

# Irritability During the Month of Ramadan

NADIA KADRI, MD, AMINA TILANE, MD, MOHAMED EL BATAL, MRA, YAMNA TALIT, MRA,  
SAMIA MECHAKRA TAHIRI, PhD, AND DRISS MOUSSAOUI, MD

**Objectives:** We hypothesized that people in Morocco are more irritable during the month of Ramadan than during the rest of the year. Our objectives were to measure irritability in fasting Muslims during the month of Ramadan, to describe its various modes of expression, and to examine risk factors for this irritability. **Methods and Subjects:** We studied 100 healthy volunteers during the month of Ramadan for two successive years (1994 and 1995). All subjects were male (mean age,  $32 \pm 5.8$  years), and 51% of them were smokers. Irritability was assessed over a 6-week period (before, four times during, and after the end of Ramadan). We assessed both subjective (visual analog scale) and objective irritability. We also recorded the consumption of psychostimulants, duration of sleep, and anxiety level as measured by the Hamilton Anxiety Scale. **Results:** Irritability was significantly higher in smokers than in nonsmokers before the beginning of Ramadan. It was higher in both groups during the Ramadan month. Irritability increased continuously during Ramadan and reached its peak at the end of the month. Consumption of psychostimulants (coffee and tea) and anxiety level followed the same pattern. Smokers and nonsmokers had a similar pattern of irritability over time, but irritability increased more in smokers than in nonsmokers. **Key words:** Ramadan month, irritability, fasting, psychostimulants, nicotine.

ANOVA = analysis of variance; HAS = Hamilton Anxiety Scale; W0 = 1 week before beginning of Ramadan month; W1 = first week of Ramadan month; W2 = second week of Ramadan month; W3 = third week of Ramadan month; W4 = fourth week of Ramadan month; W5 = first week after end of Ramadan month.

## INTRODUCTION

Fasting during the month of Ramadan represents one of the five pillars of the Islamic religion. One billion Muslims around the world, as soon as they reach puberty, are required to comply with this religious obligation every year. During Ramadan month, practicing Muslims abstain from eating, drinking, and sexual intercourse from sunrise to sunset. People who are ill or traveling and women who are breast-feeding or menstruating are temporarily exempt from complying with these regulations. After the condition that precludes fasting resolves, individuals are required to complete a whole month of fasting, even after the month of Ramadan has passed.

Ramadan occurs in the ninth month of the lunar calendar, lasting between 29 and 30 days. The lunar calendar does not correspond to the Gregorian calen-

dar; therefore, Ramadan's occurrence can vary from one season to another.

Daily routines are markedly altered during Ramadan. They also vary depending on geographic situation, socioeconomic level, and specific customs of each country. In Morocco, fasting people eat two to three meals between sunset and sunrise. The first meal, called "ftour," is eaten immediately after sunset. The second meal is eaten 1 to 3 hours after the first and represents dinner. The last meal, "shour," is eaten 30 minutes to 1 hour before sunrise.

Thus, the obligation to eat only during the night leads to a definite change in the rhythm of life; sleep, eating schedule, and the alternation of rest and activity are especially affected. In Morocco, sleep duration becomes shorter, is delayed during the 24-hour cycle, and is interspersed with the last meal.

Abstaining from eating also implies the obligations of not smoking or drinking coffee, tea, or any other caffeine-containing beverage during fasting days. As a result, individuals substantially increase their caffeine and nicotine intake during the night.

It is well established that cigarette smoking produces dependence and that nicotine withdrawal syndrome is characterized by insomnia, irritability and frustration, anger, and anxiety (1). Aciri and Grunberg (2) assessed irritability in three groups of healthy individuals (nonsmokers, smokers who were asked to abstain from smoking for 12 hours before the experiment, and smokers who continued to smoke). They found significantly higher irritability in the group that abstained from smoking than in the two other groups. Lee et al. (3) also found a positive association between hostility and negative health habits such as smoking.

Caffeine is the most widely used drug in the world. It can be consumed from a number of different sources, including coffee, tea, and caffeinated soda. Caffeine stimulates the central nervous system (4), and several

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From the University Psychiatric Center (N.K., A.T., M.E., Y.T., D.M.) and Department of Biostatistics (S.M.T.), Faculty of Medicine, University Hassan Second, Casablanca, Morocco.

Address reprint requests to: Nadia Kadiri, MD, University Psychiatric Center Ibn Rushd, Rue Tarik Ibn Ziad, Casablanca, Morocco. Email: psych@casanet.net.ma

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studies have shown that its use can produce abuse or dependence (5, 6). Behavioral disorders resulting from caffeine use are widely known (1), and some of the symptoms are indistinguishable from the symptoms of anxiety (7). Cessation of caffeine use can induce such withdrawal symptoms as headache, decrease of arousal, and fatigue (8). Several other withdrawal symptoms have been reported, including anxiety, nausea, and cravings for caffeine (7, 9).

In this respect, the month of Ramadan represents an experimental opportunity to study the relationship between irritability and intake of nicotine and caffeine. As we noticed during the daily life in Morocco during this month, we expected that smokers would respond to fasting differently than nonsmokers.

The overall objective of this study was to explore the psychological changes that occur during the Ramadan month, especially changes in irritability and aggressiveness. We hypothesized that fasting people would be more irritable and more aggressive during this month. A second hypothesis was that smokers would be more irritable than subjects who usually avoid use of psychostimulants throughout the entire year.

### SUBJECTS AND METHODS

#### Subjects

Subjects were recruited from the population of Casablanca, Morocco. To participate in the study, subjects had to meet the following criteria: 1) to be Muslim, to fast during the Ramadan month, and to live in Morocco; 2) aged 25 to 50 years (to avoid disorders that could be linked to adolescence or aging); 3) no current psychiatric or somatic illness; 4) to be male (women were not included because of interruptions of fasting during menstruation, which might obscure the effects of sustained fasting) (3, 10).

#### Methods

After giving informed consent, subjects completed a questionnaire administered by a clinician. This two-part questionnaire (available from the authors) included questions about sociodemographic characteristics (eg, age and marital status), consumption of psychostimulants (number and schedule of intake of tea and coffee per day and of smoked cigarettes for the 6-week study period), and sleep pattern (habit of naps and usual number of hours of sleep).

Irritability was assessed with a visual analog scale, which is a scale for self-assessment of subjective irritability. Subjects were asked to draw a cross on a horizontal scale graduated from 0 to 10, with 0 corresponding to a feeling of being "free from any irritability" and 10 representing a feeling of "extreme irritability." Subjects were asked to score irritability felt at the time of the assessment.

Irritability was also assessed with a semistructured interview derived from Wing's Present State Examination (11). Investigators recorded the number of times the subject reported the following irritable behaviors: quarreling or wrangling with a family member, friend, or colleague or engaging in altercations while shopping or taking transportation. Investigators also counted the number of

times the subject reported beating his children, breaking things, or uttering obscenities. The global rating for objective irritability was calculated by summing the scores of all of its components.

The HAS (9) was systematically administered during the six weekly assessments. This scale assesses somatic and psychological anxiety. Each of the 14 items was scored from 0 to 4, with 0 indicating an absence of anxiety and 4 indicating extreme anxiety felt or shown by the subject.

#### Study Design

This prospective study was conducted during the fasting month of Ramadan for two consecutive years (February 1994 and 1995; 1414 and 1415, respectively, in the Hegirian calendar). Fifty percent of the sample participated during both years. Smokers were included and were matched with nonsmokers by age and marital status. The statistical analysis was performed after the end of inclusion of the whole sample.

The fasting month usually starts without any particular preparation. People switch abruptly from their usual lifestyle to a different one, changing their alimentary rhythm as well as the duration and rhythm of sleeping. At the beginning and end of the month, the person must adapt to these changes. Therefore, we assessed subjects before, during, and after the end of Ramadan. Assessments were conducted 1 week before the beginning of the Ramadan month (W0); during the first (W1), second (W2), third (W3), and fourth week (W4) of Ramadan; and 1 week after the end of the month (W5). Assessments were conducted between 2 and 4 PM on the first day of each week.

#### Statistical Analysis

Data analysis was performed on a personal microcomputer using Epi Info, version 6.04 Fr (CDC, Atlanta, GA), and SPSS, version 7.5 (SPSS, Inc, Chicago, IL).

*Univariate analysis.* The  $\chi^2$  test was used to compare discrete variables; to compare means, we used the *t* test for two means and ANOVA for more than two means.

*Repeated measures.* To compare the irritability of subjects at different weeks of follow-up, two-factor, repeated-measures ANOVA was used. This univariate approach has a higher level of power than multivariate ANOVA. Mauchly's test was used to check the basic hypothesis by using repeated-measures ANOVA. When the results of Mauchly's test were not significant, repeated-measures ANOVA was performed. When the results were significant, the epsilon adjustment was used before ANOVA was performed.

#### Linear regression

To measure the specific effect of each variable (age, coffee, tea, and tobacco), a linear regression was conducted using the enter method. All variables were entered together. The dependent variable was irritability, a quantitative variable; the independent variables were age and tea, coffee, and tobacco consumption.

All analyses were performed with irritability as both an objective (first analysis) and subjective (second analysis) variable. To take into account the interaction between independent variables, an interaction term was entered in the model.

Results of all statistical tests were considered significant at  $p < .05$

**RESULTS**

Our original sample included 108 subjects; 2 subjects stopped fasting because of illness, and 6 subjects dropped out of the study. The final sample included 100 subjects. There were 49 nonsmokers and 51 smokers.

Among nonsmokers, the mean age was  $34.9 \pm 5.15$  (SD) years. Sixty-five percent of the group was married, and 89.8% were employed. Ninety-four percent reported regular consumption of psychostimulants: 38.8% drank coffee and tea regularly, 46.9% drank only tea, and 8.2% drank only coffee. For the coffee drinkers, the mean number of glasses or cups per day was  $0.9 \pm 1.2$ ; for tea drinkers, the mean number per day was  $3.08 \pm 2$ .

Among smokers ( $N = 51$ ), the mean age was  $35.7 \pm 5.9$  years. Fifty-five percent were married, and 88.2% were employed. At W0, 100% of smokers reported consumption of psychostimulant beverages: 90.2% of subjects drank coffee and tea, 7.8% drank only coffee, and 2% drank only tea. The mean number of glasses or cups per day was  $5.8 \pm 1.66$ . For coffee drinkers, the mean number of glasses or cups per day was  $2.8 \pm 1.4$ ; for tea drinkers, it was  $2.6 \pm 1.5$ .

The two groups were comparable in age ( $F = 0.45$ ,  $p = .45$ ) and marital status ( $\chi^2 = 1.13$ ,  $df = 1$ ,  $p = .28$ ).

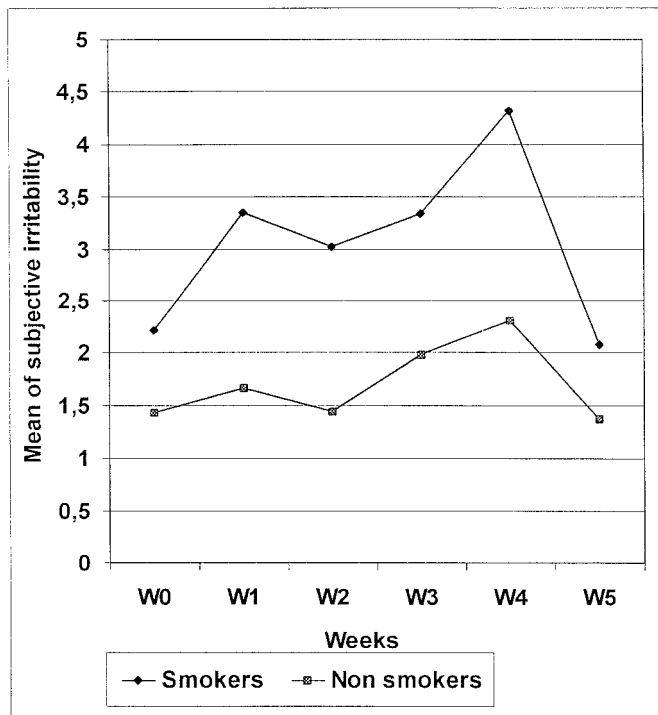


Fig. 2. Subjective irritability during the 6 weeks of the study.

**Change in Sleep Duration**

Globally, the mean duration of sleep as reported by the subjects was significantly longer during the first week of the study than during the following weeks (Fig. 1). There was no significant difference in sleep duration between the two groups ( $F = 0.29$ ,  $df = 1$ ,  $p = .58$ ). On the other hand, sleep changed significantly over the study period ( $F = 5.67$ ,  $df = 5$ ,  $p = .0001$ ).

In nonsmokers, there was a significant decrease in sleep duration at night during the first week of Ramadan, from 7.87 hours in W0 to 7.15 hours in W1 ( $p = .0001$ ). There was a slight improvement in sleep duration in W2 and W3. However, the difference remained significant between W0 and W2 ( $p = .002$ ) and between W0 and W3 ( $p = .002$ ). The difference was not significant between W0 and W4 ( $p = .065$ ). Finally, sleep duration decreased significantly in W5 as compared with W4 ( $p = .007$ ).

In smokers, there was a significant decrease in sleep duration at night during the first fasting week of Ramadan, from 7.87 hours in W0 to 7.18 hours in W1 ( $p = .001$ ). During the ensuing weeks of Ramadan, the decrease remained significant.

**Evolution of Irritability**

*Subjective irritability (visual analog scale).* Globally, there was a significant difference in scores of

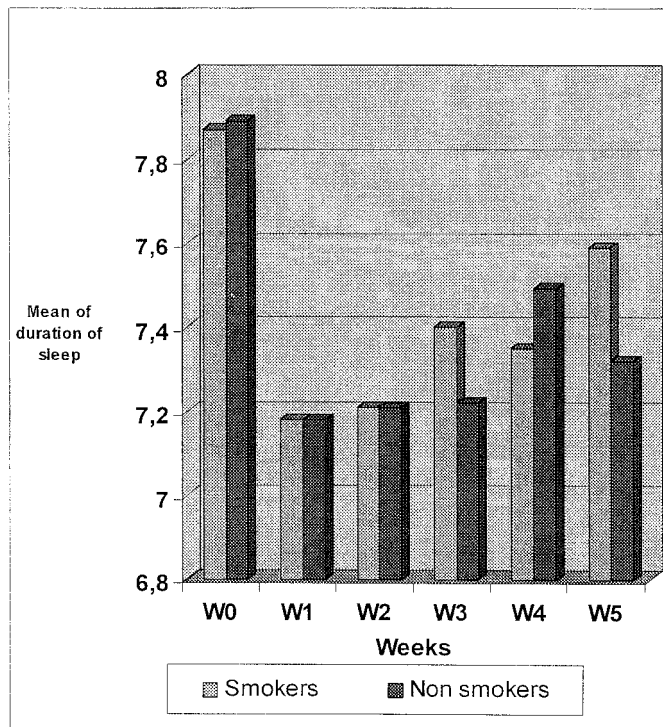


Fig. 1. Sleep duration in the two groups of the sample population during the 6 weeks of the study.

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subjective irritability between the two groups for the entire duration of the study ( $F = 81.7$ ,  $df = 1$ ,  $p = .0001$ ) (Fig. 2).

In nonsmokers, there was a progressive increase in subjective irritability. The significant peak occurred during W4 as compared with W3, with an average score of 2.3 ( $p = .013$ ). This peak was followed by a decrease in W5 back to the baseline level. In this group, the mean scores of subjective irritability were significantly different throughout the 6 weeks of the study ( $p < .01$ ).

In smokers, scores on the visual analog scale increased significantly from 2.22 in W0 to 3.35 in W1 ( $p = .0001$ ) and to 4.3 in W4 ( $p = .0001$ ). Scores decreased sharply in W5 (2.08), becoming similar to baseline scores. In this group, the mean scores of subjective irritability were significantly different during the 6-week study period ( $p < .01$ ).

The group-by-week interaction for the two groups was significantly different during the 6-week study period (within-subject difference:  $F = 2.739$ ,  $df = 11$ ,  $p = .003$ ).

**Objective irritability (from interview).** In nonsmokers, there was a slight increase in objective irritability in W1, followed by decreases in W2 and W3. Another nonsignificant increase occurred during W4 even though irritability reached its peak (score = 1.29,  $p = .08$ ) (Fig. 3).

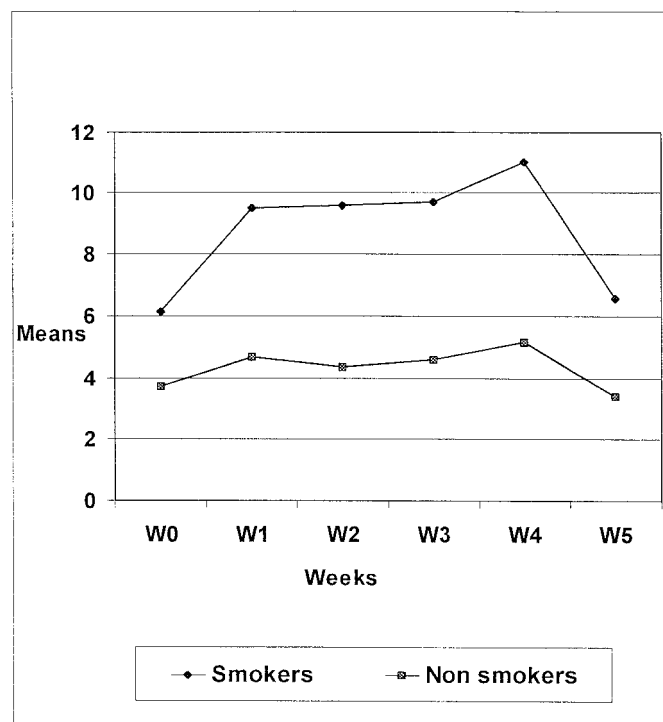


Fig. 3. Objective irritability during the 6 weeks of the study.

Among smokers, there was also a progressive increase in objective irritability during W1 ( $p = .14$ ). This increase achieved significance at W4, peaking with an average score of 2.53 ( $p = .0001$ ). During W5, irritability decreased sharply and returned to the baseline level ( $p < .001$ ).

The group-by-week interaction for the two groups was not significantly different ( $F = 1.475$ ,  $df = 11$ ,  $p = .197$ ). The difference between mean scores of objective irritability in the two groups during the 6-week study period was also not significant.

**Regression analysis.** Subjective irritability. The regression analysis for irritability showed a significant correlation between cigarette smoking and subjective irritability ( $\beta = 0.294$ ,  $t = 0.236$ ,  $p = .020$ ) and a nonsignificant association for coffee ( $\beta = -0.106$ ,  $t = -0.827$ ,  $p = .411$ ), tea ( $\beta = -0.05$ ,  $t = -0.478$ ,  $p = .633$ ), and age ( $\beta = 0.046$ ,  $t = -0.461$ ,  $p = .646$ ).

**Objective irritability.** The regression analysis for interview-assessed irritability showed a nonsignificant correlation between irritability and cigarette smoking ( $\beta = -0.095$ ,  $t = -0.745$ ,  $p = .458$ ). The same result was found for coffee intake ( $\beta = -0.043$ ,  $t = -0.327$ ,  $p = .745$ ), tea intake ( $\beta = -0.083$ ,  $t = 0.770$ ,  $p = .443$ ), and age ( $\beta = -0.040$ ,  $t = -0.398$ ,  $p = .695$ ).

### Change in Anxiety

Globally, a significant difference was found between smokers and nonsmokers ( $F = 1$ ,  $df = 1$ ,  $p < .0001$ ) and across the 6 weeks of the study ( $F = 5.46$ ,  $df = 5$ ,  $p = .0001$ ) (Fig. 4).

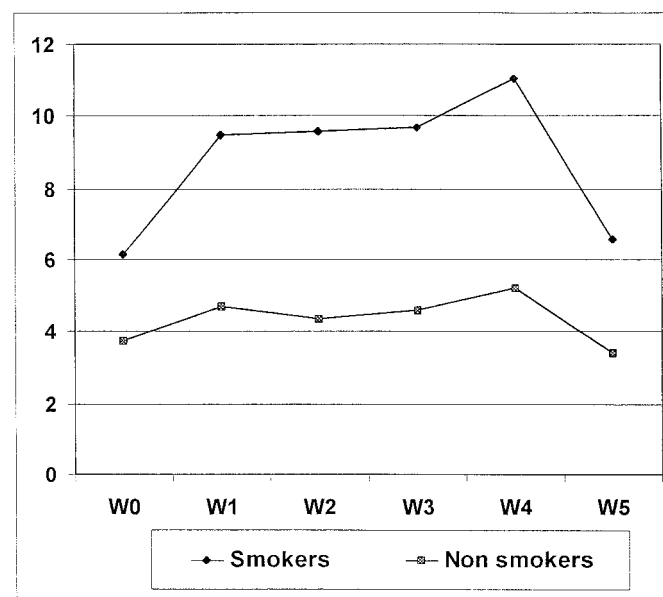


Fig. 4. HAS scores during the 6 weeks of the study.

In nonsmokers, there was a slight increase in the HAS score during the weeks of fasting. The peak was reached in W4, but the difference was not significant.

In smokers, there was an increase in anxiety level during W1. Scores increased from 6.14 during W0 to 9.47 during W1 ( $p = .0001$ ). During W2 and W3, scores did not vary significantly. There was a second significant peak during W4, with an average score of 11.02 ( $p = .0001$ ). During W5, the score returned close to the baseline level (6.65).

## DISCUSSION

### Irritability

During the week before Ramadan, smokers were significantly more irritable than nonsmokers. During the fasting period, the level of subjective and objective irritability showed an interesting pattern of progression. The most important finding is the occurrence of a significant peak in W4, confirming that people were more irritable at the end of the Ramadan month.

Different factors were analyzed to find an explanation for the higher level of irritability among smokers as compared with nonsmokers and during Ramadan in general.

*Tobacco use.* The levels of irritability during different weeks of the fasting month were higher in smokers than in nonsmokers. Tobacco use was a risk factor for higher subjective irritability during Ramadan. This finding is in concordance with results of most studies of smoking elsewhere in the world (1, 3, 12, 13). This result is also consistent with the results of Acri and Grunberg (2), who quantified the level of reactive irritability to environmental stimulating events. These authors found that the degree of irritability among abstinent smokers was higher than that among nonsmokers and smokers.

*Sociodemographic data.* There was no statistical difference between the two groups in age or profession. There was a higher level of irritability among the youngest people, but the regression analysis showed no correlation between age and irritability. These results are not consistent with those of Snaith and Taylor (13), who observed a negative relationship between age and irritability. This discordance could be explained by the fact that only people under the age of 50 years were included in our study.

*Caffeine consumption.* The highest consumption of psychostimulant beverages was observed among smokers. It increased during the 6 weeks of the study in both groups, with peaks in W1 and W4, followed by a decrease after the end of the fasting month. The

pattern of consumption of psychostimulant beverages during Ramadan was parallel to the level of irritability.

This higher consumption of psychostimulant beverages among fasting people was not correlated significantly with higher irritability in either group. Thus, in this study, the consumption of psychostimulant beverages did not represent a risk factor for irritability, contrary to what has been reported in the literature (4, 14).

*Sleep disturbance.* During the fasting month, the total amount of sleep decreased, apparently in relation to disruptions of sleep rhythms. In particular, subjects described a shift in their usual bedtime and a period of disrupted sleep related to awakening for the shour. The second reason for this decrease of sleep duration seemed to be related to use of psychostimulant beverages during the night.

Previous studies on sleep and vigilance during the fasting month (15) have shown that the decrease in sleep time and its fragmentation by one or several awakenings have a negative influence on cognitive functions, such as a decrease in vigilance during the first week of fasting. Impairment generally disappeared slowly during the second and the third weeks of Ramadan, returning to the baseline level during the fourth week.

Contrary to the studies on vigilance and attention, our study did not find the same type of psychological adaptation. Notably, we found an increase in irritability at the end of the month. The persistence of diminished sleep duration at the end of the fasting month in this study may explain the peak of irritability associated with the consumption of psychostimulant beverages, the overall disturbance in life rhythms, and abstinence from tobacco use.

*Anxiety.* During the first week of the study, before the start of Ramadan, anxiety scores among smokers were significantly higher than among nonsmokers. This suggests that anxiety in the smoking group shows no relationship with Ramadan, which raises an important question: Is anxiety a cause or a consequence of tobacco use? This issue has been addressed by several authors (16, 17).

It is important to note that progression of anxiety symptoms followed the same pattern as irritability, especially during the first and fourth weeks of the fasting month. This simultaneous increase of degree of irritability and anxiety was more marked among smokers than nonsmokers.

The common pattern of irritability and anxiety during the 6 weeks of the study suggests that they are linked. These results are consistent with other findings showing that irritability might be a symptom of anxiety (4, 13). Higher consumption of psychostimulant

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beverages, use of tobacco, and diminished sleep duration may also play a role in this relationship.

### CONCLUSION

This study showed a significant increase in irritability during the month of Ramadan. Irritability seems to be related to several lifestyle factors, especially the use of nicotine and the reduction in the amount of sleep. There are several limitations of this study that should be addressed in future research, namely that the size of the sample was small and the sample did not include women or anyone less than 25 or more than 50 years old. Thus, future research should be based on a representative sample of the general population and should take into account other issues, including alcohol withdrawal, drug abuse, and other psychological impairments during this month.

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