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Some Heavy Metals In Different Types And Brands Of Poultry Feeds In Lafia Metropolis

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ABSTRACT
The study was aimed to evaluate the concentration of some heavy metals from different feed types and brands of commercially sold feeds procured from different selling points in Lafia metropolis of Nasarawa State, Nigeria. Four feed types comprising starter, grower, finisher and layer of the four (4) different brands of commercially sold feeds (ECWA, Vital, Hybrid and Supreme) were used for this study. 2g of the sample solutions were then analyzed for heavy metals such as cadmium, lead and zinc at required wave length using Sens AA GBCAvanta Version 2.20 Atomic Absorption Spectrophotometer. Sample preparation and heavy metal determination were carried out in the International Institute for Tropical Agriculture (IITA), Ibadan, Oyo State, Nigeria. The mean concentration values were subjected to analysis of variance (ANOVA) and where significant differences occur; the means concentration values were separated using Duncan's Multiple Range Test of the Statistical Package for Social Science (SPSS 22.0). The concentration of cadmium, lead and zinc (ppm) in all the four brands of feed were significant ($P<0.05$) and the results showed that among all the brands analyzed, ECWA brand recorded the highest concentration. The high concentration of zinc in this study could be attributed to the fact that zinc is a much needed essential element for both plants and animals growth. The result of this study would provide information that could aid in the choice of feed for poultry in times of minerals supplementation and inclusion to minimized wastage and contamination.
Keywords: Heavy metals, feed types, brands, poultry, Metropolis

INTRODUCTION

The commercial poultry industry is well-grown and is the largest supplier of animal protein and reliable source of essential amino acids, vitamins and minerals for human utilization in the form of product such as meat and eggs. Its importance is even greater in developing countries where chicken are relatively cheap and can be kept in a small area, usually providing an excellent source of high quality and most palatable animal protein due to its high meat yield, low shrinkage during cooking and low cost (Faten *et al.,* 2014). Certain mineral elements such as iron, manganese, copper and zinc are essential dietary nutrients for poultry and livestock. However, all mineral elements, whether considered to be essential or potential toxic, can have an adverse effect upon humans and animals if added in the diet at excessive high concentrations.

Heavy metals are parts of the major contaminants of food supply and may be regarded the most important problem to our environment (Zaidi *et al.,* 2005). Such problem is getting more serious all over the world, especially in developing countries. Heavy metals, in general are not biodegradable, so they have long biological halflives and have the potential for accumulation in the different body organs resulting to unwanted side effects (Sathawara *et al.,* 2004). Absence or lower levels of zinc in the diet, leads to loss of appetite, decreased immune activities, slow wound healing, and skin sores (Gerberding, 2005). Lead exposure has been associated with elevated blood pressure and hypertension (Martin *et al.,* 2006). Cadmium toxicity has been linked to prostate cancer and cancer in liver, kidney and stomach (Waalkes, 2000). This study was aimed to evaluate the concentration of cadmium, lead and zinc from different types and brands of commercially sold feeds obtained at different selling points in Lafia metropolis of Nasarawa State, Nigeria.

MATERIALS AND METHODS

Study location

Lafia local government area of Nasarawa state, Nigeria falls within the Guinea Savanna agroecological zone and is found between latitudes 7°52 N/8°56 N and longitudes 7°25 E/9°37 E respectively. Lafia enjoys two separate seasonal periods namely raining season (April- September) and dry season between (October-March). Annual rainfall figures range from 1100 to 2000 mm. The mean monthly temperatures in the State range between 20 and 34ºC, with the hottest months being March/April and the coolest months being December/January (Lyam, 2000).

Source of feed/ sampling

Four (4) feed types namely; starter, grower, finisher and layer of the four (4) different brands of commercially sold feeds (ECWA, Vital, Hybrid and Supreme) were procured from different selling points within Lafia metropolis.

Sample preparation

2g of each brand were weighed into different crucibles. 1ml of concentrated nitric acid were added and then pre-ashed by placing the crucible on a heater until the contents charred. The pre-ashed samples were then transferred into a muffle furnace with a temperature of 480^0C for 2-3hrs after which they were allowed to cool. The cooled sample were dissolved using 5ml of 30% HCl and then filtered using filter papers. The filtrates were individually poured into 50ml standard flask and made up to mark with de ionized water. These were then transferred into prewashed sample bottles for analysis of the Heavy metals.

Determination of Heavy Metals

The digested samples were analyzed for the presence of heavy metals viz; cadmium (Cd), lead (Pb) and zinc (Zn) at a required wavelength using Sens AA GBCAvanta Version 2.20 Atomic Absorption Spectrophotometer. Sample preparation and heavy metal determination were carried out in the International Institute for Tropical Agriculture, Ibadan, Oyo State, Nigeria.

Statistical Analysis

The means concentration values obtained from this study were subjected to analysis of variance (ANOVA) and where significant differences occur, the means concentration values were separated using Duncan's Multiple Range Test as adopted by Steel and Torrie (1980) from Statistical Packages for Social Science (SPSS 22.0)

RESULTS

Table 1. Concentration of cadmium (ppm) in all the four brands of feed

Feed type	ECWA Mean ±SD	Vital Mean ±SD	Hybrid Mean ±SD	Supreme Mean ±SD	Sig
Starter	0.008 ± 0.007^a	0.008 ± 0.007^a	0.004 ± 0.00^b	0.006 ± 0.007^b	**
Growers	0.008 ± 0.007^a	0.004 ± 0.000^c	0.007 ± 0.000^a	0.006 ± 0.000^b	**
Finisher	0.009 ± 0.002^a	0.007 ± 0.000^{ab}	0.005 ± 0.000^b	0.004 ± 0.000^b	**
Layer	0.006 ± 0.002^a	0.006 ± 0.000^{ab}	0.007 ± 0.000^b	0.004 ± 0.000^b	**

^{abc}means on the same rows bearing different alphabets are significantly different (P<0.05).

** Significant at 95% confidence interval.

SD- Standard deviation.

Concentration of cadmium (ppm) in all the four brands of feed is presented (table 1). The mean values of the concentration of cadmium obtained were significant (P<0.05) for all the brands of feed analyzed. The mean concentration of cadmium for the starter feed was observed to be higher (P<0.05) for ECWA and Vital brand compared to the hybrid and supreme brands that recorded the least concentration of cadmium.

For grower feed type, ECWA and hybrid recorded higher concentration (P<0.05) of cadmium than their other counterparts. ECWA brand recorded higher cadmium concentration for both finisher and layer feed type although the concentration levels were not different from those of vital brand for finisher and layers' feed respectively.

Table 2. Concentration of lead (ppm) in all the four brands of feed

Feed type	ECWA Mean ±SD	Vital Mean ±SD	Hybrid Mean ±SD	Supreme Mean ±SD	Sig
Starter	0.009 ± 0.000^{b}	0.011 ± 0.001^{a}	0.006 ± 0.000^{c}	0.010 ± 0.000^{a}	**
Growers	0.010 ± 0.000^{a}	0.007 ± 0.000^{c}	0.011 ± 0.001^{a}	0.010 ± 0.001^{b}	**
Finisher	0.011 ± 0.007^{a}	0.005 ± 0.007^{d}	0.008 ± 0.007^{b}	0.006 ± 0.007^{c}	**
Layer	0.007 ± 0.007^{b}	0.009 ± 0.007^{a}	0.009 ± 0.007^{a}	0.006 ± 0.007^{c}	**

^{abcd}means on the same rows bearing different alphabets are significantly different (P<0.05).
** Significant at 95% confidence interval.
SD- Standard deviation.

Concentration of lead (ppm) in all the four brands of feed is presented (table 2). The mean values of the concentration of lead obtained were significant (P<0.05) for all the brands of feed analyzed. The mean concentration of lead for the starter feed was observed to be higher (P<0.05) for Vital and supreme brand compared to the ECWA and hybrid brand that recorded the least concentration of lead. For grower feed type, ECWA and hybrid recorded higher concentration (P<0.05) of lead than their counterparts. ECWA brand recorded higher lead concentration for finisher feed type. The concentration level of layers' feed type for both vital and hybrid brand were higher (P<0.05) compared to those of ECWA and supreme brand.

Table 3. Concentration of Zinc (ppm) in all the four brands of feed

Feed type	ECWA Mean ±SD	Vital Mean ±SD	Hybrid Mean ±SD	Supreme Mean ±SD	Sig
Starter	20.668 ± 0.255^{c}	21.006 ± 0.001c	29.541 ± 0.001^{a}	21.995 ± 0.001^{b}	**
Growers	25.562 ± 0.002^{a}	24.968 ± 0.001^{b}	17.848 ± 0.001^{d}	22.616 ± 0.001^{c}	**
Finisher	18.322 ± 0.008^{a}	17.137 ± 0.009^{b}	15.683 ± 0.005^{d}	16.919 ± 0.008^{c}	**
Layer	23.556 ± 0.004^{a}	22.891 ± 0.014^{b}	17.681 ± 0.007^{d}	18.529 ± 0.006^{c}	**

^{abcd}means on the same rows bearing different alphabets are significantly different (P<0.05).
** Significant at 95% confidence interval.
SD- Standard deviation.

The concentration of Zinc (ppm) in all the four brands of feed is shown (table 3). The mean values of the concentration of zinc obtained were significant (P<0.05) for all the brands of feed analyzed. The mean concentration of zinc for the starter feed was observed to be higher (P<0.05) for hybrid brand compared to the ECWA, vital and supreme brand that recorded the least concentration of lead however, the concentration of zinc for starter feed type for both ECWA and vital brand appears to be similar and different from the supreme brand. The result of the zinc concentration levels for grower, finisher and layer's feed type for ECWA brand recorded higher (P<0.05) concentration than their counterpart.

DISCUSSION

Cadmium cause severe respiratory symptoms, gizzard dysfunction such as; nephrotoxicity, glucosuria, amino acid, urea and decrease the glomerular filtration rate, cadmium may lead to hypertension, hepatic injury and lung damage. Cadmium chloride at teratogenic dose induced significant alterations in the detoxification of enzymes in the liver and the gizzard. Also cadmium causes osteoporosis and osteomalacia known as Itai-Itai disease (Faten *et al.,* 2014). The concentration of the cadmium in the brands used in this study were consistent with the maximum acceptable limit of 1mg/kg cadmium in feed as stipulated by European Commission *(*2003a*)*, none of the sample exceeded. However, the mean concentration values obtained in this present study were lower than 3.8-33.6mg/kg obtained by Mahesar *et al* (2010).

Lead has attendance to bio-accumulation in human tissues and organs mainly in the liver, gizzards and bones leading to several diseases. Absorbed lead in human body has biologic halflife in bone about 27 years (Hanaa *et al.*, 2004). Lead encephalopathy in children is due to lead toxicity characterized by irritability, ataxia, convulsion and altered state of consciousness, whereas lead toxicity in adults lead to neuropathy result in wrist and food drop **(**European Commission, 2001*;* Nishijo *et al.*, 2002).

High concentrations of lead and cadmium have been reported in chickens in Nigeria. Fakayode and Olu–Owolabi (2003), reported that concentrations of 0.59mg/kg lead and 0.07mg/kg cadmium in chicken eggs in Ibadan were higher than the levels reported in other countries e.g lead concentration of 0.048ppm and 0.489ppm obtain in China and India and cadmium concentrations of 0.01ppm obtain in Canada and Finland respectively.

The mean concentration of zinc of this study was within the maximum acceptable concentration level of 500mg/kg for zinc in feed as stipulated by European Commission, (2003a). Nevertheless the concentration level obtained from this present study was comparably lower than 54.3 – 482.2mg/kg obtained by Mahesar *et al* (2010*)* in their analysis of poultry feed.

Lead and cadmium are non-essential elements that are of direct health concern to both poultry and humans (Costa, 2000). These metals are more of contaminants than nutrients, therefore there should be a need in addressing the heavy metals in poultry in order to regulate and enhanced utilization of the feed by the birds. To enhance the safety of food chain and to further reduce the heavy metals contamination therefore, it is necessary for the chicken feed producers to always observe and maintain standards for heavy metals inclusion chicken feeds.

CONCLUSION

Concentration of cadmium, lead and zinc (ppm) in all the four brands of feed were significant and the results showed that among all the brands analyzed, ECWA brand recorded the highest concentration. The high concentration of zinc could be attributed to the fact that zinc is a much needed essential element for both plants and animals growth. The result of this study would provide information that could aid in the choice of feed for poultry in times of minerals supplementation and inclusion to minimized wastage and contamination.

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COMPETING INTEREST

Authors have declared that no competing interests exist regarding the manuscript.

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