

Table S1. The results of peptide and Sugar in APE

Projects	Regression curve	Decisive factor (R2)	Contents (mg/g)	Average content (mg/g)	SD
Peptide	Y=2.1283X+0.0074	0.9991	633.14	623.56	17.10
			631.05		
			640.57		
			599.38		
			632.59		
			604.63		
			34.67		
			36.03		
Sugar	Y=7.7X-0.1006	0.9936	35.66	35.22	0.72
			34.12		
			35.69		
			35.17		

Table S2. The results of pH in APE

Number of measurements	pH	Average pH	SD
1	7.96	8.12	0.26
2	8.32		
3	8.44		
4	7.76		
5	7.99		
6	8.25		

Table S3. Peptide sequence composition of APE (Top 60)

Peptide	-10lg P	Mass	Length	ppm	m/z	RT	Area Sample 2	Accession
AVFPSIVGR	25.71	944.5443	9	1.1	473.28	37.51	1.40E+10	tr Q3HNA6 Q3HNA6_RETFL:tr A0A067QL86 A0A067QL86_ZOONE:tr A0A2J7RHY5 A0A2J7RHY5_9NEOP:tr A0A2Z5RE76 A0A2Z5RE76_9NEOP:tr A0A067RMN2 A0A067RMN2_ZOONE:tr A0A2P8Z2J3 A0A2P8Z2J3_BLAG:tr A0A2R4CIH4 A0A2R4CIH4_PERAM:tr A0A2J7PLV1 A0A2J7PLV1_9NEOP:tr A0A067R416 A0A067R416_ZOONE:tr A0A2J7QYF0 A0A2J7QYF0_9NEOP
AVFPSIVGRP	29.9	1041.597	10	1.1	1042.6055	41.7	8.72E+09	tr Q3HNA6 Q3HNA6_RETFL:tr A0A067QL86 A0A067QL86_ZOONE:tr A0A2J7RHY5 A0A2J7RHY5_9NEOP:tr A0A2Z5RE76 A0A2Z5RE76_9NEOP:tr A0A067RMN2 A0A067RMN2_ZOONE:tr A0A2P8Z2J3 A0A2P8Z2J3_BLAG:tr A0A2R4CIH4 A0A2R4CIH4_PERAM:tr A0A2J7PLV1 A0A2J7PLV1_9NEOP:tr A0A067R416 A0A067R416_ZOONE:tr A0A2J7QYF0 A0A2J7QYF0_9NEOP
EITALAPSTIK	32.07	1142.6547	11	0	1143.662	35.78	8.13E+09	tr Q3HNA6 Q3HNA6_RETFL:tr A0A067QL86 A0A067QL86_ZOONE:tr A0A2J7RHY5 A0A2J7RHY5_9NEOP:tr A0A2Z5RE76 A0A2Z5RE76_9NEOP
TAPGIVASAN TAGGF	40.38	1332.6674	15	2.1	1333.6775	47.56	6.62E+09	tr Q5H799 Q5H799_9NEOP
VAAPVAVAA PVA	20.12	1034.6124	12	1.7	518.3144	48.12	5.87E+09	tr A0A2P8YBM8 A0A2P8YBM8_BLAG:tr A0A2P8YBL7 A0A2P8YBL7_BLAG:tr A0A2P8YBP8 A0A2P8YBP8_BLAG
GIITNWDDM EK	37.67	1320.6021	11	1.7	1321.6116	43.64	5.19E+09	tr Q3HNA6 Q3HNA6_RETFL:tr A0A067QL86 A0A067QL86_ZOONE:tr A0A2J7RHY5 A0A2J7RHY5_9NEOP:tr A0A2Z5RE76 A0A2Z5RE76_9NEOP
NISGWLEK	26.22	945.4919	8	-0.2	946.499	27.46	4.69E+09	tr A0A2P9A976 A0A2P9A976_BLAG:tr A0A2P8XQ42 A0A2P8XQ42_BLAG
HQGVMMGM GQK	42.34	1170.5638	11	1.2	1171.5725	9.31	3.89E+09	tr Q3HNA6 Q3HNA6_RETFL:tr A0A067QL86 A0A067QL86_ZOONE:tr A0A2J7RHY5 A0A2J7RHY5_9NEOP:tr A0A2Z5RE76 A0A2Z5RE76_9NEOP:tr A0A067RMN2 A0A067RMN2_ZOONE:tr A0A2P8Z2J3 A0A2P8Z2J3_BLAG:tr A0A2R4CIH4 A0A2R4CIH4_PERAM:tr A0A2J7PLV1 A0A2J7PLV1_9NEOP
AVFPSIVG	17.49	788.4432	8	0.2	789.4507	53.95	3.87E+09	tr Q3HNA6 Q3HNA6_RETFL:tr A0A067QL86 A0A067QL86_ZOONE:tr A0A2J7RHY5 A0A2J7RHY5_9NEOP:tr A0A2Z5RE76 A0A2Z5RE76_9NEOP:tr A0A067RMN2 A0A067RMN2_ZOONE:tr A0A2P8Z2

								J3 A0A2P8Z2J3_BLAG
								AGE:tr A0A2R4CIH4 A0A2R4CIH4_PERAM:tr A0A2J7PLV1 A0A2J7PLV1_9NEOP
								:tr A0A067R416 A0A067R416_ZOONE:tr A0A2J7QYF0 A0A2J7QYF0_9NEOP
MVYPDFK	22.95	898.4258	7	0.3	899.4333	25.16	3.86E+09	tr A0A2J7QRJ1 A0A2J7QRJ1_9NEOP:tr A0A2P9A976 A0A2P9A976_BLAG
								AGE:tr A0A067RA03 A0A067R
								A03_ZOONE
VAAAPVAKV	19.69	1304.7815	15	1.8	653.3992	33.56	3.45E+09	tr A0A2P8Z7U5 A0A2P8Z7U5_BLAG
AAVAAP								
								tr Q3HNA6 Q3HNA6_RETFL:tr A0A067QL86 A0A067QL86_ZOONE:tr A0A2J7RHY5 A0A2J7RHY5_
IWHHTFY	25.06	1002.4712	7	-0.1	1003.4784	15.34	3.32E+09	9NEOP:tr A0A2Z5RE76 A0A2Z5RE76_9NEOP:tr A0A067RMN2 A0A067RMN2_ZOONE:tr A0A2P8Z2
								J3 A0A2P8Z2J3_BLAG:tr A0A2R4CIH4 A0A2R4CIH4_PERAM:tr A0A2J7PLV1 A0A2J7PLV1_9NEOP
								:tr A0A067R416 A0A067R416_ZOONE:tr A0A2J7QYF0 A0A2J7QYF0_9NEOP
IHFGPSGK	27.49	841.4446	8	0.3	842.4521	9.12	3.05E+09	tr A0A2J7QRJ1 A0A2J7QRJ1_9NEOP:tr A0A2P9A976 A0A2P9A976_BLAG:tr A0A2P8XQ42 A0A2P8
								XQ42_BLAG
AAPALAHAP	31.72	1150.6134	12	1.3	576.3147	26.77	2.87E+09	tr A0A2J7Q400 A0A2J7Q400_9NEOP
VAY								
								tr A0A2P8YBK0 A0A2P8YBK0_BLAG:tr A0A2J7Q400 A0A2J7Q400_9NEOP:tr A0A2J7Q3Z2 A0A2J7
								Q3Z2_9NEOP:tr A0A067QWG3 A0A067QWG3_ZOONE:tr A0A2P8Z7V6 A0A2P8Z7V6_BLAG:tr A0
VAAPVAY	16.4	689.3748	7	0.8	690.3826	22.25	2.68E+09	A067QUK4 A0A067QUK4_ZOONE:tr A0A2J7QCE5 A0A2J7QCE5_9NEOP:tr A0A2P8YNR5 A0A2P8Y
								NR5_BLAG:tr A0A2J7Q412 A0A2J7Q412_9NEOP:tr A0A2J7Q3Z3 A0A2J7Q3Z3_9NEOP:tr A0A2J7PG
								72 A0A2J7PG72_9NEOP:tr A0A2P8Y889 A0A2P8Y889_BLAG:tr A0A067RB44 A0A067RB44_ZOONE:
								tr A0A2J7RR10 A0A2J7RR10_9NEOP
VPTSVPVLGK	33.9	995.6015	10	0.2	996.609	27.89	2.67E+09	tr A0A2J7QTD8 A0A2J7QTD8_9NEOP:tr A0A2P8XYU4 A0A2P8XYU4_BLAG
								tr Q3HNA6 Q3HNA6_RETFL:tr A0A067QL86 A0A067QL86_ZOONE:tr A0A2J7RHY5 A0A2J7RHY5_
VAPEEHPI	32.86	1116.6179	10	0	1117.6252	34.69	2.45E+09	9NEOP:tr A0A2Z5RE76 A0A2Z5RE76_9NEOP
								tr A0A2J7QRJ1 A0A2J7QRJ1_9NEOP:tr A0A2P9A976 A0A2P9A976_BLAG:tr A0A2P8XQ42 A0A2P8
LFVSLEQK	23.63	962.5436	8	0.2	963.5511	28.92	2.26E+09	XQ42_BLAG:tr A0A067RA03 A0A067RA03_ZOONE
LIDDHFLFK	29.86	1146.6073	9	2	574.3121	44.94	2.22E+09	tr A1KY39 A1KY39_PERAM:tr B9VAT1 B9VAT1_BLAG:tr Q2HZF2 Q2HZF2_BLAG:tr D3JUE7 D3

ISLTTQLEDTK	36.2	1247.6609	11	1	1248.6694	29.66	2.08E+09	JUE7_PERAM:tr A0A067RAL9 A0A067RAL9_ZOONE:tr A0A2J7R607 A0A2J7R607_9NEOP tr A0A2J7QRJ1 A0A2J7QRJ1_9NEOP:tr A0A2P9A976 A0A2P9A976_BLAG:tr A0A2P8XQ42 A0A2P8 XQ42_BLAG
VNELTTINVN LASAK	35.59	1585.8676	15	1.1	793.9419	48.96	2.06E+09	tr A0A140KPR3 A0A140KPR3_BLAG
TTLEASLH	26.83	870.4447	8	0.2	871.4521	13.39	2.02E+09	tr A0A2P0XJ16 A0A2P0XJ16_PERAM:tr A0A2P8ZN67 A0A2P8ZN67_BLAG
ANTVLSGGTT MYPGIADR	37.43	1822.8883	18	0.3	912.4517	45.41	1.84E+09	tr Q3HNA6 Q3HNA6_RETFL:tr A0A067QL86 A0A067QL86_ZOONE:tr A0A2J7RHY5 A0A2J7RHY5_ 9NEOP:tr A0A2Z5RE76 A0A2Z5RE76_9NEOP:tr A0A067RMN2 A0A067RMN2_ZOONE:tr A0A2P8Z2 J3 A0A2P8Z2J3_BLAG:tr A0A2R4CIH4 A0A2R4CIH4_PERAM:tr A0A2J7PLV1 A0A2J7PLV1_9NEOP :tr A0A067R416 A0A067R416_ZOONE:tr A0A2J7QYF0 A0A2J7QYF0_9NEOP
AAAPAVVAA PAVAK	41.42	1205.7131	14	1	1206.7216	22.56	1.69E+09	tr A0A2J7PG65 A0A2J7PG65_9NEOP:tr A0A2P8XG07 A0A2P8XG07_BLAG
GLGLGHGLG Y	29.87	942.4923	10	0.1	943.4996	34.29	1.62E+09	tr A0A2P8YW25 A0A2P8YW25_BLAG
AYDIQDALT GDSK	37.99	1395.6517	13	2.7	1396.6628	39.38	1.55E+09	tr A0A2P8YBK0 A0A2P8YBK0_BLAG:tr A0A2P8YBK7 A0A2P8YBK7_BLAG:tr A0A2P8YBM8 A0A 2P8YBM8_BLAG:tr A0A2J7Q400 A0A2J7Q400_9NEOP:tr A0A2J7Q402 A0A2J7Q402_9NEOP:tr A0A2 P8YBL5 A0A2P8YBL5_BLAG:tr A0A2J7R9Q9 A0A2J7R9Q9_9NEOP:tr A0A067QUK4 A0A067QUK4_ ZOONE:tr A0A2J7Q405 A0A2J7Q405_9NEOP
AAVLPVESSV VK	37.22	1197.6969	12	1	1198.7053	32.75	1.55E+09	tr R4V1V4 R4V1V4_COPFO:tr A0A2J7PEY9 A0A2J7PEY9_9NEOP
AEIGIAMGSG TAVAK	47.04	1374.7177	15	1.7	1375.7273	30.63	1.54E+09	tr A0A2J7R7U7 A0A2J7R7U7_9NEOP:tr A0A2J7R7V8 A0A2J7R7V8_9NEOP:tr A0A2J7R7U2 A0A2J7R 7U2_9NEOP:tr A0A2J7R7U1 A0A2J7R7U1_9NEOP:tr A0A067REG0 A0A067REG0_ZOONE:tr A0A2P8 XTT4 A0A2P8XTT4_BLAG
HQGV(+15.9 9)VGMGQK	39.21	1186.5587	11	0.5	1187.5665	8.53	1.43E+09	tr Q3HNA6 Q3HNA6_RETFL:tr A0A067QL86 A0A067QL86_ZOONE:tr A0A2J7RHY5 A0A2J7RHY5_ 9NEOP:tr A0A2Z5RE76 A0A2Z5RE76_9NEOP:tr A0A067RMN2 A0A067RMN2_ZOONE:tr A0A2P8Z2 J3 A0A2P8Z2J3_BLAG:tr A0A2R4CIH4 A0A2R4CIH4_PERAM:tr A0A2J7PLV1 A0A2J7PLV1_9NEOP

VAAAPVAY	19	760.4119	8	0.1	761.4193	26.04	1.35E+09	tr A0A2P8XZ18 A0A2P8XZ18_BLAG
VAAPVAVAA	32.2	1190.7135	13	0.3	1191.7212	29.25	1.34E+09	tr A0A2P8YBM8 A0A2P8YBM8_BLAG:tr A0A2P8YBL7 A0A2P8YBL7_BLAG:tr A0A2P8YBP8 A0A
PVAR								2P8YBP8_BLAG
AYDIQDALT	40.88	1379.6569	13	2.1	1380.667	41.24	1.27E+09	tr A0A2P8YBM8 A0A2P8YBM8_BLAG:tr A0A2P8YBL7 A0A2P8YBL7_BLAG:tr A0A2P8YBV6 A0A
GDAK								2P8YBV6_BLAG:tr A0A2P8YBK9 A0A2P8YBK9_BLAG:tr A0A2J7Q3Z2 A0A2J7Q3Z2_9NEOP:tr A0
AYDIQDAITG	40.88	1379.6569	13	2.1	1380.667	41.24	1.27E+09	A067QWG3 A0A067QWG3_ZOONE
DAK								tr A0A2P8YBK0 A0A2P8YBK0_BLAG:tr A0A2P8YBK7 A0A2P8YBK7_BLAG
VEIDRFPY	22.06	1037.5182	8	1.9	519.7673	40.03	1.27E+09	tr A0A2J7RQU2 A0A2J7RQU2_9NEOP:tr A0A2P8ZNR8 A0A2P8ZNR8_BLAG:tr D0VNY6 D0VNY6_
VELDRFPY	22.06	1037.5182	8	1.9	519.7673	40.03	1.27E+09	BLAG:tr A0A140KPR2 A0A140KPR2_BLAG:tr D0VNY7 D0VNY7_BLAG
KYPDDKPLGF	33.27	1537.7452	13	1.4	769.881	50.58	1.24E+09	tr A0A2P0XIG9 A0A2P0XIG9_PERAM:Q17127 HEXA_BLADI:tr I3TBB2 I3TBB2_CRYPU
PFD								tr A0A2J7RQU2 A0A2J7RQU2_9NEOP:tr Q94643 Q94643_PERAM:tr A0A067RPM2 A0A067RPM2_Z
DLTDYLMK	26.37	997.479	8	0.9	998.4872	52.51	1.24E+09	OONE:tr Q25639 Q25639_PERAM:tr A0A0A0QKL4 A0A0A0QKL4_COPFO
APSFDSAIK	34.27	1047.5601	10	1	1048.5684	31.25	1.22E+09	tr Q3HNA6 Q3HNA6_RETFL:tr A0A067QL86 A0A067QL86_ZOONE:tr A0A2J7RHY5 A0A2J7RHY5_
GVVIGTGL	19.45	714.4276	8	1.2	715.4357	42.88	1.21E+09	9NEOP:tr A0A2Z5RE76 A0A2Z5RE76_9NEOP:tr A0A067RMN2 A0A067RMN2_ZOONE:tr A0A2P8Z2
YC(+57.02)GYP	33.52	1465.7275	12	2.4	1466.7383	51	1.15E+09	J3 A0A2P8Z2J3_BLAG:tr A0A2R4CIH4 A0A2R4CIH4_PERAM:tr A0A2J7PLV1 A0A2J7PLV1_9NEOP
ENLLLPK								:tr A0A067R416 A0A067R416_ZOONE:tr A0A2J7QYF0 A0A2J7QYF0_9NEOP
YC(+57.02)GYP	33.52	1465.7275	12	2.4	1466.7383	51	1.15E+09	tr A0A2J7PVU6 A0A2J7PVU6_9NEOP
ENLLIPK								tr A0A2J7R7U7 A0A2J7R7U7_9NEOP:tr A0A2J7R7V8 A0A2J7R7V8_9NEOP:tr A0A2J7R7U2 A0A2J7R
AAPAVSY	20.84	677.3384	7	0.3	678.3459	15.55	1.08E+09	7U2_9NEOP:tr A0A2J7R7U1 A0A2J7R7U1_9NEOP:tr A0A067REG0 A0A067REG0_ZOONE:tr A0A2P8
								XTT4 A0A2P8XTT4_BLAG
								tr Q94643 Q94643_PERAM
								tr D3JUE9 D3JUE9_PERAM
								tr A0A2P8Z7V6 A0A2P8Z7V6_BLAG:tr A0A2P8XJ38 A0A2P8XJ38_BLAG

MVSDIANAW K	37.33	1133.554	10	-0.8	1134.5603	34.76	1.05E+09	tr A0A2J7RAV9 A0A2J7RAV9_9NEOP
GAPGFHSPY	25.86	931.4188	9	0.2	932.4263	16.65	1.05E+09	tr A0A067R1R9 A0A067R1R9_ZOONE
GLGHGLGY	19.35	772.3868	8	-0.8	773.3934	15.5	1.05E+09	tr A0A2J7PG65 A0A2J7PG65_9NEOP:tr A0A2P8YW25 A0A2P8YW25_BLAG
AVDSLPIGR	26	1025.5869	10	1.5	513.8015	35.26	1.03E+09	tr A0A2P8ZHF8 A0A2P8ZHF8_BLAG:tr A0A2J7Q0B3 A0A2J7Q0B3_9NEOP
GLGSGLGY	16.5	722.3599	8	0.3	723.3674	30.1	1.03E+09	tr A0A2P8YW25 A0A2P8YW25_BLAG
VDIATPVVK	24.25	940.5593	9	-0.5	941.5662	23.61	1.01E+09	tr A0A2P8YNR5 A0A2P8YNR5_BLAG:tr A0A067RB44 A0A067RB44_ZOONE
TVPIYEGY	17.47	940.4542	8	1.5	941.4629	40.91	9.93E+08	tr Q3HNA6 Q3HNA6_RETFL:tr A0A067QL86 A0A067QL86_ZOONE:tr A0A2J7RHY5 A0A2J7RHY5_9NEOP:tr A0A2Z5RE76 A0A2Z5RE76_9NEOP:tr A0A067RMN2 A0A067RMN2_ZOONE:tr A0A2P8Z2J3 A0A2P8Z2J3_BLAG:tr A0A2R4CIH4 A0A2R4CIH4_PERAM:tr A0A2J7PLV1 A0A2J7PLV1_9NEOP:tr A0A067R416 A0A067R416_ZOONE:tr A0A2J7QYF0 A0A2J7QYF0_9NEOP
DLLDQIGEGG R	29.06	1171.5833	11	2	1172.5929	46.51	9.78E+08	tr A0A2J7QRJ1 A0A2J7QRJ1_9NEOP:tr A0A2P9A976 A0A2P9A976_BLAG
NEVPPHIF	24.94	951.4814	8	0.1	952.4888	31.85	9.45E+08	tr A0A2J7QRJ1 A0A2J7QRJ1_9NEOP:tr A0A2P9A976 A0A2P9A976_BLAG:tr A0A2P8XQ42 A0A2P8XQ42_BLAG
FVEWIPNNV K	29.19	1244.6553	10	1.3	1245.6642	46.45	9.31E+08	tr A0A2J7QIE5 A0A2J7QIE5_9NEOP:tr A0A067R568 A0A067R568_ZOONE:tr A0A2J7QSV2 A0A2J7QSV2_9NEOP:tr A0A2J7QRF5 A0A2J7QRF5_9NEOP:tr A0A2J7PKK2 A0A2J7PKK2_9NEOP:tr A0A067QYS6 A0A067QYS6_ZOONE:tr A0A2J7R1W4 A0A2J7R1W4_9NEOP:tr A1C231 A1C231_CRYPU:tr A0A2P8YDV3 A0A2P8YDV3_BLAG
AGLQFPVGR	23.4	943.5239	9	0.6	472.7695	30.42	9.28E+08	tr A0A2J7RT92 A0A2J7RT92_9NEOP:tr A0A067QGN4 A0A067QGN4_ZOONE:tr A0A067QYW8 A0A067QYW8_ZOONE:tr A0A067RLA1 A0A067RLA1_ZOONE:tr A0A2P8XJ80 A0A2P8XJ80_BLAG:tr A0A067RTR6 A0A067RTR6_ZOONE:tr A0A2J7RNR6 A0A2J7RNR6_9NEOP:tr A0A126QCW4 A0A126QCW4_9NEOP:tr A0A140D4D2 A0A140D4D2_9NEOP:tr A0A223FVZ4 A0A223FVZ4_9NEOP:tr A0A2P8XJ03 A0A2P8XJ03_BLAG:tr A0A067R0G4 A0A067R0G4_ZOONE:tr R4UK09 R4UK09_COPFO
LIDFGLATK	26.22	976.5593	9	0.8	977.5674	45.24	8.99E+08	tr A0A2P8YXL7 A0A2P8YXL7_BLAG:tr A0A2J7PNB1 A0A2J7PNB1_9NEOP:tr A0A2J7PNB7 A0A2J7PNB7_9NEOP

ISLTTQLEDTK R	28.81	1403.762	12	-0.3	702.8881	19.96	8.95E+08	tr A0A2J7QRJ1 A0A2J7QRJ1_9NEOP:tr A0A2P9A976 A0A2P9A976_BLAG
								E:tr A0A2P8XQ42 A0A2P8XQ42_BLAG
KYPDDKPLGF PF	33.78	1422.7183	12	0.9	712.3671	50.81	8.76E+08	tr A0A2J7RQU2 A0A2J7RQU2_9NEOP:tr Q94643 Q94643_PERAM:tr A0A067RPM2 A0A067RPM2_Z
								OONE:tr Q25639 Q25639_PERAM:tr A0A0A0QKL4 A0A0A0QKL4_COPFO
ITLELGK	24.14	829.4909	8	1.3	830.4993	23.29	8.51E+08	tr A0A2J7PWN9 A0A2J7PWN9_9NEOP:tr A0A2P0XIF5 A0A2P0XIF5_PERAM:tr A0A2H4V6Z3 A0A2H4V6Z3_MASDA
ITIEIGK	24.14	829.4909	8	1.3	830.4993	23.29	8.51E+08	
AAPAVAAHG LLGVAY	35.67	1379.7561	15	0.2	690.8855	51.36	8.41E+08	tr A0A2P8XZ18 A0A2P8XZ18_BLAG
								tr A0A2P8YBK0 A0A2P8YBK0_BLAG:tr A0A2P8YBK7 A0A2P8YBK7_BLAG:tr A0A2P8YBM8 A0A2P8YBM8_BLAG:tr A0A2J7Q400 A0A2J7Q400_9NEOP:tr A0A2J7Q402 A0A2J7Q402_9NEOP:tr A0A2P8YBL5 A0A2P8YBL5_BLAG:tr A0A2J7Q407 A0A2J7Q407_9NEOP:tr A0A2J7Q404 A0A2J7Q404_9NEOP:tr A0A2J7Q405 A0A2J7Q405_9NEOP:tr Q5H7A6 Q5H7A6_9NEOP:tr A0A2J7Q412 A0A2J7Q412_9NEOP:tr A0A067QUK2 A0A067QUK2_ZOONE:tr A0A2P8Y146 A0A2P8Y146_BLAG:tr A0A2P8Y131 A0A2P8Y131_BLAG
SLVEPDGTR	19.24	972.4876	9	-0.4	973.4945	10.51	8.40E+08	

1 **Table S4.** Identified potential biomarkers in serum regulated by APE

Proposed identity	Formula	Rt (min)	Theoretical (m/z)	Experimental (m/z)	Error (ppm)	VIP	P(corr)	MS/MS	Ion Mode	Change Trend (M/C)	Change Trend (M+HA PE/M)
Hydroxyeicosate-traenoate	C ₂₀ H ₃₂ O ₃	1.34	319.22751	319.22751	0.167	5.70481	-0.669338	319(49), 203(23), 301(43), 115(100)	N	↑*	↓
(S)-Ureidoglycolate	C ₃ H ₆ N ₂ O ₄	1.52	133.02419	133.0242	-1.377	1.82445	0.496272	133(100), 112(1), 95(13), 80(1)	N	↓	↑#
Tryptamine	C ₁₀ H ₁₂ N ₂	1.54	161.10691	161.10689	-2.700	1.50064	0.430885	161(100), 142(24), 131(5), 116(100), 73(25)	P	↓*	↑#
Uric acid	C ₅ H ₄ N ₄ O ₃	1.82	167.02106	167.02098	-2.287	1.98642	0.458843	167(100), 147(4), 124(47), 96(7)	N	↓*	↑###
2,3-Dihydroxyindole	C ₈ H ₇ NO ₂	2.17	150.05482	150.0547	-1.700	1.95097	0.655555	150(10), 133(61), 104(100), 102(26)	P	↓	↑
Glycerone	C ₃ H ₆ O ₃	2.2	89.02307	89.02301	-3.488	2.00319	0.422191	89(100), 71(5)	N	↓	↑
Acetone cyanohydrin	C ₄ H ₇ NO	2.24	86.06037	86.06044	4.643	1.55296	0.522295	86(91), 71(2), 69(100), 57(31)	P	↑	↓#
Nicotinamide	C ₆ H ₆ N ₂ O	2.27	123.0553	123.05527	-0.158	1.92451	0.692903	123(13), 118(70), 100(100), 95(17)	P	↑*	↓
Methyl-2-pyrrolidinone	C ₅ H ₉ NO	2.53	100.07587	100.07594	2.493	1.80280	0.63572	100(70), 89(13), 72(97), 55(100)	P	↑*	↓
Hypoxanthine	C ₅ H ₄ N ₄ O	3.48	135.03006	135.03000	-1.017	2.74366	-0.45807	135(100), 122(1), 99(3)	N	↑**	↓###
Methyl-2-oxopentanoate	C ₆ H ₁₀ O ₃	3.94	129.05444	129.05441	-1.632	8.41826	-0.676791	129(100), 117(49), 105(46), 100(52)	N	↑	↓#
Adenine	C ₅ H ₅ N ₅	4.04	134.04602	134.04599	-0.983	4.00772	0.572833	134(40), 120(15), 75(5)	N	↑***	↓###
Adenosine	C ₁₀ H ₁₃ N ₅ O ₄	4.08	268.10338	268.10352	-1.904	1.83707	0.593624	268(100), 213(15), 199(11), 159(10), 95(25)	P	↑***	↓##
gamma-Glutamyl-beta-cyanoalanine	C ₉ H ₁₃ N ₃ O ₅	5.60	244.09231	244.09241	-0.382	1.62911	0.558153	244(100), 226(2), 180(18), 85(1)	P	↑**	↓###
Cytosine	C ₄ H ₅ N ₃ O	6.69	112.05064	112.05067	1.175	1.99926	0.639902	112(100), 95(12), 70(21)	P	↓**	↑
Arginine	C ₆ H ₁₄ N ₄ O ₂	6.75	174.20114	174.20115	1.011	3.10672	0.451013	174(100), 159(5), 132(17), 118(6)	P	↓*	↑###
Glycocholate	C ₂₆ H ₄₃ NO ₆	7.43	464.30101	464.30121	1.175	3.39934	-0.458653	464(100), 430(2), 330(2), 74(32)	N	↑**	↓#
Trimethylamine N-oxide	C ₃ H ₉ NO	8.18	76.07625	76.07623	3.092	1.57888	0.480898	76(100), 59(78)	P	↓*	↑
O-Propanoylcarnitine	C ₁₀ H ₁₉ NO ₄	8.34	218.13835	218.13846	-1.030	1.64078	0.548771	218(36), 159(15), 85(100), 60(13)	P	↑*	↓#

N-Acetylserotonin	C ₁₂ H ₁₄ N ₂ O ₂	8.48	219.11608	219.11592	4.220	1.72386	0.614361	219(42), 202(31), 184(24), 124(11), 116(16)	P	↑*	↓#
Proline	C ₅ H ₉ NO ₂	8.62	116.07054	116.07061	-0.042	3.0198	0.476260	116(36), 92(42), 74(100), 57(5)	P	↑*	↓#
Phenindamine	C ₁₉ H ₁₉ N	8.67	262.1638	262.16458	-1.198	1.58702	0.513712	262(100), 244(4), 200(42), 88(10)	P	↑*	↓
3-Methyleneoxindole	C ₉ H ₇ NO	8.91	146.05974	146.05981	-1.578	1.53085	0.432814	146(61), 127(3), 109(60), 82(100)	P	↑	↓#
3-Indoleacrylate	C ₁₁ H ₉ NO ₂	8.95	188.07029	188.07036	-1.303	1.62697	0.505108	188(33), 170(7), 146(100), 118(25)	P	↓*	↑#
trans-Cinnamate	C ₉ H ₈ O ₂	9.00	147.04406	147.04395	-0.721	2.23304	0.698291	147(2), 123(7), 102(100), 58(40)	N	↑	↓
Phenylalanine	C ₉ H ₁₁ NO ₂	9.01	164.07055	164.07053	-0.458	7.06554	0.486796	164(10), 147(100), 136(9), 96(12), 72(34)	N	↓*	↑##
2-Phenylacetamide	C ₈ H ₉ NO	9.02	136.0754	136.07553	-1.179	1.5497	-0.504565	136(100), 119(6), 109(3), 91(15)	P	↓**	↑
Taurocholic acid	C ₂₆ H ₄₅ NO ₇ S	9.35	514.28365	514.28381	0.992	2.58934	-0.421297	514(100), 496(1), 124(13), 106(1)	N	↓*	↑
Valine	C ₅ H ₁₁ NO ₂	9.35	118.08626	118.08622	-1.108	2.8162	-0.53002	118(60), 76(22), 72(100), 59(11)	P	↓*	↑#
Threonine	C ₄ H ₉ NO ₃	9.39	120.06551	120.06561	0.752	1.79882	0.530487	120(22), 78(10), 74(100), 56(63)	P	↓*	↑#
Pipecolate	C ₆ H ₁₁ NO ₂	9.45	130.08589	130.08621	-0.158	1.80951	0.598083	130(23), 84(100), 56(1)	P	↑*	↓
3-Sulfinol-L-alanine	C ₃ H ₇ NO ₄ S	9.5	152.00119	152.00117	-0.229	4.49157	0.440294	152(3), 108(5), 92(100), 80(6)	N	↓*	↑#
Glutamate	C ₅ H ₈ O ₄ N	9.68	146.04462	146.04488	1.601	2.13824	-0.45007	146(10), 123(8), 103(15), 61(100)	N	↓*	↑##
(E)-4-Trimethylammoniot- 2-enoate	C ₇ H ₁₃ NO ₂	10.27	144.10163	144.10176	-1.008	1.83857	0.564788	144(100), 117(10), 85(4)	P	↑*	↓
Tryptophan	C ₁₁ H ₁₂ N ₂ O ₂	8.94	205.09475	205.09683	-0.324	2.01713	-0.689973	205(2), 188(100), 146(69), 132(6)	P	↓**	↑##
Indol	C ₈ H ₇ N	9.08	118.08626	118.06547	0.344	1.97085	0.612589	118(32), 103(42), 87(100)	P	↓**	↑#

2 Delta: system error, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, M group vs Con group, # $p < 0.05$, ## $p < 0.01$, ### $p < 0.001$, M group vs M+HAPE group

3

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5

6 **Table S5.** Identified potential biomarkers in faeces regulated by APE

Proposed identity	Formula	Rt (min)	Theoretical (m/z)	Experimental (m/z)	RDB (ppm)	VIP	P(corr)	MS/MS	Ion Mode	Change Trend (M/C)	Change Trend (M+HA PE/M)
Thymine	C ₅ H ₆ O ₂ N ₂	1.52	125.03456	125.03444	-0.911	3.00458	-0.53094	125(100), 72(1), 55(1)	N	↑*	↓#
Tryptamine	C ₁₀ H ₁₂ N ₂	1.54	161.10691	161.10689	-2.700	1.50064	0.430885	205(2), 188(100), 146(69), 132(6)	P	↑**	↓#
7,8-dihydroxykynurenate	C ₁₀ H ₉ NO ₅	1.55	222.04017	222.04024	2.437	5.00473	0.476098	222(14), 160(100), 134(17), 91(3)	N	↑	↓#
Uracil	C ₄ H ₄ O ₂ N ₂	1.82	111.01868	111.01873	-1.566	4.00817	-0.477916	111(100), 83(2), 78(71)	N	↑*	↓
Hippurate	C ₉ H ₉ NO ₃	1.92	178.04991	178.05009	1.238	4.44243	0.609988	178(100), 79(11), 55(1)	N	↓*	↑#
Glycerone	C ₃ H ₆ O ₃	2.23	89.02301	89.0231	-2.477	2.48627	-0.484086	89(100), 75(25), 59(1)	N	↓*	↑
Xanthine	C ₅ H ₄ N ₄ O ₂	2.45	153.04033	153.04033	-2.430	1.84488	-0.467949	153(38), 109(100), 108(30), 85(2)	P	↑*	↓
Nicotinate	C ₆ H ₅ NO ₂	2.46	124.03917	124.03915	-1.249	2.28845	-0.416789	124(100), 112(2), 104(6), 80(8)	P	↑	↓##
N-Methyl-2-pyrrolidinone	C ₅ H ₉ NO	2.54	100.07585	100.07581	1.194	2.64073	0.588156	100(100), 85(1), 72(2), 56(15)	P	↓	↑##
Pyridoxine	C ₈ H ₁₁ NO ₃	2.83	170.0808	170.08073	-2.586	2.90206	0.575481	170(100), 152(1), 128(1)	P	↑*	↓#
N,N-Dihydroxy-L-isoleucine	C ₆ H ₁₃ NO ₄	2.87	164.09261	164.09273	-2.084	2.01201	0.402505	164(100), 146(1), 122(8), 95(1)	P	↓*	↑
Piperidine	C ₅ H ₁₁ N	3.21	86.09686	86.09679	4.228	2.67982	0.535767	86(100), 72(22), 58(9)	P	↓**	↑
Hypoxanthine	C ₅ H ₄ ON ₄	3.42	135.03002	135.03011	-0.202	2.36685	-0.451332	135(100), 99(1), 87(1), 65(6)	N	↓*	↑
N-Methyl-2-pyridone-5-carboxamide	C ₇ H ₈ N ₂ O ₂	3.60	153.06542	153.06543	-2.771	2.71579	0.557247	153(100), 136(4), 128(4),	P	↓*	↑

								110(25)			
Tazarotene	C ₂₁ H ₂₁ NO ₂ S	3.95	350.1456	350.1456	2.469	2.56927	-0.491255	350(5), 170(15), 98(11), 87(100)	N	↑	↓#
3-Methyladenine	C ₆ H ₇ N ₅	4.84	150.07709	150.0771	-2.144	4.00493	-0.668376	150(11), 133(61), 104(100), 87(10)	P	↑*	↓
Cytosine	C ₄ H ₅ N ₃ O	4.85	112.05053	112.05055	0.104	2.27972	0.60472	112(100), 95(10), 88(27), 70(93)	P	↓	↑#
4-Pyridoxate	C ₈ H ₉ NO ₄	5.84	182.04494	182.04507	1.570	3.8611	-0.429172	182(27), 138(100), 120(2), 108(27)	N	↑*	↓#
Guanine	C ₅ H ₅ N ₅ O	5.90	152.05621	152.05638	1.069	4.35983	0.546908	152(100), 136(4), 128(4), 110(36)	P	↓	↑#
N-Acetylisatin	C ₁₀ H ₇ NO ₃	8.33	188.03457	188.03455	1.757	7.49959	0.61269	188(3), 144(100), 116(3), 92(1)	N	↑	↓#
N-Acetyl-L-lysine	C ₈ H ₁₆ N ₂ O ₃	8.44	189.12311	189.12299	-2.004	1.91799	0.524277	189(4), 143(36), 132(67), 86(100)	P	↓*	↑
Propranolol	C ₁₆ H ₂₁ NO ₂	8.53	258.1457	258.14594	-1.023	1.94572	0.432626	258(91), 240(67), 214(10), 196(47)	N	↑*	↓
Proline	C ₅ H ₉ NO ₂	8.62	116.07059	116.0706	-0.044	3.24898	0.476781	116(17), 92(5), 70(100)	P	↑*	↓###
Oxadixyl	C ₁₄ H ₁₈ N ₂ O ₄	8.98	279.13292	279.13315	2.003	2.03144	-0.464018	279(31), 136(99), 116(100), 70(16)	P	↑	↓
Tolylacetonitrile	C ₉ H ₉ N	9.01	132.08045	132.08054	-1.786	6.72476	-0.512432	132(2), 86(100), 69(2)	P	↓*	↑
Tryptophan	C ₁₁ H ₁₂ N ₂ O ₂	9.02	205.09667	205.09668	-2.312	7.31568	0.418562	205(2), 188(100), 146(73), 144(13)	P	↓*	↑##
trans-Cinnamate	C ₉ H ₈ O ₂	9.11	147.04386	147.04408	0.163	1.51218	-0.739326	147(3), 102(19), 87(11), 69(14), 61(100)	N	↑*	↓
Phenylalanine	C ₉ H ₁₁ NO ₂	9.11	166.08582	166.08582	-2.620	2.18964	-0.407504	166(6), 142(4), 120(100),	P	↑*	↓##

								103(4)			
Indole	C ₈ H ₇ N	9.13	118.06502	118.06508	-0.388	2.64653	0.409402	118(17), 105(3), 95(6), 72(100)	P	↓*	↑##
3-Methylene-indolenine	C ₉ H ₇ ON	9.17	144.04424	144.04443	0.275	2.71243	0.417228	144(100), 116(2), 69(4)	N	↓*	↑##
4-Hydroxy-2-quinolinecarboxylic acid	C ₁₀ H ₇ NO ₃	9.18	188.03443	188.03452	1.598	3.6812	0.429091	188(100), 146(23), 132(16), 92(7)	N	↓	↑##
Valine	C ₅ H ₁₁ NO ₂	9.35	118.08623	118.08622	-0.298	3.84014	-0.566811	118(100), 146(24), 132(16)	P	↑*	↓###
Serine	C ₃ H ₇ O ₃ N	9.63	104.03403	104.03408	-1.342	1.78605	-0.598565	104(2), 90(100), 71(32)	N	↓*	↑#
Glutamate	C ₅ H ₈ O ₄ N	9.64	146.04469	146.04488	0.656	4.12435	-0.473216	146(69), 132(26), 87(12), 51(5)	N	↑*	↓##
3-Acetamidopropanal	C ₅ H ₉ NO ₂	9.79	116.07059	116.07061	0.042	5.02436	-0.605067	116(100), 92(25), 70(3)	P	↓	↑
Methylene-L-glutamine	C ₆ H ₁₀ N ₂ O ₃	10.31	159.07602	159.0761	-2.004	2.64587	-0.574584	159(100), 144(11), 131(18), 67(2)	P	↓	↑##
Ornithine	C ₅ H ₁₂ O ₂ N ₂	10.33	131.08132	131.0815	-0.032	3.12551	-0.532667	131(40), 121(2), 118(2), 85(100)	N	↑*	↓#
Citrulline	C ₆ H ₁₃ N ₃ O ₃	10.37	176.10257	176.1026	-2.089	2.32574	-0.565668	176(39), 159(54), 140(18), 130(31), 87(100)	P	↑*	↓##

7 Delta: system error, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, M group vs Con group, # $p < 0.05$, ## $p < 0.01$, ### $p < 0.001$, M group vs M+HAPE group.

Table S6. Linear regression equation and quantitative limits of amino acids

Name	RT (min)	Linear equation	Correlation coefficient (r)	Linearity range (ng/mL)	Limit of quantification n (ng/mL)
Alanine	4.23	y=0.01459 x + 0.02578	0.99825	5-1250	5
Proline	4.47	y=0.11913 x + 0.03634	0.99421	0.5-125	0.5
Valine	4.88	y=0.10965 x + 0.05735	0.99681	0.5-125	0.5
Threonine	4.29	y=0.01475 x + 0.11546	0.99572	20-5000	20
Glutamate	4.37	y=0.05369 x + 0.05723	0.99036	1-250	1
Phenylalanine	9.31	y=0.13259 x + 0.03824	0.99769	0.5-125	0.5
Arginine	3.77	y=0.02876 x + 0.00305	0.99573	1-250	1
Tryptophan	11.19	y=0.15131 x + 0.00966	0.99983	0.5-62.5	0.5

Table S7. Stability of various targeting substances in QC samples

Name	RSD (%)	Name	RSD (%)
Alanine	1.6229	Glutamate	1.8797
Proline	2.5268	Phenylalanine	1.8193
Valine	1.5226	Arginine	1.4680
Threonine	2.7277	Tryptophan	2.8011

Table S8. Quantitative ion pairs of amino acids

name	Parent ion	daughter ion	DP	EP	CE	CXP
Alanine	90.1	44.1	40	10	19	5
Proline	116	70	40	10	20	8
Valine	118	72	14	10	15	8
Threonine	120.1	102.1	15	10	11	11
Glutamine	148.1	84.1	20	10	21	10
Phenylalanine	166.1	120.2	40	10	18	14
Arginine	175.1	70	33	10	26	8
Tryptophan	205.1	187.9	40	10	14	10
Tryptophan-2,3,3,-d3	208.2	191	40	10	14	21

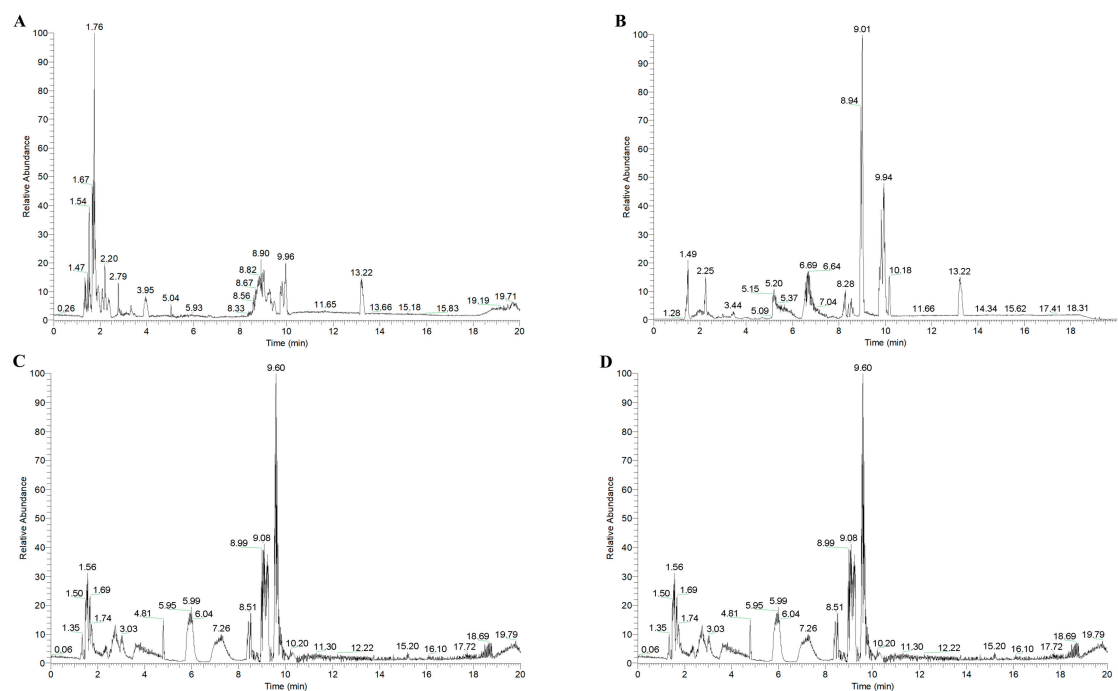
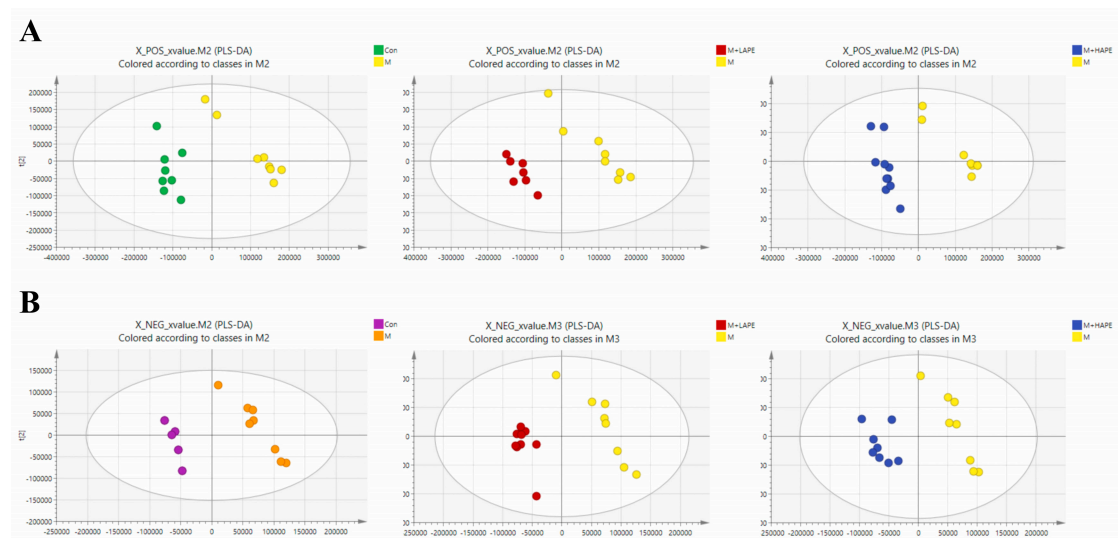


Figure S1. The Base Peak plots of QC samples in the positive and negative ions for serum and faeces samples. **(A)** The Base Peak plot of QC sample of serum samples in negative ion mode; **(B)** The Base Peak plot of QC sample of serum samples in positive ion mode; **(C)** The Base Peak plot of QC sample of faeces samples in negative ion mode; **(D)** The Base Peak plot of QC sample of faeces samples in positive ion mode.



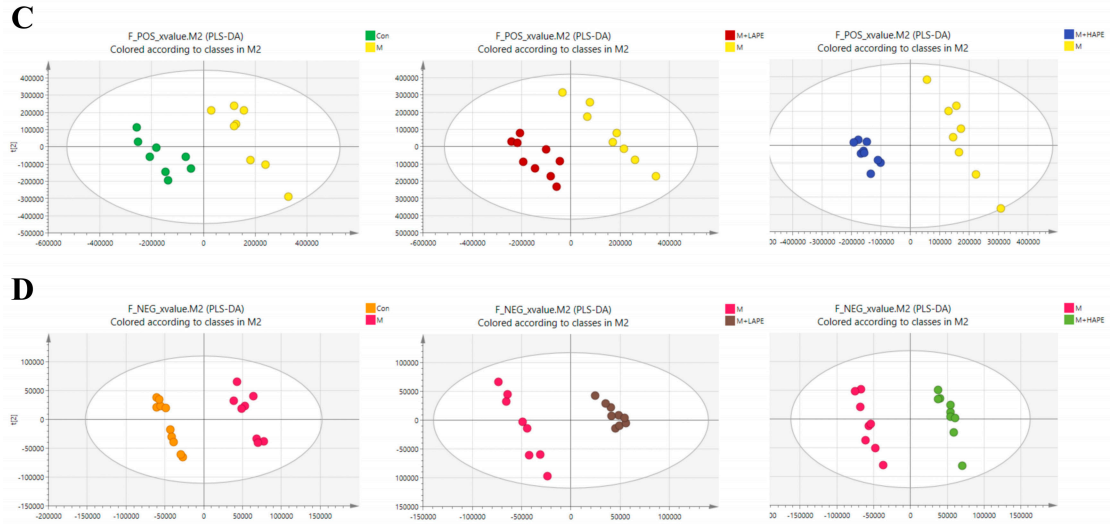


Figure S2. The result of PLS-DA analysis based on SCIMA_P 14.0. **(A)** The PLS-DA analysis of serum samples in positive ion mode; **(B)** The PLS-DA analysis of serum samples in negative ion mode; **(C)** The PLS-DA analysis of faeces samples in positive ion mode; **(D)** The PLS-DA analysis of faeces samples in negative ion mode. Con: control group, M: model group, M+LAPE: the low dose group of APE, M+HAPE: the high dose group of APE.