Evaluation of water beef buffalo from birth to two years using different growth curves

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ABSTRACT: The buffalo is a domestic animal species of growing world-wide importance. Research to improve genetic improvement programs is important to maintain the productivity of buffalo. The objective this research was to evaluate the growth of Brazilian buffalo to two years of age with different growth curves. Growth curves consolidate the information contained in the weight-age data into three or four biologically meaningful parameters. The data included 31,452 weights at birth and 120, 205, 365, 550 and 730 days of buffalo (n = 5,178) raised on pasture without supplementation. Logistic, Gompertz, quadratic logarithmic, and linear hyperbolic curves (designated L, G, QL, and LH, respectively) were fitted to the data by using proc NLIN of SAS (SAS Institute, Inc., Cary, NC, USA). The parameters estimates for L [WT= A * (((1 + exp (-k * AGE)))**-m)] were A = 865.1 ± 5.42; k= 0.0028 ± 0.00002; M= 3.808 ± 0.007; R^2 = 0.95. For G [WT= A * exp (-b * exp (-k * age)] the parameters estimates were A= 967.6 ± 7.23; k = 0.00217 ± 0.000015; b = -2.8152 ± 0.00532. For QL [WT= A + b*age + k*(age*age) + m*log (age)] parameters estimates were A= 37.41 ± 0.48; k= 0.00019 ± 6.4E^{-6}; b= 0.539 ± 0.006; m= 2.32 ± 0.23; R^2=0.96. For LH [WT= A + b*AGE + k*(1/AGE)] the parameters estimates were A= 23.15 ± 0.44; k=15.16 ± 0.66; b= 0.707 ± 0.001; R^2= 0.96. Each of these curves fit these data equally well and could be used for characterizing growth to two years in beef buffalo.

Key words: Buffalo, Growth Curve, Weight.

INTRODUCTION - Malhado (2005) reported mean birth weight, weight at 205, weight at 365, weight at 550 days of 39.5± 3.8, 195.2 ± 33.7; 300.7 ± 58.5 and 433.1 ± 88.1 kg, respectively, for Brazilian beef water buffalo. Ramos et al. (2004), studying different genetic groups of buffalo, reported weights of 210.0, 387.6 and 503.5 kg, at 205, 365 and 550 days, respectively. Growth curves consolidate the information contained in weight-age data into three or four biologically meaningful parameters. Growth traits such as birth, weaning, and yearling

weights are important traits, and can be used to derive relative and absolute growth rates, maturing rate, and mature size by using growth functions (Kaps et al., 2000). The growing importance of domesticated water buffalo signals the need for genetic research to maintain the productivity of the species. Souza and Bianchini Sobrinho (1994) stated that estimates of biologically interpretable parameters from a growth function, associated to production traits of animals, can be used for selection programs with the objectives of early maturity with heavier weight and better carcass quality. The objective this research was to evaluate the growth of Brazilian buffalo to two years of age with different growth curves.

MATERIAL AND METHODS - The data included 31,452 weights at birth and 120, 205, 365, 550 and 730 days of age from 5,178 buffalo raised on pasture without supplementation in Brazil. Logistic, Gompertz, Quadratic Logarithmic, and Linear Hyperbolic curves (designated L, G, QL, and LH, respectively) were fitted to the data by using proc NLIN of SAS (SAS Institute, Inc., Cary, NC, USA), using the Gauss-Newton method. The models used to describe growth of animals were the Logistic [WT= A*(((1+exp(-k*AGE)))**-m)], Gompertz [WT=A*exp(-b*exp(-k*age)], Quadratic Logarithmic [WT= A + b*age + k*(age*age) + m*log(age)] and Linear Hyperbolic [WT= A + b*AGE + k*(1/AGE)]. The parameter ***A*** was weight at maturity, an estimate of asymptotic weight, interpreted as adult body weight. This weight is not the maximum weight reached by the animal, but the average of weights at maturity free from seasonal variation (Brown et al., 1976). The parameter ***k*** represents the maturing rate which expresses variation in rate of change of growth rate . The parameter ***b*** represents the constant of integration, established by the initial values of age and weight; and the parameter ***m*** defines the form of the growth curve and determines at what proportion of ***A***, the asymptotic weight, the inflection point occurs.

Table 1. Predicted weights for ages 1 to 750 days from the Logistic, Gompertz, Quadratic Logarithmic and Linear Hyperbolic growth curves.

	Curves					Curves			
Age(days)	L	G	Q. L.	L.H.	Age(days)	L	G	Q.L.	L.H.
1	62.1	58.3	37.9	39.0	390	287.4	289.2	282.5	298.9
30	72.2	69.2	57.2	44.9	450	334.3	335.1	324.6	341.3
90	96.8	95.5	92.0	86.9	510	381.6	381.4	368.0	383.7
150	126.4	126.7	127.6	129.3	570	428.4	427.4	412.8	426.2
210	160.9	162.4	164.4	171.7	630	473.7	472.2	458.9	468.6
270	199.7	201.9	202.4	214.1	690	516.8	515.4	506.4	511.0
330	242.2	244.5	241.8	256.5	750	557.2	556.6	555.2	553.4

L: Logistic; G: Gompertz; Q. L.: Quadratic Logarithmic; L.H.: Linear Hyperbolic.

RESULTS AND CONCLUSIONS - Body weight represents one of the most economically important traits in beef buffalo and previous values get by growth curve permit do selection of the precocity's animals. The parameters estimates for the four curves were:

Logistic A = 865.1 ± 5.42, k = 0.0028 ± 0.00002, M = 3.808 ± 0.007, R^2=0.95; Gompertz A = 967.6 ± 7.23, k = 0.00217 ± 0.000015, b = -2.8152 ± 0.00532, R^2= 0.96; Quadratic Logarithmic A = 37.41 ± 0.48, k= 0.00019 ± 6.4E^{-6}, b = 0.539 ± 0.006, m= 2.32 ± 0.23, R^2= 0.96. For Linear Hyperbolic the parameters estimates were A= 23.15 ± 0.44; k=15.16 ± 0.66; b=0.707 ± 0.001; R^2=0.96. The Logistic and Gompertz over estimated the birth weight at 62.1 and 58.3 kg, respectively. These values were very high compared to birth weights reported by Ramos et al. (2004) and Malhado (2005). The quadratic logarithmic and linear hyperbolic curves yielded values closer to those found in the literature. For weight at 750 days, values estimated by each curve were very similar and close to literature values (Table 1). Each of these growth curves fit these data equally well and could be used for characterizing growth to two years in beef buffalo.

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