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Research Article

Predictive Factors and Characteristics of Sleep Paralysis Episodes among University Students in Jordan: A Cross-sectional Study

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Background

Sleep paralysis (SP) is characterized by rapid eye movement, sleep atonia, brain wakefulness, and a hypervigilant state.

Objective

This study assesses the predictive factors and characteristics of SP episodes among university students.

Methods

A self-reported questionnaire was administered through the university's email to students from Jordan. It inquired about SP, sleep hygiene, and perceived stress using the Unusual Sleep Experience Questionnaire, the Sleep Hygiene Index, and the Higher Educational Stress Inventory, respectively. In addition, frequency and episode features were measured, and students' demographic data were gathered.

Results

A total of 455 students were enrolled in the study. Most participants exhibited good sleep hygiene (77.6%) but also reported high stress levels. The frequency of SP episodes was associated with the duration of the episodes, prone position, and multiple sleeping disorders. In contrast, no association was found with sleep duration, sleep latency, or the presence of multiple psychiatric disorders.

Conclusion

This study is the first to examine the characteristics of SP episodes and predictive factors among university students in Jordan, highlighting the importance of recognizing factors associated with SP. This study paves the way for more extensive research on students, particularly examining the effect of stress on different aspects of their lives that could predispose them to various medical conditions, including SP.

1. INTRODUCTION

Sleep paralysis (SP) is recognized as a rapid eye movement (REM) sleep parasomnia characterized by complete muscle atonia, sparing the muscles of the eyes while preserving consciousness, in which the person experiences an inability to move their body. It usually occurs upon falling asleep or awakening and ends spontaneously or upon tactile stimulus. Even though it lasts for a brief period, the episode usually leads to significant distress, fear, and anxiety.[1,2] In addition, about 75% of episodes are associated with hallucinations, most often hypnogogic and hypnopompic, including a sense of the presence of evil in the room (intruder), a feeling of tightness in the chest (incubus), a feeling of spinning, and out-of-body feelings (vestibular-motor).[3,4]

SP is an enigmatic disorder, and multiple theories and cultural beliefs attempt to explain the nature of these episodes. It was thought to be caused by a nightmare or a supernatural evil spirit. However, from a scientific perspective, SP occurs during REM sleep, associated with a state of

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hypervigilance and loss of respiratory muscle tone, leading to hypercapnia. The combination of these events, and the patient's position and movement during the episode, creates fear, a feeling of chest tightness, the perception of an intruder, and a sense of impending doom.[5] In addition, familial tendency and genetic factors have been identified as potential pathogenic factors.[6]

Based on a recent systematic review and meta-analysis, the worldwide prevalence of SP is 30% with over two-thirds of the affected population being psychiatric patients or students. The high prevalence among students could be explained by the presence of risk factors that could initiate and exacerbate SPs, including young age, stress, poor sleep quality, traumatic events, anxiety disorders, high consumption of stimulants such as caffeine, and lack of physical activity.[7]

Multiple studies have evaluated SP among students in various countries, including Italy, Poland, Pakistan, Egypt, the United States, Argentina, Nigeria, Czechia, Ireland, Kuwait, and Sudan.[8-18] Nevertheless, no studies have been conducted in Jordan. Therefore, we aim to contribute to the literature by providing a glimpse of the predictive factors and characteristics of SP episodes among Jordanian students. Understanding this phenomenon and its exacerbating factors could improve the quality of the information supplied for the general population, particularly students, ultimately helping to mitigate the severity of this condition.

2. METHODS

2.1. ETHICAL CONSIDERATIONS

The study was approved by Yarmouk University's Institutional Review Board (IRB/2023/527). Furthermore, electronic informed consent was obtained from each participant, and the study was conducted under the Declaration of Helsinki. The data gathered was kept confidential, and only the members included in this study were allowed to view it. In addition, this study did not collect data revealing the participants' characteristics.

2.2. STUDY DESIGN

In this cross-sectional study, we targeted students at Yarmouk University from different colleges who were aged 18 years and above and had experienced SP. Students who did not experience SP were excluded from the study. The data were collected over a month using a self-report online questionnaire distributed to students via their university email addresses.

2.3. MEASURES

An easy-to-fill questionnaire, comprising four sections, was developed using Google Forms and based on previous similar studies.[8-18] The first section collected sociodemographic data and also inquired about sleeping habits and personal and/or family history of different sleep disorders, such as sleepwalking, narcolepsy, night terrors, nightmares, or insomnia.

In the second section, we utilized the unusual sleep experiences questionnaire to assess SP among participants,[19] with some adaptations to align with our cultural context. It has been translated into Arabic and back to English by a professional team of translators and medical experts. In addition, we included specific queries to assess the prevalence of SP and its predictive factors among students. At the outset of this section, respondents were asked about various unusual experiences they had during sleep, such as being unable to open their eyes or speak, hearing strange noises, concerns about their mental health, and perceptions of shadows or shapes moving toward them.

Regarding SP episodes, participants were queried about their duration and frequency, the age of onset of the first episode, their occurrence during daytime, sleeping posture, types of hallucinations experienced, attempts to physically escape the condition, timing of episodes (on waking or before falling asleep, at night or during naps), and efforts to prevent future episodes.

In the third section, we administered the valid and reliable Arabic version of the Sleep Hygiene Index (SHI; Cronbach's $\alpha = 0.749$, intercorrelation coefficient = 0.980), which comprises 13 self-assessed questions designed to evaluate sleep hygiene behaviors influencing sleep quality. Participants responded on a 5-point Likert-type scale, ranging from never to always. Previously established thresholds were used to categorize scores as indicating good sleep hygiene (<26), average (27–34), or poor (>35) sleep hygiene.[20]

In the last section, we incorporated the valid and reliable Arabic version of the Higher Education Stress Inventory (HESI; Cronbach's $\alpha = 0.75$), which consists of 16 statements designed to assess stress levels and stressors among higher education students. Participants responded using a four-point scale to indicate their level of agreement with the sentences. In this scale, we utilized the degree of agreement by calculating the weighted average value, which is determined by summing the mean values for each question and dividing them by the total number of questions.[21]

2.4. DATA ANALYSIS

Data were entered into Microsoft Excel (2016, US) for cleaning and coding, then imported into Jamovi version 2.3.26 (www.jamovi.org) for analysis. Descriptive statistics were calculated for all quantitative and categorical variables and presented as either frequencies and percentages or medians and interquartile ranges (IQRs). Ordinal logistic regression was performed to examine the association between sleep frequency (categorized as daily, weekly, monthly, and yearly) and potential predictor variables, including age, gender, smoking status, number of sleep disorders, number of psychological problems, sleep position, sleep latency, and sleep duration. Statistical significance was set at $p<0.05$.

3. RESULTS

3.1. DEMOGRAPHIC CHARACTERISTICS

A total of 455 students suffering from SP participated in the study, with the majority being female (74.1% [$n = 337$]). The median age of students experiencing SP was 20 years. In addition, students enrolled in the following colleges accounted for the highest percentages of participants: the faculty of medicine, 26.2% ($n = 119$); the faculty of literature, 13.8% ($n = 63$); and the faculty of science, 8.1% ($n = 37$). Detailed demographic characteristics of the study sample are presented in Table 1.

3.2. SLEEPING HABITS AND HYGIENE

Regarding sleeping habits, 56.3% had sufficient sleep duration (7–9 h/night). However, a recognizable percentage

Table 1. Participant's demographic characteristics

Characteristics	Values (%)
Gender	
Female	337 (74.1)
Male	118 (25.9)
Age	
Years (median, [interquartile range])	20 (3)
Academic level	
Bachelor's degree	431 (94.7)
Master's degree	19 (4.2)
Ph.D	5 (1.1)
Academic year	
1st	107 (23.5)
2nd	88 (19.3)
3rd	99 (21.8)
4th	80 (17.6)
5th	53 (11.6)
6th	28 (6.2)
Faculty	
Archeology and anthropology	8 (1.8)
Business	9 (2)
Economics and administrative sciences	12 (2.6)
Educational sciences	31 (6.8)
Engineering	51 (11.2)
Information technology and computer sciences	28 (6.2)
Languages	3 (0.7)
Law	9 (2)
Literature	63 (13.8)
Media	2 (0.4)
Medicine and surgery	119 (26.2)
Military sciences and citizenship	2 (0.4)
Nursing	19 (4.2)
Physical education	9 (2)
Science	37 (8.1)
Islamic studies	27 (5.9)
Tourism and hotels	5 (1.1)
Pharmacy	21 (4.6)
Smoking	
Yes	70 (15.4)
No	385 (84.6)

Note: Data presented as *n* (%), unless stated otherwise.

(80.9%) needed more than 10 min to fall asleep, and the most pronounced sleep problem encountered among our participants was insomnia (48.4%). In comparison, the most prevalent psychiatric condition was depression (14.7%).
Using the Arabic version of the SHI, which assesses sleep hygiene behaviors among adults, 353 individuals (77.6%) reported having good sleep hygiene habits, scoring 26 points or less. Only 23 (5.1%) exhibited poor sleep hygiene habits, scoring more than 35, as shown in Figure 1. Details of participants' responses to SHI are presented in Table S1.

Moving to the personal and family history of SP, a positive family history of SP was reported among 95 students (20.9%). In contrast, 177 (38.9%) stated a negative family history, and 183 (40.2%) were uncertain about their family history. In addition, a total of 351 respondents (66.1%) reported that their first episodes of SP occurred between 11 and 20 years, while 72 (13.6%), 25 (4.7%), and 7 (1.3%) reported their first

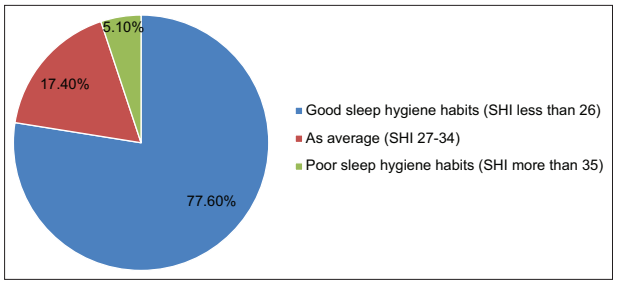

Figure 1. Sleep hygiene index (SHI) interpretation among participants

episodes at ages of 21–30 years, <10 years, and >30 years, respectively. A substantial percentage of participants declared a significant life change preceding their first episode of SP, including changes in sleep pattern (38.9%), changes in food/physical activity (24.4%), emotional changes (22%), and work-related changes (16%), while 41.1% declared no life changes preceding the first episode.

Considering episode characteristics, most episodes occurred during sleep onset (66.8%) and at night (66.2%), regardless of sleep position (56.3%). They lasted for <2 min (58.7%), were associated with feelings of fear (89%), and ended with significant physical effort (54.1%). Surprisingly, a considerable proportion, 281 individuals (61.8%), did not take any preventive measures against future episodes, and only 174 individuals (38.2%) did.

In addition, we analyzed the frequency of episodes among the participants, revealing annual patterns in 49.9%, followed by monthly, weekly, and daily patterns in 30.3%, 15.4%, and 4.4%, respectively. Furthermore, hallucinations were reported during the episodes, with visual (35.6%) and auditory (25.1%) being the most common. Table 2 shows more details of sleeping habits and episode features.

3.3. SP AND PREDICTIVE FACTORS

A heterogeneous spectrum of symptoms was experienced during SP episodes. Symptoms experiences included being unable to speak (92.5%), feeling tingling or numbness in the extremities (79.4%), sensing pressure on the chest (79.1%), inability to open their eyes (76.7%), feeling close to death (75.8%), the presence of something in the room (72.3%), suffocated (66.5%), and seeing shadows or an object moving in the room (58.5%). Other reported symptoms and their frequencies are detailed in Table 3. Participants' perceptions of their experiences after the first attack and their current explanations are detailed in Table S2.

An ordinal logistic regression was conducted to explore predictors of SP frequency (annual, monthly, weekly, daily). After adjustment for demographic, clinical, and sleep-related variables, having more than one sleep disorder was independently associated with higher odds of frequent SP episodes (adjusted odds ratio [AOR]: 1.76, 95% confidence interval [CI]: 1.14–2.57, p=0.009). Sleep position also showed a significant association: participants who slept in a prone position had lower odds of frequent SP episodes than those stating that sleep position made no difference (AOR: 0.53, 95% CI: 0.36–0.79, p=0.002). In contrast, age, gender, smoking status, psychological problems, sleep duration, sleep latency, and supine position were not significantly associated with SP frequency after adjustments (p>0.05). Table 4 details different factors and their association with episode frequency.

Table 2. Sleeping habits, features of sleep paralysis episodes, and associated factors predisposed to their development

Variable	Categories	Percentage
Sleeping hours per night	<7 h	33.4
	7–9 h	56.3
	More than 9 h	10.3
Time taken to fall asleep	<10 min	19.1
	10–20 min	35.8
	More than 20 min	45.1
Feeling energetic after waking up	Always	9.9
	Sometimes	74.5
	Never	15.6
History of sleep disorder	Insomnia	48.4
	Narcolepsy	6.2
	Sleepwalking	1.1
	Night terrors	11.6
	Nightmares	32.7
	More than one disorder	25.9
	None	33.8
History of psychiatric condition	Depression	14.7
	Schizophrenia	0.7
	Phobia	4.4
	Post-traumatic stress disorder	3.5
	More than one problem	4.5
	None	7.8
	Other problems	4.2
Family history of sleep paralysis	Yes	20.9
	No	38.9
	Unsure	40.2
Age at onset of sleep paralysis	Below 10 years	4.7
	11–20 years	66.1
	21–30 years	13.6
	Above 30 years	1.3
Life changes preceded the occurrence of sleep paralysis	Changes in sleep pattern	38.9
	Changes in food and/or physical activity	24.4
	Emotional changes	22
	Work-related changes	16
	None	41.1
Sleep position and episode occurrence	Supine	33.2
	Prone	10.5
	Sleep position did not make a difference	56.3
Time of day of the occurrence of episodes	While sleeping at night	66.2
	While taking a day nap	7.3
	Both times	26.6
Time of occurrence of the episode	At sleep onset	66.8
	Near the time of waking up	33.2
The way the episode ended	With significant physical effort	54.1
	Spontaneously	45.9
Frequency of sleep paralysis episodes	Annually	49.9
	Monthly	30.3
	Weekly	15.4
	Daily	4.4
Duration of the episodes	A few seconds to 2 min	58.7
	3–5 min	32.3
	More than 5 min	9
Presence of hallucinations	Visual	35.6
	Auditory	28.1
	Olfactory	1.8
	More than one type of hallucination	18.9
	None	53.4
Experience	Frightening	89
	Pleasant	2.2
	Both	8.8
Taken preventive measures	Yes	61.8
	No	38.2

(Cont'd...)

Table 2. ***(Continued)***

3.4. EDUCATIONAL STRESS AMONG STUDENTS EXPERIENCING SP

Table 5 presents the Arabic HESI items and illustrates the level of agreement with each item. The findings indicate that most students experiencing SP believed academic literature to be overly complex and extensive. They also perceived education as being dominated by group activities with unclear objectives and an excessive burden of responsibility placed on the student. Despite concerns about acquiring the necessary knowledge for their future careers, they expressed pride and satisfaction in their chosen profession. They believed they could make a significant impact through their studies. In addition, they felt respected by their teachers.

4. DISCUSSION

In this cross-sectional study, we aimed to study predictive factors of SP among university students and the phenomenology of SP episodes. This condition can significantly impair various aspects of people's lives and impact their ability to perform well in work, study, or social settings.

4.1. SUMMARY OF FINDINGS

In this cross-sectional study, we enrolled 455 university students with SP to examine the predictive factors of SP and conduct an in-depth analysis of episode characteristics, with an overwhelming contribution from the medicine, literature, and science faculties. The study revealed a significant association between SP frequency and episode duration, prone position, and the presence of multiple sleeping disorders. Nevertheless, sleep duration, sleep latency, and the presence of multiple psychiatric disorders showed no significant association (Table 5).

Our investigation revealed a notable gender discrepancy, with females comprising 74% of the participants, which aligns with similar cross-sectional studies.[12,16,17] However, in a global systematic review and meta-analysis, gender was found not to influence the occurrence of SP.[6,7]

Table 3. Frequency of occurrence of different sleep paralysis symptoms

Questions	0 (Never)	1 (Sometimes)	2 (Often)	3 (Always)
Do you feel pressure on your chest or other areas of your body?	95 (20.9)	147 (32.3)	113 (24.8)	100 (22)
Did you feel suffocated?	152 (33.4)	127 (27.9)	78 (17.1)	98 (21.5)
Did you hear an unusual sound?	227 (49.9)	85 (18.7)	64 (14.1)	79 (17.4)
Did you smell strange odors?	339 (87.8)	34 (7.5)	17 (3.7)	5 (1.1)
Did you feel close to death?	110 (24.2)	117 (25.7)	105 (23.1)	123 (27)
Did you feel tingling or numbness in your extremities?	94 (20.7)	101 (22.2)	95 (20.9)	165 (36.3)
Did you feel like your soul left your body?	221 (48.6)	80 (17.6)	78 (17.1)	76 (16.7)
Did you feel dizzy?	221 (48.6)	103 (22.6)	66 (14.5)	65 (14.3)
Did you feel unable to open your eyes?	106 (23.3)	99 (21.8)	108 (23.7)	142 (31.2)
Were you unable to speak?	34 (7.5)	58 (12.7)	77 (16.9)	286 (62.9)
Did you feel the presence of something in the room?	126 (27.7)	85 (18.7)	85 (18.7)	159 (34.9)
Did you feel sexual feelings?	352 (77.4)	56 (12.3)	31 (6.8)	16 (3.5)
Did you feel something was seriously wrong with your body?	230 (50.5)	90 (19.8)	64 (14.1)	71 (15.6)
Did you feel afraid of going crazy or losing your mind?	281 (61.8)	74 (16.3)	46 (10.1)	54 (11.9)
Did you feel like seeing a shadow or shape moving toward you?	189 (41.5)	88 (19.3)	64 (14.1)	114 (25.1)

Note: Data presented as *n* (%).

Table 4. The association between the frequency of sleep paralysis episodes and different variables

Variable	Annually (%)	Monthly (%)	Weekly (%)	Daily (%)	AOR	95% CI	*p*-value
Age							
Years (median [IQR])	21 (3)	20.5 (2)	20 (3)	20.5 (3.25)	0.97	0.93–1.03	0.515
Gender							
Female	169 (50.1)	103 (30.6)	52 (15.4)	13 (3.9)	Ref		
Male	58 (49.2)	35 (29.7)	18 (15.3)	7 (5.9)	1.14	0.73–1.72	0.576
Smoking							
No	196 (50.9)	117 (30.4)	61 (15.8)	11 (2.9)	Ref		
Yes	31 (44.3)	21 (30)	9 (12.9)	9 (12.9)	0.96	0.57–1.58	0.879
>1 sleep disorder							
No	186 (55.2)	92 (27.3)	47 (13.9)	12 (3.6)	Ref		
Yes	41 (34.7)	46 (39)	23 (19.5)	8 (6.8)	1.76	1.14–2.57	0.009*
>1 psychological problem							
No	221 (50.9)	131 (30.2)	64 (14.7)	18 (4.1)	Ref		
Yes	6 (28.6)	7 (33.3)	6 (28.6)	2 (9.5)	1.62	0.70–3.75	0.295
Sleep duration							
7–9 h	134 (52.3)	79 (30.9)	36 (14.1)	7 (2.7)	Ref		
<7 h	72 (47.4)	48 (31.6)	22 (14.5)	10 (6.6)	1.03	0.69–1.50	0.880
>9 h	21 (44.7)	11 (23.4)	12 (25.5)	3 (6.4)	1.24	0.70–2.34	0.456
Sleep latency							
<10 min	41 (47.1)	25 (28.7)	15 (17.2)	6 (6.9)	Ref		
10–20 min	95 (58.3)	42 (25.8)	21 (12.9)	5 (3.1)	0.62	0.37–1.03	0.069
>20 min	91 (44.4)	71 (34.6)	34 (16.6)	9 (4.4)	0.97	0.60–1.5	0.914
Sleep position							
Sleeping position did not make a difference	114 (44.5)	81 (31.6)	50 (19.5)	11 (4.3)	Ref		
Prone position	90 (59.6)	47 (31.1)	10 (6.6)	4 (2.6)	0.537	0.36–0.79	0.002*
Supine position	23 (47.9)	10 (20.8)	10 (20.8)	5 (10.4)	0.826	0.45–1.48	0.526

Note: Data presented as *n* (%), unless stated otherwise. *$p<0.05$ was considered significant.
Abbreviations: AOR: Adjusted odds ratio; CI: Confidence interval; IQR: Interquartile range.

4.2. SP AND ACADEMIC STRESS

Stress is considered a key catalyst for SP.[22,23] Various cross-sectional studies showed a positive correlation between the occurrence and frequency of SP and the presence of stress and anxiety symptoms.[8,12,13] We integrated the Arabic version of the HESI scale to assess the impact of stress on SP. Our findings suggest that the participants felt burdened by the rigorous, intensive academic courses, ambiguous course objectives, and extensive responsibilities. The participants expressed significant stress, particularly academic-related stress, which is consistent with the findings among students with SP from various countries.[8,12,13] Nonetheless, the participants displayed positive attitudes

Table 5. Higher education stress inventory scale and sleep paralysis

Question	Strongly disagree (%)	Disagree (%)	Agree (%)	Strongly agree (%)	Mean	SD	Decision
I am worried about housing (university housing)	196 (43.1)	143 (31.4)	85 (18.7)	31 (6.8)	1.89	0.938	Low agreement
Teachers provide encouragement and personal attention	113 (24.8)	170 (37.4)	148 (32.5)	24 (5.3)	2.18	0.868	Low agreement
I was less likely to be treated well because of my cultural background	204 (48)	159 (349)	68 (14.9)	24 (5.3)	1.81	0.879	Low agreement
Teachers often fail to clarify educational objectives	78 (17.1)	163 (35.8)	158 (34.7)	56 (12.3)	2.42	0.914	Low agreement
As a student, my financial situation is a concern	98 (21.5)	126 (27.7)	155 (34.1)	76 (16.7)	2.46	1.01	Low agreement
I am concerned about my future financial situation and my ability to repay my student loans	125 (27.5)	140 (30.8)	113 (24.8)	77 (16.9)	2.31	1.05	Low agreement
The references are difficult and extensive	55 (12.1)	113 (24.8)	213 (46.8)	74 (16.3)	2.67	0.888	High agreement
I am worried that I will not get all the knowledge needed for my future career	49 (10.8)	79 (17.4)	181 (39.8)	146 (32.1)	2.93	0.961	High agreement
The professional role provided in the training contradicts my personal opinions	108 (23.7)	199 (43.7)	108 (23.7)	40 (8.8)	2.18	0.893	Low agreement
As a student, I am often expected to participate in situations where my role and function are not clear	80 (17.6)	167 (36.7)	163 (35.8)	45 (9.9)	2.38	0.887	Low agreement
There is too much emphasis on learning facts and too little emphasis on seeking knowledge and making time for reflection	47 (10.3)	105 (23.1)	188 (41.3)	115 (25.3)	2.82	0.930	High agreement
I feel that my teachers treat me with respect	35 (7.7)	53 (11.6)	249 (54.7)	118 (25.9)	2.99	0.828	High agreement
Education is largely characterized by group activities with unclear objectives and too much responsibility placed on the student	47 (10.3)	160 (35.2)	181 (39.8)	67 (14.7)	2.59	0.863	High agreement
I can leave a mark on the study	38 (8.4)	84 (18.5)	211 (46.4)	122 (26.8)	2.92	0.884	High agreement
I am proud of my future profession	37 (8.1)	61 (134)	163 (35.8)	194 (42.6)	3.13	0.933	High agreement
I am satisfied with my choice of profession	44 (9.7)	74 (16.3)	159 (34.9)	178 (39.1)	3.04	0.970	High agreement

Note: Data presented as *n* (%). Decision made based on weighted average for sleep paralysis (+): 40.72/16=2.545.
Abbreviation: SD: Standard deviation.

toward their academic choices and their ambition to create a profound influence fueled by a respectful relationship with their professors.

4.3. SP PHENOMENOLOGY AND CULTURAL BELIEFS

SP is a dissociative state in which a person is aware of their surroundings with persistent REM sleep muscle atonia, predisposing the patient to intense fear and hallucinations.[24] In our study, a significant proportion reported visual and auditory hallucinations with predominantly negative feelings during the episodes, including the inability to speak or open eyes, a feeling of chest tightness, a sense of impending doom, and the presence of another person in the room, which is typical for SP episodes.

It is suggested that SP occurs during the transition from one stage to another during the sleep cycle, such as transitioning from non-REM to REM and from REM to wakefulness.[24] Thus, this transition explains the characteristics of the episodes faced by the participants, including being predominantly encountered by night during the process of falling asleep, regardless of sleep position. In addition, the presence of[24] various factors that cause sleep fragmentation and disturbances in the circadian rhythm further contribute to the initiation of SP25, including stressors, changes at work, changes in diet, physical changes, and emotional disorders, as reported by most of our participants. Nevertheless, multiple genes are implicated in the disturbance of the circadian rhythm, leading to a familial tendency in some families.[24] In our study, 20.9% of the participants with SP conveyed a positive family history.

Despite these distressing symptoms and the significant physical efforts required to end the attacks, most of the participants did not take any preventive measures. This phenomenon may be attributed to cultural beliefs that regard it as a dream, ghost, or spiritual event, which does not necessitate medical attention (Table S2). Unfortunately, non-scientific theories concerning SP are being widely circulated among the general population, with the lack of proper scientific explanation, emphasizing the importance of spreading evidence-based and trusted information by healthcare providers to enhance the awareness of the scientific background of SP and encouraging those suffering from SP to seek medical care when needed.[5]

4.4. SP EPISODES PREDICTIVE FACTORS

Surprisingly, most of our participants reported having adequate sleeping hours (7–9 h) and good sleep hygiene, as indicated by an SHI score below 26 points (77.6%) (Figure 1), despite a significant percentage experiencing sleep latency >10 min and insomnia (48%). This finding contradicts the results of the available literature, which indicate a high prevalence of sleep deprivation and poor sleep quality among students suffering from SP.[7,8,14] In addition, there was no significant association between SP episode occurrence and factors indicating poor sleep hygiene, including sleep latency and sleep duration. These findings suggest that there could be other vital factors in SP pathogenesis and occurrence that have yet to be studied, highlighting the heterogeneous spectrum of SP.

However, we observed a significant association between the frequency of SP episodes and episode duration, and the presence of multiple sleeping disorders. Despite 56% of participants reporting that sleep position did not make a difference, a significant association was found between episode frequency and sleeping on the stomach. Compared to similar cross-sectional studies, most attacks occurred while sleeping on the back.[9,13,15]

4.5. CLINICAL IMPLICATIONS

In this cross-sectional study, we broaden the understanding of SP in the Middle East by contributing the first data from Jordan and examining the predictive factors of SP episode frequency among university students. While prior research has been reported in other regions, studies from the Middle East remain limited. Our study thus fills a regional gap in the literature. We aimed to delineate the symptomatology of SP, explore potential contributing factors that influence its occurrence, investigate the interplay between anxiety and SP, and evaluate the influence of sleep hygiene on the frequency of SP episodes.

Our study revealed surprising results, despite having episode features and predictive factors consistent with the published literature, SP participants exhibited good sleep hygiene, which is uncommonly encountered in SP patients.

4.6. LIMITATIONS

While our study offers valuable insights, it is important to acknowledge its limitations, including its cross-sectional nature. As a result, we are unable to confirm the associations discussed. Additionally, the sample was limited to students from Yarmouk University. Although Yarmouk University is one of the largest universities in Jordan, we are unable to generalize the results. Moreover, the sample size may be another obstacle hindering us from generalizing the results. Finally, descriptive data analysis was mainly used, which prevents us from establishing a causal or association between the different factors studied.

5. CONCLUSION

SP is a fascinating disorder with heterogeneous presentations that have been largely overlooked in scientific research, leading to a widespread misconception among the general population. In a pioneering study involving university students in Jordan, we have identified key factors that influence the frequency of SP occurrences and features of its episodes, including the duration of the episodes, prone position, and multiple sleeping disorders. This study serves as a preliminary step toward more extensive research on students both in Jordan and worldwide concerning SP. In addition, we emphasize the importance of carefully assessing stress levels and sleep quality among students, as these factors may predispose them to a range of health-related conditions.

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CONFLICT OF INTEREST

None of the authors has any conflict of interest.

AUTHOR CONTRIBUTIONS

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ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study was approved by the Yarmouk University Institutional Review Board (IRB/2023/527). Furthermore, each participant provided electronic informed consent, and the study was conducted in accordance with the Declaration of Helsinki guidelines.

CONSENT FOR PUBLICATION

Not applicable.

DATA AVAILABILITY STATEMENT

All data are provided within the manuscript and supplementary file.

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