

*Electronic supplementary information (ESI)*

**Sphingolipidomic study of davidiin-treated HepG2 human  
hepatocellular carcinoma cells using UHPLC-MS**

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Table 1 Identification and quantification of SPLs in HepG2 cells by using UHPLC-Q-TOF and UHPLC-QQQ MS

Class	Name	$t_R$ (min)	[M + H] <sup>+</sup> ( $m/z$ )	Molecular Formula	Measured Mass	Calculated Mass	Error (ppm)	MS/MS Fragments ( $m/z$ )	MRM transitions
DHCer	Cer (m18:0/14:0)	13.22	496.5082	C <sub>32</sub> H <sub>65</sub> NO <sub>2</sub>	495.5008	495.5015	-1.43	268.3008, 286.3121, 478.4993	496.5 268.3
	Cer (m18:0/16:0)	14.70	524.5394	C <sub>34</sub> H <sub>69</sub> NO <sub>2</sub>	523.5307	523.5328	-3.99	268.3001, 286.3087, 506.5271	524.5 268.3
	Cer (m18:0/18:0)	15.89	552.5705	C <sub>36</sub> H <sub>73</sub> NO <sub>2</sub>	551.5641	551.5641	-0.07	268.3008, 286.3104, 534.5596	552.6 268.3
	Cer (m18:0/20:0)	17.26	580.6025	C <sub>38</sub> H <sub>77</sub> NO <sub>2</sub>	579.5971	579.5954	2.80	268.3010, 286.3122, 562.5921	580.6 268.3
	Cer (m18:0/22:0)	18.87	608.6332	C <sub>40</sub> H <sub>81</sub> NO <sub>2</sub>	607.6269	607.6267	0.25	268.3004, 286.3111, 590.6233	608.6 268.3
	Cer (m18:0/23:0)	19.87	622.6489	C <sub>41</sub> H <sub>83</sub> NO <sub>2</sub>	621.6413	621.6424	-1.77	268.3006, 286.3117, 604.6394	622.6 268.3
	Cer (m18:0/24:1)	19.11	634.6494	C <sub>42</sub> H <sub>83</sub> NO <sub>2</sub>	633.6421	633.6424	-0.46	268.3008, 286.3119, 616.6398	634.6 268.3
	Cer (d18:0/14:0)	12.47	512.5035	C <sub>32</sub> H <sub>65</sub> NO <sub>3</sub>	511.4965	511.4964	0.08	266.2862, 302.3050, 494.4930, 476.4841	512.5 266.3
	Cer (d18:0/16:0)	13.52	540.5343	C <sub>34</sub> H <sub>69</sub> NO <sub>3</sub>	539.5270	539.5278	-1.33	266.2853, 284.2955, 302.3055, 522.5246, 504.5120	540.5 266.3
	Cer (d18:0/18:0)	14.83	568.5652	C <sub>36</sub> H <sub>73</sub> NO <sub>3</sub>	567.5577	567.5591	-2.33	266.2859, 284.2953, 302.3064, 532.5445, 550.5552	568.6 266.3
	Cer (d18:0/22:0)	17.81	624.6282	C <sub>40</sub> H <sub>81</sub> NO <sub>3</sub>	623.6213	623.6217	-0.63	266.2861, 284.2955, 302.3063, 588.6072, 606.6181	624.6 266.3
	Cer (d18:0/23:0)	18.62	638.6255	C <sub>41</sub> H <sub>83</sub> NO <sub>3</sub>	637.6362	637.6373	-1.80	266.2868, 284.2962, 602.6177, 620.6339	638.6 266.3
	Cer (d18:0/24:0)	19.57	652.6586	C <sub>42</sub> H <sub>85</sub> NO <sub>3</sub>	651.6516	651.6530	-2.10	266.2850, 284.2948, 302.3054, 616.6399, 634.6500	652.7 266.3
	Cer	Cer (d18:1/12:0) I.S.-1	11.07	482.4565	C <sub>30</sub> H <sub>59</sub> NO <sub>3</sub>	481.4496	481.4495	0.29	264.2678
Cer (m18:1/16:0)		13.70	522.5228	C <sub>34</sub> H <sub>67</sub> NO <sub>2</sub>	521.5150	521.5172	-4.10	266.2857, 284.2943, 504.5196	522.5 266.3
Cer (m18:1/20:0)		16.28	578.5868	C <sub>38</sub> H <sub>75</sub> NO <sub>2</sub>	577.5795	577.5798	-0.54	266.2856, 284.2954, 560.5759	578.6 266.3
Cer (m18:1/22:0)		17.69	606.6177	C <sub>40</sub> H <sub>79</sub> NO <sub>2</sub>	605.6105	605.6111	-0.96	266.2859, 284.2948, 588.6076	606.6 266.3
Cer (m18:1/22:1)		16.49	604.6013	C <sub>40</sub> H <sub>77</sub> NO <sub>2</sub>	603.5981	603.5954	4.47	266.2862, 284.2944, 586.5921	604.6 266.3
Cer (m18:1/24:0)		19.44	634.6488	C <sub>42</sub> H <sub>83</sub> NO <sub>2</sub>	633.6415	633.6424	-1.40	266.2855, 284.2953, 616.6393	634.6 266.3
Cer (m18:1/24:1)		17.87	632.6318	C <sub>42</sub> H <sub>81</sub> NO <sub>2</sub>	631.6260	631.6267	-1.19	266.2860, 284.2951, 614.6232	632.6 266.3
Cer (m18:2/14:0)		12.07	492.4763	C <sub>32</sub> H <sub>61</sub> NO <sub>2</sub>	491.4690	491.4702	-2.48	252.2690, 264.2702, 282.2812, 474.4638	492.5 264.3
Cer (m18:2/18:1)		14.53	546.5220	C <sub>36</sub> H <sub>67</sub> NO <sub>2</sub>	545.5145	545.5172	-4.88	264.2700, 262.2690, 282.2810	546.5 264.3
Cer (m18:2/23:0)		17.16	618.6169	C <sub>41</sub> H <sub>79</sub> NO <sub>2</sub>	617.6100	617.6111	-1.78	252.2688, 264.2701, 282.2803	618.6 264.3
Cer (m18:2/25:0)		18.69	646.6488	C <sub>43</sub> H <sub>83</sub> NO <sub>2</sub>	645.6366	645.6424	-4.37	252.2692, 264.2700, 282.2808, 628.6434	646.6 264.3
Cer (d16:1/22:0)		15.91	594.5811	C <sub>38</sub> H <sub>75</sub> NO <sub>3</sub>	593.5736	593.5747	-1.79	224.2388, 236.2382, 254.2490, 558.5606, 576.5692	594.6 236.2
Cer (d18:1/14:0)		12.07	510.4868	C <sub>32</sub> H <sub>63</sub> NO <sub>3</sub>	509.4800	509.4808	-1.63	252.2704, 264.2699, 282.2813	510.5 264.3
Cer (d18:1/16:0)		13.23	538.5012	C <sub>34</sub> H <sub>67</sub> NO <sub>3</sub>	537.5119	537.5121	-0.33	252.2691, 264.2701, 282.2809, 300.2937, 502.4986, 520.5089	538.5 264.3
Cer (d18:1/18:0)		14.55	566.5505	C <sub>36</sub> H <sub>71</sub> NO <sub>3</sub>	565.5433	565.5434	-0.18	252.2691, 264.2702, 282.2807, 530.5283, 548.5399	566.6 264.3

	Cer (d18:1/20:3)	14.55	588.5326	C <sub>38</sub> H <sub>69</sub> NO <sub>3</sub>	587.5253	587.5278	-4.24	264.2708, 570.5238	588.5	264.3
	Cer (d18:1/21:3)	15.25	602.5475	C <sub>39</sub> H <sub>71</sub> NO <sub>3</sub>	601.5400	601.5434	-2.41	252.2689, 264.2706, 282.2811	602.5	264.3
	Cer (d18:1/22:0)	17.27	622.6122	C <sub>40</sub> H <sub>79</sub> NO <sub>3</sub>	621.6054	621.6060	-1.05	252.2691, 264.2701, 282.2804, 604.6013	622.6	264.3
	Cer (d18:1/22:1)	16.34	620.5788	C <sub>40</sub> H <sub>77</sub> NO <sub>3</sub>	619.5893	619.5904	-1.71	252.2689, 264.2699, 282.2810, 584.5735, 602.5873	620.6	264.3
	Cer (d18:1/22:3)	15.91	616.5629	C <sub>40</sub> H <sub>73</sub> NO <sub>3</sub>	615.5556	615.5591	-4.06	252.2696, 264.2688, 282.2808	616.6	264.3
	Cer (d18:1/23:0)	17.76	636.6099	C <sub>41</sub> H <sub>81</sub> NO <sub>3</sub>	635.6204	635.6217	-1.97	264.2711, 282.2811, 600.6069, 618.6192	636.6	264.3
	Cer (d18:1/23:1)	16.79	634.6116	C <sub>41</sub> H <sub>79</sub> NO <sub>3</sub>	633.6052	633.6060	-1.33	264.2702, 282.2809, 598.5910, 616.6025	634.6	264.3
	Cer (d18:1/23:3)	16.64	630.5784	C <sub>41</sub> H <sub>75</sub> NO <sub>3</sub>	629.5712	629.5747	-3.92	264.2708	630.6	264.3
	Cer (d18:1/23:4)	15.48	628.5627	C <sub>41</sub> H <sub>73</sub> NO <sub>3</sub>	627.5554	627.5591	-4.24	252.2693, 264.2693, 282.2781	628.6	264.3
	Cer (d18:1/24:0)	18.87	650.6436	C <sub>42</sub> H <sub>83</sub> NO <sub>3</sub>	649.6370	649.6373	-0.49	252.2691, 264.2700, 282.2808, 614.6235, 632.6341	650.6	264.3
	Cer (d18:1/24:1)	17.44	648.6285	C <sub>42</sub> H <sub>81</sub> NO <sub>3</sub>	647.6216	647.6217	-0.11	252.2694, 264.2703, 282.2810, 612.6078, 630.6177	648.6	264.3
	Cer (d18:1/25:1)	17.91	662.6425	C <sub>43</sub> H <sub>83</sub> NO <sub>3</sub>	661.6358	661.6373	-2.27	264.2704, 282.2812, 626.6224, 644.6371	662.6	264.3
	Cer (d18:2/16:1)	12.48	534.4851	C <sub>34</sub> H <sub>63</sub> NO <sub>3</sub>	533.4779	533.4808	-3.56	250.2531, 262.2535, 280.2649	534.5	262.3
	Cer (d18:2/18:1)	13.61	562.5169	C <sub>36</sub> H <sub>67</sub> NO <sub>3</sub>	561.5096	561.5121	-4.45	262.2543, 280.2646	562.5	262.3
	Cer (d18:2/22:0)	16.18	620.5966	C <sub>40</sub> H <sub>77</sub> NO <sub>3</sub>	619.5893	619.5904	-1.78	250.2525, 262.2534, 280.2644, 584.5732, 602.5858	620.6	262.3
	Cer (d18:2/22:2)	15.54	616.5624	C <sub>40</sub> H <sub>73</sub> NO <sub>3</sub>	615.5553	615.5591	-4.48	250.2534, 262.2531	616.6	262.3
	Cer (d18:2/24:1)	16.49	646.6100	C <sub>42</sub> H <sub>79</sub> NO <sub>3</sub>	645.6052	645.6060	-1.18	262.2534, 280.2646, 298.2747, 610.5888, 628.6024	646.6	262.3
	Cer (d18:2/24:2)	17.27	644.5946	C <sub>42</sub> H <sub>77</sub> NO <sub>3</sub>	643.5874	643.5904	-4.65	262.2541	644.6	262.3
	Cer (d19:1/24:0)	19.85	664.6595	C <sub>43</sub> H <sub>85</sub> NO <sub>3</sub>	663.6507	663.6530	-3.36	278.2843, 296.2966, 646.6512	664.7	278.3
	Cer (d19:1/24:1)	17.70	662.6425	C <sub>43</sub> H <sub>81</sub> NO <sub>3</sub>	661.6358	661.6373	-2.27	278.2845, 296.2955, 626.6240, 644.6370	662.6	278.3
Cer1P	Cer1P (d18:1/12:0) I.S.-2	10.01	562.4233	C <sub>30</sub> H <sub>60</sub> NO <sub>6</sub> P	561.4149	561.4158	-1.60	264.2688	562.5	264.3
	Cer1P (d18:0/3:0)	8.29	438.2976	C <sub>21</sub> H <sub>44</sub> NO <sub>6</sub> P	437.2902	437.2906	-1.03	266.2862, 284.2950	438.3	266.3
	Cer1P (d18:1/24:4)	12.18	722.5507	C <sub>42</sub> H <sub>76</sub> NO <sub>6</sub> P	721.5416	721.5410	0.73	264.2700	722.6	264.3
	Cer1P (d18:1/26:4)	13.35	750.5837	C <sub>44</sub> H <sub>80</sub> NO <sub>6</sub> P	749.5756	749.5723	4.40	264.2692	750.6	264.3
	Cer1P (d18:1/28:4)	14.61	778.6152	C <sub>46</sub> H <sub>84</sub> NO <sub>6</sub> P	777.6078	777.6036	2.74	264.2709	778.6	264.3
	Cer1P (d18:1/29:4)	15.31	792.6305	C <sub>47</sub> H <sub>86</sub> NO <sub>6</sub> P	791.6229	791.6193	4.62	264.2716, 774.6224	792.6	264.3
DHSM	SM (d18:0/18:0)	13.21	733.6216	C <sub>41</sub> H <sub>85</sub> N <sub>2</sub> O <sub>6</sub> P	732.6146	732.6145	0.11	184.0146, 266.2769	733.6	184.1
	SM (d19:0/17:0)	13.90	733.6216	C <sub>41</sub> H <sub>85</sub> N <sub>2</sub> O <sub>6</sub> P	732.6146	732.6145	0.11	184.0748, 280.2996	733.6	184.1
	SM (d31:0)	9.98	661.5268	C <sub>36</sub> H <sub>73</sub> N <sub>2</sub> O <sub>6</sub> P	660.5195	660.5206	-1.71	184.0742	661.5	184.1
	SM (d33:0)	12.10	691.5734	C <sub>38</sub> H <sub>79</sub> N <sub>2</sub> O <sub>6</sub> P	690.5675	690.5676	-0.12	184.0745	691.6	184.1
	SM (d35:0)	12.60	719.6084	C <sub>40</sub> H <sub>83</sub> N <sub>2</sub> O <sub>6</sub> P	718.6015	718.5989	3.72	184.0747	719.6	184.1

	SM (d37:0)	14.55	747.6362	C <sub>42</sub> H <sub>87</sub> N <sub>2</sub> O <sub>6</sub> P	746.6289	746.6302	-1.75	184.0743		747.6	184.1
	SM (d38:0)	15.20	761.6517	C <sub>43</sub> H <sub>89</sub> N <sub>2</sub> O <sub>6</sub> P	760.6444	760.6458	-1.84	184.0745		761.7	184.1
	SM (d41:0)	17.19	803.6982	C <sub>46</sub> H <sub>95</sub> N <sub>2</sub> O <sub>6</sub> P	802.6930	802.6928	0.24	184.0745		803.7	184.1
	SM (t18:0/16:0)	12.12	721.5827	C <sub>39</sub> H <sub>81</sub> N <sub>2</sub> O <sub>7</sub> P	720.5752	720.5781	-4.11	184.0747, 264.2705		721.6	184.1
SM	SM (d18:1/12:0) I.S.-3	10.44	647.5119	C <sub>35</sub> H <sub>71</sub> N <sub>2</sub> O <sub>6</sub> P	646.5046	646.5050	-0.59	184.0736, 264.2698		647.5	184.1
	SM (d17:1/16:0)	11.68	689.5593	C <sub>38</sub> H <sub>77</sub> N <sub>2</sub> O <sub>6</sub> P	688.5519	688.5519	-0.10	184.0748, 250.2533		689.6	184.1
	SM (d17:1/22:0)	15.34	773.6614	C <sub>44</sub> H <sub>89</sub> N <sub>2</sub> O <sub>6</sub> P	772.6450	772.6458	-1.13	184.0746, 250.2535		773.7	184.1
	SM (d18:1/14:0)	11.19	675.5434	C <sub>37</sub> H <sub>75</sub> N <sub>2</sub> O <sub>6</sub> P	674.5361	674.5363	-0.31	184.0749, 236.2396, 264.2698		675.5	184.1
	SM (d18:1/16:0 (OH))	11.72	719.5729	C <sub>39</sub> H <sub>79</sub> N <sub>2</sub> O <sub>7</sub> P	718.5615	718.5625	-1.36	184.0744, 264.2697		719.6	184.1
	SM (d18:1/16:0)	12.02	703.5754	C <sub>39</sub> H <sub>79</sub> N <sub>2</sub> O <sub>6</sub> P	702.5684	702.5676	1.18	184.0762, 264.2700		703.6	184.1
	SM (d18:1/17:1)	11.95	715.5733	C <sub>40</sub> H <sub>81</sub> N <sub>2</sub> O <sub>6</sub> P	714.5652	714.5676	-3.32	184.0743, 264.2697		715.6	184.1
	SM (d18:1/18:0)	13.36	731.6062	C <sub>41</sub> H <sub>83</sub> N <sub>2</sub> O <sub>6</sub> P	730.5988	730.5989	-0.05	184.0749, 264.2699		731.6	184.1
	SM (d18:1/20:0)	14.65	759.6374	C <sub>43</sub> H <sub>87</sub> N <sub>2</sub> O <sub>6</sub> P	758.6301	758.6302	-0.12	184.0749, 264.2690		759.6	184.1
	SM (d18:1/22:0)	15.98	787.6690	C <sub>45</sub> H <sub>91</sub> N <sub>2</sub> O <sub>6</sub> P	786.6617	786.6615	0.33	184.0750, 264.2705		787.7	184.1
	SM (d18:1/22:1)	15.06	785.6530	C <sub>45</sub> H <sub>89</sub> N <sub>2</sub> O <sub>6</sub> P	784.6454	784.6458	-0.50	184.0749, 264.2703		785.7	184.1
	SM (d18:1/23:0)	16.64	801.6843	C <sub>46</sub> H <sub>93</sub> N <sub>2</sub> O <sub>6</sub> P	800.6769	800.6771	-0.31	184.0747, 264.2709		801.7	184.1
	SM (d18:1/23:1)	15.48	799.6686	C <sub>46</sub> H <sub>91</sub> N <sub>2</sub> O <sub>6</sub> P	798.6610	798.6615	-0.56	184.0749, 264.2700		799.7	184.1
	SM (d18:1/23:3)	15.06	795.6328	C <sub>46</sub> H <sub>87</sub> N <sub>2</sub> O <sub>6</sub> P	794.6267	794.6302	-4.38	184.0745, 264.2715		795.6	184.1
	SM (d18:1/24:0)	17.31	815.7001	C <sub>47</sub> H <sub>95</sub> N <sub>2</sub> O <sub>6</sub> P	814.6927	814.6928	-0.07	184.0749, 264.2693, 797.6891		815.7	184.1
	SM (d18:1/24:1)	16.39	813.6843	C <sub>47</sub> H <sub>93</sub> N <sub>2</sub> O <sub>6</sub> P	812.6765	812.6771	-0.82	184.0758, 264.2705		813.7	184.1
	SM (d18:1/26:1)	17.04	841.7142	C <sub>49</sub> H <sub>97</sub> N <sub>2</sub> O <sub>6</sub> P	840.7066	840.7084	-2.16	184.0744, 264.2688		841.7	184.1
	SM (d18:2/16:0)	11.43	701.5593	C <sub>39</sub> H <sub>77</sub> N <sub>2</sub> O <sub>6</sub> P	700.5519	700.5519	0.03	184.0749, 262.2533, 280.2643		701.6	184.1
	SM (d18:2/18:0)	12.52	729.5906	C <sub>41</sub> H <sub>81</sub> N <sub>2</sub> O <sub>6</sub> P	728.5832	728.5832	0.03	184.0750, 262.2535		729.6	184.1
	SM (d18:2/18:1)	12.67	727.5726	C <sub>41</sub> H <sub>79</sub> N <sub>2</sub> O <sub>6</sub> P	726.5666	726.5676	-1.40	184.0746, 262.2530, 280.2646		727.6	184.1
	SM (d18:2/20:0)	13.73	757.6215	C <sub>43</sub> H <sub>85</sub> N <sub>2</sub> O <sub>6</sub> P	756.6138	756.6145	-0.93	184.0749, 262.2538		757.6	184.1
	SM (d18:2/22:0)	14.85	785.6531	C <sub>45</sub> H <sub>89</sub> N <sub>2</sub> O <sub>6</sub> P	784.6457	784.6458	-0.14	184.0748, 262.2535		785.7	184.1
	SM (d18:2/22:1)	13.91	783.6359	C <sub>45</sub> H <sub>87</sub> N <sub>2</sub> O <sub>6</sub> P	782.6286	782.6302	-1.98	184.0743, 262.2527		783.6	184.1
	SM (d18:2/23:0)	15.73	799.6676	C <sub>46</sub> H <sub>91</sub> N <sub>2</sub> O <sub>6</sub> P	798.6600	798.6615	-1.89	184.0746, 262.2526		799.7	184.1
	SM (d18:2/24:1)	15.20	811.6687	C <sub>47</sub> H <sub>91</sub> N <sub>2</sub> O <sub>6</sub> P	810.6612	810.6615	-0.38	184.0747, 262.2534		811.7	184.1
	SM (d18:2/24:3)	14.85	807.6349	C <sub>47</sub> H <sub>87</sub> N <sub>2</sub> O <sub>6</sub> P	806.6274	806.6302	-3.47	184.0746, 250.2524, 262.2533, 280.2646		807.6	184.1
	SM (d19:1/16:0)	12.57	717.5900	C <sub>40</sub> H <sub>81</sub> N <sub>2</sub> O <sub>6</sub> P	716.5825	716.5832	-1.05	184.0748, 278.2849		717.6	184.1

	SM (d37:1)	14.03	745.6208	C <sub>42</sub> H <sub>85</sub> N <sub>2</sub> O <sub>6</sub> P	744.6134	744.6145	-1.45	184.0747		745.6	184.1
	SM (d38:3)	13.88	755.6026	C <sub>43</sub> H <sub>83</sub> N <sub>2</sub> O <sub>6</sub> P	754.5982	754.5989	-0.95	184.0745		755.6	184.1
	SM (d39:4)	14.01	767.6026	C <sub>44</sub> H <sub>83</sub> N <sub>2</sub> O <sub>6</sub> P	766.5953	766.5989	-4.71	184.0745		767.6	184.1
	SM (d41:3)	14.55	797.6517	C <sub>46</sub> H <sub>89</sub> N <sub>2</sub> O <sub>6</sub> P	796.6432	796.6458	-3.26	184.0743		797.7	184.1
	SM (d43:3)	15.84	825.6813	C <sub>48</sub> H <sub>93</sub> N <sub>2</sub> O <sub>6</sub> P	824.6740	824.6771	-3.81	184.0748		825.7	184.1
	SM (t18:1/24:0)	15.31	831.6935	C <sub>47</sub> H <sub>95</sub> N <sub>2</sub> O <sub>7</sub> P	830.6855	830.6877	-2.65	184.0742, 262.2530		831.7	184.1
	SM (t34:2)	11.04	717.5527	C <sub>39</sub> H <sub>77</sub> N <sub>2</sub> O <sub>7</sub> P	716.5458	716.5468	-1.48	184.0745		717.6	184.1
	SM (t42:2)	14.08	829.6777	C <sub>47</sub> H <sub>93</sub> N <sub>2</sub> O <sub>7</sub> P	828.6705	828.6720	-1.91	184.0744		829.7	184.1
HexCer	GalCer (d18:1/12:0) I.S.-4	10.45	644.5081	C <sub>36</sub> H <sub>69</sub> NO <sub>8</sub>	643.5018	643.5023	-0.75	264.2684		644.5	264.3
	HexCer (d18:1/20:3)	13.35	750.5837	C <sub>44</sub> H <sub>79</sub> NO <sub>8</sub>	749.5756	749.5806	-2.57	264.2702, 570.5226		750.6	264.3
	HexCer (d18:1/26:3)	17.23	834.6784	C <sub>50</sub> H <sub>91</sub> NO <sub>8</sub>	833.6709	833.6745	-4.29	264.2674, 654.6158		834.7	264.3
	HexCer (d18:1/26:4)	15.84	832.6627	C <sub>50</sub> H <sub>89</sub> NO <sub>8</sub>	831.6550	831.6588	-4.56	264.2705, 652.6006, 670.6062		832.7	264.3
LacCer	LacCer (d18:1/12:0) I.S.-5	10.22	806.5606	C <sub>42</sub> H <sub>79</sub> NO <sub>13</sub>	805.5535	805.5551	-2.07	264.2683		806.6	264.3
	LacCer (d17:1/22:0)	14.70	932.7009	C <sub>51</sub> H <sub>97</sub> NO <sub>13</sub>	931.6935	931.6960	-2.66	250.2537, 268.2641, 590.5877, 598.5540		932.7	250.3
	LacCer (d18:1/16:0 (OH))	11.45	878.6184	C <sub>46</sub> H <sub>87</sub> NO <sub>14</sub>	877.6114	877.6127	-1.39	252.2693, 264.2697, 518.4934, 536.5043		878.6	264.3
	LacCer (d18:1/16:0)	11.73	862.6236	C <sub>46</sub> H <sub>87</sub> NO <sub>13</sub>	861.6169	861.6177	-0.93	264.2702, 282.2808, 502.5082, 520.5082, 844.6123		862.6	264.3
	LacCer (d18:1/18:0 (OH))	12.48	906.6495	C <sub>48</sub> H <sub>91</sub> NO <sub>14</sub>	905.6423	905.6440	-1.87	252.2691, 264.2695, 282.2804, 300.2885, 546.5241, 534.5245, 564.5365		906.6	264.3
	LacCer (d18:1/18:0)	12.83	890.6541	C <sub>48</sub> H <sub>91</sub> NO <sub>13</sub>	889.6472	889.6490	-2.02	264.2694, 282.2814, 530.5303, 548.5386		890.7	264.3
	LacCer (d18:1/20:0 (OH))	13.66	934.6807	C <sub>50</sub> H <sub>95</sub> NO <sub>14</sub>	933.6728	933.6753	-2.60	252.2689, 264.2704, 282.2813, 574.5567, 592.5660		934.7	264.3
	LacCer (d18:1/22:0)	15.31	946.7172	C <sub>52</sub> H <sub>99</sub> NO <sub>13</sub>	945.7103	945.7116	-1.42	252.2693, 264.2700, 282.2803, 574.5915, 586.5920, 604.6022		946.7	264.3
	LacCer (d18:1/22:1)	14.41	944.7002	C <sub>52</sub> H <sub>97</sub> NO <sub>13</sub>	943.6939	943.6960	-2.24	252.2690, 264.2700, 282.2811, 584.5738, 602.5867		944.7	264.3
	LacCer (d18:1/23:0)	15.94	960.7323	C <sub>53</sub> H <sub>101</sub> NO <sub>13</sub>	959.7249	959.7273	-2.45	252.2695, 264.2684, 282.2813, 600.6054, 618.6188		960.7	264.3
	LacCer (d18:1/24:0 (OH))	14.93	984.6936	C <sub>54</sub> H <sub>97</sub> NO <sub>14</sub>	983.6864	983.6909	-4.61	264.2695, 282.2815		984.7	264.3
	LacCer (d18:1/24:0)	16.58	974.7484	C <sub>54</sub> H <sub>103</sub> NO <sub>13</sub>	973.7415	973.7429	-1.44	252.2689, 264.2707, 282.2816, 614.6213, 632.6337		974.7	264.3
	LacCer (d18:1/24:1)	15.44	972.7253	C <sub>54</sub> H <sub>101</sub> NO <sub>13</sub>	971.7262	971.7273	-1.17	252.2693, 264.2700, 282.2805, 612.6076, 630.6180		972.7	264.3
	LacCer (t18:0/24:2)	15.05	988.7274	C <sub>54</sub> H <sub>101</sub> NO <sub>14</sub>	987.7208	987.7222	-1.44	252.2690, 264.2702, 282.2806, 616.6029, 628.6029		988.7	264.3
So	So (d17:1) I.S.-6	6.29	286.2563	C <sub>17</sub> H <sub>35</sub> NO <sub>2</sub>	285.2671	285.2668	1.02	268.2645		286.3	268.3
	So (m17:2)	6.39	268.2633	C <sub>17</sub> H <sub>33</sub> NO	267.2561	267.2562	-0.60	250.2535		268.3	250.3
	So (m18:1)	9.57	284.2954	C <sub>18</sub> H <sub>37</sub> NO	283.2881	283.2875	2.12	266.2861		284.3	266.3
	So (m18:2)	8.79	282.2794	C <sub>18</sub> H <sub>35</sub> NO	281.2722	281.2719	1.21	264.2700		282.3	264.3
	So (m20:2)	9.70	310.3109	C <sub>20</sub> H <sub>39</sub> NO	309.3035	309.3032	1.03	292.2991		310.3	292.3

	So (m22:2)	10.39	338.3419	C <sub>22</sub> H <sub>43</sub> NO	337.3347	337.3345	0.53	320.3317		338.3	320.3
	So (m24:2)	11.27	366.3731	C <sub>24</sub> H <sub>47</sub> NO	365.3657	365.3658	-0.11	348.3636		366.4	348.4
	So (d15:2)	5.01	256.2277	C <sub>15</sub> H <sub>29</sub> NO <sub>2</sub>	255.2199	255.2198	0.27	238.2167		256.2	238.2
	So (d18:1)	6.73	300.2899	C <sub>18</sub> H <sub>37</sub> NO <sub>2</sub>	299.2829	299.2824	1.54	282.2797		300.3	282.3
	So (t20:1)	8.01	344.3150	C <sub>20</sub> H <sub>41</sub> NO <sub>3</sub>	343.3084	343.3086	-0.84	326.3067		344.3	326.3
Sa	Sa (d17:0) I.S.-7	6.49	288.2915	C <sub>17</sub> H <sub>37</sub> NO <sub>2</sub>	287.2824	287.2824	-0.21	270.2805		288.3	270.2
	Sa (m14:0)	5.03	230.2480	C <sub>14</sub> H <sub>31</sub> NO	229.2408	229.2406	0.92	212.2386		230.2	212.2
	Sa (m18:0)	7.21	286.3106	C <sub>18</sub> H <sub>39</sub> NO	285.3033	285.3032	0.35	268.3006		286.3	268.3
	Sa (m20:0)	7.91	314.3416	C <sub>20</sub> H <sub>43</sub> NO	313.3334	313.3345	-3.54	296.3327		314.3	296.3
	Sa (d16:0)	4.78	274.2742	C <sub>16</sub> H <sub>35</sub> NO <sub>2</sub>	273.2670	273.2668	0.70	256.2649		274.3	256.3
	Sa (d18:0)	6.14	302.3060	C <sub>18</sub> H <sub>39</sub> NO <sub>2</sub>	301.2987	301.2981	1.96	284.2950		302.3	284.3
	Sa (d20:0)	6.83	330.3367	C <sub>20</sub> H <sub>43</sub> NO <sub>2</sub>	329.3294	329.3294	0.06	312.3268		330.3	312.3
	Sa (d21:0)	7.23	344.3518	C <sub>21</sub> H <sub>45</sub> NO <sub>2</sub>	343.3445	343.3450	-1.43	326.3434		344.4	326.3
	Sa (d22:0)	7.71	358.3680	C <sub>22</sub> H <sub>47</sub> NO <sub>2</sub>	357.3607	357.3607	0.11	340.3587		358.4	340.4
	Sa (d23:0)	9.50	372.3828	C <sub>23</sub> H <sub>49</sub> NO <sub>2</sub>	371.3691	371.3723	-8.72	354.3720		372.4	354.4
	Sa (t16:0)	5.15	290.2693	C <sub>16</sub> H <sub>35</sub> NO <sub>3</sub>	289.2620	289.2617	1.04	272.2582		290.3	272.3
	Sa (t18:0)	6.33	318.2996	C <sub>18</sub> H <sub>39</sub> NO <sub>3</sub>	317.2924	317.2930	-1.86	300.2888		318.3	300.3
	Sa (t20:0)	7.04	346.3311	C <sub>20</sub> H <sub>43</sub> NO <sub>3</sub>	345.3242	345.3243	-0.35	328.3196		346.3	328.3
	Sa (t22:0)	8.07	374.3629	C <sub>22</sub> H <sub>47</sub> NO <sub>3</sub>	373.3556	373.3556	0.13	356.3522		374.4	356.4
S1P	S1P (d17:1) I.S.-8	6.56	366.2406	C <sub>17</sub> H <sub>36</sub> NO <sub>5</sub> P	365.2331	365.2331	0.00	250.2508		366.3	250.3
Sa1P	Sa1P (d17:0) I.S.-9	6.77	368.2574	C <sub>17</sub> H <sub>38</sub> NO <sub>5</sub> P	367.2504	367.2488	4.36	270.2788		368.4	270.3

DHCer, dihydroceramide; Cer, ceramide; Cer1P, ceramide-1-phosphate; DHSM, dihydrosphingomyelin; SM, sphingomyelin; HexCer, hexosylceramide; LacCer, lactosylceramide; So, sphingosine; Sa, sphinganine; S1P, sphingosine-1-phosphate; Sa1P, sphinganine-1-phosphate. I.S. 1-9 represent the 9 internal standards added for MS analysis

Table 2 The 80 potential SPL markers identified in davidiin-treated HepG2 cells (VIP &gt; 1).

Class	Marker	Content (pmol mg <sup>-1</sup> protein)		Change	P value	VIP	
		Control	Davidiin-treated				
DHCer	Cer (m18:0/14:0)	3.82 ± 0.43	6.22 ± 0.82	↑ (1.6-fold)	< 0.001	1.13	
	Cer (m18:0/16:0)	16.23 ± 1.66	27.38 ± 1.56	↑ (1.7-fold)	< 0.001	1.23	
	Cer (m18:0/18:0)	9.09 ± 0.72	20.41 ± 2.80	↑ (2.2-fold)	< 0.001	1.20	
	Cer (m18:0/20:0)	20.82 ± 1.62	41.88 ± 4.97	↑ (2.0-fold)	< 0.001	1.20	
	Cer (m18:0/22:0)	30.84 ± 2.33	44.52 ± 4.68	↑ (1.4-fold)	< 0.001	1.12	
	Cer (m18:0/24:1)	29.90 ± 2.08	50.86 ± 3.04	↑ (1.7-fold)	< 0.001	1.24	
	Cer (d18:0/14:0)	0.53 ± 0.17	5.41 ± 0.63	↑ (10.2-fold)	< 0.001	1.25	
	Cer (d18:0/16:0)	3.77 ± 0.41	17.41 ± 1.66	↑ (4.6-fold)	< 0.001	1.25	
	Cer (d18:0/18:0)	0.33 ± 0.12	1.75 ± 0.50	↑ (5.3-fold)	< 0.001	1.13	
	Cer (d18:0/22:0)	0.46 ± 0.14	4.47 ± 1.22	↑ (9.7-fold)	< 0.001	1.17	
	Cer (d18:0/23:0)	0.09 ± 0.03	0.64 ± 0.20	↑ (7.1-fold)	< 0.001	1.13	
	Cer (d18:0/24:0)	0.49 ± 0.11	5.67 ± 1.12	↑ (11.6-fold)	< 0.001	1.21	
	Cer	Cer (m18:1/16:0)	3.86 ± 0.65	2.54 ± 0.31	↓ (1.5-fold)	< 0.001	1.02
		Cer (m18:1/24:0)	17.86 ± 1.19	13.62 ± 0.96	↓ (1.3-fold)	< 0.001	1.14
Cer (m18:2/14:0)		21.25 ± 2.26	14.37 ± 2.44	↓ (1.5-fold)	< 0.001	1.06	
Cer (m18:2/18:1)		2.30 ± 0.45	0.77 ± 0.22	↓ (3.0-fold)	< 0.001	1.16	
Cer (m18:2/23:0)		53.85 ± 6.77	20.99 ± 1.36	↓ (2.6-fold)	< 0.001	1.22	
Cer (m18:2/25:0)		1.68 ± 0.27	0.59 ± 0.11	↓ (2.8-fold)	< 0.001	1.20	
Cer (d16:1/22:0)		11.34 ± 1.31	6.79 ± 1.40	↓ (1.7-fold)	< 0.001	1.10	
Cer (d18:1/14:0)		12.35 ± 1.30	8.52 ± 1.71	↓ (1.4-fold)	< 0.001	1.01	
Cer (d18:1/18:0)		29.40 ± 1.95	20.55 ± 2.21	↓ (1.4-fold)	< 0.001	1.15	
Cer (d18:1/22:0)		96.41 ± 11.88	42.90 ± 3.99	↓ (2.2-fold)	< 0.001	1.21	
Cer (d18:1/22:1)		11.10 ± 0.98	7.95 ± 1.42	↓ (1.4-fold)	< 0.001	1.02	
Cer (d18:1/22:3)		13.60 ± 1.34	8.08 ± 1.11	↓ (1.7-fold)	< 0.001	1.17	
Cer (d18:1/23:0)		20.21 ± 2.34	7.98 ± 0.77	↓ (2.5-fold)	< 0.001	1.23	
Cer (d18:1/23:1)		6.12 ± 0.68	3.53 ± 0.57	↓ (1.7-fold)	< 0.001	1.15	
Cer (d18:1/23:4)		10.83 ± 1.36	6.59 ± 0.94	↓ (1.6-fold)	< 0.001	1.12	
Cer (d18:1/24:0)		94.34 ± 11.31	59.18 ± 4.41	↓ (1.6-fold)	< 0.001	1.15	
Cer (d18:1/25:1)		12.89 ± 1.30	7.19 ± 0.79	↓ (1.8-fold)	< 0.001	1.19	
Cer (d18:2/16:1)		0.43 ± 0.12	0.14 ± 0.11	↓ (3.1-fold)	< 0.001	1.01	
Cer (d18:2/18:1)		29.29 ± 4.66	15.50 ± 4.51	↓ (1.9-fold)	< 0.001	1.07	

	Cer (d18:2/22:0)	20.69 ± 2.36	5.54 ± 0.66	↓ (3.7-fold)	< 0.001	1.24
	Cer (d18:2/22:2)	11.92 ± 1.32	2.20 ± 0.34	↓ (5.4-fold)	< 0.001	1.25
	Cer (d18:2/24:1)	44.30 ± 4.83	15.60 ± 2.13	↓ (2.8-fold)	< 0.001	1.23
	Cer (d18:2/24:2)	0.20 ± 0.08	0.04 ± 0.04	↓ (5.0-fold)	< 0.001	1.02
	Cer (d19:1/24:0)	2.07 ± 0.16	1.31 ± 0.12	↓ (1.6-fold)	< 0.001	1.19
DHSM	SM (d19:0/17:0)	61.14 ± 6.00	486.01 ± 120.85	↑ (7.9-fold)	< 0.001	1.18
	SM (d31:0)	7.57 ± 0.84	3.80 ± 0.41	↓ (2.0-fold)	< 0.001	1.20
	SM (d33:0)	5.70 ± 0.57	18.35 ± 2.39	↑ (3.2-fold)	< 0.001	1.23
	SM (d35:0)	7.68 ± 0.84	32.41 ± 8.16	↑ (4.2-fold)	< 0.001	1.15
	SM (d37:0)	2.43 ± 0.22	6.95 ± 1.77	↑ (2.9-fold)	< 0.001	1.11
	SM (d38:0)	24.27 ± 3.18	123.33 ± 22.22	↑ (5.1-fold)	< 0.001	1.21
	SM (d41:0)	4.08 ± 0.63	13.62 ± 4.15	↑ (3.3-fold)	< 0.001	1.08
	SM (t18:0/16:0)	1.89 ± 0.22	5.07 ± 1.03	↑ (2.7-fold)	< 0.001	1.15
SM	SM (d17:1/16:0)	244.93 ± 27.64	135.19 ± 15.69	↓ (1.8-fold)	< 0.001	1.18
	SM (d17:1/22:0)	117.26 ± 14.61	55.91 ± 8.68	↓ (2.1-fold)	< 0.001	1.19
	SM (d18:1/16:0)	3006.91 ± 220.12	5082.23 ± 322.27	↑ (1.7-fold)	< 0.001	1.24
	SM (d18:1/22:0)	1155.48 ± 147.64	810.72 ± 129.01	↓ (1.4-fold)	< 0.001	1.01
	SM (d18:1/23:0)	259.03 ± 32.20	135.73 ± 21.60	↓ (1.9-fold)	< 0.001	1.17
	SM (d18:1/23:1)	505.39 ± 70.01	325.63 ± 53.08	↓ (1.6-fold)	< 0.001	1.06
	SM (d18:1/24:0)	922.37 ± 135.22	520.03 ± 75.10	↓ (1.8-fold)	< 0.001	1.13
	SM (d18:1/24:1)	2437.41 ± 193.05	3429.76 ± 385.15	↑ (1.4-fold)	< 0.001	1.12
	SM (d18:2/16:0)	397.65 ± 47.56	216.01 ± 23.74	↓ (1.8-fold)	< 0.001	1.18
	SM (d18:2/20:0)	200.55 ± 22.38	116.83 ± 15.69	↓ (1.7-fold)	< 0.001	1.16
	SM (d18:2/22:0)	571.72 ± 80.68	232.99 ± 42.66	↓ (2.5-fold)	< 0.001	1.19
	SM (d18:2/22:1)	20.44 ± 3.03	13.34 ± 2.24	↓ (1.5-fold)	< 0.001	1.03
	SM (d18:2/23:0)	110.84 ± 14.16	39.30 ± 7.56	↓ (2.8-fold)	< 0.001	1.21
	SM (d18:2/24:1)	455.59 ± 69.08	233.05 ± 41.98	↓ (2.0-fold)	< 0.001	1.14
	SM (d19:1/16:0)	234.66 ± 24.14	302.06 ± 32.19	↑ (1.3-fold)	< 0.001	1.02
	SM (d37:1)	39.53 ± 4.00	26.26 ± 3.58	↓ (1.5-fold)	< 0.001	1.11
	SM (d38:3)	2.60 ± 0.39	1.37 ± 0.22	↓ (1.9-fold)	< 0.001	1.14
	SM (d41:3)	25.77 ± 2.87	11.55 ± 2.51	↓ (2.2-fold)	< 0.001	1.19
	SM (d43:3)	9.27 ± 1.23	5.14 ± 0.90	↓ (1.8-fold)	< 0.001	1.14
HexCer	HexCer (d18:1/26:3)	1.10 ± 0.18	0.61 ± 0.21	↓ (1.8-fold)	< 0.001	1.00
LacCer	LacCer (d17:1/22:0)	1.74 ± 0.47	0.25 ± 0.28	↓ (7.0-fold)	< 0.001	1.14



	LacCer (d18:1/16:0 (OH))	20.74 ± 2.02	10.54 ± 1.25	↓ (2.0-fold)	< 0.001	1.21
	LacCer (d18:1/22:1)	10.29 ± 2.09	4.69 ± 1.04	↓ (2.2-fold)	< 0.001	1.11
	LacCer (d18:1/23:0)	11.90 ± 2.10	4.77 ± 1.68	↓ (2.5-fold)	< 0.001	1.13
	LacCer (d18:1/24:0 (OH))	15.14 ± 3.38	6.49 ± 1.85	↓ (2.3-fold)	< 0.001	1.09
So	So (m18:1)	0.18 ± 0.03	0.40 ± 0.06	↑ (2.2-fold)	< 0.001	1.15
	So (m22:2)	4.83 ± 0.74	10.43 ± 2.03	↑ (2.2-fold)	< 0.001	1.13
	So (d15:2)	0.11 ± 0.03	0.23 ± 0.05	↑ (2.1-fold)	< 0.001	1.04
	So (d18:1)	0.58 ± 0.07	1.24 ± 0.17	↑ (2.1-fold)	< 0.001	1.18
	So (t20:1)	0.63 ± 0.15	1.33 ± 0.36	↑ (2.1-fold)	< 0.001	1.00
Sa	Sa (m18:0)	42.69 ± 5.57	68.83 ± 7.73	↑ (1.6-fold)	< 0.001	1.13
	Sa (d16:0)	52.87 ± 6.41	115.68 ± 22.02	↑ (2.2-fold)	< 0.001	1.13
	Sa (d18:0)	18.79 ± 3.51	47.20 ± 8.94	↑ (2.5-fold)	< 0.001	1.15
	Sa (d20:0)	20.02 ± 2.59	42.86 ± 7.41	↑ (2.1-fold)	< 0.001	1.14
	Sa (d22:0)	20.69 ± 3.36	50.92 ± 8.76	↑ (2.5-fold)	< 0.001	1.16
	Sa (t16:0)	3.55 ± 0.53	8.39 ± 2.58	↑ (2.4-fold)	< 0.001	1.01