

Effect of Ramadan Fasting on Bone Profile in Healthy Female Adult

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Abstract

There is one month in a year which is called Ramadan in the Hijri calendar, Muslims fast during this month from dawn to dusk. In Ramadan, sleep and awake cycles are disturbed with fasting impacts the secretion of a key hormone in the human body which is parathyroid hormone (PTH) and hence bone metabolism at the same time. The study objective was to find the effect of Ramadan fasting on bone profile in female adults in Sulaymaniyah city in Iraq. Moreover, different parameters were taken with parathyroid hormone (PTH) to investigate their impact on the bone profile such as calcium, albumin, magnesium, inorganic phosphorus, total alkaline phosphate, and 25-OH vitamin D. The number of participants was only 30 healthy females from different ages. The result of this study depends on the double time of taking blood samples from each participant. The result of this study showed that there is no significant difference in each parameter before and after 28 days of Ramadan. However, serum parathyroid hormone showed a significant increase at the end of Ramadan (55.5 ± 15.09 pg/ml, $p=0.03$) compared to the value of pre-Ramadan of fasting subjects (45.7 ± 15.33 pg/ml). Overall, alterations in dietary habits throughout Ramadan influenced the secretion of PTH in a manner that could potentially have a positive impact on bone health.

Keywords: Ramadan fasting, bone metabolism, parathyroid hormone, Kurdish

Received: 29/8/2023

Accepted: 3/11/2023

E-ISSN: 2790525-X

P-ISSN: 27905268

Introduction

Ramadan is the holiest month among Muslims and every healthy Muslim is obligated to fast. During this month, all healthy adult Muslims will abstain from food and drink between sunrise and sunset. The length of this period varies depending on the season, geographical location, and the precise timing of sunrise and sunset in each particular country or region, ranging from 12 to 18 hours. During fasting, two meals are taken per day - "Iftar" as the dinner & "Sahur" at the end of the night just before dawn. Daily physical activities and sleep duration will be affected due to changes in the frequency and quantity of foods and drinks. Therefore, Ramadan fasting may cause changes in body measurements, physiology aspects, hormonal metabolism, and haematological and biochemical compositions of the blood in the human body (Hosseini et al., 2013, Sayedda et al., 2013).

Numerous studies have been undertaken to investigate how Ramadan fasting influences the metabolic and physiological aspects of human health both during and after the Ramadan period. (Elnasri and Ahmed, 2006, Bahijri et al., 2013, Khoshdel et al., 2013, Bahijri et al., 2015).. In reality, there is a shortage of studies examining the impact of Ramadan fasting on bone biomarkers, and the outcomes reported in these studies are conflicting.

Modern-era Ramadan fasting is often linked to disrupted sleep patterns. Many individuals stay awake until dawn, sleep for a few hours before heading to work, and then take another nap after work or when they have the opportunity. Prior research has indicated that these sleep disturbances during Ramadan fasting are associated with alterations in circadian rhythms and cortisol hormone levels. These hormones can change the expression of other hormones such as parathyroid hormone (PTH). As a result, it has detrimental effects on many physiological conditions (Bahijri et al., 2013). Parathyroid hormone (PTH) is a hormone that is essential for bone metabolism (Kroll, 2000). It has been found that this hormone shows circadian rhythmicity and its circulating level is affected by sleeping disturbance (Nielsen et al., 1991, Logue et al., 1992).

Several studies have been conducted on the distinct effects of Ramadan fasting on those parameters that have an essential role in bone metabolism. For example, a study showed a slight change serum in albumin, and calcium levels after Ramadan fasting (Azizi and Rasouli, 1987). However, other studies reported unchanged levels of serum constituents such as alkaline phosphatase, calcium, phosphorous, albumin, vitamin D, and magnesium. (Furuncuoğlu et al., 2007, Ibrahim et al., 2008, Mohammed, 2011, Sayedda et al., 2013, Bahijri et al., 2015). Although various studies have been conducted in order to find the effect of fasting Ramadan on various physiological conditions, their results are controversial. Therefore, this study aimed to find the effect of Ramadan fasting and the disturbance of sleep patterns on parameters of bone metabolism in healthy Kurdish women.

Patient and methods

Human subjects

This study was performed during Ramadan May-June 2019 in the city of Sulaymaniyah, Iraq. The study was conducted on 30 healthy women adults who were fasting during Ramadan. The present study was approved by the scientific advisory and the ethics committee of the Kurdistan Institution for Strategic Studies and Scientific Research. Subjects were examined twice, during their regular life (Pre-Ramadan) before, and again 28 days into the fasting period (End-Ramadan). Blood samples were collected from all subjects twice: first, one week before Ramadan and then on the 28th day of Ramadan. Serum was obtained by low-speed centrifugation at 1000g for 15 minutes, and samples were immediately separated into aliquots and samples were stored at -20C until measurements were conducted. To avoid day-to-day laboratory variation, all biological and endocrine parameters were analysed in a single batch.

Biochemical and endocrine assays

Serum biochemical and endocrine parameters of 30 serum samples were measured twice. Calcium, albumin, magnesium, inorganic phosphorus, and total alkaline phosphatase were assayed by a spectrophotometric method using cobas c111 auto-analyser (Roche-Germany). Intact parathyroid hormone and 25-OH vitamin D were measured by chemiluminescent immunoassay technique using cobas e411 auto-analyser (Roche-Germany).

Statistical analysis

The data have been recorded and tabulated using Microsoft Excel and analysed with the statistical software package SPSS 26 (SPSS Inc., Chicago, IL, USA). Results were presented as mean standard deviation. Data from before and at the end of Ramadan was compared using paired two-tailed student's T-test. The p-values less than 0.05 were considered statistically significant.

Results

A total of 30 healthy female volunteers were included in the study. The mean (\pm SD) age was 41.1 ± 14.3 years (range 18–71 years). The results of biochemical, and endocrine parameters are presented in (Table 1).

Table 1: This table shows the Serum biochemical parameters during Pre-Ramadan and End-Ramadan.

| Parameters | Pre-Ramadan | End-Ramadan | Pre-Ramadan <i>versus</i> End-Ramadan |
|------------------------------|------------------|------------------|---------------------------------------|
| | Mean \pm SD | Mean \pm SD | P- value |
| (Magnesium (mg/dl | 3.09 \pm 0.19 | 3.14 \pm 0.11 | 0.21 |
| (Parathyroid hormone (pg/ml | 55.7 \pm 15.33 | 65.5 \pm 15.09 | 0.03 |
| (OH) vitamin D (ng/dl) 25 | 11.9 \pm 6.43 | 12.25 \pm 4.76 | 0.74 |
| (Calcium (mg/dl | 10.41 \pm 0.35 | 10.52 \pm 0.23 | 0.28 |
| (Inorganic phosphorus (mg/dl | 2.71 \pm 0.52 | 2.68 \pm 0.29 | 0.78 |
| (Albumin (gm/dl | 5.02 \pm 0.27 | 5.6 \pm 0.23 | 3.25 |
| (Alkaline phosphatase (U/L | 74.8 \pm 22.65 | 66.7 \pm 21.14 | 6.4 |

According to the most recent classification of vitamin D status proposed by (Thacher and Clarke, 2011), all subjects exhibited 25-OH vitamin D levels below the established deficiency threshold of ≤ 20 ng/ml before Ramadan (Figure 1 A). Additionally, for all subjects at the end of Ramadan, their vitamin D levels remained within the insufficiency range, and none of them reached serum concentrations ≥ 30 ng/ml, which have been suggested as the cutoff values to define an optimal vitamin D status by (Kennel et al. 2010). Notably, there was no statistically significant difference observed in the mean concentration of 25-OH vitamin D between the values measured before and after Ramadan fasting.

In this study, the effect of Ramadan fasting on electrolyte parameters showed no significant change. As shown in (Figure 1, B-D), there was no significant change in the concentration of magnesium, calcium, and phosphorous before Ramadan compared to the end of Ramadan. The serum values of electrolytes were within normal reference ranges. Additionally, it has been noted that there were no significant changes in serum albumin concentration compared to pre- and end-of-Ramadan fasting (Figure 2, A). Its value remained within the normal reference range. Although a reduction in the serum alkaline phosphatase concentration was observed after Ramadan, the level re-

mained around 76.7 ± 21.14 U/L, indicating adequate enzyme production by the liver. No significant changes were noted in the means of this enzyme at the end of Ramadan fasting (Figure 2, B).

As shown in (Figure 2, C), serum parathyroid hormone showed a significant increase at the end of Ramadan (55.5 ± 15.09 pg/ml, $p=0.03$) compared to the value of pre-Ramadan of fasting subjects (45.7 ± 15.33 pg/ml), and fewer subjects having higher than normal reference levels (15-65 pg/ml).

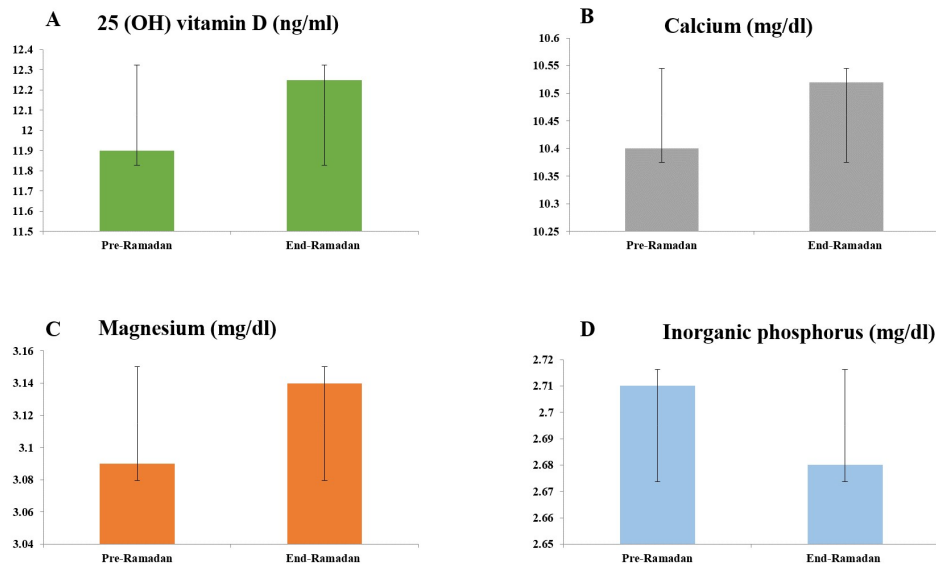


Figure 1: Serum biochemical parameters during Pre-Ramadan and End-Ramadan. The data is presented as number mean \pm SD. The p-values are the resultant of paired two-tailed student's T-test. Significant p-values are indicated in bold.

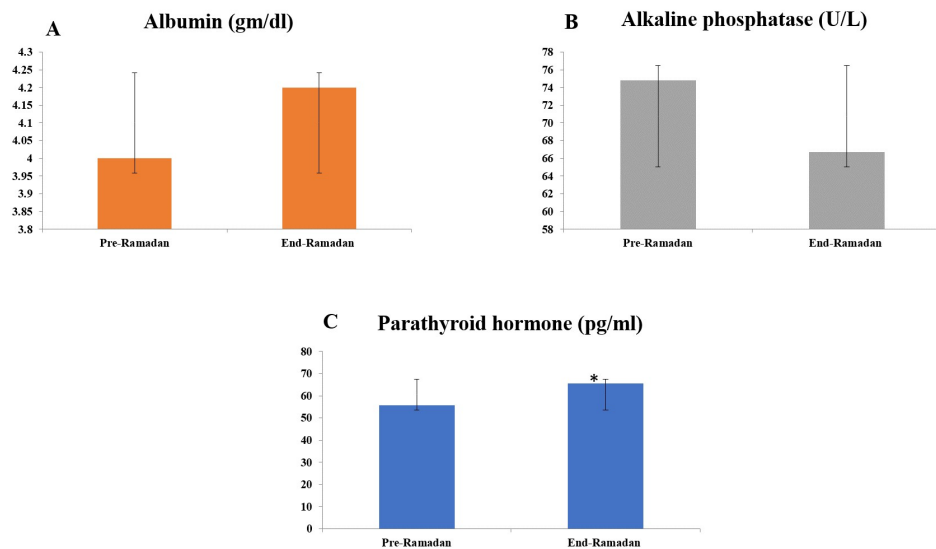


Figure 2: Serum biochemical and endocrine parameters during Pre-Ramadan and End-Ramadan. The data is presented as number mean \pm SD. The p-values are resultant of paired two-tailed student's T-test. (asterisk represents a significant P value)

Discussion

During Ramadan, for most Muslims, fasting is a religious duty merely for adult Muslims, except at some cases such as illness, travelling, etc, from dawn to sunset based on their religious belief they abstain from food and drink. As it was reported during this holy month, sleeping and daily life is changed which is influenced by calorie intake and different biochemical parameters in the body this might impact the life span with the improvement of health (Goodrick et al. 1990 and Anson et al. 2003). On the other hand, it has been suggested that fasting increases metabolic and endocrine dysregulation. This study was conducted to find out the impact of Ramadan fasting on bone metabolism and other different parameters including parathyroid hormone (PTH), calcium, albumin, magnesium, inorganic phosphorus, total alkaline phosphatase and 25-OH vitamin D.

This finding showed that the serum parathyroid hormone increased significantly at the end of Ramadan compared to pre-Ramadan time. The overall increase of PTH was observed between pre-Ramadan and post-Ramadan (45.7 ± 15.33 pg/ml), 55.5 ± 15.09 pg/ml, $p=0.03$) subsequently. Similarly, Bahijri et al., 2015 reported that during Ramadan due to changes in dietary practices, the secretion of PTH modulated to a pattern that might be beneficial to bone health. PTH plays a key role in bone turnover, with studies indicating that continuous hypersecretion of PTH is associated with bone resorption, (Kroll, 2000). Thus, manipulation of PTH secretion has been suggested as a way of increasing bone strength and treating osteoporosis (Fraser et al. 2004, Silver and Bushinsky, 2004).

As mentioned in the result different parameters were observed to find out their impact on the bone profile. For example, total vitamin D levels were under the reference range pre and post of Ramadan which means the vitamin D levels were not affected by fasting. Comparably, this is confirmed by Bahijri et al., 2015. In addition, in this study, the effect of Ramadan fasting on electrolyte parameters showed no significant changes such as magnesium, calcium, and phosphorous. The serum values of electrolytes were within normal reference ranges. Calcium serum level was not changed before and after Ramadan. It was reported that when the serum calcium level falls to a critical low, the parathyroid glands are immediately activated to boost the production of PTH (parathyroid hormone). This finding was observed at the end of the Ramadan fasting period, where a substantial increase in serum PTH was observed in response to the decrease in serum calcium values. At the end of Ramadan, the serum calcium values returned to approximately normal values and slightly above the pre-Ramadan levels (Al-Kotobe, et al., 2006).

This study is also in line with finding reported by (Khoshdel et al., 2012) detected that there was no change observed in calcium and serum phosphorous at the end of Ramadan. In addition, alkaline phosphatase concentration was not changed after Ramadan in pregnant women. It is important to increase the rate of bone metabolism. Ramadan fasting, in general, did not show any adverse effects on the concentration of albumin, the results are in line with the earlier findings either reported a decrease (Mohtasham et al., 2001) or no changes in the serum albumin levels as a result of Ramadan fasting however there is a study confirmed that the serum albumin concentration was changed significantly increased in male and female during Ramadan (Nagra et al. 2011). Albumin makes up approximately 60% of the total serum protein and its major function in the blood is to maintain the colloidal osmotic pressure (Nagra et al. 2011). As albumin is synthesized within the liver, it is an important measure of hepatic function. Medically a generous concentration of albumin in the bloodstream is regarded as a measure of quality of life (Nagra et al. 2011).

Conclusion

Overall, the results suggest that Ramadan fasting has no adverse effects in normal healthy women on biochemical substances relating to bone function in healthy women.

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