Proceedings of the Pakistan Academy of Sciences: B
Life and Environmental Sciences 60(2): 205-214 (2023)

ISSN (Print): 2518-4261; ISSN (Online): 2518-427X
http://doi.org/10.53560/PPASB(60-2)807

Pakistan Academy of Sciences

Research Article

Phenotypic Analysis and Growth Performance of Rhode Island Red, Barred Plymouth Rock and their Hybrid at Jaba Mansehra, Pakistan

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Abstract: Poultry farming is a big business in Pakistan. Poultry farming is a substantial supply of eggs and meat in rural areas, as well as a reliable source of income. Therefore the goal of this study is to compare the Rhode Island red, barred plymouth rock, and their hybrids' phenotypic traits and egg-laying capacities. The 100-day-old Rhode Island Red, Barred Plymouth Rock, and cross chicks were used in the study at Jaba District Mansehra, KP, Pakistan. The whole flock was sheltered, fed, ventilated, and immunized. Breed 3 (Jabba 21) was reported to have the longest shanks (3.78 inches SL), followed by breed 1 (Rhode Island Red) and breed 2 (Barred Plymouth Rock) (3.47 inches SL). Breed 2 is the broadest shank at 0.47 SW, followed by Breed 1 at 0.43 SW and Breed 3 at 0.30 SW (0.43 Inches SW). The breadth of the shinbone did not change substantially from week 8 to week 13 (p=0.05), although body weight changed from week 1 to week 18. Breed 1 consumed the most feed (2,112 g), followed by Breed 3 (1,452 g) and Breed 2. (990 g). Breed 2 acquired the greatest amount of weight (1,638.57 g), followed by Breed 1 (1,557.07 g) and Breed 3. (1530.3 g). From the first to the eighteenth week of observations, there was a significant (p0.05) difference between the three chicken breeds in weekly body weight gain. Breeds 1, 2, and 3 saw growth rates of 1st 63.59, 2nd 64.02 and 3rd 64.03 percent. This research gave us a fresh perspective on several products that might come to market and contend with one another. This study provides insight into what will work best for Pakistan's poultry sector going forward in the future.

Keywords: Phenotypic, Poultry, Barred Plymouth Rock, Breed.

1. INTRODUCTION

Poultry farming is a big business in Pakistan. This firm employs more than 1.5 million people (directly and indirectly). To keep the price of beef and lamb in control, the market today incorporated chicken as a counterweight. Currently, the poultry sector spends more than 700 billion rupees each year. In 2020-21, about 1.39 million tonnes of chicken meat were produced, representing 32.7 % of the nation's total meat output (4.3 million tonnes). This year, poultry contributed 1.4 % of the gross domestic product, while agricultural and livestock value added contributed 7.5 % and 12.7 %, respectively. The value of poultry added increased by 7.8 percent over the previous year, reaching Rs 175.5 billion in 2017-18 at the current labor cost. During 2016-2017, commercial, jam, and meat breeders reported increases of 7 %, 5 %, and 10 %, respectively, while rural poultry breeders witnessed a rise of 1.5 % [1]. People have grown chickens in their backyards since the beginning of time. About 80% of rural households in Pakistan engage in backyard poultry farming, which is a substantial source of income [2]. Eighty to ninety-nine percent of hens raised in developing countries are local poultry genotypes [3]. The majority of small flocks in Pakistan are comprised of indigenous 2 breeds such as Desi (non-described indigenous chicken), Aseel, naked neck (NN), Lyallpur silver black (LSB) (A breed developed several centuries ago at the University of Agriculture, Faisalabad), and other foreign breeds such as Fayoumi (Fay) and Rhode Island Red [4].

Cross-breeding may improve bird growth, feed conversion efficiency, and reproductive capacity

Received: December 2022: Accepted: June 2023
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without sacrificing local adaptability [5]. As a consequence of a major economic boom, both the efficiency and productivity of domestic chicken production will rise. According to Kiani-Manesh, the financial efficiency of rural chickens may be increased by increasing their sexual maturity, egg output, and egg and body weight at eight weeks of age [6]. Poultry farming is a substantial supply of eggs and meat in rural areas, as well as a reliable source of income. The majority of Pakistani households maintain small flocks of backyard chickens (11-13 birds) for consumption inside the household [6]. Poultry farming is gaining popularity in small-scale agricultural systems that need minimum in-house production. Utilizing local free nutritional resources and the ruins of a kitchen, using rural animals that are adapted to their environment, and preserving the old system's inherent ability to incubate and reproduce are all advantageous [7]. Low reproductive output, poor development, sickness, mortality, predation, and insufficient farmer education are obstacles to smallholder chicken production [8]. Egg production and associated parameters, such as age and body weight at sexual maturity, have been thoroughly investigated and shown to differ considerably across species and/or chicken breeds [9].

Several physical traits may be utilized to determine the genetic resources of a location [10]. Rhode Island Reed, which has been successfully maintained in rural and agricultural settings throughout the nation, may deliver higher financial returns than golf courses [11]. Due to its high egg production (178 eggs each production cycle), Rhode Island Red (RIR) is the most popular chicken breed in Pakistan [12]. Due to its extended stay in Pakistan, it has successfully acclimated to the local climate. Known as "Golden birds" in rural regions, it is a dual-purpose American breed [13]. The levels of glucose, cholesterol, calcium, total protein, alkaline phosphate, and uric acid may be used to determine the energy state of a bird.

In addition, knowing how illness affects the body's metabolic activity and electrolyte levels is crucial for repairing bird anomalies. The number of native birds is extremely low. Even though rural Pakistanis produce a broad array of poultry breeds, including Desi, Fayoumi, and RIR, very little is known about their growth, production capacity, and egg quality features [14]. The purpose of this research was to compare Rhode Island Red, Plymouth Rock, and their hybrids. To compare egg-laying ability, the phenotypic characteristics of both species and their hybrids were examined.

2. MATERIALS AND METHODS

2.1 Study Area

The present study was conducted in Jaba, which is found in the Mansehra District of Khyber Pakhtunkhwa. This district has a total land area of 1632 square kilometers and is situated in the northwestern part of the province. The population of the district as a whole is 2.34 million people; this number accounts for people living in both urban and rural regions. District Mansehra has a summer climate that is typical of the region, with an average temperature of 20.2 degrees Celsius during the summer months and a minimum temperature of 2.0 degrees Celsius during the winter months, with temperatures averaging 20.2 degrees Celsius during the summer months and 2.0 degrees Celsius during the winter months. Agriculture takes up the great majority of the available land, and the majority of the people are dependent on the agricultural industry for their livelihood (Figure 1).

Along with a vaccine, Vernier calipers, a screw gauge, and a digital weighing balance, the Poultry Research Institute of Jaba Mansehra will provide day-old chickens for purchase. These days-old chickens will include Rhode Island Reds, Barred Plymouth Rocks, and the offspring of these two breeds, which will be designated as Jaba 21. Additionally included will be leg tags in a variety of sizes.

2.2 Study Duration

According to the history of PRI Jaba for RIR and PMRT, it was anticipated that the chickens would lay their first egg in the 18th week of age; thus, the overall research period would be up to 25 weeks for comparison of egg production characteristics.

2.2.1. Housing

On the day that the eggs are laid, each of the Rhode Island red-barred Plymouth rock, and PRI21

Fig. 1. Map of Jaba District Masnehra, KP, Pakistan.

chicks will each be given a tag so that they may be recognized later on. Up to the age at which they begin producing eggs, the birds of each breed will be kept in a home with a litter floor that is three inches thick, and the weight of each bird will be recorded separately. It is planned that all of the chicks will be vaccinated at the same time, under the same conditions in terms of management, sanitation, and the environment at the same time. In line with the requirements, it will be carried out manually to ensure that food, floor space, and water are provided.

2.2.2. Feeding management

During the period of brooding, the beginning ratio had a crude protein content of 21 percent and an energy content of 2,950 kcal/kg. During the era of development, there should be 16 percent protein and 2800 kilocalories per kilogram of body weight; however, during the period of producing eggs, there should be 18 percent protein and 2700 kilocalories per kilogram

2.2.3. Lighting program

Lights are on for 24 hours the first week, then reduced by an hour a day until they are only needed for 8 hours a day throughout the growing stage. In production, lighting will run for 16 hours each day (16 hours light and 08 hours dark).

2.2.4. Measurements of body weight

The chicks will be individually weighed at the start of the experiment (when they are one day old), and then they will be weighed once a week until the end of the trial. The amount of weight gained each week will be noted.

2.2.5. Feed intake

The difference between the weight of the feed that was offered and the rest of the feed will be used to figure out how much food each animal needs each day. It will be necessary to divide the total amount of food each group eats each day by the number of birds in each group to get the average amount of food each bird eats each day. The feed intake varies with three different types of feed being used in this study. The first feed given to birds in this study was Starter, 14, afterward, the second feed with the name Ghol 12 was given to birds for experiment and the final feed is named finisher. The feed intake in this study was given a proper systematic approach to have proper empirical and accurate findings. The above format was followed throughout the experiment.

2.2.5.1 Feed conversion ratio

The feed conversion ratio (FCR) of all the selected breeds will be recorded according to the formula given as under.

FCR= Total Feed Intake ÷ Weight gain

2.2.6. Age at first lay

Age at the first lay egg in each group will be recorded.

2.2.7. The weight of the Egg first lay

The weight of the first laying egg will be recorded.

2.2.8. Morphological traits

Individual birds of both sexes will be examined until they lay their first egg (at an estimated age of 18 years) for feather/plumage features, skin color, shank, earlobe, comb, comb type, wattle, and the color of the egg they lay.

3. RESULTS AND DISCUSSION

From the eighth to the eighteenth week, the initial shank lengths for breeds 1, 2, and 3 were 2.92 cm, 2.94 cm, and 3.04 cm, respectively, in the eighth week. As of the ninth week, the shank lengths of breeds 1, 2, and 3 had grown to 2.95 percent, 2.96 percent, and 3.06 percent. Although there was no statistically significant variation in shank length across chicken breeds from weeks 8 to 12, all chicken breeds had an increase in shank length from weeks 13 to 17. (p 0.05). During the 17th and 18th weeks of observation, the shank length did not grow (Table 1; Figure 2)

A variety of chicken breeds were measured weekly for their shank width, which varied from 8 to 18 millimeters. The eighth week of the experiment revealed that breeds 1, 2, and 3 had shank widths of 0.38, 0.38, and 0.36 cm, respectively, at the beginning of the study. Between the ninth and eighteenth weeks of the trial, there was only a little rise in the hock widths of breeds 1, 2, and 3. From the eighth to the thirteenth week of observations, there were no significant variations in shank width among the 28 chicken breeds (p 0.05); however, there was a significant difference (p 0.05) from the fourteenth to the eighteenth week of observations (Table 2; Figure 3).

Table 1. Shank length of the three selected breeds from the 8th to 18th week of trail at Jaba District Mansehra, KP, Pakistan

Week	Breed 1 Shank Length	Breed 2 Shank Length	Hybrid	P-value
8th	2.92	2.94	3.04	0.1413
9th	2.95	2.96	3.06	0.3797
10th	3.06	3.04	3.17	0.3898
11th	3.26	3.25	3.28	0.3998
12th	3.38	3.36	3.38	0.4080
13th	3.47	3.45	2.47	0.4260
14th	3.56	3.55	3.59	0.4376

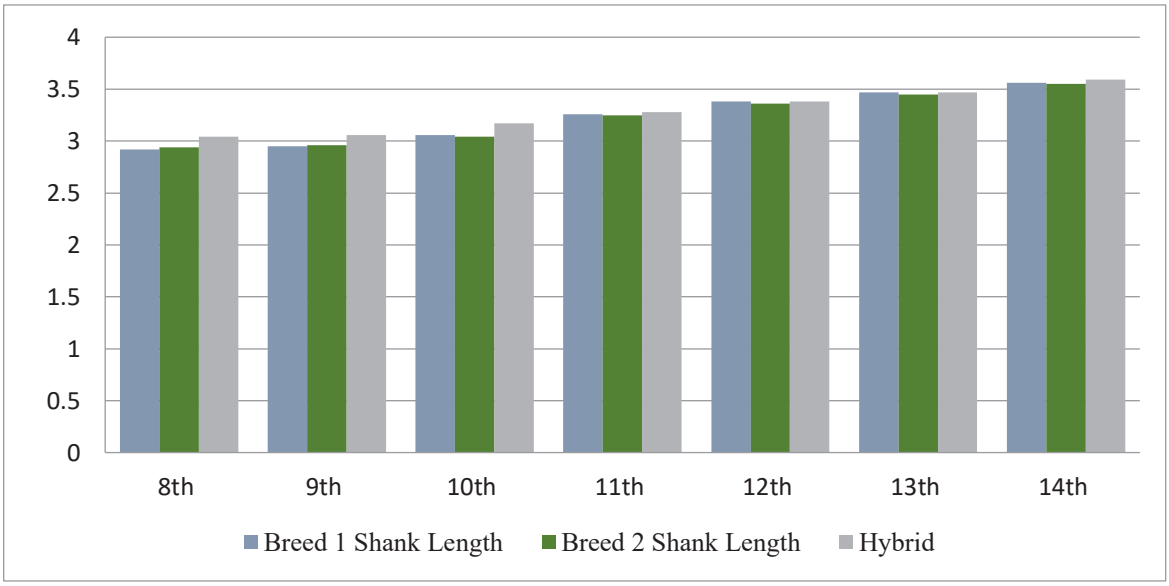

Fig. 2. Graphical representation of the variation in the shank length of the chicken from 3 selected breeds at Jaba District Mansehra, KP, Pakistan

Table 2. Shank width of the 3 selected breeds from the 8th to 18th week of the trail at Jaba District Mansehra, KP, Pakistan

Week	Breed 1 Shank Width	Breed 2 Shank Width	Hybrid Width	P-value
8th	0.38	0.38	0.36	0.1124
9th	0.40	0.39	0.40	0.1326
10th	0.41	0.40	0.41	0.1531
11th	0.41	0.41	0.42	0.1726
12th	0.42	0.41	0.43	0.1943
13th	0.43	0.42	0.44	0.1988
14th	0.43	0.43	0.45	0.2010
15th	0.44	0.44	0.46	0.2102
16th	0.45	0.44	0.47	0.2245
17th	0.46	0.45	0.48	0.2316
18th	0.48	0.47	0.48	0.2437

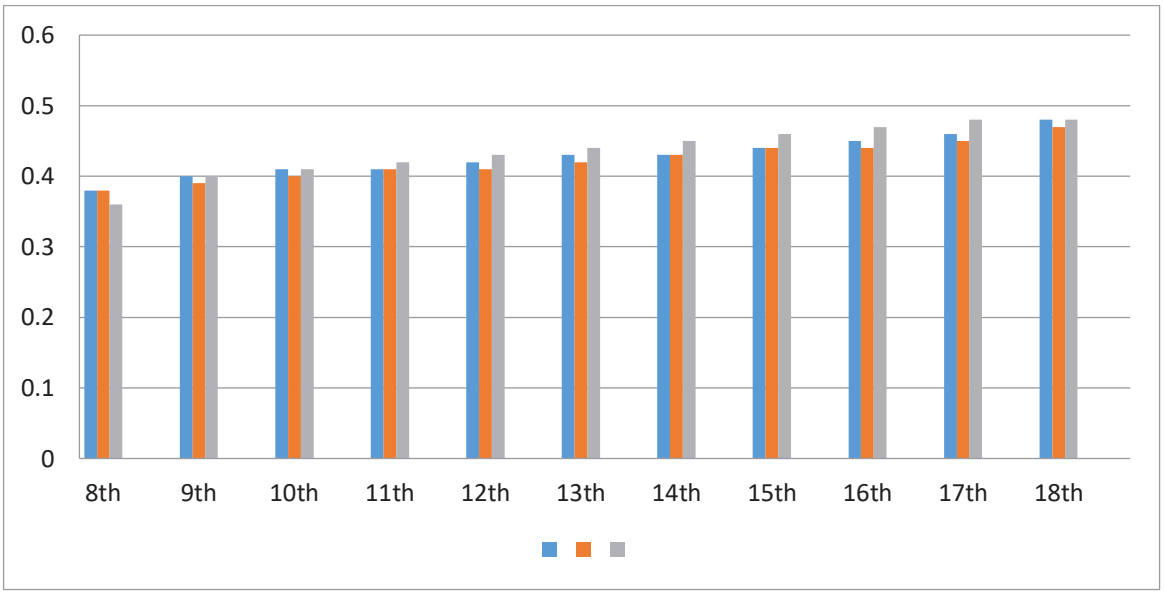

Fig. 3. Graphical representation of the variation in shank width of the chicken from 3 selected breeds at Jaba District Mansehra, KP, Pakistan

From the first to the eighteenth week of life, the body weight of chickens of different breeds was measured. At one week, the starting weights of chicken breeds 1, 2, and 3 were, respectively, 32.93 g, 34.53 g, and 37.00 g. Breed 1 weighed 45.06 g, barred 2 weighed 40.26 g, and Breed 3 weighed 37.73 g after the first week. From the beginning of the final eighteen weeks of the trial, body mass increased. Breed 2 was the biggest at 1590.0 pounds, followed by breeds 1 and 3 at 1673.1 pounds apiece. The weight of the three breeds varied greatly between the 0th and 18th weeks of monitoring as shown in (Table 3; Figure 4).

The chickens of three separate breeds were fed between 0 and 18 weeks of age. During the trial, which spanned 0 to 18 weeks, the feed consumption of the three chosen chicken breeds varied significantly (p 0.05). Breed 1 ingested no less than 25 g of feed in week zero and no more than 108 g of feed in week seventeen. During week 0, only 28 g of feed were ingested, the highest intake (114 g) happened during week 16, the lowest intake (109 g) occurred during week 16, and the highest

Table 3. Body Weight of the 3 selected breeds from the 0th to 18th week of trial at Jaba District Mansehra, KP, Pakistan

Week	Breed 1 Body Weight (g)	Breed 2 Body Weight (g)	Hybrid Body Weight (g)	P-value
0	32.93	34.53	37.00	0.0001
1st	45.06	40.26	37.73	0.0002
2nd	76.20	86.46	81.73	0.0163
3rd	128.53	133.07	135.33	0.5809
4th	175.47	175.07	192.53	0.0457
5th	253.00	248.33	290.20	0.0005
6th	380.67	367.33	420.93	0.0161
7th	471.10	495.00	541.13	0.0285
8th	625.27	661.93	680.93	0.2761
9th	735.73	729.27	811.87	0.1088
10th	874.53	870.13	920.27	0.5264
11th	924.73	943.33	968.27	0.7533
12th	1083.1	1075.5	1116.2	0.7901
13th	1176.1	1168.1	1184.1	0.8004
14th	1258.1	1446.4	1396.4	0.8025
15th	1399.7	1486.9	1498.5	0.8045
16th	1497.9	1496.3	1528.4	0.8156
17th	1500.7	1509.1	1539.8	0.8239
18th	1590.0	1580.4	1608.9	0.8246

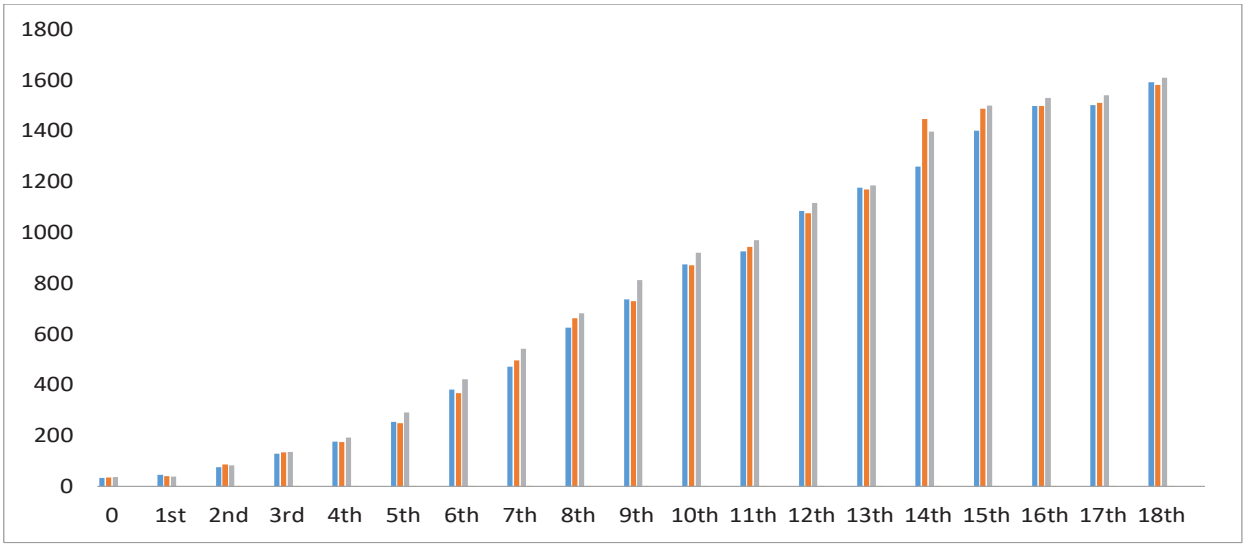

Fig. 4. Graphical representation of the variation in Body Weight of the chicken from 3 selected breeds at Jaba District Mansehra, KP, Pakistan.

intake (114 g) occurred during week 18. Breed 3 saw a minimum of 24 g in week zero, a maximum of 103 g in week sixteen, and a minimum of 99 g in week 18. During the first week, the body weight of breeds 1, 2, and 3 increased by 12.13 g each week. Breeds 1, 2, and 3 gained 43.27, 51.93, and 44.73 g body weight during the second week, but by the 18th week, their weights had reached a maximum of 1557.07, 1638.57, and 1530.3 g, respectively. It was established that Jabba 18, RIR, and Barred

reached sexual maturity at 120, 122, and 124 days, respectively. Before Jabba's eighteenth birthday, RIR and Barred had reached sexual maturity. The hybrid of Barred Plymouth Rock and Rhode Island red, RIR, and Barred weighed 1673.1, 1590.0, and 1567.3 g, respectively, at sexual maturity. The Hybrid of Barred Plymouth Rock and Rhode Island red and two other breeds have the heaviest maximum body weight during sexual maturity. The hybrid of Barred Plymouth Rock and Rhode Island red, Rhode Island Red, and Barred eggs, at sexual maturity, weighed 38, 36, and 34 g, respectively. A hybrid of breeding Plymouth Rock and Rhode Island Red had the second-heaviest eggs after Rhode Island Red and Barred Plymouth Rock.

4. DISCUSSION

In rising nations, there have been efforts to replace old breeds or establish new ones since the turn of the 20th century. Advancement has been inconsistent and depends on regional factors. Concerns about the long-term viability of cross-breeding in some regions or for specific breeding techniques have been raised due to the lack of crossbreed adaptation to challenging production settings (such as climate, illnesses, and feed availability) as well as insufficient supplementary socio-economic support. Completely contrary, crossbreeding, when done correctly in a given location, has significantly improved both animal performance and farmers' income. It is necessary to achieve increased native poultry output [15]. According to the study of Haunshi *et al*. (2009), the production performance of indigenous chicken of northeastern region and improved varieties developed for backyard farming [16]. According to the study of Choo *et al*. (2014), the comparison of Growth Performance, Carcass Characteristics and Meat Quality of Korean Local Chickens and Silky Fowl. Nacked neck and Aseel day-old, chicks weighed higher in form circumstances, however, Nicobari fowl weighed less at four weeks of age in intensive and backyard systems [14].

According to the study by Council in 2003 [18], the Kadaknath chicken breed had a greater body weight at 0, 1, 2, 3, and 4 weeks of age under farm circumstances (290.26 g, 370.38 g, 581.00 g, 831.69 g, and 1232.47 g, respectively). At 6, 8, 10, and 12 weeks of age, Kadaknath chickens weighed 2494.03 g, 3975.23 g, 5556.96 g, and 7544.72 g, respectively, compared to prior reports by [14, 16, 17] and 2494.03 g, 397.523 g, 5556.96 g and 7544.72 g as the average body weights. According to Singh, at eight weeks of age, the Kadaknath breed has a lower body weight of 250 g. Cyril *et al.* (2018), estimate that Aseel weighed 552 g at 10 weeks of age [18]. According to the study by Cyril *et al.* (2010), at six, eight, and ten weeks of age, Nicobari hens weighed 1122.45, 1173.64, 1835.11, 22212.60, and 2308.54 g, respectively [19]. The Kadaknath breed weighs less than the Aseel Bareed at various ages [17]. The genetic differences between the Aseel and Kadaknath breeds may account for the Aseel's larger body size group at various ages [20]. Several examples are reported by Chatterjee et al. [12], Mohammed et al. (2005) [21], and Devi and Reddy [22]. From 0 to 18 weeks of age, the average weight gain (in grams) of the three chicken breeds investigated varied significantly (p 0.05). There were parallels between this investigation's findings [22]. The Kadaknath breed acquired the highest weight between 8 and 12 weeks of age, according to Singh. This demonstrated that the Aseel breed gained much more weight as they aged than other kinds. At the 15-week milestone, Aseel and Kadaknath both surpassed their maximum weight growth were astounded to discover that the Rhode Island Red and White Leghorn chicken breed had the greatest growth in body weight compared to the Desi chicken breed. Variable chicken breeds emerge at different rates due to selective breeding [23].

Genes associated with faster growth rates or the strongest breed selection may be to blame. The average body weight (g) of three distinct chicken species declined considerably (P 0.05) from week zero to week eighteen observation, according to the results of this research. As found according to the study of Duncan in 1955 the crossbreed BPRxRIR generated the maximum body weight in chickens of all breeds and ages, correlating with the findings of this research. There were significant differences in BW among the different hybrids. The egg weights of various hybrids vary considerably (P 0.05) [24]. These researchers discovered that the average weights of hens at six, eight, ten, and twelve weeks of age were greater than those reported by El-Safty (2012) earlier this year (2494.03 g, 3975.23 g, 5556.96 g, and 7544.72 g, respectively [25].

Additional investigations have shown that genetic group significantly affects the weight of chickens of different ages [26]. Similar to the study of Gunawardana *et al*, (2009), the results of this study indicate that the body weights of broilers of the Aseel breed varied (p 0.05) at four weeks of age, which is consistent with the findings of this study [27]. Cyril *et al*. 2010, monthly weighed RIRBPR and other pure chicken breeds, including barred Plymouth Rock (BPR) and Rhode Island Red (RIR) [19]. At 18 weeks of age, RIRBPR had the heaviest live weight (P 0.05), whereas BPR had the heaviest live weight (P 0.05). RIRBPR had the greatest average day-old weight, RIR was in the middle, and BPR had the least. Farooq *et al*. Found that RIR chickens (34.53 g) and BPR chickens (37.00 g) had higher day-old chick weights than RIRBPR chicks (which were lighter) (2001) [28]. (32.93 g). RIRBPR chicks may be heavier than RIR and BPR chicks due to the bigger egg size. Between the ages of 14 and 18, RIR and BPR breeds consumed the most food and gained the highest weight, which may be attributed to genetic variation. However, there was no statistically significant difference in feed intake and weight increase between the RIR and BPR breeds (p 0.05).According to the study of Hassan *et al*. (1962), demonstrated that BPR chicks grew less body weight than RIRBPR and RIR chicks, confirming our findings [29]. According to the reported result of Iqbal *et al*. (2012), RIRBPR's day-old weight, ultimate body weight, and body weight growth were respectively 37.00, 1673, and 1638 g. The day-old weight of BPR was less than in the prior trial, but his ultimate body weight and weight increase were more than in the previous experiment [30].

This research discovered that BPR hens have a slow development rate, which may be attributable to their genetics.Throughout the experiment, the mean weekly feed consumption (mg) of three diverse chicken breeds varied greatly (p 0.05) Under the findings of the study by Islam and Dutta (2010), they discovered that the Fayoumi bird's feed performance was poorer and its feed consumption was much greater than that of the Lyallpur Silver Blackbird [31]. Iqbal et al. [30] noticed a substantial variation in feed consumption between four species of local Aseel hens between weeks 3 and 4 (p 0.081 and 0.0336, respectively) [31-32]. Mushki, Peshawari, and Mianwali Aseel birds consumed an average of 68.57.5 g per day, whereas Peshawari birds consumed an average of 81.810.9 g per day (Mean S.D).

5. CONCLUSION

This study concludes that poultry has a significant role in human life because it has reduced the deficiency of protein by providing meat and eggs to humans. Where the researchers give the idea that daily intake is lesser and not all people included eggs in their daily routine in different areas because every person has a different taste and different preferences unless they are unaware of the energy that their body is missing because intake of protein is very much needed in every age cycle. On the other hand, there are many problems in the poultry industry of Pakistan they are facing so many issues regarding chickens, their breeding process as well as their feeding process too. Costing and money are other issues that are hitting the poultry industry. This research has emphasized that in this manner to read the production of the egg and other related traits because this research is very much helpful for those who are new in this poultry industry. This study also concluded that different breeds give high-quality products and to evaluate this process different genes have been tested in this regard Rhode Island Red chickens have been used in rural farming Mansehra regions of the country because these chickens can produce high-quality breeding processes. Their body weight is significantly high economic component specifically barred Plymouth Rock hens because it reflects the degree of production in the economic strength of the farming operation. Poultry farming is one of the fastest growing and most profitable agricultural businesses in the current situation if all the safety measures and all the requirements are fulfilled by one who wants to start this business it is a huge industry and it can give the opportunity of jobs in rural areas to poor people so they can provide food to their homes by working on the poultry farms.

6. ACKNOWLEDGEMENTS

We highly acknowledge particularly the Poultry research institute Jaba, District Mansehra, KP, Pakistan for the provision of physical facilities during the research work.

7. CONFLICT OF INTEREST

The authors declared no conflict of interest.

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