

Supporting Information 1. Input data for QDA models.

Model (PFB): general model based on 266 brachycephalic dogs (100 pugs, 100 French bulldogs, and 66 bulldogs).

Prior probabilities (Grade 0, 1, 2, 3): 0.101, 0.327, 0.414, 0.158

Parameter means

	Te/Ti_m	PEF/PIF_m	PEF/PIF_sd	MV/BW_sd	Te/Ti_sd	MV/BW_m
Grade 0	1.047	0.964	0.138	21.466	0.205	194.589
Grade 1	1.085	0.958	0.132	23.302	0.208	196.190
Grade 2	1.107	1.235	0.282	33.902	0.294	210.431
Grade 3	1.099	1.530	0.336	38.432	0.302	240.009

Covariance matrix, Grade 0

	Te/Ti_m	PEF/PIF_m	PEF/PIF_sd	MV/BW_sd	Te/Ti_sd	MV/BW_m
Te/Ti_m	0.077	-0.022	-0.001	-0.420	0.015	2.248
PEF/PIF_m	-0.022	0.020	0.004	0.904	-0.001	0.349
PEF/PIF_sd	-0.001	0.004	0.003	0.247	0.002	0.187
MV/BW_sd	-0.420	0.904	0.246	84.437	0.277	61.160
Te/Ti_sd	0.0154	-0.001	0.002	0.277	0.008	0.701
MV/BW_m	2.248	0.349	0.187	61.160	0.701	1081.213

Covariance matrix, Grade 1

	Te/Ti_m	PEF/PIF_m	PEF/PIF_sd	MV/BW_sd	Te/Ti_sd	MV/BW_m
Te/Ti_m	0.069	-0.014	-0.002	0.096	0.019	-0.284
PEF/PIF_m	-0.014	0.019	0.005	0.471	-0.002	1.076
PEF/PIF_sd	-0.002	0.005	0.004	0.272	0.001	0.660
MV/BW_sd	0.096	0.471	0.272	68.368	0.326	99.298
Te/Ti_sd	0.019	-0.002	0.001	0.326	0.011	0.077
MV/BW_m	-0.284	1.076	0.660	99.298	0.077	995.253

Covariance matrix, Grade 2

	Te/Ti_m	PEF/PIF_m	PEF/PIF_sd	MV/BW_sd	Te/Ti_sd	MV/BW_m
Te/Ti_m	0.088	-0.040	-0.007	-0.153	0.018	-2.469
PEF/PIF_m	-0.040	0.133	0.031	1.219	-0.005	3.923
PEF/PIF_sd	-0.007	0.031	0.027	0.771	0.007	0.231
MV/BW_sd	-0.153	1.219	0.771	228.855	0.488	695.073
Te/Ti_sd	0.018	-0.005	0.007	0.488	0.018	-0.748
MV/BW_m	-2.469	3.923	0.231	695.073	-0.748	4289.307

Covariance matrix, Grade 3

	Te/Ti_m	PEF/PIF_m	PEF/PIF_sd	MV/BW_sd	Te/Ti_sd	MV/BW_m
Te/Ti_m	0.122	-0.054	-0.019	-2.376	0.038	-9.011
PEF/PIF_m	-0.054	0.259	0.028	-0.167	-0.041	10.185
PEF/PIF_sd	-0.019	0.028	0.022	0.849	0.002	1.076
MV/BW_sd	-2.376	-0.167	0.849	214.985	-0.210	513.437
Te/Ti_sd	0.038	-0.041	0.002	-0.210	0.031	-4.301
MV/BW_m	-9.011	10.185	1.076	513.437	-4.301	4567.593

Model (PD): breed specific model based on 100 pugs.

Prior probabilities (Grade 0, 1, 2, 3): 0.07, 0.26, 0.5, 0.17

Parameter means

	Te/Ti_m	PEF/PIF_m	PEF/PIF_sd	MV/BW_sd	Te/Ti_sd	MV/BW_m
Grade 0	1.268	0.945	0.166	22.200	0.298	209.835
Grade 1	1.138	0.989	0.122	25.063	0.240	189.377
Grade 2	1.152	1.310	0.317	32.211	0.330	191.267
Grade 3	1.338	1.440	0.315	32.288	0.363	209.702

Covariance matrix, Grade 0

	Te/Ti_m	PEF/PIF_m	PEF/PIF_sd	MV/BW_sd	Te/Ti_sd	MV/BW_m
Te/Ti_m	0.170	-0.044	-0.009	-1.039	0.015	4.096
PEF/PIF_m	-0.044	0.030	0.006	1.008	0.000	-1.811
PEF/PIF_sd	-0.009	0.006	0.004	0.366	0.001	-0.182
MV/BW_sd	-1.039	1.008	0.366	60.964	0.122	-26.953
Te/Ti_sd	0.015	0.000	0.001	0.122	0.005	0.701
MV/BW_m	4.096	-1.811	-0.182	-26.953	0.701	306.191

Covariance matrix, Grade 1

	Te/Ti_m	PEF/PIF_m	PEF/PIF_sd	MV/BW_sd	Te/Ti_sd	MV/BW_m
Te/Ti_m	0.108	-0.012	-0.003	0.476	0.039	1.005
PEF/PIF_m	-0.012	0.022	0.006	0.192	-0.001	1.339
PEF/PIF_sd	-0.003	0.006	0.003	0.085	0.000	0.308
MV/BW_sd	0.476	0.192	0.085	61.662	0.393	75.789
Te/Ti_sd	0.039	-0.001	0.000	0.393	0.019	-0.063
MV/BW_m	1.005	1.339	0.308	75.789	-0.063	1338.458

Covariance matrix, Grade 2

	Te/Ti_m	PEF/PIF_m	PEF/PIF_sd	MV/BW_sd	Te/Ti_sd	MV/BW_m
Te/Ti_m	0.070	-0.018	-0.005	0.430	0.016	1.304
PEF/PIF_m	-0.018	0.149	0.028	0.935	-0.011	2.969
PEF/PIF_sd	-0.005	0.028	0.033	0.388	0.007	-1.935
MV/BW_sd	0.430	0.935	0.388	193.681	0.359	507.174
Te/Ti_sd	0.016	-0.011	0.007	0.359	0.018	-1.728
MV/BW_m	1.304	2.969	-1.935	507.174	-1.728	3260.834

Covariance matrix, Grade 3

	Te/Ti_m	PEF/PIF_m	PEF/PIF_sd	MV/BW_sd	Te/Ti_sd	MV/BW_m
Te/Ti_m	0.083	-0.008	-0.004	-0.103	0.032	-3.992
PEF/PIF_m	-0.008	0.244	0.005	-2.512	-0.039	6.446
PEF/PIF_sd	-0.004	0.005	0.011	0.484	0.006	-0.498
MV/BW_sd	-0.103	-2.512	0.484	181.914	0.916	269.642
Te/Ti_sd	0.032	-0.039	0.006	0.916	0.030	-2.713
MV/BW_m	-3.992	6.446	-0.498	269.642	-2.713	3471.749

Model (FB): breed specific model based on 100 French bulldogs.

Prior probabilities (Grade 0, 1, 2, 3): 0.1, 0.34, 0.41, 0.15

Parameter means

	Te/Ti_m	PEF/PIF_m	PEF/PIF_sd	MV/BW_sd	Te/Ti_sd	MV/BW_m
Grade 0	0.957	1.037	0.139	26.168	0.172	212.021
Grade 1	1.093	0.981	0.176	26.939	0.223	215.883
Grade 2	1.117	1.235	0.286	38.234	0.290	235.494
Grade 3	0.923	1.749	0.414	45.056	0.288	268.068

Covariance matrix, Grade 0

	Te/Ti_m	PEF/PIF_m	PEF/PIF_sd	MV/BW_sd	Te/Ti_sd	MV/BW_m
Te/Ti_m	0.028	-0.016	-0.003	-0.650	0.003	1.112
PEF/PIF_m	-0.016	0.017	0.003	0.924	0.002	-1.652
PEF/PIF_sd	-0.003	0.003	0.001	0.188	0.001	-0.303
MV/BW_sd	-0.650	0.924	0.188	115.594	0.318	-180.928
Te/Ti_sd	0.003	0.002	0.001	0.318	0.003	-0.585
MV/BW_m	1.112	-1.652	-0.303	-180.928	-0.585	714.316

Covariance matrix, Grade 1

	Te/Ti_m	PEF/PIF_m	PEF/PIF_sd	MV/BW_sd	Te/Ti_sd	MV/BW_m
Te/Ti_m	0.080	-0.027	-0.004	-0.652	0.013	-2.217
PEF/PIF_m	-0.027	0.023	0.006	0.625	-0.006	0.209
PEF/PIF_sd	-0.004	0.006	0.004	0.199	-0.001	-0.108
MV/BW_sd	-0.652	0.625	0.199	69.565	0.110	35.016
Te/Ti_sd	0.013	-0.006	-0.001	0.110	0.010	-0.504
MV/BW_m	-2.217	0.209	-0.108	35.016	-0.504	554.613

Covariance matrix, Grade 2

	Te/Ti_m	PEF/PIF_m	PEF/PIF_sd	MV/BW_sd	Te/Ti_sd	MV/BW_m
Te/Ti_m	0.134	-0.102	-0.022	-1.259	0.021	-7.510
PEF/PIF_m	-0.102	0.143	0.035	1.869	-0.015	8.751
PEF/PIF_sd	-0.022	0.035	0.023	1.334	0.003	3.074
MV/BW_sd	-1.259	1.869	1.334	318.541	0.697	1071.959
Te/Ti_sd	0.021	-0.015	0.003	0.697	0.019	1.342
MV/BW_m	-7.510	8.751	3.074	1071.959	1.342	5670.779

Covariance matrix, Grade 3

	Te/Ti_m	PEF/PIF_m	PEF/PIF_sd	MV/BW_sd	Te/Ti_sd	MV/BW_m
Te/Ti_m	0.124	-0.098	-0.038	-3.154	0.045	-6.815
PEF/PIF_m	-0.098	0.345	0.041	0.693	-0.079	16.927
PEF/PIF_sd	-0.038	0.041	0.029	1.019	-0.007	0.198
MV/BW_sd	-3.154	0.693	1.019	283.464	-1.052	743.391
Te/Ti_sd	0.045	-0.079	-0.007	-1.052	0.042	-5.542
MV/BW_m	-6.815	16.927	0.198	743.391	-5.542	6261.032

Model (BD): breed specific model based on 66 bulldogs.

Prior probabilities (Grade 0, 1, 2, 3): 0.152, 0.409, 0.288, 0.152

Parameter means

	Te/Ti_m	PEF/PIF_m	PEF/PIF_sd	MV/BW_sd	Te/Ti_sd	MV/BW_m
Grade 0	0.982	0.905	0.117	16.250	0.174	166.484
Grade 1	1.024	0.900	0.086	17.027	0.160	177.952
Grade 2	0.968	1.036	0.179	29.004	0.207	206.779
Grade 3	0.958	1.354	0.254	38.943	0.218	249.443

Covariance matrix, Grade 0

	Te/Ti_m	PEF/PIF_m	PEF/PIF_sd	MV/BW_sd	Te/Ti_sd	MV/BW_m
Te/Ti_m	0.030	-0.011	0.002	0.096	0.010	-0.251
PEF/PIF_m	-0.011	0.011	0.002	0.304	0.000	0.834
PEF/PIF_sd	0.002	0.002	0.002	0.140	0.003	-0.027
MV/BW_sd	0.096	0.304	0.140	32.490	0.337	112.945
Te/Ti_sd	0.010	0.000	0.003	0.337	0.010	0.690
MV/BW_m	-0.251	0.834	-0.027	112.945	0.690	808.985

Covariance matrix, Grade 1

	Te/Ti_m	PEF/PIF_m	PEF/PIF_sd	MV/BW_sd	Te/Ti_sd	MV/BW_m
Te/Ti_m	0.015	-0.006	0.000	0.158	0.005	-0.087
PEF/PIF_m	-0.006	0.007	0.000	0.033	-0.002	0.511
PEF/PIF_sd	0.000	0.000	0.001	0.074	0.001	-0.055
MV/BW_sd	0.158	0.033	0.074	17.267	0.116	10.608
Te/Ti_sd	0.005	-0.002	0.001	0.116	0.004	-0.136
MV/BW_m	-0.087	0.511	-0.055	10.608	-0.136	402.121

Covariance matrix, Grade 2

	Te/Ti_m	PEF/PIF_m	PEF/PIF_sd	MV/BW_sd	Te/Ti_sd	MV/BW_m
Te/Ti_m	0.016	-0.003	-0.001	0.100	0.002	-0.513
PEF/PIF_m	-0.003	0.024	0.006	0.008	0.004	-0.511
PEF/PIF_sd	-0.001	0.006	0.007	0.241	0.003	1.090
MV/BW_sd	0.100	0.008	0.241	74.707	0.188	90.033
Te/Ti_sd	0.002	0.004	0.003	0.188	0.004	-0.990
MV/BW_m	-0.513	-0.511	1.090	90.033	-0.990	2030.671

Covariance matrix, Grade 3

	Te/Ti_m	PEF/PIF_m	PEF/PIF_sd	MV/BW_sd	Te/Ti_sd	MV/BW_m
Te/Ti_m	0.031	-0.005	-0.003	-0.934	0.003	0.047
PEF/PIF_m	-0.005	0.079	0.006	-0.726	0.003	-4.899
PEF/PIF_sd	-0.003	0.006	0.016	0.360	0.004	1.481
MV/BW_sd	-0.934	-0.726	0.360	70.298	-0.042	36.372
Te/Ti_sd	0.003	0.003	0.004	-0.042	0.006	-1.131
MV/BW_m	0.047	-4.899	1.481	36.372	-1.131	1750.422