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# INFLUENCE OF RAMADAN FASTING ON THE FATIGUE LEVELS AND SLEEP PATTERNS AMONG DENTISTS IN QASSIM REGION, SAUDI ARABIA – A CROSS-SECTIONAL STUDY

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**Abstract**

Ramadan fasting might induce several changes that might affect work performance. Both fatigue as well as sleep are one of the important parameters to be observed for this effect. This study aimed to determine the impact of Ramadan fasting on fatigue as well as sleep of Dentists working in Qassim region of Saudi Arabia. Dentists, working in private as well as Public sector were invited to complete the questionnaire twice, one week before Ramadan and then during the second or third week of Ramadan. Fatigue severity scale (FSS) and the FOSQ 10 to measure the subjective perception of global fatigue and difficulty carrying out daily activities due to sleep problems. The FSS is a self-administered 9-item questionnaire in which each statement is scored between 1 (strongly agree) and 7 (strongly disagree).

The FOSQ 10 is also a self-reported questionnaire with ten item questions. Every question can be scored on a 4-point measuring tape (1–4). 121 of them responded and completely filled the questionnaire.

The results of the present study showed no significant changes on the overall sleep pattern or fatigue level, though minor changes at subscale were noted.

**Keywords**: Ramadan, Fasting, Fatigue, sleep.

## INTRODUCTION

Ramadan is the ninth month of the Islamic lunar calendar and fasting during Ramadan is a religious duty for all healthy adult Muslims. Hundreds of millions of people observe the Ramadan fasting each year as more than a billion people worldwide follow Islam. (1) The fasting period involves abstinence

from food and drinks from dawn to sunset during the entire month of Ramadan for a period of 29 or 30 days, depending on the time of the year. [2]
The geographical location, as well as the season, influences the length of fasting. Therefore, when studying sleep patterns during Ramadan, it is essential to report the time of year and the times of dawn and sunset. [3]

During fasting, many lifestyle changes are observed, such as dietary changes, reduction of energy intake, delaying the start of work, shortening working hours and working late at night. [4]Alterations in sleep patterns have been observed, especially in some Islamic countries. All these changes have an impact on working conditions and day-to-day performance of certain activities and tasks. [5]

Fatigue is an important factor to be determined for daily performance as it is strongly related to poor physical performance, including during RF. "Fatigue is defined as a subjective experience and includes such symptoms as rapid inanition, persisting lack of energy, exhaustion, physical and mental tiredness and apathy''. [6] Fatigue is the result of multiple factors, such as time of awake, time of day, and workload. Because fatigue has an impact on regular daily activities and performance at the workplace, fatigue should be studied thoroughly during the time of Ramadan fasting. [7]

Studies have analyzed the effect of RF in patients with metabolic disorders, such as diabetes [8], kidney-related problems [9], and asthma [10]. In patients, health professionals should carefully monitor the RF. Other studies also reported the effect of RF on young males [11-13], health care workers [14]
Many studies have investigated the effect of Ramadan on dental patients and their oral health and habits during Ramadan [15,16,17], to the best of our knowledge, no study has investigated the effect of Ramadan fasting on the performance of dentists.
Hence, our study aims to investigate the effect of Ramadan fasting on the performance of dentists working in dental polyclinics and hospitals in Al Qassim region: Buraydah and UNaizah.

## Materials and Methods:

### Type of study

This is a descriptive and cross-sectional study performed one week before Ramadan, during the last week of Shabaan (which was used as a baseline), and during the second and last week of Ramadan between March and April 2023. During the study period, fasting day was about 13 to 14 hours, dawn (beginning of fasting) was between 04.15 to 4.45 am, and sunset (end of fasting) was between 06:15 and 06:30 pm. The weather was hot, with an average ambient temperature of approximately 30 °C. - 35˚C.
The university ethics committee approved the study and informed consent was obtained from each participant.
Participants
The study was carried out in private and public dental hospitals, dental clinics, and polyclinics, as well as in dental colleges in the Qassim region.
Muslim Dentists who were working and had been fasting during Ramadan for more than 15 days were included in the study; however, those who did not fast consistently, pregnant females and lactating mothers were not included in the study. Approximately 200 subjects were approached at the beginning; around 80 had immediately refused to participate because of lack of time or interest in the studied subject. As a result, 121 participants agreed to participate in this study.

### Data collection

Participants were requested to complete an anonymous self-administered questionnaire with honesty and were assured of the absolute confidentiality of all their responses. It contained questions concerning the following aspects: demographic parameters, socioeconomic conditions, habits and

pathological antecedents, working conditions, eating behaviors, sleepwake schedule, quality of sleep, wakefulness at work, and daytime performance.

The questionnaire consisted of the Fatigue Severity Scale (FSS) to measure the subjective perception of global fatigue, and the FOSQ 10 to measure difficulty in performing daily activities due to sleep problems. The FSS is a self-administered 9-item questionnaire, in which each statement is scored between 1 (strongly agree) and 7 (strongly disagree). The FOSQ 10 is also a self-reported questionnaire with ten item questions. Each question was scored on a 4-point measuring tape (1–4). "The FSS was selected because it is one of the best-known and the most commonly used fatigue scales. Its brevity and simple self-report format make it a cost-effective alternative to elaborate methods. Furthermore, its availability in several languages is also considered an advantage, suggesting worldwide acceptance from the scientific community''. [18]

''The Functional Outcomes of Sleep Questionnaire (FOSQ) is a gold-standard, disease-specific instrument designed to assess the impact of sleepiness on the ability to conduct daily activities, conceptually defined as functional status, a component of quality of life." "The short version of the FOSQ is brief and can be easily administered, with strong psychometric properties of reliability and validity that adequately assess how symptoms of daytime sleepiness affect daily activities.'' [19,20] The total score will be used to interpret the degree of impairment associated with daytime sleepiness.

**Statistical analysis**

**Sample Size Determination**

Minimum sample size required for the survey for each group was determined using the formula

n= 〖2(z_(α⁄2))〗^2/d^2

where n is the sample size, α is the level of significance, and d is the effect size (Cohen's d.

The researcher has chosen The level of significance as 0.05 (i.e., $p<0.05$) and Cohen's d as 0.25. Table values of =1.96 (obtained from standard normal table). The formula for the minimum value of n resulted in 62 patients per subgroup, and the total sample size was 121.

Data were analyzed using the statistical package SPSS version 26.0. The following statistical tools were used to analyze the data.

**Statistical Analysis of data**

Descriptive statistics: Frequency tables, Percentages and Cronbach's Alpha for Reliability test for the Questionnaire

Hypothesis Testing: Chi-square, p-value and McNemar's test

The data were analyzed (SPPS 26.0) using descriptive statistics and expressed in the text and tables as mean ± standard deviation or as percentages, when appropriate. Comparisons of continuous variables were performed using paired tests. When the difference was significant, post hoc testing was performed using Dunn's multiple comparison test. The chi-square test was used for discrete variables. Statistical significance was set at $p<0.05$.

**Results**

**Demographic characteristics**

A total of 121 registered dentists employed in hospitals, communities, and public health settings and dental graduates were recruited to participate in the study. Before sending the online questionnaire, an overview of the purpose of the study was well explained in person, including the importance of filling out the questionnaire twice, before and after Ramadan. All the subjects completed the questionnaire correctly, with a response rate of 100%. The sex ratio was 66%, with a male predominance, and 33.1% of the patients were female. 62% of the participants were single, and 38% were married. 64.the participants, 64.5 profile weree was in the private sector, and 3were% was in the public sector. Among the participants, 84.3% stayed with their families, whereas only 15.7% stayed alone. There were more dental graduates (60.3%) in the survey, whereas only 14.9% were students/interns. Of the participants, 79.3% had less than ten years of work experience, whereas

20.7% had more than ten years of work experience. Of the participants, 58.7% worked the morning shift, whereas 41.3% worked the night shift.

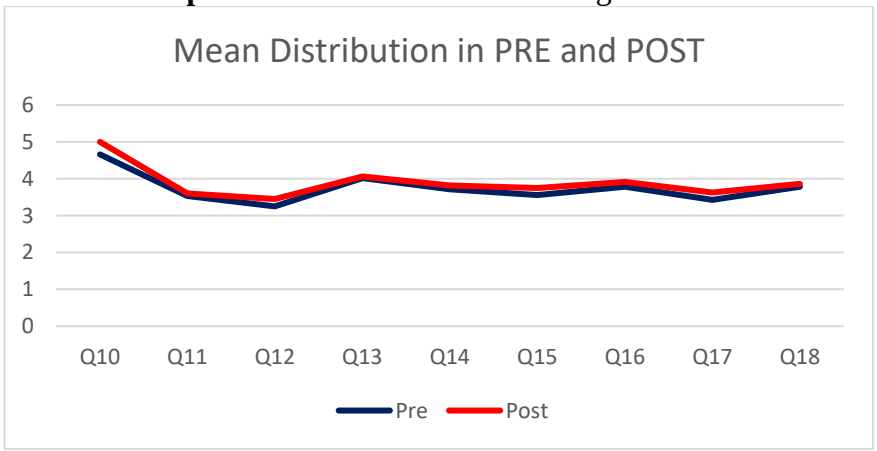
**Table 1** summarizes the baseline characteristics of our population

| Variables | | Freq | % |
|---|---|---|---|
| Gender | Female | 40 | 33.1% |
| | Male | 81 | 66.9% |
| | Total | 121 | 100.0% |
| Age | 20-29 years | 75 | 62.0% |
| | 30-39 years | 34 | 28.1% |
| | 40-49 years | 11 | 9.1% |
| | 50-59 years | 1 | 0.8% |
| | Total | 121 | 100.0% |
| Marital status | Married | 46 | 38.0% |
| | Single | 75 | 62.0% |
| | Total | 121 | 100.0% |
| Work profile | Private sector | 78 | 64.5% |
| | Public sector | 43 | 35.5% |
| | Total | 121 | 100.0% |
| Staying with | Alone | 19 | 15.7% |
| | Family | 102 | 84.3% |
| | Total | 121 | 100.0% |
| Qualification | Dental Graduate | 73 | 60.3% |
| | Dental Postgraduate | 30 | 24.8% |
| | Dental student / Intern | 18 | 14.9% |
| | Total | 121 | 100.0% |
| work experience | Less than 10 years | 96 | 79.3% |
| | More than 10 years | 25 | 20.7% |
| | Total | 121 | 100.0% |
| Working shift | Morning shift | 71 | 58.7% |
| | Night shift | 50 | 41.3% |
| | Total | 121 | 100.0% |

**Comparison of fatigue mean scores of Participants before and during Ramadan**

Results obtained before and during Ramadan when compared, no statistically significant difference was found between total fatigue mean scores, ($p < 0.76$) However, at the individual level, there was a statistically significant difference during exercise ( $p < 0.01$) in Ramadan and fatigue brought a significant interference in the work and family life as well as difficulty in carrying certain duties and responsibilities. ($p < 0.02$)

**Graph 1:** Mean distribution for Fatigue Pattern:



**Graph 2:** Mean difference distribution in PRE and POST (Fatigue Pattern)

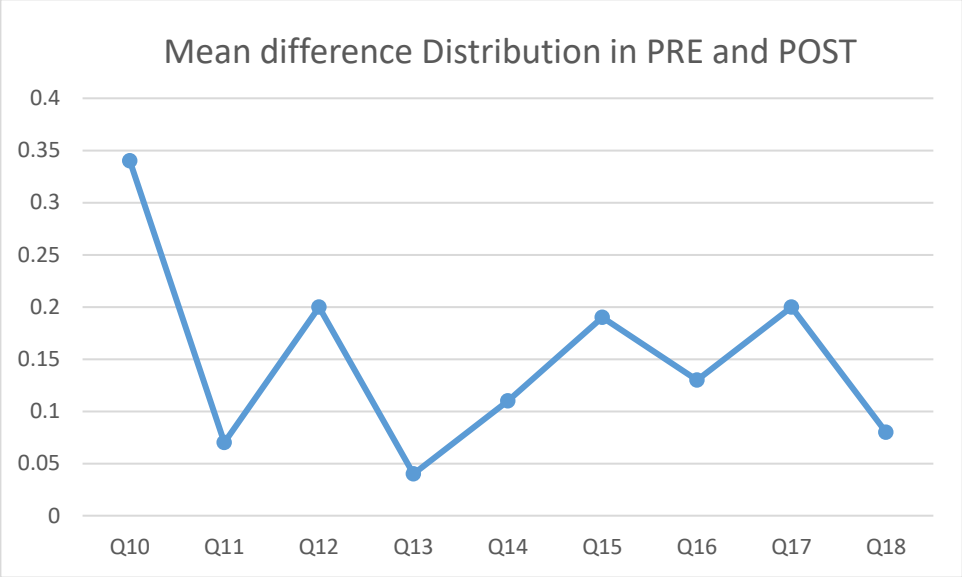



**Table 2:** Paired t-test: Fatigue Pattern:

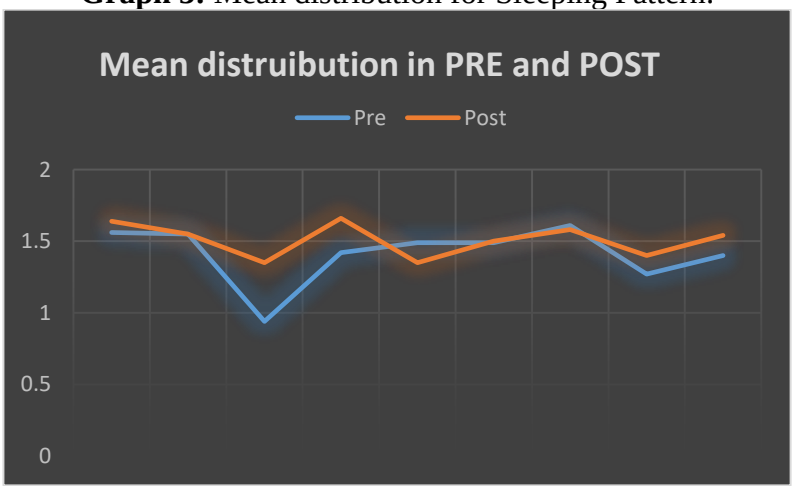
| Statement | Before Mean ± SD | After Mean ± SD | p-value | Suggestion |
|---|---|---|---|---|
| My motivation is lower when I am fatigued | 4.66 ± 0.824 | 5.00 ± 0.821 | 0.16 | Not Significant |
| Exercise brings on my fatigue. | 3.53 ± 0.623 | 3.60 ± 0.666 | 0.01 | Significant |
| I am easily fatigued. | 3.25 ± 0.680 | 3.45 ± 0.647 | 0.006 | Significant |
| Fatigue interferes with my physical functioning | 4.02 ± 0.807 | 4.06 ± 0.767 | 0.601 | Not Significant |
| Fatigue causes frequent problems for me | 3.71 ± 0.630 | 3.82 ± 0.775 | 0.02 | Significant |
| My fatigue prevents sustained physical functioning | 3.56 ± 0.683 | 3.75 ± 0.663 | 0.583 | Not Significant |
| Fatigue interferes with carrying out certain duties and responsibilities. | 3.78 ± 0.800 | 3.91 ± 0.740 | 0.021 | Significant |
| Fatigue is among my most disabling symptoms | 3.43 ± 0.726 | 3.63 ± 0.748 | 0.057 | Not Significant |
| Fatigue interferes with my work, family, or social life | 3.78 ± 0.930 | 3.86 ± 0.880 | 0.024 | Significant |
| Overall Total | 33.71 ± 10.8 | 33.26 ± 11.61 | 0.763 | Not Significant |

**Comparison of Sleep mean scores of Participants before and during Ramadan**

Graphs 3 and 4 show the mean distribution of sleep patterns before and during Ramadan.

Statistical findings revealed that most of the doctors showed no significant changes in the overall sleep scores for FOSQ 10 questionnaire pre and post Ramadan (12.73 ± 6.58 vs 13.55 ± 6.56) ($p < 0.32$) However, a significant difference in pre and post Ramadan was seen in operating motor vehicles and driving long as well as short distances. (1.61 ± 0.247 vs 1.58 ± 0.250) ($p < 0.035$) as well as doing their employed work at workplace ( 1.58 ± 0.250 vs 1.54 ± 0.265 )($p < 0.04$) (table 3) stating that they felt tired and sleepy during driving as well as performing their employed work during Ramadan.

**Graph 3:** Mean distribution for Sleeping Pattern:



**Graph 4:** Mean difference distribution in PRE and POST Sleeping Pattern

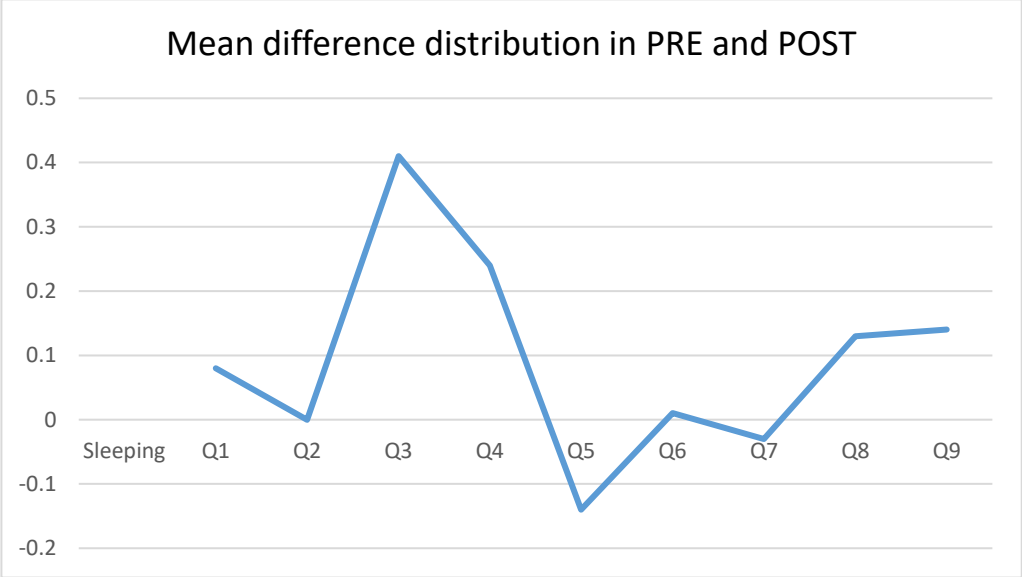



**Table 3:** Paired T-Test: Sleeping Pattern:

| Statement | Before Mean ± SD | After Mean ± SD | p-value | Suggestion |
|---|---|---|---|---|
| Do you have difficulty concentrating on the things you do because you are sleepy or tired? | 1.56 ± 0.196 | 1.64 ± 0.204 | 0.053 | Not Significant |
| Do you generally have difficulty remembering things, because you are sleepy or tired? | 1.55 ± 0.271 | 1.55 ± 0.278 | 0.062 | Not Significant |
| Do you have difficulty finishing a meal because you become sleepy or tired? | 0.94 ±0.260 | 1.35 ± 0.358 | 0.02 | Significant |
| Do you have difficulty working on a hobby (for example, sewing, collecting, gardening) because you are sleepy or tired ? | 1.42 ± 0.195 | 1.66 ± 0.215 | 0.127 | Not Significant |
| Do you have difficulty operating a motor vehicle for long distances (greater than 100 miles) because you become sleepy or tired? | 1.49 ± 0.191 | 1.35 ± 0.174 | 0.035 | Significant |
| Do you have difficulty doing work around the house (for example, cleaning house, doing laundry, taking out the trash, repair work) because you are sleepy or tired? | 1.49 ± 0.191 | 1.50 ± 0.170 | 0.07 | Not Significant |
| Do you have difficulty getting things done because you are too sleepy or tired to drive or take public transportation? | 1.61 ± 0.247 | 1.58 ± 0.250 | 0.038 | Significant |
| Do you have difficulty taking care of financial affairs and doing paperwork (for example, writing checks, paying bills, keeping financial records, filling out tax forms, etc.) because you are sleepy or tired? | 1.27 ± 0.245 | 1.40 ± 0.307 | 0.143 | Not Significant |
| Do you have difficulty performing employed or volunteer work because you are sleepy or tired? | 1.40 ± 0.235 | 1.54 ± 0.265 | 0.04 | Significant |
| Total | 12.73 ± 6.58 | 13.55 ± 6.56 | 0.32 | Not Significant |

## Discussion

This is one of the first studies to assess the impact of Ramadan fasting on fatigue and sleep patterns of Muslim Dentists in Qassim region of Saudi Arabia.

Fatigue is a workplace hazard and an important parameter that should be controlled to achieve good performance in conducting daily activities. [7]

Problems experienced by healthcare workers not only affect their lives but also reduce their overall productivity in the workplace. [14] Therefore, the purpose of this study was to explore the perception of dentists regarding the impact of Ramadan fasting on their sleep patterns and fatigue levels. A better understanding of the situation might help propose policies regarding the working conditions of dentists during the holy month of Ramadan.

Many studies have been conducted to quantify the changes in perceived performance with regard to specific fatigue levels and to show how the individual dimensions and states of fatigue vary in their association with perceived performance decrements. [21] Research has also been conducted to investigate the effect of fasting on sleep patterns and fatigue in other healthcare providers [15,22] , but

none of them have been conducted for dentists. However, many of them have shown the effects of Ramadan fasting on dental patients. [15,16]

The current study was conducted to investigate the impact of Ramadan fasting on sleep patterns and fatigue levels of working dentists in the Qassim region, and the results demonstrated no significant change in the overall fatigue levels pre- and post-Ramadan, which is in agreement with some previous studies. Identical Results were obtained by a research conducted by Nugraha et al, [12] where they studied the effect of Ramadan fasting, during three different timings of the day on fatigue, mood and health related quality of life of health young males and females. They compared two groups, fasting and non-fasting, and concluded that Ramadan fasting did not significantly influence mood, fatigue, and QoL when compared to NFG. In fact, they found it beneficial for the fasting group with regard to these parameters.

Another analogous study [23] that determined the effect of Ramadan fasting (RF), particularly on fatigue in both young males and females as well as parameters such as sleepiness, mood-related symptoms (MRSs), and body composition (BC) were also determined. This study observed numerous positive effects of RF. The participants experienced significantly less fatigue than the non-fasting group. However, the results of our study did not reveal any improvement in fatigue levels.

Mertens A et al utilized a survey based assessed to study, similar to our study the impact of Ramadan on tiredness and neuroperformance in Belgian Muslims and concluded that there is no effect on Fatigue. He used FAS as the assessment method, which is a 10 item self-report scale that evaluates symptoms of chronic fatigue. [24]

In the above two studies, there was no significant change in fatigue levels, but both showed an improvement in fatigue levels during fasting. These findings are corroborated by our research, which showed no significant differences in fatigue levels during the fasting period. However, during exercise and employment, there was a slight increase in fatigue levels.

Ovayolu et al [14] evaluated the effect of Ramadan fasting on fatigue levels of nurses. The results obtained before and during Ramadan were compared; fatigue subscale mean scores and total fatigue mean scores increased significantly, except for the affective subscale. This is not in agreement with the results of our study, in which there was no change in the overall fatigue level. This could be attributed to the different characteristics and activities of the participants, for example, nurses have long and hectic working schedules compared to dentists. These differences could also be due to the use of different assessment scales in the various studies. Another reason that could contribute to the difference might be the different timings of Ramadan each year, different climatic conditions, and even the geographical location of the place.

Discussing about the sleep changes, studies that utilized surveys, similar to ours, have demonstrated several changes and modifications in the sleep patterns.

One study using an objective assessment method conducted by Bahamas [3 comparing Muslim and non-Muslim volunteers demonstrated no significant differences in increased sleepiness during fasting.

A similar study[11] that determined the effect of Ramadan fasting (RF), particularly on sleep and fatigue in both young males and females observed numerous positive effects of RF. In addition, the researchers illustrated that Ramadan fasting did not have any significant effect on the participants' overall sleep scores. [11]This was in agreement with Bahammam et al., who showed no effect on ESS; IF resulted in decreased rapid eye movement sleep with no impact on other sleep stages, the arousal index, or daytime sleepiness. [25]

Both of these studies are in agreement with our study, where we used FOSQ 10, which is helpful in assessing the impact of sleepiness on daily activities. No overall significant difference was seen in the sleep score, demonstrating no change in daytime sleepiness and hence no change in functional status. However, significant changes were observed in the difficulty of operating vehicles, doing employed work, and using public transportation. The sleepiness scores of all participants and only males, as well as only females in this study, were not significantly different.

Another investigation by Sameh Msaad et al. on medical trainers in Tunisia [26] demonstrated substantial dissatisfaction with sleep quality; they found it difficult to get up and show up for work. The majority of participants experienced extra daytime sleepiness during the month of Ramadan. This is in contradiction with our study, as well as the two previous studies.

Another survey conducted by Bahammas [4] on healthy Muslim medical students during Ramadan fasting revealed several modifications in lifestyle and eating patterns that affected daytime functioning and daytime sleepiness, although there was no significant change in total sleep time (TST). He also noted that the percentage of subjects who exercised regularly dropped from 24% before Ramadan to 5% at the end of Ramadan, without any clear reason for this decline. [4] This finding is in accordance with that of our study.

Another study was conducted by Singh et al. among Malaysian Muslim athletes regarding their sports performance, diet, and sleep pattern. There were diverse views on their perceptions of training, performance, and sleep patterns during the Ramadan fast. [27]

Likewise, in a sample of 2171 healthcare workers in Moroccan hospitals, sleepiness at work increased to 49.8% as compared to 9.8% at baseline, and the frequency of Epworth greater than 10 increased from 19.4% to 46%.[28] hence they concluded that sleep, daytime alertness, and health were affected.

The notion that Ramadan fasting affects daytime sleepiness and fatigue, which I turn on, is not supported by the results of our study. Further research is required to clarify this issue, with all parameters considered while conducting the study.

**Limitations of our study**

Few areas in which our study had limitations and has to be addressed are:

1. The survey could only determine the subjective perception of the participants, as no objective assessment methods were used.
2. The findings of this study are specific to Muslim dentists working in the Qassim area of Saudi Arabia and are not necessarily valid with regard to other countries that observe Ramadan fasting.

Further research that is more subjective in nature is needed in Saudi Arabia and the adjacent Maghreb countries to objectively assess the effects of Islamic intermittent fasting on sleep architecture and fatigue levels. Considering that the effect of RF could differ in different age groups, future studies should consider recruiting age groups as an important parameter.

**Conclusion**

Our study suggests that changes in lifestyle and eating behaviors during Ramadan did not affect daytime sleepiness and functioning, nor did they affect overall fatigue levels.

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