

Original article

Sleep Pattern During Ramadan among Libyan Adults: Changes and Factors Associated with Nighttime Sleep Duration

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Email: drsana04@yahoo.com**Keywords**

Ramadan fasting, Sleep duration, Nighttime sleeping, Daytime sleeping, Sleep pattern, Libya.

ABSTRACT

Adequate sleep is an essential physiological need, and insufficient sleep is associated with adverse health impacts. Changes in daily routine during Ramadan may affect sleeping patterns. This study describes the pattern of sleep during Ramadan among Libyan adults and compares nighttime, daytime, and total sleep duration during and outside Ramadan. It also investigates the association of sociodemographic characteristics, physical activity sufficiency, and daytime sleep duration with nighttime sleep duration during Ramadan. A community-based, cross-sectional study was conducted in Tripoli, Libya, using a self-reported structured questionnaire developed as a part of a larger study on health-related behaviors. This analysis included 113 respondents. Their median age was 28.00 years (IQR: 23.00- 36.00), and females comprised 60.2% of the sample. Nighttime sleep duration was significantly shorter during Ramadan than outside Ramadan (mean difference = -3.12 hours, $p < 0.001$, Cohen's $d = -1.124$), while daytime sleep duration was significantly longer during Ramadan (mean difference = 2.20 hours, $p < 0.001$, Cohen's $d = 0.742$). Total sleep time was also significantly lower during Ramadan (Median = 8.00 hours) than outside Ramadan (Median = 8.50 hours), with a medium effect size ($r = -0.46$). Among all studied variables, only daytime sleep duration showed a significant association with nighttime sleep duration, with a strong negative correlation ($r = -0.701$, $p < 0.001$). In conclusion, sleep patterns changed considerably among Libyan adults during Ramadan, with a marked reduction in nighttime sleep duration that was compensated for by increased daytime napping. Health education promoting adequate nighttime sleep during Ramadan is warranted.

Introduction

Sleep is a fundamental physiological need, and maintenance of a regular sleep pattern is essential for normal physiological functions and overall health. Adequate sleep is also important for energy level and overall quality of life. A large body of research evidence links inadequate and irregular sleep with adverse physical health impacts. Irregular sleep contributes to obesity and obesity-related health outcomes (1, 2). Additionally, an increased risk of developing diabetes was found among individuals with irregular sleep duration (3). Several studies have shown that an inconsistent sleep pattern is associated with increased risk of cardiovascular events (4, 5), and a large prospective study on healthy adults proposed irregular sleep as a cardiovascular risk factor that is independent from other traditional cardiovascular risk factors (6). Furthermore, irregular sleep patterns have been linked to increased mortality (7), with sleep regularity being a stronger predictor of all-cause mortality than sleep duration (8). Research has also linked irregular sleep patterns to poorer mental well-being (9, 10). Sleep disturbance increases the risk of anxiety, and this relation is bidirectional (11). Research reviews have indicated that sleep disturbance is a risk factor for depression development (12, 13) and poorer treatment outcomes (13).

Sleep deprivation could impact cognitive processes and intellectual functions, including attention and memory (14). Several studies found that inconsistent sleep patterns and suboptimal sleep negatively impact school performance (15-17). Moreover, changes in sleep patterns reduce workers' productivity (18, 19). Sleeping patterns during Ramadan among fasting Muslims may change due to several changes in their daily routine. Religious practices such as Taraweeh and Qiayam al-Layl are performed at night, which may delay bedtime. Social habits during Ramadan may involve nighttime activities such as family gatherings for food. Changes in official work hours meant to ease the burden of fasting during Ramadan in some settings may allow people to stay up later at night and take longer daytime naps. Together, these changes may alter sleep duration and pattern in Ramadan.

Several studies conducted among Muslims in Ramadan identified changes in sleep duration and pattern, particularly in total sleep time (20, 21), which is concerning in the light of the well-documented health consequences of inadequate and irregular sleep patterns. Generally, most of the identified studies on sleep pattern during Ramadan among Muslims have focused on total sleep time, with fewer studies examining nighttime and daytime separately. Furthermore, despite the well-documented health consequences of irregular sleep, no study has comprehensively examined sleep pattern changes during Ramadan among Libyan adults, with the exception of one older, small-scale study (22). Additionally, sociodemographic

characteristics and lifestyle factors such as level of physical activity and daytime napping duration may further shape how nighttime sleep is affected during Ramadan, and this remains largely unexamined.

Given that Ramadan-related lifestyle changes and their association with sleep are likely to be shaped by local culture and social habits, conducting a study within the Libyan setting is warranted. Findings from such a study could inform culturally appropriate health education aimed at promoting adequate sleep during this month. Therefore, this study was conducted to describe the pattern of sleep during Ramadan among Libyan adults and compare nighttime, daytime, and total sleep duration during and outside Ramadan. It also investigates the association of sociodemographic characteristics, physical activity sufficiency and daytime sleep duration with nighttime sleep duration during Ramadan.

Methodology

This study is a part of a broader community-based cross-sectional study on health-related behaviours during Ramadan conducted in Tripoli, Libya in March 2025, with the present analysis focusing on sleep pattern and factors associated with nighttime sleep duration during Ramadan (23). A total of 117 adults were recruited conveniently to participate in the main study. Libyans aged 18 and above who agreed to participate in the study were included. Non fasting individuals as due to medical exemptions or other reasons were excluded.

A self-reported structured questionnaire was developed for the main study, of which three parts were utilized for the purpose of the present paper. The first part covers sociodemographic characteristics (e.g., age, sex). The second part measures physical activity during Ramadan using the Arabic version of the Short Form of the International Physical Activity Questionnaire (IPAQ-SF) (24, 25), which has been used among Arab populations (26, 27). The third part assessed average sleeping hours per night and during the day, both during Ramadan and outside Ramadan.

Physical activity sufficiency status was assessed based on standard IPAQ criteria (28), and categorized as: sufficient (moderate and high activity) versus insufficient (low activity). The details on physical activity measurement and scoring are reported elsewhere (23). Sleeping hours during nighttime and daytime, both during and outside Ramadan, were treated as continuous variables (hours per day).

Only 113 respondents had complete data and were considered for analysis. Data analysis was run using SPSS version 26. A few missing values (≤ 6) on some sociodemographic variables were managed using listwise deletion in the bivariate analysis. For the IPAQ-SF, missing duration data despite non-zero reported days occurred in 5.3% of vigorous activity, 13.3% of moderate activity, and 20.4% of walking activity domains, and these were excluded from the respective activity domain and total MET-minute calculations. Illogical responses such as zero days but non-zero duration were recoded to zero, and durations exceeding 180 minutes per session were capped at 180 minutes as previously detailed (23).

Paired t-tests and the Wilcoxon signed-rank test were used as appropriate to compare sleep durations during Ramadan with those outside Ramadan. Cohen's d was used to quantify the effect size for paired t-tests, while effect size r was used for the Wilcoxon signed-rank test. Independent-samples t-tests, one-way ANOVA, and Pearson's and Spearman's correlations were used, as appropriate, to examine the bivariate association between each study variable and the nighttime sleep duration in Ramadan. Statistical significance was set at p-value ≤ 0.05 .

Results

Respondents' median age was 28.00 years (IQR: 23.00-36.00), with females comprising 60.2% of the sample. The majority were unmarried (68.8%) and held a university-level education or higher (83.2%). More than half of the respondents (56.1%) had insufficient physical activity during Ramadan (Table 1).

Table 1 Sociodemographic characteristics and physical activity sufficiency among respondents (n=113)

Sociodemographic characteristics	f	(%)
Age (Years), Median (IQR)	28.00	(23.00- 36.00)
Sex		
Male	45	(39.8)
Female	68	(60.2)
Educational level		
Secondary schooling or less	19	(16.8)
University or higher	94	(83.2)
Marital status (n=112)		
Unmarried	77	(68.8)
Married	35	(31.3)
Employment		
Employed	49	(43.4)
Unemployed	64	(56.6)
Income (n=107)		

< 2000 LD	40	(37.4)
2000-3999 LD	43	(40.2)
≥4000 LD	24	(22.4)
Physical activity sufficiency status in Ramadan(n=82)		
Insufficient	46	(56.1)
Sufficient	36	(43.9)

Nighttime sleep duration was significantly shorter during Ramadan compared with outside Ramadan (mean difference = -3.12 hours, 95%CI: -3.63 to -2.60, $p<0.001$), with a large effect size (Cohen's $d= -1.124$). Conversely, daytime sleep during Ramadan was significantly longer than outside Ramadan (mean difference = 2.20 hours, 95%CI: 1.65 to 2.76, $p<0.001$), with a medium effect size (Cohen's $d= 0.742$). Total sleep time was significantly lower during Ramadan (Median=8.00 hours, IQR: 7.00-9.00) than outside Ramadan (Median=8.50 hours, IQR: 7.50-10.00), with a medium effect size ($r=-0.46$) (Table 2).

Table 2: Comparison of nighttime, daytime and total sleep time during and outside Ramadan (n=113)

Sleep period (Hours)	Outside Ramadan	During Ramadan	Mean difference	95% CI	p	Cohen's d
	Mean ±SD	Mean ±SD				
Nighttime	7.03±1.73	3.91±2.81	-3.12	(-3.63 – -2.60)	<0.001	-1.124
Daytime	1.65±1.44	3.85±2.90	2.20	(1.65 – 2.76)	<0.001	0.742
Total sleep time	8.50(7.50-10.00)	8.00(7.00-9.00)	-	-	<0.001	-0.46 ^a

^a Effect size r based on the Wilcoxon test statistic Z

Table 3 presents the examination of the association between nighttime sleep duration in Ramadan (outcome variable) and the sociodemographic characteristics, physical activity sufficiency and daytime sleep duration (Independent variables). Employed respondents had a mean nighttime sleep duration of 4.43 hours (SD=2.49) compared with 3.51 hours (SD= 3.07) among unemployed respondents ($p=0.094$). However, of all studied variables, only daytime sleep duration displayed a statistically significant association with nighttime sleep duration, with a strong negative correlation observed between the two variables ($r= -0.701$, $p<0.001$), indicating that the longer the daytime sleep durations associated with shorter nighttime sleep duration.

Table 3: Bivariate association between nighttime sleep duration in Ramadan and sociodemographic characteristics, physical activity sufficiency and daytime sleep duration

Variables	During Ramadan		p
	Mean	±SD	
Age	0.075 ^d		0.430 ^a
Sex			
Male	4.02	±2.71	0.752
Female	3.84	±2.96	
Educational level			
Secondary schooling or less	4.42	±2.63	0.371
University or higher	3.81	±2.89	
Marital status			
Married	4.36	±2.48	0.270
Unmarried	3.73	±3.00	
Employment			
Employed	4.43	±2.49	0.094
Unemployed	3.51	±3.07	
Income			
< 2000 LD	4.46	±2.46	0.286 ^b
2000-3999 LD	3.47	±2.75	
≥4000 LD	3.83	±3.53	
Daytime sleep duration	-0.701 ^e		<0.001 ^c
Physical activity sufficiency			
Insufficient	3.57	±2.89	0.869
Sufficient	3.68	±2.75	

^ap value based on Spearman's correlation, ^bp value based on one-way ANOVA, ^cp value based on Pearson's correlation, ^d Spearman's correlation coefficient (ρ). ^e Pearson's correlation coefficient (r).

Discussion

Sleep pattern during Ramadan among Libyan adults was significantly different from that outside Ramadan. Nighttime sleep duration was about three hours shorter on average during Ramadan compared with outside Ramadan, with a large effect size. Conversely, daytime sleep during Ramadan was two and one-third hours longer than outside Ramadan, with a medium effect size. In other words, fasting individuals in this cohort slept for a shorter duration during Ramadan nights than in their routine nights outside Ramadan, and also took longer daytime naps compared with their naps outside Ramadan. When nighttime and daytime sleep were combined, total sleep time was also significantly reduced during Ramadan, with a medium effect size. Based on the reported effect sizes of the changes in the three compared sleep durations (nighttime, daytime, and total sleep time), the marked change was in nighttime sleep duration. The reported sleep duration change, particularly in nighttime sleep duration, is likely driven by changes in daily routine during Ramadan, including nighttime religious practices, social gatherings, and adjusted work hours that may allow employed individuals to stay up later.

Consistent with the reported significant reduction in total sleep time in the current study, an objective assessment of sleep time during Ramadan among Saudi adults also reported a significant reduction in total sleep time during the first two weeks of Ramadan (21). Similarly, a meta-analysis of 24 studies conducted across 12 countries reported a significant reduction in total sleep time during Ramadan compared with outside Ramadan (20). However, a more recent study among adults in Jeddah, Saudi Arabia found no significant change in the total sleep duration during Ramadan compared with outside Ramadan (29).

An older small study compared Muslims in the UK (n=31) and adults in Libya (n=33) and found that daytime napping was prolonged among Libyans during Ramadan, though the study found that the change was not statistically significant, perhaps due to the small sample size limiting the statistical power. Nevertheless, they found that Libyans took significantly longer daytime naps during Ramadan compared with UK Muslims (22). None of the sociodemographic factors displayed significant association with nighttime sleep duration during Ramadan in this cohort. Although employed respondents reported longer nighttime sleep duration than unemployed respondents, which is in line with the theoretical expectations, this difference did not reach the statistical significance threshold. Likewise, the level of physical activity during Ramadan did not appear to shape nighttime sleep duration in this month. This finding contrasts with a large multinational study, which found that optimum sleep duration during Ramadan was significantly associated with a sufficient physical activity level (30). Nevertheless, daytime sleep duration during Ramadan showed a strong negative relationship with nighttime sleep duration in this month, suggesting that respondents compensated for shorter nighttime sleep with increased daytime napping. A similar compensation pattern was described in an earlier study among students in Ramadan, where the percentage of respondents who napped increased significantly (31). However, we could not locate a study that examined the strength and direction of the relationship between daytime and nighttime sleep duration during Ramadan, suggesting that the present study's finding may present a novel contribution to this literature.

Conclusion

In conclusion, sleep patterns changed considerably among Libyan adults during Ramadan, with a marked reduction in nighttime sleep duration that was strongly compensated for by increased daytime napping. Even with napping as a compensatory strategy, inadequate nighttime sleep duration could impact health and productivity. Health education promoting adequate nighttime sleep during Ramadan is warranted. This study has several limitations that should be considered when interpreting its findings. First, the use of a convenience sampling technique reduces the external validity of the results. Second, sleep durations were self-reported, which may be subject to recall bias, particularly as respondents were asked to estimate sleep durations outside Ramadan as well. Third, the absence of significant associations for most sociodemographic characteristics and physical activity level with nighttime sleep duration may reflect limited statistical power due to the small sample size.

Despite these limitations, the study has notable strengths. Unlike most previous studies, which focused on total sleep time in Ramadan, this study presents a detailed examination comparing nighttime, daytime, and total time durations during and outside Ramadan separately, allowing for a better description of the sleep pattern shift during this month. Besides, while previous studies have described daytime napping during Ramadan, this study is among the few studies that tested and quantified the strength of the relationship between daytime and nighttime sleep duration.

Conflict of interest. Nil

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