Research Article

Effect of Egg Weight on Egg Quality of Ross 308 Broiler Breeder Chickens

Achy Nkune[1], Thobela Louis Tyasi[2]*, Jones Wilfred Ng'ambi[1]

[1]Department of Agriculture and Animal Health, University of South Africa, Florida Science Campus, Private Bag X6, Florida 1710, South Africa; [2]Department of Agricultural Economics and Animal Production, University of Limpopo, Private Bag X1106, Sovenga, Limpopo 0727, South Africa.

Abstract | Ross 308 broiler chicken is the best, bred for meat. The study was conducted to determine the characteristics of egg quality traits, correlation between egg quality traits, effect of egg weight on egg quality traits and estimate the egg weight from egg quality traits of Ross 308 broiler chickens. A total of 1000 eggs were purchased from Daybreak farm for the study, and a completely randomized design was used. About eight external and five internal egg quality traits were measured. The descriptive statistics revealed that egg weight had a minimum and maximum value of 32.59 g and 98.25 g respectively. One-way ANOVA revealed that egg weight has a significant effect ($p < 0.05$) on egg length, egg width, shell weight, shell index, shell surface area, unit surface shell weight, shell ratio, yolk weight, albumen weight, albumen ratio, yolk ratio and yolk/albumen. Pearson's correlation displayed that egg weight had a highly positive association ($p < 0.01$) with egg length, egg width, shell weight, unit surface shell weight, albumen weight, yolk weight, yolk ratio and yolk/albumen. Stepwise regression findings revealed that the model, including yolk weight, yolk ratio, albumen weight and albumen ratio, is the best-fitted model ($R^2 = 1.00$ and RMSE = 0.05) for estimation of egg weight. The study concludes that improving yolk weight, yolk ratio, albumen weight and albumen ratio might improve the egg weight of Ross 308 broiler chicken. The study findings may assist farmers in the egg quality traits to consider during breeding to improve the egg weight.

Keywords | Yolk weight, Shell weight, Yolk ratio, Albumen weight, Albumen ratio

Received | May 29, 2025; **Accepted** | November 22, 2025; **Published** | July 11, 2026
***Correspondence** | Thobela Louis Tyasi, Department of Agricultural Economics and Animal Production, University of Limpopo, Private Bag X1106, Sovenga, Limpopo 0727, South Africa; **Email:** louis.tyasi@ul.ac.za
Citation | Nkune A, Tyasi TL, Ng'ambi JW (2026). Effect of egg weight on egg quality of ross 308 broiler breeder chickens. J. Anim. Health Prod. 14(3): 1112-1118.
DOI | https://dx.doi.org/10.17582/journal.jahp/2026/14.3.1112.1118
ISSN (Online) | 2308-2801

INTRODUCTION

Chicken egg is a naturally designed tool for reproduction and nourishing the developing embryo (Ukwu *et al.*, 2017). In poultry industry, chicken eggs are quite essential for the growth of the economy of a country (Orhan *et al.*, 2016). In the egg production industry, egg weight is one of the important traits which require serious attention to the egg producers (Tyasi *et al.*, 2022), and they are not equal and need to be routinely checked for quality (Shi *et al.*, 2009). Shi *et al.* (2009) and Hegab and Hanafy (2019), reported that among the external and internal egg quality traits which are important for reproduction, egg weight is one of the primary factors that influence internal and external egg quality traits in poultry. Egg weight can be determined without breaking the egg and it is directly proportion to albumen, yolk and shell (Shi *et al.*, 2009; Alkan *et al.*, 2014). Chicken egg weight is affected by many factors such as breed, age, diseases, strain, hen body size, water and feed consumption (Alkan *et al.*, 2014). In determination of quality of eggs in poultry, many factors such as egg weight in relation to external and internal quality traits should

be taken into consideration, because quality of egg affects chick quality and future performance of herd in breeding stocks (Celik *et al*., 2018). Based on the authors' knowledge, there is no documented study on effect of egg weight and its prediction from egg quality traits of Ross 308 broiler breeder chicken breed. Hence, the objectives of the study were 1) to quantify the egg weight and egg quality traits, 2) to determine effect of egg weight on egg quality traits 3) to determine correlation between egg weight and egg quality traits, 4) to predict egg weight from egg quality traits of Ross 308 broiler chicken breed. This study will help Ross 308 broiler breeder farmers identify the key traits to focus on when breeding for improved egg weight.

MATERIALS AND METHODS

Purchase of eggs

A total of 1000 Ross 308 broiler breeder eggs were used to conduct the study. The eggs were bought from Daybreak farms at Merinovlakte near Bela Bela town. This farm is located at 24°992 S longitude and 28°294 E latitude, the estimate terrain elevation above sea level is 1100 meters. The temperature in this location is approximately 19.6 °C. The farm receives annual rainfall of less than 636 mm, with most rainfall occurring during summer (Shabalala et al., 2019). The eggs were bought during the peak period (hens aged 30 weeks) and transported with suitable transport and portable refrigerator to avoid possible deterioration to the University of Limpopo Animal laboratory for data collection.

Breeding stock management

The chickens were housed under intensive production conditions at Daybreak farms. The chicken houses were well-ventilated, where curtains opened automatically to control the ventilation and the temperature in the chicken houses. Wood shavings were used as bedding material in the nest boxes and on the floor. The chicken houses were cleaned seven days before the chickens arrived and disinfected to avoid transmission of pathogenic diseases to the chickens. The biosecurity protocols were followed in the area, where the footbaths and hand sprays with disinfectants were placed at the door for disinfection before entering the chicken houses. The feed and water were provided *ad libitum*. Feeds, light program and other management conditions were administered to broiler breeder chickens in accordance with Ross breeder guidelines and recommendations (Ross Breeders, 2023). Vaccinations and medication were carried out following the company's comprehensive health management plan.

Experimental design

A completely randomized design was used. A total of 1000 eggs were randomly selected during the purchase from the Ross 308 broiler breeder chickens. The eggs were classified into three (3) different egg weight groups such as small (< 60 g), medium (60-69 g) and large (> 69 g), small eggs were 740, medium were 140 and 120 were large. Egg weight was the treatment and the egg categories, small (740), medium (140) and large (120) were replications of the study.

External egg quality traits

The egg weight and external egg quality traits such as egg length, egg width and shell weight were measured in the study as described by Kgwatalala *et al*. (2013). Egg weight was measured using an electronic scale with a precision of 0.01 g, whereas egg length and width were determined with a digital vernier calliper with an accuracy of 0.01 mm. Shell weight was determined by weighing the shell on the electronic weighing scale. Other external egg quality traits including egg shape index, shell surface area, unit surface shell weight and shell ratio were calculated using formulas as recommended by Tyasi *et al*. (2022):

$$\text{Shape index (\%)} = (\text{Egg width})/(\text{Egg length}) \times 100$$
$$\text{Shell surface area (cm}^2) = 3.9782 \times \text{egg weight}^{0.75056}$$
$$\text{Unit surface shell weight (g/cm}^2) = (\text{Shell weight}) / (\text{Shell surface area})$$
$$\text{Shell ratio (\%)} = (\text{Shell weight}) / (\text{Egg weight}) \times 100$$

Internal egg quality traits

The internal egg quality traits that were measured include egg yolk weight and albumen weight. Internal egg quality traits were measured following the procedure of Tyasi *et al*. (2022). Briefly, the individual eggs were carefully broken out, cautious not to break the membranes that enclose the egg yolk and albumen. The egg yolk was carefully separated from the albumen using egg yolk separator, and the weight of the egg yolk was determined using an electronic scale. Albumen weight was calculated by subtracting the yolk weight and the shell weight from the whole egg weight. Other internal egg quality traits like albumen ratio, yolk ratio, yolk/albumen and egg volume were calculated using the formulas as indicated by Tyasi *et al*. (2022).

$$\text{Albumen weight (g)} = \text{egg weight} - (\text{yolk weight} + \text{shell weight})$$
$$\text{Albumen ratio (\%)} = \text{albumen weight}/\text{egg weight} \times 100$$
$$\text{Yolk ratio (\%)} = \text{yolk weight}/\text{egg weight} \times 100$$
$$\text{Yolk / albumen} = \text{yolk weight}/\text{albumen weight} \times 100$$

Statistical analysis

Statistical Package for Social Sciences version 29.0 (IBM SPSS, 2023) was used to analyze the data. Descriptive statistics, One-way Analysis of Variance (ANOVA). Pearson's Correlation and. Stepwise regression was used as statistical techniques for data analysis. The following ANOVA model was used:

$$Y_{ij} = \mu + S_i + e_{ij}$$

Where: Y_{ij}: j^{th} observation (egg quality traits) of the j^{th} treatment (egg weight). μ: Overall mean. S_i: Effect of the i^{th} treatment (i = age and egg weight). e_{ij}: Residual error.

The following stepwise regression model was used:

$$Y = a + b_1X_1 + \ldots + b_nX_n$$

Where: Y= dependent variable (egg weight), a= intercept, b1 –bn= coefficient of regression, and X 1 – X n= independent variables (egg quality traits). The significance was observed at $p<0.05$.

RESULTS

Descriptive statistics of external egg quality traits

Descriptive statistics of external egg quality traits such as egg weight (EW), egg length (EL), egg width (EWD), shell weight (SW), shape index (SI), shell surface area (SA), unit surface shell weight (USW) and shell ratio (SR) are presented in Table 1. The results indicated that SA had the highest mean numerical value (84.95), and USW had the lowest mean numerical value (0.10) than the other external egg quality traits.

Table 1: Descriptive statistics of external egg quality traits.

Trait	Minimum	Maximum	Mean	Standard error	Standard deviation
Egg weight (g)	32.59	98.25	59.30	1.04	11.20
Egg length (mm)	46.61	70.36	56.09	0.41	4.44
Egg width (mm)	23.07	51.75	42.87	0.29	3.08
Shell weight (g)	4.37	9.84	6.94	0.09	0.92
Shape index (%)	37.58	82.73	76.66	0.47	5.08
Shell surface area (mm^2)	54.37	124.47	84.95	1.10	11.75
Unit surface shell weight (g)	0.04	0.10	0.08	0.00	0.01
Shell ratio (%)	5.51	16.38	11.87	0.12	1.30

Table 2: Descriptive statistics of internal egg quality traits.

Trait	Minimum	Maximum	Mean	Standard error	Standard deviation
Yolk weight (g)	5.31	34.02	17.35	0.47	5.00
Albumen weight (g)	15.11	67.68	35.00	0.64	6.87
Albumen ratio (%)	46.36	76.78	59.12	0.39	4.16
Yolk ratio (%)	14.94	40.23	29.01	0.40	4.25
Yolk/Albumen (%)	21.02	86.76	49.78	1.00	10.58

Descriptive statistics of internal egg quality traits

Descriptive statistics of internal egg quality traits such as yolk weight (YW), albumen weight (AW), albumen ratio (AR), yolk ratio (YR) and yolk/albumen (Y/A) are presented in Table 2. The results indicated that AR had the highest mean numeric value (59.12), and the YW had the lowest mean numeric value (17.35) than the other internal egg quality traits.

Effect of egg weight on internal egg quality traits

Table 3 presents the effect of egg weight on internal egg quality traits. The results indicated that egg weight affects all measured internal egg quality traits ($P < 0.05$). The results showed that large egg weight group had higher ($P < 0.05$) YW, YR and Y/A than small and medium egg weight groups.

Table 3: Effect of egg weight on internal egg quality traits.

Trait	Egg weight groups		
	Small	Medium	Large
Yolk weight (g)	15.55 ± 0.25^{c}	17.48 ± 0.26^{b}	28.16 ± 1.62^{a}
Albumen weight (g)	32.31 ± 0.35^{a}	37.46 ± 0.51^{b}	48.51 ± 2.53^{c}
Albumen Ratio (%)	59.27 ± 0.36^{ab}	60.22 ± 0.51^{a}	56.86 ± 2.20^{b}
Yolk ratio (%)	28.47 ± 0.38^{b}	28.13 ± 0.47^{b}	33.32 ± 1.92^{a}
Yolk/albumen (%)	48.50 ± 0.95^{b}	46.86 ± 1.17^{b}	60.95 ± 4.70^{a}

[a, b, c]: means in the same row with different superscripts are significantly ($P < 0.05$) different.

Effect of egg weight on external egg quality traits

Effect of egg weight on external egg quality traits are shown in Table 4. The results showed that egg weight affects all measured external egg quality traits ($P < 0.05$). The results showed that the medium egg weight group had a higher ($P < 0.05$) EW, EL, EWD, SW, SI and SA than small and large egg weight groups.

Table 4: Effect of egg weight on external egg quality traits.

Trait	Egg weight groups		
	Small	Medium	Large
Egg weight (g)	54.53 ± 0.52^{c}	62.18 ± 0.50^{b}	84.99 ± 2.31^{a}
Egg length (mm)	54.18 ± 0.22^{c}	57.58 ± 0.64^{b}	65.97 ± 0.72^{a}
Egg width (mm)	42.10 ± 0.17^{b}	42.59 ± 1.33^{b}	47.87 ± 0.57^{a}
Shell Weight (g)	6.66 ± 0.07^{c}	7.24 ± 0.13^{b}	8.32 ± 0.35^{a}
Shell index (%)	77.77 ± 0.30^{a}	74.29 ± 2.69^{b}	72.62 ± 0.85^{b}
Shell surface area (mm^2)	79.94 ± 0.53^{b}	88.28 ± 0.53^{b}	111 ± 2.28^{a}
Unit surface shell weight (g)	0.08 ± 0.00^{a}	0.08 ± 0.00^{a}	0.07 ± 0.00^{b}
Shell ratio (%)	12.25 ± 0.11^{a}	11.65 ± 0.16^{a}	9.81 ± 0.38^{b}

[a, b, c]: means in the same row with different superscripts are significantly ($P < 0.05$) different.

Correlation matrix between external egg quality traits

The relationship between external egg quality traits of Ross 308 broiler breeder chickens is presented in Table 5. The results indicated that EW had a highly significant positive correlation (P < 0.01) with EL (r = 0.92), EWD (r = 0.73), SW (r = 0.75) and SA (r = 1.00); and negative statistical correlation with SI (r = -0.28), USW (r = -0.37) and SR (r = -0.67).

Table 5: Correlation between external egg quality traits.

Trait	EW	EL	EWD	SW	SI	SA	USW	SR
EW								
EL	0.92**							
EWD	0.73**	0.56**						
SW	0.75**	0.64**	0.55**					
SI	-0.28**	-0.54**	0.40**	-0.14ns				
SA	1.00**	0.92**	0.73**	0.75**	-0.27**			
USW	-0.37**	-0.41**	-0.30**	0.33**	0.18*	-0.37**		
SR	-0.67**	-0.67**	-0.49**	-0.03ns	0.24*	-0.67**	0.93**	

ns= no significant; *= Correlation is significant at the 0.05 level; **= Correlation is significant at the 0.01 level, EW = Egg weight, EL = Egg length, EWD = Egg width, SW = Shell weight, SI = Shell index, SR = Shell ratio, USW = Unit surface shell weight, SA = Shell surface area.

Correlation matrix between internal egg quality traits

Table 6 shows the relationship between internal egg quality traits of Ross 308 broiler breeder chickens. The results indicated that YW had a high positive correlation (P < 0.01) with AW (r = 0.57), YR (r = 0.74) and Y/A (r = 0.71), while had a negative correlation with AR (r = -0.59).

Table 6: Correlation between internal egg quality traits.

Trait	YW	AW	AR	YR	Y/A
YW					
AW	0.57**				
AR	-0.59**	0.28**			
YR	0.74**	-0.06ns	-0.95**		
Y/A	0.71**	-0.10ns	-0.96**	0.99**	

ns= no significant, **= Correlation is significant at the 0.01 level, YW= Yolk weight, AW= Albumen weight, AR= Albumen ratio, YR= Yolk ratio, Y/A= Yolk/Album.

Correlation matrix between internal and external egg quality traits

The relationship between internal and external egg quality traits of Ross 308 broiler breeder chickens is presented in Table 7. The results indicated that EW had a highly significant positive correlation (P < 0.01) with EL (r = 0.92), EWD (r = 0.73), SW (r = 0.75) and SA (r = 1.00); and negative statistical correlation with SI (r = -0.28), USW (r = -0.37) and SR (r = -0.67).

Prediction of egg weight

Stepwise regression exploration was conducted to fit the best model for prediction of egg weight of Ross 308 broiler breeder chickens as shown in Table 8. The results revealed that in case of external traits, SA alone accounted for 100% variation in egg weight; and addition of other traits did not make any remarkable difference in improving the EW of Ross 308 broiler breeder chickens. Further, the results revealed that under internal egg quality traits, YW alone accounted for 72% of variation in egg weight. Meanwhile, the inclusion of YR improved the accuracy to 95% while inclusion of AW and AR improved the accuracy to 100%.

Table 7: Correlation between internal and external egg quality traits.

Trait	EW	EL	EWD	SW	SI	SA	USW	SR	YW	AW	AR	YR	Y/A
EW													
EL	0.92**												
EWD	0.73**	0.56**											
SW	0.76**	0.64**	0.55**										
SI	-0.3**	-0.54**	0.40**	-0.14ns									
SA	1.00**	0.92**	0.73**	0.75**	-0.27**								
USW	-0.37**	-0.41**	-0.26**	0.33**	0.18*	-0.37**							
SR	-0.70**	-0.70**	-0.49**	-0.03ns	0.24*	-0.67**	0.93**						
YW	0.85**	0.82**	0.63**	0.69**	-0.27**	0.85**	-0.27**	-0.53**					
AW	0.91**	0.82**	0.66**	0.58**	-0.24*	0.91**	-0.46**	-0.69**	0.57**				
AR	-0.12ns	-0.16ns	-0.12ns	-0.29**	0.06ns	-0.12ns	-0.18ns	-0.09ns	-0.59**	0.28**			
YR	0.32**	0.36**	0.27**	0.29**	-0.13ns	0.32**	-0.11ns	-0.22*	0.74**	-0.06ns	-0.95**		
Y/A	0.28**	0.33**	0.23*	0.28**	-0.13ns	0.28**	-0.06ns	-0.16ns	0.71**	-0.10ns	-0.96**	0.99**	

ns= no significant, * = Correlation is significant at the 0.05 level, ** = Correlation is significant at the 0.01 level, EW = Egg weight, EL = Egg length, EWD = Egg width, YW = Yolk weight, AW = Albumen weight, SW = Shell weight, SI = Shell index, SR = Shell ratio, AR = Albumen ratio, YR = Yolk ratio, Y/A = Yolk/Albumen, USW = Unit surface shell weight, SA = Shell surface area.

Table 8: Best fitted regression models with stepwise regression analysis

Estimators	Models	R^2	MSE	P value
External traits as estimators				
SA	EW = – 21.60 + 0.95SA	1.00	14284.31	0.000
Internal traits as estimators				
YW	EW = 26.26 + 1.90YW	0.72	35.17	<0.001
YW and YR	EW = 59.79 + 3.08YW – 1.86YR	0.95	7.06	<0.001
YW, YR and AW	EW = 8.97 + 1.28YW – 1.86YR + 0.96AW	1.00	0.34	<0.001
YW, YR, AW and AR	EW = 58.72 + 1.10YW – 0.64YR + 1.12AW – 0.67AR	1.00	0.05	<0.001

EW = Egg weight, SA = Shell surface area, YW = Yolk weight, YR = Yolk ratio, AW = Albumen weight, AR = Albumen ratio.

DISCUSSION

Egg quality characteristics influence embryo development, hatchability, and growth performance of chicks (Ukwu *et al*., 2017). Egg weight is one of the most important characteristics because each component of the egg depends on it (Tumova *et al*., 2009). Egg weight is important in broilers because, Hegab and Hanafy (2019), reported that egg weight together with other egg quality traits affect both hatchability and hatching weight of chickens. Hence, this study was conducted firstly to quantify the egg weight and egg quality traits of Ross 308 broiler breeder chickens. Descriptive statistics was used, and the results indicated that egg weight, egg length, egg width and shell weight had a mean of 59.30 g, 56.09 mm, 42.87 mm and 6.94 g respectively. Abanikannda *et al*. (2006) reported results on Harco chicken layer genotype, which are similar to the results of the present study. However, results of Ukwu *et al*. (2017) on Isa Brown egg layer chickens and Tyasi *et al*. (2022) on the Potchefstroom Koekoek chicken genotype are higher than the results of the present study. These differences might be due to breed difference, since Khan *et al*. (2004) indicated that bird breed affects egg quality traits of chickens. Descriptive statistics do not reveal the effect of the measured characteristics, hence the following objective reveals the effect of egg weight on the measured traits.

The second objective was to use Analysis of Variance to examine the effect of egg weight on the egg quality traits. The results revealed that egg weight significantly affected yolk weight, albumen weight, albumen ratio, yolk ratio and yolk/albumen. Yolk weight and albumen weight increased with increasing egg weight. The results agree with a study of Hegab and Hanafy (2019), who reported similar results on Japanese Quail eggs (*Coturnix coturnix japonica*). Moreover, it has been reported that egg weight influences the internal egg characteristics in brown-egg layer strain of Nike (Shi *et al*., 2009). Results of the present study disagree with the study of Tyasi *et al*. (2022), who reported no effect of egg weight on albumen ratio and yolk ratio. The results of the present study imply that yolk weight, albumen weight, albumen ratio, yolk ratio and yolk/albumen should be considered when improving egg weight of Ross 308 broiler breed.

Effect of egg weight was further examined on external egg quality traits. The results revealed a significant effect of egg weight on egg length, egg width, shell weight, shell index, shell surface area, unit surface shell weight and shell ratio. Egg length, egg width, shell weight, shell index and unit surface shell weight as egg weight increases. Shell index and shell ratio decreased in increase of egg weight. Results of Hegab and Hanafy (2019) and Ukwu *et al*. (2017) indicate that egg weight affects the external egg quality traits, which agree with the results of the present study. However, Alkan *et al*. (2014) results indicate that unit surface shell weight is not affected by egg weight in partridge (*Alectoris Chukar*), which disagree with the present study. The variation might be due to the difference in breed and production system, since Alkan *et al*. (2014) used a cage system. These results suggest that egg length, egg width, shell weight, shell index, shell surface area, unit surface shell weight and shell ratio should be considered when breeding to improve the egg weight. Analysis of Variance does not reveal the correlation between the measured characteristics, hence the following objective reveals the correlation between the measured characteristics.

Pearson's correlation technique was used to investigate the correlation between egg weight and egg quality traits of the Ross 308 broiler breed, to accomplish the third objective. The findings revealed that egg weight positively correlated with external traits, egg length, egg width, shell weight, and unit surface shell weight, and negatively correlated with shell index and shell ratio. Study of Alkan *et al*. (2014) and Tyasi *et al*. (2024) agree with the current study, that egg weight has a positive correlation with egg length, egg width, shell weight and negative correlation with shell ratio. These results imply that egg weight might improve when improving egg length, egg width, shell weight, and decrease when increasing shell ratio.

Moreover, the correlation between egg weight and internal egg quality traits of Ross 308 broiler breed was

investigated. The results revealed that egg weight has a positive correlation with albumen weight, yolk weight, yolk ratio, yolk/albumen and negative correlation with albumen ratio. Hegab and Hanafy (2019), who reported positive correlation between egg weight and albumen weight, which agrees with the present study. However, Tyasi *et al.* (2022) reported positive correlation between egg weight and albumen ratio, which disagrees with the present study. Furthermore, the results of the study also disagree with the study of Tyasi *et al.* (2024), who reported positive correlation between egg weight and albumen ratio. These results imply that egg weight might increase when increasing albumen weight, yolk ratio and yolk/albumen, and decrease when increasing albumen ratio. Therefore, egg length, egg width, shell weight, unit surface shell weight, albumen weight, yolk ratio and yolk/albumen might be employed in the selection criteria during breeding to improve egg weight of Ross 308 broiler breeder chickens. Pearson's correlation technique does not estimate egg weight from egg quality traits, rather association between them, hence the following objective reveals models to estimate egg weight from egg quality traits.

Stepwise regression technique was used to investigate which egg quality traits are closely related and what percentage contributes to predicting egg weight from egg quality traits. The regression results indicated that under external estimators, the shell surface area alone contributed 100% to the variation of egg weight in the Ross 308 broiler breeder chicken. Furthermore, the results revealed that the model including yolk weight, yolk ratio, albumen weight and albumen ratio had the greatest coefficient of determination and least residual mean square error. Thus, it was selected as the best fit model for prediction of egg weight of the Ross 308 broiler breeder chicken. The results of Tyasi *et al.* (2024) agree with the results of the study. Moreover, this study suggests that egg weight might be best predicted with more egg quality traits. As a result, yolk weight, yolk ratio, albumen weight and albumen ratio might be selected together for the prediction of egg weight of Ross 308 broiler breeder chickens. Portillo-Salgado *et al.* (2021), found that egg weight can be best predicted with egg surface area, egg polar diameter and egg equatorial, which disagree with the results of the current study. There is a need to conduct more studies to investigate the best fit model for prediction of egg wight in other broiler breeder chicken breeds.

CONCLUSION

It is concluded that egg weight affects all measured egg quality traits of Ross 308 broiler breeder chicken, based on analysis of variance findings. Moreover, the results of stepwise regression revealed that the model, including yolk weight, yolk ratio, albumen weight and albumen ratio had the highest R^2 and lowest MSE. Therefore, it was selected as the best fit model for predicting egg weight of R0ss 308 broiler breeder chicken. This suggests that egg weight might be improved by making selection based on these traits during breeding. The study might be helpful to broiler farmers during selection to improve egg weight during breeding.

ACKNOWLEDGEMNT

The authors extend their gratitude to University of Limpopo for providing resources to complete this research.

NOVELTY STATEMENT

This study provides the first empirical evaluation of the relationship between egg weight and egg quality traits of Ross 308 broiler breeder chickens. The study highlights that improving yolk weight, yolk ratio, albumen weight and albumen ratio might improve the egg weight of Ross 308 broiler chicken.

AUTHOR'S CONTRIBUTION

AN have made substantial contributions to acquisition and interpretation of data and have been involved in drafting and revising the manuscript critically. TLT and JWN: have made substantial contributions to conception and design of the study, analysis of data, and have given final approval of the version to be published.

Generative AI and AI assisted technology statement

The authors declare that no generative AI and AI assisted technology was used in the creation of this manuscript.

Conflict of interest

The authors have declared no conflict of interest.

REREFENCES

Abanikannda OTF, Olutogun O, Leigh AO, Ajayi LA (2006). Statistical modeling of egg weight and egg dimensions in commercial layers. Int. J. Poult. Sci., 6(1): 59–63. https://doi.org/10.3923/ijps.2007.59.63

Alkan S, Galiç A, Karsli T, Karabağ K (2014). Effects of egg weight on egg quality traits in partridge (Alectoris Chukar). J. Appl. Anim. Res., 43(4): 450–456. https://doi.org/10.1080/09712119.2014.980419

Celilk S, Sengul T, Inci H, Sodgut B, Sengul A, Kuzu C, Ayasan T (2018). Estimation of egg weight from some external and internal quality characteristics in quail by using various data mining algorithms. Indian J. Anim. Sci., 87(12). https://doi.org/10.56093/ijans.v87i12.79871

Hegab IM, Hanafy AM (2019). Effect of egg weight on external and internal qualities, physiological and hatching success of Japanese quail eggs (*Coturnix coturnix japonica*). Braz. J. Poult. Sci., 21(3). https://doi.org/10.1590/1806-9061-2018-0777

IBM SPSS (2023): Statistical packages for social sciences for windows: base system user's guide. – IBM statistics, 29. Chicago: SPSS Inc. doi:10.2527/jas.2013-6967

Kgwatalala PM, Bolebano L, Nsoso SJ (2013). Egg quality characteristics of different varieties of domesticated helmeted guinea fowl (*Numida meleagris*). Int. J. Poult. Sci., 12(4): 245–250. https://doi.org/10.3923/ijps.2013.245.250

Khan MKI, Khatun MJ, Kibria AKMG (2004). Study the quality of eggs of different genotypes of chickens under semi-scavenging system at Bangladesh. Pak. J. Biol. Sci., 7(12): 2163–2166. https://doi.org/10.3923/pjbs.2004.2163.2166

Orhan H, Eyduran E, Tatliyer A, Saygici H (2016). Prediction of egg weight from egg quality characteristics via ridge regression and regression tree methods. Rev. Brasil. Zoot., 45(7): 380–385. https://doi.org/10.1590/S1806-92902016000700004

Portillo-Salgado R, Cigarroa-Vázquez FA, Ruiz-Sesma B, Mendoza-Nazar P, Hernández-Marín A, Esponda-Hernández W, Bautista-Ortega J (2021). Prediction of egg weight from external egg traits of guinea fowl using multiple linear regression and regression tree methods. Braz. J. Poult. Sci., 23(3). https://doi.org/10.1590/1806-9061-2020-1350

Ross Breeders (2023). Parent Stock Management Handbook. https://aviagen.com/assets/Tech_Center/Ross_PS/Aviagen_Ross_PS_Handbook_2023_Interactive_EN.pdf.

Shabalala ZP, Moeletsi ME, Tongwane MI, Mazibuko SM (2019). Evaluation of in filling methods for time series of daily temperature data: a case study of Limpopo Province, South Africa, Climate., 7 (86): 1 – 117. https://doi.org/10.3390/cli7070086

Shi SR, Wang KH, Dou TC, Yang HM (2009). Egg weight affects some quality traits of chicken eggs. J. Food Agric. Environ., 7(2). https://www.researchgate.net/publication/254936495_Egg_weight_affects_some_quality_traits_of_chicken_eggs

Tumova E, Skřivan M, Englmaierová M, Zita L (2009). The effect of genotype, housing system and egg collection time on egg quality in egg type hens. Czech J. Anim. Sci., 54(No. 1): 17–23. https://doi.org/10.17221/1736-CJAS

Tyasi TL, Ngorima L, Hlokoe VR (2024). Predicting egg weight from egg quality traits of the lohmann brown chicken breed using stepwise regression. Adv. Anim. Vet. Sci., 12(3). https://doi.org/10.17582/journal.aavs/2024/12.3.436.440

Tyasi TL, Rashijane LT, Mokoena K, Molabe KM, Mathapo MC, Hlokoe RV, Selala LJ, Maswana M, Bila L (2022). Effects of egg's weight on egg quality traits of the Potchefstroom Koekoek chicken genotype. KnE Life Sci., 54(4). https://doi.org/10.18502/kls.v0i0.11825

Tyasi TL, Xu R, Qin N, Jing Y, Mu F, Zhu H, Liu D, Yuan S (2017). Assessment of relationship between body weight and body measurement traits of indigenous Chinese Dagu chickens using path analysis. Indian J. Anim. Res., 51(OF). https://doi.org/10.18805/ijar.v0iOF.6990

Ukwu HO, Ezihe CO, Asaa SK, Anyogo ME (2017). Effect of egg weight on external and internal egg quality traits of Isa Brown egg layer chickens in Nigeria. J. Anim. Sci. Vet. Med., 2(4): 126–132. https://doi.org/10.31248/JASVM2017.051