



Iodine status of crossbred cattle from Shiwalik and middle mountains of north-west Himalayas

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ABSTRACT

Base-line survey was conducted in the Jammu division of Jammu and Kashmir state involving 6 districts under different agro-climatic zones to know the iodine status of crossbred (*taurus×indicus*) cattle. Plasma blood samples (252) were collected from crossbred cattle of different age groups from 60 villages. Plasma inorganic iodine (PII) along with thyroid hormones estimation was done. Average value of PII, triiodothyronine (T₃) and thyroxine (T₄) in cattle were 0.63±0.11 nmol/l and 58.10±4.21 nmol/l, respectively. Sub-clinical iodine deficiency was observed in 91.66% animals as 44.44% crossbred cattle were marginally deficient having plasma inorganic iodine (PII) levels 50–104.90 ng/l and 47.22% animals were having low levels (<50 ng/ml) of PII thus indicating dietary deficiency of iodine. Triiodothyronine and thyroxine levels were poorly related to iodine status thus indicated that thyroid hormones are not the true index of sub-clinical deficiency.

Key words: Crossbred cattle, India, Iodine deficiency, Thyroxine, Tri-iodothyronine

Iodine is important among essential trace elements required for the synthesis of thyroid hormones thyroxine and triiodothyronine. According to the Ministry of Health (GoI), out of 239 districts in 25 states and Union Territories which have been surveyed, 197 districts have iodine deficiency. Moreover, the area under study falls within the endemic belt of iodine deficiency, which extends all along the southern slopes of Himalayas from Kashmir in the north-west to Naga Hills in the east including the foothills. Livestock population might be sharing this deficiency as they thrive on the feed and fodders grown in local area. Present study was undertaken to know the iodine status of crossbred cattle from Jammu division.

MATERIALS AND METHODS

Base-line survey was conducted in 60 villages representing Low Altitude Sub-tropical zone including Jammu district and lower part of Kathua, Udhampur and Rajouri districts (located at the height between 300 m to nearly 800 m above sea level), Mid to high altitude Intermediate zone including the districts of Doda, Poonch, part of Rajouri, Udhampur and Kathua districts (located at the height between 800 M to 1500 M in mid altitude and up

to about 4000 m in high altitudes above sea level). A total of 252 blood samples from cattle involving 193 households were collected to have a due representation of animal population. Dairy animals sampled were categorised into 3 age groups, viz. group 1 (<3 years), group 2 (3 to 6 years) and group 3 (>6 years).

Sample collection: Blood samples from selected animals were collected in mineral free glass vials (dipped overnight in 2N HCl) and were centrifuged to separate plasma immediately after collection. Plasma samples were stored at –10°C in deep freeze for subsequent analysis.

Analysis: Plasma inorganic iodine (PII) was determined by a chromatographic and colorimetric technique (Aumont and Tressol 1987). On the basis of PII values the animals were classified as normal (>105 ng/ml), marginal (51 to 104 ng/ml) and low (<51 ng/ml) as reported by Rogers (1992). Triiodothyronine (T₃) and thyroxine (T₄) were assayed by radioimmunoassay (Khurana and Madan 1986) using kits from Bhaba Atomic Research Centre Navi Mumbai. Radioactivity of the precipitate was measured as counts per minute using a gamma counter. Statistical comparison of data was done as per Snedecor and Cochran (1989).

RESULTS AND DISCUSSION

The overall mean value of PII in crossbred cattle was 61.21±2.76 ng/ml (Table 1) which was lower than the critical level of 104.9 ng/ml (Rogers 1992), indicating that dietary

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Table 1. Plasma inorganic iodine (ng/ml) status of crossbred cattle (mean±SE)

	Jammu	Kathua	Udhampur	Rajouri	Doda	Poonch	Total
Group 1	51.49 ^a ±5.11 (n=20)	46.60 ^b ±1.51 (n=3)	28.8 ^{abc} ±1.79 (n=7)	74.14 ^c ±14.21 (n=12)	79.95 ^{bc} ±12.12 (n=13)	44.37±8.0 (n=5)	58.7 ^{bc} ±4.70 (n=60)
Group 2	50.71 ^a ±4.54 (n=41)	44.80 ^b ±3.10 (n=12)	30.49 ^{abc} ±1.01 (n=14)	57.89 ^{bcd} ±3.37 (n=12)	89.67 ^{abcd} ±12.31 (n=24)	83.83±30.82 (n=6)	58.65 ^c ±4.03 (n=109)
Group 3	48.73 ^a ±5.72 (n=19)	41.3 ^b ±2.02 (n=9)	31.53 ^{abc} ±1.48 (n=11)	82.19 ^{abcd} ±0.22 (n=7)	94.3 ^{abc} ±11.73 (n=31)	61.16 ^{bcd} ±8.0 (n=5)	66.38 ^{bcd} ±5.56 (n=83)
Total	50.43 ^a ±2.93 (n=80)	43.71 ^b ±1.74 (n=24)	30.47 ^{abc} ±0.69 (n=32)	69.66 ^{abcd} ±0.16 (n=31)	89.92 ^{abcde} ±7.20 (n=68)	64.22 ^c ±11.34 (n=17)	61.21 ^{bcd} ±2.76 (n=252)

•Figures in parenthesis indicate the number of animals; •means marked with similar superscript a, b, c, d differ significantly (P<0.05) in a row.

Table 2. Percentage prevalence of PII deficiency in cattle

	Jammu	Kathua	Udhampur	Rajouri	Doda	Poonch	Total
Group 1	95.00 (M: 35.0; L: 60.0)	100 (L)	100 (L)	91.66 (M: 75.0; L: 16.66)	84.61 (M: 69.23; L: 15.38)	100 (M: 80.0; L: 20.0)	93.33 (M: 48.33; L: 45.00)
Group 2	92.68 (M: 45.83; L: 50.00)	100 (L)	100 (L)	100 (M: 66.66; L: 33.33)	83.33 (M: 79.16; L: 4.16)	66.66 (M: 16.66; L: 50.0)	91.74 (M: 43.11; L: 48.62)
Group 3	100 (M: 41.17; L: 55.88)	100 (L)	100 (L)	85.71 (M: 85.71; L: Nil)	77.41 (M: 58.06; L: 19.35)	100 (M: 66.66; L: 33.33)	90.36 (M: 43.37; L: 46.98)
Total	95.00 (M: 37.50; L: 55.55)	100 (L)	100 (L)	93.54 (M: 74.19; L: 19.35)	80.88 (M: 67.64; L: 13.23)	88.23 (M: 52.94; L: 35.29)	91.66 (M: 44.44; L: 47.22)

PII (Marginal 50–104.90 ng/ml; Low: <50 ng/ml).

intake of iodine in the crossbred cattle of area was less. Earlier survey carried to know the PII status in rural crossbred cattle herds from sub-mountainous districts of adjoining state of Punjab reported overall average value of 92.78 ng/ml in crossbred cattle (Singh *et al.* 2006). Age wise, no significant (P<0.05) variation in the levels of PII between different groups was observed. District-wise the level of PII in crossbred cattle of Udhampur (30.47±0.69 ng/ml) and Kathua (43.71±1.74 ng/ml) was lowest followed by Jammu (50.43±2.93 ng/ml), Poonch (64.22±11.34 ng/ml), Rajouri (69.66±0.16 ng/ml) and Doda (89.92±7.20 ng/ml) (Table 1). Differences observed in the level of inorganic iodine between different districts could be due to differences in dietary composition or type of fodder (Crush and Caradus 1995), soil level (Parker and McCutcheon 1989) and intestinal parasitism (Pritchard *et al.* 1974).

Overall prevalence of deficiency in crossbred cattle was 91.66% as shown in Table 2 with highest prevalence of 93.33% in group 1 animals followed by groups 2 (91.74%) and 3 (90.36%). Randhawa and Randhawa (2001) and Kaur (2002) reported prevalence of sub-clinical iodine deficiency in 35.4 and 72.22% of crossbred cattle from central districts

of Punjab, whereas Singh *et al.* (2006) reported iodine deficiency in 48.78% crossbred cattle from sub-mountainous region of Punjab. Districtwise, the highest prevalence of deficiency was in Kathua and Udhampur, where 100% animals were deficient in iodine followed by Jammu (95.0%), Rajouri (93.54%), Poonch (88.23%) and Doda (80.88%) as shown in Table 2.

While comparing the health status of the sampled animals with their iodine status, it was observed that 45.77% of PII deficient animals were having normal physical appearance. Non-specific clinical signs like emaciation/ poor body condition (54.23%), anoestrus (47.47%), repeat breeding (7.60%), abortions/ still births (1.90%), earlier history of retention of placenta (3.16%). However, these symptoms were also observed in animals with normal iodine status therefore, were not of much relevance as cardinal clinical signs of iodine deficiency like perinatal weakness, still births, hairlessness, neonatal goiter were not observed in animals.

Mean value of T₃ in crossbred cattle was 0.63±0.11 nmol/l (Table 3) identical to the value of 0.58 nmol/l (range 0.27–1.16 nmol/l) reported by Rehman and Roychoudhary (1996). Khurana and Madan (1986) quoted normal mean range during

Table 3. Thyroid hormone status of crossbred cattle (mean±SE)

Hormone	Age-wise			Total
	< 3 years	3–6 years	>6 years	
T ₃ (nmol/l)	0.77±0.10	0.67±0.08	0.52±0.06	0.63±0.11
T ₄ (nmol/l)	62.31±3.75	60.29±3.41	53.47±2.99	58.10±4.21

different seasons as 0.29 to 1.73 nmol/l. Significantly, higher values of 1.27 nmol/l, 2.03 nmol/l and 1.67 nmol/l were reported by Randhawa and Randhawa (2001), Rajkumar and Srivastava (2008) and Chhabra *et al.* (2008), respectively. The mean value of T₄ was 58.10 nmol/l which falls within normal range of 54–110.7 nmol/l quoted by Kaneko *et al.* (1999) (average mean 82.4 nmol/l). Rehman and Roychoudhary (1996), Randhawa and Randhawa (2001), Rajkumar and Srivastava (2008) and Chhabra *et al.* (2008) reported average value of 36.67 nmol/l, 45.5 nmol/l, 43.41 nmol/l and 36.52 nmol/l respectively.

While comparing the thyroid hormones (T₃ and T₄) status of cattle in different age groups having normal I status with deficient animals of corresponding age groups, nonsignificant ($P < 0.05$) differences were observed. Based on finding, it was concluded that thyroid hormones are not the true index of sub-clinical I deficiency. Nonsignificant decline in the T₃ level and T₄ levels with advancing age was observed (Table 3). Numerous other factors than PII like ambient temperature, gastro-intestinal parasitism, feed intake, adrenocortical activity have been observed to influence the hormone status (Andrewartha *et al.* 1980, Hennessy and Prichard 1981).

Thus, the specific clinical signs of iodine deficiency were not apparent in crossbred cattle and their thyroid hormone activities were within the normal reference range, in spite of low PII values. Occurrence of non-clinical/asymptomatic form of iodine deficiency in cattle has also been reported by Rogers (1992) and Randhawa and Randhawa (2001). Based on the findings, it was concluded that sub-clinical deficiency of PII is prevalent among the dairy cattle of Jammu division however further studies are warranted especially by conducting dose response trials.

REFERENCES

- Andrewartha K A, Caple I W, Davies W D and Mc Donald J W. 1980. Observations on serum thyroxine concentrations in lambs and ewes to assess iodine nutrition. *Australian Journal of Veterinary Science* **56**: 18–21.
- Aumont G and Tressol J C. 1987. Rapid method for the direct determination of inorganic iodine in plasma using ion-exchange chromatography and the Sandell and Kolthoff reaction. *Analyst* **112**: 875–77.
- Chhabra S, Randhawa S S, Dhaliwal P S and Jindal R. 2008. Management of iodine deficient dairy animals. *Indian Journal of Animal Sciences* **78** (9): 959–60.
- Crush J R and Caradus J R. 1995. Cyanogenesis potential and iodine concentration in white clover (*Trifolium repens* L.) cultivars. *New Zealand Journal of Agriculture Research* **38**: 309–16.
- Hennessy D R and Prichard R K. 1981. Functioning of the thyroid gland in sheep infected with *Trichostrongylus colubriformis*. *Research in Veterinary Science* **30**: 87–91.
- Kaur K. 2002. 'Studies on iodine deficiency and its therapy in dairy animals.' M.V.Sc Thesis, Punjab Agricultural University, Ludhiana, India.
- Khurana M L and Madan M L. 1986. Seasonal influence of thyroidal response to thyrotropin releasing hormone in cattle and buffaloes. *Journal of Endocrinology* **108**: 57–61.
- Parker W J and McCutcheon S N. 1989. Effects of iodine supplementation on the productivity of romney ewes in the Wairarapa region of NewZeland. *NewZeland Journal of Agriculture Research* **32**: 207–12.
- Pritchard R K, Hennessy D R and Griffiths D A. 1974. Endocrine responses of sheep to infection with *Trichostrongylus colubriformis*. *Research in Veterinary Science* **17**: 182–87.
- Rajkumar R and Srivastava S K. 2008. Serum thyroid hormones and macrominerals in cyclic and acyclic crossbred cows. *Indian Veterinary Journal* **85**: 445–46.
- Randhawa C S and Randhawa S S. 2001. Epidemiology and diagnosis of subclinical iodine deficiency in crossbred cattle of Punjab. *Australian Veterinary Journal* **79**: 349–51.
- Rogers P A M. 1992. Iodine deficiency in cattle. *Irish Veterinary News* pp.14–17 September issue.
- Singh R, Randhawa S S and Randhawa C S. 2006. Iodine status of crossbred cattle from sub mountainous areas of Punjab. *Indian Veterinary Journal* **83** (2): 181.
- Snedecor G W and Cochran W G. 1989. *Statistical Methods*. 8th edn. Iowa State University Press, London.