Growth Curve in male and female lambs of Baluchi Sheep by Nonlinear Growth Models

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Baluchi Sheep

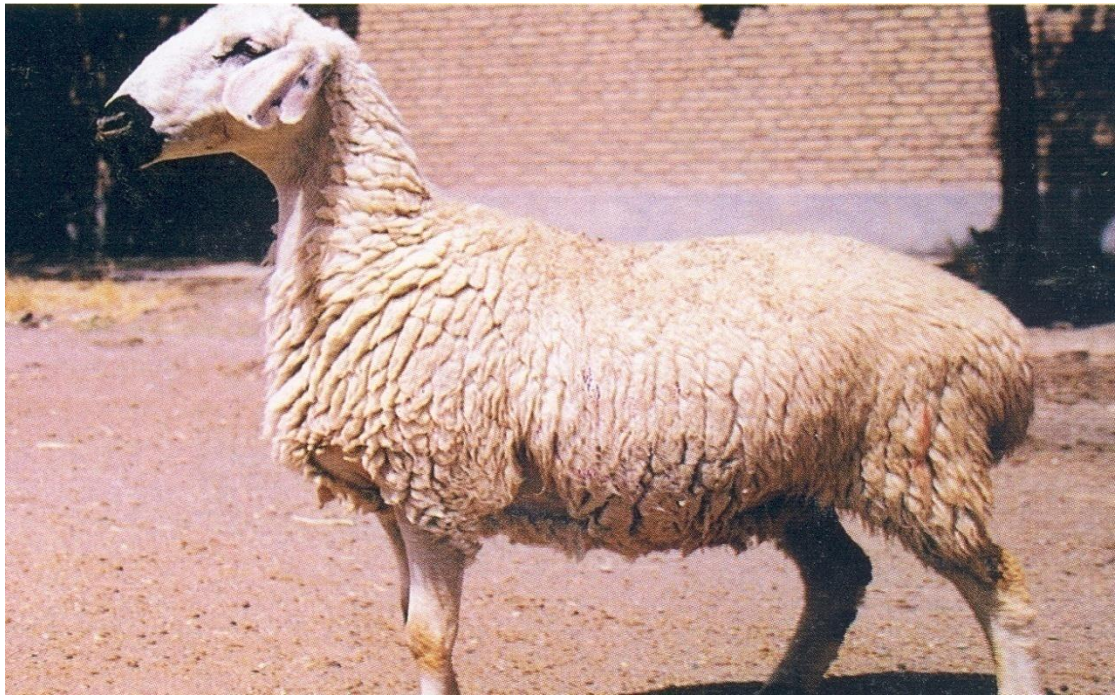
- **Baluchi is the most common native breed of sheep in Iran, comprising 30% of the sheep population.**
- **This breed is native to the eastern part of the country, which has a dry and hot climate.**
- **The animals have had to adapt to the harsh environment.**

Baluchi Sheep

- This breed belongs to the fat-tailed sheep, its wool is coarse with white fleece and pigmented head and legs (Yazdi *et al. 1997).*

Baluchi Sheep

- Baluchi sheep are used for multiple purposes, including wool production and also play an important role in meat production (Tahmoorespur and Sheikhloo 2011)



Introduction

- Growth is one of the most essential traits for animals, is defined as an increase in tissues and organs of the animals per unit time and effected by genetic and environmental factors (Tariq et al., 2011).
- Therefore, it may be divided into phases to explain it.

Introduction

- The growth that has sigmoid form is explained reliably by non-linear growth models such as:
- Gompertz, logistic, Richards, Weibull, Monomolecular, Brody and von Bertalanffy.
- Information about parameters of these non linear models enables researchers to obtain beneficial clues for selection studies.

Objective

The purpose of this study was to describe growth curve in Baluchi Sheep by application of nonlinear growth models.

Materials and methods

Materials and methods

- The records of 1228 male and 676 female lambs of Baluchi sheep were used.
- The records collected in animal breeding center of Abas Abad in north east of Iran(Mashhad).
- The records were from 2005 to 2010.

Materials and methods

- The record belongs to growth traits of birth weight and one, two, three, four, six, nine and one years of age.
- The total numbers of 9824 and 5408 records of weights belonged to male and female lambs were used.
- The data were edited by excel and for analysis of data, the SAS software (ver., 9.1) were used by NLIN procedure.

Materials and methods

	Statistics descriptive of studied traits (Female)							
Parameter	**BW**	**1 MW**	**2MW**	**3MW**	**4MW**	**6MW**	**9MW**	**12MW**
Mean(kg)	4.16	11.5	16.6	21.8	25.5	30.8	34.8	39
SD(kg)	0.63	2.6	3.8	4.2	4.7	4.9	4.3	5.1
SE(kg)	0.024	0.1	0.15	0.19	0.21	0.22	0.21	0.26
CV(%)	15	22	23	19	18	16	12	13

Materials and methods

	Statistics descriptive of studied traits (male)							
Parameter	BW	1 MW	2MW	3MW	4MW	6MW	9MW	12MW
Mean(kg)	4.42	12.32	18.1	23.8	28.7	35.5	39	45.8
SD(kg)	0.73	2.76	4.2	5.2	5.4	5.5	5.18	6.04
SE(kg)	0.027	0.11	0.17	0.23	0.24	0.26	0.26	0.32
CV(%)	16	22	23	22	19	15	13	13

Materials and methods

The four non linear models were as follow:

$$1 - Gomperts: \quad W_t = Ae^{(-Be^{-kt})} + \varepsilon$$

$$2 - Logistic: \quad W_t = A(1 + Be^{-kt})^{-1} + \varepsilon$$

$$3 - Brody: \quad W_t = A(1 - Be^{-kt}) + \varepsilon$$

$$4 - Von\ Bertalanffy: \quad W_t = A(1 - Be^{-kt})^{-3} + \varepsilon$$

W_t = Weight at time : A= asymptotic mature weight: B= point of inflection, rate of body weight gained after birth to mature body weight and "k" rate of growth or maturity rate

Materials and methods

- Model selection criteria was based on:
- Coefficient of Determination (R^2)
- Root Mean Square Error (RMSE)
- Mean Absolute Error (MAE)

Results and Discussion

Results and Discussion

Model	Sex	A	B	k	R^2	RMSE	MAE
Von . B	M	38.35(0.3)	0.43(0.006)	0.01(0.0003)	90.41	8.36	5.7
	F	35.68(0.15)	0.5(0.005)	0.01(0.0001)	96.85	4.54	3.16
Brody	M	39.38(0.37)	0.84(0.006)	0.008(0.0002)	90.42	8.35	5.65
	F	37.2(0.19)	0.9(0.004)	0.008(0.0001)	90.82	4.57	3.13
Gompertz	M	38.03(0.28)	1.62(0.027)	0.01(0.0003)	90.40	8.36	5.73
	F	35.26(0.14)	1.98(0.025)	0.01(0.0002)	96.83	4.56	3.21
Logistic	M	37.42(0.24)	3.49(0.1)	0.01(0.0004)	90.37	8.38	5.8
	F	35.53(0.12)	4.78(0.1)	0.02(0.0003)	96.70	4.65	3.4

Correlations between parameter

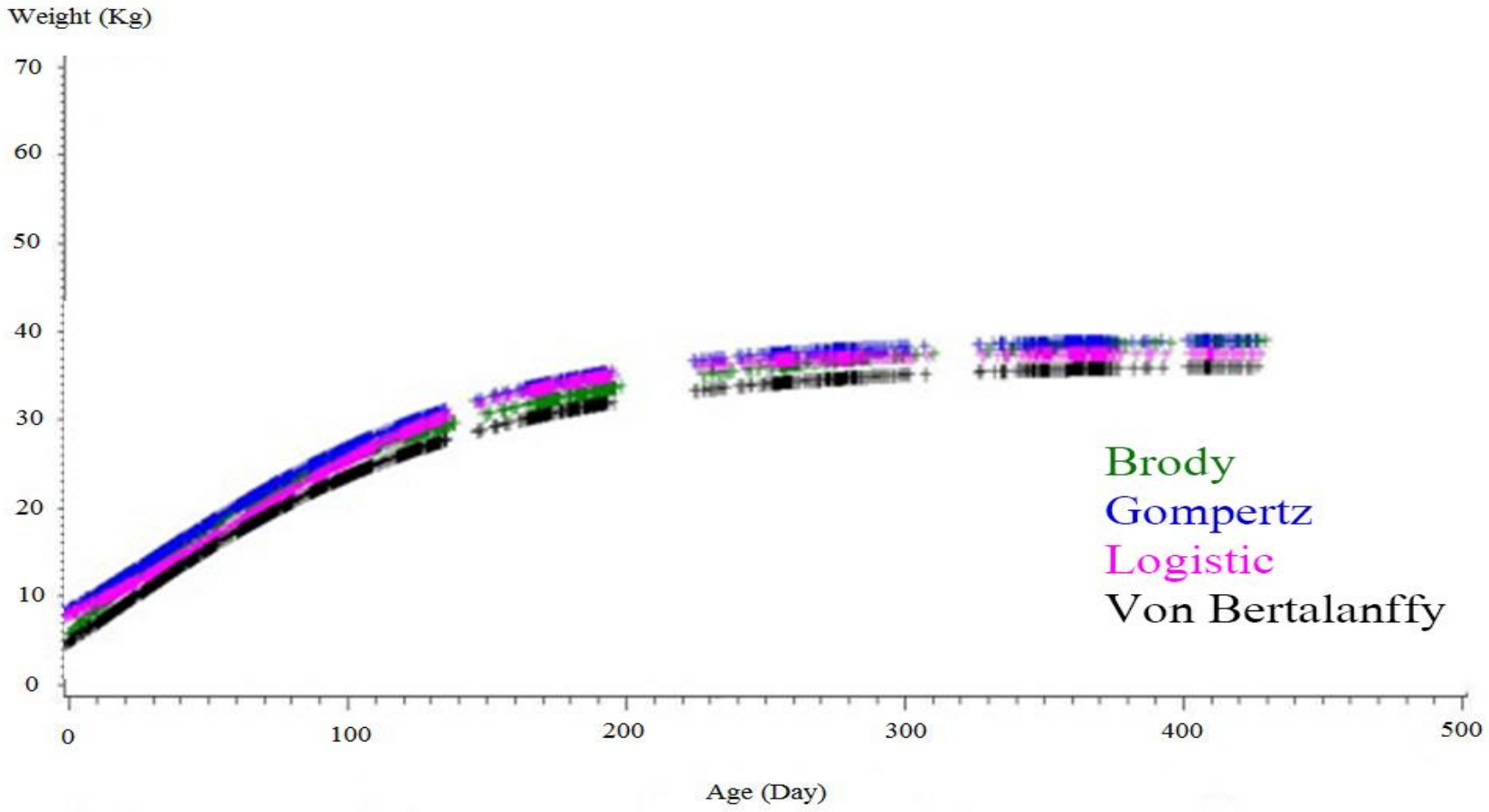
Model	r_{AB}	r_{AK}	r_{BK}
Von . B	-0.13	-0.36	-0.05
Brody	0.18	-0.54	-0.51
Gompertz	-0.14	-0.3	0.06
logistic	-0.2	-0.21	0.0015

- Parameter estimation of nonlinear growth models and correlation coefficients between A and k parameters for both sexes are presented.
- The importance of the relationship between A and k has been discussed by several authors (Brown *et al.*,1976; López de Torre and Rankin, 1978; López de Torre *et al., 1992).*

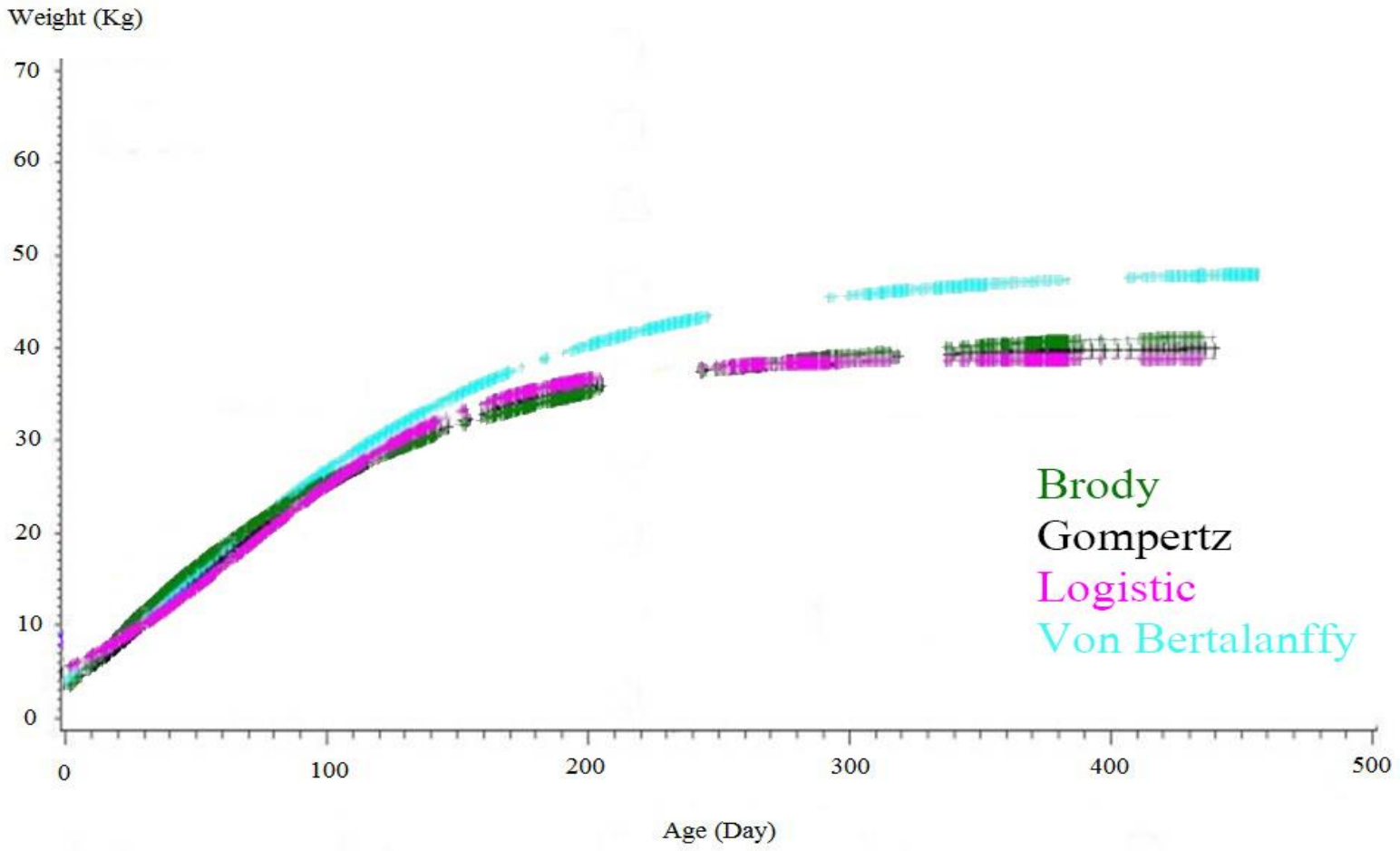
- *The negative* association between these two parameters indicates that the sheep with smaller mature weight will be maturing faster.
- Negative correlations between the parameters A and k were obtained in all nonlinear models in this study .
- These results are in agreement with the reports of Taylor and Fitzhugh Jr. (1971), DeNise and Brinks (1985), Bathaei and Leroy (1998), Eyduran *et al. (2008), and Malhado et al. (2009).*

- The negative correlation between parameter A and B showed that the lambs with faster growth could have lower mature weight

Growth curve of male lambs by none linear regression model



Growth curve of female lambs by none linear regression model



Conclusion

- Among studied growth model in this study and According the model criteria
- we can conclude that:
- The appropriate model for explaining the growth curve for predicting the weight for male Lamb is the Brody Model and
- for female lamb is Von Bertallanfy Model
- for Baluchi sheep so we can used this two model for predicting weights at different ages.

Thanks For Your Attention