

Prevalence of Insomnia and its Characteristics among Pilgrims in the 2024 Hajj: A Roadmap to Enhancing Health Services

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Abstract

Background and Aims: Religious pilgrimages, such as the Hajj, are widely publicized gatherings that attract millions of people worldwide. These events can strain the public health resources of the host nation, necessitating a high level of readiness and response capacity. This study aims to evaluate the Prevalence of Insomnia and its characteristics among pilgrims during the 2024 Hajj. **Materials and Methods:** A cross-sectional questionnaire study was conducted over one month in 2024 at the Jeddah International Airport. The questionnaire contained sociodemographic, insomnia, and characteristics, comprising 4 binary-scale items; and (3) awareness of emergency contact numbers for health services and presence of companions in the holy city (2 items). **Results:** Among the 4,721 pilgrims who responded, 614 (13%) reported insomnia symptoms and met the inclusion criteria for final analysis. The demographic breakdown of these pilgrims showed that 48.2% ($n = 296$) were male, with 29% ($n = 178$) aged 31–40 years and 22.8% ($n = 140$) aged 41–50 years. The most common insomnia symptoms reported were: trouble falling asleep (46.3%), frequent nighttime awakenings (24.4%), difficulty staying awake (10.4%), and feeling unrefreshed after waking up (10.1%). Notably, pilgrims with higher education levels (graduate-level or literate) reported more sleep-related issues, including difficulty staying awake, unrefreshing sleep, frequent awakenings, and snoring. **Conclusion:** This study reveals that insomnia symptoms exist among pilgrims, with the most frequently reported issues being difficulty initiating sleep, waking up multiple times during the night, struggling to stay awake during the day, and waking up feeling unrested. We recommend educating individuals on the importance of sleep and promoting awareness of sleep health during pre-hajj preparations. In addition, we suggest offering counseling services and support groups for pilgrims who may be experiencing sleep disturbances. These services would focus on stress reduction, relaxation techniques, and coping strategies.

Key words: Factors, health, insomnia, mass gathering, Saudi Arabia, staying awake

INTRODUCTION

The Hajj pilgrimage, one of the world's largest religious gatherings, attracts approximately 2–3 million Muslims from over 183 countries annually.^[1,2] According to recent reports, the number of pilgrims reached 1.84 million in 2023 and is expected to increase, with projections suggesting 30 million pilgrims by 2030.^[2–5] This mass gathering poses significant logistical, health, and organizational challenges, including the risk of infectious disease transmission and complications from chronic diseases among pilgrims.^[6] Performing

Hajj requires pilgrims to be in good health, necessitating adequate rest and sleep to complete the rituals. Sleep

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is a foundational pillar of human health, underpinning physical regeneration, cognitive restoration, and emotional equilibrium.^[7,8] Without restful sleep, the immune system weakens, mood destabilizes, and metabolic and cardiovascular systems falter. For pilgrims undertaking physically and spiritually demanding journeys such as the Hajj, sleep disturbances are challenging and linked to inconveniences during their Hajj journey by critically impairing well-being, hindering spiritual focus, and exacerbating underlying health issues.^[8]

Recent studies have highlighted significant sleep disruptions among pilgrims. A cross-sectional study of 228 Hajj pilgrims found widespread dissatisfaction with nighttime rest, difficulty initiating or maintaining sleep, and excessive daytime sleepiness meeting criteria for clinically significant insomnia.^[9] Similarly, qualitative interviews among Indonesian Umrah pilgrims revealed substantial sleep disturbances attributed to prolonged travel and lengthy arrival processes. These findings collectively underscore the profound impact of pilgrimage on sleep quality.^[9]

The Hajj pilgrimage involves physically demanding activities, including extensive walking, prolonged physical exertion, and exposure to extreme heat and high altitudes.^[10] Climate change has exacerbated these challenges, with rising temperatures disrupting sleep patterns by delaying sleep onset and reducing sleep duration, particularly affecting older adults and those from lower-income nations.^[10] Furthermore, environmental and cultural stressors in pilgrimage settings, such as crowded and noisy conditions, uncomfortable accommodations, and nighttime prayers, can significantly disrupt sleep. The “first-night effect” can suppress deep sleep, while heat, humidity, and noise can impede restorative sleep, with cultural factors like nighttime prayers dictating sleep schedules and reinforcing fragmented sleep patterns.^[10,11]

The health of pilgrims is another significant factor affecting sleep during Hajj. Many pilgrims suffer from chronic diseases, such as hypertension, diabetes, respiratory conditions, and obesity.^[2,12-14] These health issues can exacerbate sleep disruptions.^[15-17] For example, obesity increases the risk of obstructive sleep apnea (OSA), while diabetes and asthma can disrupt nighttime breathing.^[15,16] In addition, pilgrims’ travel behaviors, including long-distance travel, dehydration, and excessive caffeine consumption to stay alert during rituals, can further impede sleep onset and quality.^[18] Sleep is essential for Hajj pilgrims due to the physically demanding nature of the pilgrimage. Adequate sleep prevents fatigue, reduces illness risk, and enhances overall well-being. However, pilgrims face significant sleep challenges due to crowded and noisy environments, extreme temperatures, and rigorous rituals. Prioritizing sleep improves physical and mental resilience, enabling safe and effective ritual performance. While studies have examined specific health issues during Hajj, such as infectious diseases^[19-22]

and climate-related risks, understanding sleep problems and associated demographics is crucial for mitigating issues and informing pre-Hajj planning.^[23-25] This study aimed to assess the prevalence of insomnia and Its Characteristics Among Pilgrims in the 2024 Hajj.

MATERIALS AND METHODS

A cross-sectional study was conducted among Hajj pilgrims in Mecca and Medina, Saudi Arabia, from June to July 2024. Data were collected using pre-validated questionnaires. The study included pilgrims of multinational backgrounds, both male and female, aged 18 years and above, able to respond to the questionnaires and provide informed consent. Female pilgrims who were pregnant or in a postpartum period were excluded from the study. Before data collection, the study questionnaires were reviewed and approved by the Global Center for Mass Gathering Medicine, Ministry of Health, Riyadh (IRB-24-289E). All study procedures were conducted according to the Declaration of Helsinki guidelines for human research. Pilgrims were informed that the data would be used solely for research purposes and confidentiality would be maintained throughout the study. Additionally, pilgrims or respondents had the option to withdraw from the study at any time.

Sample size

To determine the required sample size, similar to earlier studies^[26-30] this study utilized the Raosoft online calculator, setting parameters at a 95% confidence interval, 50% response distribution, and 1.5% margin of error. This calculation yielded a target sample size of approximately 4259 pilgrims. Anticipating a potential 10% non-response rate, we adjusted our target to a minimum of 4750 pilgrims to ensure adequate representation.

Questionnaire design and data collection

A comprehensive, anonymous questionnaire was developed based on existing literature to collect data.^[2,8,9,15,31] The questionnaire consisted of three sections: (1) demographic information, including age, gender, education, awareness of free health services during Hajj, and country of origin (5 items); (2) insomnia characteristics, comprising 4 binary-scale (Yes/No) items; and (3) awareness of emergency contact numbers for health services and presence of companions in the holy city (2 items). Data collection took place in departure areas at Jeddah airports, where pilgrims were randomly selected after completing the Hajj rituals. To facilitate participation, translators fluent in various languages were available to assist pilgrims from diverse linguistic backgrounds.

Statistical analysis

The data were entered into Excel and then converted to the Statistical Package for the Social Sciences (SPSS) for analysis. The data was analyzed using SPSS version 27. Descriptive statistics, such as frequencies (*n*) and percentages (%), were used to describe categorical data, while continuous data were presented as mean and standard deviation (Std), median, minimum, and maximum. To determine the association between the pilgrims' characteristics, a Chi-square or Fisher's exact test was used, with a $P < 0.05$ considered a statistically significant difference.

RESULTS

Out of the 4,721 pilgrims who responded, only 614 of them reported having insomnia symptoms, and those who met the inclusion criteria were included in the final analysis, while others who did not have insomnia symptoms were excluded from the study. Among them, 48.2% ($n = 296$) were male 29% ($n = 178$) of them were aged between 31 and 40 years, while 22.8% ($n = 140$) were between 41 and 50 years old. The majority (53.7%) of them were able to graduate, while 21.3% of them were able to read and write. A majority, 66% of the pilgrims, were aware that health services during the hajj are free of charge, while one third of them did not know about it, as shown in Table 1.

The pilgrims' countries of origin were diverse, with the largest proportion (22.1%, $n = 136$) hailing from Qatar. Pakistan accounted for 15.1% ($n = 93$), followed by Bahrain (13.2%, $n = 81$), Yemen (10.7%, $n = 66$), Bangladesh (9.3%, $n = 57$), and Egypt (5.9%, $n = 36$). A detailed breakdown is presented in Figure 1.

In this study, insomnia symptoms were prevalent in 13% ($n = 614$). Among the insomnia symptoms reported most commonly were trouble falling asleep 46.3%, followed by often waking up during sleep 24.4%, difficulty staying awake 10.4%, and feeling unrefreshed after waking up 10.1% as shown in Table 2.

In this study 52% of the pilgrims were aware of the emergency contact number, and the majority, 71.3% them, had a companion who cared for them, while 6.5% of the pilgrims reported no need for a companion and no need for care, as shown in Table 3.

This study revealed variations in insomnia symptoms among pilgrims. For instance, difficulty staying awake during the day was more prevalent among males (11.3%) compared to females (9.5%). In contrast, females reported higher frequencies of feeling unrefreshed after waking up (10.5%), often waking up during sleep, and trouble falling asleep.

Table 1: Sociodemographic characteristics of participants ($n=614$)

Characteristics	Frequency (<i>n</i>)	Percentage	Mean (Std)
Gender			
Male	296	48.2	
Female	318	51.8	
Age (in years)			
<20	9	1.5	44.18±13.63 Median=42
21–30	100	16.3	
31–40	178	29	
41–50	140	22.8	
51–60	114	18.6	
>61 years	73	11.9	
Education			
Illiterate	87	14.2	
Intermediate or Secondary	66	10.7	
Able to read and write	131	21.3	
University	330	53.7	
Do you know if health services during Hajj were available free of charge or paid?			
Paid	22	3.6	
Free of charge	409	66.6	
I don't know	183	29.8	

Table 2: Insomnia symptoms among pilgrims in 2024 Hajj ($n=614$)

Characteristics	Frequency (<i>n</i>)	Percentage
Often wake up during sleep	150	24.4
Difficulty staying awake during the day	64	10.4
Trouble falling asleep	284	46.3
Snoring	54	8.8
Feeling unrefreshed after waking up	62	10.1

However, no significant association was found between insomnia symptoms and pilgrims' gender ($P = 0.909$). Similarly, age did not show a significant association with insomnia symptoms. Notably, pilgrims' education level was significantly associated with insomnia symptoms ($P = 0.004$). Specifically, pilgrims with a graduate-level education or those who could read and write reported higher frequencies of difficulty staying awake during the day, feeling unrefreshed after waking up, often waking up during sleep, and snoring compared to those with lower education levels, as shown in Table 4.

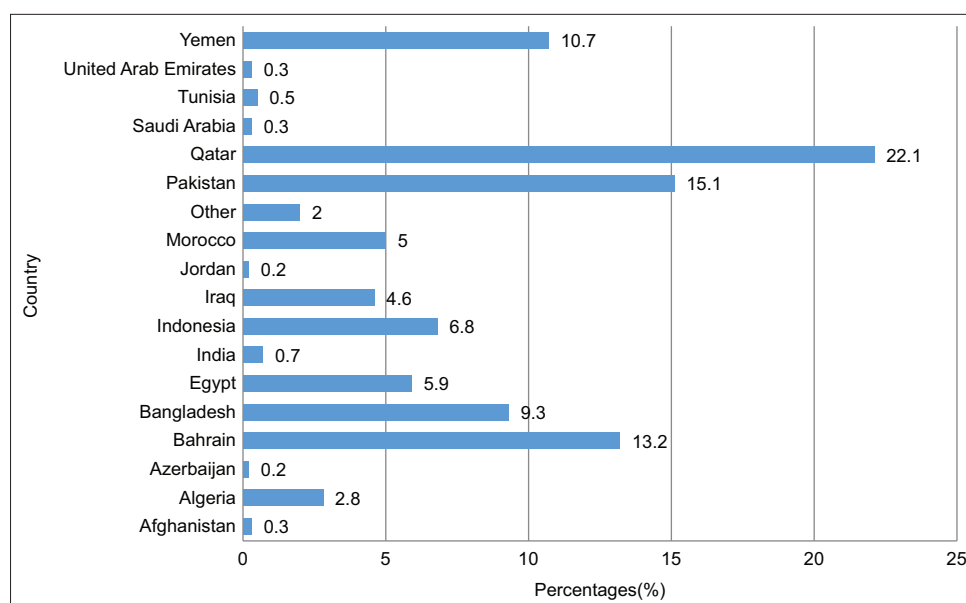


Figure 1: Nationality of the pilgrims

Table 3: Status of emergency awareness and care of pilgrims

Characteristics	Frequency (n)	Percentage
Did you know the emergency number in case you have a health issue?		
Yes	295	48
No	319	52
Did you have any relatives or friends who cared for and accompanied you on this Hajj?		
Yes, I have a companion	438	71.3
No	136	22.1
No need for care	40	6.5

DISCUSSION

This study found a 13% prevalence of insomnia among pilgrims during Hajj, with difficulty falling asleep being the most common issue (38.9%), followed by frequent nighttime awakenings (24.4%). These findings are consistent with previous research highlighting sleep disturbances as a prevalent problem during Hajj.^[9] For instance a 2024 study by Amigos and Badahdah reported similar findings, noting that poor sleep quality was more common among older, obese males and most prevalent sleep-related issues were dissatisfaction with daily sleep quality (38%), sleep apnea-related symptoms (58%), morning tiredness (47%), snoring (25%), difficulty initiating or maintaining sleep (22%).^[9] Furthermore, 25% of participants exhibited excessive daytime sleepiness. While their reported prevalence is higher than the 13% observed in our study, the difference may be attributed to differing measurement tools. Our study relied on self-reported prevalence of specific symptoms, rather than standardized indices.

In a study by Masood *et al.*, clinical interviews conducted by qualified psychiatrists reported that 59% of pilgrims experienced some form of sleep disruption.^[32] Similarly, another study among pilgrims during the 2016 Hajj found that 7.3% of pilgrims reported insomnia.^[33] Furthermore, another study revealed that insomnia symptoms are more common among pilgrims.^[34] Studies suggest that sleep problems and insomnia are common among pilgrims, particularly during the initial weeks in Mecca and the core Hajj period.^[34] This period can be especially stressful due to factors such as navigating a foreign environment, fear of getting lost, and anticipation of potential mishaps like stampedes or terror attacks. In addition, environmental factors like extreme heat and dehydration can exacerbate confusion, especially among older adults, and are often preventable.^[34] Moreover, insomnia symptoms among pilgrims during Hajj may be due to environmental and psychosocial stressors, such as shared sleeping arrangements, noise from co-pilgrims, and anxiety related to religious obligations, which might impact sleep quality. It is known that poor sleep is not only prevalent but also associated with increased daytime fatigue and reduced cognitive alertness, findings consistent with our participants' reports of difficulty staying awake and feeling unrefreshed on waking. Pilgrims suffered from sleep deprivation due to the tight schedules of rituals, fatigue, and weather-related discomfort. Notably, night-time rituals and the long walking distances between Hajj sites were major factors disrupting circadian rhythms, a point that supports the elevated levels of difficulty falling asleep observed in our study.

Although the relatively lower prevalence of overall sleep problems (13%) in our study might also reflect a positive trend in health service delivery and improved accommodations during Hajj, the Saudi Ministry of Health's efforts in increasing awareness, improving lodging environments, and expanding access to medical support may have contributed

Table 4: Association between insomnia symptoms and participants' demographic characteristics

Variables	Daytime sleepiness (%)	Feeling unrefreshed after waking up (%)	Wake up often at night (%)	Snoring (%)	Trouble falling asleep (%)	Chi-square	P-value
Gender							
Male	36 (11.3)	31 (9.7)	74 (23.3)	28 (8.8)	149 (46.9)	1.004	0.909
Female	28 (9.5)	31 (10.5)	76 (25.7)	26 (8.8)	135 (45.6)		
Age							
<20	1 (11.1)	1 (11.1)	2 (22.2)	1 (11.1)	4 (44.4)	12.055	0.914
21-30	9 (9.0)	13 (13.0)	24 (24.0)	11 (11.0)	43 (43.0)		
31-40	21 (11.8)	16 (9.0)	43 (24.2)	21 (11.8)	77 (43.3)		
41-50	15 (10.7)	15 (10.7)	28 (20.0)	10 (7.1)	72 (51.4)		
51-60	13 (11.4)	10 (8.8)	32 (28.1)	8 (7.0)	51 (44.7)		
>61 years	5 (6.8)	7 (9.6)	21 (28.8)	3 (4.1)	37 (50.7)		
Education							
Illiterate	5 (5.7)	11 (12.6)	12 (13.8)	3 (3.4)	56 (64.4)	28.879	0.004
Intermediate	9 (13.6)	11 (16.7)	15 (22.7)	4 (6.1)	27 (40.9)		
Read and Write	14 (10.7)	17 (13.0)	29 (22.1)	15 (11.5)	56 (42.7)		
University	36 (10.9)	23 (7.0)	94 (28.5)	32 (9.7)	145 (43.9)		

to the improved sleep conditions compared to earlier years. However, even with improvements, the high proportion of participants reporting trouble falling asleep (nearly half of those with sleep problems) indicates that initial insomnia remains a persistent concern. Factors such as travel-related fatigue, unfamiliar sleeping environments, and elevated stress levels associated with fulfilling religious obligations may continue to significantly contribute to sleep initiation issues during Hajj.

This study revealed important patterns in the distribution of sleep problems among Hajj pilgrims, particularly regarding gender and education level. While the prevalence of specific sleep problems varied between male and female participants, no statistically significant association was found between gender and overall insomnia symptoms. Similarly, age did not show a significant association with sleep problems. However, a significant association was identified between pilgrims' educational level and sleep disturbances, with more educated individuals reporting higher rates of various sleep-related symptoms. These findings aligned with existing literature on sleep. For instance, Alost *et al.* in 2024 found that women were revealed to have a higher prevalence of all types of sleep disturbances than men,^[35] which they attributed to a greater psychological burden and caregiving responsibilities, especially in shared or crowded accommodations. In line with our findings, although women reported more frequent issues such as trouble falling asleep and frequent awakenings, the overall gender difference was not statistically significant. This suggests that while gendered patterns in symptom reporting may exist, other factors, such as environment, stress, or biological rhythms during travel, may override gender as

a direct predictor. Regarding age, the lack of a statistically significant association in our study contrasts with the earlier work, where the author observed that older pilgrims (aged 60 and above) were more susceptible to sleep disorders, including OSA and insomnia.^[36] Their study emphasized the role of comorbidities, physical exhaustion, and decreased adaptability to environmental changes as contributors to poor sleep in older populations. The absence of such a trend in our sample may be due to differences in study design or a younger average age of participants. A key finding of this study was the significant association between educational attainment and sleep problems. Pilgrims with graduate-level education or literacy reported more sleep-related complaints, including daytime sleepiness, unrefreshing sleep, frequent nighttime awakenings, and snoring. This may be attributed to two factors: (1) greater health awareness among educated individuals, leading to increased self-reporting of sleep issues, and (2) higher stress levels due to added responsibilities, logistical planning, or religious expectations during Hajj, exacerbating sleep disturbances.

CONCLUSION

This study reveals that around 13% of pilgrims experienced sleep-related issues. The most frequently reported problems included difficulty initiating sleep, waking up multiple times during the night, struggling to stay awake during the day, and waking up feeling unrested. Interestingly, a significant link was found between sleep disturbances and educational level, with more complaints noted among those with higher education. However, no meaningful associations were

observed with demographic factors such as age or gender. These findings emphasize the need to prioritize sleep health among pilgrims, especially those with advanced educational backgrounds. The results can guide the development of targeted interventions and sleep support initiatives to improve the overall well-being of pilgrims during this important religious journey. We recommend educating individuals on the importance of sleep, as well as promoting awareness of sleep health during pre-hajj preparations. In addition, we suggest offering counseling services and support groups for pilgrims who may be experiencing sleep disturbances. These services would focus on stress reduction, relaxation techniques, and coping strategies.

DATA AVAILABILITY STATEMENT

All relevant data are within the manuscript and its Supporting Information files.

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