

# PCA analysis

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```
# Import datasets
ABC_total_raw = readxl::read_excel("./ABC_Cord Blood_Metabolomics_new.xlsx") %>% as.data.frame()

# Tidy dataset
ABC_total =
  ABC_total_raw %>%
  janitor::clean_names()

# Divide the dataset to confounding information and experimental data
ABC_information = ABC_total[1:10]
ABC_data = ABC_total[11:930]

# Generate z-scores for each analyte
# Extract the subset of all controls
subset_control =
  ABC_total %>%
  group_by(strata) %>%
  filter(asd == 0)

# Calculate the mean and standard deviation of the control group
mean_control = sapply(subset_control[11:930], function(x) mean(x))
sd_control = sapply(subset_control[11:930], function(x) sd(x))

# Write a for-loop to calculate z-score of data for both control and ASD groups
for(i in 1:920) {
  ABC_data[i] = (ABC_data[i] - mean_control[i])/sd_control[i]
}

# Principal component analysis
ABC_pca = prcomp(ABC_data[c(1:920)], center = T, scale. = T)
summary(ABC_pca)

## Importance of components:
##              PC1      PC2      PC3      PC4      PC5      PC6
## Standard deviation  9.6984 8.74290 6.92489 6.67434 5.83071 5.32466
## Proportion of Variance 0.1022 0.08309 0.05212 0.04842 0.03695 0.03082
## Cumulative Proportion 0.1022 0.18532 0.23745 0.28587 0.32282 0.35364
##              PC7      PC8      PC9     PC10     PC11     PC12
## Standard deviation  5.1025 4.88809 4.58516 4.45439 4.24583 4.15761
## Proportion of Variance 0.0283 0.02597 0.02285 0.02157 0.01959 0.01879
## Cumulative Proportion 0.3819 0.40791 0.43076 0.45233 0.47192 0.49071
##              PC13     PC14     PC15     PC16     PC17     PC18
## Standard deviation  4.01912 3.75017 3.68688 3.48056 3.42575 3.36037
## Proportion of Variance 0.01756 0.01529 0.01478 0.01317 0.01276 0.01227
## Cumulative Proportion 0.50827 0.52356 0.53833 0.55150 0.56426 0.57653
##              PC19     PC20     PC21     PC22     PC23     PC24
## Standard deviation  3.2664 3.14380 3.07224 3.0031 2.97082 2.89428
## Proportion of Variance 0.0116 0.01074 0.01026 0.0098 0.00959 0.00911
## Cumulative Proportion 0.5881 0.59887 0.60913 0.6189 0.62853 0.63763
```

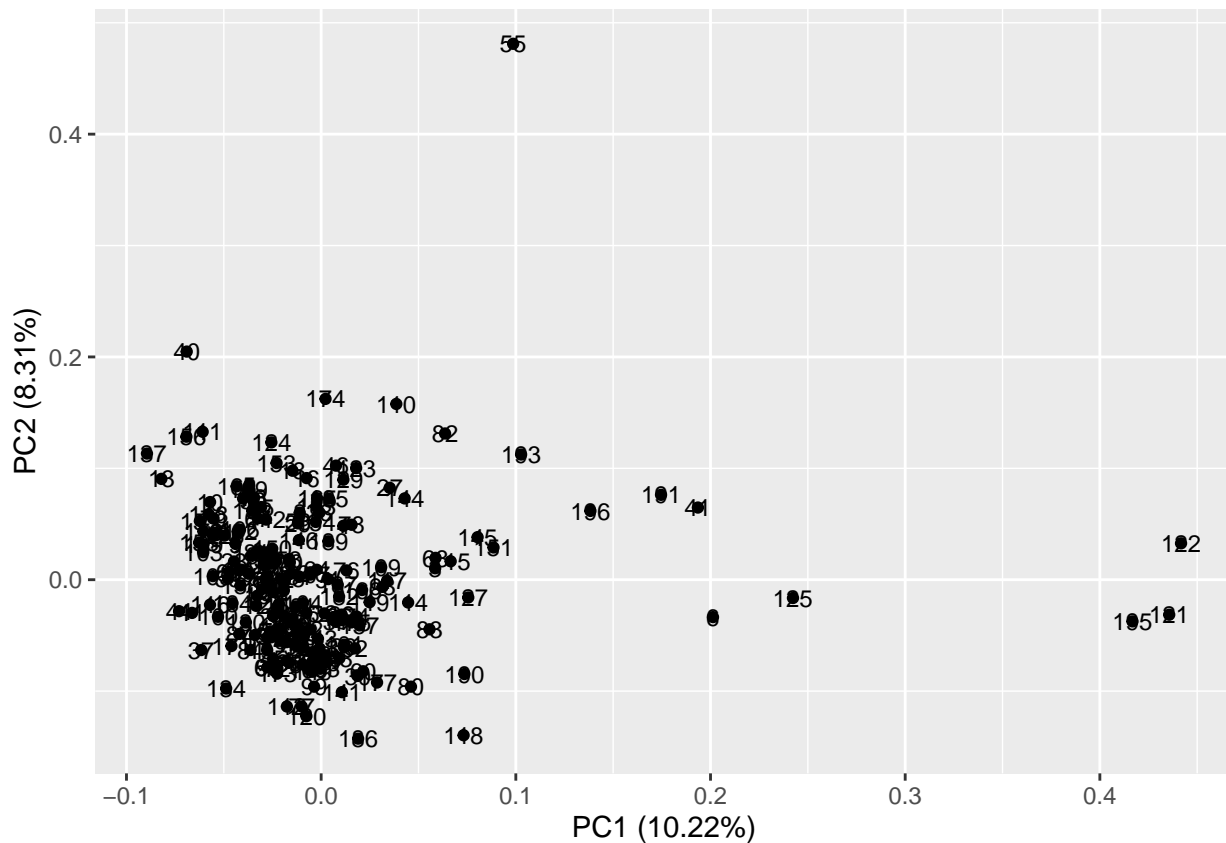
##		PC25	PC26	PC27	PC28	PC29	PC30
##	Standard deviation	2.79008	2.68493	2.65256	2.6095	2.57618	2.54467
##	Proportion of Variance	0.00846	0.00784	0.00765	0.0074	0.00721	0.00704
##	Cumulative Proportion	0.64609	0.65393	0.66158	0.6690	0.67619	0.68323
##		PC31	PC32	PC33	PC34	PC35	PC36
##	Standard deviation	2.50776	2.46047	2.41058	2.40243	2.36730	2.33603
##	Proportion of Variance	0.00684	0.00658	0.00632	0.00627	0.00609	0.00593
##	Cumulative Proportion	0.69007	0.69665	0.70296	0.70924	0.71533	0.72126
##		PC37	PC38	PC39	PC40	PC41	PC42
##	Standard deviation	2.31113	2.24587	2.22699	2.17506	2.16241	2.13316
##	Proportion of Variance	0.00581	0.00548	0.00539	0.00514	0.00508	0.00495
##	Cumulative Proportion	0.72706	0.73255	0.73794	0.74308	0.74816	0.75311
##		PC43	PC44	PC45	PC46	PC47	PC48
##	Standard deviation	2.11408	2.06520	2.03623	2.02524	2.0110	2.00326
##	Proportion of Variance	0.00486	0.00464	0.00451	0.00446	0.0044	0.00436
##	Cumulative Proportion	0.75797	0.76260	0.76711	0.77157	0.7760	0.78033
##		PC49	PC50	PC51	PC52	PC53	PC54
##	Standard deviation	1.97814	1.96298	1.93305	1.93000	1.87925	1.86687
##	Proportion of Variance	0.00425	0.00419	0.00406	0.00405	0.00384	0.00379
##	Cumulative Proportion	0.78458	0.78877	0.79283	0.79688	0.80072	0.80450
##		PC55	PC56	PC57	PC58	PC59	PC60
##	Standard deviation	1.85162	1.81535	1.80728	1.77884	1.75697	1.75491
##	Proportion of Variance	0.00373	0.00358	0.00355	0.00344	0.00336	0.00335
##	Cumulative Proportion	0.80823	0.81181	0.81536	0.81880	0.82216	0.82551
##		PC61	PC62	PC63	PC64	PC65	PC66
##	Standard deviation	1.73904	1.71717	1.69960	1.67959	1.66649	1.65793
##	Proportion of Variance	0.00329	0.00321	0.00314	0.00307	0.00302	0.00299
##	Cumulative Proportion	0.82879	0.83200	0.83514	0.83820	0.84122	0.84421
##		PC67	PC68	PC69	PC70	PC71	PC72
##	Standard deviation	1.64873	1.62233	1.61668	1.6054	1.59547	1.59140
##	Proportion of Variance	0.00295	0.00286	0.00284	0.0028	0.00277	0.00275
##	Cumulative Proportion	0.84717	0.85003	0.85287	0.8557	0.85844	0.86119
##		PC73	PC74	PC75	PC76	PC77	PC78
##	Standard deviation	1.55263	1.54497	1.53522	1.52394	1.5155	1.50608
##	Proportion of Variance	0.00262	0.00259	0.00256	0.00252	0.0025	0.00247
##	Cumulative Proportion	0.86381	0.86640	0.86896	0.87149	0.8740	0.87645
##		PC79	PC80	PC81	PC82	PC83	PC84
##	Standard deviation	1.49286	1.4858	1.48081	1.45819	1.44762	1.43238
##	Proportion of Variance	0.00242	0.0024	0.00238	0.00231	0.00228	0.00223
##	Cumulative Proportion	0.87887	0.8813	0.88366	0.88597	0.88825	0.89048
##		PC85	PC86	PC87	PC88	PC89	PC90
##	Standard deviation	1.42716	1.40580	1.3884	1.37526	1.37039	1.36397
##	Proportion of Variance	0.00221	0.00215	0.0021	0.00206	0.00204	0.00202
##	Cumulative Proportion	0.89269	0.89484	0.8969	0.89899	0.90103	0.90305
##		PC91	PC92	PC93	PC94	PC95	PC96
##	Standard deviation	1.35241	1.34202	1.32613	1.31448	1.30499	1.29389
##	Proportion of Variance	0.00199	0.00196	0.00191	0.00188	0.00185	0.00182
##	Cumulative Proportion	0.90504	0.90700	0.90891	0.91079	0.91264	0.91446
##		PC97	PC98	PC99	PC100	PC101	PC102
##	Standard deviation	1.2873	1.26676	1.26014	1.25641	1.2503	1.24265
##	Proportion of Variance	0.0018	0.00174	0.00173	0.00172	0.0017	0.00168
##	Cumulative Proportion	0.9163	0.91800	0.91973	0.92145	0.9231	0.92482
##		PC103	PC104	PC105	PC106	PC107	PC108
##	Standard deviation	1.23503	1.22479	1.20340	1.19974	1.19073	1.18128

## Proportion of Variance	0.00166	0.00163	0.00157	0.00156	0.00154	0.00152
## Cumulative Proportion	0.92648	0.92811	0.92969	0.93125	0.93279	0.93431
##	PC109	PC110	PC111	PC112	PC113	PC114
## Standard deviation	1.16820	1.15479	1.14909	1.14363	1.1338	1.12689
## Proportion of Variance	0.00148	0.00145	0.00144	0.00142	0.0014	0.00138
## Cumulative Proportion	0.93579	0.93724	0.93868	0.94010	0.9415	0.94288
##	PC115	PC116	PC117	PC118	PC119	PC120
## Standard deviation	1.11015	1.10122	1.09640	1.07656	1.06916	1.06144
## Proportion of Variance	0.00134	0.00132	0.00131	0.00126	0.00124	0.00122
## Cumulative Proportion	0.94422	0.94553	0.94684	0.94810	0.94934	0.95057
##	PC121	PC122	PC123	PC124	PC125	PC126
## Standard deviation	1.05873	1.04556	1.03583	1.03027	1.01988	1.01705
## Proportion of Variance	0.00122	0.00119	0.00117	0.00115	0.00113	0.00112
## Cumulative Proportion	0.95179	0.95297	0.95414	0.95529	0.95642	0.95755
##	PC127	PC128	PC129	PC130	PC131	PC132
## Standard deviation	1.01444	1.00045	0.99137	0.98289	0.97282	0.96456
## Proportion of Variance	0.00112	0.00109	0.00107	0.00105	0.00103	0.00101
## Cumulative Proportion	0.95867	0.95976	0.96082	0.96187	0.96290	0.96391
##	PC133	PC134	PC135	PC136	PC137	PC138
## Standard deviation	0.94442	0.93734	0.93119	0.92981	0.91627	0.91395
## Proportion of Variance	0.00097	0.00096	0.00094	0.00094	0.00091	0.00091
## Cumulative Proportion	0.96488	0.96584	0.96678	0.96772	0.96863	0.96954
##	PC139	PC140	PC141	PC142	PC143	PC144
## Standard deviation	0.9096	0.89608	0.88162	0.87832	0.86909	0.86508
## Proportion of Variance	0.0009	0.00087	0.00084	0.00084	0.00082	0.00081
## Cumulative Proportion	0.9704	0.97131	0.97216	0.97300	0.97382	0.97463
##	PC145	PC146	PC147	PC148	PC149	PC150
## Standard deviation	0.85356	0.84407	0.83740	0.83196	0.82734	0.81964
## Proportion of Variance	0.00079	0.00077	0.00076	0.00075	0.00074	0.00073
## Cumulative Proportion	0.97542	0.97620	0.97696	0.97771	0.97846	0.97919
##	PC151	PC152	PC153	PC154	PC155	PC156
## Standard deviation	0.80695	0.79555	0.79004	0.78657	0.78142	0.76464
## Proportion of Variance	0.00071	0.00069	0.00068	0.00067	0.00066	0.00064
## Cumulative Proportion	0.97989	0.98058	0.98126	0.98193	0.98260	0.98323
##	PC157	PC158	PC159	PC160	PC161	PC162
## Standard deviation	0.75473	0.74847	0.7438	0.73871	0.73680	0.72617
## Proportion of Variance	0.00062	0.00061	0.0006	0.00059	0.00059	0.00057
## Cumulative Proportion	0.98385	0.98446	0.9851	0.98565	0.98624	0.98682
##	PC163	PC164	PC165	PC166	PC167	PC168
## Standard deviation	0.72129	0.71187	0.70663	0.70583	0.69595	0.69245
## Proportion of Variance	0.00057	0.00055	0.00054	0.00054	0.00053	0.00052
## Cumulative Proportion	0.98738	0.98793	0.98848	0.98902	0.98954	0.99007
##	PC169	PC170	PC171	PC172	PC173	PC174
## Standard deviation	0.6780	0.66935	0.66827	0.66375	0.65391	0.65054
## Proportion of Variance	0.0005	0.00049	0.00049	0.00048	0.00046	0.00046
## Cumulative Proportion	0.9906	0.99105	0.99154	0.99202	0.99248	0.99294
##	PC175	PC176	PC177	PC178	PC179	PC180
## Standard deviation	0.64387	0.63193	0.62400	0.61444	0.6102	0.59511
## Proportion of Variance	0.00045	0.00043	0.00042	0.00041	0.0004	0.00038
## Cumulative Proportion	0.99339	0.99383	0.99425	0.99466	0.9951	0.99545
##	PC181	PC182	PC183	PC184	PC185	PC186
## Standard deviation	0.59277	0.58966	0.57503	0.55949	0.54969	0.53748
## Proportion of Variance	0.00038	0.00038	0.00036	0.00034	0.00033	0.00031
## Cumulative Proportion	0.99583	0.99621	0.99657	0.99691	0.99724	0.99755

```
##          PC187 PC188 PC189 PC190 PC191 PC192
## Standard deviation 0.53207 0.5259 0.5216 0.51692 0.50373 0.49606
## Proportion of Variance 0.00031 0.0003 0.0003 0.00029 0.00028 0.00027
## Cumulative Proportion 0.99786 0.9982 0.9985 0.99875 0.99902 0.99929
##          PC193 PC194 PC195 PC196
## Standard deviation 0.47435 0.46755 0.45891 4.306e-15
## Proportion of Variance 0.00024 0.00024 0.00023 0.000e+00
## Cumulative Proportion 0.99953 0.99977 1.00000 1.000e+00
```

```
# Plot PC1 and PC2
```

```
library(ggfortify)
autoplot(ABC_pca, label = T, label.size = 3)
```



```
# Delete outliers
```

```
ABC_total =
  ABC_total[-c(55, 56, 121, 122, 195, 196), ]
```

```
# Re-generate z-scores
```

```
subset_control =
  ABC_total %>%
  group_by(strata) %>%
  filter(asd == 0)
```

```
# Calculate the mean and standard deviation of the control group
```

```
mean_control = sapply(subset_control[11:930], function(x) mean(x))
sd_control = sapply(subset_control[11:930], function(x) sd(x))
```

```
ABC_data_2 = ABC_total[11:930]
```

```

# Write a for-loop to calculate z-score of data for both control and ASD groups
for(i in 1:920) {
  ABC_data_2[i] = (ABC_data_2[i] - mean_control[i])/sd_control[i]
}

# PCA again
ABC_pca_2 = prcomp(ABC_data_2[c(1:920)], center = T, scale. = T)
summary(ABC_pca_2)

```

```

## Importance of components:
##
##          PC1      PC2      PC3      PC4      PC5      PC6
## Standard deviation  8.82839 8.18279 7.12792 6.6312 5.93338 5.51485
## Proportion of Variance 0.08472 0.07278 0.05523 0.0478 0.03827 0.03306
## Cumulative Proportion 0.08472 0.15750 0.21272 0.2605 0.29879 0.33184
##
##          PC7      PC8      PC9      PC10     PC11     PC12
## Standard deviation  5.18857 4.78823 4.75808 4.53767 4.31908 4.14308
## Proportion of Variance 0.02926 0.02492 0.02461 0.02238 0.02028 0.01866
## Cumulative Proportion 0.36111 0.38603 0.41064 0.43302 0.45329 0.47195
##
##          PC13     PC14     PC15     PC16     PC17     PC18
## Standard deviation  4.03255 3.91421 3.71861 3.55995 3.46270 3.4179
## Proportion of Variance 0.01768 0.01665 0.01503 0.01378 0.01303 0.0127
## Cumulative Proportion 0.48963 0.50628 0.52131 0.53509 0.54812 0.5608
##
##          PC19     PC20     PC21     PC22     PC23     PC24
## Standard deviation  3.22921 3.1814 3.14922 3.0929 2.96374 2.94794
## Proportion of Variance 0.01133 0.0110 0.01078 0.0104 0.00955 0.00945
## Cumulative Proportion 0.57215 0.5831 0.59393 0.6043 0.61388 0.62332
##
##          PC25     PC26     PC27     PC28     PC29     PC30
## Standard deviation  2.80966 2.75007 2.70144 2.6614 2.63369 2.58991
## Proportion of Variance 0.00858 0.00822 0.00793 0.0077 0.00754 0.00729
## Cumulative Proportion 0.63190 0.64012 0.64806 0.6558 0.66330 0.67059
##
##          PC31     PC32     PC33     PC34     PC35     PC36
## Standard deviation  2.5549 2.54099 2.50279 2.45059 2.38698 2.34047
## Proportion of Variance 0.0071 0.00702 0.00681 0.00653 0.00619 0.00595
## Cumulative Proportion 0.6777 0.68470 0.69151 0.69804 0.70423 0.71018
##
##          PC37     PC38     PC39     PC40     PC41     PC42
## Standard deviation  2.30101 2.27324 2.26090 2.23538 2.20144 2.1658
## Proportion of Variance 0.00576 0.00562 0.00556 0.00543 0.00527 0.0051
## Cumulative Proportion 0.71594 0.72156 0.72711 0.73254 0.73781 0.7429
##
##          PC43     PC44     PC45     PC46     PC47     PC48
## Standard deviation  2.15143 2.12129 2.10403 2.08230 2.07275 2.04243
## Proportion of Variance 0.00503 0.00489 0.00481 0.00471 0.00467 0.00453
## Cumulative Proportion 0.74794 0.75283 0.75764 0.76236 0.76703 0.77156
##
##          PC49     PC50     PC51     PC52     PC53     PC54
## Standard deviation  2.01848 2.00634 1.96804 1.92712 1.90759 1.90194
## Proportion of Variance 0.00443 0.00438 0.00421 0.00404 0.00396 0.00393
## Cumulative Proportion 0.77599 0.78036 0.78457 0.78861 0.79257 0.79650
##
##          PC55     PC56     PC57     PC58     PC59     PC60
## Standard deviation  1.87404 1.85662 1.84131 1.82564 1.80373 1.78740
## Proportion of Variance 0.00382 0.00375 0.00369 0.00362 0.00354 0.00347
## Cumulative Proportion 0.80032 0.80406 0.80775 0.81137 0.81491 0.81838
##
##          PC61     PC62     PC63     PC64     PC65     PC66
## Standard deviation  1.77323 1.75606 1.73622 1.72513 1.71397 1.70606
## Proportion of Variance 0.00342 0.00335 0.00328 0.00323 0.00319 0.00316
## Cumulative Proportion 0.82180 0.82515 0.82843 0.83166 0.83485 0.83802

```

##		PC67	PC68	PC69	PC70	PC71	PC72
##	Standard deviation	1.68126	1.67339	1.66554	1.64284	1.62118	1.61601
##	Proportion of Variance	0.00307	0.00304	0.00302	0.00293	0.00286	0.00284
##	Cumulative Proportion	0.84109	0.84413	0.84715	0.85008	0.85294	0.85578
##		PC73	PC74	PC75	PC76	PC77	PC78
##	Standard deviation	1.60073	1.58780	1.57860	1.57352	1.55266	1.54019
##	Proportion of Variance	0.00279	0.00274	0.00271	0.00269	0.00262	0.00258
##	Cumulative Proportion	0.85856	0.86130	0.86401	0.86670	0.86932	0.87190
##		PC79	PC80	PC81	PC82	PC83	PC84
##	Standard deviation	1.53059	1.5163	1.50552	1.49565	1.48045	1.47038
##	Proportion of Variance	0.00255	0.0025	0.00246	0.00243	0.00238	0.00235
##	Cumulative Proportion	0.87445	0.8770	0.87941	0.88184	0.88423	0.88658
##		PC85	PC86	PC87	PC88	PC89	PC90
##	Standard deviation	1.45060	1.43884	1.42902	1.42048	1.41553	1.39382
##	Proportion of Variance	0.00229	0.00225	0.00222	0.00219	0.00218	0.00211
##	Cumulative Proportion	0.88886	0.89111	0.89333	0.89553	0.89770	0.89982
##		PC91	PC92	PC93	PC94	PC95	PC96
##	Standard deviation	1.38696	1.37160	1.36702	1.35011	1.33908	1.32731
##	Proportion of Variance	0.00209	0.00204	0.00203	0.00198	0.00195	0.00191
##	Cumulative Proportion	0.90191	0.90395	0.90598	0.90796	0.90991	0.91183
##		PC97	PC98	PC99	PC100	PC101	PC102
##	Standard deviation	1.31682	1.30957	1.29527	1.29167	1.28117	1.26568
##	Proportion of Variance	0.00188	0.00186	0.00182	0.00181	0.00178	0.00174
##	Cumulative Proportion	0.91371	0.91558	0.91740	0.91921	0.92100	0.92274
##		PC103	PC104	PC105	PC106	PC107	PC108
##	Standard deviation	1.25723	1.2501	1.23647	1.23389	1.21815	1.21097
##	Proportion of Variance	0.00172	0.0017	0.00166	0.00165	0.00161	0.00159
##	Cumulative Proportion	0.92446	0.9262	0.92782	0.92947	0.93109	0.93268
##		PC109	PC110	PC111	PC112	PC113	PC114
##	Standard deviation	1.19280	1.19034	1.17144	1.16741	1.15809	1.14779
##	Proportion of Variance	0.00155	0.00154	0.00149	0.00148	0.00146	0.00143
##	Cumulative Proportion	0.93423	0.93577	0.93726	0.93874	0.94020	0.94163
##		PC115	PC116	PC117	PC118	PC119	PC120
##	Standard deviation	1.14351	1.13066	1.12391	1.11659	1.11103	1.0943
##	Proportion of Variance	0.00142	0.00139	0.00137	0.00136	0.00134	0.0013
##	Cumulative Proportion	0.94305	0.94444	0.94581	0.94717	0.94851	0.9498
##		PC121	PC122	PC123	PC124	PC125	PC126
##	Standard deviation	1.08256	1.08109	1.06355	1.05479	1.0513	1.04600
##	Proportion of Variance	0.00127	0.00127	0.00123	0.00121	0.0012	0.00119
##	Cumulative Proportion	0.95108	0.95236	0.95358	0.95479	0.9560	0.95718
##		PC127	PC128	PC129	PC130	PC131	PC132
##	Standard deviation	1.03533	1.01687	1.0078	1.00269	0.99650	0.98843
##	Proportion of Variance	0.00117	0.00112	0.0011	0.00109	0.00108	0.00106
##	Cumulative Proportion	0.95835	0.95947	0.9606	0.96167	0.96275	0.96381
##		PC133	PC134	PC135	PC136	PC137	PC138
##	Standard deviation	0.97774	0.97472	0.96682	0.95176	0.93846	0.93181
##	Proportion of Variance	0.00104	0.00103	0.00102	0.00098	0.00096	0.00094
##	Cumulative Proportion	0.96485	0.96588	0.96690	0.96788	0.96884	0.96979
##		PC139	PC140	PC141	PC142	PC143	PC144
##	Standard deviation	0.92166	0.91660	0.9079	0.90485	0.89368	0.89029
##	Proportion of Variance	0.00092	0.00091	0.0009	0.00089	0.00087	0.00086
##	Cumulative Proportion	0.97071	0.97162	0.9725	0.97341	0.97428	0.97514
##		PC145	PC146	PC147	PC148	PC149	PC150
##	Standard deviation	0.88281	0.86661	0.85242	0.84670	0.84483	0.83019

```

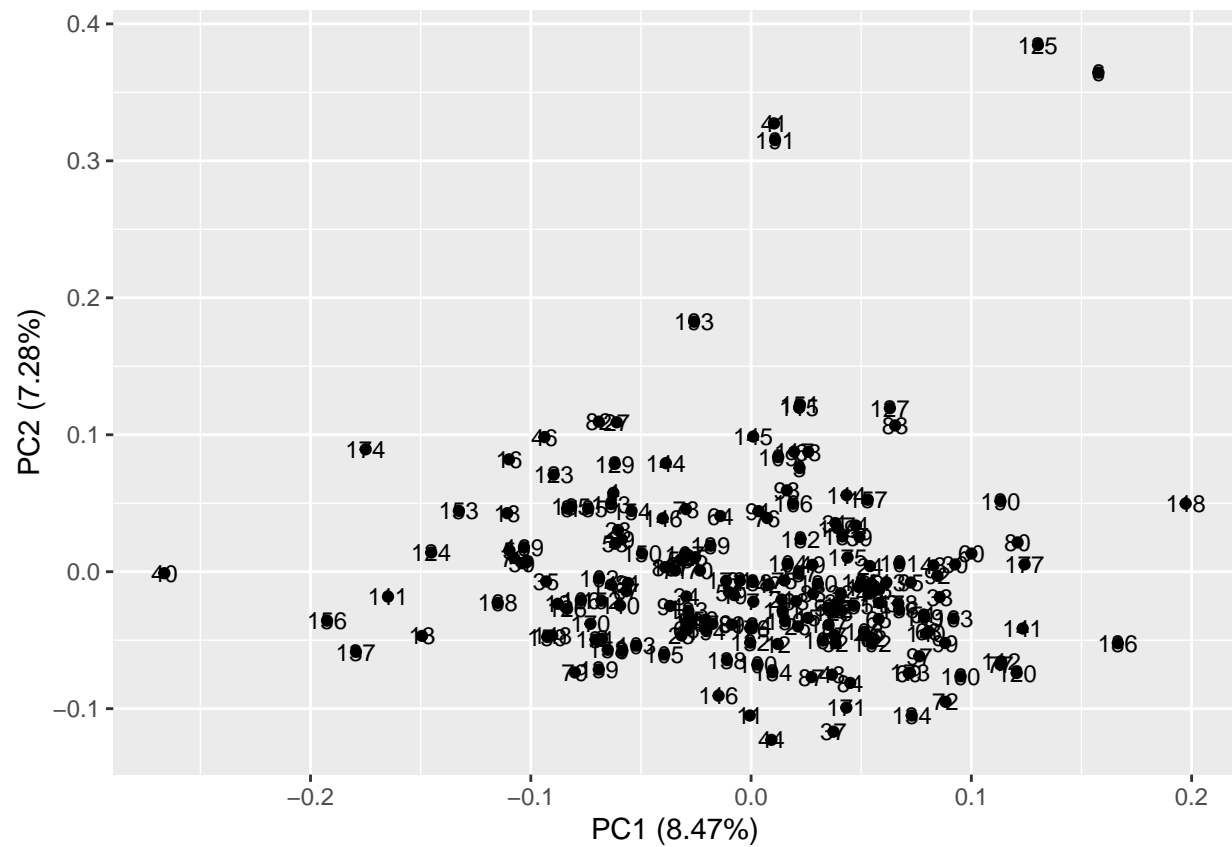
## Proportion of Variance 0.00085 0.00082 0.00079 0.00078 0.00078 0.00075
## Cumulative Proportion 0.97598 0.97680 0.97759 0.97837 0.97915 0.97989
## PC151 PC152 PC153 PC154 PC155 PC156
## Standard deviation 0.82589 0.82472 0.81398 0.80586 0.79882 0.79143
## Proportion of Variance 0.00074 0.00074 0.00072 0.00071 0.00069 0.00068
## Cumulative Proportion 0.98064 0.98138 0.98210 0.98280 0.98350 0.98418
## PC157 PC158 PC159 PC160 PC161 PC162
## Standard deviation 0.78269 0.77829 0.76479 0.76194 0.75875 0.75779
## Proportion of Variance 0.00067 0.00066 0.00064 0.00063 0.00063 0.00062
## Cumulative Proportion 0.98484 0.98550 0.98614 0.98677 0.98739 0.98802
## PC163 PC164 PC165 PC166 PC167 PC168
## Standard deviation 0.74730 0.72910 0.72211 0.71481 0.70799 0.70589
## Proportion of Variance 0.00061 0.00058 0.00057 0.00056 0.00054 0.00054
## Cumulative Proportion 0.98862 0.98920 0.98977 0.99032 0.99087 0.99141
## PC169 PC170 PC171 PC172 PC173 PC174
## Standard deviation 0.69668 0.69305 0.68923 0.67481 0.66802 0.65774
## Proportion of Variance 0.00053 0.00052 0.00052 0.00049 0.00049 0.00047
## Cumulative Proportion 0.99194 0.99246 0.99298 0.99347 0.99396 0.99443
## PC175 PC176 PC177 PC178 PC179 PC180
## Standard deviation 0.65215 0.64870 0.63480 0.62667 0.61966 0.59578
## Proportion of Variance 0.00046 0.00046 0.00044 0.00043 0.00042 0.00039
## Cumulative Proportion 0.99489 0.99535 0.99578 0.99621 0.99663 0.99701
## PC181 PC182 PC183 PC184 PC185 PC186
## Standard deviation 0.59086 0.58798 0.57070 0.55960 0.55545 0.54990
## Proportion of Variance 0.00038 0.00038 0.00035 0.00034 0.00034 0.00033
## Cumulative Proportion 0.99739 0.99777 0.99812 0.99846 0.99880 0.99913
## PC187 PC188 PC189 PC190
## Standard deviation 0.5295 0.51428 0.50715 3.902e-15
## Proportion of Variance 0.0003 0.00029 0.00028 0.000e+00
## Cumulative Proportion 0.9994 0.99972 1.00000 1.000e+00

```

```

# Plot PC1/PC2
autoplot(ABC_pca_2, label = T, label.size = 3)

```



```
# Plot PC2/PC3
autoplot(ABC_pca_2, x=2, y=3, label = T, label.size = 3)
```



