THE EFFECT OF DIFFERENT LEVELS OF IODIDE FEEDING ON SERUM INORGANIC AND PROTEIN-BOUND IODINE, WITH A NOTE ON THE FREQUENCY OF ADMINISTRATION REQUIRED TO MAINTAIN A HIGH LEVEL OF SERUM INORGANIC IODINE

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This study was designed to determine the effects of normal dietary intake of supplemental iodine (KI) on the serum inorganic iodine and the protein-bound iodine levels of cattle. The application of the results to the frequency of iodine treatment in actinomycosis and other mycotic infections is made. Two mature cows were selected for the experiment. Editor.

Previous experiments (3) showed that the feeding of thyroprotein at the rate of 15 or 25 g. per day resulted in high levels of serum inorganic iodine. The protein-bound iodine (PBI) levels in the serum also were much higher than would be expected in the absence of any clinical evidence of hyperthyroid activity. These high PBI levels were assumed to be partly due to the formation of noncalorigenic PBI resulting from the combination of inorganic iodine in thyroprotein with certain serum protein constituents (3) and also to the presence of noncalorigenic iodinated compounds other than thyroxine in the thyroprotein, which have been demonstrated by Friedberg and Reineke (2).

The study reported here was designed to determine the effects of normal dietary intake of supplemental iodine and the feeding of increasing amounts of KI above normal supplemental levels on the serum inorganic iodine and PBI levels of cattle. In this way the effects of dietary inorganic iodine on PBI, uncomplicated by oral intake of protein-bound iodine, could be determined.

Since, in iodine therapy for actinomycosis and other mycotic infections in cattle there is a wide variation in the recommended frequency of dosing, it was of special interest in this experiment to observe the length of time that high blood iodine levels were maintained after discontinuance of iodine feeding. Milks (5) recommended 15-30 g. of sodium iodide in 500 cc. distilled water intravenously, repeating every 4-5 days until iodism is produced. Merchant (4) recommended 30 g. of sodium iodide in 500 cc. distilled water administered intravenously at 18-day intervals.

The results will be discussed in relation to their possible application to the frequency of iodine treatment in actinomycosis and other mycotic infections.

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132
EXPERIMENTAL PROCEDURE

Two mature Jersey cows weighing 900-1,000 lb. were selected for the experiment. Iodized salt was withdrawn from the ration of each for a period of several weeks so as to insure basal serum iodine levels. During the first week of the experimental period 11 mg. of potassium iodide were added to the ration of each animal. This quantity was calculated to be the approximate amount of supplemental iodide fed daily in 12 lb. of grain containing 1% iodized salt (0.02% KI). This quantity was fed daily for 1 week. The quantity of KI fed daily was doubled each week for three successive weeks. Beginning with the fifth week the quantity was increased by 50% each week for the remaining 10 weeks, so that during the last week 2.816 g. of KI were being fed daily. During the entire KI feeding period blood samples were taken in the morning prior to feeding KI, or about 24 hours after the previous feeding. This was done to avoid the transient rise in serum iodine expected if the blood sampling was done shortly after the oral administration. Blood analyses for inorganic iodine and protein-bound iodine were made at the end of each weekly period by the method of Connor et al. (1). When the higher levels of iodine were fed, extra washing of the precipitated protein was employed to minimize contamination of the PBI fraction by inorganic iodine. After 14 weeks of iodine feeding, all supplemental iodine was withdrawn from the ration of both cows. Blood samples were drawn daily for a time, followed by weekly sampling, in order to follow closely the pattern of decline of both inorganic iodine and PBI as they returned to normal levels.

RESULTS AND DISCUSSION

Relation of the amount of supplemental KI fed to the serum inorganic iodine level. The supplementary feeding of KI at levels of 11 mg. and 22 mg. per day

![Figure 1](image-url)  
**Fig. 1.** The effect of increasing oral doses of KI on the blood serum level of PBI and inorganic iodine.
resulted in no effect on the serum inorganic iodine level (Figure 1). It is reasonable to assume that there may be a mechanism of homeostasis in operation which tends to keep the serum iodine level constant at these levels of iodine intake. When the KI feeding level was increased to 44 mg. or more per day, the quantity of inorganic iodine in the serum rose approximately in direct proportion to the quantity fed (Figure 1). This change occurred in both cows. When the level of 2.816 g. of KI per day was reached, additional KI failed to increase the inorganic iodine in the serum proportionately as much as would be predicted from results of previous lower dosages.

After the termination of the KI feeding, blood samples were drawn at 24-hour intervals for the first 3 days and again at the end of each week for 56 days (Figure 1). The serum inorganic iodine level fell precipitously. At the end of 24 hours after the last regular feeding period the serum inorganic iodine level dropped to about 85% of the highest levels; at 48 hours to 69%; at 96 hours to 46%; at 1 week to 16%; and at 2 weeks to 0.8%, which was the control level.

Thus, it appears that where iodism is being induced to treat actinomycosis and other mycotic infections, oral KI feeding should be administered no less often than at 2-day intervals in order to maintain a high level of blood inorganic iodine. Dosage intervals greater than 2 days accordingly would not be indicated where it is desired to maintain the serum at a continuously high level.

Relation of the amount of supplemental KI fed to the serum protein-bound iodine level. With the feeding of potassium iodide at levels as high as 22 mg. per day there was no effect on the serum protein-bound iodine (PBI) level. This observation was considered to be significant since it showed that the PBI test was not affected by the supplemental iodine intake likely to be encountered under usual conditions of feeding. With levels of 44 mg. or above of KI per day, the quantity of PBI in the serum rose roughly in proportion to the amount fed, up to 792 mg. per day. After this quantity was exceeded, the PBI level remained high but varied considerably.

It is thus reasonable to assume that with supplemental levels of iodine equivalent to 44 mg. and above of KI per day nonealorogenic iodine-containing compounds were formed which interfered with the use of the PBI test as a measure of thyroid status.

The results of this experiment show that as long as the inorganic iodine level is within normal limits, iodine intake can be assumed to be within limits that will not interfere with the PBI test of thyroid activity. The policy of using the inorganic iodine level as a guide in determining whether or not a blood sample is iodinated (in case of incomplete history) is thus well founded.

No evidence of toxicity from iodism or hyperthyroidism was noted at any of the levels of iodine feeding.

Unpublished results of in vitro experiments indicate that cellulose digestion by rumen organisms was not impaired by the presence of an amount of iodine occasioned by feeding as much as 2.8 g. of KI per day.
SUMMARY AND CONCLUSIONS

An experiment was conducted in which increasing amounts of potassium iodide were fed to two adult Jersey cows over a 14-week period. The first amount fed was 11 mg. (8.4 mg. I₂) per day, an amount approximately equal to half the recommended daily allowance of supplemental iodine in iodized salt. This level was maintained for a week and then increased at weekly intervals until finally 2.816 g. KI (2.15 g. I₂) per day were being fed. Blood samples were drawn for serum inorganic iodine and protein-bound iodine analysis at the end of each feeding level and at frequent intervals after the termination of KI feeding.

Levels of supplemental iodine intake as high as 22 mg. of KI per day had no influence on the serum inorganic iodine level. This suggested that a mechanism of homeostasis was in operation which served to keep this level constant. At 44 mg. of KI per day, the serum inorganic iodine level began to rise and continued to rise in direct proportion to the quantity fed, up to 2.816 g. per day. From a practical standpoint, the serum inorganic iodine up to the level of 500% can be effected by merely adjusting the amount of iodine fed daily within these limits of KI intake. After the termination of KI feeding, the serum inorganic iodine level fell 50% during the first 3 days and to the basal level by the end of 2 weeks.

In order to maintain a constantly high therapeutic level in the systemic treatment of mycotic infections, no more than 2 days should elapse between treatments. This would serve to keep the serum inorganic iodine level between 75 and 100% of the highest experimental level.

It was found that a supplemental KI intake as high as 22 mg. per day had no effect on the PBI level. This quantity is about twice that likely to be consumed in the recommended daily supplemental feeding of iodine in iodized salt. The PBI test therefore would not be affected by the usual level of supplementary iodine intake.

No evidence of toxicity from iodism or hyperthyroidism was noted at any of the levels of iodine feeding.

REFERENCES