glandular mucosa of calcium-infused rats. Hypercalcemia appeared to alter the function of both parietal and chief cells of rat stomach under the conditions of this experiment.

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Essential Fatty Acids, Plasma Protein Bound Iodine, and the Thyroid Gland* (32891)

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One of the earliest signs of an essential fatty acid (EFA) deficiency in the rat is an increased basal metabolic rate (1,2). Although the weight of the thyroid gland in rats is significantly decreased by an EFA-deficiency (3,4,5), histological studies suggest the activity of the thyroid gland is not grossly abnormal and could not account for the large increase in oxygen consumption. The purpose of this investigation was to determine the effects upon the plasma protein bound iodine (PBI) and size of the thyroid gland when the essential fatty acids were restored in the diet of rats which had been fed an EFA-free diet.

Materials and Methods. The basal semi-purified diet containing 3% of hydrogenated coconut oil (6) was fed *ad libitum* to 36 female weanling rats (40–50 gm) of the Wistar strain for 12 weeks. In addition, a positive control group was fed the basal diet containing soybean oil in place of hydrogenated coconut oil. The 36 rats were placed in individual cages and divided into four groups which received the following diets *ad libitum* for 3 weeks: basal; positive control diet; stock colony diet; and basal plus 0.1% thiouracil (Table I). After this period, the rats were weighed and anesthetized. Blood samples were then obtained by heart puncture and the thyroid glands were removed, blotted, and weighed on a torsion balance. Plasma PBI was determined by the procedure described by Highley *et al.* (7).

Results. The body weight and the weight of the thyroid gland of EFA-deficient female rats were less than those of positive controls, and the plasma PBI concentration was higher (Table I). Body weights and plasma PBI concentrations were reestablished at the levels of the positive control group by refeeding soybean oil or the colony stock diet for 3 weeks. The weight of the thyroid gland was increased by feeding the colony diet or soybean oil, however, only the colony diet returned the weight of the gland to normal within 3 weeks.

Feeding thiouracil for 3 weeks did not af-

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TABLE I. Thyroid Responses of EFA-Deficient Female Rats to Dietary Unsaturated Fat and Thiouracil. (5–9 rats/group; mean values ± SE)

Dietary treatment		Relative mean body wt.	Weight of thyroid		Plasma PBI (μg/100 ml)
First 15 weeks	Subsequent 3 weeks		(mg)	(mg/100 gm)	
Basal + soybean oil	Basal + soybean oil	100	13.36 ± 1.07	6.93 ± 0.55	4.41 ± 0.24
Basal	Basal	76	7.80 ± 0.59[a]	4.64 ± 0.09[a]	7.90 ± 1.45[b]
Basal	Basal + soybean oil	96	10.66 ± 0.38[b]	5.06 ± 0.24	4.17 ± 0.38[b]
Basal	Colony diet	100	11.60 ± 0.69	5.23 ± 0.28	4.51 ± 0.21[b]
Basal	Basal + thiouracil	76	22.58 ± 1.86[a]	13.03 ± 0.89[a]	2.39 ± 0.51[a]

[a] The t value is significant at 1% between basal and control or basal treatments.
[b] The t value is significant at 5% between control or basal and treatments.

fect the body weight, but did increase the absolute weight of the thyroid gland, and did decrease the plasma PBI concentration (Table I).

Discussion. An EFA-free diet caused a decrease in the weight of the thyroid gland and an increase in the PBI concentration. Morris *et al.* (5) reported that the thyrotropic hormone (TSH) activity in the pituitary gland was not affected on a fat-free diet, and histologically the activity of the thyroid gland is not grossly abnormal (3), therefore TSH is probably not increased during an EFA-free diet. Similarly, since thiouracil decreased the PBI concentration and increased the weight of the thyroid gland, the synthesis or secretion of TSH is probably not affected by an EFA-deficiency. The increase in the PBI concentration could explain the increased metabolic rate observed previously in rats fed an EFA-free diet Kennely and Maynard (8) reported that fat-free diets containing thyroid powder increased oxygen consumption, and this was alleviated by adding 30% cottonseed oil. Our studies have shown that elevated PBI concentration caused by an EFA-free diet could be returned to normal by feeding the essential fatty acids. The EFA deficiency did not affect the incorporation of ^{131}I into protein by the thyroid gland although the conversion ratio of ^{131}PBI in thyroid/total sera ^{131}I was greater in rats fed fat-free diets (5). This suggests that fat-deficient rats may have a greater capacity to accumulate ^{131}I and convert it to thyroxine. An EFA-free diet increases the PBI concentration in an unknown manner, presumably due to hypersecretion of the thyroid gland, and this may account for the increased metabolic rate observed during an EFA deficiency.

Summary. Plasma protein bound iodine (PBI) of female rats fed an essential fatty acid (EFA) deficient diet for 15 weeks was higher than that of controls receiving dietary EFA, even though weight of the thyroid gland was less in deficient rats. After refeeding EFA to the deficient rats either as soybean oil or the colony stock diet for 3 weeks, the PBI concentration was decreased to the control values and the weights of the thyroid gland increased. Thiouracil added to the EFA-deficient diet lowered the PBI concentration in plasma and increased the weight of the thyroid gland. These data suggest that the increase in plasma PBI in EFA-deficiency is not dependent on TSH but the control mechanism that regulates the secretion of thyroidal iodine is dependent on essential fatty acids

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