

# The growth curve of Logistic and Gompertz models in body weight of Nigerian Fulani Ecotype chicken

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## ABSTRACT

The growth curve in livestock animals are important to evaluate the management system and selection program. This research was carried out to estimate the growth curve of body weight (BW) in Nigerian Fulani Ecotype (NFE) chickens. Two non-linear growth curve models of Logistic (L) and Gompertz (G) were performed in this study. Total of 211 birds (100 males and 111 females) were used in this study for growth analysis. Research showed that the coefficient of determination (R<sup>2</sup>) in both models were similar. However, the standard error (SE) in G model was lower than L model. The asymptotic weight (A) was reached of about 1493.83 g (L) and 2318.47 g (G). The weight of inflection (W<sub>i</sub>) was reached of about 746.92 g (L) and 852.32 g (G). The time of inflection (t<sub>i</sub>) was reached about 14.58 weeks (L) and 16.23 weeks (G). The maximum growth rate (MGR) was reached about 71.17 g/week (L) and 67.94 g/week (G). It can be concluded that non-linear G model had highly of accuracy to predict BW in NFE chicken from hatching to adult age. **Keyword:** Body weight, growth curve, inflection, NFE chickens, non-linear models

## MATERIALS AND METHODS

Total of 211 Nigerian Fulani Ecotype (NFE) chickens (100 males and 111 females) were used in this study for analysis. obtained through incubation and hatching of NFE eggs collected from an existing population of NFE chicken at the University of Ilorin Teaching and Research Farm were used for this experiment. On the day of hatch, the chicks were wing banded for easy identification, weighed and randomly distributed to the brooding pens. They were brooded and raised for a period of 20 weeks, placed on the same diets as recommended by NRC (1994) for chicks and growing pullets. All the necessary vaccinations and medications were administered to the birds accordingly. The weighing time in birds was performed every two weeks until 20 weeks age. Hence, data BW was used to obtain the growth curve of Logistic (L) and Gompertz (G) models using CurveExpert 1.4 software. The predicted weight (W<sub>t</sub>), weight of inflection (W<sub>i</sub>), time of inflection (t<sub>i</sub>) and maximum growth rate (MGR) for both models were calculated as follows [10]:

$$\begin{aligned} \text{Logistic} &: W_t = A/2 \quad t_i = (\ln B)/k \quad \text{MGR} = (W_i \times k)/2 \quad (1) \\ \text{Gompertz} &: W_t = A/e \quad t_i = B/k \quad \text{MGR} = W_i \times k \quad (2) \end{aligned}$$

Where, A is the asymptotic (final) weight (g); B is the scaling parameters (constant of integration); k is the maturing rate (g/week); e is the natural constant (2.72); t<sub>i</sub> is the time (week). Therefore, the growth curve with high coefficient of correlation (R<sup>2</sup>) and low standard error (SE) values can be suggested that this curve is accurate for BW prediction from hatching to adult weight.

## CONCLUSION

The Gompertz model was found to be the best suited to model the growth curve of NFE chickens for both sexes. Thus, according to Gompertz model, the inflection of weight and time were in male birds were reached about 827.32 g and 13.89 weeks respectively and for female birds were reached of 877.44 g and 18.57 weeks respectively.



**Fulani Ecotype Chicken**

**Table 1.** The average of body weight (g) in Nigerian Fulani Ecotype chickens\*

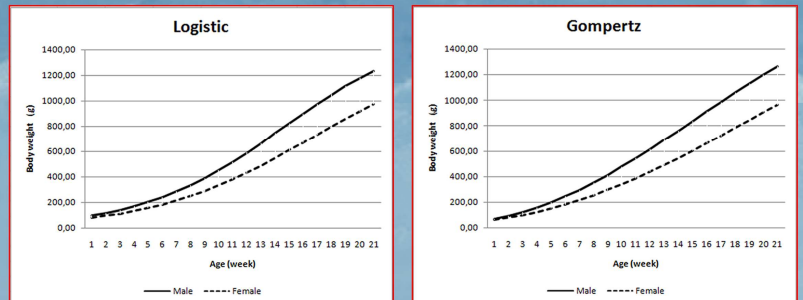
Age (week)	Male (N = 100)	Female (N = 111)
0	38.74±0.20	33.96±0.05
2	80.06±0.23	79.24±0.07
4	169.56±0.36	151.14±0.12
6	305.86±0.21	221.86±0.14
8	452.81±0.22	331.18±0.19
10	547.52±0.19	439.28±0.18
12	652.30±0.20	487.40±0.23
14	755.60±0.16	590.60±0.23
16	893.00±0.33	683.80±0.26
18	1107.40±0.08	921.00±0.29
20	1237.90±0.03	984.40±0.29

N: number of bird; \*sex had significantly effect (P<0.05)

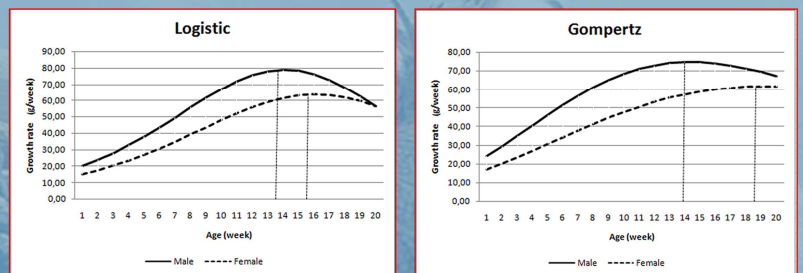
**Table 2.** The growth curve parameters for body weight in Nigerian Fulani Ecotype chickens

Breed / Model	A	B	k	W <sub>i</sub>	t <sub>i</sub>	MGR	R <sup>2</sup>	SE
<b>Male</b>								
Logistic	1575.96	15.11	0.20	787.98	13.58	78.80	0.99	52.79
Gompertz	2250.30	1.25	0.09	827.32	13.89	74.46	0.99	40.46
<b>Female</b>								
Logistic	1411.69	16.52	0.18	705.85	15.58	63.53	0.99	43.31
Gompertz	2386.63	1.30	0.07	877.44	18.57	61.42	0.99	37.63

A: the asymptotic weight (g) when times goes to infinity; B: scaling parameters (constant of integration); k: maturing rate (g/week); t<sub>i</sub> time (week); W<sub>i</sub>: weight of inflection (g); t<sub>i</sub>: time of inflection (week); MGR: maximum growth rate (g); R<sup>2</sup>: coefficient of determination; SE: standard error.



**Figure 1.** The growth curve model of body weight in Nigerian Fulani Ecotype chickens



**Figure 2.** The growth rate in body weight of Nigerian Fulani Ecotype chickens according to Logistic and Gompertz models



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