Proximate Composition, Minerals, Heavy Metal And Pesticide Resudues Of Three Popular Cut-Up Parts Of Commercial Chicken From North 24-Parganas Area, West Bengal

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ABSTRACT

Study was conducted to determine the proximate and mineral composition as well as heavy metals and pesticide residues in three popular cut-up parts (drumstick, breast and wing) of commercial chicken. A total number of 120 broiler birds of 35-42 days of age were selected from different areas of North 24-Parganas, West Bengal and the slaughtering and dressing were done as per the standard procedure. The data were analyzed statistically for valued conclusion. Significant (P<0.05) differences were observed among the three cut-up parts in terms of moisture, protein, ether extract and ash content. The mineral contents also differed significantly (P<0.05) and Fe was found highest in breast and Ca, Na and K was highest in drumstick. Amount of Cu did not differ significantly but the amount of Zn differed among the three parts. The amount DDT, though within the permissible limit, was found highest in drumstick part. Pb, Aldrin and Endosulfan was found below the detectable limit.

Key words : *proximate composition, mineral, heavy metal, cut-up parts, chicken.*

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INTRODUCTION

Chicken meat, popularly known as 'white meat', is distinguished from other meats such as beef, chevon etc by it's lower iron content (0.7mg compared with 2mg/100gm). About 50% of the fat from chicken is made up of desirable mono-saturated fats. Therefore, it is considered as a healthy meat. It does not contain the trans-fat that contribute to coronary heart diseases (Farrell, 2009). That's why the world poultry meat consumption is of significant economic importance in more than 50 countries worldwide and will undoubtedly continue in an upward trend (Roenigk, 1999). In India, there is a sharp increase in poultry meat production, i.e. 175% over the 1995 to 2005 as per FAO and 120% as per USDA data (Mehta and Nambiar. 2007). Here the poultry industry has grown at the rate of around 14% per annum while the agricultural production has been rising at the rate of 2% per annum over the past two or three decades (FAOSTAT, 2006). In 2006, there was an annual turnover of US$7500 million in poultry Industry in India (FAOSTAT, 2006). On the other hand, the continuous consumption of food stuffs contaminated with heavy metals that exceed the safe permissible limits may result in a serious health problem through progressive irreversible accumulation in human body (Goyer, 1997). Pesticide contamination of chicken and meat resulting from feeding a diet containing low-concentration of pesticides is a well-established fact (Aulakh et al. 2006). Accurate nutrient composition data are essential in communicating nutrition information to consumers (Cobiac et al. 2003). Knowledge of the carcass composition is necessary to provide the preferred cut to the consumer as such or by further trimming of the cut to the consumer's preference (Hopkins et al. 1995). In view of the above, the present study was conducted to determine the proximate, mineral composition and heavy metals, pesticide residues in three popular cut-up parts of commercial chicken.

MATERIALS AND METHODS

A total number of 120 broiler birds of 35-42 days of age were selected from different areas of North 24-Parganas, West Bengal. Broilers were hung by their feet in steel shackles and

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were electrically stunned by manually placing their heads in a saturated saline bath (11.5 volts, < 0.5 mA AC to DC current for 3 sec). The shackle line speed was constant and set so that approximately 22 broilers were stunned per minute. Unilateral neck cutting was manually performed immediately after stunning, and bleeding lasted for 140sec. Upon completion of exsanguination, the broilers were scalded at 53.3 C for 191 sec, picked for 35 sec using a rotary drum picker and then mechanically eviscerated after recording the carcass characteristics. The cut-up parts, i.e. drumstick, breast and wings were separated. The samples were wrapped in polyethylene bags and were transferred to the LPT laboratory of West Bengal University of Animal and Fishery Sciences, Kol-37. The moisture, protein, ether extract and ash content of meat samples were determined by the method described by AOAC (1995). Atomic Absorption Spectrophometry was used for estimation of Fe, Ca, Cu, Zn, Pb and for Na and K, a flame photometer was used. The method of Demirbas (1999) was followed for this purpose. For detection of pesticide residues namely Lindane, Aldrin, Endosulfan and DDT in meat cuts, the method of Darko and Acquaah (2007) was followed. All the data which were obtained during the present investigation were analyzed statistically to draw valid conclusion in SPSS (Version 16.0) software. One way analysis of variance (ANOVA) technique was used to compare the means of varying parts. F-statistics were calculated to test the level of significance for each variable under study. Duncan's test (at 5% level of significance) was used to test the homogeneity of means of different parts.

RESULTS AND DISCUSSION

Table 1 clearly depicted that the moisture content (%) varied significantly ($P<0.05$) among the raw wholesale cuts, i.e. drumstick, breast and wing where the wing had the highest value followed by drumstick and breast. The crude protein content also differed significantly ($P<0.05$) among the three cuts and breast had the highest mean value followed by drumstick and wing. The mean ether extract value was found to be highest in breast and lowest in wing. The total ash content was highest in breast and lowest in wings and the variation was also significant. USDA (2012) had reported that the de-skinned breast meat of broiler contained about 21% protein and 75.8% moisture. Abeni and Bergoglio (2001), Al-Najdawi and Abdullah (2002), van Heerden (2002), Wattanachant et al. (2004) and Chuaynukool et al. (2007) had reported that chicken meat contained about 16.44-23.31% protein, 0.37-7.20% fat, 0.19-6.52% ash and 72.8-80.82% moisture which strongly supported the present findings. The findings of Chueachuaychoo et al. (2011) and Bae et al. (2013) were also almost in agreement with the present findings. The slight variation in contents might be due to differences in species, breed or strain, muscle type, sex, age and methods of precessing of carcass (Chuaynukool et al. 2007; Wattanachant and Wattanachant., 2007). The present study also denoted significant differences between the breast and drumstick muscles in terms of protein and fat content which were also in agreement with the findings of Simeonova (1999).

The results depicted in Table 2 showed that significant ($P<0.05$) variations were observed in terms of Fe, Ca, Na and K content (mg/100gm) among the three commercial broiler cuts. The breast part was having the highest value for Fe but Ca, Na and K content was found to be highest in drumstick. The values obtained in the present study for various macro and micro minerals in different broiler cuts were in agreement with findings of Iwegbue et al. (2008) and Poltowicz and Doktor (2013). The present study also depicted that K was the most important mineral quantitively which was in agreement with Lawrie (1990). The present study strongly justified the findings of Addis (1986) and Poltowicz and Doktor (2013) who reported that the leg muscles contained more Ca than the other parts because of greater demand of leg muscle contraction as compared to that of other muscles.

Regarding the heavy metals (mg/100gm), Pb was found to be below the detectable limit in all the three parts. Table 2 also showed that the copper (Cu) content (mg/100gm)did not differ significantly among the raw broiler cuts and the concentration (mg/100gm) of zinc (Zn) was found to be higher in wing than that of breast and drumstick in raw samples. The present study regarding the presence of Cu and Zn and its quantity were in agreement with the findings of Mohanna and Nys (1998), Iwegbue et al. (2008) and Rehman et al. (2012). Though within the permissible limit, the concentration (μg/kg) of DDT among the raw broiler cuts showed that the highest concentration was obtained in drumstick (2.840) followed by breast (2.378) and wing (1.972). The level of Aldrin and Endosulfan was found to be below the detectable limit (0.2mg/kg in case of Aldrin and 0.004mg/kg in case of Endosulfan) as per FAO/WHO (2006). Though the quantum of DDT in various cut-up parts differed, but it's presence in broiler meat in this study strongly justified the findings of Ahmad et al. (2010) and Jadhav and Waskar (2011). The differences in values might be due to the differences in quantum of exposure to those pesticides, feed etc.

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Table 1. Proximate composition of some wholesale cuts of commercial chicken with Duncan's test of significance at 5% level.

Process	Poultry cuts		Moisture	Crude protein	Ether Extract	Total ash
Raw	Drum stick	Mean	73.682^{b}	21.763^{b}	3.920^{b}	0.849^{b}
		SE	0.030	0.023	0.016	0.008
	Breast	Mean	71.571^{c}	22.905^{a}	4.256^{a}	0.939^{a}
		SE	0.018	0.014	0.012	0.012
	Wing	Mean	74.170^{a}	21.621^{c}	3.069^{c}	0.779^{c}
		SE	0.020	0.024	0.014	0.013

• Means with different superscripts in a column differ significantly ($P<0.05$).

Table 2: Mineral composition (mg/100gm) and heavy metals (mg/100gm) and pesticide residues (μg/kg) in some wholesale cuts of commercial chicken with Duncan's test of significance at 5% level.

Poultry cuts		Fe	Ca	Na	K	Cu	Zn	DDT	Pb	Ald	End
Drum stick	Mean	0.830^{b}	10.517^{a}	76.533^{a}	330.78^{a}	0.442	2.880^{b}	2.840^{a}	BDL	BDL	BDL
	SE	0.011	0.032	0.073	0.472	0.004	0.009	0.306	BDL	BDL	BDL
Breast	Mean	0.871^{a}	9.419^{c}	75.492^{b}	329.07^{b}	0.440	2.902^{b}	2.378^{b}	BDL	BDL	BDL
	SE	0.009	0.012	0.021	0.150	0.007	0.017	0.262	BDL	BDL	BDL
Wing	Mean	0.793^{c}	10.257^{b}	75.468^{b}	327.85^{c}	0.427	3.007^{a}	1.972^{c}	BDL	BDL	BDL
	SE	0.009	0.032	0.074	0.068	0.004	0.015	0.248	BDL	BDL	BDL

• Means with different superscripts in a column differ significantly ($P<0.05$).