The Study of Elements in Poultry Feed

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Summary: Nine essential elements (Cd, Co, Cr, Cu, Fe, Mg, Mn, Ni and Zn) were analyzed by atomic absorption spectrophotometry in the processed guar seed (*Cyamopsis psolaroides* D.C) which was successfully used for egg laying poultry feed. The results indicated that the poultry feed formulations are devoid of toxic metals but they contain sufficient amount of nutritional elements.

Introduction

It is observed that in many areas of health science remarkable progress has been made during the last few decades. The pivotal role of inorganic compounds in disease has definitely shared this explosion of scientific knowledge. Extensive research in recent years has explored inorganic elements as structural and functional groups of metalloproteins and enzymes in cellular processes. Several pathological conditions in experimental animals, including man are implied to be associated with deficiencies of a number of essential trace elements. An adequate supply of iron is essential for vital functions in the body because the oxygen is transported in the blood by heamoglobin. In addition to a sufficient supply of iron, small traces of copper must also be provided in the food to make possible the formation of hemoglobin in the body. The copper does not form part of the heamoglobin, but is necessary to enable the body to produce heamoglobin. The poultry have special needs for manganese. The deficiency of manganese is the chief cause of *perosis* or slipped tendon in chicks in which the legs are deformed. The deficiency also causes a shortening and thickening of the long bones of the legs and wings [1].

According to Hooker, Cr, Mg and Zn have an important role in the metabolism of cholesterol as well as heart diseases [2]. The intake of Mg and Zn lowers the cholesterol level [3]. Where as Cu, Cr, Mn and Zn also play an important role in sugar and cholesterol disorders [4].

Thus, it was of interest to investigate the essential elements in the processed guar seed (*Cyamposis psolaroides* D. C) and various formulations of poultry feed incorporating guar meal

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Table 1. Elemental Analysis of Poultry feeds:

S. #	Contents	PCSIR-I (ppm)	PCSIR-II (ppm)	PCSIR-III (ppm)	Guar Meal (ppm)	Toxic Limit (ppm)
1.	Manganese	8.52	10.46	7.52	9.95	100 [6]
2.	Zinc	25.05	30.06	31.33	33.18	75 [6]
3.	Copper	7.64	9.14	8.65	9.82	10 [6]
4.	Iron	231.70	78.16	68.92	99.53	40 [6]
5.	Chromium	1.5	1.08	1.25	1.06	50-800** [7]
6.	Cobalt	<0.19*	<0.19*	<0.19*	<0.19*	1 [6]
7.	Lead	<0.5*	<0.5*	<0.5*	<0.5*	6-20** [8]
8.	Cadmium	<0.025*	<0.025*	<0.025*	<0.025*	165-180 ** [9]
9.	Nickel	1.5	1.92	2.51	1.86	300-100** [10]

* These are the least detectable limits of these elements for the instrument.
** These value are optimal permissible limit.

which were previously used to accomplish wonderful results for egg laying poultry [5].

Results and Discussion

Poultry farming has a large industrial setup in Pakistan. There are many local made poultry feeds available in market but none of them has a balanced formula and a low cost. This study is started with an aim to produce a cheap and balanced formula of poultry feed that should be devoid of toxic metal, by utilizing industrial waste and by-products. First of all Guar meal has been tested and it showed that it contains all those elements which are essential for the poultry feed.

Table 1 shows the concentration of Mn, Zn, Cu, Fe, Cr and Ni calculated with respect to dry weight of poultry feed formula I, II, III and guar meal respectively. All of the PCSIR formula contained the guar meal and it is observed that iron and zinc are in abundance in all of these samples as well as in guar meal which controls metabolism of cholesterol and ultimately heart diseases as mentioned before. However, experimental results proved that PCSIR formula III is a very powerful combination for egg-laying poultry [5]. The presence of appropriate concentration of iron, chromium and nickel in PCSIR formula III is distinguishing it among others as a recommended poultry feed. The only difference in formula I and formula III is that the concentration of molasses in formula I is lower than that of formula III, while millet is present in formula I and absent in formula III. The high concentration of iron (231.7ppm) in formula I as compared to formula III (68.92ppm) is perhaps due to the presence of millet. Hence it is inferred from results in Table 1 that in poultry feeds appropriate concentrations of the above mentioned elements might play an important role in selection of effective feeds for poultry. Moreover it is devoid of any toxic element (e.g. Cd, Pb, Co).

At present, there are no easily available diagnostic techniques by which one could detect the marginal deficiencies of a number of trace elements. At the same time, the basic biochemical mechanism by which trace element deficiencies and excesses cause diseases are not yet completely elucidated. Alarming health hazards are ringing the bell to start active research on medical elementology.

Experimental

All PCSIR samples contained the guar meal in various proportions (see Table 2)

Preparation of Solution

1-3 gm of dried PCSIR poultry feed samples in duplicate were digested with conc. nitric acid in acid washed pyrex tubes at 120 °C. After digestion clear solutions were obtained and volume were reduced to about 1-2 ml, the solutions were diluted with double distilled water up to certain volume [11]. Appropriate dilutions of sample solutions were made so that the Conc. remained within the linear range of absorbance. Standard solutions against which the trace elements were estimated were also diluted as such. Reading of every element in each solution was taken in duplication.

Table 2. PCSIR Formulae for Poultry Feed.

S. #	Contents	PCSIR-I %age	PCSIR-II %age	PCSIR-III %age
1.	Mustard meal (cake)	10	10	10
2.	Molasses	20	20	25
3.	Guar meal	60	65	60
4.	Millet	05	-	-
5.	$Ca\ Co_3$	02	02	02
6.	$Mg\ Cl_2$	02	02	02
7.	Ca-lactate	0.5	0.5	0.5
8.	NaCl	0.5	0.5	0.5

Estimation of Elements

Hitachi Model Z-8000 Atomic Absorption Spectrophotometer was used for the estimation of elements. Instrument was equipped with zeeman background corrector and data processor. All parameters were set and followed strictly the manufacturers instructions using flame atomization. Standard solutions for atomic absorption spectrophotometer were prepared from stock solution (1000 ppm) of M/s. E. Merck.

Standard deviation has not been determined as the readings for each elements were almost same.

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