	kJ/100g	225.00	287.00

**Table S6.** List of lipids identified by LipidSearch™ software.

<b>Group</b>	<b>Lipid name</b>
<b>P-Choline</b>	Lysophosphatidylcholine
	Platelet-activating factor
	Phosphatidylcholine
<b>P-Ethanol Amine</b>	Lysophosphatidylethanolamine
	Lysodimethylphosphatidylethanolamine
	Phosphatidylethanolamine
	Dimethylphosphatidylethanolamine
<b>P-Serine</b>	Lysophosphatidylserine
	Phosphatidylserine
<b>P-Glycerol</b>	Lysophosphatidylglycerol

	Phosphatidylglycerol
<b>P-Inositol</b>	Lysophosphatidylinositol
	Phosphatidylinositol
	Phosphatidylinositol
	Phosphatidylinositol
	Phosphatidylinositol
<b>P-Ethanol</b>	Lysophosphatidylethanol
	Phosphatidylethanol
<b>P-Acid</b>	Lysophosphatidic acid
	Phosphatidic acid
	Cyclic phosphatidic acid
<b>P-Methanol</b>	Lysophosphatidylmethanol
	Phosphatidylmethanol
<b>Sphingolipids</b>	Sphingomyelin
	Lysosphingomyelin
	Sphingomyelin(phytosphingosine)
<b>Neutral glycerolipid</b>	Monoglyceride
	Diglyceride
	Triglyceride
<b>Fatty Acid</b>	Fatty acid
	(O-acyl)-1-hydroxy fatty acid

<b>Cardiolipin</b>	Cardiolipin
<b>Sphingoid base</b>	Sphingosine
	Sphingosine phosphate
<b>Neutral Glycosphingolipids</b>	Glucosylsphingosine
	Simple glc series
	Simple glc series
	Simple glc series
	Simple glc series
	Simple glc series
	Simple glc series
<b>Glycosphingolipids</b>	Ceramides
	Ceramides phosphate
	Gangliosides
	Gangliosides
	Gangliosides
	Gangliosides
	Gangliosides
	Gangliosides
	Gangliosides
	Gangliosides
	Gangliosides

	Gangliosides
	Gangliosides
	Gangliosides
	Gangliosides
	Gangliosides
<b>Steroid</b>	Cholesteryl ester
	Zymosteryl ester
	Stigmasteryl ester
	Sitosteryl ester
	Deuterated cholesteryl ester
<b>Coenzyme</b>	Coenzyme
<b>Glycoglycerolipid</b>	Monogalactosylmonoacylglycerol
	Monogalactosyldiacylglycerol
	Digalactosylmonoacylglycerol
	Digalactosyldiacylglycerol
	Sulfoquinovosylmonoacylglycerol
	Sulfoquinovosyldiacylglycerol
<b>Neutral glycerolipid (deuterated)</b>	Deuterated diglyceride
	Deuterated triglyceride