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4435

Effect of Potassium Iodide and Desiccated Thyroid Substance on Metabolic Rate of Guinea Pigs.

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A study was made of the changes in the basal metabolism of guinea pigs under the influence of the administration of potassium iodide, thyroid substance, and of a combination of potassium iodide and thyroid. All determinations were made with an apparatus devised by Foster and Sundstroem,[1] and the results are expressed as calories/kilo guinea pig/hr.

Our purpose was to correlate the metabolic changes, or their absence, with previous microscopic studies made in our laboratory on the thyroid gland of guinea pigs under the influence of iodine, and of the other substances mentioned.

Loeb[2] has found that oral administration of thyroid substance to guinea pigs in which a considerable part of the thyroid gland had been removed, prevents compensatory hypertrophy from taking place, depressed activities in the gland, and mitotic activity is diminished. On the other hand, administration of KI does not prevent hypertrophy, it favors the solution of the colloid, and the hypertrophy is, on the whole, apparently greater in the gland of those animals which have received this drug. In a similar way, Gray and Loeb[3] found KI to increase very markedly the proliferation of the gland and also slightly to increase the size of the epithelium and to soften somewhat the colloid.

In view of these structural changes, it was of interest to determine whether there was a corresponding alteration in the basal

[1] Foster, G. L., and Sundstroem, E. S., *J. Biol. Chem.*, 1927, lxix, 565.

[2] Loeb, Leo, *J. Med. Res.*, 1920, xli, 481.

[3] Gray, S. H., and Loeb, Leo, *Am. J. Path.*, 1928, iv, 257.

metabolic rate. It should be expected that alteration of so pronounced a character in a gland which largely controls the metabolic rate of the organism would affect that rate.

Thirty-six guinea pigs, weighing between 350 and 500 gm., were used. During the experiment which in the majority of cases extended over a period of thirty days, repeated metabolic studies on each animal were made and a careful record of changes in weight was kept.

Kunde,[4] Snell, Ford and Rowntree,[5] and Liebesney[6] have studied metabolic changes following KI administration, both in human cases and in animals. All conclude that in normal individuals the change may be quite variable, and that it is never very great. Marine, Deutch, and Cipra,[7] experimenting with 18 normal rabbits, found a drop in metabolic rate in 5, a slight increase in rate in 2, and no appreciable change in the remaining 11. Webster and Chesney[8] found a decrease in metabolic rate after the first dose of Lugol's which attained a maximum on the third day, after which there was a tendency to return to a normal level.

In 10 animals, over a 30 day period, we found that oral administration of KI had no appreciable effect on the basal metabolic rate, but that there may be some individual variation both above and below the normal averages. The weights of the animals remained comparatively unchanged.

As was to be expected, there was a definitely increased metabolic rate, with an accompanying loss of weight, in the 11 animals which received thyroid substance alone. The maximum metabolic level was practically attained during the first 10 days and there was only a slight increase in metabolism between the tenth and twentieth day. These changes are clearly demonstrated in the averages shown on the accompanying table.

In addition to the guinea pigs which received KI alone, this substance was also administered to animals which had previously received thyroid substance over a 20 day period. A similar number of animals were given no KI when the thyroid feeding was discontinued and were used for controls. The aim of this experiment was

[4] Kunde, M. M., *Am. J. Physiol.*, 1927, lxxxii, 195.

[5] Snell, A. M., Ford, F., and Rowntree, L. G., *J. Am. Med. Assn.*, 1920, lxxv, 515.

[6] Liebesny, P., *Wien. klin. Wchnschr.*, 1924, xxxvii, 521.

[7] Marine, D., Deutsch, M., and Cipra, A., PROC. SOC. EXP. BIOL. AND MED., 1927, xxiv, 657.

[8] Webster, B., and Chesney, A. M., *Bull. Johns Hopkins Hospital*, 1928, xliii, 291.

TABLE.

	Begin		1-10 days		10-20 days		20-30 days	
	Weight	B.M.R	Weight	B.M.R.	Weight	B.M.R.	Weight	B.M.R.
Controls	383	4.11	370	4.45	374	4.35	377	4.14
Administration of KI	358	4.58	349	4.77	369	4.47	419	4.32
Administration of desiccated thyroid	402	4.24	350	6.03	346	6.26		
Administration of KI and thyroid	397	4.05	341	5.82	344	6.04	377	5.99

Animals to which KI was not given after the thyroid feeding was discontinued.				Animals to which KI was given after thyroid feeding was discontinued.			
Days	1	3	5	Days	1	3	5
Average B.M.R.	5.86	5.24	4.33	Average B.M.R.	5.76	4.90	4.26
Average decrease		.62	1.53	Average decrease		.86	1.50

* All B.M.R. results are expressed as Cal./kilo guinea pig/hr.

to determine whether KI influences the return of the metabolism to the normal level after cessation of thyroid feeding. In one case, the KI seemed to hasten the return to a normal level, but generally, we found that it exerted no influence on the return to a normal metabolic rate previously raised by the feeding of thyroid substance. All animals had attained a normal level in 5 days.

In a series of 9 animals, to which thyroid substance and KI were fed in combination during the same period, we found that KI has no effect on the rise in basal metabolic rate in experimentally induced hyperthyroidism. The rate in these animals was approximately the same as that of those animals to whom thyroid alone was fed.

Determinations were also made on a series of 5 controls. Here the results were constant and there was very little variation from the normal average in individual cases.

From our results, we may conclude that KI, notwithstanding its stimulating effect on the gland substance, does not lead to an increased output of thyroxin, for when KI is given either alone, or in combination with thyroid substance, it produces no noticeable alteration in the metabolic rate. Administration of thyroid substance, as is well known, increases the metabolic rate, especially during the first 10 days of administration of the substance due to a direct action, and not through its action on the thyroid gland.

To explain the results, we may, as Loeb[9] points out in a recent paper, consider the following possibilities: (1) 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

[9] Loeb, Leo, read before the Association for the study of Goiter, Dayton, Ohio, March 25, 1929. To be published later.

acini; 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.

Of these assumptions, the first seems to be the most probable. However, further experimental studies must be made before we can accept this interpretation as definite.

4436

Effect of Irradiated Ergosterol on Mammalian Thrombocyte Counts.*

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The suggestion for this work was found in the observations of F. D. Gunn,[1] who found that by exposing young rabbits to radiations from the mercury vapor lamp, a distinct increase in the number of thrombocytes was obtained in one week. Brougher[2] had demonstrated that large doses of cod liver oil administered to dogs with an experimental obstructive jaundice caused a return to normal of the coagulation time, which had been prolonged. Moise and Sooy[3] showed a rise in the thrombocyte count in thrombocytopenic purpura in human beings following irradiation with ultra violet rays over a period of 3 weeks.

The question arose in our minds as to whether or not irradiated ergosterol would produce a similar rise in thrombocytes. We did not concern ourselves with the coagulation time at the beginning of these experiments.

We chose rats, since Laurens and Sooy[4] had described a simple method for thrombocyte counts in these animals and charted what they found to be the normal counts. Five rats, male and female, of unknown age, were selected at random, and the erythrocytes and

* We wish to acknowledge our indebtedness to the Department of Medicine and particularly to Dr. Thompson, whose timely advice and assistance has been invaluable.

[1] Gunn, F. D., PROC. SOC. EXP. BIOL. AND MED., 1926, xxiv, 120.

[2] Brougher, J. C., *Science*, 1928, lxviii, 256.

[3] Sooy, J. W., and Moise, T. S., *J. Am. Med. Assn.*, 1926, lxxxvii, 94.

[4] Sooy, J. W., and Laurens, H., PROC. SOC. EXP. BIOL. AND MED., 1924, xxii, 116.