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Effects of Fasting in Patients with Asthma

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Abstract

Fasting is a fundamental practice in many religions worldwide. The holy month of Ramadan is a sacred duty that can diversely affect different diseases. Refraining from some medications during Ramadan can adversely affect patients with asthma. This research evaluates the role of fasting on disease severity and spirometry parameters in patients with asthma before, during, and after Ramadan. This research enrolled 120 patients with asthma who were referred to the clinic during Ramadan and allocated them to fasting and non-fasting groups. All the patients underwent Spirometry before and at the end of Ramadan. The rate of control over asthma pre- and post-Ramadan was assessed, followed by comparing the findings in each group and between the two groups. There was no significant difference in the spirometric parameters pre- and post-Ramadan between fasting and non-fasting groups and in each group. The difference in asthma control pre- and post-Ramadan was insignificant between the two groups. Nevertheless, FEV1 change in the fasting group was significantly higher than in the non-fasting group. Fasting during Ramadan exerts no significant effect on the severity of asthma and spirometric parameters in patients with moderate to severe asthma. Thus, regular inhalation therapy during Ramadan with altering the hours of medication consumption can efficiently avert exacerbation or asthma attacks.

Keywords: Asthma, Ramadan, Fasting, Spirometry

Introduction

Asthma is a complicated condition characterized by inflammation, bronchial hyperresponsiveness, intermittent airflow obstruction, and airway remodeling. According to the Iranian Asthma Association, the overall prevalence of asthma in Iran is estimated at 8 to 12% of the population. A multitude of factors is currently reported to be beneficial in precluding asthma attacks and relieving its associated symptoms. However, all the guidelines accentuate the regular use of medications, follow-up and education of patients, and evading risk factors (1).

Fasting is a fundamental practice in many religions worldwide, particularly Islam, and Muslims are commanded to fast during the holy month of Ramadan. Similar to other circadian rhythms, Islamic fasting involves periods of "nutrition-abstinence from nutrition" which are repeated in a certain order. As such, the feeding phase that falls in the darkness is the interval between the time of the sunset Adhan to the sunrise Adhan, while the phase of abstinence from having food that falls in the lightness is the interval between the sunrise Adhan and the sunset Adhan. In simple terms, Islamic fasting can be regarded as a rhythmic and harmonic process.

The pattern of beginning or exacerbation of asthma follows circadian variations. As such, the exacerbation periods in this disease happen between midnight and early morning (2). Such variations in the symptoms and severity in asthmatic patients can be defined by circadian variations in the lungs' physiology and their volumes and inflammation of the airways (3, 4).

Ramadan fasting can alter the pattern of medication consumption, thereby significantly affecting the duration and outcomes of diseases (5). Research advocates that 67% of Muslims remain fasting during Ramadan, despite suffering from moderate to severe asthma. As reported, nearly all patients take medications before Sahar (dawn) and after Iftar. Again, the duration of fasting fluctuates based on whether Ramadan falls in summer or winter, and thereby, the interval between Sahar and Iftar will not exceed twelve hours. This research explores altered medication schedules and their impact on asthma control.

In the literature, few studies have explored the effect of fasting on the exacerbation of asthma and variations in spirometry findings, with some reported conflicting outcomes (6, 7). In a study conducted on 10 Muslim asthma women (14–24 years of age) living in Denmark, it was found that fasting coinciding with using inhalers is not detrimental, rather both coincidently lead to asthma relief and control (8).

Research reveals that the respiratory muscles' strength alters during fasting. For example, Soori et al. studied 35 healthy young men pre- and post-Ramadan to evaluate the pulmonary alterations in the participants by measuring weight, maximum respiratory muscle pressure (MIP), and peak inspiratory flow (PIF). There was a significant increase in MIP, PIF, and weight after Ramadan. Collectively, they reported a potential reduction of respiratory muscle strength during Ramadan fasting as mediated by reduced body weight (9).

Elsewhere, Ben Fraj et al. studied healthy adolescents to compare spirometric data between fasters and non-fasters, where the study groups were matched in terms of gender and age. Ramadan fasting did not affect forced vital capacity (FVC), forced expiratory volume in 1 s (FEV1), FEV1/FVC, peak expiratory flow (PEF), and maximal mid-expiratory flow. Indeed, spirometric data in the pre-Ramadan, mid-Ramadan, and post-Ramadan were not different between the two groups. They concluded that Ramadan fasting does not affect the spirometric data of Tunisian healthy male adolescents (10).

There exist few studies in the literature concerning the effect of fasting on the exacerbation of asthma and variations in spirometry findings, with some reported conflicting outcomes (11, 12). While some studies report no interaction between fasting and spirometric findings (e.g., 13 and 14), other studies advocate that fasting alters spirometry data (see, e.g., 11, 12, 15, 16). For example, Latiri et al. reported that Ramadan fasting does not significantly alter spirometric parameters in non-smoking male adults aged 20 to 40 (13).

Siddiqui et al. studied 46 healthy males pre- and post-Ramadan regarding spirometry findings. They reported no significant change in lung function during Ramadan, compared to the pre-Ramadan period. FVC was decreased significantly in the post-Ramadan period, presumably associated with a significant increase in BMI (16). Subhan et al. studied 46 non-smoker healthy individuals for pulmonary functioning tests during the months of Shaban, Ramadan, and Shawwal. They reported no changes in pulmonary function tests pre- and post-Ramadan. However, FEV1 was increased post-Ramadan, and this increase was negatively correlated with changes in the BMI of patients (12). Moosavi et al. studied 117 healthy individuals undergoing spirometry 10 days before Ramadan, 2 times during Ramadan, and one time 10 days after Ramadan. It was found that the pulmonary capacity of healthy individuals increases during Ramadan (15). In another study, Benner et al. reviewed 1590 asthmatic patients who were hospitalized with asthma over four years in the pre-, mid-, and post-Ramadan months. They reported no significant statistical differences in spirometry findings before, during, and after Ramadan (17).

Erkekol et al. studied the effect of fasting on 121 fasting asthmatic patients. Of all patients, 96% stated the usability of inhalation treatments during fasting, whereas only 13% used their treatments during fasting. Most patients rearranged their inhalation medication-consumption hours to be before dawn and after Iftar. Likewise, 96% of patients received data about taking inhalation treatments during fasting from their physicians, but they referred mostly to religious authorities for making decisions. Accordingly, patients need to be properly followed up during Ramadan to control their continued use of medications (18).

In a cohort study in Mashhad, Norouzy et al. evaluated 29 (19 females and 10 males) well-controlled asthmatic patients with an average age of 47 years to assess the effect of fasting on the spirometric variables and clinical symptoms. They reported no significant changes in clinical symptoms in asthmatic patients at the end of Ramadan fasting. Among spirometric variables, only PEF was improved after Ramadan. There was also a significant

reduction in the mean PEF variability from 13% in the first week to 10% in the fourth week of fasting. Indeed, Ramadan fasting improved PEF and the mean PEF variability (6).

In another study, Askari et al. evaluated the effects of fasting on spirometry findings in 15 asthmatic patients compared to 14 healthy-matched controls. The parameters studied were hematological indices, inflammatory mediators, pulmonary function tests (PFT), and respiratory symptoms. Ramadan fasting significantly reduced the values of MCH and MCHC (in both groups) and monocyte counts (in asthmatic patients) while reducing platelet count in asthmatic and controls respectively compared to the pre-Ramadan fasting period. The hs-CRP level was significantly reduced in control and asthmatic groups after Ramadan fasting. In both groups, PFT values post-Ramadan were insignificantly higher than pre-fasting values except for FVC. In the asthma group, Ramadan fasting insignificantly reduced respiratory symptoms in asthmatic patients but resulted in a significant reduction in wheezing. Collectively, they reported that Ramadan fasting does not negatively affect asthma and may have some positive effect on asthma severity, as evident by a reduction of hs-CRP concentration and chest wheeze (1).

Adeli et al. studied the effect of fasting during Ramadan on asthma severity and pulmonary function tests. Their study enrolled 30 patients with asthma to assess impacts on asthma severity and pulmonary function tests in the months of Shaban, Ramadan, and Shawwal. The mean age of patients was 43.42 years and 43.3% of them were males. The mean scores for the asthma severity questionnaire were 20.4, 21, and 20.17 respectively during Shaban, Ramadan, and Shawwal, implying statistically no significant differences between the results of the pulmonary functioning test and asthma severity. Collectively, they concluded that fasting in patients with asthma does not affect pulmonary function and asthma severity (7).

Defining a new circadian rhythm in Ramadan and proposing a new pattern of drug consumption (chronotherapy) are two key alterations in Islamic fasting. This study investigates the effect of fasting in Ramadan on spirometric indices and respiratory symptoms in patients with asthma.

Materials and Methods

The present cohort study was conducted from May to June 2019. The study enrolled 120 volunteer patients with well-controlled moderate to severe asthma, based on GINA guidelines, referred to the lung super specialty clinics at Imam Reza Hospital in Tabriz. The participants were selected through the convenient sampling method. The overall sample size was estimated at 51 cases for each group using G-Power software version 3.1.9.2, assuming an alpha error of 0.05, a study power of 0.8, and an effect size of 0.5. Assuming the probability of loss to follow-up, 60 individuals were ultimately allocated to each group (120 cases for both groups).

The inclusion criteria were having previously diagnosed with asthma by a physician, being a Muslim patient aged 18-50, having FEV1 less than 80%, and manifesting two or more

asthma symptoms such as recurrent wheezing, cough, or chest tightness at rest, night, or early morning wheezing, activity-based cough or wheezing. The exclusion criteria were having concurrent cardiovascular disease, hypertension, hypo/hyperthyroidism, pregnancy, lactating women, recent respiratory disease, abnormal chest graphic, chronic cardiovascular or known neuromuscular disease, malignancy, chest deformations, and abdominal or thoracic surgery.

In this research, the patients meeting inclusion criteria were categorized into fasting (n: 60) and non-fasting (n: 60) groups, depending on whether they fast during the holy month of Ramadan. The demographic characteristics and respiratory symptoms were recorded in a pre-prepared checklist. The asthma control status was evaluated before and after Ramadan according to the Asthma Control Assessment Questionnaire. The questionnaire covered five items regarding the patient's status over the last month, including asthma severity (nocturnal and daytime), the need for a bronchodilator, the effect of assessing asthma control, and the degree of limitation in the patient's daily activities with a score ranging from 1 to 5 for each item. The overall scores above 20, from 15 to 20, and less than 15 were assumed to be well-controlled, poorly controlled, and very poorly controlled, respectively. All the patients underwent spirometry tests the day before and the day after Ramadan to assess pulmonary function. Before each spirometry, the patients were instructed on the study procedures. The best spirometry setting was chosen from three spirometry tests performed. The study was approved by the ethical committee of the university under the approval ethical code of IR.TBZMED.REC.1398.485. All the data were analyzed in SPSS 24.

Findings

The mean age of patients was 35.79±9.08 years, and the mean duration of fasting in the fasting group was 26.37±3.13 days. The minimum and maximum duration of fasting were 20 and 30 days, respectively. Table 1 compares the demographic information between fasting and non-fasting groups. As can be seen, both groups are similar in terms of demographic information and the duration of disease.

Patients underwent spirometry tests before and after Ramadan, with the results given in Table 2. As can be seen, there is no statistically significant difference in the spirometric parameters in the fasting group pre-Ramadan, as compared to the post-Ramadan period.

Similarly, there was no statistically significant difference in the spirometric parameters in the no-fasting group post-Ramadan, as compared to the pre-Ramadan period (Table 3).

Table 1. Demographic findings between fasting and no-fasting groups

		Fasting	**Non-fasting**	**p-value**
Age (years)		36.10±9.47	35.48±8.72	0.71
Gender	Male	40 (66.7%)	28 (46.7%)	0.13
	Female	20 (33.3%)	32 (53.3%)	

Place of accommodation	Urban	59 (98.3%)	60 (100%)	0.31
	Rural	1 (1.7%)	0	
Educational level	Illiterate	3 (5%)	1 (1.7%)	---
	Primary	3 (5%)	1 (1.7%)	
	Diploma	35 (58.3%)	63 (63.3%)	
	Bachelor	19 (31.7%)	19 (31.7%)	
	MSC and higher	0	1 (1.7%)	
Occupation	Self-employed	30 (50%)	31 (51.7%)	---
	Housewife	15 (25%)	16 (26.7%)	
	Employee	9 (15%)	10 (16.7%)	
	Mechanic	3 (5%)	1 (1.7%)	
	Farmer	3 (5%)	2 (3.4%)	
Duration of asthma disease (years)		8.43±1.57	7.10±3.10	0.41

Table 2. Spirometric findings before and after Ramadan in the fasting group

	Before Ramadan	**After Ramadan**	**p-value**
FEV1	83.19±15.46	83.85±18.27	0.14
FVC	90.14±16.27	90.48±14.58	0.75
PEF	67.14±27.96	66.92±22.56	0.90
FEV1/FVC	81.11±4.63	80.06±10.69	0.44

Table 3. Spirometric findings before and after Ramadan in the non-fasting group

	Before Ramadan	**After Ramadan**	**p-value**
FEV1	83.65±18.01	83.36±17.37	0.35
FVC	88.17±13.39	86.99±16.63	0.38
PEF	69.54±28.05	68.67±26.23	0.16
FEV1/FVC	81.70±5.66	81.57±5.91	0.51

Tables 2 and 3 compare the effect of Ramadan fasting on the spirometric parameters in asthmatic patients under chronotherapy before and after Ramadan. There was no statistically significant difference between the two groups before or after Ramadan.

Table 4 compares variations in spirometric findings for the pre-and post-Ramadan periods in fasting and non-fasting patients. As demonstrated, the changes are significant only for FEV1 in the fasting group compared to the non-fasting group. However, there is no

significant difference in other parameters between the two groups. Figures 1 and 2 show the results of the asthma control questionnaire before and after Ramadan between the fasting and non-fasting groups, respectively. As shown, despite the higher cases of well-controlled asthma in the non-fasting group before and after Ramadan, this difference is not statistically significant (P=0.151 for both groups).

Table 4. The changes in spirometric findings post-Ramadan compared to pre-Ramadan in the fasting and non-fasting groups

	Fasting	**Non-fasting**	**p-value**
FEV1 change (%)	1.5±46.37	-0.13±3.08	0.04
FVC change (%)	1.46±11.65	-1.24±11.87	0.20
PEF change (%)	3.42±22.53	-0.59±3.80	0.17
FEV1/FVC change (%)	-1.17±12.62	-1.17±12.62	0.54

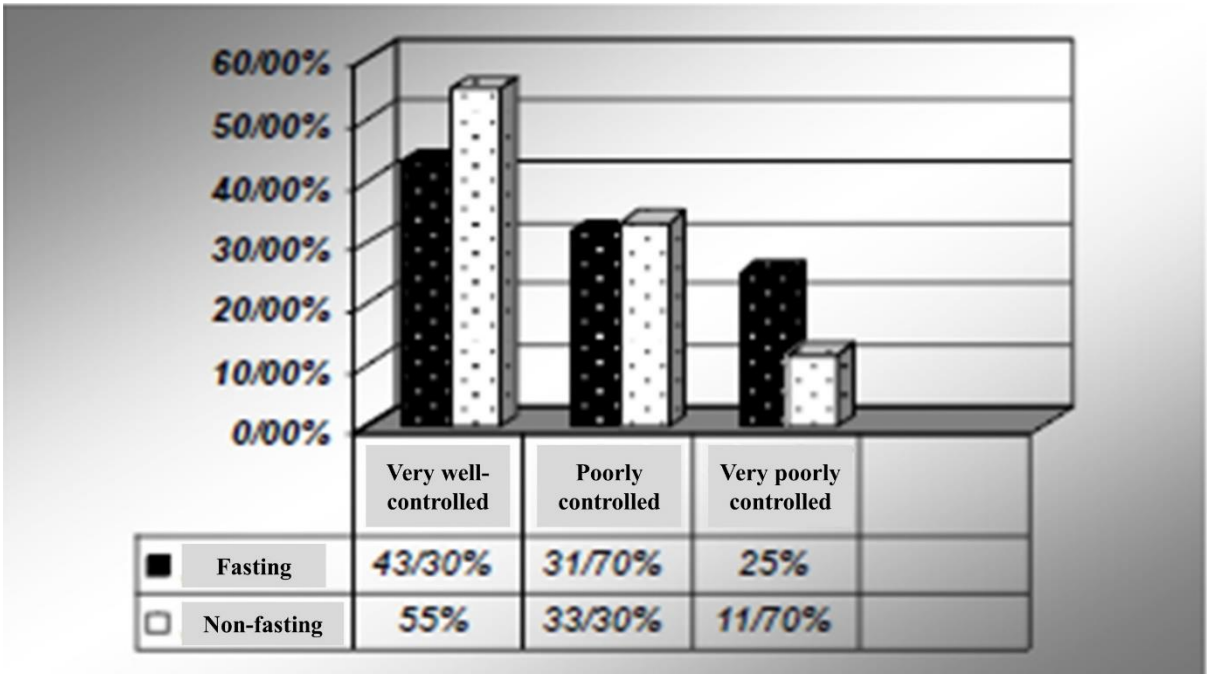

Figure 1. Asthma control diagram based on asthma control questionnaire before Ramadan between two fasting and non-fasting groups

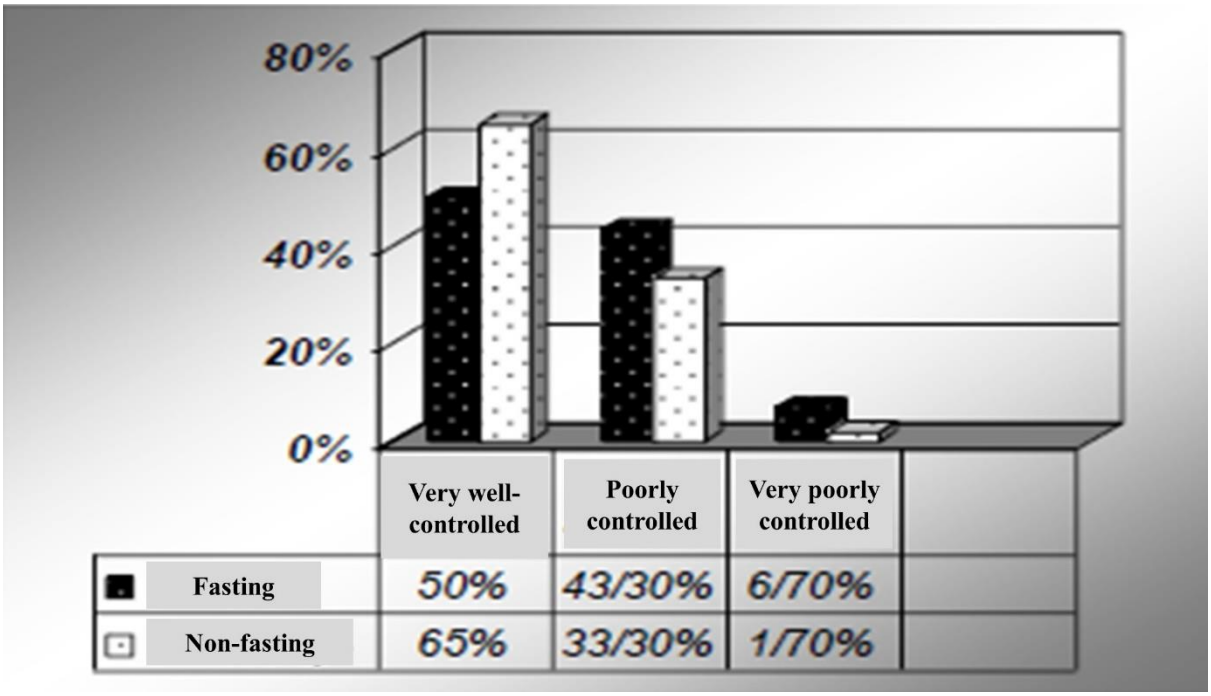

Figure 2. Asthma control diagram based on asthma control questionnaire after Ramadan between two fasting and non-fasting groups

Discussion

Ramadan fasting is a sacred duty for all Muslims, in which they should refrain from eating, drinking, and smoking from dawn to Iftar. During Ramadan, the sleep-wake cycle is disrupted and thereby may exert some effects on the body systems. Research has previously stated the positive and negative effects of fasting on some diseases such as diabetes and other endocrine diseases. Likewise, some studies have reported that fasting may worsen or improve symptoms in asthmatic patients.

This research assessed the effect of Ramadan fasting on the severity of asthma in asthmatic patients by measuring spirometric parameters. There was no statistically significant difference observed among fasting and non-fasting groups before and after Ramadan in terms of spirometric parameters. However, changes in FEV1 were more significant in fasting patients than in non-fasting patients.

There are few studies concerning fasting asthmatic patients with consistent similar results. In a study on 29 patients with controlled asthma, Norouzy et al. reported that of all the pulmonary function tests, only PEF improved after Ramadan. They further showed that PEF has declined from 13% at the beginning of Ramadan to 10% after four weeks (6).

Bener et al. reviewed 1590 asthmatic patients over 4 years and found no significant change in the pulmonary function tests when comparing Ramadan results with those pre- and post-Ramadan findings (17). There was similarly no change in the pulmonary function tests in patients before and after Ramadan in the present study.

Adeli et al. observed no significant difference between the pulmonary test results and the severity of asthma before and after Ramadan fasting in asthmatic patients (7). Indeed, fasting did not affect pulmonary test results tests, which is consistent with the results of the present study. Amini et al. reported similar findings for asthmatic patients, except for PEFR which was improved during Ramadan fasting (6). Likewise, Askari et al. reported that Ramadan fasting exerts positive effects on the severity of asthma (1).

No study has previously explored the effects of Ramadan fasting on the spirometric parameters in asthmatic patients. In the present study, Ramadan fasting altered and improved FEV1 in the fasting group, compared to non-fasting patients, implying the potential role of fasting in improving spirometric findings, though this is trivially evident in the literature. Other studies have primarily been concerned with the effect of fasting on healthy non-asthmatic individuals, with the results mostly revealing no significant difference in findings before and after fasting. For example, Siddiqui et al. studied 46 healthy men and found no significant changes in the findings of pulmonary tests during Ramadan. The only reported improvement after Ramadan was for FVC due to an increase in BMI (16). Similar results have been reported by Subhan et al. (12). They found an improvement only in FEV1 after Ramadan, which is in line with the results of the present study. However, Moosavi et al. reported that the pulmonary capacity of healthy individuals increases during Ramadan (15). Some research has shown that Ramadan fasting does not significantly alter symptoms of asthmatic patients, including dyspnea, cough, wheezing, and chest tightness by fasting (1). Similar findings have also been reported in other studies (18). The results of the present study revealed no significant change in asthma control in fasting or non-fasting asthmatic patients.

Erkekol et al. reported that Muslim asthmatic patients do not consider asthma as a barrier to fasting during Ramadan, and they, while continuing their medications and treatment habits, can remain fast during Ramadan (18). Research on other lung diseases has similarly reported that fasting does not affect spirometry findings. For example, Zouraei et al. studied male COPD patients and found that Ramadan fasting does not affect spirometry parameters (19). One reported reason for changes in respiratory markers during Ramadan is weight changes upon Ramadan fasting (17). Hakala et al. studied 15 overweight asthmatic patients and found that a low-calorie diet reduces weight and, thereby, decreases the volume of airway constriction (20).

Some other proposed parameters can alter the pulmonary function and disease severity during Ramadan, including reduced physical activity, low levels of food allergens, a lower stomach volume that comes with less pressure on the diaphragm in Ramadan, reduced smoking, and declined esophageal reflux. Similarly, hunger causes body stress and the release of catecholamines, culminating in dilated airways (7).

There are several hypotheses proposed in the literature to explain the contradiction in the results reported for the effect of Ramadan fasting in asthmatic patients undergoing chronotherapy. Some include cultural and economic diversity worldwide, diving on various

diets, gender-based hormonal differences, the season Ramadan is located in, and the general health status of people during this period (21, 22).

Conclusion

The results of this study reveal that Ramadan fasting does not significantly affect the severity of asthma and spirometric findings in patients with moderate to severe asthma. The best way to avoid asthma exacerbation or attacks is regular use of inhalation medication during Ramadan and altering and adjusting hours of medication use. However, more reliable results can be assumed when conducting research with a higher sample size and assessing series changes before, during, and after Ramadan.

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