

**Original research****THE IMPACT OF RAMADAN FASTING ON SLEEP AND TREATMENT COMPLIANCE IN PSYCHIATRIC PATIENTS: A SURVEY STUDY**

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**Abstract. Background:** During Ramadan, fasting is a duty for all healthy adult Muslims. During this month, there is a major and abrupt break in chrono-biological rhythms, sleep duration and timing, and the activity/rest cycle.

**Aims:** This study aims to explore the impact of the month of Ramadan, with its various biological, behavioral, and social repercussions, on mental health in Tunisian psychiatric patients who may or may not be fasting.

**Objective:** To determine the impact of the month of Ramadan on sleep and treatment compliance in psychiatric patients.

**Methods:** This was a survey study of all patients under follow-up at the Monastir psychiatric outpatient department for mental disorders, with two measurements during and after the month of Ramadan in 2019 (i.e., from May 05 to June 04, 2019, the number of hours of fasting in Tunisia was between 15h 43 min and 16 h 36 min). The data was analyzed in 2020.

**Results:** After studying 107 survey responses twice, during and after Ramadan, this study shows that sleep quality was significantly impaired during Ramadan for both fasters and non-fasters. There was also a significant difference between Ramadan and post-Ramadan in terms of treatment compliance; hence, adherence to treatment in the study population depended on the Ramadan effect and not the Fasting effect.

**Conclusion:** This study showed that sleep quality assessed by the ISI insomnia scale was significantly impaired during the month of Ramadan for both fasting and non-fasting subjects. Also, adherence to treatment in the study population depended on the Ramadan effect and not the fasting effect.

**Keywords:** Fasting, Ramadan, sleep duration, chrono-biological rhythms, psychiatry.

**INTRODUCTION** Before being abandoned by modern medicine, fasting, defined as the partial or total deprivation (with the exception, most often, of water), whether forced or not, of all food for a certain period [1], was a long part of the therapeutic arsenal in ancient times. It has been practiced for thousands of years by all the

major religions. In recent years, there has been renewed interest in fasting as a complementary therapy for cancer, inflammatory bowel disease, and metabolic disorders [2]. The motivations for fasting are manifold: weight loss and balancing various chronic diseases (hypertension, environmental allergies, intestinal imbalances) [3]. Therefore, voluntary fasting has become increasingly popular in our food-abundant societies and is often aimed at correcting a continuous excess of caloric intake that is harmful to health. Religious beliefs, such as the Ramadan fast, can also motivate voluntary fasting, where food deprivation is associated with spiritual enhancement. There are many types of religious fasting, intermittent or continuous, of varying duration, more or less restrictive,

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and associated or not with physical activity, prayer, and meditation [4].

Fasting is a duty for all healthy adult Muslims during the month of Ramadan, one of the five pillars of Islam. It's a very special time of year for Muslims worldwide, a time meant to be devoted to spiritual meditation, devotion to God, and self-control [5]. During this month, there is a major and abrupt break in chrono-biological rhythms, with a change in mealtimes, sleep duration, timing, and the activity/rest cycle [5].

Numerous publications have examined the effects of fasting on health, both religious and non-religious. Research in this field has found numerous health benefits [6].

The aim of this study was to explore the impact of the month of Ramadan, with its various biological, behavioral, and social repercussions, on mental health in Tunisian psychiatric patients who may or may not be fasting.

The objectives of this work were to:

1. Determine the impact of the month of Ramadan on sleep and treatment compliance in psychiatric patients.
2. Distinguish between the Fasting effect and the Ramadan effect in a population of patients with psychiatric disorders.

## MATERIALS AND METHOD

**Study Type.** The study is a descriptive, longitudinal, prospective research of all patients under follow-up at the Monastir psychiatric outpatient department for mental disorders with two measurements during and after the month of Ramadan in the year 2019 (i.e., from May 05 to June 04, 2019, the number of hours of fasting in Tunisia was between 15h 43 min and 16h 36 min) [7].

**Characteristics of the Sample.** The present study involved 107 patients under follow-up at the psychiatry outpatient department at Fattouma Bourguiba Hospital in Monastir, those who had consulted between the 2nd and 4th week of Ramadan fasting or not fasting and who had agreed to participate in the study. Among patients (n=250), those with a follow-up time of less than six months (n=18), patients whose diagnosis had not yet been established (n=3), and those who had refused to take part in the study (n=122) were excluded from the study. 66.35% (n=71) of the participants (n=107) were fasting. Patients hospitalized during this period were not included, as most of them had relapsed, which could constitute a selection bias. The established protocol is explained in Figure 1.

All participants signed written informed consent for engagement in the study. This work respects the rules of patient privacy.

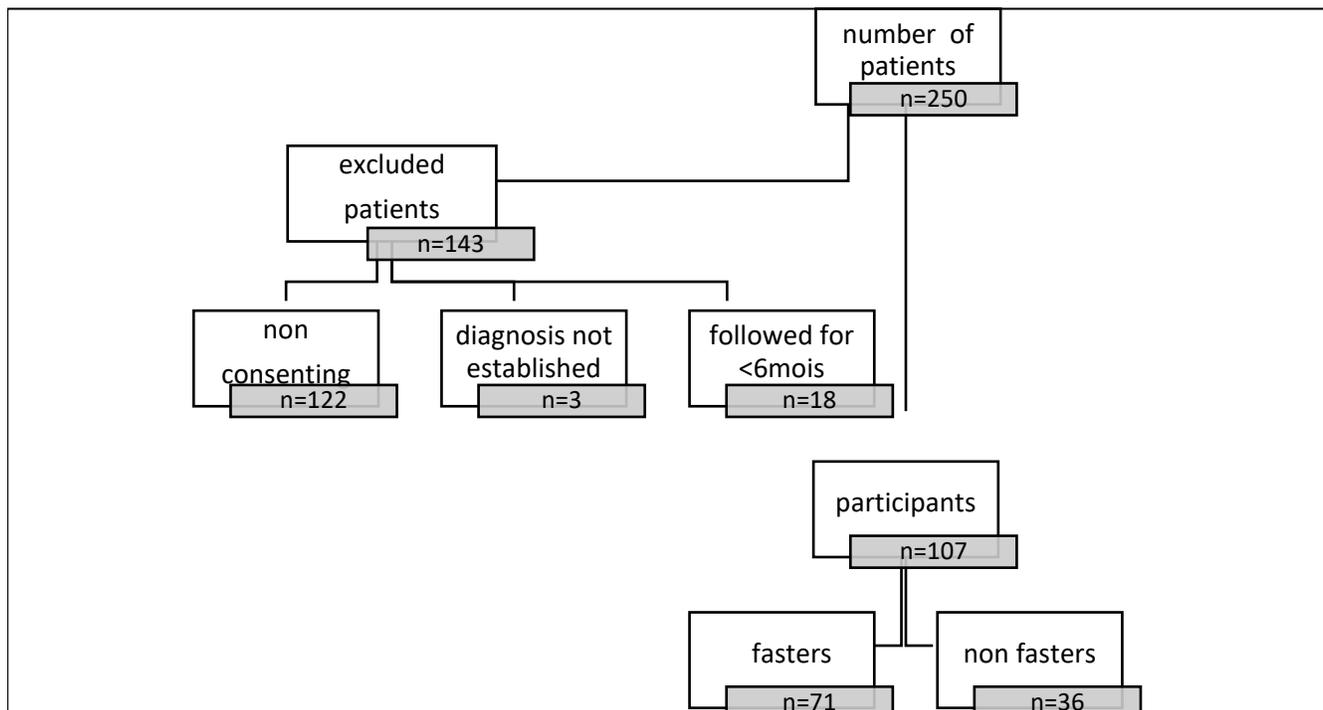


Figure 1. The chart flows.

**Study Protocol.** The literature describes various types of fasting. This study focused on Ramadan fasting, which is part of long fasting, defined as fasting for more than five days. For this reason, the choice was made to begin this study in the second week of fasting, when the physiological mechanisms of adaptation have already been brought into play [8].

Participants were assessed through a psychiatric interview carried out in two stages:

- A first examination on the day of their consultation between the 2nd and 4th week of Ramadan (T0);
- A second assessment outside the month of fasting, one month after the first date (T1).

Standardized symptom assessments were carried out using psychometric scales appropriate to each disorder. The latter serves as a measurement tool in psychiatry, carried out by the clinician, not as a self-administered questionnaire. An interval of one month between the two examination times was chosen to have the same climatic conditions at both times (to avoid the bias of climatic and seasonal effects) [9].

By dividing the study sample into two groups (fasting and non-fasting), we were able to distinguish between the Ramadan effect, which comprises all the changes observed in all participants (fasting and non-fasting) during the month of Ramadan, and the Fasting effect, which can only be identified in the group of fasting subjects.

**Definition of Variables.** The variables studied were:

- Sociodemographic characteristics (age, sex, marital status, number of dependent children, level of education, occupation, lifestyle habits, etc.).
- Personal and family medical and psychiatric history.
- Clinical data relating to psychiatric pathology (nature of the disorder, duration of evolution, underlying personality, etc.).
- Number of fasting days.
- Sleep disorders.
- Treatment compliance.

**Insomnia Severity Index (ISI).** Insomnia was assessed in all participants at T0 and T1 using an insomnia scale (Insomnia Severity Index: ISI) in its validated French version<sup>10</sup>. It is a test designed by Charles Morin in 1993, comprising 7 simple questions relating to insomnia severity (falling asleep, waking up early, maintaining sleep), patient satisfaction with sleep, disruption of

functioning, and deterioration in quality of life and degree of preoccupation with insomnia [10].

This test is interpreted as follows:

- 0-7: No insomnia.
- 8-14: Sub-clinical insomnia (sub-threshold).
- 15-21: Clinical insomnia (moderate).
- 22-28: Clinical insomnia (severe).

#### **Medication Adherence Report Scale (MARS).**

In its validated French version, the Medication Adherence Report Scale (MARS) was used to explore therapeutic adherence; it is a short and easy measurement instrument consisting of 5 questions scored from 0 to 5, to be completed with the patient [11].

The total score indicates compliance: the higher the score, the better the compliance. If the MARS total score is 21 or the score reaches 4 for each question, a patient was considered to be compliant with treatment.

## **RESULTS**

**Demographics and Social Functioning.** The study found a male predominance of 57% (n=61), with a sex ratio of 1.32. Out of the 46 females in the study, only 10 did not fast, compared to 26 out of 61 in the male group.

The mean age of the participants was 44.06 ±14.13 years. The most represented age group of patients was between 36 and 50 (35.5%). 30.8% of participants were aged between 20 and 35 years old. The group aged between 51 and 65 represented 28% of the participants in the study while participants between 66 and 80 were a minority representing 4.7%, with only 0.9% aged more than 80.

The participants' educational profiles showed that 55.1% (n=59) had a primary school education, 23.3% studied in high schools (n=25), 10.2% reached higher education (n=11), and 11.2% were illiterate (n=12).

**Psychiatric Diagnosis.** As the figure shows, major depressive disorder was the most common pathology in the study population (33.6%), with schizophrenia a close second (25.2%). Chronic delusional disorder and obsessive-compulsive disorder were the least represented diagnoses, with a similar percentage (0.9%). Other psychiatric disorders accounted for (5.6%): intellectual disability, unspecified psychotic disorder, and somatoform disorders.

**Interruption of Fasting for Fasters' Group.** Patients who continued fasting throughout the month of Ramadan numbered 77. This number of patients was significantly greater than those who could not continue fasting until the end of Ramadan ( $p < 0.01$ ).

Twenty eight percent of participants interrupted fasting for different reasons. 13.1% interrupted their fasting because of menstruation, 9.3% due to decompensation of organic diseases, and 5.6% of patients ( $n=6$ ) due to decompensation of their psychiatric pathology. Of the patients who interrupted fasting, two were being treated for bipolar disorder, two for schizophrenia, one for schizoaffective disorder, and one for major depressive disorder (Table1, Figure 2).

**Changes in Sleep Patterns during Ramadan.** Implementing the ISI insomnia scale at two different times (T0) and (T1) made it possible to estimate the prevalence among participants and compare this prevalence between T0 and T1, as shown in Table 2 and Figure 3.

For the fasting group, there was a statistically significant difference between the prevalence of insomnia between T0 and T1 ( $p < 0.01$ ). In the fasting group, insomnia was more frequent at T0.

**Assessment of Treatment Compliance.** Using the MARS adherence scale, the difference between the level of adherence to treatment at T0 and T1 was significant ( $p < 0.01$ ) for the entire study population (fasters and non-fasters). However, there was no significant difference in MARS compliance between the fasting and non-fasting groups ( $p = 0.495$ ). It can be deduced, therefore, that treatment compliance in the study population depended on the Ramadan effect, not the fasting effect.

**DISCUSSION**

**Demographic Factors**

The results of the present study showed that fasting during the month of Ramadan did not depend on the age of the participants. This was consistent with the results of an Algerian study which compared a group of students with

		Frequency	Percentage(%)		
<b>Interruption of fasting</b>	No	77	72,0		
	Menstruation	14	13.1		
	Decompensation of organic pathology	10	9,3		
	Decompensation of psychiatric pathology	Bipolar disorder	2	6	1.8
		Schizophrenia	2		1.8
		Schizoaffective disorder	1		0.9
		Major depressive disorder	1		0.9
<b>Total</b>	<b>107</b>	<b>100.0</b>			

Table 1. Causes of interrupting fasting.

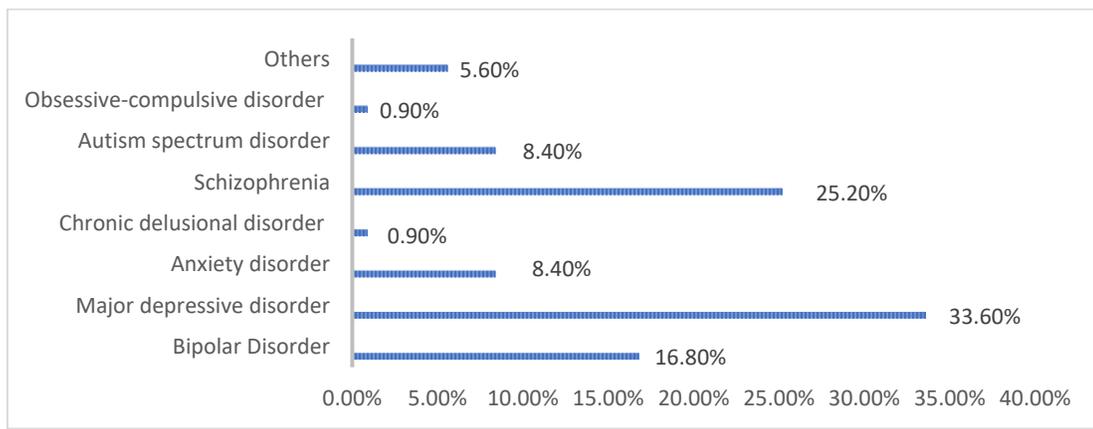


Figure 1: Distribution of patients by psychiatric diagnosis.

	<i>ISI 0</i>	<i>ISI 1</i>	<i>P</i>
<b>Average</b>	7.97±5.9	5.60±4.4	<0.01

Table 2. Average ISI insomnia scale in T0 and T1.

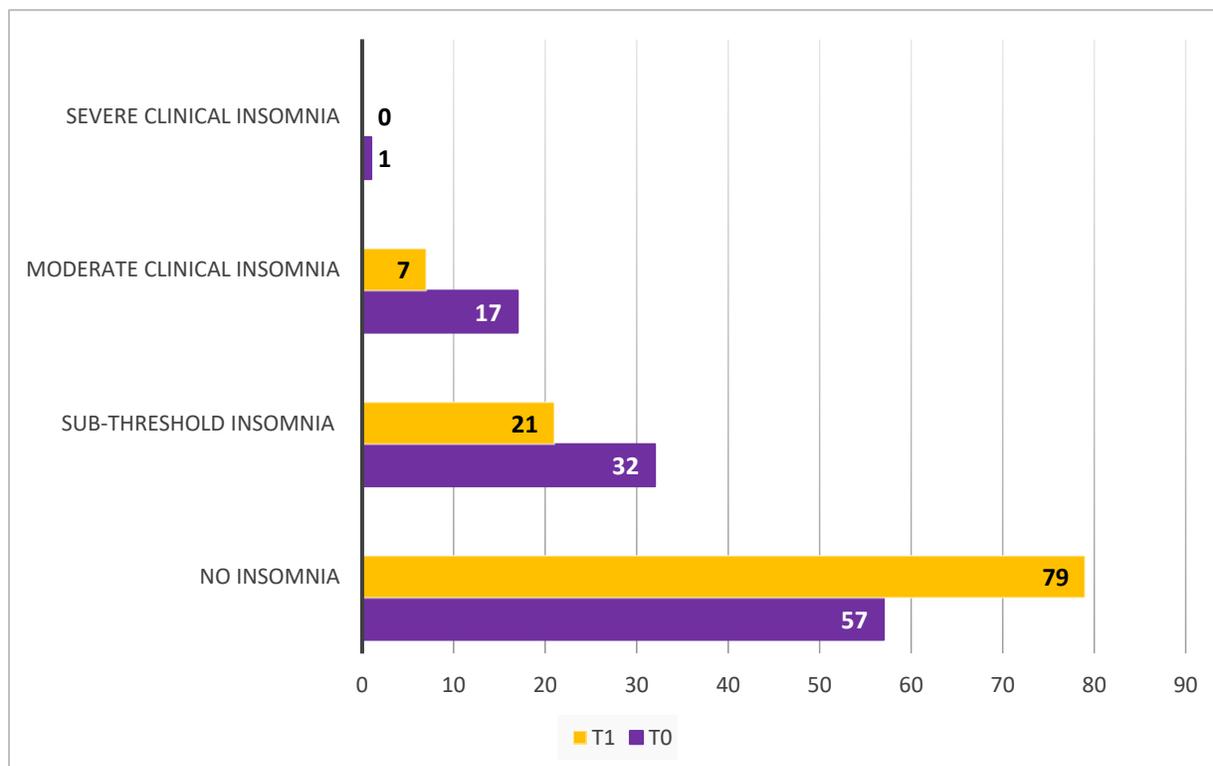


Figure 2. Prevalence of insomnia according to the ISI scale in the study population.

an average age of  $22.3 \pm 2.5$  years with a group of parents with an average age of  $48.7 \pm 7.6$  years and found no impact of age on whether or not they fasted [12].

When comparing men and women, the percentage of fasters was much higher in the female group. However, the choice of fasting between men and women has yet to be studied in most studies, which have focused solely on a group of fasting subjects. This makes the present study particular in that it included a group of fasters and non-fasters.

#### Causes of Fasting Interruption

The majority of participants in this study were able to continue fasting for 30 days. For those who interrupted the fast (28%), the dominant etiology was menstruation,

explained by Islam's prohibition of fasting during menstrual days [13]. Second is the decompensation of organic diseases such as diabetes mellitus.

Only six patients (5.6%) discontinued fasting because of decompensation of their psychiatric disorders. Two patients were being followed for bipolar disorder, two for schizophrenia, one for schizoaffective disorder, and one for major depressive disorder.

There are very few studies investigating the etiologies of fasting disruption. Kadri et al. conducted a study in Morocco of bipolar patients fasting during Ramadan, of whom two patients had manic episodes and stopped fasting [14]. Two other patients had depressive relapses and were excluded because they stopped fasting [14].

Only one patient stopped fasting because she suffered from a somatic problem (pulmonary sarcoidosis) [14].

#### **Ramadan and the History of Somatic Diseases**

Of the participants in our study, 42.1% had a history of chronic illness (diabetes, hypertension, dyslipidemia, thyroid dysfunction). This had no impact on their ability to fast during Ramadan, although they did require regular medication.

Herrag et al. were able to distinguish, through a literature review, the different types of somatic pathologies that have a higher risk of decompensation during fasting. These are essentially represented by gastro-duodenal ulcers and their complications (digestive hemorrhages or perforations), diabetes with a risk of acid-ketotic decompensation and hypoglycemia, asthma, and several other cardiovascular diseases [15].

The study carried out by Bouguerra et al. in 2003 on 25 Tunisian type 2 diabetics showed that fasting did not significantly change systolic or diastolic blood pressure between the periods before, during, and after Ramadan [16].

#### **Ramadan and Changes in Sleep**

The results of the present study were able to identify an alteration in the sleep quality of patients according to the Insomnia Scale (ISI). When comparing the two groups of patients (fasting and non-fasting), no difference was found in sleep changes between the two groups. This led to the conclusion that the changes in sleep parameters were linked to the Ramadan effect and not to the Fasting effect.

Sleep during the month of Ramadan has been studied qualitatively and quantitatively in numerous studies. Bahammam et al. used polysomnography to study the different stages of sleep objectively and showed a decrease in REM sleep duration during Ramadan [17]. However, the other stages of sleep were not altered [17]. This same result was demonstrated by the study by Roky et al. involving healthy volunteers, in whom it was found that fasting during Ramadan delays sleep onset and alters sleep patterns, particularly REM sleep [18]. Under normal conditions, REM sleep episodes are longer towards the end of the night. Other factors, such as cortisol and insulin, may account for the decrease in REM sleep, as an increase in nocturnal cortisol and insulin has been observed during Ramadan and after meals.

Moreover, REM sleep always occurs when there is a decrease in adrenocortical activity [18].

In a meta-analysis of sleep patterns among athletes by Trabelsi et al., no change in total sleep duration was found in athletes fasting during Ramadan in six out of eleven studies [19]. Four studies showed decreased total sleep duration during Ramadan [19].

The effect of the season in which Ramadan takes place was explored in the study by Berrichi et al., which showed that sleep is progressively out of phase from the first week and throughout the duration of Ramadan in summer; this generates a sleep debt that is not compensated by daytime naps [20].

Additionally, Margolis et al. used the Epworth Sleepiness Scale in medical students to study sleep disorders before, during, and after Ramadan. According to the latter scale, there was no significant variation in the score of students who were fasting between pre-, during, and post-Ramadan [21].

In a literature review conducted by Almeneessier et al., differing opinions were found regarding daytime sleepiness and the change in circadian rhythm during Ramadan [22]. Previous studies have suggested that fasting during Ramadan causes a delay in circadian rhythm, core body temperature, and hormone secretion [22]. However, more recent studies investigating lifestyle changes that may influence circadian rhythm have not demonstrated any effect of intermittent fasting during Ramadan on circadian rhythm [22].

#### **Ramadan and Treatment Compliance**

Therapeutic compliance is an important issue influencing the management of chronic diseases. For both fasters and non-fasters, the month of Ramadan represents a radical change in the rhythm of meals, life, and medication intake.

The present study showed that patients' adherence to treatment during the month of Ramadan decreased according to the MARS adherence scale. When comparing the fasting and non-fasting groups, the level of compliance was not significantly different between the two groups ( $p=0.49$ ). Consequently, this parameter was related to the Ramadan effect and not to the effect of fasting per se.

Impaired compliance during Ramadan was observed in patients followed up for hypothyroidism in the study carried out in 2019 in Morocco by Drissi et al. using the Morisky questionnaire [23]. According to their results, one in four patients had difficulty taking their treatment regularly. They concluded that fasting during the month of

Ramadan hinders compliance among hypothyroid patients [23]. Alternatively, in a study carried out in Tunis, most participants treated for bipolar disorder reported taking their medication regularly, i.e., on a daily basis, with no change in doses [24]. In another study carried out by Bouznad et al. on hypertensive diabetic patients, only 24.5% of these patients were fully compliant with the prescribed treatment, 30.8% of whom were fasting [25]. This study reported several causes of non-compliance, such as forgetfulness, the high cost of medication, treatment-related side effects, etc. [25]. According to the same reference, Ramadan is an additional factor in poor compliance, even in patients who are not fasting [25].

In a descriptive Tunisian study conducted by Chelbi et al. on fasting and non-fasting type 2 diabetic patients during Ramadan, poor compliance was found in 32% of fasters versus 28% of non-fasting patients [26]. This study showed that Ramadan could negatively influence therapeutic compliance [26]. No data, however, were found on the administration of antipsychotics during Ramadan in the study by Masood et al., aimed at determining the effect of Ramadan on the treatment of psychoses [27].

According to other studies, fasting during Ramadan has no negative impact on treatment adherence. During Ramadan 2010, 139 breast cancer patients were surveyed at the Egyptian National Cancer Institute to assess their adherence to Oral Hormone Therapy (OHT) [28]. The result showed adherence to OHT during Ramadan and the previous month to be 94.2% and 95.7%, respectively ( $p = 0.77$ ). Non-adherence to OHT before Ramadan and OHT of short duration ( $\leq 2$  years) was associated with non-adherence to OHT during Ramadan ( $p < 0.001$  and  $0.003$ , respectively) [28].

Chehovich et al. attempted to study the impact of Ramadan on physical and mental health through a review of the literature and a clinical case concerning a patient followed for schizophrenia [29]. The latter, while fasting during Ramadan, presented adverse effects under clozapine in the form of arterial hypotension. They deduced that drug titration should be slowed down, taking into account the reduced water and food intake during religious fasts, such as that observed during Ramadan, due to an increased incidence of adverse effects [29].

**Strengths and Limitations** Although this paper covers an understudied topic and compares diachronically between a time T0 and T1 and synchronically between two groups of fasting and non-fasting patients, there are still some

limitations. Indeed, the multitude of diagnoses split the sample into several subgroups. This limited the subgroups' size and presented a constraint in achieving statistically significant results. Evaluating the patients at T-1 before Ramadan would also lay a more thorough analysis.

## CONCLUSION

Fasting is an ancient practice currently enjoying renewed interest in various contexts, from religious rituals to medical practices to simple lifestyle choices. During the month of Ramadan, fasting involves abstinence from eating and drinking between dawn and sunset and a major change in mealtimes and eating habits, with related changes in several hormones and circadian rhythms [30]. To date, the literature does not agree on the impact of the month of Ramadan on patients with psychiatric disorders. This study showed that sleep quality, assessed by the ISI insomnia scale, was significantly impaired during the month of Ramadan for both fasting and non-fasting subjects.

According to the results of the present study, there was also a significant difference between Ramadan and post-Ramadan in terms of treatment compliance estimated by the MARS scale. However, when comparing the fasting and non-fasting groups, there was no significant change in compliance. Hence, we concluded that adherence to treatment in the study population depended on the Ramadan effect and not the Fasting effect. Broadening the scope of our research, gaining more details on this subject, and drawing more refined conclusions would be useful.

## Availability of data and materials

The data that support the findings of this study are available from the corresponding author upon reasonable request.

## Conflicts of interest

All authors declare that there are no conflicts of interest.

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