DOG HAIRS AS A SENTINEL OF TRACE METALS

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Abstract:

Dogs and humans share the same environment and are exposed to same trace metals therefore dogs can be used as a reliable indicator of metal burden in humans. Animal hairs grow at a constant rate and are easy to obtain. They tend to bio-accumulate the trace metals, the analysis of trace metals content from hair can be used to detect recent exposure to trace metals. Hair sample from seven breeds of dogs were analysed using AAS and Flame Photometer for ten metals. Among the metals studied, concentration of Manganese, Cadmium, Cobalt and Nickel was found to be Zero, only Pomeranian breed has highest concentration of iron and other breeds have higher concentration of sodium.

The area of Nagpur city was not polluted with Cd. The absence of Mn, Co and Ni might be the result of interference by other trace metals in the biological function of these traces metals.

Keywords: Atomic Absorption spectrometry, Flame Photometry, Hair, Dog breeds, Trace metals.

Introduction:

Hair reflects the metal burden in the body (Perumal and Thangamani, 2011). The quantification of trace metals in hair has been used for assessment for long term environmental and occupational exposure to trace metal as well as metabolic status. Since the hair contains about 200-300 times more toxic metals as compare to blood or urine, its hair used to detect recent exposure to toxic metals. Hair is reliable and convenient biological indicator of environmental pollution (Dongarra *et. al.*, 2010 and Souad *et. al.*, 2006). Since collection, transport and storage of hair is easy, convenient and can give an idea about past metabolism, thus it is preferred over other body fluids and organs (Hac *et al*.1997).

However the metabolic state and or exogenous deposition can affect the trace element content. The present work was aimed at determining the trace element content from the hair sample from seven breeds of dog. The metals have played a key role in the civilization of human but unsustainable use of these metals led to ecological imbalance and undue exposure to potentially hazardous metals. International agencies and researches are using hair as a biological indicator in bio-monitoring (Sela *et. al.*, 2007).

The trace metals, deficient or excess, are associated with health complications. The estimation of trace metals from biological sample can be used to assist the long term risk to general public. The Global Environmental Monitoring System has chosen the hair as a biopsy material to estimate the metal body (Vehter, 1982). The anthropogenic activities like electric power plants transportation, agriculture adds to the metal burden of an ecosystem. Since dogs live in close proximity with humans they are exposed to same pollutants like that of man and hence can be used as a parallel indicator of environmental load as on humans (Kozak *et.al.*, 2002).

Material and methods:

The hair sample was collected from seven breeds of dog viz. Pomeranian, cross Pomeranian, Golden Retriever, Rottweiler, Labrador, German Shepard and Saint Bernard which are most commonly reared in Nagpur city (M.S. India). The sample was stored in labelled polythene bag.

Sample Washing:

Sample was first pre wash with deionised water by soaking it for 10 min. then sample was washed with deionised water for three times then once with acetone and again for one time wash with deionised water. The sample was then dried in hot air oven at 110°C.

Digestion Procedure:

The samples were digested using the procedure of (Perumal and Thangamani, 2011) Each of dried hair sample was first weighed about 0.25g and individual hair sample was taken in about 50ml beaker for digestion by adding 6:1 mixture of conc.HNO_3 and Perchloric acid and kept overnight at room temperature. The contents in a beaker washed on a hot plate at 60°-80°C to obtained white crystalline residues. It was then diluted with 0.1Nconc.$HNO_3$and made up to 100ml. The blank was prepared the same way but without hair sample.

Analytical Procedure:

As the analytical procedure mentioned here we analysed quantity of some heavy metals in various breeds of dog hair by using Atomic Absorption Spectrometer and Flame Photometer for Sodium and Potassium.The sample was analysed for Copper, Iron, Manganese, Zinc, Cobalt, Chromium, Cadmium and Nickel.

Results and discussion:

Hair is a reliable and convenient indicator of environmental pollution. The concentration of the trace element might be the result of environmental exposure or intake from food and drinking water. The presence of smoke at house and living close to heavy traffic can affect the element concentration in hair. The toxicity of trace metals depends on the physiology of an animal exposed to it and the physico-chemical parameters of trace metals. The sensitivity of animals to a particular toxicant depends on the factors like gender, age, growth period and location.

Hayashi and Tsukamoto (1987) studied the distribution of lead in suburban dogs. Kucera (1988) demonstrated dogs as an indicator of urban lead distribution. Domestic animals can be used as sentinel for exposure of people to the tracemetals. Diagnosis of high trace metals content can be used to indicate the need for testing of people for trace element concentration. Since the animals hair grows at a relative constant rate and obtaining hair samples is easy and its can used to determine the accepted quantity of metal (Mankovska, 1990). The use of dog hairs as bio-indicators of metal burden and potential risk assessment was recommended. The applicability of the results of study to human and urgent needs to improve the environment was discussed.

The lack of Co and Mn from hair samples from all the dog breeds might be due to negative interaction between the other metals and Co and Mn (Mehra *et al*. 2010). This demonstrated that the trace metals interfere with the biological function of other trace metals leading to deficiency of one or other element (Mehra and Juneja, 2003). The absence of Cd denoted lack of exposure to Cd.

Table No.-1: Trace metal concentration in hair sample of various breeds of dog listed in table below:

Sr. No.	Parameters (ppm)	Pomeranian	cross-Pomeranian	Golden Retriever	Rottweiler	Labrador	German Shepard	Saint Barnard
1	Copper	14.4	18.8	27.2	22.4	18	23.2	0.8
2	Iron	1155.2	215.6	179.2	441.2	439.6	768.8	253.6
3	Manganese	0	0	0	0	0	0	0
4	Zinc	144.8	196	203.2	170.8	141.2	211.6	141.6
5	Cobalt	0	0	0	0	0	0	0
6	Chromium	53.2	29.2	38	40.8	47.2	70.4	46
7	Cadmium	0	0	0	0	0	0	0
8	Sodium	464	824	1100	1076	1036	856	476
9	Potassium	244	696	724	220	632	176	56
10	Nickel	0	0	0	0	0	0	0

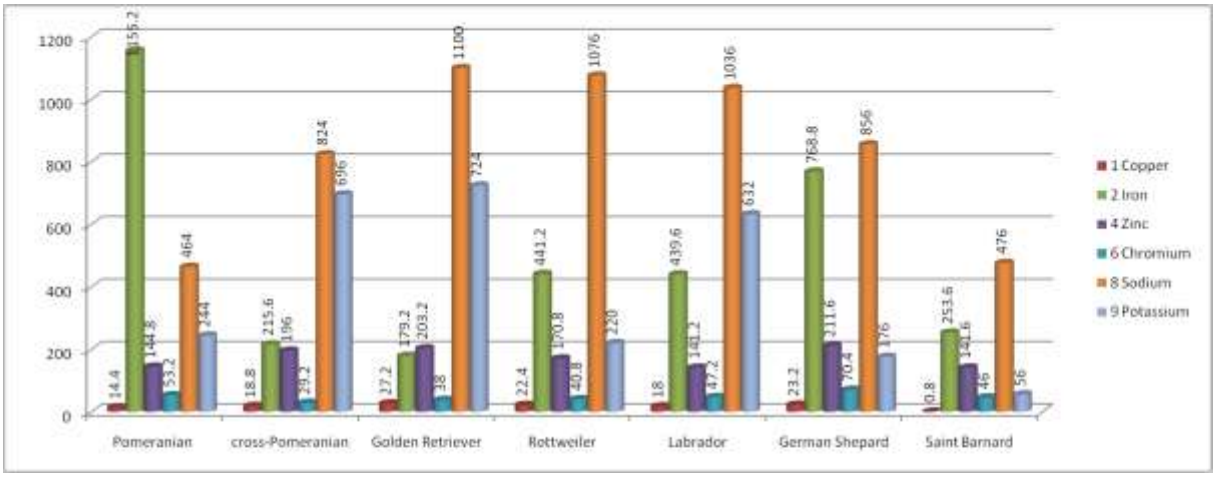

Figure-1: Graph showing the concentration of trace metals in hairs of seven breeds of dogs.

The mean value of ten trace metals were analysed in hair sample from seven breeds of dog. The mean value of tree trace metals viz. manganese (Mn), cobalt (Co), Cadmium (Cd) and Nickel (Ni) were found to be zero in all sample.

The mean concentration of copper (Cu) was highest in Golden Retriever (27.2 ppm) and lowest in Saint Bernard (0.8 ppm).

Iron was highest in Pomeranian (11155.2 ppm) and lowest in Golden Retriever (179.2 ppm). Chromium load was recorded at 70.4ppm in German Shepard and lowest in Cross-Pomeranian.

Concentration of both Sodium and Potassium (1100 ppm and 124 ppm) was highest in Golden Retriever. Low concentration of sodium was recorded from hair sample of Pomeranian (46.41 ppm), while Saint Bernard had low concentration of Potassium (56.00 ppm).

Conclusion:

From the result obtained after the analysis, it can be concluded that metals like cadmium, Manganese, Nickel and Cobalt do not accumulate in hair of various breeds of dogs. The anthropogenic activates may contributes to pollution and sharing of same environmental by human and non-human may be used to assist in concurrent exposure to toxicants.

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