

Physiological and Metabolic parameters associated with Ramadan Fasting among undergraduate Medical Students: A Prospective Observational Study

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Abstract: Background: Ramadan fasting is a form of intermittent fasting practised by Muslims worldwide during the ninth month of the Islamic lunar calendar. During this period, individuals refrain from consuming food, fluids, and smoking from dawn to sunset for nearly 29–30 consecutive days. Changes in dietary patterns and lifestyle during Ramadan may influence various anthropometric, cardiovascular, and metabolic parameters. **Objective:** The present study aimed to evaluate the effects of Ramadan fasting on anthropometric, cardiovascular, and metabolic parameters among undergraduate medical students. **Materials and Methods:** A prospective observational study was conducted among 140 healthy medical students of Mamata Academy of Medical Sciences, Hyderabad, during Ramadan (February–March 2026). Anthropometric and physiological measurements were recorded at two time points: before the commencement of Ramadan and at the end of the fasting period (30th day). Parameters assessed included body weight, body mass index (BMI), waist circumference, waist–hip ratio (WHR), heart rate, blood pressure, pulse pressure, mean arterial pressure (MAP), and random blood sugar (RBS). **Results:** A significant reduction in mean BMI was observed following Ramadan fasting compared to pre-fasting values (25.81 ± 6.1 ; $p < 0.001$). Mean mid-arm circumference was significantly lower among fasting individuals (26.7 ± 3.92 cm) compared to non-fasting individuals (28.39 ± 3.98 cm) ($p = 0.01$). In addition, fasting participants demonstrated lower heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, and random blood sugar levels when compared with non-fasting participants. These differences were statistically significant ($p < 0.05$). **Conclusion:** The findings indicate that fasting has beneficial effects on anthropometric parameters, cardiovascular and metabolic health of individuals.

Keywords: Ramadan fasting, body mass index (BMI), waist–hip ratio (WHR), blood pressure, random blood sugar.

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INTRODUCTION

Fasting is the voluntary abstinence from food or beverages for a specific period of time. It is considered a non-pharmacological intervention and includes different forms such as dietary restriction (DR), alternate-day fasting (ADF), and caloric restriction (CR). Dietary restriction involves limiting certain foods or nutrients, alternate-day fasting consists of alternating fasting and non-fasting days, while caloric restriction reduces daily caloric intake without completely skipping meals [1]. Fasting is commonly practised for both therapeutic and religious purposes. Several studies suggest that fasting may help in eliminating harmful substances from the body and may provide various

health benefits [2]. During the month of Ramadan, Muslims observe fasting according to Islamic principles by abstaining from food and drink from dawn until sunset for 29–30 consecutive days each year. Healthy individuals are expected to fast, whereas exemptions are given to people with illnesses, chronic diseases, or conditions that may negatively affect health [3]. Research has demonstrated that Ramadan fasting can produce significant changes in body composition. Most Muslims consume two meals daily during Ramadan, one before dawn (Suhoor) and another after sunset (Iftar) [4]. The duration of fasting during Ramadan varies according to geographical location and season, ranging approximately from 8 to 17 hours. Several

researchers have reported noticeable alterations in blood pressure during fasting, possibly due to dehydration and increased blood viscosity [5]. Studies have also shown that fasting improves glycemic control in both individuals with Type 2 diabetes mellitus and healthy adults [6]. In recent years, investigations into energy intake and body composition during Ramadan have yielded mixed results. These differences may be attributed to variations in fasting duration, dietary habits, and total food intake [7]. During Ramadan, dietary patterns change considerably, often resulting in reduced intake of food and fluids. These changes may lead to weight loss and mild dehydration, which can influence anthropometric and biochemical parameters associated with body water balance [8]. Several surveys have reported a significant reduction in body weight and body mass index (BMI) during Ramadan fasting [9]. However, some studies have produced inconsistent findings and reported no significant changes in body weight or body composition during the fasting period [10]. Fasting induces several physiological and metabolic adaptations that contribute to its beneficial effects on health. During fasting, glycogen stores become depleted, leading to a metabolic shift from glucose utilization to lipolysis and ketone body production. This metabolic switching improves insulin sensitivity, enhances fat oxidation, and promotes reduction in body weight and visceral adiposity. Fasting also activates important cellular pathways such as AMP-activated protein kinase (AMPK) and sirtuin-1 (SIRT1), while suppressing the mammalian target of rapamycin (mTOR) pathway, thereby promoting autophagy and cellular repair mechanisms [11,12]. The present study was undertaken to evaluate the beneficial effects of fasting on body weight, body mass index (BMI), waist-hip ratio (WHR), heart rate, blood pressure, and metabolic health parameters. In recent years, fasting has gained considerable attention worldwide as a popular lifestyle practice for improving health, preventing metabolic disorders, and supporting disease management. Understanding the physiological effects of fasting may help establish it not only as a spiritual practice but also as a potential non-pharmacological intervention for promoting overall health and well-being [13].

MATERIALS AND METHODS

Study Setting

The present study was conducted in the Research Laboratory of the Department of Physiology at Mamata Academy of Medical Sciences during the month of Ramadan (February–March 2026), after obtaining approval from the Institutional Ethics Committee, MAMS-Bachupally (IEC/MAMS/2026/201).

Study Design

This study was designed as a prospective observational study.

Study Participants

The study participants were selected from Phase I, II, and III MBBS students using a simple random sampling method after taking informed consent. Among the total participants included in the study, nearly half were observing fasting during the month of Ramadan.

Inclusion Criteria

- Students belonging to the age group of 18–24 years
- Healthy individuals without any known medical illness
- Subjects willing to participate and provide informed consent

Exclusion Criteria

- Participants who were unable to report for post-fasting assessment due to personal reasons were excluded from the study.

Data Collection

Data were collected from 140 healthy participants. Each participant was assessed at two different time points: before the commencement of Ramadan fasting and after completion of the fasting period. All recordings were obtained during the morning hours.

The subjects included in the fasting group had been regularly practising Ramadan fasting every year. Possible confounding factors were minimized by advising all participants to maintain a uniform fasting schedule. Since the study subjects belonged to a similar geographical region, their dietary habits and cultural practices were relatively comparable, thereby reducing variation in health-related effects due to lifestyle differences.

Physiological Variables Assessed

1. **Anthropometric Measurements:**
Height (in meters) and weight (in kilograms) were recorded for each participant. Body Mass Index (BMI) was calculated using the formula: $BMI = \text{Weight (kg)} / \text{Height (m)}^2$
2. **Waist and Hip Measurements:**
Waist circumference (WC) and hip circumference (HC) were measured in centimeters using a measuring tape. Waist-hip ratio (WHR) was calculated as:
$$WHR = \text{Waist Circumference} / \text{Hip Circumference}$$
3. **Blood Pressure:**
Blood pressure was measured in mmHg using a mercury sphygmomanometer under resting and quiet conditions.
4. **Heart Rate:**
Heart rate was measured by the palpatory method.
5. **Pulse Pressure:**
Pulse pressure was calculated by subtracting



diastolic blood pressure from systolic blood pressure.

Pulse Pressure = SBP - DBP

6. **Mean Arterial Pressure (MAP):**

Mean arterial pressure was calculated using the following formula:

$MAP = DBP + 1/3 [SBP - DBP]$

7. **Random Blood Sugar (RBS):**

Random blood sugar levels were measured in mg/dL using an Accu Sure simple blood glucose meter. Capillary blood was obtained by finger prick using a sterile lancet. The fingertip was cleaned with alcohol and allowed to dry before sample collection. Blood was applied to the test strip inserted into the glucometer, and the reading was recorded in mg/dL according to the manufacturer's instructions (Medical device license no. IMP/IVD/2018/000033). Standard infection control precautions were followed during the procedure.

variables were presented as frequencies and percentages, while quantitative variables were expressed as mean $\pm$ standard deviation (SD).

A paired sample t-test was used to compare the mean values before and after Ramadan fasting among fasting participants. An independent sample t-test was applied to compare quantitative physiological variables between fasting and non-fasting individuals at the end of Ramadan. A p-value less than 0.05 was considered statistically significant.

RESULTS

The present study was conducted among MBBS students to assess the effect of fasting on various physiological parameters. Among the total participants, 37.8% were from Phase I and 40.7% were from Phase II MBBS. The majority of the participants (70.7%) belonged to the 19–20 years age group. Female participants constituted 56.4% of the study population, while males accounted for 43.6%. Out of the 140 participants included in the study, 69 students observed fasting continuously for one month.

Data Analysis

The collected data were entered into Microsoft Excel and analysed using SPSS version 20.0. Categorical

Table 1: Demographic Details of study population.

Variables	Frequency (N)	Percentages (%)
Year of study		
MBBS Phase 1	53	37.8
MBBS Phase 2	57	40.7
MBBS Phase 3	30	21.4
Age (years)		
17-18	31	27.9
19-20	99	70.7
>20	2	1.4
Gender		
Male	61	43.6
Female	79	56.4
Fasting		
Yes	69	49.3
No	71	50.7

Table 2: Effect of Fasting on physiological Variables (N=69)

Variables	Mean $\pm$ SD	t, p value
BMI		
Before Fasting	25.81 $\pm$ 6.1	9.345, <0.001
After Fasting	25.08 $\pm$ 5.7	
Waist Hip Ratio		
Before Fasting	0.79 $\pm$ 0.05	0.245, 0.8
After Fasting	0.78 $\pm$ 0.06	
Mid arm circumference (cm)		
Before Fasting	28.14 $\pm$ 3.6	10.402, <0.001
After Fasting	26.76 $\pm$ 3.9	
Heart Rate		
Before Fasting	80.18 $\pm$ 9.19	4.798, <0.001
After Fasting	76.86 $\pm$ 7.94	
Blood Pressure (Systolic mm of		



Hg)		
Before Fasting	117.79±6.9	8.101, <0.001
After Fasting	113.79±6.7	
Blood Pressure (Diastolic mm of Hg)		
Before Fasting	77.94±5.4	8.309, <0.001
After Fasting	74.97±4.7	
Pulse Pressure (mm of Hg)		
Before Fasting	39.85±4.6	1.825, 0.07
After Fasting	38.82±4.6	
Mean Arterial Pressure (mm of Hg)		
Before Fasting	91.14±5.57	10.191, <0.001
After Fasting	87.91±5.05	
RBS (mg/dl)		
Before Fasting	81.52±11.55	5.317, <0.001
After Fasting	75.53±8.29	

Table 2 presents the comparison of pre-fasting and post-fasting physiological parameters among individuals who observed fasting. A significant reduction in mean BMI was observed after fasting compared to the pre-fasting value (25.81 ± 6.1 ; $p < 0.001$). Similarly, the mean mid-arm circumference showed a significant decline in the post-fasting period compared to the pre-fasting measurement (28.14 ± 3.6 ; $p < 0.001$).

Heart rate, systolic blood pressure, and diastolic blood pressure were also lower after fasting when compared

with pre-fasting values, and these differences were statistically significant ($p < 0.001$). In addition, the mean arterial pressure decreased significantly from 91.14 ± 5.57 before fasting to 87.91 ± 5.05 after fasting ($p < 0.001$).

A significant reduction in random blood sugar (RBS) levels was also noted following fasting, with post-fasting values (75.53 ± 8.29) being lower than pre-fasting values (81.52 ± 11.55) ($p < 0.001$).

Table 3: Effect of Fasting on Physiological Variables among Fasting and Non-Fasting students(N=140)

Variables	Mean ±SD	t, p-value
BMI		
Fasting individuals	25.10±5.8	-1.965, 0.05
Non-Fasting individuals	27.07±6.04	
Waist-Hip Ratio		
Fasting individuals	0.78±0.06	-0.971, 0.33
Non-Fasting individuals	0.80±0.06	
Mid arm circumference (cm)		
Fasting individuals	26.7±3.92	-2.431, 0.01
Non-Fasting individuals	28.39±3.98	
Heart Rate		
Fasting individuals	76.8±7.9	-2.160, 0.03
Non-Fasting individuals	79.5±6.3	
Blood Pressure (Systolic mm of Hg)		
Fasting individuals	113.8±6.7	-3.588, <0.001
Non-Fasting individuals	117.8±6.6	
Blood Pressure (Diastolic mm of Hg)		
Fasting individuals	74.9±4.7	-2.467, 0.01
Non-Fasting individuals	76.9±4.8	
Pulse Pressure (mm of Hg)		
Fasting individuals	38.8±4.6	-2.743, 0.00



Non Fasting individuals	40.9±4.3	
Mean Arterial Pressure (mm of Hg)		
Fasting individuals	87.9±5.0	-3.130, 0.00
Non-Fasting individuals	90.6±5.07	
RBS (mg/dl)		
Fasting individuals	75.5±8.2	-5.122, <0.001
Non-Fasting individuals	82.6±8.1	

Table 3 presents the comparison between fasting and non-fasting individuals. The mean mid-arm circumference was lower among fasting individuals (26.7 ± 3.92) compared to non-fasting individuals (28.39 ± 3.98), and this difference was statistically significant ($p = 0.01$). In addition, heart rate, systolic and diastolic blood pressure, pulse pressure, mean arterial pressure, and random blood sugar (RBS) levels were lower among fasting individuals than non-fasting individuals. These differences were found to be statistically significant ($p < 0.05$).

DISCUSSION

Fasting is considered a beneficial lifestyle practice that may contribute to overall health and well-being. It promotes physiological adaptation by facilitating the removal of harmful metabolic by-products and enhancing the body's natural repair mechanisms. Previous studies have suggested that fasting may accelerate cellular recovery processes and improve metabolic efficiency [14].

Several studies have demonstrated that fasting exerts beneficial effects by reducing oxidative stress. This is reflected by decreased oxidative damage to proteins, lipids, and DNA. Fasting has also been associated with improved resistance to different forms of physiological stress, including oxidative, metabolic, and thermal stress. Enhanced immune function and improved cellular adaptation mechanisms may contribute to the positive impact of fasting on overall health and longevity [15-17].

Ramadan fasting is associated with marked alterations in meal timing and frequency. Food intake is mainly restricted to night time hours, with meals generally consumed before dawn and after sunset. Such changes in eating patterns may influence both total energy consumption and nutrient intake [9].

Waist circumference is considered a more reliable indicator of visceral obesity than BMI and has a strong association with hypertension, dyslipidaemia, and insulin resistance. The findings of the current study revealed significant reductions in body weight, BMI, waist circumference (WC), waist-hip ratio (WHR), and blood pressure following the fasting period. These observations are in agreement with the findings of previous studies conducted by Fakhrazadeh *et al.* [18],

Varady *et al.* [19], Heilbronn *et al.* [20], and Mustafa *et al.* [21].

There is a well-established association between BMI and blood pressure parameters such as SBP and DBP. The reduction in blood pressure observed during Ramadan fasting may be related to weight loss, even in the absence of salt restriction [22]. In the present study, systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) showed a statistically significant reduction after fasting. Similar findings have been reported by Dewanti *et al.* [22] and Varady *et al.* [23]. The current study also demonstrated a decrease in heart rate following fasting, which is consistent with the findings of Mager *et al.* [24]. and Guy *et al.* [25]. suggested that Ramadan fasting may lower blood pressure and heart rate during daytime hours, although variations may occur during the evening and early morning periods. These cardiovascular effects may be associated with increased vagal activity during fasting [26].

Weight reduction has been shown to improve autonomic cardiac regulation by enhancing parasympathetic activity, which clinically manifests as a reduction in heart rate [27]. Increased sympathetic nervous system (SNS) activity relative to parasympathetic nervous system (PNS) activity is considered a major risk factor for cardiovascular disease. Obesity and aging are often associated with sympathetic overactivity, whereas weight reduction and regular exercise improve autonomic balance. Fasting, particularly when combined with physical activity, may positively influence SNS/PNS balance [28].

In healthy individuals, the physiology behind the decrease in blood glucose level during fasting is due to suppressed insulin secretion [29].

One strength of the present study is that it evaluated the association of pre- and post-Ramadan fasting with BMI, waist-hip ratio (WHR), blood pressure (BP), and random blood sugar (RBS) among healthy adults using a control group for comparison. However, the study had certain limitations. It was not possible to monitor detailed dietary records or food intake during non-fasting hours, particularly because of the increased consumption of sugar-rich foods. In addition, reduced physical activity during Ramadan may have acted as a confounding factor during data collection. Therefore,



further studies are needed to confirm and expand upon these findings. Further multicentric studies with larger sample sizes are required to evaluate the long-term physiological impact of Ramadan fasting.

CONCLUSION

Ramadan fasting was associated with favourable alterations in anthropometric and metabolic parameters, including reductions in BMI, body weight, waist circumference, blood pressure, heart rate, and random blood sugar levels. The findings indicate that Ramadan fasting may have beneficial effects on cardiovascular and metabolic health in healthy individuals.

Recommendation: Adopting intermittent and well-structured fasting practices a few times during the year may contribute to improved metabolic and cardiovascular health with effective weight control, and the development of more mindful eating behaviours.

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