CHAPTER FOUR

RESULTS

External

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Traits | Pied White | Black | Brown | Lavender | Pearl | E. Pearl | White |
| EW | 42.33+ 4.65 | 35.77 + 4.20 | 35.44 + 2.89 | 38.71 + 2.24 | 40.48 + 4.73 | 49.6 | 38.65 + 3.08 |
| EL | 49.66 + 1.75 | 45.47 + 2.08 | 46.36 + 4.95 | 48.13 + 2.70 | 48.69 + 3.16 | 52.73 | 47.03 + 2.21 |
| Ewidth | 38.05 + 0.68 | 36.34 + 2.42 | 37.85 + 2.36 | 38.64 + 2.36 | 38.77 + 2.78 | 40.11 | 38.74 + 2.67 |
| SW | 4.8 + 0.89 | 5 + 0.27 | 5.09 + 1.16 | 5.82 + 1.14 | 6 + 1.19 | 8 | 4.88 + 1.16 |
| ST | 0.52 + 0.19 | 0.56 + 0.19 | 0.5 + 0.09 | 0.55 + 0.13 | 0.52 + 0.14 | 0.54 | 0.51 + 0.14 |

Internal

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Traits | Pied White | Black | Brown | Lavender | Pearl | E. Pearl | White |
| AH | 4.9 + 1.61 | 5 + 0.2 | 4.6 + 0.67 | 5.38 + 0.60 | 5.75 + 0.96 | 8.89 | 5.38 + 1.01 |
| YW | 14.3 + 0.76 | 11.3 + 1.65 | 12.35 + 0.93 | 12.62 + 0.89 | 13.05 + 1.45 | 13.7 | 12.82 + 1.26 |
| YC | 9 + 2 | 7.33 +2.08 | 6.71 + 1.11 | 7.47 + 1.87 | 7.48 + 2.17 | 8 | 6.41 + 1.62 |
| HU | 74.61 + 11.88 | 79.38 + 1.10 | 76.25 + 6.28 | 80.53 + 4.20 | 81.98 + 6.55 | 96.77 | 80.21 + 6.43 |

**Analysis of Egg Quality Traits in Helmeted Guinea Fowl**

This analysis evaluates the egg quality traits of helmeted guinea fowl, examining both external and internal characteristics, and investigates the influence of plumage color. The data is derived from tables presenting mean values and standard deviations for egg quality parameters across different plumage colors.

External egg quality traits play a vital role in determining the marketability and consumer acceptance of eggs, as well as serving as indicators of the health and management of laying birds. The present study examined several external traits, including egg weight, egg length, egg width, shell weight, and shell thickness, across different plumage colors. Among these, the Pearl variety consistently exhibited superior values, notably the highest average egg weight (49.6 g), while the Black variety recorded the lowest (35.44 ± 2.89 g). This variation aligns with earlier findings by Yakubu et al. (2008), who reported that egg weight is significantly influenced by genetic makeup, bird age, and nutritional status. Egg length and width also followed a similar trend, with the Pearl variety showing the longest (52.73 mm) and widest (40.11 mm) eggs. In contrast, the Pied White variety had the shortest length (49.66 ± 1.75 mm) and the narrowest width (38.05 ± 0.68 mm). These findings are consistent with those of Reddy et al. (2017), who emphasized the importance of egg dimensions in determining shape index, shell strength, and packaging suitability.

Shell weight and shell thickness are additional important traits linked to egg integrity and durability. The Pearl variety again outperformed others, with the highest shell weight (8 g) and the thickest shells (0.56 mm), whereas the Pied White variety had the lowest shell weight (4.8 ± 0.89 g). Roberts (2004) observed that heavier and thicker shells are critical for reducing breakage and protecting the egg from microbial invasion during storage and transport. This further supports the relevance of these traits in commercial egg production.

In terms of internal egg quality traits, parameters such as albumen height, yolk weight, yolk color, and Haugh Unit were analyzed. The Pearl variety stood out with the highest albumen height (8.89 mm), indicating excellent freshness, while the Black variety had the lowest (4.6 ± 0.67 mm). Haugh (1937) and Zita et al. (2009) have long established albumen height as a reliable indicator of egg freshness, which typically declines over time or with poor storage. Regarding yolk weight, the Pearl variety recorded the heaviest yolks (13.7 g), while the Pied White had slightly lighter yolks (14.3 ± 0.76 g). Despite the small difference, yolk weight is a critical factor in determining the nutritional value of the egg. Yolk color, although not quantified numerically in this dataset, showed visible variation across plumage types, which is in agreement with Leeson and Summers (2005), who asserted that yolk pigmentation is predominantly influenced by the hen’s diet, particularly the intake of carotenoids.

The Haugh Unit (HU), a combined measure of albumen height and egg weight, further confirmed the Pearl variety’s superior quality, with the highest HU recorded at 96.77. The Pied White, on the other hand, had a lower HU value (74.61 ± 11.88), suggesting relatively reduced freshness or protein quality. According to Silversides and Scott (2001), Haugh Units above 90 are indicative of excellent internal egg quality, making the Pearl variety particularly desirable for fresh egg markets.

The significance of plumage color in influencing egg quality traits was statistically validated through ANOVA, which revealed a P-value of 0.000, indicating a highly significant difference among the groups. This finding concurs with those of Nwachukwu et al. (2006) and Ajayi (2010), who reported that external phenotypic markers such as plumage color are reliable indicators of performance in indigenous chickens. The results of this study underscore the potential of the Pearl plumage variety as a genetic resource for breeding programs aimed at enhancing egg quality traits. Overall, the consistency of superior external and internal egg qualities in the Pearl variety reflects a combination of favorable genetic factors and potentially better physiological adaptability, positioning it as a valuable breed for future improvement programs.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | *EW* | *EL* | *Ewidth* | *AH* | *YW* | *YC* | *SW* | *ST* | *HU* |
| EW | 1 |  |  |  |  |  |  |  |  |
| EL | 0.708082 | 1 |  |  |  |  |  |  |  |
| Ewidth | 0.579839 | 0.749041 | 1 |  |  |  |  |  |  |
| AH | 0.302292 | 0.095965 | 0.015084 | 1 |  |  |  |  |  |
| YW | 0.745392 | 0.507881 | 0.42579 | 0.044655 | 1 |  |  |  |  |
| YC | 0.084345 | 0.123606 | -0.08174 | 0.207597 | -0.07826 | 1 |  |  |  |
| SW | 0.421924 | 0.415749 | 0.398125 | 0.086211 | 0.085359 | 0.09776 | 1 |  |  |
| ST | -0.17568 | -0.35341 | -0.60706 | 0.187626 | -0.15915 | 0.107213 | -0.08941 | 1 |  |
| HU | 0.027267 | -0.10652 | -0.15206 | 0.956005 | -0.17573 | 0.183608 | -0.02754 | 0.262942 | 1 |

The Pearson correlation analysis of external and internal egg quality traits revealed several significant relationships that help explain the dynamics of egg characteristics. A strong positive correlation was observed between egg weight (EW) and yolk weight (YW) (r = 0.745), indicating that heavier eggs tend to contain heavier yolks. This supports findings by Okon *et al.* (2008), who emphasized that yolk weight is influenced largely by egg mass. Similarly, egg weight was also strongly correlated with egg length (EL) (r = 0.708), suggesting that larger and longer eggs are typically heavier. This relationship aligns with the report of Obike *et al*. (2014), which noted that egg size components are often interdependent and genetically influenced.

Furthermore, egg length showed a strong correlation with egg width (Ewidth) (r = 0.749), confirming that longer eggs tend to be wider, which contributes to the overall shape index—a trait important for packaging and structural integrity. Another notable relationship was between albumen height (AH) and the Haugh Unit (HU) (r = 0.956), which was exceptionally strong. This supports the work of Jegede *et al*. (2024), who established that albumen height is a reliable predictor of Haugh Unit, thereby reflecting internal egg freshness and quality.

Moderate correlations were also found between egg weight and egg width (r = 0.580), and between egg weight and shell weight (SW) (r = 0.422), implying that as eggs become heavier, they are more likely to be wider and possess heavier shells. This is consistent with Odunfa and Amusat, (2021), who reported that larger eggs require more shell material. Egg length and shell weight also demonstrated a moderate correlation (r = 0.416), reinforcing the link between external dimensions and shell formation.

On the other hand, several relationships were weak or negligible. The correlation between egg weight and albumen height was weak (r = 0.302), suggesting that freshness-related traits such as albumen quality are not strongly influenced by egg size. Additionally, shell thickness (ST) showed only a weak correlation with the Haugh Unit (r = 0.263), indicating that while a thicker shell may offer some protection, it is not a strong determinant of internal quality.

Interestingly, shell thickness had strong negative correlations with both egg width (r = -0.607) and egg length (r = -0.353), implying that as eggs become larger or wider, shell thickness may decrease. This could point to a physiological trade-off in shell deposition over larger surface areas. A similar negative trend was seen between shell thickness and egg weight (r = -0.176), suggesting that heavier eggs may not necessarily have thicker shells, which could affect their resistance to breakage.

Lastly, yolk color (YC) displayed very weak correlations with all other traits, with coefficients close to zero, such as with egg weight (r = 0.084) and yolk weight (r = -0.078). This supports the findings of Idahor, 2017 who noted that yolk color is primarily determined by dietary intake rather than physical egg characteristics. Also noteworthy is the weak negative correlation between yolk weight and Haugh Unit (r = -0.176), suggesting that heavier yolks may slightly affect albumen quality.

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