Employing logistic model to predict the egg production of quails receiving digestibility enhancer supplementation

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INTRODUCTION

- Start the production phase at about 45 days of age
- Egg production reaching 250–300 eggs per year

Coturnix coturnix japonica

Suplementation betain and silica+ → Evaluation with Nonlinear model

To optimize the nutrient digestion and absorption

OBJECTIVE

To predict the egg production of quails supplemented with a combination of betaine and silica+ as digestibility enhancer and the fitness of using the logistic model.

MATERIALS AND METHODS

Experimental design and diet

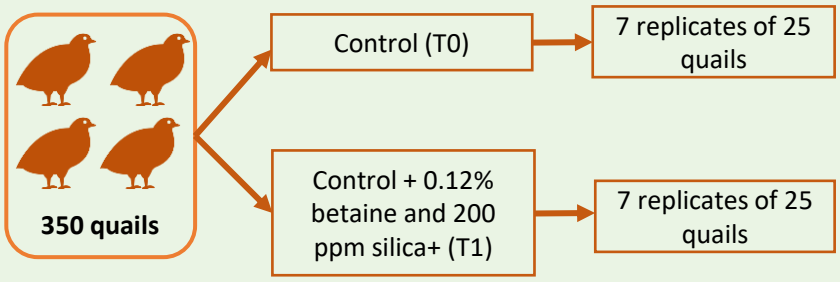

Table 1. Nutrient content of the diet experiments

Nutrients	T0	T1
Metabolisable energy (kcal/kg)	2800	2795
Crude protein (%)	20.00	19.9
Calcium (%)	3.35	3.35
Phosphorus (%)	0.46	0.46

Data collection

Egg production data were collected for 3 periods (3×28 days) and started from 42 days of age. The data collected are used to display the egg production curve.

Data management and analysis

- T-test
  To compare the effect of the treatment
- Logistic regression model
  To identify egg production patterns through the egg production curve,

$$Yt = \frac{\alpha}{1 + \beta\, exp[kt]}$$

Where:
Yt = production at time-t
α = peak production
β = carrying capacity
k = production rate
t = time of production

Furthermore, the fitness of the model assessed using the coefficient of determination termination parameter (R^2).

RESULTS AND DISCUSSION

Treatments comparison

T1 groups produced more eggs than T0 groups (P<0.05). It was found that T1 had 4.26% higher egg production than T0 (P<0.05) (Table 2) and a positive response to the combination of betaine and silica+ supplementation indicated by an increase in egg production (Figure 1).

Table 2. Effect of two different diets on quail egg production

Treatments	Min (%)	Max (%)	Mean±sd[1]	P value[2]
1st Period				
T0	0.00	78.26	28.35±22.08	0.59
T1	0.00	91.67	29.61±24.49	
2nd Period				
T0	36.36	90.91	65.79±10.73	2.94×10^{-11}
T1	44.00	96.00	72.94±9.90	
3rd Period				
T0	40.91	95.45	71.88±10.20	3.48×10^{-9}
T1	50.00	100	77.98±9.74	
1st-3rd Period				
T0	0.00	95.45	54.96±24.62	0.01
T1	0.00	100	59.22±27.12	

[1] standard deviation
[2] Significant if P<0.05

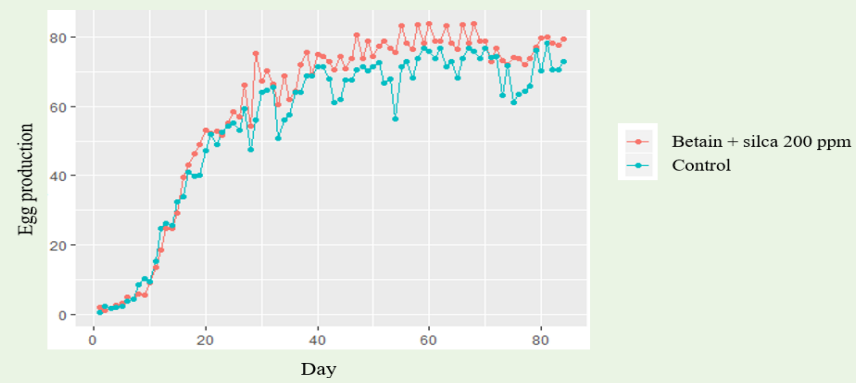

Figure 1. Egg production pattern

Logistic regression model

Logistic regression was employed to predict the trend from actual egg production in both control (**Figure 2**) and a combination of betaine and silica+ supplementation (**Figure 3**).

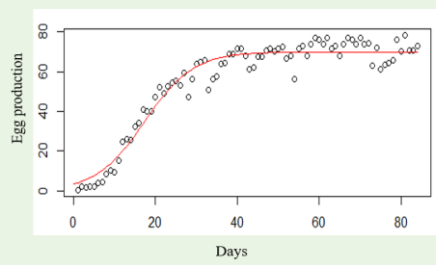

Figure 2. Non linier curve of control group

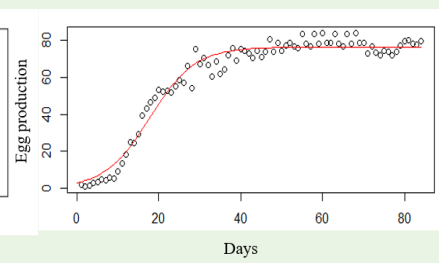

Table 3. Non linier curve supplemented group

- T1 groups had a higher peak production than T0 (76.43% vs 69.20%).
- The accuracy of logistic regression models for T0 and T1 were 0.98 and 0.97 respectively.

CONCLUSION

The logistic model proved to be employed to analyse the biological impact of egg production in quails with a high prediction accuracy.