

**Effect of KI upon Basal Metabolism and Respiratory Quotient in
Thyroidectomized Guinea Pigs.***

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Loeb,¹ Gray and Rabinovitch,² McCordock,³ and others have found that the administration of potassium iodide causes a marked stimulation of the thyroid gland in guinea pigs, as shown by a great increase in the number of mitotic figures, a slight softening of the colloid and an increase in the height of the acinar epithelial cells. Cordonnier⁴ and the author⁵ found that the basal metabolism was only very slightly affected after administration of KI in guinea pigs. In the latter experiments, the majority of the determinations as well as the average for all the animals was at the upper limit of the variations obtained in normal animals. Loeb¹ suggested the following possibilities to explain this discrepancy which exists between the marked degree of stimulation of the thyroid gland and the very slight effect upon basal metabolism after administration of KI. (1) Although KI stimulates the thyroid gland at certain periods of its action at the same time it prevents an excess of thyroxin thus produced from leaving the acini, and instead it is at least partly retained in the gland. (2) The stimulation of the acini does not necessarily lead to an excess production of thyroxin. (3) Peripheral effects counteract the stimulating effect of the thyroid hormone upon the basal metabolism.

The following experiments were carried out to investigate the peripheral action of KI. Twelve male guinea pigs, weighing between 400 and 450 gm., were as completely thyroidectomized as was possible, and 3 weeks after the operation, 8 were given 0.05 gm. of KI by mouth daily and biweekly metabolism tests were made. The remaining 4 guinea pigs served as controls. These were similarly thyroidectomized but were not given KI. At the

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¹ Loeb, Leo, *Am. J. Path.*, 1926, **2**, 19.

² Gray, S. H., and Rabinovitch, J., *PROC. SOC. EXP. BIOL. AND MED.*, 1929, **26**, 468.

³ McCordock, Howard A., *PROC. SOC. EXP. BIOL. AND MED.*, 1928, **26**, 109.

⁴ Cordonnier, J., *PROC. SOC. EXP. BIOL. AND MED.*, 1929, **26**, 636.

⁵ Siebert, Walter J., and Smith, Robt. S., *PROC. SOC. EXP. BIOL. AND MED.*, 1930, **27**, 629.

operation, a careful effort was made to remove all of the thyroid gland tissue and to leave behind sufficient parathyroid tissue to prevent tetany from occurring. It was found, however, when autopsies were performed and preparations made of suspicious tissue for microscopic confirmation that in the majority of animals small remnants of thyroid tissue could be found. It is very probable that these remnants of thyroid gland tissue become sufficiently large to be seen only after compensatory hypertrophy has occurred. The control animals and the KI fed animals were tested at the same time under similar conditions. The Haldane open circuit respiratory calorimeter was used to make the tests, made after a 24-hour fasting period. Amytal (Lilly) in small doses was injected subcutaneously just prior to the trial periods to keep the animals quiet while determinations were being made. Two hour test periods were used in each case. The basal metabolism values of the 4 control animals ranged from 2.0 to 3.14 calories per kilo per hour; while the KI fed animals showed variations between 1.91 and 3.42 calories per kilo per hour before the administration of KI began. Thus the values for the basal metabolism in these guinea pigs after complete or almost complete thyroidectomy ranged between 0 and 45% below the average for normal guinea pigs. Within a few days following the daily administration of 0.05 gm. KI by mouth all 8 guinea pigs began to show basal metabolism values distinctly lower than those obtained in the animals which were thyroidectomized but to which no KI was administered. This lowering of the basal metabolic rate continued throughout the entire period of the experiments, from 14 to 30 days. The values obtained in the KI fed animals ranged between 1.52 and 3.30 calories per kilo per hour; and in all except a very few determinations the rates were distinctly lower in each individual experiment in this group than in those obtained at the same time in the control animals. This alteration in the basal metabolic rate ranged from 2% above to 55% below the average of those which were thyroidectomized but to which no KI was administered. The total average of the 36 determinations for the control group was 2.87 calories per kilo per hour, which is 18% below the average which we obtained in normal guinea pigs; while the total average for the 50 determinations of those which had received KI was 2.38, 32% below that of normal animals. Thus the average basal metabolism was approximately 14% lower in the 8 thyroidectomized guinea pigs which had received KI than the average of the 4 thyroidectomized guinea pigs to which no KI was administered.

The respiratory quotients of the thyroidectomized guinea pigs

which had received KI were distinctly higher in the large majority of cases as compared with those which did not receive KI. The respiratory quotients varied between 0.706 and 0.819 in the control group, whereas in the KI fed group they ranged between 0.727 and 1.04. The total average of all the respiratory quotients in the controls was 0.747, as compared with 0.859 in the KI fed group. In only 12 out of 50 determinations were the respiratory quotients within the range of the control, while in the remaining 38 tests, the KI fed guinea pigs had respiratory quotients distinctly higher than those of the control experiments. There was no correlation between the lowering of the basal metabolic rate and the rise in the respiratory quotient in individual cases.

Conclusions. The administration of KI to completely or almost completely thyroidectomized guinea pigs causes (1) a lowering of the basal metabolic rate and (2) a rise in the respiratory quotient. The peripheral effect of KI in causing a depression in basal metabolism is at least partly responsible for the fact that KI causes only a very slight effect upon the basal metabolism although the thyroid gland shows evidence of a marked degree of stimulation.