THE INTERNATIONAL JOURNAL OF SCIENCE & TECHNOLEDGE

Comparison of Chemical Composition and Nutritive Value Characteristics of Vigova Super M and Kuttanad Ducks

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Abstract:
A study was conducted to compare the chemical composition and nutritive value characteristics of Vigova Super M duck, a broiler duck strain and Kuttanad duck, a dual purpose duck indigenous to Kerala. Chemical composition characteristics, viz., proximate composition including moisture, fat, protein ash and carbohydrate, mineral composition and nutritive value characteristics including calorific value and per Recommended Daily Allowance (RDA) for human diet, of breast and thigh muscles of the two groups of ducks were studied. Vigova thigh meat showed significantly higher (P<0.05) moisture content while Kuttanad thigh meat showed significantly higher (P<0.05) fat content. Higher mean protein, ash, sodium and potassium values were observed in Kuttanad duck meat, values being higher for thigh meat than breast meat. The highest calorific value from carbohydrate was found in Vigova breast meat and it differed significantly (P<0.05) from all others. Calorific value of protein, fat and per cent contribution to RDA were highest in Kuttanad thigh and lowest in Vigova breast meat and differed significantly (P<0.05) The highest energy value, contribution to RDA of sodium and potassium was from Kuttanad thigh meat. Significant difference (P<0.05) in contribution to RDA was observed between Kuttanad and Vigova thigh meats with respect to sodium and potassium. Highest contribution to RDA of calcium and phosphorus was from Vigova breast. Kuttanad duck meat could meet the recommended human daily allowance for various nutrients better and this breed can be popularised as a meat breed in respect to the above nutrients.

Keywords*: Duck, Vigova, Kuttanad, Meat,chemicalcomposition, nutritive value, Comparison*

1. Introduction

Poultry meat is of high nutritional value and is a good source of protein. Though majority of poultry meat in India is constituted by chicken, duck meat is slowly gaining popularity due to its nutritional value (Kanagaraju *et al*., 2012). Duck meat production in India was 37700 tonnes in 2010 (FAOSTAT, 2010). Duck meat has combined characteristics of red meat - contains high levels of phospholipids, precursors of aromas and the dietetic characteristics of poultry meat - contains high levels of mono unsaturated fatty acids, especially oleic and linoleic acids which constitutes about 60 % of total fatty acids. With recommendations for the reduction of red meat intake due to its association with cardiovascular pathologies, the consumption of white meats and duck meat is gaining more attention. Kerala with its extensive network of inland water bodies is highly suitable for rearing of ducks. Vigova Super M (Super Meat) is a broiler strain of duck which is a cross of White Pekin and Aylesbury and has its origin in Vietnam. They have high disease resistance, faster growth rate and good feed conversion efficiency. These are ideally suited for the Indian climate and are gaining popularity in India. Kuttanad duck, the most popular duck of Kerala is native to the state and includes both *Chara and Chemballi* varieties. They are reared in large flocks in the paddy fields of Kuttanad area in Kerala and are mainly kept for egg production, but are dual purpose in nature with high disease resistance and good adaptability.

It would be beneficial if the chemical composition and nutritive value characteristics of meat of these two ducks are studied and compared. Only very few works had been so far conducted in this area. Hence a study was envisaged with the objectives of evaluating and comparing the chemical composition and nutritive value characteristics of Vigova and Kuttanad ducks.

2. Materials and Methods

Comparative studies on quality characteristics of Vigova Super M and Kuttanad duck meat were conducted at the Department of Livestock Products Technology, College of Veterinary and Animal Sciences, Mannuthy. Twenty each of Vigova Super M ducks (aged six to eight weeks) and Kuttanad ducks (aged 5 to 6 months) of either sex selected at random were used for the study.

Vigova Super M ducks were purchased from local farmers and Kuttanad ducks from the University Poultry and Duck Farm (UPDF), Mannuthy. Ducks were humanely slaughtered and hygienically processed in the Department. Breast and thigh meat of each duck without skin and subcutaneous fat were salvaged and kept chilled at 0 to 4^{o}C for the evaluation of nutritive value characteristics. Duck meat was analyzed for chemical composition characteristics, viz., proximate composition including moisture, fat, protein ash and carbohydrate and mineral composition on the day of slaughter. The composition of proximate principles was expressed as per cent of the duck meat on wet matter basis as per AOAC (1990). Mineral contents of duck meat were determined according to the methods of AOAC (1990). The sodium and potassium contents were estimated using a Flame Photometer (Systronics flame photometer 128, Ahmadabad, India) and calcium content was determined using Atomic Absorption Spectrophotometer (Perkin Elmer, 3110, US Instrument division, Norwalk, USA) at a wavelength of 422.7 nm. Phosphorous was determined by ANSA method (Fiske and Subbarow, 1925). Of the nutritive value characteristics, calorific values were determined as per FAO (2002).

- Calories from fat = Fat per cent x 9
- Calories from protein = Protein per cent x 4
- Calories from carbohydrate = Carbohydrate per cent x 4
- Total calories = Calories from fat + Calories from protein + Calories from carbohydrate.

Per cent Recommended Daily Allowance (RDA) of calories from fat, protein and carbohydrate were calculated based on a 2200 kcal diet (ICMR, 1990).

Per cent daily value of minerals of duck meat was calculated and expressed as per cent of RDA using the following formula.

Per cent daily value of sodium in duck meat = Sodium per cent in meat/RDA of the sodium. RDA of sodium was taken as 2400 mg; potassium - 3500 mg (Code of Federal Regulations, 1995), calcium -800 mg and Phosphorus - 800 mg (NRC, 1989).

The data obtained were statistically analyzed by Independent *t*-test, Paired *t*-test, Mann-Whitney-U test and Wilcoxon Signed Ranks test using SPSS soft ware as per Snedecor and Cochran (1994).

3. Results and Discussion

The chemical composition including proximate and mineral composition, and nutritive value characteristics including calorific value and percent RDA of minerals of breast and thigh meat of Vigova and Kuttanad ducks are shown in Table 1 ,Table 2 and Table 3 respectively.

3.1. Proximate Composition

Between the two groups, the moisture content differed significantly ($P<0.05$), being higher for Vigova duck meat. This might be due to the higher slaughter age of Kuttanad ducks which might have increased the protein and fat contents as supported by findings of Huda *et al.* (2011).Mean moisture per cents of breast meat in both groups of ducks showed higher values compared to thigh meat. Higher protein per cent values in Kuttanad ducks might be due to higher slaughter age which increased protein levels in meat. Protein per cent of thigh meat showed higher value compared to breast meat in both groups of ducks. Between the two groups, mean fat per cent value of meat differed significantly ($P<0.05$), being higher for Kuttanad ducks. This might be due to the higher slaughter age of Kuttanad ducks which resulted in more fat deposition. Thigh meat showed higher fat per cent values compared to breast meat in both groups of ducks which was in agreement with findings of by Witak (2008) and Huda *et al.* (2011). Between the two groups, ash content differed significantly ($P<0.05$), being higher for Kuttanad ducks and might be due to the higher slaughter age of Kuttanad ducks.

3.2. Mineral Composition

Highest mean sodium value was observed for Kuttanad thigh meat and lowest for Vigova breast meat and the difference was significant ($P<0.05$). Highest potassium value was observed for Kuttanad thigh meat. In both groups of ducks, significantly higher ($P<0.05$) levels of calcium and phosphorus were seen in breast meat when compared to thigh meat. Similar phosphorus levels were observed in breast and thigh meat of both groups of ducks. Stadelman *et al*. (1988) studied mineral composition of meat of broiler ducks with skin and observed similar phosphorus values in breast and thigh meat.

Parameters	**Treatment mean values**			
	Vigova breast	**Vigova thigh**	**Kuttanad breast**	**Kuttanad thigh**
Moisture	76.82 ± 0.26^{c}	75.76 ± 0.22^{b}	74.26 ± 0.32^{a}	73.66 ± 0.26^{a}
Protein	19.46 ± 0.19^{a}	20.32 ± 0.19^{bc}	20.27 ± 0.24^{b}	20.83 ± 0.20^{c}
Fat	1.26 ± 0.03^{a}	1.48 ± 0.03^{b}	3.05 ± 0.07^{c}	3.12 ± 0.10^{c}
Ash	0.92 ± 0.01^{a}	0.95 ± 0.02^{a}	1.11 ± 0.03^{b}	1.30 ± 0.62^{c}
Carbohydrate	1.53 ± 0.19^{ab}	1.48 ± 0.08^{b}	1.32 ± 0.11^{ab}	1.10 ± 0.10^{a}
Sodium	67.15 ± 0.88^{a}	69.71 ± 1.52^{a}	79.9 ± 1.0^{b}	80.93 ± 1.10^{b}

Potassium	222.77±4.42[a]	232.29±8.27[ab]	239.58±4.08[b]	253.18±3.62[c]
Calcium	19.96±0.40[b]	15.33±0.40[a]	18.87±0.77[b]	14.87±0.32[a]
Phosphorus	223.78±4.84[a]	213.66±6.15[a]	220.39±5.16[a]	216.55±4.83[a]

Table 1: Chemical composition characteristics of Vigova Super M and Kuttanad duck meat
Means bearing identical alphabets in the rows and numbers in the column do not differ significantly (P<0.05)

3.3. Nutritive Value

3.3.1. Calorific Value

The RDAs for human diet are used by nutritionists and dieticians as the basis for most public health programmes and hence of great importance. The highest calorific value from carbohydrate was found in Vigova breast meat and it differed significantly (P<0.05) from others. Calorific value of protein and percent contribution to RDA were highest in Kuttanad thigh and lowest in Vigova breast. Calorific value from fat was highest in Kuttanad thigh and lowest in Vigova breast meat. Between the groups of ducks, there was significant difference (P<0.05) in calorific value from fat and per cent contribution to RDA value, the values being higher for Kuttanad.

Parameters		**Treatment mean values**			
		Vigova breast	**Vigova thigh**	**Kuttanad breast**	**Kuttanad thigh**
Carbohydrate	kcal/100g	6.16±0.78[b]	5.92±0.36[a]	5.26±0.45[a]	4.39±0.41[a]
	% of RDA	0.28±0.04[b]	0.27±0.02[a]	0.24±0.02[a]	0.20±0.07[a]
Protein	kcal/100g	77.82±0.76[a]	81.31±0.74[bc]	81.08±0.96[b]	83.32±0.80[c]
	% of RDA	3.54±0.03[a]	3.67±0.03[bc]	3.69±0.04[b]	3.79±0.04[c]
Fat	kcal/100g	11.35±0.30[a]	13.35±0.23[b]	27.40±0.50[c]	28.04±0.91[c]
	% of RDA	0.52±0.01[a]	0.61±0.01[b]	1.25±0.28[c]	1.27±0.04[c]
Total energy	kcal/100g	95.33±1.18[a]	100.56±0.86[b]	113.76±1.44[c]	115.74±1.41[c]
	% of RDA	4.33±0.05[a]	4.57±0.04[b]	5.18±0.07[c]	5.26±0.06[c]

Table 2: Calorific value of nutrients (kcal/100g) and their per cent contribution to RDA in Vigova and Kuttanad duck meat
Means bearing identical superscripts in the rows do not differ significantly (P<0.05)

3.3.2. Per Cent Daily Values of Protein and Minerals

RDA of Na– 2400 mg; K- 3500 mg (Code of Federal Regulations, 1995), Ca-800 mg and P- 800 mg (NRC, 1989). Highest contributions to RDA for human diet for sodium and potassium were in Kuttanad thigh meat. Significant difference (P<0.05) was observed between Kuttanad and Vigova thigh meats with respect to sodium and potassium.Thigh meat contributed more to RDA in both ducks. Highest contributions to RDA of calcium and phosphorus were from Vigova breast and the values of calcium differed significantly (P<0.05) from those of thigh meats of Vigova and Kuttanad; however values of phosphorus did not differ significantly.

Parameters (%)	Treatment mean values			
	VBM	VTM	KBM	KTM
Sodium	2.80±0.03[a]	2.90±.06[a]	3.33±0.04[b]	3.37±0.05[b]
Potassium	6.37±0.13[a]	6.63±0.24[ab]	6.85±0.12[b]	7.23±0.10[c]
Calcium	2.36±0.10[b]	2.50±0.18[a]	1.86±0.14[b]	1.92±0.05[a]
Phosphorus	27.97±0.61[a]	26.71±0.77[a]	27.55±0.65[a]	27.07±0.60[a]

Table 3: Percent RDA of minerals in Vigova and Kuttanad duck meat

Means bearing identical superscripts in the rows do not differ significantly ($P<0.05$).

From the study it can be concluded that Kuttand duck meat was superior for human diet and nutrition. Kuttanad duck meat could meet the recommended human daily allowance for various nutrients better and this breed can be popularised as a meat breed in respect to the above nutrients.

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