Correlation of Body Weight and External Body Measurements in Philippine Deer and Philippine Monkey

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Introduction

Importance of Animal Weight Determination

- Assessment of growth rate
- Determination of market value
- Selection of breeding stock
- Calculation of drug dosage
- General health index

Methods of Animal Weight Determination

- Weighing scale
- Visual or ocular estimation
- Body measurements

Previous Studies in the Philippines

- Swine (Eusebio *et al*., 1957; Murillo and Valdez, 2004)
- Cattle (Ovejera, 1960; Matias *et al*., 2002; Bagui and Valdez, 2007)
- Water buffalo (Esguerra *et al*., 1972; Del Pilar *et al*., 2002)
- Goat (Valdez *et al*., 1981)
- Sheep (Valdez *et al*., 1997)
- Native dog (Amba, 1990; Valdez and Valencia, 2004)
- Native cat (Valdez and Recuenco, 2003)
- Native horse (Macatangay and Valdez, 2002)
- Labrador Retriever dog (Lalic and Valdez, 2005)
- Thoroughbred horse (Marante *et al*., 2007)

Objectives of Study

- To determine the relationship between body weight and external body measurements
- To establish prediction equations for body weight determination
- To develop tables for body weight determination

Experimental Animals

- **Deer (28 males; 52 females)**
  8-48 months (raised in confinement)
- **Monkey (64 males; 185 females)**
  1-146 months (raised in confinement)

Materials Used

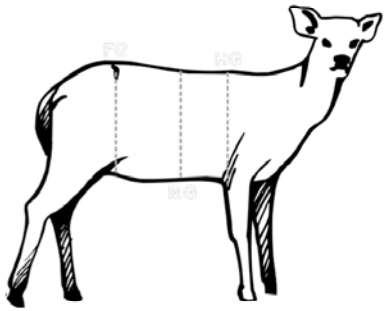
- Tape measure
- Weighing scale

External Body Parameters Measured

- Actual Body Weight – live weight in kilograms

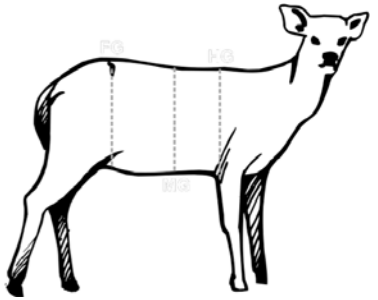
External Body Parameters Measured

- Heart girth (HG) or chest girth (CG) – chest circumference immediately behind the front legs shoulder and withers



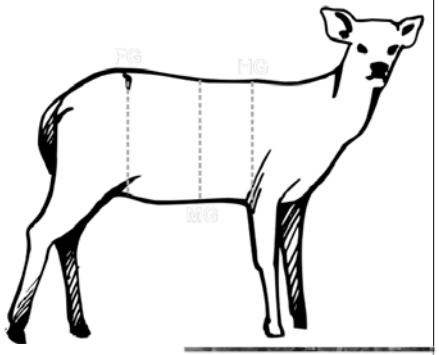
External Body Parameters Measured

- Midriff girth (MG) – circumference of the abdominal region at the level of the umbilicus or just in front of the prepuce in males



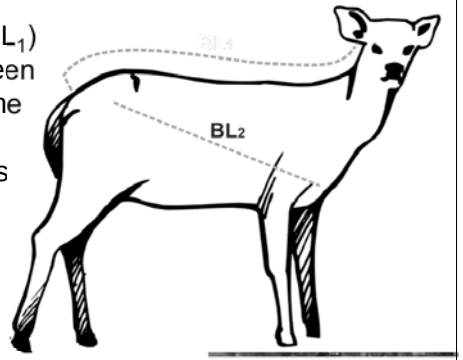
External Body Parameters Measured

- Flank girth (FG) – circumference of the pelvic region just in front of the hip



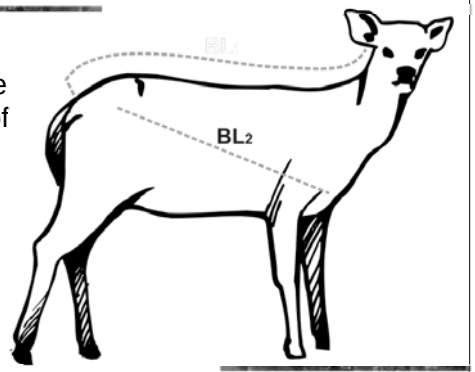
External Body Parameters Measured

- Body length 1 (BL_1) – distance between the tail base to the point midway between the ears



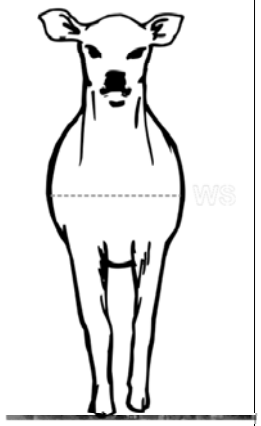
External Body Parameters Measured

- Body length 2 (BL_2) – distance from the point of the shoulder to the pin bone



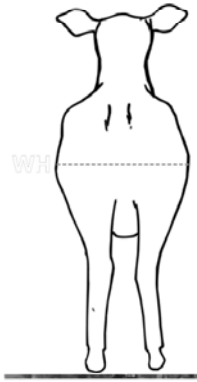
External Body Parameters Measured

- Width of the shoulder (WS) – widest portion across the chest, that is, between the points of the shoulder

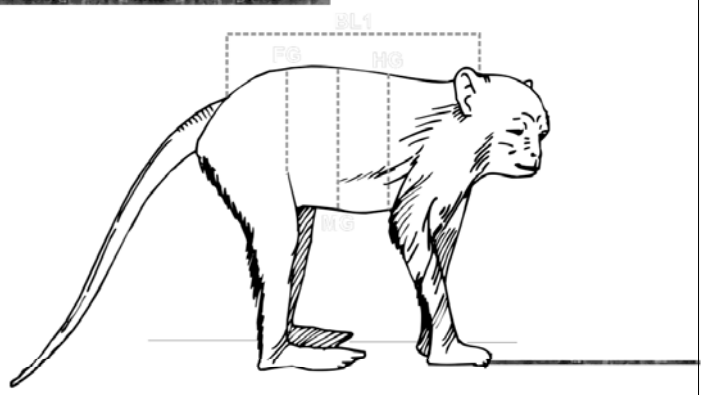


External Body Parameters Measured

- Width of the hips (WH) – measurement across the hindquarters between the points of the hip



External Body Parameters Measured



Statistical Analysis

- Species grouping by age and sex
- Data analysis using Statistical Analysis System (SAS)
- Correlation analysis of body weight and measurements
- SAS stepwise regression analysis

Simple BW=a+bx

Where a= intercept, b= slope of regression, x = body measurement

Multiple $BW= a+b_1x_1+b_2x_2$

Where a= intercept, b_1,b_2 = regression coefficient, x_1,x_2 = body measurement

RESULTS

Correlation values between body weight and measurement in deer

Sex	Age	Hearth	Midriff	Flank	Body	Body	Width at	Width at
	(months)	Girth	Girth	Girth	Length1	Lenght2	Shoulders	Hips
F	8-11	0.99	0.97	0.86	0.97	0.49	0.87	0.79
F	12-35	0.70	0.88	0.84	0.46	0.79	0.55	0.81
F	36-47	0.22	0.60	0.34	0.40	0.18	0.06	0.55
F	48 and above	0.51	0.80	0.56	-0.45	0.26	0.40	0.63
F	(all)	0.86	0.94	0.76	0.66	0.79	0.79	0.90
M	8-11	0.52	0.71	0.33	0.63	0.98	0.41	0.25
M	12-35	0.94	0.90	0.90	0.87	0.92	0.89	0.99
M	36-47	0.63	0.41	0.02	-0.17	0.53	0.88	0.93
M	48 and above	0.75	0.64	0.48	-0.04	0.47	0.54	0.66
M	(all)	0.93	0.95	0.91	0.85	0.43	0.87	0.92

Prediction equations for body weights based on stepwise regression analysis in deer

Sex	Age (months)	Simple Regression Equation	Coefficient of Determination	Multiple Regression Equation	Coefficient of Determination
F	8-11	Y=-16.48+0.52 HG	0.9830		
F	12-35	Y=-29.65+0.66 MG	0.7700	Y=-47.28+53 MG+0.12 BL1+1.16 WS	0.9537
F	36-47	Y=-1.52+0.34 MG	0.3549	Y=-20.59+0.28 MG+0.10 BL1+0.94 WH	0.6462
F	48 & above	Y=-53.78+0.95 MG	0.6322	Y=-16.34+0.90 MG-0.32 BL1	0.7624
M	8-11	Y=-2.51+0.34 BL2	0.9507		
M	12-35	Y=-5.35+1.71 WH	0.9843	Y=-11.94+0.08 FG+0.17 BL2+1.28 WH	0.9999
M	36-47	Y=-19.81+0.78 WH	0.8642		
M	48 & above	Y=-27.46+0.91 HG	0.5550		
OVERALL		Y= -56.16 + 0.98 MG	0.8697	Y= -55.2 + 0.76 MG + 1.17 WS	0.8912

Approximate weight using midriff girth in deer

Midriff Girth (centimeters)	Weight (kilograms)
60	2.64
62	4.60
64	6.56
66	8.52
68	10.48
70	12.44
72	14.40
74	16.36
76	18.32
78	20.28
80	22.24
82	24.20
84	26.16
86	28.12
88	30.08
90	32.04
92	34.00
94	35.96
96	37.92
98	39.88
100	41.84
102	43.80
104	45.76
106	47.72
108	49.68
110	51.64
112	53.60
114	55.56
116	57.52
118	59.48
120	61.44

Philippine Deer

Midriff Girth = Highest correlation to weight

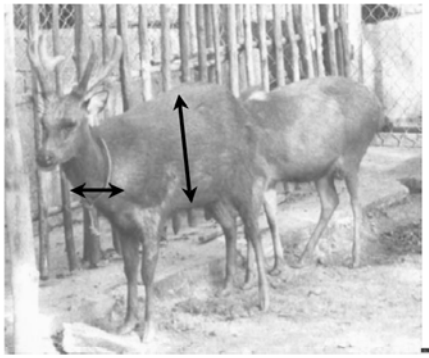
Formula 1

BW = -56.16 +0.98 x midriff girth

Formula 2

BW = -55.2 + 0.76 x midriff girth + 1.17 x width of shoulder

Philippine Deer



Correlation analysis between bodyweight and body measurement in male and female Philippine cynomolgus monkey[1]

Variable	Male		Female		All	
	R	r^2	r	r^2	r	r^2
Age	0.90	0.81	0.87	0.75	0.80	0.64
Chest Girth	0.97	0.94	0.92	0.84	0.92	0.84
Midriff Girth	0.95	0.90	0.88	0.72	0.88	0.77
Flank Girth	0.98	0.94	0.93	0.86	0.91	0.82
Body Length	0.89	0.79	0.85	0.72	0.83	0.68

[1]For all 249 sample monkeys (64 males and 185), P < .0001

Regression analysis for both male and female Philippine cynomolgus monkey

	Male		Female		All	
	Equation	**r^2**	**Equation**	**r^2**	**Equation**	**R^2**
Simple	-5.49 + 0.36FG	0.95	-2.41+0.21FG	0.87	-3.95+0.24CG	0.84
Multiple	-5.60+0.18CG+ 0.21FG+-0.04BL	0.96	2.59+0.06CG+ 0.01MRG+0.05FG +0.03BL	0.92	-4.49+0.10CG + 0.06 MRG + 0.04FG + 0.03 BL	0.87

Prediction equations based from stepwise regression analysis

Sex and Age (months)*	Simple Regression Equation	r^2	Multiple Regression Equation	R^2
Male & Female 1-12	-0.56 + 0.08FG	0.48	-1.74 + 0.02 MRG + 0.05FG + 0.05BL	0.62
Male & Female 13-24	-1.83 + 0.16MRG	0.56	-2.91 + 0.15MRG + 0.03BL	0.70
Female Subadult 25-48	-0.79 + 0.08BL	0.50	-.55 +0.09CG –0.06MRG + 0.04FG + 0.05BL	0.66
Male Subadult 25-60	-5.76 + 0.36FG	0.92	-6.75 + 0.25FG + 0.09BL	0.98
Female Adult 49-128	-1.39 + 0.15CG	0.59	-3.02 + 0.10HG + 0.04MRG + 0.04 BL	0.67
Male Adult 61-146	-8.33 + 0.39CG	0.90		

*** Age classification by Fooden (1991); all models are significant at 0.15 level**

Approximate weight of the Philippine cynomolgus monkey using chest girth

Chest girth (cm)	Body weight (kg)
17	0.13
18	0.37
19	0.61
20	0.85
21	1.09
22	1.33
23	1.57
24	1.81
25	2.05
26	2.29
27	2.53
28	2.77
29	3.01
30	3.25
31	3.49
32	3.73
33	3.97
34	4.21
35	4.45
36	4.69
37	4.93
38	5.17
39	5.41
40	5.65
41	5.89
42	6.13
43	6.37
44	6.61
45	6.85
46	7.09
47	7.33

Philippine Cynomolgus Monkey

Heart Girth = Highest correlation to weight

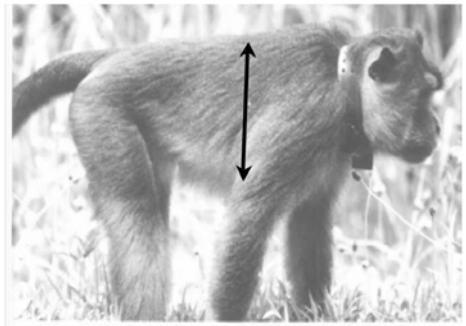
Formula 1

BW = -3.95 +0.24 x heart girth

Formula 2

BW = -4.49 + 0.10 x heart girth + 0.06 x midriff girth + 0.04 x flank girth + 0.03 x body length1

Philippine Cynomolgus Monkey



Conclusions

- Body measurement is a simple and reliable method for determining weight.
- Generally, a single body measurement is adequate to predict weight. But, more variables may be used to increase the accuracy of predicted weight.
- The best single determinant of weight is heart girth in the Philippine cynomolgus monkey and midriff girth in the Philippine deer.

Conclusions – cont'd

- Age and sex also influence the determination of body weight and should be considered in developing formulas to estimate weight.
- However, for practicality and convenience of target users under field conditions, formulas may be developed irrespective of these factors.

Recommendations

In the absence of a weighing scale, the prediction equations developed in previous and present studies could be used to estimate the body weight of local domestic and wildlife animals. Hence, a Handbook of Weight Tables for local Domestic and Wildlife Animals should be published or Weight Tapes may be produced for the convenient use of farmers, students, educators, field vets, and animal husbandmen.

Thank You!!!!