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Phenotypic and production performance of the indigenous Chirunkothu chickens (*Gallus gallus*) in Kolli hills area of Tamil Nadu

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Abstract
The tribals of Kolli hills rear "Chirunkothu chicken" for subsistence under backyard poultry farming system. This bird plays an important role in meeting out protein requirements and food security of households. This activity engages the tribal women members of the households. Chirunkothu chicken are self-propagating and are known for their adaptability, disease resistance, sturdiness and the ability to thrive on low plane of nutrition. These birds are reared under zero (low) input system with meager input coming out from outside of farming system/household. These chicken meat have been getting higher premium rate than other desi birds among the consumers on account of taste and farming system. Wide variation was observed with regard to morphological traits *viz*., Plumage pattern, plumage color and shank color. Males were significantly heavier than females at all ages in 4, 8, 16 and 24 weeks of age. The body weight of males and females were 175.12 ± 4.65 and 152.83 ± 5.38 at 4 weeks; 343.21 ± 7.61 and 312.83 ± 5.92 at 8 weeks; 622.61 ± 112.18 and 585.60 ± 18.59 at 16 weeks and 1025.80 ± 36.41 and 970.34 ± 24.75 grams at 24 weeks of age, respectively. The egg weight of Chiruvidai chicken were smaller than those of normal egg with mean weight of 36.99± 0.18 gm and the egg shell colour ranging from brown to off-white in colour. Although almost half of the eggs had Haugh unit values ranging from 36 to 50, 1 out of 10 had almost no thick albumen and all eggs are falling in "B" grade category. The measured mean values of specific gravity, Albumen percent, Albumen Index, Haugh Unit, Shape Index, Shell percent, Shell Thickness (mm), Shell weight (g), surface area (cm^2), Yolk percent and Yolk index were 1.033 ± 0.312; 52.14± 0.14, 0.058± 0.37, 38.59± 0.40, 74.73 ± 0.20, 10.52± 0.05, 0.29± 0.01, 3.98± 0.01, 57.85± 0.12, 37.56± 0.22 and 0.26± 0.01.

Keywords: Chirunkothu chickens, *Gallus gallus*, Kolli Hills, chittancozhi, chiruvedai

Introduction
Backyard poultry farming is important subsidiary enterprise for their livelihood of the villagers. It plays major role for the improvement of socio-economic and nutritional status of rural poor people for generation of self-employment and supplementary income. Further, cheap source of protein (eggs and meat) is the essential food supplement for eradication of malnutrition in village children. In India, around 30 million farmers are engaged in backyard poultry and accounts for 20 percent of Indian poultry sector, which is worth over Rs. 800 billion [1]. The average number of backyard poultry breeders in India is 89 percent (5.3 percent) [2]. This backyard poultry rearing is mainly practiced by rural women in the household.

Kolli Hills is a small mountain range located in the central part of Tamil Nadu in the southern part of India. The range is 1000 to 1300 m above sea level and covers an area of 280 sq km. Its highest peak is 4663 feet (1400 m) (Fig.1). The major population in Kolli Hills is from Malayali tribals primarily owning agricultural land. Backyard farming in rural areas depends on the color of the bird, taste and lean meat production exclusively for the rural population [3]. India has 21 registered breeds of poultry and out of these, 19 belong to native chicken [4]. There are a limited number of poultry species in Tamil Nadu, depending on the region. The small type of poultry species Chirunkothu chicken, especially in the Kolli Hills, is increasingly being bred and also called as Chittancozhi and Chiruvedai. These indigenous chickens are well known for their adaptability and disease resistance, while their smaller size helps in protecting themselves against predators. The present research work was carried out to document the importance of indigenous Chirunkothu Chickens (*Gallus gallus*) present in the Kolli Hills region of Tamil Nadu.

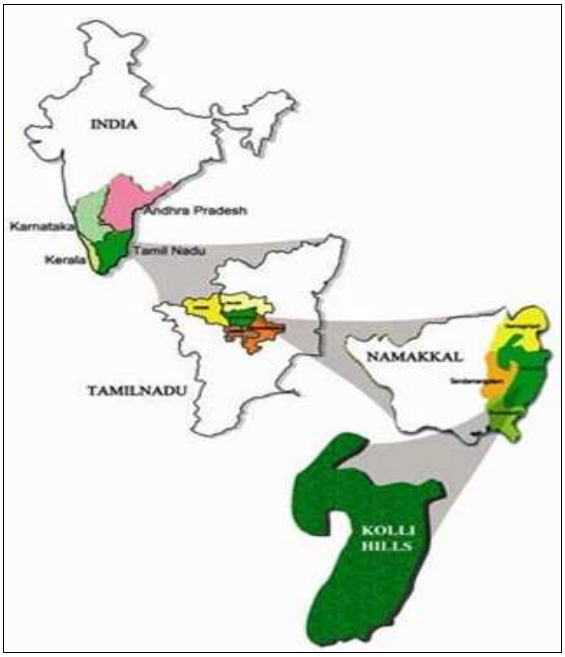

Fig 1: Location of Kolli Hills

Materials and Methods

In this study, a total of 64 chickens (40 females and 24 males) were taken from different parts of the Kolli Hills region for analysis. Interview was done using a structured questionnaire from the individual farmer's about population size, phenotypic characteristics, disease management, feeding regime, production and reproductive performance. Further, different phenotypic characters of plumage colors and patterns, shank color, comb type, skin color, beak color, eye color and earlobe colour were observed from adult Chirunkothu Chicken. Morphometric measurements like live body weight at different ages, egg weight, egg number and egg shell color were measured. Moreover egg quality traits like specific gravity, shape index; haugh unit, shell thickness (mm) and shell weight (g) were also measured.

Results and Discussion

Kolli Hills is ecologically important because it has four different types for forest types *viz*., scrub jungles, deciduous, semi-evergreen and evergreen. The native birds of Chirunkothu chicken are grown in many panchayats of Kolli Hills of Namakkal district *viz*., Vazhavandi Nadu, Valappur Nadu, Ariyur Nadu, Tinnanur Nadu, Guntur Nadu, Selur Nadu, Devanur Nadu, Alandur Nadu, Kunduni Nadu, Tirupuli Nadu, Edappuli Nadu, Chittoor Nadu, Perakkarai Nadu, Bail Nadu, Pallappadi Nadu and Pudukombai Nadu. The phenotypic features of Chirunkothu Chicken were examined for comb type, skin color, beak color, eye color and ear lobe color. Adult chickens are unique, often compact body, small, firm and lean, mainly used for meat purpose (Fig. 2 & 3). Adult male have majestic appearance has strong shank, curved beak in the small head with single comb (Figure 2). Almost all the birds have small single comb, firmly set on the head and are red in colour. The ear lobe was mostly smaller in size for both sexes and red in colour (Fig. 3). The ear lobes of the hens were small and red; some of the hens were white and black (Fig. 4). All chickens had round, black eyes that were perfect. The neck was uniformly long. Skin color was yellowish and white in both males and females, with exposed areas bright red.

The shank was straight and well developed and it was observed that both male and female of Chirunkothu Chicken have clean shank. The tail can be classified into several plumage colors with a sloping appearance straight from the back to the neck. The feather comes in a variety of colors, mainly dark brown, black, red, gold, yellow and white (Fig. 2 & 3). In male it was long, shiny tail feathers and downward. Although the primary feather color was black in both sexes, differences in feather pattern were observed.

Mostly, the Chirunkothu Chicken are met their feed by grazing on farms and community lands. Occasionally, surplus foods or waste grains are used as food form the household kitchen waste. These chickens are reared outside the house on agricultural land under zero (low) input method. Due to the taste of this chicken meat and its natural farming method, it is getting more expensive among the consumers than other poultry (Aseel bird). Chirunkothu Chicken is excellent for their adaptability, immunity, resilience and ability to thrive under low nutrient management.

Chirunkothu chickens are often bred indoors and they are naturally immune compromised. The special feature is that the hen does not need to be housed and does not require much attention as it can be grown under wide managemental conditions. The farmers from Nadukkombai, Chentamangalam, Kalappanayakkanpatti, Pelukurichi, Singalandapuram, Namagiripettai, Thammampatti, Mullukurichi, Koppampatti and Puliyancholai villages of Kolli Hills region are growing their chicken for commercial sales. Wide variation was found in morphological characteristics. At 4, 12 and 16 weeks the cocks weigh more than the females. The body weight of males and females were 175.12 ± 4.65 and 152.83 ± 5.38 at 4 weeks; 343.21 ± 7.61 and 312.83 ± 5.92 at 8 weeks; 622.61 ± 112.18 and 585.60 ± 18.59 at 16 weeks and 1025.80 ± 36.41 and 970.34 ± 24.75 gram at 24 weeks of age, respectively. The male weight ranges from 0.78 to 1.03 kg and the females weighs from 0.61 to 0.95 kg.

Chirunkothu Chickens reach their maturity around 180 days. They are capable of laying 85 to 90 eggs per year. Eggs weight is from 35 to 39 grams at 40 weeks (Table 1). Fertility in Chirunkothu Chicken is around 75 percent and hatchability is around 64 percent. Shell colour was 67 percent brown and 33 percent light brown. Similarly, brown eggs are with strong shell thickness than the light colored eggs. The egg weight of the Chirunkothu Chicken was comparatively much lower than the normal egg weight with an average of 36.99± 0.18 g. Approximately,50 percent of the haugh unit values in eggs are 36 to 50 percent, 1 in 10 is of low albumen thickness and almost all the eggs have a "B" rating. The measured mean values of specific gravity, albumen percent, albumen Index, Haugh Unit, shape index, shell percent, shell thickness (mm), shell weight (g),surface area (cm^2), yolk percent and yolk index were 1.033 ± 0.312; 52.14± 0.14, 0.058± 0.37, 38.59± 0.40, 74.73 ± 0.20, 10.52± 0.05, 0.29± 0.01, 3.98± 0.01, 57.85± 0.12, 37.56± 0.22 and 0.26± 0.01 (Table 1).

Chirunkothu Chicken meat is known for its taste, fragrant and medicinal value. The people believe that Chirunkothu Chickens meat contains low cholesterol than other poultry meat and contains more essential amino acids and other nutrients. The people of the Kollimalai region traditionally sacrifice the cocks in the temples during Diwali festival. The Kolli Hills people believe that the consumption of this chicken meat will cure chronic diseases like arthritis and neuritis.

Many authors have suggested that the colours of feathers are

highly variable in nature [5, 6, 7, 8]. The plumage color of the Bangladesh dwarf chickens various from black, blackish red, reddish black, golden and blackish golden, black with white spot while black colour (41.11 percent) was most predominant [9]. The findings on plumage colors are in agreement with the reports of several authors [10,11,12] mentioned that the Aseel has no fixed colors, the principal colors seen being light red and dark red with grease and red-wheat in females. In another investigation, deep purple plumage color in Aseel chicken [13] which partially agrees with the present findings.

In the present study, almost all the birds had Single comb and are reddish in colour. The other author reported that Aseel birds had a reddish pea comb pattern [6]. In Bangladesh, another author has reported that aseel hens with strawberry comb and also with small pea comb which was less likely to be injured during fights [7]. Even though, colour of earlobes is not consistent pertaining to the native chicken and it was various from reddish white [14], 80 percent red in native [13], 100 percent red in Hilly [15] and 80 percent white in indigenous chicken [16]. But in the present findings all the birds had red colour ear lobe.

Similar to the present findings, cocks were heavier ($P \leq 0.05$) than the hens in Aseel chicken [17]; however, the both sexes of Chirunkothu chicken's body weight is lower than the Assel. In a report Aseel and Kadaknath had higher body weight than Chirunkothu chicken at different ages, since these birds have been selected for a longer time for their egg, meat and fighting purpose, thus resulting in heavy body weight [18]. Further, higher body weights were also reported [18] and he found that the adult body weight of Aseel chicken ranged between 1.7 to 4.5 kg. Whereas, British Poultry Standard [10] given the guidelines of the adult live weight was 1.8 to 2.70 kg in cock and 1.35 to 2.25 kg in hen and reported the average live weight of cock and hen to be 2.49 kg and 1.81 kg, respectively [19].

Chirunkothu Chicken egg size is much lower than commercial egg size because commercial layers have larger body weight at maturity and mostly genetically selected [20]. The native Aseel chickens are mature at a later age and have higher egg weight in contrary to our present study [21, 22]. The mean egg weight at 40 and 72 wk of age was 38.8± 0.6 and 47.5± 0.7 g respectively in Aseel chickens [17]. The egg weight gradually increased as age increased, showing the positive correlation between egg weight and age, which might be due to the higher body weight at older age as heavier birds laid larger eggs. The lower egg weight of 36.99 ± 0.18 g in Chirunkothu chicken was due to lower body weight of female hens when compared to Aseel chicken which might be breeding trait.

The mean number of egg production at 40, 52, 64 and 72 weeks of age was 18, 30, 47 and 64 respectively [21] where as in Chirunkothu chicken the annual egg production was about 85-90 eggs which might be due to lower body weight and better scavenging ability favors for egg production. The fertility and hatchability were influenced by breed, nutrition, age, and management of birds. The mean fertility and hatchability rate was 67.18 and 44.71 (TES) percent respectively in Aseel chicken where as in Chirunkothu chicken the mean fertility and hatchability were 75 and 64 (TES) percent respectively. The variations in fertility and hatchability might be due to the differences in age of the birds and environmental conditions.

A study in Non-descript Desi (ND), Hilly (H) and Naked Neck (NN) chicken under intensive management system in Bangladesh and reported that all hens of ND, H and NN laid light brown (62.42%) to cream or off white (30.28%) colored eggs which is in correspondence with our findings[16]. The major constraints of backyard poultry farming in India are high mortality rate in young chicks due to a combination of diseases, lack of scientific knowledge, and low production performance of desi birds, lack of infrastructure, predation, malnutrition, climatic exposure and feed price fluctuations throughout year [23].

Fig 2: Photograph of Adult Cock Chirunkothu Chickens (*Gallus gallus*)

Fig 3: Photograph of Adult hen Chirunkothu Chickens (*Gallus gallus*) with chicks

Fig 4: Photograph of comb type, eye colour, ear lobe and beak of Chirunkothu Chicken

Table 1: Descriptive statistics of egg quality characteristics of Chirunkothu (*Gallus gallus*) chickens**.**

Parameters	No of observations	Mean ± SE	Range (Min – Max)	CV %
Egg Weight (g)	40	36.99± 0.18	35.35- 38.88	3.127
Albumen %	40	52.14± 0.14	50.76- 54.00	1.759
AlbumenIndex	40	0.058± 0.37	0.024-0.098	39.831
Haugh Unit	40	38.59± 0.40	36.68 - 50.00	6.649
Shape Index	40	74.73 ± 0.20	73.00- 77.00	1.714
Shell Percent	40	10.52± 0.05	10.00- 11.00	3.003
Shell Thickness (mm)	40	0.29± 0.01	0.26- 0.31	3.051
Shell weight (g)	40	3.98± 0.01	3.82- 4.15	1.981
surface area (cm^2)	40	57.85± 0.12	57.00- 59.00	1.331
Yolk percent	40	37.56± 0.22	34.00- 40.00	3.708
Yolk index	40	0.26± 0.01	0.01- 0.34	30.337

Conclusions

Chirunkothu Chicken is a famous indigenous meat bird which has been maintained over the long period of time by the Kolli Hills farmers in Namakkal District of Tamil Nadu. Chirunkothu Chicken are naturally immune and can thrive under any circumstances, action should be taken to protect such special breeds of chickens. This study was the first attempt to characterize elaborately the morphological features of Chirunkothu Chicken in Tamil Nadu. However, the present study gives some basic information on Chirunkothu Chicken which could be useful for taking any on-ward attempt to prevent from genetic dilution of this valuable genetic resource through conservation and utilization. Further, detecting the genetic structure of this breed based on molecular techniques at genome level which is eventually to understand the need of this bird for improving their productive and reproductive ability.

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