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Distribution of Chromium from Chrome Shaving Dust to Poultry Feed

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Abstract:

The poultry industry is a rising sector in Bangladesh. A large amount of poultry feed needs of this sector. Poultry feeds consist of various types of elements. This study carried out on 18 samples, including 4 samples from the local meat bone production process, 2 mixed meat bone, 8 foreign feed samples, 4 final poultry feed samples and samples to bring out the real cycle of chromium toxicity. AAS flame method was used to determine the chromium (Cr) concentration. The chromium concentration was determined from 7225 mg/kg to BDL in meat bone and 148.5 to BDL in processed feed and also some foreign meat bone. This chromium can easily enter the human food chain through an edible portion of poultry. Therefore, the health of the consumer is in the threat.

Key words: Chromium, poultry feed, food chain, Toxicity, meat bone, shaving dust.

INTRODUCTION

Poultry meat is the main source of protein for human beings all over the world. According to WHO and FAO in Bangladesh, the consumption of meat per year is 23 kg per head in where 35.25% comes from the poultry industry [1]. The main ingredient of poultry is poultry feed. In the last few years, poultry feed is made from chrome shaving dust, which is a solid waste of leather industry. In Bangladesh, only Hazaribagh tannery industries are processed about 220 metric tons of hide and skin per day. A ton of hides and skin is associated with the generation of approximately 600 to 1000 kg of solid waste [2]. The highest amount of chromium concentration in the chrome shaving dust was found to be 3.203% [4]. Before this huge amount of shaving, dust disposed directly on land which causes leaching out chromium in the environment. As a result, the soil and the environment become polluted drastically. But present this solid waste is converted into a protein source for poultry feed or organic fertilizer by the local businessman. Approximately 200-250 tons of protein produced every day in Hazaribagh [2]. Once the tannery owner had to some for dumping this solid waste, but now they are earning some money by selling this solid waste [5]. There is more than 200 tannery exists in Hazaribagh which is helped by supplying solid waste for the poultry feed producer [6]. After collecting the chrome shaving dust it boiled with sulfuric acid and then dried in sunlight and finally grinded to make powder. This powder mixed with a certain percentage, which known as local meat bone. This percentage depends on poultry age [7]. According to the research of Dhaka university and Bangladesh council for scientific and industrial research(BCSIR) chromium concentration this type of poultry cross the permissible limit which resulting the higher amount of chromium in various part of the chicken body [3,7]. This study has been demonstrated to

observe the actual percentage and source of chromium in poultry feed.

In the present study, we observe that Hazaribagh and Gazipur are the two main places from where the poultry feed have been supplied all over the Bangladesh. Hazaribagh is the south-west part of Dhaka which is located between $23^0$43.85 to $23^0$44.05N latitude and $90^0$21.85 to $90^0$22.15 E longitude [4].

SAMPLE COLLECTION AND STORAGE

This analysis, samples were collected 18 to 23 December 2015 from the Hazaribagh local meat bone production industry and the biggest poultry feed market in Gazipur. The local meat bones were collected each stage of the production process from the raw to finish of poultry food from local production industry and foreign feeds from Gazipur. In a total number of samples were collected in plastic bottle After collecting all three categories, samples were then labeled to indicate the sample number, sample ID and date of sampling. Then the samples carried to the laboratory and stored in a refrigerator at 25^0c until analysis.

MATERIALS AND METHOD

Study area location

Sample ID	Characteristic	Collection place
Raw shaving dust	Local meat bone production process	Hazaribagh
Boiling water	Local meat bone production process	Hazaribagh
Local meat bone	Local meat bone production process	Hazaribagh
Color	Use in local meat bone	Hazaribagh

Red mix	Local and foreign meat bone mixture	Hazaribagh
Black mix	Local and foreign meat bone mixture	Hazaribagh

Table 01: Details of sampling

Sample ID	Characteristic	Collection place
Netherland	Foreign meat bone	Gazipur
U S A	Foreign meat bone	Gazipur
Brazil	Foreign meat bone	Gazipur
Belgium	Foreign meat bone	Gazipur
Malaysia	Foreign meat bone	Gazipur
Thailand	Foreign meat bone	Gazipur
German	Foreign meat bone	Gazipur
Yuam	Local processed feed	Gazipur
Kazi	Local processed feed	Gazipur
Muslim	Local processed feed	Gazipur
Aftab	Local processed feed	Gazipur

Table 02: Details of sampling

Sample Preparation and Analysis

The samples were prepared by using concentrated HNO_3 method and HCl (Merck Germany, analytical).According to www.cem.com Mathews NC28016, at first concentrated digestion of vegetable (root and stem to leaf) samples were done by using concentrated HNO_3 and HCl (Merck Germany, Analytical grade). According to the method of www.cem.com,mathews NC28106, At first concentrated HNO_3 (10ml) and then HCl (2ml), were added in 0.5 GM of vegetable in XP 1500 plus vessels and then allow the samples predigest by standing open for a minimum of 15 minutes before sealing vessels and proceeding for the heating program. This digestion was completed at 200^0c and 800 pressures by the setup program (1600 watt, Ram time 15 minutes, Hold time 15 minutes). After

digestion, the solution filtered using Whitman 11 cm filter paper onto 25 ml volumetric flask and topped up to the mark with distilled water. Similarly, the blank sample was prepared. After preparing all of these samples were kept at room temperature until analysis.

Reagent and Chemicals

Concentrated nitric acid (65% Merch, Germany)
Hydrochloric Concentrated acid (37% Merch Germany)

RESULTS AND DISCUSSION

Different stages of meat bone production (chart 01)

1.Chrome saving dust	**6350 mg/kg**
2.Boiling water	**1350mg/kg**
3.Local meat bone	**6150mg/kg**
4.Colour meat bone	**48.4mg/kg**

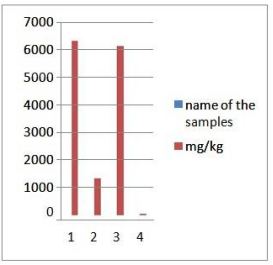

Chart 01 shows that chromium concentration is highest in chrome shaving dust, the raw material of local meat bone. After boiling there is no significant change in chromium concentration. During boiling, some chromium is removed through boiling water. The normal colour of chromium is

bluish. Sometimes red colour is used to make red meat bone. In our study, we found that colour is also contaminated with chromium.

Mixture 0f local & foreign meat bone (Chart 02)

Red	2550 mg/kg
Black	2900 mg/kg
Mean	2725 mg/kg

As shown in Chart 02, the concentrations of chromium were in the range of 2950 mg/kg to 2550 mg/kg. The mean concentration of chromium is 2770 mg/kg. All of the values are much higher than the acceptable label.

Different types of foreign meat bone in local market (Chart 03)

Brazil	BDL mg/kg
Germany	7 mg/kg
Thailand	607 mg/kg
Malaysia	BDL mg/kg
Belzium	BDL mg/kg
Netherland	BDL mg/kg
Luxemburg	BDL mg/kg
Pakistan	825mg /kg

Chart 03 represents that the mean concentration of chromium is 179.87 mg/kg. The highest concentration of chromium in a foreign meat bone is 825 mg/kg and some other meat bones also have chromium value of below detection limit. This table indicates not only our local meat bones are contaminated by

chromium but also some of the foreign meat bones are also contaminated.

Final feed from different industries in Bangaldesh (chart 04)

Kazi feed	BDL mg/kg
Yaum feed	148.5 mg/kg
Aftab feed	1.5 mg/kg
Muslim feed	49.5 mg/kg

In chart 04, the mean concentration of chromium was 49.845 mg/kg. And the highest value of chromium was 148.5 mg/kg in Yaum and lowest concentration of chromium in Kazi was below detection level. This happens because of some poultry feed mill use contaminated meat bone and others do not. Meat bone is only used 8-5 % in poultry feed as a protein concentrate. There is no permissible limit for chromium in poultry feed given by EU [8]. Bangladesh ministry of fisheries and livestock has no standard for the heavy metals concentrations in poultry feed [9]. A little amount of chromium is required as a micronutrient for human and other animals. Trivalent chromium is essential for normal carbohydrate and lipid metabolism [10]. A Large amount of trivalent chromium causes toxic effects but the major reason for concern is chromium compound (hexavalent). Dermatitis, allergic and eczematous skin reactions, Skin and mucous ulcerations, perforation of the nasal septum, allergic aesthetic reaction, bronchial carcinomas, hepatic cellular deficiency, gastro-enteritis and renal oligo-anuric deficiency etc are occurred by chromium [11].

CONCLUSION:

A Higher level of chromium presents not only our local meat but also some foreign meat bones are also contaminated. Chromium can easily enter into our food chain through the chicken. This excess amount of chromium leads to the carcinogenic effect on human body. To maintain the food chain safe from chromium, it is necessary to have a definite standard for chromium for all possible pathways towards our food chain. In the interest of public health proper guideline should be established for local and poultry feed.

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