

Islamic Fasting and Thyroid Hormones

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1. Introduction

Alteration in human homeostasis and various parameters of body function during Islamic fasting of Ramadan is completely different from experimental fasting. During Ramadan, the majority of Muslims have two good-sized meals, one immediately after sunset and the other just before dawn. They begin their day of fasting at dawn and continue until sunset. They eat and drink only between sunset and dawn. Since the Islamic calendar is based on a lunar cycle, the Islamic year has 354 days. Therefore, Ramadan moves back 11 days every year and may fall during any of the four seasons, making the duration of daily fasting vary between 11 and 18 hours in the north and in tropical countries. Islamic fasting provides a unique model of intermittent daily fasting from a physiological standpoint. It is also distinct from regular voluntary or experimental fasting in that the faster does not drink during fasting hours. Not only does Ramadan fasting discipline the body to restrain from eating food and drinking water, but a Muslim engages his or her entire body in the physical observance of the Ramadan fast. From foregoing introduction, one may assume that physiological changes occurring during Islamic fasting would differ from those observed during an experimental fast (1).

2. Thyroid Functions During Ramadan

It has been shown that in experimental studies fasting is associated with a decline in serum T3 and a rise in serum rT3. At least part of the reduction in serum T3 is due to a decrease in the peripheral conversion of T4 to T3, mostly in hepatic cells. It has been reported that both serum T3 and rT3 return to prefasting values upon refeeding with a mixed diet (2-4). We have also found that refeeding with a mixed diet or predominantly carbohydrate, diet even though hypocaloric, reverses the changes in serum T3 and rT3 caused by fasting. This finding complements those of other studies that demonstrate the importance of dietary carbohydrate in the modulation of serum T3

(5). A few days of experimental fasting decreases serum TSH concentration, both basal and after administration of thyrotropin-releasing hormone (TRH) (6). Prolonged starvation (3 weeks or more), causes no change in basal serum TSH although there may or may not be a decrease in the TSH response to TRH stimulation. Adult patients with protein calorie malnutrition have normal serum TSH values. In anorexia nervosa, basal serum TSH is normal but the TSH response to TRH may be prolonged. Therefore, at least in states of chronic malnutrition, the basal serum TSH does not appear depressed and the response to TRH is not decreased (5, 6). No significant alterations in serum concentrations of T4, T3, TSH, and TSH response to TRH stimulation were found in fasting Muslim males (7). Serum T4 and T3 concentrations may decrease in the last days of Ramadan, in women (8); however, the decline is mainly due to alterations in protein binding, as free thyroid indices remain unchanged (9, 10). A small increase in serum T4 in the last days of Ramadan has been reported by some studies, but not substantiated by others (8-11). Serum T3 may decrease in pre-menarche girls without any increase in serum TSH (12).

3. Thyroid Hormone Replacement

Levothyroxine is the appropriate medication for thyroid replacement in both primary and secondary hypothyroidism. Levothyroxine is taken usually orally in an empty stomach. The amount of thyroxine absorbed decreases from 80% in the fasting state to 60% in the fed state (13). Hence, when taken with food, the absorption of levothyroxine may be incomplete, resulting in more variable and higher serum TSH levels. Therefore, standard recommendation is that levothyroxine should be taken an hour before breakfast on an empty stomach, to prevent interference of its uptake by food or medication (14). While taking levothyroxine in between or with food might not be best, taking it at bedtime is an

other option, as two studies have shown to have almost the same effect as when taken on an empty stomach (15, 16). In contrast, a randomized crossover trial compared taking levothyroxine in the fasting state, with breakfast, or at bedtime in 65 thyroid cancer, patients with primary hypothyroidism found that fasting state and most beneficial than other times (17). To my experience, taking levothyroxine at bedtime in the Middle-Eastern countries, where dinner is taken between 9-10 pm, is not appropriate. In addition, many foods and medications such as cholestyramine, resin, sucralphate, iron sulphate, calcium preparations, aluminum antacids, raloxifene, activated charcoal, fiber-rich diet, and coffee early in the morning, various soya products and food and herbal remedies may affect levothyroxine absorption (14, 18-23).

4. Thyroid Hormone Replacement During Ramadan

Studies related to levothyroxine replacement during Islamic fasting are sparse. Karoli et al. (24) studied the impact of bedtime levothyroxine supplementation on serum TSH levels during Ramadan in 47 patients, and found that 29 (62%) had changes ≥ 2 $\mu\text{u/l}$ of serum TSH by the end of Ramadan. However, they related these changes mainly to the interval between levothyroxine ingestion and the last meal. Since there is no change in disposal of thyroid hormones in the first 24 hours of experimental fasting (5), one may conclude that there should be no need to change the dosage of levothyroxine during Ramadan fasting. However, other factors which change the absorption, metabolism and disposal of thyroid hormones during Ramadan should be carefully considered by both patients and physicians. It is assumed, but not substantiated, that during the month of Ramadan, changes in gastric motility (due to prolonged fasting), interference with heavy meals (gorging), possible alteration in the circadian rhythm and the effect of the deiodinase activity might alter the metabolism of the drug in the body (25). When should a hypothyroid faster take its levothyroxine? Based on the above information, it can be postulated that during Ramadan, the proper administration of levothyroxine is achieved if it is taken either one hour before Iftar (meal taken after sunset) or one hour before Sehur (meal taken before dawn); however, most of the patients find it difficult to wait before Iftare or to wake up that early before Sehur and therefore, either miss the dose or take it with the meal. This problem can be easily managed, if levothyroxine is taken at bedtime, which too has an almost identical lowering effect (if not better) on TSH. However, the patient should not take any food for at least 2 hours before bedtime. In conclusion, changes in serum thyroid hormones and therefore, TSH concentrations during Islamic fasting are minimal and do not alter the health of fasted individuals. In addition, Ramadan fasting per se

does not cause any need for change in dosage of levothyroxine in hypothyroid patients, although other factors that require change in levothyroxine dose, in particular the distance between ingestion of medication and last meal and/ or next meal should be considered.

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