

Oikos

OIK-00755

Labocha, M. K., Schutz, H. and Hayes, J. P. 2013.
Which body condition index is best? – Oikos 000:
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Appendix A1

Supplementary material Appendix 1. Pearson correlations between morphometric measurements and body mass in *Mus musculus*.

Females (N = 35)

	body mass	body length	head length	zygomatic breadth	hind foot length	chest circumference	pelvic circumference
body mass	1	0.739**	0.379*	0.277	0.554**	0.470**	0.568**
body length	0.739**	1	0.647**	0.219	0.669**	-0.023	0.229
head length	0.379*	0.647**	1	0.315	0.629**	-0.156	0.012
zygomatic breadth	0.277	0.219	0.315	1	0.421*	0.101	0.380*
hind foot length	0.554**	0.669**	0.629**	0.421*	1	0.021	0.311
chest circumference	0.470**	-0.023	-0.156	0.101	0.021	1	0.406*
pelvic circumference	0.568**	0.229	0.012	0.380*	0.311	0.406*	1

Males (N = 36)

	body mass	body length	head length	zygomatic breadth	hind foot length	chest circumference	pelvic circumference
body mass	1	0.660**	0.567**	0.476**	0.740**	0.324	0.597**
body length	0.660**	1	0.453**	0.381*	0.520**	-0.011	0.450**
head length	0.567**	0.453**	1	0.285	0.408*	0.039	0.171
zygomatic breadth	0.476**	0.381*	0.285	1	0.386*	0.026	0.454**
hind foot length	0.740**	0.520**	0.408*	0.386*	1	0.349*	0.547**
chest circumference	0.324	-0.011	0.039	0.026	0.349*	1	0.222
pelvic circumference	0.597**	0.450**	0.171	0.454**	0.547**	0.222	1

* p-value <0.05; ** p-value <0.01

Which body condition index is best? Labocha M.K., Hayes J.P. & Schutz H.

Appendix A2

Principal component analysis for females and males of *Mus musculus*: (a) principal components (PC) for females, (b) total variance explained by principal components in females, (c) principal components (PC) for males, (d) total variance explained by principal components in males.

(a) Principal components 1 to 5 in females (n = 35)

Morphometric trait	PC1	PC2	PC3	PC4	PC5
body_length	0.822	-0.284	-0.312	-0.145	0.354
head_length	0.790	-0.435	0.169	-0.251	-0.309
zygomatic_breadth	0.596	0.508	0.601	-0.046	0.156
left_hind_foot_lenght	0.884	-0.067	-0.062	0.452	-0.084
pelvic_circumference	0.431	0.774	-0.419	-0.125	-0.153

(b) Total variance explained by PC's in females

Component	Eigenvalues		
	Total	Variability (%)	Cumulative %
PC1	2.621	52.412	52.412
PC2	1.132	22.636	75.048
PC3	0.666	13.326	88.374
PC4	0.306	6.116	94.49
PC5	0.275	5.51	100

(c) Principal components 1 to 5 in males (n = 36)

Morphometric trait	PC1	PC2	PC3	PC4	PC5
body_length	0.784	0.186	-0.172	0.558	-0.097
head_length	0.611	0.710	0.151	-0.194	0.247
zygomatic_breadth	0.681	-0.281	0.664	0.003	-0.127
left_hind_foot_lenght	0.806	-0.024	-0.320	-0.351	-0.353
pelvic_circumference	0.735	-0.502	-0.206	-0.052	0.402

(d) Total variance explained by PC's in males

Component	Eigenvalues		
	Total	Variability (%)	Cumulative %
PC1	2.642	52.831	52.831
PC2	0.871	17.416	70.248
PC3	0.639	12.782	83.030
PC4	0.476	9.510	92.540
PC5	0.373	7.460	100.000

Supplementary material Appendix 3. The slopes and intercepts for multiple regression models and condition indices used to predict body fat mass (BFMass), residual fat mass (resBFM), and body fat percentage (BF%) in *Mus musculus*.

Multiple regressions predicting BFMass in females (N = 35)

Independent variables										
Intercept	BM	BL	ZB	FL	CC	PLC	r^2_{adj}	AICc	$\Delta AICc$	p
-1.03	0.13		-0.36			0.08	0.55	-69.45	0	<0.01
-2.30	0.12		-0.38	0.10		0.08	0.55	-67.05	2.40	<0.01
-0.02	0.14		-0.36		-0.03	0.08	0.54	-67.03	2.42	<0.01
-1.18	0.17	-0.01					0.36	-58.56	10.89	<0.01
-1.67	0.15						0.38	-60.97	8.49	<0.01

BM-body mass, BL – body length, ZB – zygomatic breadth, FL – foot length, CC – chest circumference, PLC – pelvic circumference

Which body condition index is best? Labocha M.K., Hayes J.P. & Schutz H.

Multiple regressions predicting BF% in females (N = 35)

Independent variables									
Intercept	BM	BL	ZB	FL	PLC	r^2_{adj}	AICc	$\Delta AICc$	p
3.73			-1.32		0.37	0.30	26.38	0	<0.01
-0.79		0.08	-1.40		0.35	0.32	27.05	0.66	<0.01
-4.03			-1.51	0.67	0.35	0.31	27.30	0.92	<0.01
3.98	0.29	-0.03				0.05	37.28	10.89	0.18
2.54	0.25					0.07	34.81	8.43	0.06

BM-body mass, BL – body length, ZB – zygomatic breadth, FL – foot length, PLC – pelvic circumference

Which body condition index is best? Labocha M.K., Hayes J.P. & Schutz H.

Multiple regressions predicting resBFM in females (N = 35)

Independent variables									
Intercept	BM	BL	HL	ZB	PLC	r^2_{adj}	AICc	$\Delta AICc$	p
-2.51				-0.38	0.12	0.39	-67.56	0	<0.01
0.56	0.07		-0.12	-0.32	0.08	0.44	-66.88	0.68	<0.01
0.49	0.11	-0.04		-0.37	0.08	0.44	-66.86	0.70	<0.01
1.18	0.17	-0.06				0.22	-58.57	8.99	0.01
-1.96	0.08					0.09	-54.92	12.64	0.04

BM-body mass, BL – body length, HL- head length, ZB – zygomatic breadth, PLC – pelvic circumference

Which body condition index is best? Labocha M.K., Hayes J.P. & Schutz H.

Condition indices predicting BFMass in females (N = 35)

Index	Intercept	Slope	r^2_{adj}	AICc	$\Delta AICc$	p
BM/BL	-2.62	18.06	0.27	-55.51	13.94	<0.01
BM/BL ²	1.18	387.56	-0.01	-44.08	25.37	0.40
BM/BL ³	2.87	-18220.78	-0.02	-43.77	25.68	0.52
BM/BL ^x	-1.86	54.37	0.18	-51.17	18.28	0.01
³ √BM/BL	3.97	-52.99	-0.02	-43.74	25.71	0.54
logBM/logBL	-14.10	22.98	0.34	-58.78	10.67	<0.01
BM/prBM	-1.86	4.16	0.18	-51.22	18.23	0.01
logBM/prBM	-11.42	13.72	0.18	-51.43	18.02	0.01
BM/pr-nonBM	-1.84	4.14	0.18	-51.11	18.34	0.01
resBM/BL	2.30	0.17	0.19	-51.76	17.69	0.01
resBM/BL ³	2.30	0.17	0.20	-52.02	17.43	<0.01
reslogBM/logBL	2.30	9.86	0.19	-51.60	17.85	0.01
resnonlBM/BL	2.30	0.17	0.19	-51.65	17.80	0.01
resPLC/BL	2.30	0.001	-0.03	-43.33	26.12	0.97

Which body condition index is best? Labocha M.K., Hayes J.P. & Schutz H.

resCC/BL	2.31	-0.03	0.00	-44.38	25.07	0.32
SMI	0.02	0.09	0.04	-45.88	23.57	0.12

For condition indices abbreviations see Table1 in paper, x value for slope-adjusted ratio index is 1.28

Which body condition index is best? Labocha M.K., Hayes J.P. & Schutz H.

Condition indices predicting BF% in females (N = 35)

Index	Intercept	Slope	r^2_{adj}	AICc	$\Delta AICc$	p
BM/BL	0.60	30.56	0.05	35.51	9.13	0.10
BM/BL ²	6.68	775.31	-0.02	38.19	11.81	0.60
BM/BL ³	9.64	-22947.52	-0.03	38.41	12.03	0.80
BM/BL ^x	1.74	94.08	0.03	36.39	10.01	0.16
$\sqrt[3]{BM/BL}$	10.82	-60.30	-0.03	38.43	12.05	0.83
logBM/logBL	-18.33	38.20	0.07	34.98	8.60	0.07
BM/prBM	1.76	7.17	0.03	36.40	10.02	0.16
logBM/prBM	-14.62	23.55	0.03	36.36	9.98	0.16
BM/pr-nonBM	1.76	7.17	0.03	36.40	10.02	0.16
resBM/BL	8.93	0.29	0.03	36.24	9.86	0.15
resBM/BL ³	8.93	0.31	0.04	36.02	9.64	0.13
reslogBM/logBL	8.93	16.94	0.03	36.32	9.94	0.16
resnonlBM/BL	8.93	0.29	0.03	36.24	9.86	0.15
resPLC/BL	8.93	0.05	-0.02	38.19	11.81	0.60

Which body condition index is best? Labocha M.K., Hayes J.P. & Schutz H.

resCC/BL	8.94	-0.05	-0.02	38.22	11.83	0.62
SMI	4.76	0.16	-0.01	37.67	11.29	0.39

For condition indices abbreviations see Table1 in paper, x value for slope-adjusted ratio index is 1.28

Which body condition index is best? Labocha M.K., Hayes J.P. & Schutz H.

Condition indices predicting resBFM in females (N = 35)

Index	Intercept	Slope	r^2_{adj}	AICc	$\Delta AICc$	p
BM/BL	-4.08	14.94	0.22	-60.40	7.16	<0.01
BM/BL ²	-2.91	1002.63	0.15	-57.20	10.36	0.01
BM/BL ³	-1.22	39270.84	0.04	-53.08	14.48	0.12
BM/BL ^x	-4.24	55.47	0.23	-60.84	6.72	<0.01
$\sqrt[3]{BM/BL}$	-3.80	121.13	0.05	-53.21	14.35	0.11
logBM/logBL	-11.38	15.94	0.19	-58.76	8.80	<0.01
BM/prBM	-4.22	4.22	0.23	-60.78	6.78	<0.01
logBM/prBM	-13.70	13.70	0.23	-60.68	6.88	0.01
BM/pr-nonBM	-4.24	4.24	0.25	-61.72	5.84	<0.01
resBM/BL	0.00	0.17	0.24	-61.13	6.43	<0.01
resBM/BL ³	0.00	0.17	0.24	-60.68	6.88	<0.01
reslogBM/logBL	0.00	9.81	0.23	-60.78	6.78	<0.01
resnonlBM/BL	-0.00	0.17	0.23	-60.84	6.72	<0.01
resPLC/BL	-0.01	0.05	0.08	-54.59	12.97	0.05

Which body condition index is best? Labocha M.K., Hayes J.P. & Schutz H.

resCC/BL	-0.00	0.03	0.01	-51.84	15.72	0.26
SMI	-3.62	0.14	0.19	-59.07	8.49	<0.01

For condition indices abbreviations see Table1 in paper, x value for slope-adjusted ratio index is 1.28

Which body condition index is best? Labocha M.K., Hayes J.P. & Schutz H.

Multiple regressions predicting BFMass in males (N = 36)

Independent variables									
Intercept	BM	BL	HL	ZB	PLC	r^2_{adj}	AICc	$\Delta AICc$	p
-8.35			0.24	-0.52	0.19	0.27	-8.39	0	<0.01
-2.79	0.13			-0.54	0.14	0.27	-8.18	0.21	<0.01
-3.48				-0.43	0.19	0.23	-7.90	0.49	<0.01
0.13	0.19	-0.03				0.10	-2.36	6.03	0.06
-2.27	0.16					0.12	-4.58	3.81	0.02

BM-body mass, BL – body length, HL – head length, ZB – zygomatic breadth, PLC – pelvic circumference

Which body condition index is best? Labocha M.K., Hayes J.P. & Schutz H.

Multiple regressions predicting BF% in males (N = 36)

Independent variables										
Intercept	BM	BL	HL	ZB	FL	PLC	r^2_{adj}	AICc	$\Delta AICc$	p
-0.95				-1.65		0.51	0.19	75.20	0	0.01
-11.04			0.50	-1.84		0.50	0.19	76.58	1.38	0.02
-8.80				-1.73	0.69	0.46	0.17	77.50	2.30	0.03
9.79	0.35	-0.12					-0.01	83.17	7.97	0.48
1.46	0.24						0.01	80.98	5.78	0.28

BM-body mass, BL – body length, HL – head length, ZB – zygomatic breadth, FL – foot length, PLC – pelvic circumference

Which body condition index is best? Labocha M.K., Hayes J.P. & Schutz H.

Multiple regressions predicting resBFM in males (N = 36)

Independent variables									
Intercept	BM	BL	HL	ZB	PLC	r^2_{adj}	AICc	$\Delta AICc$	p
-3.91				-0.49	0.17	0.19	-7.42	0	0.01
-7.51			0.18	-0.56	0.17	0.21	-6.41	1.01	0.02
-3.46	0.09			-0.56	0.14	0.19	-5.93	1.49	0.02
3.01	0.19	-0.09				0.07	-2.36	5.06	0.11
-3.28	0.11					0.04	-2.90	4.52	0.12

BM-body mass, BL – body length, HL – head length, ZB – zygomatic breadth, PLC – pelvic circumference

Which body condition index is best? Labocha M.K., Hayes J.P. & Schutz H.

Condition indices predicting BFMass in males (N = 36)

Index	Intercept	Slope	r^2_{adj}	AICc	ΔAICc	p
BM/BL	-3.55	19.98	0.12	-4.38	4.01	0.02
BM/BL ²	-1.57	1310.31	0.04	-1.37	7.02	0.13
BM/BL ³	1.14	44111.64	-0.02	0.64	9.03	0.50
BM/BL ^x	-2.91	211.37	0.08	-2.91	5.48	0.05
$\sqrt[3]{\text{BM/BL}}$	-2.14	147.58	-0.01	0.56	8.95	0.47
logBM/logBL	-17.67	27.32	0.12	-4.58	3.81	0.02
BM/prBM	-2.93	5.50	0.08	-2.97	5.42	0.05
logBM/prBM	-16.41	18.99	0.08	-3.12	5.27	0.05
BM/pr-nonBM	-2.91	5.49	0.08	-2.92	5.47	0.05
resBM/BL	2.58	0.19	0.09	-3.43	4.96	0.04
resBM/BL ³	2.58	0.20	0.09	-3.52	4.87	0.04
reslogBM/logBL	2.58	13.09	0.09	-3.25	5.14	0.04
resnonlBM/BL	2.57	0.19	0.09	-3.39	5.00	0.04
resBM/PC1	2.57	0.16	0.01	-0.31	8.08	0.25

Which body condition index is best? Labocha M.K., Hayes J.P. & Schutz H.

resPLC/BL	2.58	0.15	0.13	-5.13	3.26
resCC/BL	2.58	0.08	0.03	-0.87	7.52
SMI	-0.68	0.11	0.02	-0.58	7.80

For condition indices abbreviations see Table1 in paper, x value for slope-adjusted ratio index is 1.54

Which body condition index is best? Labocha M.K., Hayes J.P. & Schutz H.

Condition indices predicting BF% in males (N = 36)

Index	Intercept	Slope	r^2_{adj}	AICc	$\Delta AICc$	p
BM/BL	-1.53	33.10	0.01	80.71	5.51	0.24
BM/BL ²	0.49	2570.71	0.00	81.23	6.03	0.34
BM/BL ³	4.77	117688	-0.02	81.85	6.65	0.56
BM/BL ^x	-1.23	379.88	0.01	80.90	5.70	0.27
$\sqrt[3]{BM/BL}$	-4.14	399.37	-0.02	81.78	6.58	0.52
logBM/logBL	-23.91	43.88	0.01	80.76	5.56	0.24
BM/prBM	-1.19	9.80	0.01	80.90	5.70	0.27
logBM/prBM	-25.20	33.81	0.01	80.86	5.66	0.26
BM/pr-nonBM	-1.24	9.86	0.01	80.89	5.69	0.27
resBM/BL	8.61	0.35	0.01	80.71	5.51	0.24
resBM/BL ³	8.61	0.37	0.01	80.62	5.42	0.22
reslogBM/logBL	8.61	23.42	0.01	80.80	5.60	0.25
resnonlBM/BL	8.61	0.36	0.01	80.70	5.50	0.23
resBM/PC1	8.61	0.22	-0.02	81.91	6.71	0.60

Which body condition index is best? Labocha M.K., Hayes J.P. & Schutz H.

resPLC/BL	8.61	0.39	0.10	77.55	2.35
resCC/BL	8.61	0.19	0.01	80.49	5.74
SMI	1.80	0.23	-0.01	81.44	6.24

For condition indices abbreviations see Table1 in paper, x value for slope-adjusted ratio index is 1.54

Which body condition index is best? Labocha M.K., Hayes J.P. & Schutz H.

Condition indices predicting resBFM in males (N = 36)

Index	Intercept	Slope	r^2_{adj}	AICc	$\Delta AICc$	p
BM/BL	-5.31	17.32	0.08	-4.37	3.05	0.05
BM/BL ²	-5.03	1590.66	0.08	-4.04	3.38	0.06
BM/BL ³	-2.97	90910.24	0.03	-2.34	5.08	0.15
BM/BL ^x	-5.61	216.47	0.09	-4.57	2.85	0.04
$\sqrt[3]{BM/BL}$	-9.34	292.41	0.04	-2.53	4.89	0.14
logBM/logBL	-16.46	22.21	0.07	-3.97	3.45	0.06
BM/prBM	-5.58	5.58	0.09	-4.54	2.88	0.04
logBM/prBM	-18.97	18.97	0.09	-4.56	2.86	0.04
BM/pr-nonBM	-5.61	5.61	0.09	-4.57	2.85	0.04
resBM/BL	0.00	0.19	0.10	-4.90	2.52	0.04
resBM/BL ³	-0.00	0.20	0.10	-4.56	2.86	0.03
reslogBM/logBL	0.00	13.04	0.09	-4.66	2.76	0.04
resnonlBM/BL	-0.00	0.20	0.10	-4.94	2.48	0.03
resBM/PC1	0.00	0.16	0.01	-1.65	5.77	0.24

Which body condition index is best? Labocha M.K., Hayes J.P. & Schutz H.

resPLC/BL	-0.00	0.14	0.14	-6.66	0.76	0.01
resCC/BL	-0.00	0.08	0.03	-2.23	5.19	0.17
SMI	-4.46	0.15	0.06	-3.55	3.87	0.08

For condition indices abbreviations see Table1 in paper, x value for slope-adjusted ratio index is 1.54

Which body condition index is best? Labocha M.K., Hayes J.P. & Schutz H.

Multiple regression of statistically controlled density body condition (SDBC) predicting fat content in females (N = 35)

	Independent variables								
	Intercept	BM ^{1/3}	BL	AV ^{1/3}	PLC	r ² _{adj}	AICc	ΔAICc	p
BFM									
	-10.39	3.02	-0.01	0.24		0.36	-56.62	12.83	<0.01
	-10.08	3.20	0.00		0.05	0.37	-57.43	12.02	<0.01
BF%									
	-13.03	2.63	-0.03	0.86		0.04	39.28	12.90	0.26
	-11.96	2.95	0.01		0.18	0.06	38.37	11.99	0.18
resBFM									
	-8.03	3.02	-0.06	0.24		0.21	-56.62	10.94	0.02
	-7.72	3.20	-0.05		0.05	0.23	-57.43	10.13	0.01

BM^{1/3}-cubic-root of body mass, BL – body length, AV^{1/3}- cubic-root of abdomen volume, PLC – pelvic circumference

Which body condition index is best? Labocha M.K., Hayes J.P. & Schutz H.

Multiple regression of statistically controlled density body condition (SDBC) predicting fat content in males (N = 36)

Independent variables									
	Intercept	BM ^{1/3}	BL	AV ^{1/3}	PLC	r ² _{adj}	AICc	ΔAICc	p
BFM									
	-12.74	2.83	-0.06	0.57		0.14	-2.25	6.14	0.05
	-10.79	3.36	-0.04		0.11	0.16	-2.95	5.44	0.04
BF%									
	-15.12	0.82	-0.20	1.91		0.03	83.06	7.86	0.26
	-8.67	2.88	-0.15		0.36	0.04	82.60	7.40	0.22
resBFM									
	-9.86	2.83	-0.11	0.57		0.11	-2.25	5.17	0.09
	-7.91	3.36	-0.10		0.11	0.13	-2.95	4.47	0.06

BM^{1/3}-cubic-root of body mass, BL – body length, AV^{1/3}- cubic-root of abdomen volume, PLC – pelvic circumference

Which body condition index is best? Labocha M.K., Hayes J.P. & Schutz H.