International Journal of Science and Research Archive
eISSN: 2582-8185
Cross Ref DOI: 10.30574/ijsra
Journal homepage: https://ijsra.net/

(RESEARCH ARTICLE)

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IMPACT OF WATER INTAKE ON EGG PRODUCTION IN LAYING BIRDS

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International Journal of Science and Research Archive, 2026, 20(02), 419–424

Publication history: Received on 07 July 2026; revised on 15 August 2026; accepted on 17 August 2026

Article DOI: https://doi.org/10.30574/ijsra.2026.20.2.1630

ABSTRACT

Water is considered the most important nutrient for poultry; it is so important that it impacts virtually every physiological function in a bird's body. This study was conducted to investigate the impact of water intake on the quantity and quality of egg production in laying birds.

A total of 230 Isa brown hens (58 weeks of age), initially purchased from CHI Farms and reared in a deep litter system, were acclimatized and randomly divided into three (3) groups (A, B, C) and in three replicates of 25 hens each (A_1, A_2, A_3; B_1, B_2, B_3; C_1, C_2, C_3). Birds in each replicate were fed a standard layer ration of 100g per day. Water intake was calculated per group at the ratio of feed to water ratio. Group A was given a feed: water ratio of 1:2, Group B was given a feed: water ratio of 1:3, and Group C was given a feed: water ratio of 1:5. The study was carried out for 8 weeks.

Group B, given a feed-water ratio of 1:3, significantly experienced an increase in the percentage of egg production (A- 58.60%, B- 78.42% and C- 69.66%), egg size uniformity and quality across all the weeks when compared with other groups, especially group A given a feed-water ratio of 1:2.

It was also observed in group C, given a feed-water ratio of 1:5, that an increase in the water intake above 100% without a subsequent increase in feed intake results in a significant reduction in egg production percentage.

It can be concluded that laying birds fed with a feed-water ratio of 1:3 had better results than other groups, which shows that consistent water-to-feed ratios are more critical for sustaining peak egg production.

Keywords: Laying birds, Isa Brown, Egg production Percentage, Egg quality, Egg Size

1 INTRODUCTION

Water is considered the most important nutrient for poultry. The carcass composition of most poultry ranges from 60 to 75% water, and therefore, it is important to provide them with good-quality drinking water. Water is so important

that it impacts virtually every physiological function in a bird's body. Therefore, any limited water supply would inevitably disrupt the productive process in domestic chickens. When domestic chickens face a period of limited water supply, this consequently results in lower body water losses by adjustments in the pattern of loss from various body water compartments (Ahmed and Alamer 2011).

Water intake through drinking water on an absolute basis increases with age, although its consumption per unit of body weight decreases with age. For birds, the drinking behaviour is intimately associated with the hypothalamic control centres of the brain, type of feed, ambient temperature and release of anti-diuretic hormones from the pituitary, which decrease the output of water excreted via the kidneys and the possible storage of water in the cells and tissues.

Other sources of water for the bird include metabolic water produced in the body as byproducts of nutrient catabolism and dietary water, which is present in both biologically active and structural forms. All these water sources help meet the birds' water needs. (Offiong et al., 2003)

Water deprivation often happens in poultry due to neglect, which can be a serious concern because it may negatively impact the overall performance of the bird. Because feed intake and water consumption are closely linked, any reduction in water availability tends to be accompanied by a decrease in feeding activity (Savory, 1978; Abdelsamie and Yadiailo, 1981). This decline can lead to decreased egg production and lower live weight in laying hens (Esonu, 2000; Fujita et al., 2001). Birds generally consume about twice as much water as feed, on a weight basis (Abbas et al., 2008; Boumedous et al., 2017; Raut et al., 2025).

Given the critical role of water in poultry production and the gaps in knowledge regarding its impact on egg production, there is a pressing need for a detailed investigation into how variations in water quantity and deprivation influence egg production and egg quality. Hence, this study was conducted to investigate the impact of water intake on the quantity and quality of egg production in laying birds.

2 MATERIAL AND METHODS

2.1 Experimental Site

The study was carried out in the Poultry Research Unit of Peace House Agricultural Training Institute, Isarun, Ondo State.

2.2 Animal Management and Experimental Design

A total of 230 Isa brown hens (58 weeks of age) initially purchased from CHI Farms reared in a deep litter system were acclimatized and randomly divided into three (3) groups (A, B, C) and in three replicates of 25 hens each (A_1, A_2, A_3; B_1, B_2, B_3; C_1, C_2, C_3). Birds in each replicate were fed a standard layer ration of 100g per day. Water intake was calculated per group at the ratio of feed to water ratio.

Group A was given a feed: water ratio of 1:2, Group B was given a feed: water ratio of 1:3 and Group C was given a feed: water ratio of 1:5. The study was carried out for 8 weeks.

2.3 Parameters Measured

A well-documented and consistent record was maintained throughout the time of research. Daily water intake, daily feed intake and daily egg production were recorded. Egg deformities were noted in detail (Shell-less egg and soft-shell egg), and the sizes of eggs produced were recorded (Large, medium and small)

2.4 Statistical analysis

The means and standard error of mean (SEM) of the data were calculated. The results were analyzed by One-way analysis of variance (ANOVA) using SPSS version 31 to determine significant differences between means. The differences between groups were considered significant at $P < 0.05$.

3 RESULTS

3.1 Egg production

The results of the impact of water intake on the percentage of egg production in this study is shown in the table and figure below.

Table 1: Egg Production (%)

	Group A	Group B	Group C
Week 1	52.48	58.21	53.69
Week 2	56.49[a]	71.80[b]	61.45[c]
Week 3	54.32[a]	76.28[b]	65.75[c]
Week 4	58.60[a]	78.42[b]	69.66[c]
Week 5	59.19[a]	72.56[b]	69.75[b]
Week 6	51.40[a]	71.36[b]	60.04[c]
Week 7	57.30[a]	73.59[b]	65.38[c]
Week 8	56.37[a]	74.39[b]	70.00[b]
SEM	**1.76**	**1.59**	**3.25**

Values expressed in Mean±SD. The values in the same row with different superscript shows significant difference (P<0.05). while the values in the same row with the same superscript show no significant difference

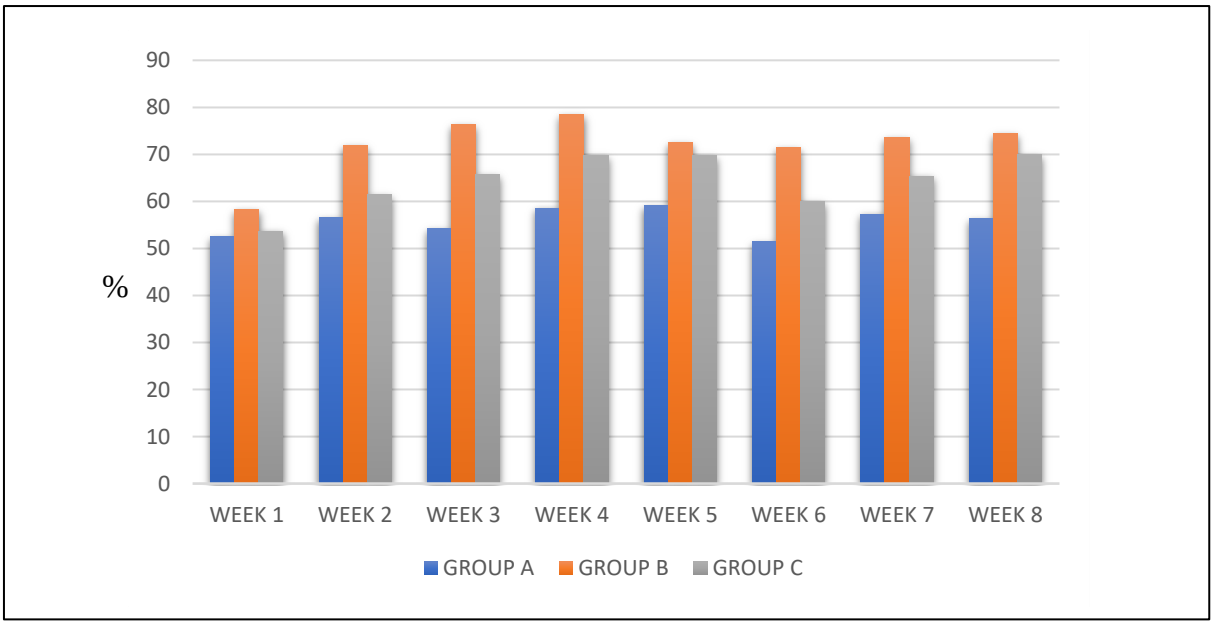

Figure 1: Egg Production (%)

3.2 Egg Size

The results of the impact of water intake on the sizes of egg in this study is shown in the **table and figure below.**

Table 2: Egg Size (%)

	Group A	Group B	Group C
Large	11.57±2.62[a]	7.31±3.42[a]	7.33±1.28[a]
Medium	86.85±3.36[a]	92.43±3.37[a]	92.22±1.53[a]
Small	1.62±1.09[a]	0.57±0.37[a]	0.32±0.21[a]

Values expressed in Mean±SD. The values in the same row with different superscript shows significant difference (P<0.05). while the values in the same row with the same superscript show no significant difference

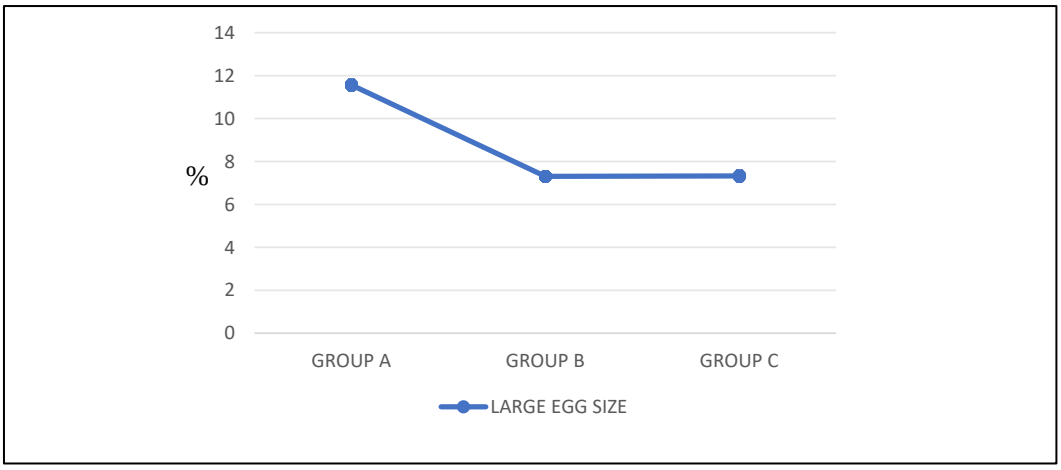

Figure 2: Egg Size (Large)

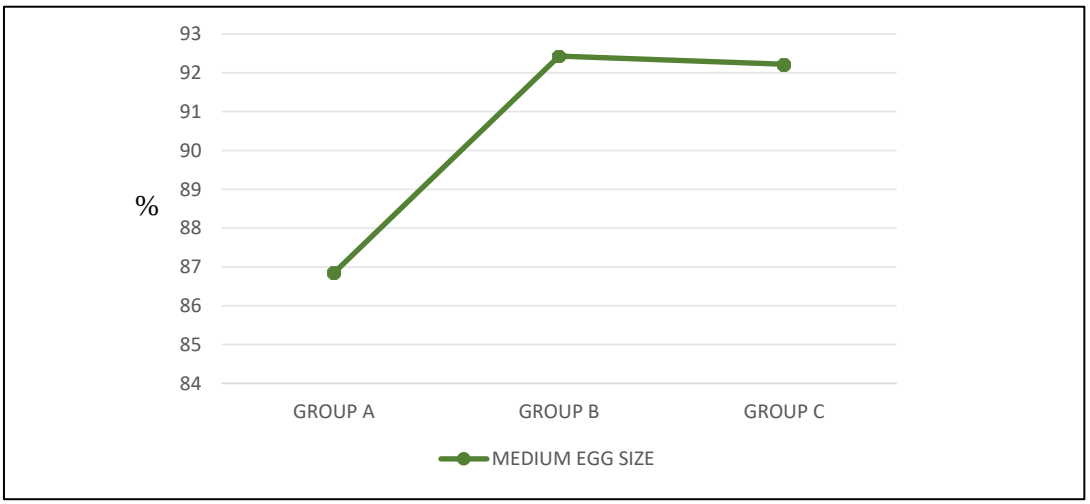

Figure 3: Egg Size (Medium)

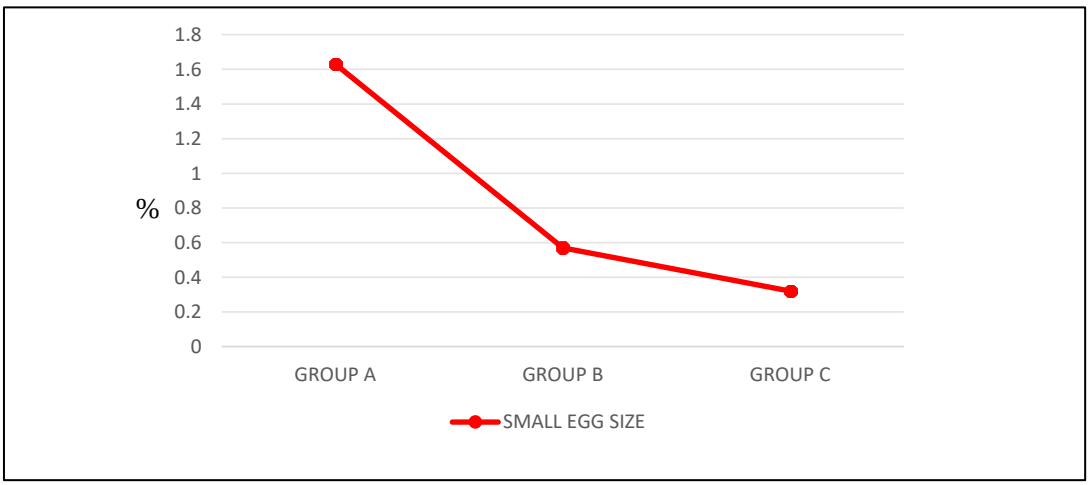

Figure 4: Egg Size (Small)

4 DISCUSSION

The experimental study results unveil significant insights into the impact of water intake on egg production and quality in laying birds.

This study demonstrates a clear correlation between experimental groups (presumably differing in water consumption levels or water quality) and the efficiency of egg production and size.

This research result indicates that birds have been deprived of sufficient water intake over time, and this was evident in the result of production in the first week. For birds exposed to increased water intake, egg production increased significantly from the second week. This finding is in accordance with that of Ahmed and Alamer (2011), who reported that there was an evident response during the first week of restriction in the commercial line, but it was delayed until the second week of restriction in the local breed.

Group B given feed-water ratio of 1:3 significantly experienced an increase in the percentage of egg production across all the week when compared with other group especially group A given feed-water ratio 1:2. This aligns with the findings of Eltahan *et al*. (2023), who noted that water is one of the nutrients with several positive benefits in poultry, making it the most crucial and essential nutrient for overall health; even a marginal increase in accessible, high-quality cold water can lead to a disproportionate increase in metabolic output and egg production. This finding also supports the report of Ahmed and Alamer (2011), who said that their research results indicate that 40% water restrictions negatively affect egg production irrespective of breed.

Water deprivation results in water stress, and during this condition, there is a threshold effect, it is suggested that the hypothalamic osmoreceptors are activated by the increase in blood tonicity, and the hypothalamic- hypophyseal-adrenal axis is consequently activated as well. This would result in increased arginine vasotocin (AVT), prolactin and probably ACTH. These hormones increase water reabsorption to cope with water restriction stress, while declining egg production rate.

It was also observed that an increase in the water intake above 100% without a subsequent increase in feed intake results in a significant reduction in egg production percentage. This was seen in Group C given a feed-to-water ratio of 1:5.

Across all groups, medium egg size was the primary output (>86%). Interestingly, while Group A produced a higher percentage of "Large" eggs compared to other groups, this result was overshadowed by a significant decrease in egg production and quality defects. Group A produced a higher number of "Small" eggs, including extremely small (pewee) eggs. There were frequent observations of light, fragile shells, making the eggs more susceptible to breakage during handling in Group A. Group A birds produced the softest-shelled eggs, suggesting a potential deficiency in calcium metabolism or high stress levels within this group, which could have been induced by low water intake.

5 CONCLUSION

Based upon the findings of this study, laying birds fed with a feed-to-water ratio of 1:3 had better results than laying birds in the other groups. Group B experienced a significant increase in egg production, quality and egg size uniformity. This shows that consistent water-to-feed ratios are more critical for sustaining peak egg production.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

Acknowledgments

We like to acknowledge Bro Gbile Akanni, the Chairman, Governing Council, Peace House Agricultural Training Institute, Isarun, Ondo State, for his support towards the research and Dr [Mrs] Sade Akanni of Peace House, Gboko, for her support towards the research.

Disclosure of conflict of interest

The authors declare no conflict of interest.

Statement of ethical approval

Ethical approval with reference number AEC/25/01/002 was obtained from the Institutional Animal Care and Use of Peace House Agricultural Training Institute, Isarun, Ondo State.

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