The Pharma Innovation Journal 2022; SP-11(7): 1186-1189

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(7): 1186-1189

www.thepharmajournal.com
Received: 02-05-2022
Accepted: 05-06-2022

Dinesh Kumar Sunwasiya
Division of Animal Genetics and Breeding, ICAR- National Dairy Research Institute, Karnal, Haryana, India

Corresponding Author
Dinesh Kumar Sunwasiya
Division of Animal Genetics and Breeding, ICAR- National Dairy Research Institute, Karnal, Haryana, India

Study of non-linear growth curve models parameters in goat

Dinesh Kumar Sunwasiya

Abstract
"Understanding evolutionary changes and creating effective breeding strategies depend on the inheritance of growth curves. Determining the genetic and non-genetic components of development curves is crucial because it can be used to correct data irregularities based on by random environmental impacts. As a result, knowledge can be used to directly choose animals to improve growth traits".

Keywords: Breeding strategies, growth curves, growth traits

Introduction

Non-linear Growth curve models are important to assess to potential worth of growth parameters for selection criteria to make breeding strategies for animals. Animal growth models are used to calculate the daily food nutrient requirements for animals at different stages of development and to identify alternative techniques to increase the efficiency of livestock production (Schinckel and de Lange, 1996) [20]. Additionally, they have been applied to calculate adult weight and increases in live body weight (Nasholm and Danell, 1990; Jenkins and Leymaster, 1993) [14, 9].

Growth curve explains the changes in yield that occur as a result of this interaction over time (or as a function of age) (Kor *et al*., 2006) [11]. The weight or size of any organ, the composition of tissues and cell size, as well as living weight, can all alter with age (Eisen, 1976) [4].

Growth curves are useful in the production of animals because they may be used to: (1) assess the response to various treatments throughout time; (2) examine the relationship between treatments and time; and (3) identify heavier animals within a population at younger ages (Bathaei and Leroy, 1996; Freitas, 2005; Malhado *et al*., 2009) [1, 5, 13].

Genetic parameters of growth curve parameters are necessary to examine the potential worth of the growth parameters as selection criteria for breeding strategies. The importance of this concept has been demonstrated (Kachman *et al.* (1988) [10] ; Daskiran *et al.*, (2010) [3].

Three parameters were primarily evaluated using several non-linear growth curve models: asymptotic mature live body weight (A), folding point of growth (B), and growth rate (K). The parameters changed based on the species, breed, management practices, impact of the environment, flock size, clusters, nutritional status, and selection techniques. The coefficient of determination (R^2) is parameter for goodness of fit which indicate higher value good indication for fitting of non-linear model.

In the Brody non-linear growth curve model for both sexes, parameter (A) varied from 29.13 (Waheed *et al*., 2011) [24] in the Beetal goat to 52.90 in the Kalahari red goat (Hifzan *et al*., 2015), parameter (B) varies from 0.75 (Pire *et al*., 2017) [18] in Repartida goat to 0.91 by (Waheed *et al*., 2011) [24] in Beetal goat and parameter (K) value from 0.00 (Pire *et al*., 2017) [18] in Repartida goat to 0.10 (Waheed *et al*., 2011) [24] in Beetal goat.

In Gompertz non-linear growth curve model value ranged for both sexes parameter (A) reported from 16.5 (Gaddour *et al.*, 2012) [7] in Alpine goat to 55.06 (Wahi *et al.*, 2004) [25] in Jamunapari goat, parameter (B) from 0.02 (Gaddour and Najari 2008) [6] in Alpine goat 2.52 (Wahi *et al.*, 2004) [25] in Jamunapari goat and parameter (K) varies from -0.31 (Gaddour and Najari 2008) [6] in Alpine goat to 52.34 (Cak *et al.*, 2017) [2] in coloured mohair goat.

Value of parameter (A) extended from 14.35 (Cak *et al.*, 2017) [2] in coloured mohair goat to 32.53 (Paul *et al.*, 2016) [17] in non-descript goat, parameter (B) laying from 0.75 (Pire *et al.*, 2017) [18] in Repartida goat to 3.75 (Paul *et al.*, 2016) in non-descript goat and parameter (K) from 0.01 (Pire *et al.*, 2017) [18] in Repartida goat to 0.17 (Paul *et al.*, 2016) in non-descript

goat for Logistic non-linear growth curve model for both sexes.

In Bertallanffy non-linear growth curve model parameter (A) incresing from 25.43 (Pire *et al.,* 2017) [18] in Repartida goat to 37.62 (Paul *et al.,* 2016) [17] in non-descript goat, parameter (B) valued from 0.37 (Pire *et al.,* 2017) [18] in Repartida goat to 2.09 (Paul *et al.,* 2016) [17] in non-descript goat and parameter (K) observed from 0.00 (Pire *et al.,* 2017) [18] in Repartida goat to 0.40 (Tatar *et al.,* 2009) [22] in young hair goat for both sexes.

The coefficient of determination (R^2) was reported in goat for both sexes in Brody non-linear growth model from 87.53 per cent (Pires *et al.,* 2017) [18] in Repartida goat to 99.80 per cent (Waheed *et al.,* 2011) [24] in Beetal goat.

The coefficient of determination (R^2) was increaesd by Gompertz non-linear growth curve model from 71.00 per cent (Gaddour *et al.,* 2012) [7] in Alpine goat to 99.80 per cent (Waheed *et al.,* 2011) [24] in Beetal goat in goat for both sexes.

The coefficient of determination (R^2) was extended in Logistic non-linear growth curve model from 91.47 per cent (Pires *et al.,* 2017) [18] in Repartida goat to 99.76 per cent (Paul *et al.,* 2016) [17] in non-descript goat in goat for both sexes.

The coefficient of determination (R^2) was oscillated in goat for both sexes by Bertalanffy non-linear growth curve model from 88.58 per cent (Pires *et al.,* 2017) [18] in Repartida goat to 99.79 per cent (Paul *et al.,* 2016) [17] in non-descript goat.

Table: Estimated non-linear growth curve model parameters for various goat breeds

Animal	Growth curve model	Sex	Growth curve model parameters			Goodness of fit	References
			A	B	K	R^2	
Jamunapari goat	Gompertz	Both sexes	55.06	2.52	0.08	96.02	Wahi *et al.,* (2004) [25]
	Logistic		-	-	-	95.93	
Beetal goat	Gompertz	Both sexes	28.54	1.86	0.16	98.51	
	Logistic		-	-	-	97.86	
Barbari goat	Gompertz	Both sexes	32.96	2.48	0.11	99.14	
	Logistic		-	-	-	98.81	
Balck Bangal goat	Gompertz	Both sexes	20.20	2.43	0.15	99.46	
	Logistic					99.23	
Jamunapari x Beetal goat	Gompertz	Both sexes	33.75	2.15	0.13	99.35	
	Logistic					99.09	
Jamunapari x Barbari goat	Gompertz	Both sexes	36.84	2.35	0.10	98.70	
	Logistic					98.34	
Jamunapari x Black Bangal goat	Gompertz	Both sexes	26.29	2.32	0.14	99.23	
	Logistic					99.38	
Beetal x Barbari	Gompertz	Both sexes	31.64	2.17	0.13	98.98	
	Logistic					98.59	
Beetal x Black Bangal goat	Gompertz	Both sexes	34.56	2.49	0.12	99.23	
	Logistic					98.90	
Barbari x Black Bangal goat	Gompertz	Both sexes	23.42	2.30	0.14	99.17	
	Logistic					98.78	
Akkeci goat	Gompertz	Female	48.4	-0.00	103.27	97.85	Kor *et al.,* (2006) [11]
KambingKatjang goat	Brody	Both sexes	31.8	0.91	0.01	93.90	Tsukahara *et al.,* (2008) [23]
	Bertalanffy		28.8	0.49	0.022	93.70	
	Gompertz		28.1	1.90	0.026	93.60	
	Logistic		27.0	4.38	0.037	93.00	
KambingKatjang goat x German Fawn goat (F_1)	Brody	Both sexes	33.7	0.94	0.021	92.40	
	Bertalanffy		32.2	0.52	0.032	92.30	
	Gompertz		31.8	2.06	0.037	92.10	
	Logistic		31.2	5.15	0.053	91.40	
Back cross with 75per cent GF genes (BC)	Brody	Both sexes	35.5	0.93	0.027	92.90	
	Bertalanffy		34.2	0.50	0.038	92.70	
	Gompertz		33.9	1.94	0.044	92.50	
	Logistic		33.2	4.50	0.062	91.80	
F_2 (F_1 X F_1)	Brody	Both sexes	34.9	0.89	0.021	91.40	
	Bertalanffy		33.3	0.46	0.029	91.00	
	Gompertz		32.9	1.76	0.033	90.70	
	Logistic		32.3	3.76	0.045	89.70	
Alpine goat	Gompertz	Both sexes	16.53	0.02	-0.31	-	Gaddour and Najari (2008) [6]
Damascus goat	Gompertz	Both sexes	15.04	0.05	-0.33	-	
Local	Gompertz	Both sexes	12.47	0.04	-0.32	-	
F_1 Alpine X Local	Gompertz	Both sexes	17.1	0.03	-0.39	-	
F_2 Alpine X Local	Gompertz	Both sexes	15.73	0.05	-0.42	-	
F_1 Damascus X Local	Gompertz	Both sexes	17	0.02	-0.21	-	
F_2 Damascus X Local	Gompertz	Both sexes	16.67	0.03	-0.25	-	
Young Hair Goat	Gompertz	Both sexes	32.70	1.83	0.46	97.70	Tatar *et al.,* (2009) [22]
	Logistic		32.03	4.04	0.66	96.40	
	Brody		34.35	0.89	0.28	98.90	
	Bertalanffy		33.07	0.47	0.40	98.20	

Animal	Growth curve model	Sex	Growth curve model parameters			Goodness of fit	References
			A	B	K	R^2	
Angora goat	Gompertz	Both sexes	23.39	0.91	0.00	95.60	Ozdemir and Dellal (2009) [16]
	Logistic		20.70	4.96	0.01	95.70	
Alpine goat	Gompertz	Male	31.90	-	-	-	Kume and Hanjo (2010) [12]
		Female	27.8	-	-	-	
Beetal goat	Brody	Both sexes	29.13	0.91	0.10	99.80	Waheed *et al.*, (2011) [24]
		Male	28.91	0.91	0.12	99.60	
		Female	30.21	0.91	0.09	99.90	
	Gompertz	Both sexes	23.45	1.98	0.25	99.80	
		Male	24.02	1.98	0.27	99.70	
		Female	22.94	1.99	0.23	99.80	
Alpine goat	Gompertz	Both sexes	16.5	-	-	71.00	Gaddour *et al.*, (2012) [7]
Indigenous goat	Gompertz	Both sexes	12.47	-	-	71.00	
Beetal goat	Gompertz	Male	27.62	2.54	0.10	-	Nouman and Abrar (2013) [15]
		Female	29.33	2.53	0.09	-	
	Logistic	Male	7.67	0.17	24.74	-	
		Female	8.29	0.16	25.90	-	
Non-descript goat of Nigeria	Gompertz	Male	8.40	0.15	0.07	94.31	Raji *et al.*, (2015) [19]
		Female	6.42	0.15	0.09	94.60	
	Logistic	Male	7.66	0.61	0.10	93.70	
		Female	6.22	0.20	0.12	94.14	
Kalahari red goat	Brody	Both sexes	52.90	0.89	0.08	97.70	Hifzan *et al.*, (2015) [8]
	Gompertz	Both sexes	48.90	1.84	0.15	97.9	
Non-descript goat (master sample)	Logistic	Both sexes	32.53	3.75	0.17	98.66	Paul *et al.*, (2016) [17]
	Gompertz		42.96	1.88	0.08	98.97	
	Bertallanffy		37.62	2.09	0.12	98.96	
Non-descript goat (Bootstrap sample)	Logistic	Both sexes	32.53	3.75	0.17	99.76	
	Gompertz		42.96	1.88	0.08	99.79	
	Bertallanffy		37.62	2.09	0.12	99.79	
Coloured mohair goat(singleton)	Logistic	Both sexes	17.19	5.31	0.03	99.53	Cak *et al.*, (2017) [2]
	Gompertz		18.86	0.01	38.99	99.70	
Coloured mohair goat(twin)	Logistic	Both sexes	14.35	6.16	0.02	99.53	
	Gompertz		16.69	0.01	52.34	99.53	
Repartida goat	Brody	Both sexes	29.68	0.75	0.00	87.53	Pires *et al.*, (2017) [18]
	Bertalanffy		25.43	0.37	0.00	88.58	
	Logistic		22.31	-	0.01	91.47	
	Gompertz		24.41	1.44	0.01	90.97	
Sirohi goat	Brody	Both sexes	25.38	0.89	0.14	99.39	Sunwasiya *et al.*, (2020) [21]
	Gompertz		22.39	1.80	0.29	98.47	
	Logistic		21.46	3.89	0.42	97.37	
	Bertalanffy		22.97	0.47	0.24	98.82	
	Brody	Male	26.66	0.88	0.14	99.46	
	Gompertz		23.48	1.79	0.28	98.62	
	Logistic		22.49	3.84	0.41	97.58	
	Bertalanffy		24.10	0.46	0.24	98.95	
	Brody	Female	24.81	0.89	0.14	99.35	
	Gompertz		21.90	1.80	0.28	98.39	
	Logistic		20.99	3.87	0.41	97.28	
	Bertalanffy		22.47	0.47	0.24	98.76	

References

1. Bathaei SS, Leroy PL. Growth and mature weight of Mehraban Iranian fat-tailed sheep. Small Ruminant Research. 1996;22:155-162.
2. Cak B, Yilmaz O, Keskin S, Bayril T, Tariq MM. Determination of Appropriate Growth Models for Early Selection Possibilities in Goats. Pakistan Journal of Zoology. 2017;49(2):543-547.
3. Deskiran I, Koncagul S, Bingol M. Growth characteristics of indigenous Nordus female and male lambs. Journal of Agricultural Science. 2010;16:62-69.
4. Eisen EJ. Result of growth curve analysis in mice and rate. Journal of Animal Science. 1976;42:1008-1023.
5. Freitas AR. Curvas de crescimento na produc ao animal. R Bras Zootec. 2005;34:786-795.
6. Gaddour A, Najari S. Adjustment of the kids growth curve in pure goat breeds and crosses under Southern Tunisian conditions. Journal of Applied Research. 2008;34:117-120.
7. Gaddour A., Ouni M, Najari S. Growth Curve Estimation in Pure Goat Breeds and Crosses of First and Second Generation in Tunisian oases. Journal of Cell and Animal Biology. 2012;6(6):99-103,15.
8. Hifzan RM, Idris I, Yaakub H. Growth pattern for body weight, height at withers and body length of Kalahari red goat. Pakisthan Journal of Biological sciences. 2015;18(4):200-203.
9. Jenkins TG, Leymaster KA. Estimation of maturing rates and masses at maturity for body components of sheep. Journal Animal Science. 1993;71:2952-2957.

10. Kachman SD, Baker RL, Gianola D. Phenotypic and genetic variability of estimated growth curve parameters in mice. Theoretical and Applied Genetics. 1988;76:148-156.
11. Kor A, Baspinar E, Keskin S. The Determination of Growth in Akkeci (White Goat) Female Kids by various Growth Models. Czech Journal Animal Sciences. 2006;51(3):110-116.
12. Kume K, Hanjo L. Study of growth curve variations foer kids 0-6 months old of Alpine goat breed in Albania. Archiva Zootechnica, 2010;13(2):54-62.
13. Malhado CHM, Carneiro PLS, Affonso PRAM, Souza AAO Jr., Sarmento JLR. Growth curve in Dorper sheep crossed with local Brazilian breeds, Morada Nova, Rabo Largo and Santa Ines. Small Ruminant Research. 2009;84:16-21.
14. Nasholm A, Danell O. Growth and mature weight of Swedish Fine Wool Landrace ewes. I. Growth curves and estimation of individual mature weight. Acta Agric. Scan. 1990;40:71-81.
15. Nouman S, Abrar Y. Non-linear growth models for Beetal goat. African Journal of Water Conservation and Sustainability. 2013;1(2):30-32.
16. Ozdemir H, Dellal G. Determination of growth curve in young Angora Goats. Tarim Bilimleri Dergisi, 2009;15(4):358-362.
17. Paul AK, Singh RK, Das NM, Wahi SD, Singh NO. Genetic Variability of Growth Curve Parameters in Goats: Application of Bootstrap Techniques. Journal of the Indian Society of Agricultural Statistics. 2016;70(3):211-218.
18. Pires LC, Machado TMM, Carneiro PLS, Silva JBL, Barbosa ADHB, Torres RA. Growth curve of Repartida goat reared in the Caatinga region, Brazil. *Semina Ciencias Agrarias*, Londrina. 2017;38(2):1041-1050.
19. Raji AO, Asheikh LG, Mahammed ID. Comparison of Growth of Male and Female Kids of Nondescript Goats in a Semi Arid Region of Nigeria. Iranian Journal of Applied Animal Science. 2015;5(1):115-120.
20. Schinckel AP, De Lange CF. Characterization of growth parameters needed as inputs for pig growth models. Journal of Animal Science. 1996;74:2021-2036.
21. Sunwasiya DK, Gautam L, Kumar V, Garhwal P. Comparison of non-linear growth curve models in Sirohi goat. Ruminant Science. 2020;1(9):145-150.
22. Tatar MA, Tekel N, Ozkan M, Bartci I, Dellal G. The determination of growth function in young hair goat. Journal of Animal and Veterinary Advances. 2009;8(2):213-216.
23. Tsukahara Y, Chomei Y, Oishi K, Panandam JM, Mukherjee TK, Hirooka H. Analysis of growth patterns in purebred Kambing Katjang goat and its crosses with the German Fawn. Small Ruminant Research. 2008;80:8-15.
24. Waheed A, Khan MS, Ali S, Sarwar M. Estimation of Growth Curve Parameters in Beetal Goats. Leibniz Institute of Farm Animal Biology, Dummerstorf, Germany Archiv Tierzucht, 2011;54(3):287-296.
25. Wahi SD, Chand L, Bhatia VK. A Growth Pattern Study in Crosses and Pure Indian Breeds of Goats. Indian Journal of Animal Science. 2004;74(9):955-958.