THE MODIFIED HORN RING METHOD AS A TOOL IN DETERMINING THE AGE OF CARABAO
(Bubalus bubalis)

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ABSTRACT

The accuracy of the modified horn ring method to determine the age of carabao (Bubalus bubalis) was tested using 127 carabaos of both sexes, aged one to 23 years old, randomly selected at an auction market. The length and circumference of the horns were measured while the number of rings were counted in both the right and left horns. The results showed that although variations occurred in the length, circumference and number of rings between right and left horns and between male and female animals in relation to age, such variations were not statistically significant. Furthermore, the linear regression model showed a direct correlation between the number of horn rings and·the age of the animal. Thus the formula:

$$y = 1.22322503 + .264245856 \ (x)$$

where y is the age and x is the number of horn rings, was arrived at to estimate the age of the carabao. Using this formula, a table of confidence interval (Table 2) was subsequently made to facilitate age determination.

Key words: age determination, bubalus bubalis, horn ring method, ruminant.

INTRODUCTION

In the past years, a procedure for age determination known as "mouthing" in cattle has evolved using the eruption time of permanent teeth as the basis. Another method makes use of the life cycle of teeth; from growth to attrition and abrasion (Orban, 1972, Merck, 1979). However, these methods present some limitations such as the possible subjective judgment of the examiner; the effect of nutritional, health, environmental and other conditions on dental development (MacCropsey, 1973); and the difficulty of estimating age from incisors after 10-12 years of age (Cockrill, 1974).

Another method which has been used to determine the age is the horn ring method which considers horn growth and horn ring development as parameters (Rudge, 1972). Contrasting reports have been made regarding the accuracy of the horn ring method in determining age. Kaleff (1942) as cited by Cockrill (1974), had considered the horn ring method as an accurate way of determining age; while Ferrara, as cited by Cockrill (1974) and Rudge (1972) had reported that horns are unreliable indicators of age due to pronounced sexual dimorphism; inconsistent ring formation; formation of double rings; failure of horns to grow for several years; omission of growth of horn rings in some years; and lack of sharp seasonal variation in climate and food supply. The same author, however, had noted that there is no difference in growth rate between the left and right horns. Variations in size and spacing of horns as well as clarity of horn rings have also been observed (Villegas, 1970; Cockrill, 1974), not only in relation to age but also to sex (Chauveau, 1906; Dyce, *et al.,* 1987) and breed (Sisson and Grossman, 1975; Limcumpao, 1983; Dyce, *et al.,* 1987).

The contrasting observations made by the previous authors were however, not subjected to statistical analysis. The present study was therefore conducted to determine the accuracy of the horn ring method in determining the age of carabaos; and if possible, to come up with a formula and a table of confidence interval to facilitate age determination.

MATERIALS AND METHODS

One hundred twenty seven (71 males and 56 females) carabaos were selected at random in an auction market and the actual ages of the animals were taken from the certificates of ownership provided by the owner or dealer. Both the left and right horns of each animal were observed and measured.

The number of horn rings was determined by counting the prominent ridges, the sharpest and most marked among a series of pencil point grooves, on the dorsal aspect of the horn. Branched rings were counted as one. In addition, the length and circumference of the horns were measured using a soft plastic tape measure. The length was measured along the greater curvature of the horn, from the base where it met the skin, to the tip. The circumference was measured at the base of the horn. All figures were recorded in cm.

The collected data were subjected to statistical analysis using the multivariate method to find out the correlation of the three factors (length, circumference and number of rings) with the age and sex of the animal; and the ANOVA (analysis of variance) to determine the difference, if any, between the right and left horns and between the male and female carabaos. Linear regression was used to correlate age with number of horn rings.

RESULTS AND DISCUSSION

Table 1 shows the actual age of the carabaos taken from the certificates of ownership; and the length, circumference and number of rings of the right and left horns. The actual age of the carabaos ranged from one to 23 years old while the number of horn rings ranged from one to 34. The horn length ranged from 16.2 to 98 cm while the circumference at the base of the horn ranged from 15.6 to 36.3 cm.

The results showed variations in the length, circumference and number of rings of the right and left horns. Such variations have also been reported by Villegas (1970), Cockrill (1974) and Limcumpao (1983) in different breeds of bufallo; and by Chauveau (1906) and Sisson and Grossman (1975) in other ruminants. However, statistical tests used in the present study showed that

these variations were not significant. Though sexual dimorphism was observed grossly, similar to that reported by Rudge (1972), it was not statistically significant. Measurements of the right and left horns did not vary significantly (P>.05), similar to an earlier observation of Rudge (1972).

The multivariate method showed a highly significant correlation between the age of the animal and the length, circumference and number of rings of its horns. A highly significant correlation between the age and the number of horn rings was also obtained using the linear regression model.

The coefficient correlation of the age group from one to 23 years old was R = .811819 (P<.001) while that of the age group from one to nine years old was R = .91094901 (P<.001). This means that the younger age group (one to nine years old) had a higher correlation. A graph of the mean and standard deviation (SD) showed that after nine years of age, the figures became erratic. Such observation has not been reported by previous workers.

A table of confidence interval (Table 2) was made using the age group of one to nine years old as the basis. To determine the age of a carabao using the horn ring method, the following formula could thus be used:

$$y = 1.22322503 + .264245856 (x)$$

where y is the estimated age and x is the number of horn rings.

A test back was made and the result of 99.38% correct came out which means that of the raw data obtained, 99.38% fit into the table made.

SUMMARY AND CONCLUSION

The accuracy of a modified horn ring method for determining the age of Philippine carabao *(Bubalus bubalis)* was determined by using 127 randomly selected carabaos of both sexes with ages ranging from one to 23 years old. The results showed that although variations were grossly observed in the length, circumference and number of rings of horns between sexes and between the right and left horns, such variations were not significant when subjected to

statistical analysis   using the multivariate method and the ANOVA. Furthermore, the linear regression model showed that there is a direct correlation between the number of horn rings and the age of the animal. Thus the formula:

$$y = 1.22322503 + .264245856 \ (x)$$

where y is the age of the carabao and x is the number of horn rings, was arrived at. Using this formula, a table of confidence interval (Table 2) was subsequently made to facilitate age determination. A test back on the raw data using the formula showed that 99.38% fit into the table made. It is therefore concluded that the horn ring method can be used to determine the age of the Philippine carabao.

ACKNOWLEDGEMENT

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Table 1.   Measurements (cm) of the length and circumference of the horns and the number of horn rings in carabaos *(Bubalus bubalis)*.

Carabao No.	Actual Age (Yrs)	Sex	Horn Length		Horn Circum.		Number of Horn Rings	
			R	L	R	L	R	L
1	1	F	20	20.3	19	17.8	2	2
2	1	M	21	20	18	19	2	2
3	1	M	25	27	23	23	4	5
4	1	M	19	18	15.6	16	1	1
5	1	M	18	16.2	16	17	1	2
6	1.5	F	25.3	26.7	21	21	3	3
7	1.5	M	23	23	21	22	2	2
8	1.5	M	24	23.4	20	20	2	1
9	2	F	18	19.4	16.8	18	4	4
10	2	M	25.4	25.4	21.6	20.3	3	2
11	2	M	25.5	27	24	25.2	4	4
12	2	M	24.3	25	18.6	19	4	3
13	2	M	26	25	25	23.4	3	3
14	2.5	M	32	30	25.3	25	3	4
15	3	F	38.6	35.6	24.2	23	10	10
16	3	F	38	38.1	23	24	14	11
17	3	F	30.5	29.2	22.9	22.9	6	7
18	3	F	33	33	24.1	25.4	10	8
19	3	F	34.4	34.3	30.5	30.5	5	6
20	3	F	34	33	25	25.4	8	8
21	3	M	27.5	29.1	24	25	3	3
22	3	M	35.9	37.4	31	31	10	12
23	3	M	40	41	26	27	13	13
24	3	M	48.5	50	27	27	14	16
25	3	M	38	36.5	30.5	28	7	8
26	3	M	34.3	36.8	29	29.2	7	6
27	3	M	30.5	34	32	31	5	6
28	3	M	48	48.3	30	28	11	11
29	4	F	40	40	26	27	11	12
30	4	F	50.8	50.8	22.9	25.4	17	14
31	4	F	43.2	43.2	25	24	10	9
32	4	F	43	43	25	24.1	16	14
33	4	M	48.5	51	32	34	14	14
34	4	M	50	48.8	30.6	30	13	15
35	4.5	M	54.6	53	33	32	13	14
36	5	F	61	61	32	30	21	18
37	5	M	36.9	37	27.2	29	10	9
38	5	M	54	52.4	31.7	30	19	17
39	5	M	61	63.3	32	30.5	16	16
40	6	F	44.5	43.2	25.3	25.4	12	10

Table 1 cont...

Carabao No.	Actual Age (Yrs)	Sex	Horn Length		Horn Circum.		Number of Horn Rings	
			R	L	R	L	R	L
41	6	F	50	48	29	28	16	14
42	6	F	53	55	35	35	10	12
43	6	F	48	49	27	26	18	20
44	6	F	47.8	50.3	22	22.2	16	17
45	6	F	56	57.6	25	26	19	21
46	6	M	66	63.5	33	33	25	22
47	6	M	55.8	56	32	30.5	20	22
48	6	M	56	53.3	30.5	28	21	20
49	6	M	46	47.3	31	30	14	15
50	6	M	61	58.2	35	34	19	17
51	6	M	54.8	57	34	34	12	14
52	6	M	50	50	31	32	13	16
53	7	F	74	69.9	33	33	22	21
54	7	F	54	53.4	35	35	20	18
55	7	F	65	63.8	34	32	19	19
56	7	F	51	51.6	21	21	20	18
57	7	M	61.5	63	30	30	23	23
58	7	M	67.3	68	30	31	21	21
59	7	M	53.8	55	31	30	19	19
60	7	M	58	59	33	33	20	20
61	7	M	57	57	30	30	19	19
62	8	F	53	57	24	24	16	20
63	8	F	59	59	31	30	17	19
64	8	F	61	64	30	30	26	27
65	8	F	58	57	32	31	19	19
66	8	F	55.9	53.3	24	22.9	21	21
67	8	M	66	65	31	32	19	20
68	8	M	71	70	32	31	24	24
69	8	M	71	73	31	33	32	33
70	8	M	76.2	76	34.3	34	35	34
71	9	F	71	73.6	36	36	22	23
72	9	F	67	66	35	35	28	28
73	9	F	62	62	23.3	25	20	21
74	9	F	64	64	35	34	31	30
75	9	M	72.4	71	33	33	31	30
76	9	M	81.3	77.5	35.6	35.6	30	31
77	9	M	76	76	34.3	33	32	29
78	9	M	65	63	33.2	35	23	20
79	9	M	73	74	35	34	27	25
80	9	M	79	80.2	35	36	34	33
81	9	M	61	63	29	30	27	29
82	10	F	70	69	31	32	22	22
83	10	F	58.4	54.6	24	24	24	21

Table 1 cont...

Carabao No.	Actual Age (Yrs)	Sex	Horn Length		Horn Circum.		Number of Horn Rings	
			R	L	R	L	R	L
84	10	F	63.5	58.4	31.8	30.5	22	21
85	10	F	68.5	68.6	34	33	26	26
86	10	F	59.7	58.4	25	25.4	23	23
87	10	M	84	85	30	30	32	27
88	10	M	53	55	30	32	18	17
89	10	M	71	70	32	30.5	22	23
90	10	M	76	77.5	33	33	34	31
91	10	M	76	76	34.3	33	31	32
92	11	F	76	76	35.6	35.6	22	22
93	11	F	65	63	23	24	27	30
94	11	F	64	64	26	25	30	32
95	11	M	66	66	33	34.3	27	25
96	11	M	78.7	78.7	30.5	30.5	28	25
97	11	M	80	81	31	31	28	30
98	11	M	66	67	32	32	23	23
99	12	F	64	65	21	20	23	25
100	12	F	68	66	32	32	23	23
101	12	F	73	70.6	33	33	26	23
102	12	F	70	68.2	32.2	33	25	21
103	12	F	61	63.5	25.4	25.4	20	20
104	12	F	58.4	56	25	23	24	24
105	12	F	76.2	75	22.9	22.9	31	27
106	12	F	46	46	22	20.3	22	18
107	12	M	66	65	30	31	21	20
108	12	M	86	84.5	31.8	34	32	33
109	12	M	86.8	89	31	32.4	29	28
110	12	M	70	71	31	30	29	30
111	12	M	64.8	63.5	33	35.6	18	18
112	12	M	81.3	81.3	35.5	35.6	32	28
113	12	M	62	66	34.3	36	20	21
114	13	F	61	61	24	25.4	32	31
115	13	F	67	66	25	25	28	27
116	13	M	72	73	32	30	25	25
117	14	F	65.8	67	30	30	29	29
118	14	M	97.2	96	34	35	32	32
119	14	M	98	98	35	33	32	30
120	14	M	88	86.5	36.3	34	29	28
121	14	M	75.6	75.6	34.3	33.7	29	30
122	14	M	75.4	76	35.6	35.6	24	30
123	15	F	61.7	60.4	20	20	28	27
124	15	M	82.4	82	31.7	32	31	28
125	16	F	53.8	54	26	24	25	25
126	16	F	58	58.4	20.3	24	21	22
127	23	F	66	67.3	22.9	24.1	28	24

Table 2.   Confidence interval based on the number of horn rings of
            carabaos one to nine years of age.

X (number horn rings)	Y age (in years)	Minimum age (Y)	Maximum age (Y)
1	1.487	(1)	4.90
2	1.751	(1)	4.33
3	2.015	(1)	4.57
4	2.279	(1)	4.82
5	2.543	(1)	5.07
6	2.807	(1)	5.31
7	3.071	(1)	5.56
8	3.335	(1)	5.81
9	3.599	1.13	.07
10	3.863	1.40	6.32
11	4.127	1.67	6.58
12	4.391	1.95	6.84
13	4.655	2.21	7.10
14	4.919	2.478	7.36
15	5.183	2.75	7.62
16	5.447	3.01	7.88
17	5.711	3.27	8.15
18	5.975	3.53	8.42
19	6.239	3.79	8.69
20	6.503	4.05	8.96
21	6.767	4.30	9.23
22	7.031	4.555	(9)
23	7.295	4.81	(9)
24	7.559	5.060	(9)
25	7.823	5.31	(9)
26	8.807	5.54	(9)
27	8.351	5.80	(9)
28	8.615	6.04	(9)
29	8.879	6.29	(9)
30	9.143	6.53	(9)