

## Hypothyroidism and Ramadan Fasting

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### ABSTRACT

**Introduction:** Fasting during the holy month of Ramadan is an obligation for all adult, healthy Muslims. As several studies have indicated, both fasting and energy restriction can alter thyroid hormone metabolism and affect the clinical features and well-being of hypothyroid patients. Hypothyroidism is more prevalent among women and the elderly. Its prevalence has been reported to be 4-8% of the general population. Despite the large body of animal research on fasting, few human studies have focused on Ramadan fasting and its impacts on hypothyroid patients.

**Method:** PubMed and Google scholar databases were searched using keywords such as Ramadan, fasting, hypothyroidism, and food restriction. Animal and human studies, which were highly relevant to the topic, were selected.

**Results:** Four animal and 7 human studies were included in this article. We found that levothyroxine dosage should be increased for hypothyroid patients from the beginning of the month until 15-20 days after the end of Ramadan.

**Conclusion:** Fasting can change the concentration of thyroid hormones, thyroid-stimulating hormone level, and the associated metabolisms both in animals and humans. As the results indicated, hypothyroid individuals, who fast during the month of Ramadan, particularly women and the elderly, may suffer from thyroid hormone changes. For these patients, levothyroxine dosage should be increased to 25-50 µg/per day from the beginning of Ramadan until 15-20 days after the end of this month. An increased dose of levothyroxine during Ramadan is recommended for hypothyroid patients, particularly women and the elderly.

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### Introduction

Hypothyroidism is defined as the reduction of thyroid hormone level. There are different types of hypothyroidism with different causes (1). Primary hypothyroidism is due to permanent loss or failure of the thyroid gland. On the other hand, central hypothyroidism refers to pituitary defects with insufficient secretion of thyrotropin-releasing hormone (TRH) or thyroid-stimulating hormone (TSH) or defects in TSH molecules. In terms of severity, hypothyroidism is categorized into overt and subclinical forms; the latter is also called mild thyroid failure (1).

Hypothyroidism is a relatively common condition among different communities and is more prevalent among women and the elderly.

Its prevalence has been reported to be 4-8% of the general population (2). Female-to-male ratio is 3:1, although in some reports, its prevalence among females has been reported to be 10 times higher than males (3). Postpartum hypothyroidism, a transient phase of hypothyroidism after delivery, is found in 5-10% of women (2) and may require thyroxine (T4) therapy similar to other types of hypothyroid states.

Fasting during the month of Ramadan is one of the fundamental principles of Islam. Every adult, healthy Muslim is required to fast during this holy month, with the exception of women during their menstrual period. Muslims, who practice this religious obligation, are commanded to abstain from eating, drinking,

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and sexual intercourse.

Ramadan fasting begins at dawn and ends at sunset in the evening. Its duration is dependent on the geographical location and alters in different seasons of the year. In fact, duration of fasting may vary from a few hours (about 4 hours) during summer in a country like England to about 12-14 hours in winter in a country like Iran.

A large number of Muslims fast all over the world. However, a fraction of them may suffer from hypothyroidism. As several studies have reported, both fasting and energy restriction can alter different aspects of thyroid hormone metabolism and may affect the clinical features and well-being of hypothyroid patients. In this study, probable changes in thyroid hormones during fasting are discussed.

## Materials and Method

PubMed and Google scholar databases were searched using keywords such as Ramadan, fasting, hypothyroidism, and food restriction. Animal and human studies, which were highly relevant to the topic were selected; clinical experience of the first author was also included.

## Results

Four animal and 7 human studies were included in this article. Based on our clinical experience, during the month of Ramadan, fasting patients with hypothyroidism, especially women and the elderly, complain of the worsening of their symptoms. We increased Levothyroxine dosage for these patients by 25-50 µg/per day from the beginning until 15-20 days after the end of Ramadan. It was also found from other studies that Levothyroxine can be used at bedtime at least 2 hours after the meal or half an hour before eating at dawn (4).

## Discussion

A large number of Muslims fast all over the world. However, a fraction of them may suffer from hypothyroidism. As several studies have reported, both fasting and energy restriction can alter different aspects of thyroid hormone metabolism and may affect the clinical features and well-being of hypothyroid patients. In this study based on our clinical experience, during the month of Ramadan, fasting patients with hypothyroidism, especially women and the

elderly, complain of the worsening of their symptoms. Therefore, it is suggested that levothyroxine dosage for these patients be increased by 25-50 µg/per day from the beginning until 15-20 days after the end of Ramadan.

In animal studies, as a previous study indicated, 2-day starvation in rats reduced hepatic triiodothyronine (T3) generation from T4 by 47%. In addition, administration of carbohydrates and amino acids resulted in increased T3 concentration in fasting rats; however, such alteration was not observed during lipid administration (5).

Furthermore, chronic food restriction decreased thyroid hormone level in rats. In a food-restricted group of rats, which were fed 60% of the amount consumed by the ad libitum group (for 6 months), serum T3 level decreased and the circadian rhythm of T3 changed in fasting animals (6). It has been reported that 2 days of feeding rats did not change the content of hypothalamic TRH, although pituitary TSH was significantly decreased; moreover, 5-day fasting significantly decreased the serum TSH level and the percentage of single-dose radioiodine (<sup>131</sup>I) in T3 and T4. In addition, serum total T4 (TT4), free T4, total T3 (TT3), and free T3 levels all decreased within 2 and 5 days of fasting (7).

In an animal study, hypothyroidism in rats, induced by thyroidectomy and congenital secondary hypothyroidism in dwarf mice, resulted in decreased T4-to-T3 conversion in the liver; however, this conversion in starved rats was not increased by thyroid hormone replacement therapy. Therefore, it was suggested that reduction of hepatic T4-to-T3 conversion, following starvation, is not the result of hypothyroidism; also, the underlying mechanisms of lower T3 production, observed in starvation and hypothyroidism, are not similar (5).

According to a study by Cheikh et al., which assessed lipolysis in epididymal adipocytes of Wistar rats, hypothyroidism had a significant effect on the prevention of lipolysis, while it was weakly activated by fasting. It is interesting that in fasted hypothyroid rats, lipolysis was slightly reduced and could be restored by administration of thyroid hormones; this indicates the dual regulation of lipolysis by

fasting and hypothyroidism. A large body of similar animal studies is available in the literature (8).

Despite the large number of animal studies regarding fasting, few human studies have focused on Ramadan fasting and its impacts on hypothyroid patients. However, extensive research has been performed on fasting and hypothyroidism in different biochemical studies. Some of the relevant articles have been discussed here.

Riad et al. conducted a study on male subjects, aged 25-50 years, who fasted during the month of Ramadan. Blood samples were collected on the first and last days of Ramadan; serum TT4, TT3, free T4, and TSH levels were measured on both days. No significant differences were found for the measured parameters between the first and last day of Ramadan (9).

In a human study during the holy month of Ramadan on fasting Muslim patients, selected from a thyroid clinic, effect of levothyroxine administration at bedtime (instead of morning hours) on TSH level was evaluated. Levothyroxine intake was more effective during the fasting state, compared to its administration at bedtime or time of breaking the fast (10). It was reported that TSH level was significantly correlated with meal-levothyroxine interval ( $r = -0.032$ ,  $P = 0.01$ ). In fact, during Ramadan, fiber and fat consumption increases during the evening meal and a 2-hour interval between meal and levothyroxine intake is essential; however, about 75% of patients refuse to follow this order.

Another human study was conducted on healthy subjects during the holy month of Ramadan in Tehran, Iran. It was found that T4 significantly reduced in both sexes, although TSH increased in only male subjects; however, these alterations were within the normal range. Furthermore, the number of fasting days and T4 level were shown to be positively correlated in women (11).

In a cohort study during the holy month of Ramadan, Fifty eight girls aged 9 -13 years were entered in two groups (fasted and non-fasted groups) from before Ramadan until afterwards. Measuring serum concentrations of T3, T4 and TSH hormones were showed that T3 decreased significantly by fasting ( $P < 0.001$ ), but it was

maintained in the normal range and T4 decreased and TSH increased slightly in both groups (12).

In another study by Sajid et al. on both male and female fasting subjects in the month of Ramadan, T3 level did not reduce as expected during Ramadan; however, TSH level showed a significant gradual rise, though within the normal range. They showed that the level of TSH in the blood sample, 23 days after the end of Ramadan, was lower than that observed on the 26<sup>th</sup> day of Ramadan; five months after Ramadan, TSH returned to the pre-Ramadan level (4).

According to a study by Scriba et al., there was no evidence of primary hypothyroidism during prolonged fasting and refeeding in obese patients. After the start of fasting, rapid T3 reduction, increased resin T3 uptake, and slower thyroxine-binding globulin (TBG) reduction, were reported, though the mechanisms could not be fully explained; furthermore, fasting reduced the TBG level. It has been also reported that refeeding rapidly restored the normal range (13).

Moreover, as reported by Raza et al., the amount of absorbed T4 reduced from 80% in fasting state to 60% in fed state in hypothyroid individuals. In addition, taking T4 at bedtime was reported to have the same effect as empty stomach; thus, hypothyroid patients can take their pills at bedtime on an empty stomach (4).

## Conclusion

Fasting can change the concentration of thyroid hormones and TSH level in both animals and humans. As discussed in this study, fasting for only a few days or long periods may change thyroid hormone level and its metabolism; therefore, the impact of thyroid hormones on several body systems may be variant and could cause a hypothyroid condition. Fasting in the holy month of Ramadan, which is accompanied by a phase of food restriction, may affect the level of thyroid hormones and give rise to some clinical manifestations of hypothyroidism. Hypothyroid patients, fasting in the month of Ramadan, especially women and the elderly, may suffer from thyroid hormone changes. Therefore, levothyroxine dosage should be increased for these patients from the beginning of the month until 15-20 days after the end of Ramadan.

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