

Macro and Micro Mineral Contents in Plasma of Different Age Group Dogs

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Abstract

Minerals play very important role in physiology and metabolism of all living organisms. Plasma macro and micro minerals profile of 226 dogs reported to Referral Veterinary Polyclinic (RVP), IVRI, Izatnagar, belonging to different age and being provided with vegetarian homemade diet by their owners was assessed for estimation of macro (Ca, P, Mg, Na, K) and microminerals (Cu, Fe, Zn, Se and Co), and their status analysis. Selected dogs were further subdivided into six (0-1 yr, 1-2 yr, 2-3 yr, 3-4 yr, 4-5 yr and >5 yr) different age groups. Present study revealed deficiency of plasma macro (Ca, P and Mg) and micro minerals (Cu, Fe, Zn, Se) in the surveyed dogs.

Keywords: Macro minerals; Micro minerals; Dogs; Age; Plasma

Introduction

The importance of minerals in regulating biological systems, growth, production and reproduction is well documented [1-3]. Calcium (Ca) and phosphorus (P) are the major macro minerals involved in the formation of bone and cartilage in the body. Other important macro minerals include magnesium (Mg), potassium (K), sodium (Na) and chloride (Cl) which are needed for nerve impulse transmission, muscle contraction, and cell signaling. Trace element status influences growth and reproduction (Zinc (Zn), Selenium (Se)), immune functions (Zn, Se, Iron (Fe)), cognitive functions (Zn, Se), bone density (Copper (Cu), Zn), and oxidative stress (Zn, Se, Cu, Fe) [4,5]. Deficiencies in pets are uncommon in western developed countries as a result of widespread feeding of complete and balanced pet foods that meet the nutrient profiles specified by the expert's scientific panel. But, the scenario in India is quite different, where homemade diets constitute the mainstay of feeding with majority pet owners feeding the dogs according to their own convenience and perceptions [6]. However, more precise information is still required about nearly every essential nutrient for companion animals, bioavailability of nutrients and

their interactions. Keeping in view the above facts, present clinical research work was undertaken to estimate plasma macro (Ca, P, Mg, Na, K) and micro minerals (Cu, Fe, Zn, Se, Co), and status analysis in dogs.

Materials and Methods

Plasma profile of macro and micro minerals of 226 dogs reported to Referral Veterinary Polyclinic (RVP), IVRI, Izatnagar, belonging to different age group and being provided with vegetarian homemade diet by their owners was assessed for estimation of macro (Ca, P, Mg, Na and K) and micro minerals (Cu, Fe, Zn, Se and Co), and status analysis. Selected dogs were further subdivided into six (0-1 yr, 1-2 yr, 2-3 yr, 3-4 yr, 4-5 yr and >5 yr) different age groups. Plasma samples were digested for mineral estimation (Table 1) [7]. Ca, P, Na and K was estimated spectrophotometrically using commercial kits obtained from Span diagnostic, Surat as per manufacturer instructions. Cu, Fe, Zn, Co, Se and Mg were estimated using atomic absorption spectrophotometer (ECIL AAS 4141). Data collected was analyzed as per the method described by Snedecor and Cochran [8].

Parameter	Age group						Reference value
	0-1 yr	1-2 yr	2-3 yr	3-4 yr	4-5 yr	>5 yr	
Ca (mg/dl)	8.74±0.41	8.44±0.34	8.07±0.44	7.80±0.62	7.64±0.29	7.46±0.22	8.7-11.8
P (mg/dl)	3.52±0.29 ^b	3.34±0.21 ^{ab}	3.47±0.32 ^{ab}	3.38±0.22 ^{ab}	3.45±0.24 ^b	2.35±0.22 ^a	2.9-6.2
Mg (mg/dl)	1.45±0.08	1.37±0.06	1.46±0.13	1.32±0.08	1.47±0.10	1.24±0.09	1.7-2.7
Na (mEq/L)	138.00±2.45	141.73±3.78	142.22±1.74	143.32±1.49	144.09±2.16	144.66±1.22	140-154
K (mEq/L)	4.07±0.12	4.05±0.29	4.20±0.20	4.26±0.13	4.48±0.12	4.49±0.13	3.8-5.6
Cu (µg/dl)	0.48±0.03	0.54±0.02	0.55±0.03	0.59±0.02	0.57±0.02	0.53±0.05	
Fe (µg/dl)	0.82±0.05	0.84±0.09	0.99±0.08	0.89±0.04	1.06±0.05	0.94±0.05	
Zn (µg/dl)	0.47±0.03	0.52±0.02	0.56±0.02	0.52±0.02	0.55±0.06	0.50±0.04	
Se (µg/dl)	0.11±0.008 ^{ab}	0.13±0.004 ^{bc}	0.14±0.005 ^{bc}	0.15±0.006 ^c	0.14±0.003 ^{bc}	0.12±0.007 ^a	
Co (µg/dl)	0.025±0.0008	0.024±0.0009	0.026±0.001	0.026±0.0008	0.023±0.001	0.022±0.001	

Table 1: Plasma macro and micro minerals profile (mean±SE) of Dogs of different age group.

Values with different superscript differ significantly ($P<0.05$) between the group.

Values with identical superscript do not differ significantly ($P<0.05$) between the group.

Results and Discussion

The mean concentration of Ca and Mg was non-significantly different and towards lower range in dogs of different age groups. Tilkian et al. [9] opined that Ca is a highly regulated blood mineral and any marked change in serum concentration of this ion indicates possible metabolic and endocrine dysfunction. Concentration of Ca towards higher range (8.74±0.41) was recorded from 0-1 yr and towards lower range (7.46±0.22) from > 5 yr age group dogs in the present study. Our findings were in agreement with Hedhammar [10] who stated that because of rapid bone growth, concentrations of Ca are often elevated slightly in young growing dogs and with Kaspar and Norris [11] who stated that because of retardation of bone growth, concentrations of Ca are often lowered in geriatric dogs.

Concentration of Mg is low which might be due to low fiber, less bone meal and no supplementation of non-veg in the home made food of dog. The principal role of Mg ion is Ca channel blocking agent and to regulate heart and skeletal muscle function. Mg deficiency is also pro-inflammatory and is associated with increases in oxidative stress *in vivo* and cardiac susceptibility to ischemia/reperfusion (I/R) injury [12].

Concentration of P in growing age groups was found to be in lower range but significantly ($p<0.05$) higher as compared to older dogs which is in agreement with the findings of Kaspar and Norris [11] who opined that concentration of P is known to be high in young dogs due to normal bone growth and because of retardation of bone growth, concentrations of P are often lowered in geriatric dogs. Similarly, other researchers [13-15] have also reported higher total Ca and P levels in dogs >6 months of age. In this age, the action of growth hormone

(GH) and osteosynthesis are at their highest level with the formation of ossification nucleus, longitudinal growth and bone maturation reflecting high physiological levels of these serum biochemical markers [16].

Plasma Na, K, and Co concentration were non-significantly ($p>0.05$) different in dogs of different age groups and were in normal range. Normal plasma Na and K concentrations are maintained by balanced intake and excretion, intracellular and extracellular osmotic pressure, and pH [17,18] stated that Co deficiency per se has never been clearly demonstrated in monogastric species. In non-ruminants, Co and Fe appear to share a common intestinal transport system and Co absorption is greatly increased in Fe deficiency [19].

The mean concentration of Cu, Fe and Zn was not significantly ($p>0.05$) different and towards lower range in dogs of different age groups. Most meat ingredients, especially organ meats are rich in Cu and Zn. Deficiency of Cu is marked by microcytic, hypochromic anemia and often, by a reddish tinge to the hair in a white-haired animal. Dogs may also experience a higher demand for Zn under circumstances of stress, during growth periods, levels of high activity, gestation, lactation or illness [20]. In adult pets, signs of Zn deficiency are confined mainly to the skin, but these may be accompanied by impaired growth and other abnormalities in young animals.

Concentration of Fe was lowest (0.82±0.05) in dogs from 0-1 yr age group. The lower serum Fe observed in animals under 6 months can be explained by their small food intake and the animal's high demand in response to rapid growth [21]. Furthermore, studies have shown the availability of Fe to be relatively high from liver,

muscle and animal by-products [22]. Young puppies are especially vulnerable because of the low Fe content of milk.

In the present study, the mean concentration of plasma Se was significantly ($p < 0.05$) lower in > 5 yr (0.11 ± 0.008) and 0-1 yr (0.12 ± 0.007) age group of dogs. In animals, most of the studies focused on Se status in cattle and pigs. Limited number of deficiency studies reported in dogs. The lower concentration might be due to the provision of only vegetarian diet to the dogs as fish, meat and poultry products are typical sources of this nutrient.

On the basis of the findings of the present study it can be concluded that analysis of blood should be done periodically in dogs for monitoring mineral status for preventing diseases.

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