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REPRODUCTIVE PERFORMANCE OF FOUR VARIETIES OF INDIGENOUS ASEEL CHICKEN UNDER DIFFERENT REARING SYSTEMS

M. S. Rehman[1]*, A. Mahmud[2], S. Mehmood[2], T. N. Pasha[3], J. Hussain[2], M. T. Khan[4], M. Shafiq[1], M. I. Abbas[1] and M. A. Akram[1]

[1]Livestock and Dairy Development Department, Poultry Research Institute, Rawalpindi-46300, Pakistan; [2]Department of Poultry Production, University of Veterinary and Animal Sciences, Lahore-54000, Pakistan; [3]University of Education, Lahore-54000, Pakistan; [4]Department of Poultry Science, Cholistan University of Veterinary and Animal Sciences, Bahawalpur-63100, Pakistan.
*Corresponding author's email: pdomultan@gmail.com

ABSTRACT

A study was undertaken to investigate the effect of three rearing systems (free range, semi-intensive and confinement) on reproductive performance in four varieties of indigenous Aseel chicken (Lakha, Mushki, Peshawari and Sindhi). A total of 192 adult birds (168 females and 24 males), 48 from each variety, were subjected to 3 rearing systems under Randomized Complete Block Design (RCBD) in a factorial experiment. Data regarding reproductive performance [settable eggs (%), fertility (%), hatch of fertile (%), hatchability (%), embryonic mortality (%) and A-grade chicks (%)] were recorded from 31 to 46 weeks of age. The collected data were analyzed by using ANOVA technique. The results demonstrated improved settable eggs, fertility and hatchability in hens reared under confinement and semi-intensive rearing systems. Among different varieties, Sindhi and Peshawari hens depicted higher settable eggs (95.41±0.54) and A-grade chicks (59.36±2.57), respectively. Interaction of rearing systems and varieties clearly indicated maximum settable eggs in both Sindhi and Peshawari hens reared under confinement rearing system. Fertility and hatchability were greater (P≤0.05) in Sindhi hens under semi-intensive rearing system. The highest (P≤0.05) A-grade chicks (63.59±4.68) were found in Peshawari hens under semi-intensive rearing system. From the findings, it can be concluded that confinement and semi-intensive rearing systems remained comparatively better with respect to settable eggs, fertility and hatchability. Both Sindhi and Lakha varieties of Aseel hens can be raised in semi-intensive rearing system as they demonstrated better performance with respect to settable eggs and A-grade chicks.

Key words: Aseel chicken, Reproductive performance, Rearing systems.

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INTRODUCTION

Profitability of hatchery industry depends on fertility and hatchability of breeder flocks producing viable chicks. Both these factors are the major constraints, which depends on genetics and physiology of chicken breed, affecting proliferation of progeny. The performance parameters of breeder flock, regarding final body weight, egg production, fertility, and hatchability depend on highest inputs in different housing systems (Ahmad, 2019). The native chickens are reared in rural areas of Pakistan, which are a source of premium quality protein, generate income, and contribute to the national GDP as well (Anonymous, 2018-19).

In recent years, free-range poultry production has gained much popularity due to increasing consumers interest (Chen *et al.,* 2013). Free-range or outdoor rearing systems are widely encouraged as being natural and animal welfare friendly (Brown *et al.,* 2008; Husak *et al.,* 2008). These systems provide natural and stimulating environment to the hens with reduced stocking density, improving the overall welfare of the flocks (Fanatico and Born, 2001; Sundrum, 2001; Brown *et al.,* 2008; Hegelund *et al.,* 2006). Additionally, free range systems help in mitigating the stressful conditions and increase birds' comfort (Blokhuis *et al.,* 2000), most probably due to more exercise and walking ability (Fanatico *et al.,* 2005, Fanatico, 2008). Outdoor rearing systems are ideally covered with vegetation where birds have complete freedom for scavenging, feed selection and other similar activities that improve their welfare and comfort (Ponte *et al.,* 2008; Chen *et al.,* 2013). These systems, moreover, help in the expression of their natural behaviour, which otherwise seems impossible in totally confined systems (Zelnter and Maurer, 2009).

Ideally, slow-growing chicken such as indigenous poultry (Magala *et al.,* 2012) can only benefit from a free range or outdoor system (Reiter and Bessei, 1998; Castellini *et al.,* 2002; Branciari *et al.,* 2009). In developing countries, rural poultry production is mainly based on small flocks of scavenging birds (FAO, 2004), which are relatively sturdy in nature and have ability to survive on inadequate feed resources in local climatic conditions (FAO, 2004; Khan, 2015) under the traditional

free range system (Mekria and Gezahegn, 2010). Therefore, these birds or indigenous poultry has key role in the sustenance of various rural communities (Faouzi *et al.,* 2002; Mekria and Gezahegn, 2010). However, fast-growing birds, which are selected for better growth rate, tend to stay indoors rather than go outdoors to reduce energy cost (Branciari *et al.,* 2009). Furthermore, under intensive rearing system birds have no access to green pastures enriched with vitamins that play a significant role in improving the reproductive efficiency of birds (Okeno *et al.,* 2010).

Aseel being hardy with the ability to thrive in harsh environmental conditions might be the aspirant germplasm for improvement through selective breeding. Production of low input free range poultry can be enhanced by introducing the improved Aseel varieties in countryside to earn livelihoods (Haunshi *et al.,* 2019). Aseel is one of the major breeds among indigenous poultry in Indo-Pak subcontinent. It is widely recognized due to its sturdiness and adaptability in extreme climatic conditions (Khan, 2015). The present study was planned to evaluate the effects of three different rearing systems on overall reproductive performance in four varieties of indigenous Aseel chicken in Pakistan.

MATERIALS AND METHODS

Experimental site: The present study was conducted at Indigenous Chicken Genetic Resource Centre (ICGRC), Department of Poultry Production, University of Veterinary and Animal Sciences, Ravi campus, Pattoki, Lahore for the duration of 16 weeks (31-46 weeks).

Experimental birds: A total of 192 adult birds (168 females and 24 males) from four varieties of indigenous Aseel (Lakha, Mushki, Peshawari and Sindhi), 48 (42♀ + 6♂) from each variety, at the age of thirty weeks were randomly divided into three treatment groups (free range, semi-intensive and confinement) and replicated 14 times with individual hen in each replicate under Randomized Complete Block Design (RCBD) in a factorial arrangement. Two males were assigned to 14 females in each experimental group.

Housing management: Experimental birds were maintained in an independent open-sided poultry house (dimension 20×20 feet) under standard environmental conditions. The birds under confinement rearing system were maintained in three-tier laying cages with sloping wire floor to facilitate egg collection. The removable dropping trays were fitted under the mesh floor for removal of fecal material. Hens were kept separately in individual cages to get the separate record of every hen regarding egg production. Feed and water were provided through removable trough feeders installed in front of cage and automatic nipple drinking system, respectively. Floor space of 1.5 square feet was provided to each hen.

Feeding management: In cages, male and female birds were offered male and female broiler breeder rations, respectively following the nutrient requirements of parent stocks according to the recommendations of NRC (1994). Birds under semi-intensive rearing system were kept half day in cages with 50% feed allowance in the evening (6:00 pm) according to standard scale and half day in free range area (9:00 am to 1:00 pm) enriched with seasonal fodders (legumes, beans, lentils, it-sit, herbs and grass). However, hens under free range system had whole day access to free range area (9:00 am to 5:00 pm) with 25% feed allowance (6:00 pm) and at the end of the day, they used to be kept on floor in the same house with litter as bedding material. In free range area, replication was done with the help of fish net each having one nest box for egg laying. Hen in each replicate was tagged to get separate record for egg production. Water was also provided outdoors using water pans with reservoirs. To keep the predators away from the experimental birds, wire mesh fencing of eight feet height was provided around the free range area.

Mating system: Stud mating system was practiced, in which each hen had access to one male in the same group once a week (one hen/cock/20hrs.). The eggs were collected and set in the incubator in eight batches under standard conditions of incubation to study hatching traits. Every batch comprised fortnight collection.

Data collection: Daily egg production was recorded to calculate fortnightly settable eggs. At the end of each hatch, fertility, hatchability, embryonic mortality and A-grade chicks' percent was calculated through break out analysis. Hatch of fertile was calculated by dividing total chicks hatched over total fertile eggs.

Statistical analysis: The data regarding reproductive performance of Aseel chicken were collected and subjected to Analysis of Variance (ANOVA) technique under factorial arrangements using SAS 9.1 (2002-03). Means among treatments were compared through Duncan's Multiple Range (DMR) test (Duncan, 1955). The statistical model used was:

$$Yijk = \mu + Vi + Rj + (V \times R)ij + \varepsilon ijk$$

Where *Yijk* is the *kth* observation of the *ith* bird (V) in the *jth* rearing system (R), (V × R)ij is the interaction of Aseel variety and rearing system. μ is the overall mean and εijk is the residual error associated with *Yijk* observation.

RESULTS AND DISCUSSION

Settable eggs (%): Different rearing systems, varieties as well as their interaction revealed clinical difference in settable eggs. Hens under confinement rearing system produced higher settable eggs (95.90±0.48) than those under semi-intensive (93.87±0.78) and free range rearing

systems (92.06±0.74). This might be attributed to the various factors including proper diet and minimum disturbance during laying process in confinement rearing system. Among different varieties, hens of Sindhi Aseel indicated higher settable eggs (95.41±0.54) compared to those of Mushki (93.02±0.95). This discrepancy in settable eggs might be attributed to the genetic variation in different varieties as it has already been claimed that settable eggs vary due to strain effect (Renema *et al.,* 2001). Similarly, a recent study conducted on Aseel also displayed disparity in settable eggs (Khan, 2015). Interaction of different rearing systems with varieties displayed maximum settable eggs (96.52±0.61) in Peshawari hens under confinement rearing system.

Fertility (%): Fertility was found to be vary with respect to different rearing systems and their interaction with different varieties. Remarkable improvement in fertility was observed in hens reared under semi-intensive (81.27±1.15) and confinement (79.00±0.82) rearing systems compared to free range (74.00±1.35). Balanced diet, better management and somewhat moderate temperature in confinement might be the motives behind improved fertility as it is believed that fertility of poultry breeding stock is improved due to proper management (Udeh and Omeje, 2014). On the contrary, in free range area, high temperature, poor management practices, mating behaviour and nutrients deficiency may adversely affect the fertility (Hocking *et al.,* 2007). A study on turkeys, likewise, claimed highest fertility under intensive rearing system followed by semi-intensive and free range (Anandh *et al.,* 2012).

Varieties, however, independently could not show any influence on fertility, which can be explained by the fact that genotype might have no effect on fertility (Shafik *et al.,* 2013). Interaction of rearing systems with varieties displayed maximum fertility in Sindhi under semi-intensive rearing system (83.79±1.98).

Hatch of fertile (%): All treatments separately as well as during their interaction with each other demonstrated no clear difference in hatch of fertile. Hatch of fertile showed no variations with respect to various Aseel varieties. Similar response of different breeds on hatch of fertile has already been claimed (Alsobayel and Albadry, 2012) showing that there was no correlation between hatch of fertile and different genotypes (Shafik *et al.,* 2013) or phenotype of poultry (Bobbo *et al.,* 2013). Different rearing systems indicated no difference in hatch of fertile. However, a study on turkeys presented facts other way round and reported variations in hatch of fertile showing highest value of it in intensive system followed by semi-intensive and free range system (Anandh *et al.,* 2012).

Hatchability (%): Variations were found in hatchability regarding different rearing systems and their interaction with different Aseel varieties. However, varieties independently could not demonstrate variations in hatchability. Hens reared under semi-intensive (60.27±1.19) and confinement (59.18±0.79) rearing systems indicated improved hatchability than those of free range (52.64±1.21). In the same trial, better fertility under semi-intensive and confinement systems might have caused improvement in hatchability. Some earlier studies, likewise, reported amelioration in hatchability under confinement rearing system (Anandh *et al.,* 2012) showing positive correlation between intensive rearing system and hatchability (Kugonza *et al.,* 2012). In interaction of rearing systems with varieties, Sindhi hens once again appeared to be the best demonstrating maximum hatchability (83.79±1.98) under semi-intensive rearing system.

Embryonic mortality (%): All treatments separately and interacting with each other revealed no significant ($P>0.05$) difference in embryonic mortality. It was, similarly, claimed that breed had no effect on embryonic mortality (Alsobayel and Albadry, 2012). In the current study, difference in embryonic mortality was non-significant with respect to different rearing systems. Contrary to this, highest percentage of embryonic mortality was noticed under free range followed by semi-intensive and confinement (Anandh *et al.,* 2012). In turkeys, the highest embryonic mortality was detected in intensive than semi-intensive and free range rearing systems (Anandh *et al.,* 2012). A study conducted to probe the effect of two housing systems on quails, revealed lower embryonic mortality in floor pens than in battery cages (Roshdy *et al.,* 2010).

A-grade chicks (%): Varieties alone and in combination with different rearing systems showed fluctuations in overall means of A-grade chicks whereas no clinical difference was found with respect to different rearing systems. A-grade chicks percent was found to be greater (59.36±2.57) in Peshawari hens than Sindhi (54.82±1.71), Mushki (52.30±2.63) and Lakha (52.76±1.89) hens. This difference in A-grade chicks might be linked with the variations in genetic make-up of different Aseel varieties. Discrepancies in A-grade chicks were also found in a study on Aseel varieties (Khan, 2015). Interaction of rearing systems and varieties clearly indicated higher A-grade chicks (63.59±4.68) from the Peshawari hens under semi-intensive rearing system.

Table 1: Overall reproductive performance in four varieties of Aseel under three rearing systems (31-46 weeks).

Parameter / Variable		Settable eggs (%)	Fertility (%)	Hatch of fertile (%)	Hatchability (%)	Embryonic mortality (%)	*A-grade chicks (%)
Rearing systems							
Free range		92.06±0.74^{b}	74.00±1.35^{b}	72.29±1.38	52.64±1.21^{b}	21.74±1.19	54.05±2.26
Semi-intensive		93.87±0.78^{b}	81.27±1.15^{a}	74.89±0.95	60.27±1.19^{a}	20.76±0.65	55.15±1.96
Confinement		95.90±0.48^{a}	79.00±0.82^{a}	74.86±0.94	59.18±0.79^{a}	19.69±0.76	55.23±1.70
Varieties							
Lakha		93.40±0.98^{ab}	76.53±1.65	74.13±1.58	55.91±1.66	20.62±1.13	52.76±1.89^{ab}
Mushki		93.02±0.95^{b}	78.29±1.26	74.17±1.19	57.53±1.37	20.82±0.95	52.30±2.63^{b}
Peshawari		93.95±0.77^{ab}	78.88±1.38	72.87±1.20	57.22±1.24	21.44±1.13	59.36±2.57^{a}
Sindhi		95.41±0.54^{a}	78.66±1.43	74.89±1.21	58.80±1.38	20.05±0.99	54.82±1.71^{ab}
Rearing systems × Varieties							
	Lakha	88.93±1.38^{d}	71.36±3.14^{d}	71.80±4.07	50.23±2.92^{e}	21.13±2.86	53.12±4.65^{ab}
Free range	**Mushki**	92.95±1.73^{abc}	74.76±1.86^{bcd}	70.31±2.36	51.57±2.41^{de}	23.38±2.10	50.00±5.50^{b}
	Peshawari	91.54±0.97^{bcd}	76.40±3.41^{abcd}	71.49±1.88	54.02±1.84^{cde}	23.16±2.53	59.17±5.44^{ab}
	Sindhi	94.83±1.11^{abc}	73.48±2.29^{cd}	75.54±2.49	54.76±2.55^{bcde}	19.30±2.14	53.90±1.77^{ab}
	Lakha	95.60±1.56^{ab}	79.98±2.98^{abc}	75.67±1.12	59.67±3.00^{abc}	20.31±0.86	50.70±2.89^{ab}
Semi-intensive	**Mushki**	91.08±1.68^{cd}	79.14±2.31^{abc}	76.80±1.94	59.58±1.68^{abc}	19.55±1.39	55.07±3.96^{ab}
	Peshawari	93.78±1.67^{abc}	82.17±1.85^{ab}	71.32±2.18	58.47±2.72^{abcd}	22.75±1.48`	63.59±4.68^{a}
	Sindhi	95.03±1.00^{abc}	83.79±1.98^{a}	75.78±1.94	63.36±1.98^{a}	20.42±1.40	51.23±2.70^{ab}
	Lakha	95.67±0.94^{ab}	78.25±1.54^{abcd}	74.90±2.36	57.82±1.62^{abcd}	20.42±1.93	54.45±2.09^{ab}
Confinement	**Mushki**	95.03±1.45^{abc}	80.97±2.02^{abc}	75.39±1.18	61.45±1.41^{ab}	19.51±1.07	51.83±4.50^{ab}
	Peshawari	96.52±0.61^{a}	78.06±1.17^{abcd}	75.80±2.05	59.17±1.50^{abc}	18.42±1.43	55.31±2.98^{ab}
	Sindhi	96.38±0.73^{a}	78.71±1.84^{abcd}	73.35±2.01	58.28±1.79^{abcd}	20.42±1.71	59.33±3.70^{ab}

Note: Different superscripts on means in columns show significant (P≤0.05) differences

*Chicks weighing above 35gm without physical deformity

Conclusions: Based on the findings of this experiment, it can be concluded that among three rearing systems, confinement and semi-intensive rearing systems remained comparatively better in terms of settable eggs, fertility and hatchability. Among different Aseel varieties, Sindhi and Peshawari hens showed better performance in terms of settable eggs and A-grade chicks. Interaction of rearing systems and varieties clearly demonstrated that Sindhi hens when reared under confinement and semi-intensive rearing systems produced maximum settable eggs with the highest fertility and hatchability whereas Peshawari hens showed maximum settable eggs under confinement and the highest A-grade chicks under semi-intensive rearing system.

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