

# Euthyroid Range Reevaluation for Radioactive Iodine Uptake Test

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*A new radioactive iodine uptake euthyroid range with  $^{131}\text{I}$  was obtained at our institution. The thyroid status of 150 patients seen at this institution for RAIU tests was determined utilizing thyroid hormone levels. A mean and standard deviation (s.d.) of the RAIU was calculated on the 57 patients with normal hormone levels. Two s.d.s. about the mean yielded a range of 3.0–37.4%. We established a new normal range of 10–35% with the previous normal range being 10–30%.*

The 24-hr radioactive iodine uptake (RAIU) has been widely used to assess the status of the thyroid gland because it provides a good separation between low, normal, and elevated function. It is, therefore, necessary for each laboratory to periodically reevaluate its normal RAIU range to maintain the accuracy of this test.

One of the first to reevaluate the normal values for thyroid uptake of radioiodine was Pittman, et al. (1). They determined that their mean 24-hr RAIU had fallen from  $28.6 \pm 6.5\%$  in 1959 to  $15.4 \pm 6.8\%$  in 1967–1968. It was concluded that the decrease in the value was caused by the larger intake of dietary iodine in the later study.

In 1969, Bernard, et al. (2) used  $\text{T}_3$  uptake,  $\text{T}_4$ , and protein binding index (PBI) values and determined the new 24-hr RAIU range to be 6–24%. The previous 24-hr normal RAIU range at their laboratory was 15–40% (2).

A study performed in Minnesota in 1975 (3) showed that the normal range for RAIU in the thyroid had shifted twice in the past 20 yr. In 1957, the mean RAIU uptake value in the Minneapolis area was  $25 \pm 8\%$ . In 51 normal subjects used in 1971, the mean value was determined to be  $11.5 \pm 4.4\%$ , and in 1975 it increased to  $20.5 \pm 6.1\%$ . The dietary intake of iodine, especially in bread, seemed to be the major factor causing the change in uptake ranges. The increase in values in 1975 was caused by a proven decrease or elimination of iodine in local commercial white bread.

An unpublished reevaluation of normal RAIU range was performed at the University of Nebraska Medical Center in Omaha, Nebraska in 1979 (4). Patients were classified as having normal functioning thyroid glands if their serum  $\text{T}_3$  and  $\text{T}_4$  values were normal. The new 24-hr RAIU range at that institution was calculated to be 5–30%.

Laboratories should be aware of the need to reevaluate nor-

mal RAIU ranges and that these ranges may vary because of differences in the dietary intake of iodine.

## MATERIALS AND METHODS

One hundred and fifty consecutive thyroid uptake patients seen over a 1-yr period (August 1983–July 1984) were utilized for this study. Thyroid hormone values ( $\text{T}_3$  uptake,  $\text{T}_3$ ,  $\text{T}_4$ ,  $\text{T}_7$ , and TSH) performed within 6 wk before the RAIU were obtained on the patients from either the patient's medical chart in the hospital's medical records department or from records from the referring physician. In addition, all hormone values were accompanied by the individual laboratory's normal ranges for each hormone level. These hormone values and the patient's overall clinical status were used to determine the functional status of their thyroid gland. Patients with normal hormone levels were considered to be euthyroid and their 24-hr RAIU values were used in the calculation of the normal RAIU range. Patients on thyroid replacement therapy, patients who had recent examinations using radiographic dyes containing iodine, and patients on medications that interfere with RAIU tests were disregarded from the study.

After careful evaluation of individual patients, each patient was placed in one of five categories: euthyroid, hypothyroid, hyperthyroid, disregarded, and no obtainable thyroid hormone values. The mean and standard deviation (s.d.) were calculated on the RAIU values of patients categorized as euthyroid. Two s.d.s about the mean were used to determine the new euthyroid RAIU range because 95% of the euthyroid population should fall within this range.

## RESULTS

Evaluation of the thyroid hormone levels found 57 of the 150 subjects selected for this study to be euthyroid, 31 subjects were hyperthyroid, and four subjects were hypothyroid. Seven subjects were disregarded from the study because of inconsistencies in hormone levels, such as an elevated  $\text{T}_4$  and a low  $\text{T}_3$  uptake with no clinical indications for such values. Twenty-six subjects were eliminated from the study because of medications, such as synthroid, that could interfere with normal uptake of radioiodine in the thyroid gland. One subject was disregarded from the study because of a radiological examination using contrast media that was performed 4 wk prior to the RAIU. Thyroid hormone levels on 24 of the subjects were not obtained because of lack of referring physician

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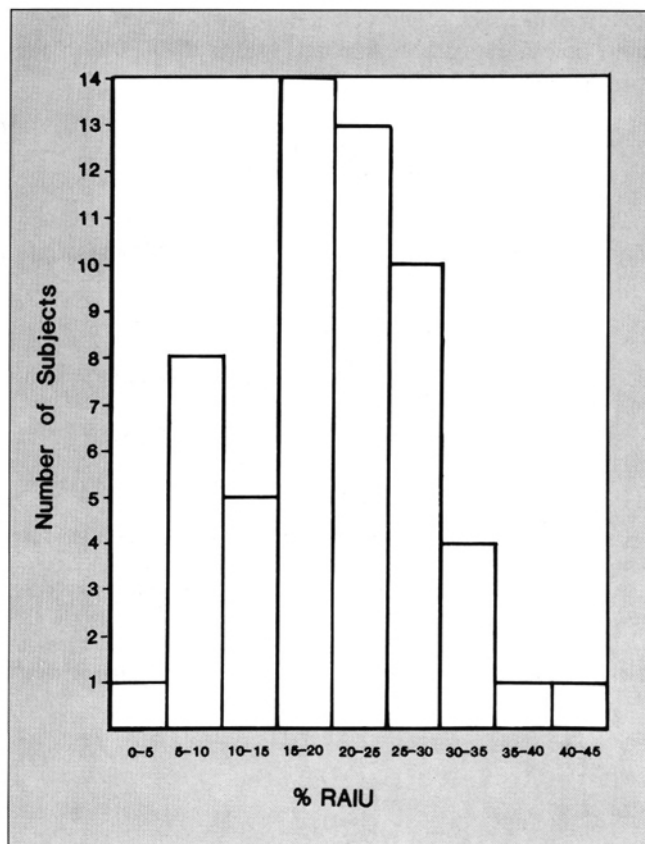


FIG. 1. Histogram of RAIU distribution for 57 euthyroid subjects.

information. These 24 subjects were eliminated from the study.

Figure 1 shows the distribution of the 24-hr RAIU in the 57 subjects determined to be euthyroid by thyroid hormone levels. In Figure 2, a comparison is made between 24-hr RAIU in the four hypothyroid subjects, the 57 euthyroid subjects, and the 31 hyperthyroid subjects.

A mean of 20.2% was obtained using all 57 normal patients,

TABLE 1. Mean, Standard Deviation, and 95% Range of Selected Euthyroid Groups

Group	No. in Group	Mean and $\bar{x}$ (%)	S.D. %	$\bar{x} + 2 \text{ S.D.}$ (%)
Males and Females	57	20.2	8.6	3.0–37.4
Females	44	22.0	8.2	5.6–38.4
Males	13	14.0	7.0	0–28.0
Females $\leq 50$ yr	20	23.0	8.4	6.2–39.8
Females $> 50$ yr	24	21.2	8.1	5.0–37.4
Males $\leq 50$ yr	6	12.1	6.5	–0.9–25.1
Males $> 50$ yr	7	15.6	7.5	0.6–30.6
Males and Females $\leq 50$ yr	26	20.5	9.2	2.1–38.9
Males and Females $> 50$ yr	31	19.9	8.2	3.5–36.3

which included 44 females and 13 males. Using two s.d.s about the mean, the euthyroid RAIU range was determined to be 3.0–37.4%.

Twenty-four-hour RAIU ranges were also evaluated on the 57 normal subjects according to age and sex (Table 1). Student t-tests, which determine if the mean values of the two groups are significantly different, were performed on the following groups: 1) all females as opposed to all males; 2) females  $\leq 50$  yr of age as opposed to females  $> 50$  yr of age; 3) males  $\leq 50$  yr of age as opposed to males  $> 50$  yr of age; and 4) all normal subjects  $\leq 50$  yr of age as opposed to all normal subjects  $> 50$  yr of age. A significant difference ( $p < 0.01$ ) in the sample means of all females as opposed to all males was found. There was no significant difference in the groups in relation to subject age.

## DISCUSSION

The stimulus for undertaking this study was the acquisition of a new thyroid uptake probe. The previous device which had been in use for  $\sim 20$  yr was replaced, and it was suggested that physical changes in the units, especially a difference in thickness of the detecting crystal, would result in a different

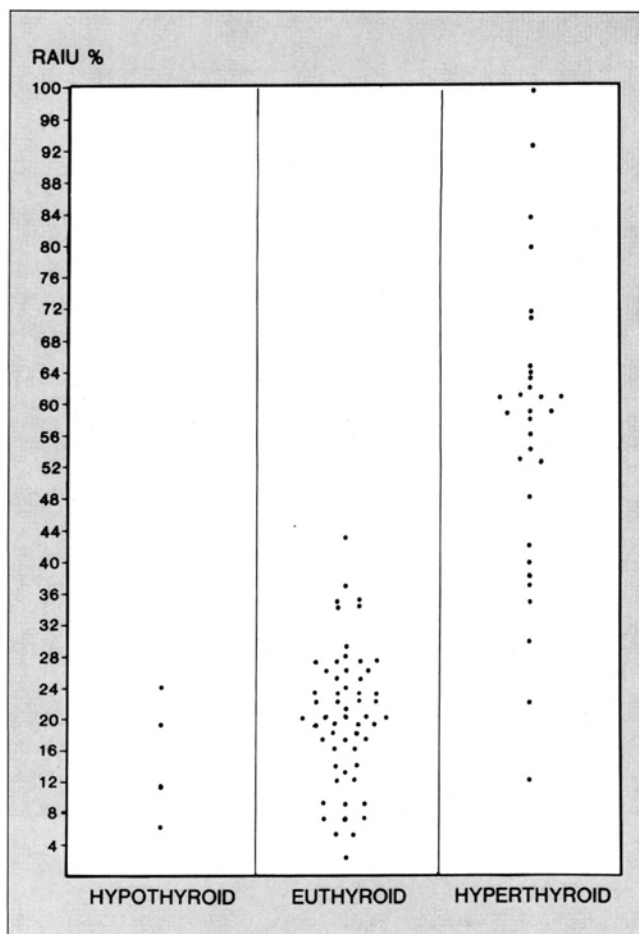


FIG. 2. Comparison of RAIU for hypothyroid, euthyroid, and hyperthyroid subjects.

normal range for the thyroid uptake determination. The reevaluation of the upper limits of our euthyroid range was the major concern in this study.

The study included only a few patients in the abnormal low (hypothyroid) range. This is related, in part, to the types of patients seen at our institution and the fact that the majority of the patients clinically suspected of having hypothyroidism are evaluated with TSH radioimmunoassay as the primary diagnostic determination. We chose to continue using 10% as the lower limit of the normal range because of the validity of RIA TSH measurements in diagnosis of hyperthyroidism.

There is a significant difference in the normal range in our study for males and females (see Table 1). This question has been addressed in the past by Oddie, et al., and Quimby, et al. (5,6). There is no definite clear-cut explanation for this difference. Standard textbooks define a normal thyroid uptake range as identical for both males and females. We have no definite explanation for the observed difference in our male and female population.

We feel that the study is a valid means of determining the radioiodine uptake range. Normal ranges should be checked periodically and randomly in patients to insure that the range

remains stable. The results of this study have effected a change in the normal range from previous values of 10–30% to our current range of 10–35%.

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