



# Estimation of hydroxy proline and collagen content in skin of turkey (*Meleagris gallopavo*)\*

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## Abstract

*Estimation of hydroxyproline and collagen in skin of turkey (Meleagris gallopavo) was done using skin samples procured from 12 birds each of either sex of four to six months of age. The samples were stored at -20°C and the hydroxyproline content of moisture-free and fat-free samples of the skin was estimated. From the values arrived at, the collagen content was calculated on fresh matter basis. Average content of hydroxyproline was 5.20 and 5.30 per cent in male and female turkeys respectively. Collagen content was found to be as 8.16 per cent in male and 8.14 per cent in female turkeys. On statistical analysis, significant difference was not detected in the mean percentage of hydroxyproline and collagen content between sexes. Hence, the skin of turkey with its high content of collagen can be recommended as a source for collagen production in the avian industry. Moreover, with a contribution of 8.43 to 9.65 per cent to the total carcass weight, the potentials of skin of turkey could be effectively harnessed for further processed products.*

**Key words:** Collagen, hydroxyproline, skin, turkey

Indian poultry sector has flourished during the last three decades evolving from backyard rearing to a commercial agro-industrial business. Turkey (*Meleagris gallopavo*), a large gallinaceous bird, originally native of North America, is now being reared as a source of food all over the world. As per the current reports, turkeys contribute two per cent of the total poultry population in India. Turkey industry, which is offering low fat and high protein meat, is gaining momentum at national level. Measures are being undertaken by poultry organizations in India to increase the population of this species. Increase in turkey production is inseparably related with the challenge of disposal of the wastes, among which skin has a significant contribution. The yield of skin in turkey varies

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from 5.8 to 12.4 percentage by weight of the eviscerated carcass (MacNeil and Buss, 1968) which is quite substantial for a waste by-product to be a potential source for further processed products. Collagen is a fibrous insoluble protein found in skin and other tissues of body in all species. In industry, the collagen has been widely used for production of gelatin especially in pharmaceuticals and cosmetic industries. Due to the outbreak of diseases like BSE, TSE, FMD etc., in land animals, there has been an increased demand of collagen from avian sources from industrial point of view. Hydroxyproline is an abundant amino acid in collagenous tissue and the determination of its level helps to arrive indirectly at the collagen content of a sample. Skin of turkey being an underutilized by-product may be recommended as a source for collagen production to meet increasing demand for gelatin production and in the field of tissue engineering. Information on histological structure of skin in broiler chicken (Bharathi *et al.*, 2019) and chemical properties of feather in broiler and *Kuttand* ducks (Alphine *et al.*, 2019) are available. Hence, the current study was undertaken to estimate the hydroxyproline content and in turn the collagen content in the skin of this avian species.

### Materials and Methods

Skin samples were procured from 12 birds each of either sex of four to six months age and stored at -20°C for estimation of hydroxyproline. The total collagen content of the skin was calculated from the amount of hydroxyproline recorded as per Stegemann and Stadler (1967).

About 100 mg of dried fat-free meat sample was hydrolysed with ten millilitres of 6 N HCl in a sealed test tube at 110°C for 18-20 hours. The hydrolysate was cooled and filtered using Whatman No. 4 filter paper into a standard flask and was diluted to 100 mL using distilled water. Five millilitres of the diluted hydrolysate was neutralized to pH 6.8 using sodium hydroxide solution and the volume was made up to 100mL using distilled water.

Five millilitres of the neutralized diluted tissue hydrolysate was mixed with two millilitres of oxidizing agent and kept

at room temperature for 20 minutes. Two millilitres of colouring reagent was added and incubated in a water bath at 60°C for 15 minutes, cooled under running tap water for three minutes. The absorbance of the coloured solution was measured using a single beam spectrophotometer (Systronics, India) at 560 nm from which hydroxyproline content was determined of the unknown samples using regression equation:

$$y = 0.223x + 0.017$$

where, y is the absorbance and x is the concentration of hydroxyproline

Total collagen content of the sample was determined by multiplying the hydroxyproline content with the factor 7.50. The total collagen was expressed as per cent of fresh basis by taking in to account the moisture and fat percentage of the sample. Statistical analysis was done to compare the content of hydroxyproline and collagen between male and female birds using independent t-test (Snedecor and Cochran, 2014).

### Results and Discussion

The mean body weight of the birds under study was 8.34±0.37 and 3.94±0.15 kg in males and females respectively, indicating significant difference between the sexes with males being heavier than females. Skin weight contributed 8.43 per cent in male and 9.65 per cent in female turkeys to the total carcass weight, with the latter contributing more in accordance with the findings of Murawska (2013) in turkeys. The share of skin weight to the total carcass weight in the current study was within the range of 5.8 to 12.4 per cent in turkey as mentioned by MacNeil and Buss (1968).

According to Du *et al.* (2014), hydroxyproline is considered to be an abundant amino acid present in the collagenous material so that determination of its content indirectly reflected the amount of collagen, which in turn represented 30 per cent of the total protein. Moisture percentage in male and female turkeys was 69.95 and 68.33 per cent, respectively. Fat content was 9.03 per cent in both sexes. The estimated values for hydroxyproline and collagen content of skin in male and female

**Table 1.** Comparison of content of collagen and hydroxyproline in the skin of male and female turkeys (Mean±SE)

Sl. No.	Parameter	Male	Female	t-value	p-value
1.	Hydroxyproline (%)	5.20±.03	5.30±0.16	0.136 <sup>ns</sup>	0.895
2.	Collagen (%)	8.16±0.05	8.14±0.07	1.345 <sup>ns</sup>	0.218

ns: non-significant

turkeys are shown in table 1.

Average content of hydroxyproline on fresh matter basis was 5.20 and 5.30 per cent in male and female turkeys in the present study. Collagen content on fresh matter basis was 8.16 per cent in male and 8.14 per cent in female turkeys, which was found higher than that in chicken and duck. According to Bonifer and Froning (1996), the chicken had three per cent collagen in the skin. In duck, the cutaneous collagen was found to be five per cent as per the reports of Alphine (2018). Due to the non-availability of collagen from animal sources resulting from outbreak of diseases like BSE, TSE, FMD etc., the demand of collagen from avian and marine sources was reported to increase recently, to be used for industrial needs like gelatin production (Silvipriya *et al.*, 2015). Purified collagen is considered as a useful biomaterial in the manufacture of cosmetics and medical items (Cliche *et al.*, 2003).

### Summary

Respective average content of hydroxyproline was estimated as 5.20 and 5.30 per cent in male and female turkeys. Mean collagen content in male and female turkeys was derived to be 8.16±0.05 per cent and 8.14±0.07 per cent respectively. No significant difference was found in the mean percentage of hydroxyproline and collagen content between male and female turkeys in this study. Hence, the skin of turkey with its high collagen content of eight per cent may be recommended as a preferred raw material for gelatin and scaffold preparation.

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