Full Length Article

CARCASS AND MEAT QUALITY CHARACTERISTICS OF *SIRUVIDAI* CHICKEN REARED IN DIFFERENT DISTRICTS OF TAMIL NADU

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ABSTRACT

The current study was designed to evaluate the carcass and meat quality characteristics of Siruvidai chicken of Tiruvannamalai, Dharmapuri, Ariyalur and Perambalur districts of Tamil Nadu. The carcass characteristics namely New-York dressed weight, eviscerated carcass weight, ready-to-cook weight, giblets weight, abdominal fat weight and meat: bone ratio were recorded. No significant differences observed in carcass characteristics among the districts except for pre-slaughter weight and breast yield. A significantly ($p \leq 0.05$) higher breast yield was recorded from Ariyalur and Perambalur districts. The pH, water holding capacity, shear force value, tyrosine value and thio-barbituric acid (TBA) number did not show significant differences among the districts. The Siruvidai chicken of Tamil Nadu is meant for egg production and mothering ability. From this study, it is concluded that Siruvidai chicken may be utilized economically for meat production and processing.

Keywords: Siruvidai chicken, Carcass characteristics - meat quality

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INTRODUCTION

Commercial broilers contribute up to 85-90% of chicken meat in India and the contribution of native chicken is much less i.e. 10-15% (Rajkumar *et al*., 2016). The native and improved fowl population are 10.92 million and 2.36 million respectively in India contributing 10-15% and 12% to the total egg production. The meat production from poultry is 4.995 million tonnes, contributing

about 51.14% of the total meat production of the country (BAHS, 2023). Though the population and contribution are less, there is a huge demand for desi birds' meat and egg as consumer's preferences lean towards them. The meat from slow-growing native chicken breeds is considered an alternative to commercial broiler meat. The meat of native chicken reared in an outdoor production system has better taste and flavor compared to conventionally produced broiler chicken (Fanatico *et al*., 2006).

Many consumers prefer to buy products from chicken raised in free range, because they believe that these products have superior sensory qualities (Yang *et al*., 2015). Attention should be given to studying and characterising the lesser-known and largely neglected ecotypes and breeds like the *Siruvidai* chicken, and detailed characterization of this chicken concerning its carcass and meat quality traits is generally unavailable under field condition. Hence, this study was designed to evaluate the carcass characteristics and cut-up parts of *Siruvidai* chicken of the North -Eastern region (Tiruvannamalai district), North-Western (Dharmapuri district) and the Cauvery Delta region (Ariyalur and Perambalur districts) of Tamil Nadu and to document the carcass characteristics of *Siruvidai* chicken grown under an extensive system of management.

MATERIALS AND METHODS

A study was designed to evaluate the carcass and meat quality characteristics of *Siruvidai* chicken of Tiruvannamalai, Dharmapuri, Ariyalur and Perambalur districts of Tamil Nadu. As per ICAR - NBAGR (2016) guidelines a total of 50 birds including 25 males and 25 females were randomly selected for the slaughter study and all the birds were slaughtered at 8 months of age. Out of 50 birds, 8 males and 8 females were selected randomly from each zone namely the North Eastern (Tiruvannamalai) and North-Western zones (Dharmapuri), and 9 males and 9 females were selected in the Cauvery delta zone (Perambalur and Ariyalur) of Tamil Nadu for slaughter studies. All the birds reared under backyard management system with supplemental scavenging method of feeding. The birds were fed with the available feed ingredients like maize, cumbu, broken rice along with scavenging feed resources. The birds were starved for three hours and pre-slaughter body weight was measured using an electrical weighing balance with 0.1 g accuracy. The humane method of sacrificing was carried out followed by scalding, de-feathering, singeing and evisceration as described by Lesson and Summers (1980).

The pre-slaughter body weight, New-York dressed weight, eviscerated carcass weight, ready-to-cook weight, giblets weight, abdominal fat weight, and meat: bone ratio were recorded (Arumugam and Panda, 1970) using a weighing balance of 0.1 g accuracy and their percentage was expressed based on the live weight. The cut-up parts namely the neck, breast, back, thighs, drumsticks and wings were also weighed using a 0.1 g accuracy weighing balance, and their percentage were calculated based on eviscerated carcass weight. To reduce the variation in the cutting,

all the procedures were carried out by one operator.

$$\text{New-York dressed yield (\%)} = \frac{\text{New-York dressed weight (g)}}{\text{Pre-slaughter body weight (g)}} \times 100$$

$$\text{Dressing yield (\%)} = \frac{\text{Eviscerated carcass weight (g)}}{\text{Pre-slaughter body weight (g)}} \times 100$$

$$\text{Ready to cook yield (\%)} = \frac{\text{Ready- to- cook weight (g)}}{\text{Pre-slaughter body weight (g)}} \times 100$$

Organ weight

The giblets namely the gizzard without kaolin, the heart without pericardium, and the liver without gall bladder were weighed separately. The organ weights were calculated on the per cent pre-slaughter body weight basis as follows

$$\text{Individual organ yield (\%)} = \frac{\text{Organ weight (g)}}{\text{Pre-slaughter body weight (g)}} \times 100$$

Meat: bone ratio

The weight of the carcass was recorded and the lean meat, separable fat, and bone were separated by a single skilled person to avoid human error and the weight of lean, meat fat and bone were recorded separately. The weight of the meat and bone was expressed in the form of a ratio, to provide the meat: bone ratio.

Cut-up parts

The carcasses were cut into the back, neck, breast, legs, thigh, drumstick, and wings by a single skilled person to avoid human error and the cut-up parts were individually weighed. The concerned cut-up parts weights were calculated on the per cent eviscerated weight basis as shown below.

$$\text{Cut-up parts yield (\%)} = \frac{\text{Weight of the individual cut-up part (g)}}{\text{Eviscerated carcass weight (g)}} \times 100$$

Meat Quality Parameters

The meat quality parameters like pH, water holding capacity, shear force value, thio-barbituric acid value and tyrosine value were analyzed from the collected meat samples as per the standard methods. The pH of the *Siruvidai* chicken meat was measured using a digital pH meter (Digisun Electronic System, Model: 2001) by following the procedure of Trout *et al*. (1992). The water holding capacity (WHC) of the meat was estimated by the method given by Grau and Hamm (1957), Shear force value (SFV) of meat was recorded by using Warner Bratzler Shear Press. The tyrosine value of meat was calculated by a modified method of Pearson (1968) as described by Strange *et al*. (1977). The Thio-barbituric acid (TBA) value of meat was calculated by the method of Strange *et al.* (1977).

STATISTICAL ANALYSIS

The collected data were subjected to statistical analysis using one way ANOVA to identify the significant difference of meat quality among the different districts of Tamil Nadu. Pair-wise comparisons were done using a Tukey's test.

RESULTS AND DISCUSSION

Mean values of carcass characteristics and meat quality of indigenous *Siruvidai* chicken in selected districts of Tamil Nadu are presented in Tables 1, 2 and 3.

Pre-slaughter body weight

The pre-slaughter body weight of indigenous *Siruvidai* chicken of Tiruvannamalai, Dharmapuri, Ariyalur and Perambalur districts were 1126.65, 1326.41 and 1100.00 g respectively with the mean value of 1176.88 g. Dharmapuri district recorded significantly ($p \leq 0.05$) higher pre-slaughter body weight compared to other districts. The results of this study were nearer to the results of Gupta *et al.* (2023) in Narmada Nidhi chicken (1138 gm) at market age, Bhimraj *et al.* (2018) in desi chicken (1182 g) and Bai *et al.* (2022) in backyard chicken of Karnataka (1295 g). Higher values were recorded by Haunshi *et al.* (2013) in Aseel birds (1713 g) and Shakila *et al.* (2020) in Rajasri chicken (1.52 kg). The difference in pre-slaughter body weight of indigenous *Siruvidai* chicken in the Dharmapuri district was attributed to geographical conditions, nutrition and managemental practices.

New-York dressed yield

The average New-York dressed yield to the live weight of indigenous *Siruvidai* chicken of Tiruvannamalai, Dharmapuri and Ariyalur and Perambalur districts was 90.47, 90.23 and 90.55% with the mean New-York dressed yield of 90.43%. No significant difference was found between districts on New -York dressed yield. The results are in concurrence with the findings of Vasanthi *et al.* (2023).

Dressing percentage

The average dressing percentage of indigenous *Siruvidai* chicken of Tiruvannamalai, Dharmapuri and Ariyalur and Perambalur districts was 64.26, 64.00 and 66.22% with the mean dressing percentage of 64.87%. No significant difference was found among the districts on dressing percentage. The results of this study are in accordance with the findings of Vasanthi *et al.* (2023) in indigenous *Siruvidai* chicken (63.94%) and Bai *et al.* (2022) in backyard chicken of Karnataka (65.40%). Higher values were observed by Shakila *et al.* (2020) in Rajasri chicken (67.47%), Haunshi *et al.* (2022) in Kadaknath chicken (70.50%) and Singh *et al.* (2020) in Uttara chicken (72.42%). Lower value was observed by Sudhir (2021) in backyard chicken reared in Gulbarga division of Karnataka (70.69%) and Kadaknath (61.59%) chicken.

Ready to cook percentage

The average ready-to-cook percentage of indigenous *Siruvidai* chicken of Tiruvannamalai, Dharmapuri, Ariyalur and Perambalur districts was 70.34, 69.59 and 71.84 with the mean ready- to- cook percentage of 70.64. No significant difference was found among the districts on ready-to-cook percentage. Similar values were observed by Vasanthi *et al.* (2023) in indigenous *Siruvidai*

chicken under farm condition with mean ready-to-cook percentage of 69.62%. A higher value was recorded by Bhimraj *et al.* (2018) in desi chicken under different rearing system and lower values were recorded by Haunshi *et al.* (2013) in Aseel (66.47%) and Kadaknath (64.80%).

CUT-UP PARTS

Neck yield

Average neck yield of indigenous *Siruvidai* chicken of Tamil Nadu was 6.41% and the neck yield for Tiruvannamalai, Dharmapuri and Ariyalur and Perambalur districts were 6.36, 6.15 and 6.69% respectively. The neck yield was not significantly different among different districts. The result of this study is in accordance with Chandrashekar *et al.* (2021) in Punjab broiler 2 chicken (6.47%) and Sudhir (2021) in indigenous chicken of Gulbarga division of Karnataka (6.38%). Higher values were recorded by Shakila *et al.* (2020) in Rajasri chicken (7.02%) and Kalita *et al.* (2021) in Daothigir chicken (8.24 and 7.86% in male and female chicken). Lower values were observed by Geetha *et al.* (2019) in Kadaknath under different rearing system (ranged from 4.93 – 5.03%) and Bai *et al.* (2022) in backyard chicken (5.94%).

Wings yield

Average wing yield of indigenous *Siruvidai* chicken of Tamil Nadu was 12.47% and the wing yield of *Siruvidai* chicken of Tiruvannamalai, Dharmapuri and Ariyalur and Perambalur districts were 12.69, 12.61 and 12.13% respectively. The wing yield was not significantly different among different districts. The same results were revealed by Shakila *et al.* (2020) in Rajasri chicken (12.96%) under deep litter rearing and Thamizhannal *et al.* (2022) in Gramasree (12.86%). Lower values were recorded by Chandrashekar *et al.* (2021) in indigenous chicken of Karnataka (10.02%) and Sudhir (2021) in desi chicken of Gulbarga division of Karnataka (11.25%).

Breast yield

The breast yield of indigenous *Siruvidai* chicken of Tiruvannamalai, Dharmapuri and Ariyalur and Perambalur districts was 22.98, 23.35 and 27.51% with the mean breast yield of 24.68%. Significantly ($p \leq 0.01$) higher breast yield was found in birds from Ariyalur and Perambalur district. The similar results were obtained by Bhimraj *et al.* (2018) in desi chicken reared under cage rearing (24.23%) and Bai *et al.* (2022) in native chicken under backyard rearing (24.76%). Lower values were recorded by Shakila *et al.* (2020) in Rajasri chicken (23.11%) and Chandrashekar *et al.* (2021) in backyard chicken of Karnataka (18.86%).

Back yield

The back yield of indigenous *Siruvidai* chicken of Tiruvannamalai, Dharmapuri and Ariyalur and Perambalur districts was 24.74, 23.00 and 19.95% respectively with the mean back yield of 22.54%. Similar results were reported by Vasanthi *et al.* (2023) in indigenous *Siruvidai* chicken under farm condition (21.26%) and Bai *et al.* (2022)

under backyard (22.91%) and farm condition (22.37%) in backyard chicken of Karnataka. Lower values were observed by Shakila *et al.* (2020) in Rajasri chicken (21.10%), Chandrashekar *et al.* (2021) in indigenous chicken of Karnataka (14.55%) and Haunshi *et al.* (2022) in Kadaknath chicken (15.30%).

Drumstick yield

The drumstick yield of indigenous *Siruvidai* chicken of Tiruvannamalai, Dharmapuri and Ariyalur and Perambalur districts was 15.77, 17.00 and 16.26% with the mean drumstick yield of 16.31%. No significant difference was found on drumstick yield among the study area. Similar results were recorded by Kalita *et al.* (2021) in Daothigir chicken (16.06%), Bai *et al.* (2022) in native chicken of Karnataka under backyard (16.29%) and farm reared (16.05%) chicken. Lower values were recorded by Edmew *et al.* (2018) in indigenous chicken of Ethiopia (15.4%), Shakila *et al.* (2020) in Rajasri chicken (13.87%), Chandrashekar *et al.* (2021) in indigenous chicken of Karnataka (11.40%) and Sudhir (2021) in indigenous chicken of Gulbarga division of Karnataka (13.51%).

Thigh Yield

The thigh yield of indigenous *Siruvidai* chicken of Tiruvannamalai, Dharmapuri and Ariyalur and Perambalur districts was 17.46, 17.89 and 17.48% with the mean thigh yield of 17.59%. No significant difference was found between districts on thigh yield of indigenous *Siruvidai* chicken. The results of this study are agreeable with Shakila *et al.* (2020) in Rajasri chicken under farm conditions (16.93%) and Bai *et al.* (2022) in native chicken of Karnataka (17.47%).

Giblets yield

The giblets yield of indigenous *Siruvidai* chicken of Tiruvannamalai, Dharmapuri and Ariyalur and Perambalur districts was 4.31, 4.50 and 4.80% with the mean thigh yield of 4.54%. No significant difference was found between districts on giblets yield of indigenous *Siruvidai* chicken. Higher value was recorded by Behera *et al.* (2017) in Hansli chicken (7.40%). Lower value was recorded by Shakila *et al.* (2020) in Rajasri (3.24%) chicken under deep litter system of management.

Abdominal fat yield

The abdominal fat yield of indigenous *Siruvidai* chicken of Tiruvannamalai, Dharmapuri and Ariyalur and Perambalur districts was 2.47, 1.85 and 2.41% with the mean abdominal fat yield of 2.31%. No significant difference was found between districts on abdominal fat yield of indigenous *Siruvidai* chicken. Lower value was reported by Patra *et al.* (2002) in Naked neck (1.01%) chicken and Haunshi *et al.* (2022) in broiler chicken (1.1%) under intensive rearing.

Meat: bone ratio

The meat - to - bone ratio of indigenous *Siruvidai* chicken did not show significance among the three districts. Higher value was reported by Patra *et al.* (2002) in Naked neck (1.30) chicken, Jaturasitha *et al.* (2008) in

Thai indigenous chicken (1.23) and Haunshi *et al.* (2022) in Kadaknath (2.94) and broiler chicken (3.61) under intensive rearing. Lower values were reported by Vasanthi (2022) in TANUVAS Aseel (1.15), Nicobari (1.07) and *Siruvidai* chicken (0.96) under intensive rearing. Jaturasitha *et al*. (2004) reported that bone portion was high and lean bone ratio was low in local chicken. Hence, the lower meat-bone ratio recorded in this study indicated lower meat content in the birds at slaughter age.

Nielsen *et al*. (2003) reported that slow-growing birds were characterized by a low thigh, drumstick yield and higher back yield compared to fast-growing chicken which is in agreement with the results of this study.

MEAT QUALITY

pH

The pH of the meat plays a vital role in meat quality. The mean pH value of meat was 6.78. The results of the present study indicated that the birds were not under any kind of pre-slaughter stress as pH was within the range of normal rested birds of 6.5-6.8 (Lawire, 2011). The results were in concurrence with the findings of Devatkal *et al*. (2018). It was reported that pH and colour of the muscles are highly correlated. The lower pH of meat is desirable and indicates better meat quality.

Water holding capacity

In the present study, there was no significant difference in water-holding capacity. Lower values were recorded by Shakila *et al.* (2020) in Rajasri (24.10%) and broiler (32.51%) chicken under intensive rearing. Bora *et al.* (2022) indicated that the water holding capacity of breast muscle of Uttara pure breed, Uttara cross bred and Kadaknath chicken were 33.43, 29.45 and 37.30% respectively. However, Fanatico *et al*. (2007) found that chicken raised in a free-range system had significantly lower water holding capacity and Wang *et al.* (2009) reported lower water holding capacity in slow-growing chicken.

Shear force value

The Shear force value (kg/cm^2) showed non-significant difference among selected districts. It has been reported that Shear force value and sarcomere length had negative correlation in duck and chicken breast meat and that sarcomere shortening was major contributor to the toughness of meat and higher sarcomere length resulted in lower Shear force value (Dunn *et al*., 2000). The lower Shear force value due to lower collagen and sarcomere length. The higher Shear force values in backyard chicken might be due to lower collagen solubility as heat stable crosslink in collagen increases with age of the birds.

Thio-barbituric acid (TBA) number

No significant difference was noticed on thio-barbituric acid number of *Siruvidai* chicken meat samples collected from different districts of Tamil Nadu. Higher values were reported by Farzana *et al.* (2017) in indigenous (0.06 mg/kg) and commercial broiler chicken

Table 1. Mean (± S.E) values of carcass characteristics of indigenous *Siruvidai* chicken in selected districts of Tamil Nadu

Particulars / District	Pre-slaughter body weight (g)	New-York dressed (%)	Dressing yield (%)	Giblets yield (%)	Ready-to-cook yield (%)
Tiruvannamalai (n=16)	1126.65^{b}±40.89	90.47±0.41	64.26±0.97	4.31±0.18	70.34±0.81
Dharmapuri (n=16)	1326.41^{a}±98.62	90.23±0.44	64.00±1.53	4.50±0.32	69.59±1.23
Ariyalur and Perambalur (n=18)	1100.00^{b}±52.81	90.55±0.43	66.22±0.74	4.80±0.22	71.84±0.51
Overall (n=50)	1176.88±39.14	90.43±0.24	64.87±0.63	4.54±0.14	70.64±0.50
P Value	0.04*	0.86^{NS}	0.28^{NS}	0.34^{NS}	0.18^{NS}

Means bearing different superscripts within column differs significantly

NS – Not significant; * - Significant ($p \leq 0.05$)

Table 2. Mean (± S.E) values of cut-up-parts of indigenous *Siruvidai* chicken in selected districts of Tamil Nadu

Particulars / District	Neck (%)	Wings (%)	Breast (%)	Back (%)	Drumstick (%)	Thigh (%)	Meat: bone ratio
Tiruvannamalai (n=16)	6.36 ± 0.21	12.69 ± 0.43	24.74^{ab} ±0 .82	22.17± 0.47	15.77 ± 0.36	17.46 ± 0.51	1.14 ± 0.04
Dharmapuri (n=16)	6.15 ± 0.20	12.61 ± 0.51	23.35^{b} ± 0.58	23.00± 0.77	17.00 ± 0.36	17.89 ± 0.5	1.21 ± 0.04
Ariyalur and Perambalur (n=18)	6.69 ± 0.27	12.13 ± 0.44	25.71^{a} ± 0.69	22.54± 0.92	16.26 ± 0.46	17.48 ± 0.42	1.15 ± 0.04
Overall (n=50)	6.41 ± 0.14	12.47 ± 0.26	24.68 ± 0.44	22.54±0.55	16.31 ± 0.24	17.59 ± 0.27	1.17 ± 0.02
P Value	0.27^{NS}	0.63^{NS}	0.02*	0.09^{NS}	0.11^{NS}	0.21^{NS}	0.55^{NS}

Means bearing different superscript within column differ significantly

NS – Not significant; * - Significant ($p \leq 0.05$)

Table 3. Mean (± S.E) values of meat quality parameters of indigenous *Siruvidai* chicken of selected district of Tamil Nadu.

S. No	Parameters	Tiruvannamalai (n=6)	Dharmapuri (n=6)	Ariyalur and Perambalur (n=6)	Overall (n=18)	P value
1	pH	6.78 ± 0.37	6.77 ± 0.38	6.78 ± 0.37	6.78 ± 0.21	0.97^{NS}
2	Water holding capacity (%)	57.44 ± 2.69	56.88 ± 2.70	57.44 ± 2.69	57.25 ± 1.56	0.98^{NS}
3	Shear force value (kg/ cm^2)	2.04 ± 0.19	2.02 ± 0.19	2.03 ± 0.19	2.03 ±0.11	0.99^{NS}
4	Tyrosine value (mg/100g)	1.25 ± 0.056	1.23 ± 0.056	1.25 ± 0.056	1.24 ± 0.032	0.94^{NS}
5	TBA number (mg/kg)	0.0013 ± 0.0002	0.0013 ± 0.0002	0.0013 ± 0.0002	0.0013 ± 0.0002	1.0^{NS}

NS – Not significant

(0.21 mg/kg), Gnanaraj *et al.* (2020) in Kadaknath (0.18 mg/kg), Nicobari (0.19 mg/kg) and Naked Neck (0.27 mg/kg) chicken. Strange *et al*. (1977) reported that TBA numbers may increase due to lipid oxidation and not specifically due to bacterial action.

Tyrosine value

There was no significant difference in the tyrosine value of *Siruvidai* chicken meat between the three districts. Higher values were reported by Gnanaraj *et al.* (2020) in Kadaknath (2.57), Nicobari (2.45) and Naked Neck (2.63) chicken. Tyrosine value enumerates the extent of proteolysis and measures the amino acid tyrosine and tryptophan of the extract of meat, which is an effective monitor of the meat quality. The meat samples analysed were fresh and there was no significant change in the tyrosine value of meat among the three districts. The increase in tyrosine value of meat may be due to intrinsic (autolysis) changes in meat and bacterial action (Strange *et al*., 1977).

CONCLUSION

The *Siruvidai* chicken of Tamil Nadu is mainly reared for egg production. Most of the carcass and meat quality traits except for breast yield were not affected by the location of the farm. This indicates the uniformity of the trait for the genetic group despite the difference in management practices between districts. From this study, it is concluded that

the *Siruvidai* chicken of Tamil Nadu may also be considered for meat production due to higher breast yield.

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