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Evaluation of the laying performance of local chickens fed the conventional layer's mash

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Abstract

Twelve (12) local chickens (*Gallus gallus domesticus*) were randomly assigned and confined in twelve (12) pens each measuring 2m x 1m in a parallel group design. They were fed on the conventional layers mash (LM) adlibitumly for a period of eight (8) weeks. Data pertaining to average number of eggs (ANE), average egg weight (AEW), average longitudinal circumference (ALC) and average transverse circumference (ATC) of eggs was recorded. The data collected for each parameter was compared with literature values for performance of local chickens on free range (FR). The mean number of eggs laid by local chickens fed LM was observed to be 258, while the recorded value for those under FR was 225 during the trial period. The AEW from local chickens fed LM was found to be 44.43g against the recorded value of 45g for those under FR. Results indicated 14.8cm as the ALC of eggs from chickens fed LM against the recorded value of 14.6cm for local chickens on FR. The research further revealed 12.7cm as ATC for local chickens fed LM against a value of 12.5cm for those on FR. ANE from local chickens fed LM (258) was significantly($p<0.05$) higher than that of local chickens on FR (225). AEW for local chickens fed LM (44.43g) did not differ significantly ($p>0.05$) from the documented value (45g). Results of the study indicated that both ALC (14.8cm) and ATC (12.7cm for local chickens fed LM did not differ significantly ($p>0.05$) from the documented values of 14.6cm and 12.5cm respectively for chickens on FR.

Keywords: Local Chickens; Longitudinal Circumference; Transverse Circumference; Egg Weight; Number of Eggs; Free Range; Layers Mash

1 Introduction

In a rural set-up almost every villager keeps traditional (local) chickens, but this is rarely done for egg production. Poultry keeping has been a formal business among Zambians who mostly keep them under free-range system. Free range system of poultry has been practiced for a century or more. This method fell out of favor in the 1960s due to diseases (Schekman, 1996) [11]. Free-range is a method of animal husbandly where the chickens are allowed to roam freely instead of being confined in any manner.

The significance of poultry keeping is that, they provide both meat and eggs as sources of income and protein. Eggs are well balanced in most nutrients, which include proteins, vitamins and minerals; therefore provide most essential nutrients required for the growth and maintenance of the body (Wilbberly and Joy, 1979) [14]. Malnutrition in children can be prevented by including eggs in their diet regularly (Ministry of Agriculture and Co-operatives, 2006) [7]. Poultry keeping creates employment opportunities. Egg production contributes to the country's foreign exchange earnings and reduces importation of poultry products. Since initial investment is low poultry can be kept by the poorest of the poor. Poultry is also used for food at traditional ceremonies, for sports and aesthetic value.

Despite the significance of poultry keeping, people keeping local chickens experience low egg production. This was also confirmed by Kekeocha (1984) [4] who reported that a local chicken could only lay 220-230 eggs in a year with a weight of 45g-50g. Schekman, (1996) [11] discovered that if a chicken is not given enough feed it becomes weak and is prone

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to disease attack. Layer's mash contains the necessary nutrient requirements for egg-laying in chickens (Owen, 1973) [9]. Layer's mash is fortified with minerals and vitamins essential for egg laying. This indicates that when chickens are fed layers mash, they can produce many eggs since layer's mash contains nutritional elements needed for maximum performance of the chicken in egg laying. In addition layer's mash is needed for body maintenance.

Other nutritional components of Layer's mash include15% of trace elements and mineral concentrate, 15% of white fishmeal, 15% maize meal, 35% barley meal, 12½ wheat meals, 5 % groundnut meal and 2½% lime flour (Baron, 1966) [1]. According to Schekman (1996) [11] Layer's mash is composed of 20% crude protein, 4.5% fat, 7.0% crude fiber, 0.8% phosphorus, 0.8% calcium and 20% ash. Egg weight is a fairly highly heritable characteristic, which is unfortunately negatively correlated with egg production, and this generally results in strains of poultry, which lay small eggs (The Tropical Agriculture, 2001) [12]. Rath et al (2015) [10] observed that the heritability estimates from different egg quality traits were moderate to high. Since most of the traits have high heritability values, these traits can be improved by mass selection.

Parameters such as egg size and clutch size are highly affected by both environmental and genetic factors. Furthermore a number of egg phenotypic features are highly correlated. This is supported by Wang et al (2021) [13] who reported that egg weight, shell membrane weight, and calcified shell weight were significantly correlated with geometric mean diameter, surface area, and volume. In accordance with false discovery rate–adjusted *P* value, both shell membrane relative weight and calcified shell thickness showed no significant correlations with any of the geometrical parameters.

However, the same workers observed that correlations between geometrical parameters and other shell variables (calcified shell weight, shell relative weight, calcified shell thickness uniformity, and eggshell breaking strength) depend on breed. Both constitutive proportions and percentage contents of 3 eggshell matrix components (acid-insoluble, water-insoluble, and both acid and water facultative-soluble matrix) had no effects on egg shape and size. The correlations between the amounts of various shell matrix, egg shape and size depend on breed or species.

Results of the study by Nassar et al (2017) [8] showed that Cairo L-2 strain egg production until 36 week of age, average about 80% of that of LBL strain after 5 generations of selection for egg production of Cairo L-2 strain. In addition, there were positive responses in ovarian morphology, egg production, and egg quality traits of Cairo L-2 strain as a result of selection program.

A study by Kejela (2019) [3] indicated that in spite of suboptimal management and feeding egg quality of the exotic chickens was higher than those of the native chickens. And differences were also observed in the egg quality traits between the genotypes reared in the two locations, which can be ascribed to genotype by environment interactions. So then, it is perceived that if the chickens are provided with scientific management, the egg quality of the chicken can improve significantly.

The number of eggs laid by local chickens is not enough to meet national demand despite statistical records showing significant populations in Zambia. The size and weight of eggs are also affected by the type of feed they feed on. In a free range system of chicken production access to a balanced diet by chickens is not guaranteed. The feed does not contain all nutritional values that promote consistent egg-laying. It is against this background that an evaluation of the laying performance of local chickens fed layer's mash was carried out at Kanchindu area in Sinazongwe with the following objectives:

- To compare the number of eggs laid by local chickens fed layer's mash and those on free-range.
- To compare the weight of eggs laid by local chickens fed layer's mash and those on free-range.
- To compare the longitudinal circumference of eggs laid by local chickens fed layer's mash and those on free-range.
- To compare the transverse circumference of eggs laid by local chickens fed layer's mash and those on free range.

2 Materials and methods

2.1 Study Site

The research was carried out in Kanchindu area of Sinazongwe district in the Southern province of Zambia. The area lies 900m above sea level. It is located between latitude of 17°45'S and longitude of 27°15'E. The mean annual rainfall is approximately 400mm – 800mm. The temperature varies from 22°C to 41°C with sand-loam soils (Ministry of Agriculture and co-operatives, 2008) [6].

2.2 Experimental Units, Feeding Trial and Data Collection

The experiment involved two treatments; layer's mash and free range. Local chickens of the same breed were confined in a poultry house and were fed layers mash. Feeding was done twice a day in the morning and late afternoon. Feed and clean water were available adlibitumly in feeders and drinkers respectively.

The parallel group design was used in this study and the chickens were randomly allocated to compartments in the poultry house by picking lots. A poultry house measuring 12m by 2m was divided into twelve (12) pens each measuring 1m by 2m. The layout was as shown in Figure 1.

1	2	3	4	5	6	7	8	9	10	11	12

Figure 1. Experimental layout

Eggs were counted, weighed and measured for both longitudinal circumference (LC) and transverse circumference (TC). Secondary data from literature was used for free range.

2.3 Statistical Model

$$Y_{ijk} = \mu + R_i + A_j + W_k + (RA)_{ij} + (RAW)_{ijk} + bx + \varepsilon_{ijk}$$

Where y_{ij} = observed laying performance on individual chicken of a given ration, age and k^{th} weight.
μ = overall mean for effect of a given i^{th} ration.
R_i = effect of the i^{th} ration
A_j = effect of j^{th} age
W_k= effect of k^{th} weight
$(RA)_{ij}$ = Interaction effect of the i^{th} ration and j^{th} age
$(RW)_{ik}$= Interaction effect of i^{th} ration and k^{th} weight
(AW)jk= Interaction effect of j^{th} age and k^{th} weight
$(RAW)_{ijk}$=Three way interaction of i^{th} ration, j^{th} age and k^{th} weight
bx= b is a regression coefficient for initial age, x used as a covariate.
ε_{ijk} = random error component.

2.4 Statistical Analysis

Data was analyzed in Excel by comparing the means using one sample T- test

3 Results

The number, weight, longitudinal circumference (LC) and transverse circumference (TC) of eggs were compared on average, for local chickens fed layer's mash (LM) and those on free-range feeding (FRF). The comparisons were summarized in Table 1 below:

Table 1 Averages of observed parameters

TREATMENT	No. EGGS	WEIGHT (g)	LC (cm)	TC (cm)
LM	258	44.43	14.8	12.7
FRF	225	45	14.6	12.5

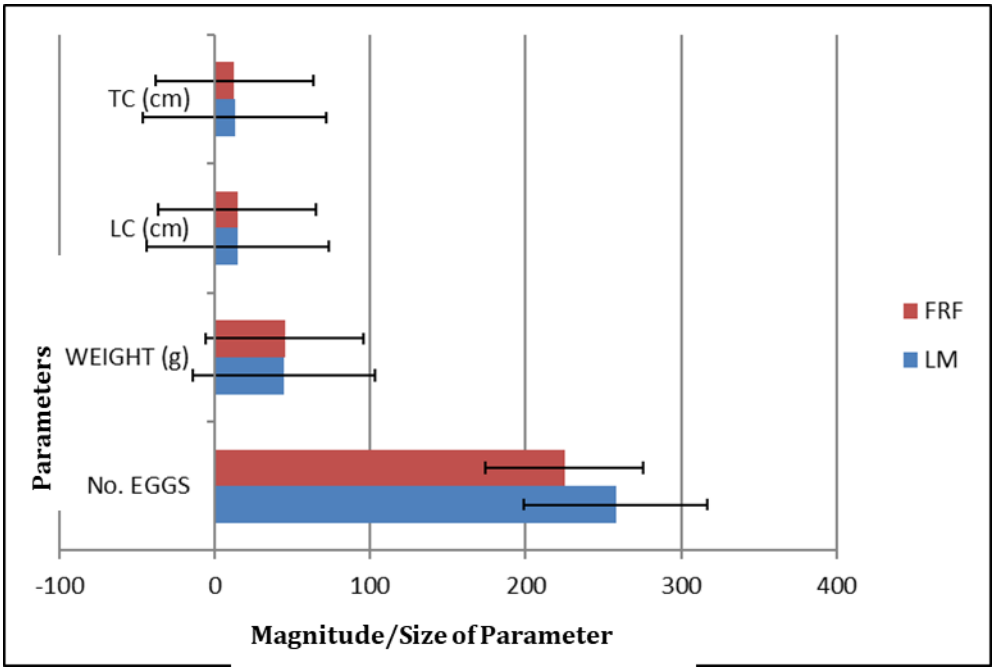

Figure 2 Effects of Treatments on Egg Parameters

The average mean for the number of eggs laid by local chickens fed layer's mash was 258 while recorded value from local chickens on free-range feed, was 225. The average weight of eggs from local chickens fed layer's mash was 44.43g while literature value for those on free-range feed was 45g. The average for Longitudinal Circumference (LC) was 14.8cm for local chickens fed layer's mash while the literature value for those on free-range feed is 14.6cm. In addition, the average mean for Transverse Circumference (TC) of eggs laid by local chickens fed layer's mash was 12.7cm while that for those on free-range feed was 12.5cm. The means for parameters under consideration were also compared using the t-values at $P<0.05$ level of significance (Table 2).

Table 2 Comparisons of t-values

	No. EGGS	WEIGHT (g)	LC (cm)	TC (cm)
Mean	258	44.43	14.8	12.7
Standard Deviation	46.3	7.19	0.7	0.7
Sample size (n)	12	12	12	12
Standard value	225	45	14.6	12.5
t- calculated	2.43	-0.27	1.2	0.8
t-tabulated	2.2	2.2	2.2	2.2

LC=Longitudinal Circumference, TC=Transverse Circumference; Add standard error

4 Discussion

Egg weight had significant influence on egg length, egg width oblong circumference and egg shell weight. Egg weight also had influence on yolk height, yolk diameter and albumen height (Henry et al, 2017) [2].

4.1 Number of Eggs

The number of eggs was observed to be higher (258) than the standard value (225) per year. The cause can only be attributed to differences in nutritional level since all birds were of the same breed. The average number of eggs for local chickens fed layer's mash was significantly ($p < 0.05$) different from the documented standard for local chickens on free range feeding ($t_{cal} > t_{tab}$). This difference is attributed to differences in nutrient composition of the feed in the two feeding

systems. This is supported by Owen, (1973) [9] who observed that layer's mash contains the necessary nutrients for egg laying.

4.2 Egg Weight

Egg weight (44.43g) for local chickens fed layer's mash was not significantly ($p>0.05$) different from the documented standard value (45g) (Table 2). Egg weight is a predominantly genetic factor, though environmental factors such as plane of nutrition can play a role. This means that layer's mash has more influence on increasing number of eggs laid by a bird than egg weight. A report by Manitoba Agriculture and Resource Development (2017) [7] indicated that feed intake has a direct impact on the hens' intake of nutrients and the size of eggs that they produce. Any factor that limits feed consumption, for example crowding, heat stress or inadequate water supply will reduce egg size. Results of the current study are in consonance with those of Kejela (2019) [3] who perceived that if chickens are provided with scientific management, the egg quality of the chicken can improve significantly.

Protein level in the feed can be used to alter egg size at different stages of production. In the first couple of months of egg production feeding a high, 18% to 20% protein layer ration will increase egg size. After the flock has reached maximum egg production, high protein diets no longer promote large increases in egg size. After 36 weeks of age, feeding rations with 15% to 17% protein will help to slow increases in egg size (Manitoba Agriculture and Resource Development, 2017) [5].

4.3 Egg Longitudinal Circumference and Transverse Circumference

When evaluated for longitudinal circumference (LC) and transverse circumference (TC) it was observed that both parameters did not differ significantly ($p>0.05$) (Table 2). Furthermore, the transverse circumference (TC) did not differ significantly ($p>0.05$) from the documented value of 12.5cm. The LC and TC are genetically controlled parameters.

5. Conclusion

Results of the study have indicated superiority of egg laying for local chickens fed layer's mash over local chickens on free range system. However, the digestive system of local chickens is not adapted to the layer's mash and adaptation period could have been longer than two months (lag period). The study also concluded that feed has no influence on egg weight and egg size. Local chickens should be fed layer's mash to increase the number of eggs. However, there is need to investigate the influence of breed on laying percentage.

Compliance with ethical standards

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Data Availability

Readers can access the data used in the conclusions for this article by contacting the corresponding author through the following contact details: Email: *mcmchisowa@yahoo.com.sg* or *southernuni11@yahoo.com*

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Disclosure of conflict of interest

As author I declare that there are no competing interests. There is no conflict of interest regarding the publication of this article.

References

[1] Baron M. 1966. Poultry keeping, in schools, Pergamon Press Ltd. London, UK.

[2] Henry O. U., Ezihe C. O., Asaa S. K. and Anyogo M. E. 2017. Effect of egg weight on external and internal egg quality traits of Isa Brown egg layer chickens in Nigeria.

[3] Kejela Y. Banerjee S. and Taye M. 2019. Some internal and external egg quality characteristics of local and exotic chickens reared in Yirgalem and Hawassa towns, Ethiopia. International Journal of Livestock Production Vol. 10(5), pp. 135-142, May 2019 DOI: 10.5897/IJLP2018.0547 Article Number: B9 BA64160597 ISSN 2141-2448, Hawassa University, Hawassa, Ethiopia.

[4] Kekeocha C. C. 1984. Poultry Production, Handbook. MacMillan Education Ltd. London, U.K.

[5] Manitoba Agriculture and Resource Development, 2017. Egg Size and Your Small Flock of Laying Hens. Livestock Production Report, Canada.

[6] Ministry of Agriculture and Co-operatives, 2008. Poultry Production, Sinazongwe District, Zambia.

[7] Ministry of Agriculture and Co-operatives, 2006. Poultry Production. Wilms Enterprises Ltd. Lusaka, Zambia.

[8] Nassar F. S., El-Komy E. M., Abdou,A. M. 2017. Ovarian Morphology and Egg Quality Traits of Egyptian Selected Strain for Egg Production Compared with Commercial Laying Strains 683. Brazilian Journal of Poultry Science, ISSN 1516-635X Oct - Dec 2017 / v.19 / n.4 / 683-688http://dx. DOI.org/10.1590/1806-9061-2016-0455.

[9] Owen, G.H. 1973. Agriculture Science, Longman Group Ltd. London, U.K.

[10] Rath P. K., Mishra P. K., Mallick B. K. and Behura N. C. (2015). Evaluation of different egg quality traits and interpretation of their mode of inheritance in White Leghorns, Veterinary World 8(4): 449-452. EISSN: 2231-0916.

[11] Schekman W. 1996. Focus on Agriculture, College Press Publishers (PVT) Ltd. Harare, Zimbabwe.

[12] The Tropical Agriculturalist, 2001. Poultry Revised Edition, Macmillan Education, Malasia.

[13] Wang L. C., Ruan Z.T., Wu Z.W., Yu Q. L., Chen F., Zhang X. F., Zhang F. M., Linhardt R. J. and Liu Z.G. 2021. Geometrical characteristics of eggs from 3 poultry species, Poultry Science, Volume 100, Issue 3, 2021, Article 100950.

[14] Wilbberly H. and Joy D. 1979. A Tropical Agriculture, Handbook Cassel Ltd, London, UK.