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Prevalence of subclinical iodine deficiency in the ruminants of Punjab

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Abstract

The present study was conducted in nine districts of Punjab divided into three zones based on the geographical locations viz., Sub Mountainous Districts (Zone-I), Central Districts (Zone-II), and Southwestern Districts (Zone-III). A total of 225 blood samples of crossbred cows and buffaloes were collected from Zone-I, II and III and 103 blood samples of sheep and goats were collected from Zone-II and III. Plasma inorganic iodine (PII) levels were determined by the method of Aumont and Tressol (1987). Overall, 89.3 percent of cows and 95.2 percent of buffaloes of Zone-I; 89.5 percent cows and 83.1 percent buffaloes of Zone-II; 52.0 percent cows and 73.91 percent buffaloes of Zone-III were found to have deficient levels of plasma inorganic iodine with mean PII levels well below the critical level of 104.9 ng/ml. Similarly, 95.0 percent sheep and 98.2 percent goats of Zone-II; 86.7 percent sheep and 85.7 percent goats of Zone-III were found to have deficient levels of plasma inorganic iodine with mean PII levels well below the critical level of 100 ng/ml (Bobek, 1998). In conclusion, there is widespread prevalence of subclinical iodine deficiency in ruminants of Punjab with majority of the animals having marginal plasma inorganic iodine levels.

Keywords: Ruminants, iodine deficiency, plasma.

Despite a worldwide application of successful iodine supplementation programs over the last few decades, iodine deficiency remains one of the most prevalent deficiency disorders in humans and farm animals causing huge economic losses (McDowell, 2003). Iodine is an essential micronutrient present in the body in trace amounts, almost exclusively in the thyroid gland. It is an essential component of the thyroid hormones, which effects body's metabolism by virtue of control of cellular energy exchange, basal metabolic rate, tissue growth, reproduction and lactation. It is alarming to note that 30% (Khazan *et al.,* 2013) of the world's population lives in areas with iodine deficient soil. Extensive 'goitrous' areas were eventually discovered on every continent, often associated with an environmental deficiency of iodine, and these can still cause problems in livestock (Singh *et al.,* 2005). In India also, the entire population is prone to iodine deficiency disorders (IDD) as the subcontinent soil is iodine deficient.

Punjab is one of the major contributors to the animal husbandry in the national economy. A significant number of animals of the state suffer from micro-mineral imbalances (Singh, 2002; Chhabra, 2006). Low iodine status of the soils of Punjab state had earlier been recorded by Jain (1990). Extensive work has been done in humans pertaining to this subject however, a systematic study of iodine status in ruminants is still lacking and is required to determine the status of the deficiency in them.

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Materials and Methods

The survey was conducted in 9 districts of Punjab viz. Hoshiarpur, Ropar, Amritsar, Nawanshahar, Ludhiana, Patiala, Moga, Muktsar and Bathinda**.** These districts were divided into three zones based on the geographical location in the following manner:

Sub Mountainous Zone (ZONE - I)	:	Hoshiarpur and Ropar.
Central Districts (ZONE - II)	:	Amritsar, Nawanshahar, Ludhiana, Patiala and Moga
Southwestern Districts (ZONE - III)	:	Muktsar and Bathinda.

Animals were selected randomly without keeping into consideration any mineral deficiency symptoms. A total of 225 blood samples were collected from crossbred cows and buffaloes included in the study. In case of sheep and goats total 103 blood samples were collected (Table 1).

Plasma collection

From every selected animal, whole blood was

Table 1. Zonal distribution of animals sampled for survey

Zones	Number of animals sampled			
	Cows	Buffaloes	Sheep	Goats
Zone - I	28	21	__	__
Zone - II	57	71	20	54
Zone - III	25	23	15	14

collected in heparinised acid washed mineral free glass vials. Plasma was separated by centrifugation and stored at -10^{0}C for analysis of PII.

Laboratory Analysis

Plasma inorganic iodine (PII): Since PII is very sensitive to iodine intake in ruminants (Rogers, 1992); it was employed to assess iodine status. The concentration was measured by a chromatographic and colorimetric technique (Aumont and Tressol, 1987). On the basis of their PII values, the animals were classified as normal (>105 ng/ml), marginal (51 to 104 ng/ml) and low (<51 ng/ml) (Rogers, 1992).

Results and Discussion

The epidemiological surveillance in different zones of Punjab was done with primary objective to determine the iodine status of ruminants of different zones with different soil types.

Cows and buffaloes

Zone I: Survey was conducted in Hoshiarpur and Ropar districts of Zone I.

In the present study, mean plasma inorganic iodine levels of cows and buffalo were 57.95±3.81 ng/ml and 49.95±3.88 ng/ml which were lower than the critical values of 104.9 ng/ml suggested by Rogers (1992). Overall, 89.30 per cent cows and 95.24 per cent of buffaloes were found to have deficient levels of PII (Table 2). On the basis of Rogers (1992) guidelines for the classifications of iodine status based on PII, 50.00 per cent of cows and 57.14 per cent of the buffaloes were having marginal PII levels (51-104.9 ng/ml), whereas 39.30 per cent cows and 38.1 per cent buffaloes were having low levels of iodine in their plasma (<51ng/ml) (Table 2).

Zone II: Survey was conducted in Amritsar, Nawanshahar, Ludhiana, Patiala and Moga districts of Zone II.

Overall mean plasma inorganic iodine levels of cows and buffalo were 58.60±3.48 ng/ml and 66.67±3.39 ng/ml, respectively which were lower than the critical value of 104.9 ng/ml suggested by Rogers (1992) Table 5. In the present study overall prevalence of iodine deficiency among cows was 89.5 per cent and in buffaloes was 83.1 per cent. PII levels of 38.6 per cent cows were within the moderately deficient range of 51-104.9 ng/ml and 50.9 per cent cows were having low (<51ng/ml) low levels of PII. Overall, 42.3 per cent buffaloes were having moderately deficient PII level and 40.8 per cent was having low PII levels. (Table 2).

Zone III: Survey was conducted in Muktsar and Bathinda districts of zone III.

Overall mean PII levels in cows and buffaloes of zone III were 81.05±7.74 and 79.12±7.15 ng/ml, respectively and were lower (P≤0.01) than the

Table 2. Prevalence (%) of iodine deficiency on the basis of PII levels in cows and buffaloes of Zone - I, II and III

Geographical Zones	Animal Species	Normal PII (>104.9 ng/ml)	Marginal PII (51-104.9 ng/ml)	Low PII (<51 ng/ml)	Overall deficiency (<104.9 ng/ml)
Zone - I	Cows (n=28)	10.70 (3)	50.00 (14)	39.30 (11)	89.30 (25)
	Buffaloes (n=21)	4.8 (1)	57.14 (12)	38.1 (8)	95.24 (20)
Zone - II	Cows (n=57)	10.5 (6)	38.6 (22)	50.9 (29)	89.5 (51)
	Buffaloes (n=71)	16.9 (12)	42.3 (33)	40.8 (26)	83.1 (59)
Zone - III	Cows (n=25)	48.0 (12)	32.0 (8)	20.00 (5)	52.00 (13)
	Buffaloes (n=23)	26.08 (6)	65.22 (15)	8.7 (2)	73.91 (17)

Figures in parenthesis indicate number of animals.

Table 3. Prevalence (%) of iodine deficiency on the basis of PII levels in sheep and goats of Zone - II and III

Geographical Zones	Animal Species	Normal PII (≥100 ng/ml)	Low PII (<100 ng/ml)
Zone - II	Sheep (n=20)	5.0 (1)	95.0 (19)
	Goats (n=54)	5.56 (3)	94.44 (51)
Zone - III	Sheep (n=15)	13.33 (2)	86.67 (13)
	Goats (n=14)	21.43 (3)	78.57 (11)

Figures in parenthesis indicate number of animals.

critical value of 104.9 ng/ml suggested by Rogers (1992). The overall prevalence of iodine deficiency among cows and buffaloes of Zone III was 52.00 and 73.91 per cent, respectively (Table 2). Thirty two and 65.22 per cent of cows and buffaloes, respectively had moderate PII levels (51-104.9 ng/ml) whereas 20.0 per cent and 8.7 per cent cows and buffaloes, respectively were having low PII (≤51 ng/ml) levels Table 2.

Sheep and goats

The mean PII concentration in sheep and goats were 58.82±6.61 ng/ml and 53.19±2.53 ng/ml, respectively in Zone II which were lower than critical level of 100 ng/ml (Bobek, 1998). Overall, 95.0 per cent sheep and 94.44 per cent goats were found to have deficient PII levels (Table 3).

The mean PII levels in sheep and goats of Zone III were 68.26±5.88 and 62.23±4.34 ng/ml which were lower than critical value of 100 ng/ml (Bobek, 1998). Overall, 86.76 per cent sheep and 78.57 per cent goats were having deficient PII levels (Table 3).

The most common cause of iodine deficiency is the failure to provide iodine in the diet. There is a complex relationship between soil, plants and animals due to specific characteristics of the plants and interaction between different minerals. Low iodine status of the soils of Punjab state had earlier been recorded by Jain (1990). A sufficient iodine intake is essential for normal function of the thyroid gland. Thyroid hormones play an important role in metabolic processes and basal functions. Hypofunction of thyroid gland due to low iodine intake is usually accompanied with health disorders collectively called as iodine deficiency disorders (IDD). Earlier, Chhabra (2006) had recorded 73.5 per cent and 93.4 per cent prevalence of iodine deficiency in cows; 88.70 per cent and 84.6 percent prevalence of iodine deficiency in buffaloes of Amritsar, Ludhiana and Patiala districts during summer and winter seasons, respectively. Kaur (2002) also observed high prevalence (72.22%) of iodine deficiency in cows of Ludhiana and Sangrur districts.

While there is no comparable data available on PII status of sheep and goats of Punjab, however, indirect evidence to the occurrence of iodine deficiency in other states was provided by the presence of goitre in 10 per cent goats in Bareilly district, hilly and sub mountain area of Uttar Pradesh, India (Ray *et al.,* 1959). Raina and Pachauri (1984) observed 0.16 to 5.66 per cent goitre prevalence in goats in Nainital and Rampur districts of Uttar Pradesh (Uttarakhand). Presence of goitrous lesions of thyroids of goats obtained from Bareilly abattoir (Ramakrishna and Prasad, 1991) were associated with low soil iodine content in those areas.

From the above findings it can be concluded that, there is widespread prevalence of iodine deficiency in the ruminants of Punjab with 44% of the large ruminants having marginal levels and 34% having lower levels of plasma inorganic iodine with overall 78% having levels below normal recommended level of iodine and in small ruminants, 91% animals are having plasma inorganic iodine levels below normal recommended levels, showing the need of supplementation of iodine to the deficient animals.

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