**Introduction:**

Eggs are a good source of animal protein, high in economic value, and a global staple due to their low cost (Gao et al., 2021). As the standard of living in developed and developing countries rises, more people are interested in the nutritional content of eggs, such as the amount of omega-3 and omega-6 unsaturated fatty acids in the egg yolk. Albumen, yolk, and shell make up an egg. Egg yolks have 48% water, 17.5% protein, 32.5% lipids, and 2% minerals, while albumen has 88% water, 11% protein, 0.2% lipids, and 0.8% minerals. Since egg yolk lipids are largely produced from diet oils, oils affect laying hen output and egg quality. Breeders and producers are paying more attention to the function dietary oils play in livestock and poultry feed as livestock and poultry output improves (Bryden et al., 2021).

Thus, to meet customer demands, the poultry industry must create techniques to improve egg quality and production. The chicken industry relies on egg quality to determine consumer satisfaction, nutritional content, and market competitiveness. Eggs are a vital aspect of human nutrition and global agriculture, with production and consumption rising worldwide. Egg quality includes albumen consistency, yolk color, shell integrity, and freshness (Khatibi et al., 2021). All of these traits affect consumer choices and impressions. In addition, in a time when health consciousness and dietary tastes are constantly changing, high-quality eggs are essential to meet the needs of consumers who want healthy, ethically produced food. Maintaining good egg quality increases customer loyalty and helps poultry farmers stand out in the market and enhance profitability (Reis et al., 2023).

Therefore, understanding and optimizing egg quality factors is crucial to the poultry industry's growth and competitiveness (Gautron et al.,2022). These include feed composition, management, and environment. Domestic chickens provide eggs, an important protein source, to the population. Eggs are considered a "complete food" since they provide a balanced diet for survival and development. Global hen egg production exceeded 80 million tons in 2017, and it has been rising annually. Despite rising food supply, 821 million people globally lack appropriate food, preventing them from enjoying a normal and active life. Global livestock can provide eggs, which can be easily collected from hens, to combat famine (Ramadhon et al., 2021). Much evidence suggests that genetic and environmental factors affect chicken egg production and quality. Heritability estimates for quality and production parameters such egg weight, eggshell strength, albumen, and yolk weights are 0.30–0.70. These data show that genetic variables account for 30 to 70% of phenotypic trait variation, but environmental influences also account for 30 to 70% and are almost equivalent in importance. Thus, genetic and environmental influences affect egg traits (Hammershoj et al., 2021). Egg nutrition management has produced eggs with improved yolk and albumen.

To meet worldwide demand, egg producers offer "designer eggs" brands. Japan has approximately 1,000 egg brands with iodine, minerals, and alpha-linolenic acid. Hens' diets considerably affect egg omega-3 polyunsaturated fatty acid (n-3 PUFA) levels. By changing hens' diets, many countries produce eggs high in long-chain n-3 polyunsaturated fatty acids (PUFAs) like EPA and DHA (George et al., 2023). This is done because PUFAs have several health benefits. Explored where dietary linoleic acid affects yolk composition in different layer breeds. The researchers found that hen food and breed affected yolk fatty acid and cholesterol levels. Thus, breed and food affect yolk and albumen constituent levels. Knowing about it can help egg farmers and customers in the upcoming livestock business. Nutrition is crucial to chicken egg production since it affects quality (Obianwuna et al., 2022). A well-balanced feed tailored to laying hens' nutritional demands is essential for optimal egg production and quality. Egg taste, appearance, nutritional value, and marketability depend on feed composition.

Dietary protein, vitamins, minerals, and fatty acids affect egg quality, including shell thickness, yolk color, albumen quality, and weight. Egg quality might drop due to vitamin deficiencies, lowering consumer satisfaction and producer profits. The mix and quality of feed components can also affect laying hens' health and egg output (Nguyen et al., 2021). Thus, understanding how feed compositions affect egg quality is essential for maximizing chicken nutrition, egg production efficiency, and consumer demand for high-quality eggs. Various systems can be considerably influenced by different meals, resulting in changes in egg quality.

Diets that contain a high amount of omega-3 fatty acids, which are commonly found in sources such as flaxseed or fish oil, have been linked to higher levels of omega-3 fatty acids in eggs(Mwai.,2021). This results in improved egg yolk color and enhanced nutritional value. In contrast, diets that contain excessive amounts of saturated fats or cholesterol might have an adverse effect on the quality of eggs. This is because they can raise the cholesterol levels in eggs, which might influence how consumers perceive the healthiness of eggs. Moreover, the incorporation of particular nutrients like vitamins, minerals, and antioxidants in feed compositions can impact the strength, thickness, and general quality of eggshells, thus influencing the longevity of eggs and their ability to withstand damage during handling and transit (Untea et al.,2023). Furthermore, discrepancies in protein content and amino acid composition in various feeds might impact the growth and maturation of egg-laying hens, ultimately altering the dimensions, mass, and protein content of the eggs they produce. In order to optimize poultry nutrition and meet consumer demand for high-quality eggs with desirable nutritional profiles, it is crucial to have a comprehensive understanding of the precise impacts that various feeds have on egg quality (Guarino et al., 2022).

**Limitation of the Study**

Environmental variability must be considered while studying dietary effects on egg quality. Temperature, humidity, and seasonal changes affect poultry productivity and egg quality. Environmental variables may complicate the feed composition-egg quality relationship. Even when study settings are controlled for environmental variables, climate and weather can still alter laying hen physiology and behavior, affecting egg attributes including shell thickness, yolk color, and albumen quality. Thus, while performing feeding trials to assess the impact of different feeds on egg quality, researchers must be aware of environmental variability, which may restrict generalizability and interpretation.

**Problem Statement**

The poultry industry strongly depends on comprehending the complex correlation between feed content and egg quality. Nevertheless, despite thorough investigation in this domain, there still exists a deficiency in our comprehension of how particular feed compositions affect the parameters that determine the quality of eggs. The lack of expertise in this area impedes the industry's capacity to enhance feed formulations for optimal egg quality, nutritional value, and consumer pleasure. Furthermore, the presence of different feed ingredients, variances in nutritional profiles, and diverse production processes add complexity to the task of establishing uniform standards. Poultry farmers may have challenges in meeting consumer demand for consistently high-quality eggs if they lack a comprehensive grasp of how various feeds impact egg quality. It is imperative to tackle this issue in order to improve the competitiveness and sustainability of the poultry business, while also guaranteeing the production of healthy and marketable eggs.

**Hypothesis**

In our study examining the impact of various diets on egg quality, we propose that differences in feed composition will have a substantial effect on crucial aspects of egg quality. We expect that incorporating certain nutrients, such as omega-3 fatty acids, vitamins, and antioxidants, into animal feeds will result in enhancements in egg quality characteristics, such as yolk color, shell strength, and nutritional composition. Our prediction is that diets with ideal protein-to-energy ratios and well-balanced amino acid profiles will enhance the growth of egg-laying hens and lead to the production of larger, heavier eggs with increased protein content. In contrast, our hypothesis suggests that diets with high amounts of saturated fats, cholesterol, or anti-nutritional substances could have a detrimental effect on the quality of eggs. This could be due to compromised shell strength, changes in yolk composition, or alterations in egg size and weight. Our research aims to offer significant insights into the correlation between feed content and egg quality, enabling informed decision-making in chicken nutrition management techniques.

**Aims of the Objective**

1. To Assess the influence of different meal compositions on eggshell quality metrics, including thickness, strength, and integrity.
2. To Evaluate the impact of various dietary components on the nutritional composition of eggs, encompassing protein, lipid, vitamin, and mineral profiles.
3. To Examine the impact of different feed ingredients on the color and texture of egg yolks, which are important factors in determining the nutritional value and consumer appeal.
4. To Investigate the correlation between the mix of feed and the size, weight, and form of eggs, considering the possible consequences for production efficiency and marketability.

**Literature Review:**

According to (Bryden et al., 2021) In order to ensure that they remain in good health and continue to produce eggs, laying hens have specific dietary requirements that must be met. These requirements cover a wide variety of nutrients, such as proteins, carbs, lipids, vitamins, minerals, and water. Others include vitamins and minerals. Methionine and lysine are two examples of amino acids that play critically important functions in the process of egg protein synthesis. Proteins are necessary for the growth of muscles as well as the creation of eggs. Both the metabolic processes and the activities that are involved in egg formation are supported by carbohydrates, which serve as a key source of energy. There is a correlation between fats, namely important fatty acids such as omega-3 and omega-6, and the production of the yolk.

According to (Bonnefous et al., 2022) fats also have an effect on the quality characteristics of eggs, such as their color and flavor. Furthermore, vitamins and minerals are essential for a variety of physiological processes, such as the maintenance of healthy bones, the functioning of the immune system, and overall reproductive effectiveness. For instance, calcium and phosphorus are necessary for the development of eggshells, and vitamin D makes it easier for calcium to be absorbed and utilized. Additionally, the consumption of water is essential for the maintenance of hydration levels, the composition of eggshell moisture, and the general quality of eggs. The composition of the feed that is given to laying hens has a significant impact on the eggs' nutrient intake, which in turn has an effect on the criteria that determine the quality of the eggs.

According to (Macelline et al., 2021) The nutritional profile of eggs can be altered by variations in feed formulas, which can have an effect on characteristics such as the color of the yolk, the consistency of the albumen, the strength of the shell, and the total nutrient content. As a result, it is vital to have an awareness of the nutritional requirements of laying hens and to optimize feed formulations in accordance with these requirements in order to guarantee high-quality egg production and to satisfy the demands of consumers for eggs that are both healthy and tasty. Studies investigating the impact of various diets on the quality of eggs have produced diverse and occasionally contradictory results.

According to (Underwood et al., 2021) Research has indicated that incorporating certain nutrients, such as omega-3 fatty acids obtained from sources like flaxseed or fish oil, into diets can improve egg quality by enhancing yolk color and raising amounts of beneficial fatty acids in eggs. In contrast, several studies indicate that diets rich in saturated fats or cholesterol can have an adverse effect on the quality of eggs. This is due to the elevated cholesterol levels in eggs, which may influence how consumers perceive the healthiness of eggs. Furthermore, the incorporation of specific feed additives, including as vitamins, minerals, and antioxidants, has been linked to enhancements in eggshell durability, thickness, and overall shell excellence in certain research investigations, however other studies have reported no notable impacts. Furthermore, discrepancies in protein content and amino acid composition among various feed formulations have been associated with disparities in egg size, weight, and protein content. However, the results of these investigations have not always been uniform. In summary, the contradictory results in the existing body of research emphasize the intricate nature of the connection between the composition of feed and the quality of eggs.

According to (Yamark et al., 2021) This emphasizes the necessity for additional studies to gain a deeper understanding of the underlying mechanisms and enhance the practices of chicken nutrition. Aside from diet composition, various other factors can exert a substantial influence on the quality of eggs in laying hens. The quality and quantity of eggs produced are greatly influenced by the conditions in which the hens are housed. Various factors, including temperature, humidity, illumination, ventilation, and space availability, might influence the well-being of hens, their stress levels, and their overall productivity. Stressful or overcrowded living conditions might result in reduced egg production and diminished egg quality as a consequence of elevated levels of cortisol and other stress hormones in hens.

According to (Gautron et al., 2022) Additionally, insufficient nesting places or unsatisfactory cleanliness standards might contribute to the occurrence of unclean or fractured eggs, which can undermine their aesthetic appeal and consumer approval. The choice of laying hen breed is also a crucial factor in influencing the characteristics of egg quality. Various breeds may display differences in egg size, shell color and thickness, yolk colors, and general nutritional makeup. Heritage or specialty breeds can yield eggs with unique attributes that are highly valued by specific consumers, such as deeper yolks or more robust shells. Breeding programs that focus on improving particular characteristics, such as the size of eggs or the strength of their shells, also have a role in creating variations in egg quality among different breeds.

According to (Kowalska et al., 2021) Egg production and quality can be influenced by environmental factors like as seasonal fluctuations, weather conditions, and geographic location. Severe temperatures, excessive humidity, or changes in daylight duration can disturb the hormonal equilibrium of laying hens, leading to disruptions in their reproductive cycles and egg-laying patterns. Hot temperatures can cause a decline in feed consumption, a drop in egg size, and an increase in shell quality issues such as thinning or brittleness. In addition, the presence of environmental pollutants such as mycotoxins or heavy metals in the hen's feed, water, or surroundings can have a negative impact on the health of the hen and the quality of its eggs. This poses dangers to both the well-being of the animal and the safety of the food produced. In commercial egg production systems, it is crucial to have a comprehensive understanding and effective management of these different parameters, as well as feed composition, in order to achieve optimal egg quality.

**METHADOLODY:**

**Study Area**

The city of Sargodha, which is located in Pakistan, will serve as the location for the study. The city of Sargodha was chosen because of the huge number of chicken farms that are located there and because it is reflective of the typical environments in which eggs are produced. Within the city of Sargodha, there will be multiple farms that will be included in order to represent the heterogeneity that exists in feed management strategies, environmental circumstances, and hen breeds.

A total of 225 eggs were used to calculate the external and internal morphological parameters., Hen (*Gallus gallus domesticus*), were studied to measure the external and internal quality parameters.

**External egg quality Parameters:**

The following external egg parameters were studied.

**Egg weight (g)** was taken by digital weighing balance measuring up to 0.001 g.

**Egg length and breadth (cm)** was taken by vernier caliper up to 0.01 cm.

**Egg volume, Egg shape index and egg surface area** were calculated by using following formulae:

**Egg Volume (cm³) =**V=KxLxB² (Ashraf et al., 2016)

Where;

L-Egg Length in cm

B- Egg Breadth in cm

K\_{v} = Coefficient for volume calculation (K\_{v} = 0.496)

**Egg Shape Index (%)**= B / L \* 100t Parmar et al., 2006; Monira et al., 2003)

**Egg Surface area (cm2)** = K pi\*L \* B ^ 2 / 6) ^ 0.67 (Ashraf et al., 2016)

Where:

K = Constant

**Internal Egg Quality Parameters:**

For study of internal quality parameters, Eggs were broken in glass plate and after five minutes’ quality parameters were measured.

The following internal egg parameters were studied.

**Albumen diameter, Albumen height (cm)** were measured by Vernier caliper measuring up to 0.001 cm.

Albumen weight (g) was taken by digital weighing balance measuring up to 0.001 g.

**Albumen pH** were measured by pH meter (HI 98107 pH).

**Albumen index and ratio (%)** were calculated by following formulae (Ashraf et al., 2016)

**Albumen Index (%)** = Albumen height/Albumen diameter × 100

**Albumen ratio (%)** = Albumen weight / Total egg weight 100

**Haugh Unit** = 100 x log (Albumen weight +7.57-1.7 x egg weight x 0.37)

**Yolk diameter, Yolk height (cm)** were measured by Vernier caliper measuring up to 0.001 cm.

**Yolk weight (g)** was taken by digital weighing balance measuring up to 0.001 g.

**Yolk pH** were measured by pH meter (HI 98107 pHep®).

**Yolk index and ratio** were calculated by following formulae (Ashraf et al., 2016)

**Yolk Index (%)** = Yolk height/Yolk diameter × 100

**Yolk ratio (%)** = Yolk weight/ Total egg weight × 100

**Shell weight** was taken by digital weighing balance measuring up to 0.001 g.

**Shell thickness, Shell membrane thickness and Shell ratio** were calculated by following formulae (Ashraf et al., 2016)

**Shell thickness (mm)** = (sharp point thickness + equator thickness + stubby thickness)/3

**Shell membrane thickness (mm)** = (sharp point + equator + stubby)/3

**Shell ratio (%)** = Shell weight/ total egg weight x 100

**Statistical analysis:**

Data were analyzed with analysis of variance (ANOVA) and means were compared by LSD (Least significant difference). All statistical computation was executed with R studio (statistical software for windows).

**References**

Gao, Z., Zhang, J., Li, F., Zheng, J., & Xu, G. (2021). Effect of oils in feed on the production performance and egg quality of laying hens. Animals, 11(12), 3482.

Bryden, W. L., Li, X., Ruhnke, I., Zhang, D., & Shini, S. (2021). Nutrition, feeding and laying hen welfare. Animal Production Science, 61(10), 893-914.

Khatibi, S. M. R., Zarghi, H., & Golian, A. (2021). Effect of diet nutrients density on performance and egg quality of laying hens during the post-peak production phase of the first laying cycle under subtropical climate. Italian Journal of Animal Science, 20(1), 559-570.

Reis, M. P., Ferreira, N. T., Gous, R. M., & Sakomura, N. K. (2023). Update and evaluation of the egg production model in laying hens. animal, 101015.

Gautron, J., Dombre, C., Nau, F., Feidt, C., & Guillier, L. (2022). Production factors affecting the quality of chicken table eggs and egg products in Europe. Animal, 16, 100425.

Ramadhon, R., Rusdarti, R., & Pujiati, A. (2021). Strategy Analysis of Laying Chicken Business Development in Semarang City. Business and Economic Analysis Journal, 1(2), 92-103.

Hammershoj, M., Kristiansen, G. H., & Steenfeldt, S. (2021). Dual-purpose poultry in organic egg production and effects on egg quality parameters. Foods, 10(4), 897.

George, A. S., & George, A. H. (2023). Optimizing poultry production through advanced monitoring and control systems. Partners Universal International Innovation Journal, 1(5), 77-97.

Obianwuna, U. E., Oleforuh-Okoleh, V. U., Wang, J., Zhang, H. J., Qi, G. H., Qiu, K., & Wu, S. G. (2022). Natural products of plants and animal origin improve albumen quality of chicken eggs. Frontiers in Nutrition, 9, 875270.

Nguyen, X. H., Nguyen, H. T., & Morgan, N. K. (2021). Dietary soluble non-starch polysaccharide level and xylanase supplementation influence performance, egg quality and nutrient utilization in laying hens fed wheat-based diets. Animal Nutrition, 7(2), 512-520.

Mwai, L. M. (2021). Mulberry (Morus Alba) Leaf Meal in Indigenous Chicken Layer Diets Effect on Egg Production and Quality (Doctoral dissertation, Egerton University).

Untea, A. E., Saracila, M., & Vlaicu, P. A. (2023). Feeding Strategies and Nutritional Quality of Animal Products. Agriculture, 13(9), 1788.

Guarino Amato, M., & Castellini, C. (2022). Adaptability Challenges for Organic Broiler Chickens: A Commentary. Animals, 12(11), 1354.

Bryden, W. L., Li, X., Ruhnke, I., Zhang, D., & Shini, S. (2021). Nutrition, feeding and laying hen welfare. Animal Production Science, 61(10), 893-914.

Bonnefous, C., Collin, A., Guilloteau, L. A., Guesdon, V., Filliat, C., Réhault-Godbert, S., ... & Leterrier, C. (2022). Welfare issues and potential solutions for laying hens in free range and organic production systems: A review based on literature and interviews. Frontiers in Veterinary Science, 1148.

Macelline, S. P., Toghyani, M., Chrystal, P. V., Selle, P. H., & Liu, S. Y. (2021). Amino acid requirements for laying hens: a comprehensive review. Poultry Science, 100(5), 101036.

Underwood, G., Andrews, D., & Phung, T. (2021). Advances in genetic selection and breeder practice improve commercial layer hen welfare. Animal Production Science, 61(10), 856-866.

Yamak, U. S., Sarica, M., Erensoy, K., & Ayhan, V. (2021). The effects of storage conditions on quality changes of table eggs. Journal of Consumer Protection and Food Safety, 16(1), 71-81.

Gautron, J., Dombre, C., Nau, F., Feidt, C., & Guillier, L. (2022). Production factors affecting the quality of chicken table eggs and egg products in Europe. Animal, 16, 100425.

Kowalska, E., Kucharska-Gaca, J., Kuźniacka, J., Lewko, L., Gornowicz, E., Biesek, J., & Adamski, M. (2021). Egg quality depending on the diet with different sources of protein and age of the hens. Scientific Reports, 11(1), 2638.