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Sleep Deprivation and Its Association with Physical and Mental Health Among Adults in the United Arab Emirates (UAE): A Cross-Sectional Survey

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Abstract: Background: Sleep deprivation is a global health concern with clinical, economic, and social consequences. Studies conducted in Asia reported a significant prevalence of poor sleep quality. There is a paucity of data on sleep deprivation in the Middle East and UAE, in particular. We set out to determine the prevalence of sleep deprivation and its association with physical and mental health in UAE. Methods: We used a cross-sectional design with a sample size estimated using StatCalc software. Data collection tool was a survey instrument that we developed and then validated. Data analysis was done using Statistical Package for Social Sciences (SPSS). Results: Nearly 51% of the participants were younger than 25 years. Sleep deprived participants reported experiencing headaches frequently (25%) with a p-value of 0.07, with 22% having feelings of depression and lack of concentration with a p-value of 0.016. Discussion: sleep deprivation showed an association with depression/hopelessness but not statistically significant. However, sleep-deprived individuals may be more prone to physical and mental health conditions in the long term, requiring further research. Conclusion: This study establishes a link between sleep deprivation and physical/mental health outcomes, requiring further research. The willingness of many sleep-deprived individuals to seek help offers a promising avenue for intervention. Policymakers ought to integrate sleep health into broader public health policy.

Keywords: sleep deprivation; mental health; physical health; depression

1. Introduction

Sleep deprivation is a significant global health concern with significant clinical, economic, and social consequences. For optimal health, the CDC recommends that adults aged 18-60 get at least 7 hours of sleep per night, while those aged 61-64 should aim for 7-9 hours.[1] Sleep deprivation is a notable problem in the UAE and other Asian countries globally. In UAE, more than 40% of residents need more quality sleep, according to a survey of more than 950 individuals.[2]. Another study conducted in the UAE examines the relationship between sleep quality and various quality-of-life factors among 36,515 working adults in Abu Dhabi, using data from the Abu Dhabi Quality of Life survey. The findings highlight direct and indirect associations between sleep quality and factors like social connections, income satisfaction, and physical health, providing insights for improving well-being [3].

This trend extends globally with a high prevalence of sleep deprivation (SD) among adolescents [4] in countries such as the United States [5], Europe [6], China [7], Japan [8], and Kuwait [9]. In Saudi Arabia, the research found a 31% prevalence of adolescents sleeping less than 7 hours per night in 2009–2010 [10]. Furthermore, in another study, similarly high rates of SD were noted among children and adults in Saudi Arabia, with recent data showing that 33.8% of Saudi adults sleep less than 7 hours [11].

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Studies conducted in Singapore and across other Asian countries have highlighted a significant prevalence of poor sleep quality and insomnia [12,13,14,15]. In Japan, a study reported that 26.4% of men and 31.1% of women experience poor sleep [14]. Similarly, about 27% of individuals in China reported suffering from insomnia [15,16], and 39.4% of the representative population in Hong Kong reported poor sleep quality [17]. In Singapore, the Singapore Health 2012 study, a comprehensive population-wide survey, found that 27.2% of respondents experienced poor sleep [18]. These findings underscore the widespread issue of sleep disturbances in various Asian countries, indicating a need for targeted public health interventions to address sleep duration, quality, and associated health impacts.

The 2019 global sleep survey, "The Global Pursuit of Better Sleep Health," highlighted significant sleep challenges worldwide. Despite increasing awareness of sleep's importance, with 77% of respondents acknowledging its significant impact on health, they may still need help to achieve quality sleep [19]. WHO defines health as complete physical, mental, and social well-being, not merely the absence of disease or infirmity. [20]

According to WHO, people are classified by their BMI (body mass index) into categories such as Underweight (≤ 18.5), Normal (18.5–24.9), Pre-Obesity (25.0–29.9) and Obesity (≥ 30) [21]. Studies about the impact of sleep deprivation on physical health revealed that individuals who slept less than 7 hours per night were more likely to have higher average body mass indexes (BMI) and develop obesity than those who slept more. Studies showed that experimental sleep restriction was associated with increased levels of ghrelin, salt retention, and inflammatory markers and decreased leptin and insulin sensitivity [22]. Sleep loss is associated with Diabetes and impaired glucose tolerance. Short sleep duration (<6 h/day) was associated with a 38% absolute increase in the incidence of obesity. [23]. A study by the American Cancer Society Study showed that men sleeping 4 hours or less had higher mortality from chronic heart diseases (CHD) than those sleeping 7-7.9 hours 24. Sleep deprivation is also strongly associated with somatic problems such as headaches and abdominal pain [25].

In terms of mental health, sleep deprivation was associated with emotional distress, mood disorders, impairment of cognition, memory, and performance deficits, as well as behaviour problems in otherwise healthy individuals [25]. In a study with 231 participants, it was revealed that individuals who reported less than 6 hours of sleep per 24 hours were more likely to report being depressed compared to those who reported 7 hours of sleep. Insufficient sleep was associated with lower happiness in healthy adults, and a self-reported questionnaire was used as a single item to measure happiness [26]. Individuals chronically sleep-restricted may exhibit increased risk-taking behaviour or may show deficiencies in reasoning that result from seeking premature conclusions without considering all aspects of a problem. Sleeplessness is also connected to a strong tendency toward brief mental lapses (or microsleep episodes), occurrences that significantly increase the risk of a motor vehicle and other accidents [26]. Studies show that up to 20% of road traffic accidents are sleep-related, with over 1000 road deaths a year in UAE [27].

Understanding the impact of sleep deprivation on individuals' physical and mental health is vital in the United Arab Emirates (UAE) as the nation continues its pursuit of good health for development and progress. Despite the significant consequences that sleep deprivation can have, research on this topic within the UAE remains limited. This highlights the need to explore its prevalence and implications for physical and mental health. This research aligns with UAE's goal of achieving sustainable development goals of good health and well-being by 2030 [28].

As lifestyle behaviours leading to sleep deprivation become more prevalent in the UAE, addressing this issue is critical to ensuring better physical and mental health for individuals, thereby supporting the overall health and productivity of the community.

Research Question: What is the association of sleep deprivation on the physical and mental health of adults in United Arab Emirates?

Objectives:

- To determine the effect of sleep deprivation on mental health among adults in the UAE.
- To determine the effect of sleep deprivation on physical health among adults in the UAE.
- To determine the primary contributing factors that cause sleep deprivation

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- To investigate modifiable behaviour patterns that can improve sleep deprivation
- To generate evidence to aid policy and public health education

2. Materials and Methods:

2.1. Study Design

In addressing the research question and the associated objective, this study employed a cross-sectional design with mixed methods (qualitative and quantitative) to explore sleep deprivation among UAE adults aged 18-65.

2.2. Research Methods

The research utilized quantitative methods (surveys collecting data on demographics such as gender, age groups, and sleep duration) to gain insights into behaviours, associated factors, and the impact of sleep deprivation on health. For qualitative methods, we cross-tabulated the degree of sleep duration associated with individuals' physical and mental health through a series of questions assessing these aspects.

2.3. Population and Sample

The study targeted adults aged 18-65 who had lived in the UAE for more than 6 months (including citizens and expatriates). Participants were drawn from all seven Emirates of the UAE: Abu Dhabi, Dubai, Sharjah, Ajman, Umm Al Quwain, Ras Al Khaimah, and Fujairah. The inclusion criteria involved all adults aged 18-65 in UAE who had been in the country for more than 6 months, including citizens and expatriates. Exclusion criteria included children below 18 and all residents above 65 in study settings.

The study sample was identified using a stratified cluster convenience sampling technique. The minimum sample size was calculated using StatCalc [owned by CDC 29] to achieve a 95% confidence interval and a 5% margin of error.

2.4. Data Collection and Tool

Data collection occurred between September and December 2023 using a hybrid approach of face-to-face interviews and online surveys. This dual method facilitated broader participation and allowed researchers to reach various population segments.

We developed our data collection tool based on literature review regarding physical and mental health effects of sleep deprivation and standard screening tools such as Patient Health Questionnaire – 9 (PHQ-9) and Generalised Anxiety Disorder (GAD-7) instruments developed by Spitzer et al [30][31][32]. This was contextualized to the UAE setting to suit the study objectives of this research. We validated this instrument by administering it to five individuals in our university campus.

2.5. Ethics Approval

Ethical considerations were central to the study, with protocols in place to ensure informed consent, participant anonymity, and data confidentiality, following the principles of the Helsinki Declaration. This study received ethical approval from Dubai Medical College for Girls, reference number: IBR/DMCG/AY23-24/S-14, before data collection started.

2.6. Data Analysis

The data from our study were analyzed using the Statistical Package for Social Sciences (SPSS) developed by IBM software [33] to produce descriptive statistics (mean, median, and mode), and reported as descriptive statistics which were then displayed as frequency distributions and charts.

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3. Results:

3.1. Demographics

The study analyzed data from a sample of 321 participants, and the findings offer insights into how sleep patterns might correlate with health outcomes. In this study, the majority of the participants were female 76.3% (245), and the highest number of responses were recorded from the emirate of Dubai 45.8% (147) and most of them belonged to the ethnicity of South Asia, 59.2% (190). Most of our participants were younger than 25 years – 51.4% (165). The demographic characteristics of the participants have been described in Table 1.

Table 1. Participant demographic characteristics.

Category	Variable	Percentage (n)
Gender	Female	76.3% (245)
	Male	23.7% (76)
Emirate	Dubai	45.8% (147)
	Sharjah	27.4% (88)
	Abu Dhabi	10.6% (34)
	Ajman	7.8% (25)
	Fujairah	6.5% (21)
	Umm Al Quwain	0.9% (3)
	Ras Al Khaimah	0.9% (3)
Ethnicity	South Asia	59.2% (190)
	Middle East	17.8% (57)
	Southeast Asia	12.55% (40)
	African/Caribbean	5% (16)
	East Asia	4.4% (14)
	Americans	0.9% (3)
	European	0.3% (3)
Age [34] (in years)	Youth (18-24)	51.4% (165)
	Young Adult (25-44)	35.2% (113)
	Middle Age (45-65)	13.4% (43)

Sleep duration was categorized as adequate sleep for more than 6 hours, and sleep deprivation as sleep for less than 6 hours [35]. This study revealed that 29.6% (95) of the participants reported being sleep-deprived, as shown in Figure 1.

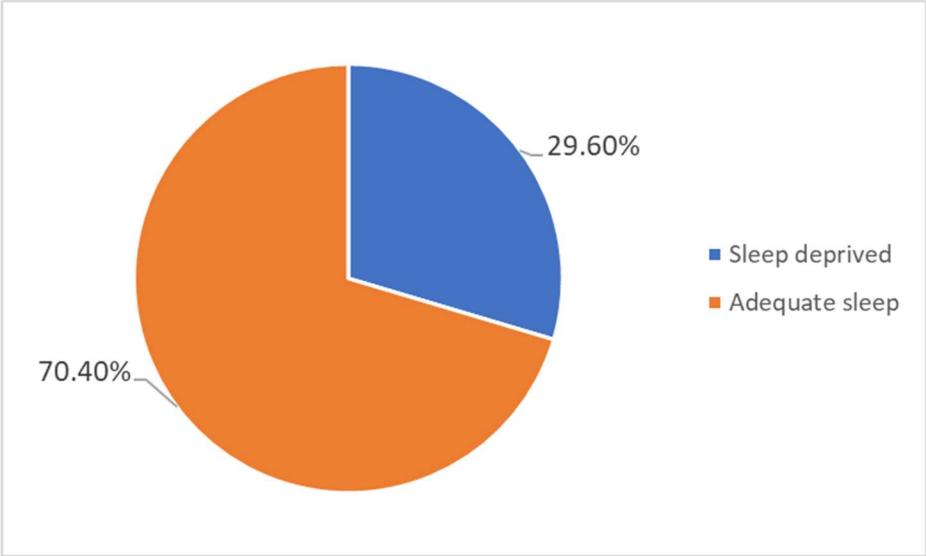

Figure 1. Percentage of individuals based on sleep duration.

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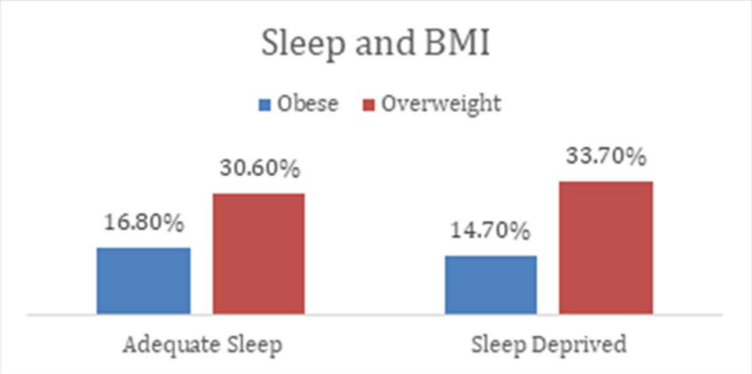
3.2. Sleep Deprivation and Physical Health

Using the WHO classification of BMI [36], our study found that 14.7 % (14) of those who reported being sleep deprived were obese, and 33.7% (32) were overweight, with a p-value of 0.77, as shown in Graph 1.



Graph 1. BMI and sleep duration about here.

We analyzed the relationship between sleep duration and various health conditions and presented it in the table below. Our parameters included diabetes/pre-diabetes, high cholesterol, hypertension, and multiple comorbidities (having two or three conditions). Sleep-deprived individuals have diabetes/pre-diabetes 4.21%(4), high cholesterol 3.15% (3), and hypertension 2.1%(2). Additionally, 1.05%(1) of individuals with three comorbidities and 5.26% (5) with two conditions are sleep-deprived with a p-value of 0. 88 (Table 2)

Table 2. Sleep duration and physical health conditions.

Physical health conditions	Sleep Duration	p-value
Pre-diabetic/diabetes	Sleep Deprived (4) 4.21%	
	Adequate sleep (16) 7.07%	
High Cholesterol	Sleep Deprived (3) 3.15%	
	Adequate sleep (9) 3.98%	
Hypertension	Sleep Deprived (2) 2.1%	
	Adequate sleep (3) 1.32%	
Three comorbidities	Sleep Deprived (1) 1.05%	0.88
	Adequate sleep (2) 0.88%	
Two comorbidities	Sleep Deprived (5) 5.26%	
	Adequate sleep (8) 3.53%	
No health conditions	Sleep Deprived (80) 84.2%	
	Adequate sleep (188) 83.1%	

According to our study, participants in the sleep deprived category who reported to have frequently experienced headaches was 25.26% (24), muscle pain was 15.7% (15), abdominal pain was 1.05% (1) and those who reported having frequently experienced more than one of the above listed 36.8% (35) with a p-value of 0.07. (Table 3)

Table 3. Sleep duration and physical symptoms.

3.3. Sleep Deprivation and Mental Health

As shown in Table 4, around 24.2% (23) of the sleep-deprived individuals reported frequent forgetfulness. This was 19% (43) among individuals with adequate sleep, with a p-value = 0.50. Among those with sleep deprivation, 28.4% (27) frequently reported difficulties in concentration, while individuals with adequate sleep showed 16.8%, with a p-value = 0.04. Regarding irritability

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due to minor issues, the percentage of participants feeling frequently irritable in sleep deprived was 29.4% (28) compared with 23.4% (53) in participants with adequate sleep, with an overall p-value = 0.27. In terms of decision-making, 8.7% (28) of sleep-deprived individuals reported facing frequent difficulty in decision making, while it was 20.8% (47) in those with adequate sleep, with a p value = 0.211

Table 4. Sleep duration and mental health.

Category	Sleep duration	Frequently	Sometimes/Infrequently	P - Value
Sleep Duration and Forgetfulness	Sleep Deprived (95)	24.2% (23)	72 (75.7%)	0.5
	Adequate sleep (226)	19.0% (43)	183 (81 %)	
Sleep duration and difficulty in concentrating during daily tasks	Sleep deprived (95)	28.4% (27)	71.5% (68)	0.04
	Adequate sleep (226)	16.8% (38)	83.1% (188)	
Irritability/ Annoyance	Sleep Deprived (95)	29.47% (28)	70.5% (67)	0.277
	Adequate sleep (226)	23.4% (53)	76.5% (173)	
Decision Making	Sleep Deprived (95)	8.7% (28)	70.5% (67)	0.211
	Adequate sleep (226)	20.8% (47)	79.2% (179)	

As shown in Table 5, in terms of the tendency to engage in **risky behaviours**, 5.3% (5 out of 95) of the sleep-deprived group reported engaging in these behaviours frequently. However, 7.1% (16 out of 226) of those with adequate sleep engaged in risky behaviours frequently, with a p-value = 0.539.

In the sleep-deprived category, 22% (21) of participants reported experiencing feelings of depression/hopelessness. Conversely, this was seen to be only 15% (34) of those with adequate sleep, with a p-value of 0.016. Additionally, 7.36% of individuals in the sleep-deprived category reported falling asleep while performing daily tasks like cooking, driving, reading, etc., compared to only 4% in the category of adequate sleep, with a p-value = 0.08.

Table 5. Comparison of engaging in risky behaviours, feelings of depression/hopelessness and micro sleep episodes over sleep duration.

Category	Sleep duration	Frequently	Sometimes/Infrequently	P - value
Engaging in risky behaviours	Sleep Deprived (95)	5.3% (5)	94.7% (90)	0.539
	Adequate sleep (226)	7.1% (16)	92.9% (210)	
Feelings of Depression / Hopelessness	Sleep Deprived (95)	22.10% (21)	77.89% (74)	0.016
	Adequate sleep (226)	15.04% (34)	84.95% (192)	
Sleep Duration and Micro Sleep Episodes (Falling asleep while doing daily tasks)	Sleep Deprived (95)	7.36% (7)	92.63% (88)	0.08
	Adequate sleep (226)	4.86% (11)	95.13% (215)	

The percentage of sleep deprived individuals who "always" and "often" felt nervous, anxious or on edge totaled 28.5% (27) as opposed to only 21.7% (49) in those who had adequate sleep with a p-value of 0.054 (Table 6).

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Table 6. Feelings of anxiety/nervousness across sleep duration (n=321).

	Sleep duration	Always	Often	Sometimes	Rarely	Never	P- value
Feelings of Anxiety/ Nervous/ On Edge	Sleep Deprived (95)	7.4% (7)	21.1% (20)	44.2% (42)	11.6% (11)	15.8% (15)	0.054
	Adequate sleep (226)	7.5% (17)	14.2 %(32)	37.2% (84)	26.1% (59)	15% (38)	

Among participants who were sleep deprived, 5.26% were involved in road traffic accidents, whereas only 3.53% of those who reported adequate sleep were involved in such accidents, with a p-value of 0.64 (Table 7).

Table 7. Road Traffic Accidents and Sleep Duration.

Category	Sleep duration	Yes	No	I do not drive	P-Value
Road Traffic Accident	Sleep Deprived (95)	5.26% (5)	66.3% (63)	28.42% (27)	0.64
	Adequate Sleep (226)	3.53% (8)	70.79% (160)	25.66% (58)	

An important parameter of our research was assessing the willingness of participants to seek help with their sleeping habits and patterns (Figure 2). In the category of sleep deprived individuals, 33.7% (32) indicated that they do not require any assistance with their sleep patterns, 22.1% (21) were unsure, and 44.2% (42) of participants were willing to seek help with sleep patterns and habits. This shows that the mode of the responses in our study, which was 44.2%, reflects that the most frequent preference among sleep deprived individuals is to seek help for their sleep-related issues.

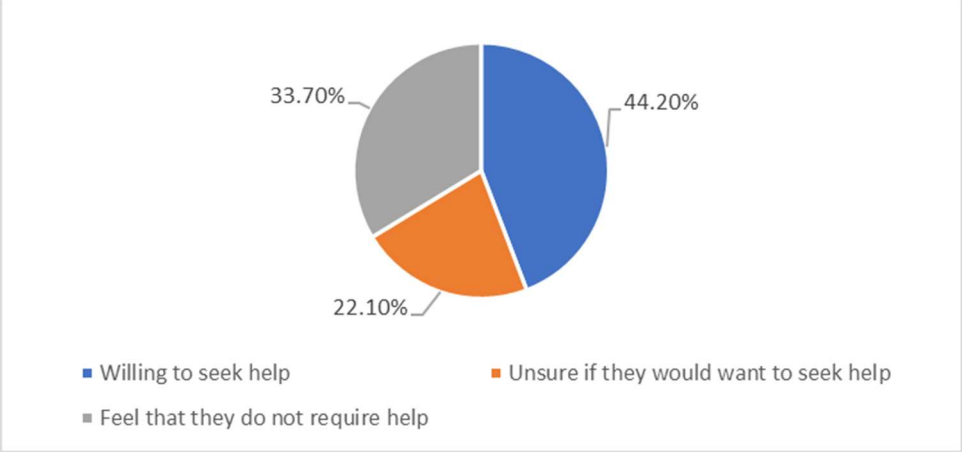

Figure 2. Willingness to Seek Help Among Sleep Deprived Individuals.

4. Discussion

Overall, sleep deprivation negatively impacts an individual's health and well-being. Through our research, we set out to determine the impact of sleep deprivation on physical and mental health among adults in the UAE. In our study, 29.6% (95) of the participants experienced sleep deprivation, compared to 33.8% in Saudi Arabia [11] and 39.4% in Hong Kong [37]. However, only 44% (42) of the individuals in the sleep deprived category in our study were willing to seek help with their sleep patterns and habits.

In this study, participants were asked to report any diagnosed conditions, including diabetes, pre-diabetic state, hypertension (high blood pressure), high cholesterol, stroke, or if they had no health issues or any other conditions. This is because sleep deprivation is noted to be associated with

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comorbidities [38]. Additionally, participants were asked to identify any symptoms they frequently experienced (2-3 times per week), such as headaches, abdominal pains, muscle pains, or other symptoms, with the option to select none if applicable. This approach aimed to comprehensively understand how sleep might be associated with physical health concerns.

As for BMI, in our study, about 15% of participants within the sleep deprived category were obese and around 33% were noted to be overweight, with a p-value of 0.77, making the result not statistically significant. As per the literature, sleep deprivation is associated with obesity. An epidemiological study of older adults concluded that sleep duration of less than 5 hours, compared with sleeping 7–8 hours, increased the likelihood of developing obesity by 40% [39] while a meta-analysis of 11 prospective studies (197 906 participants) found a significant association in both sexes between short sleep duration (defined as less than 5–6 hours per night) and the risk for developing obesity [40]. Examination of the database from the National Health and Nutritional Examination Survey I between 1982 and 1992 revealed that subjects between the ages of 32 years and 49 years with self-reported sleep durations at baseline less than 7 hours had higher average BMIs and were more likely to be obese than subjects with sleep durations of 7 hours [41].

Therefore, our results must align with the findings of the literature overall. This is probably because most of our participants are in the youth age group, which is known to have higher energy levels and metabolism. Several previous studies have found that insufficient sleep is associated with negative physical health and social outcomes, including adverse performance at school and in the labour market. Reduced sleep duration has been linked to 7 of the 15 leading causes of death in the U.S., including cardiovascular disease, malignant neoplasm, cerebrovascular disease, accidents, diabetes, septicemia, and hypertension [42,43].

In our analysis of the association between sleep deprivation and diabetes, we found a p-value of 0.88, indicating that the results are statistically insignificant. However, this does not imply any association between the two. Additionally, our study revealed that 4.21% of individuals with diabetes/ prediabetes experience sleep deprivation, which contradicts findings from well-established studies linking sleep deprivation to diabetes [44,45]. For example, A study of **o**ne hundred fifty-five females and males of Caucasian and African American ethnicity aged between 19-70 revealed that more people with prediabetes suffered from poor sleep than in the regular glucose group (62% vs. 46%). [46] .

Another case-control study involving 172 people with diabetes and 188 healthy controls compared sleep duration between individuals with Type 2 diabetes and healthy counterparts. This study found a significant difference in nocturnal sleep duration, with a p-value of 0.033, suggesting that a sleep duration of less than six hours predisposes individuals to the development of diabetes. [47]

A study conducted by Spiegel and colleagues explains the pathophysiology. 11 healthy men were assessed, and it found that sleep-deprived individuals develop higher insulin sensitivity, which potentially leads to insulin resistance and diabetes [48]. Insufficient sleep, particularly the suppression of slow-wave sleep and rapid eye movement (REM) sleep, has been closely linked to insulin resistance, which significantly increases the risk of developing diabetes [42,49].

In another study examining the association between sleep and glucose homeostasis in children and adolescents, factors such as biological maturation, physical activity levels, screen time, and dietary habits were not controlled, presenting a significant limitation [50].

When comparing our study results with those of other research, we found no significant association between diabetes and sleep deprivation. This discrepancy may be attributed to the fact that most participants in our study were young adults, which could influence the outcomes.

Our research findings on hypertension indicate that 21% of individuals experience sleep deprivation. This aligns with a cohort study involving 1,525 adults aged 12 to 25, which found that individuals with hypertension experienced less decline in percentage of N3 sleep over time compared to those without hypertension ($p < 0.05$) [51]

Additionally, data from the first National Health and Nutrition Examination Survey, which included 4,810 participants, revealed that five hours or less of sleep duration was significantly

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associated with an increased risk of hypertension. This link is attributed to the activation of the sympathetic nervous system, which serves as a crucial mechanism connecting sleep-disordered breathing to combined systolic and diastolic hypertension, particularly prevalent among middle-aged hypertensive patients [52].

Regarding high cholesterol and cardiovascular diseases [53],31.5% are sleep deprived. A longitudinal study on Chinese adults found a bidirectional relationship between sleep duration and multimorbidity. Short sleep duration is consistently linked to multimorbidity, where individuals with multiple chronic conditions, such as diabetes and hypertension, report a higher prevalence of sleep disturbances due to some cellular processes such as degenerative intracellular processes, oxidative stress, autonomic activity, dysregulated appetite-regulating hormones, inflammation, allergic and epigenetic processes, which are associated with multimorbidity [54,55].

According to a study, Individuals who reported six or fewer hours of sleep had higher levels of three inflammatory markers: fibrinogen, IL-6 and C-reactive protein. In particular, average C-reactive protein levels were about 25 per cent higher (2 milligrams per litre compared to 1.6) in people who reported fewer than six hours of sleep compared to that reported between six and nine hours. People whose C-reactive protein levels are in the upper third of the population (above 3 milligrams per liter) have roughly double the risk of a heart attack compared with people with lower C-reactive protein levels, according to the American Heart Association and Centers for Disease Control and Prevention [56]. In another study, A significant positive association between the latent factors of sleep inconsistency and inflammation was observed, suggesting inconsistent sleep is associated with higher levels of inflammatory biomarkers [57].

Our study also found that among individuals with sleep deprivation, 25.26% reported frequent headaches, 15.7% reported frequent muscle pain, 1.05% reported frequent abdominal pain, and 36.8% reported frequently experiencing more than one of the above-listed symptoms. However, with a p-value of 0.07, these results are not significant.

In contrast, the literature review suggests a significant association between sleep deprivation and the frequency of symptoms such as headaches and muscle pains. A study of 2695 participants revealed that headache frequency was significantly higher among migraineurs with short sleep duration $p = 0.048$) and poor sleep quality, $p = 0.009$) than among those without [58]. Another study showed that among individuals with migraine, 38% reported sleeping for less than 6 h per night [59].

In one study, forced awakening leading to interrupted sleep was associated with more excellent next-day spontaneous pain reports and reduced conditioned pain modulation (reduction in the body's ability to process pain, resulting in more significant pain experiences) [60]. In another study, upon evaluating the extremes of sleep duration, using raw data, sleeping for three hours of less was associated with an 81% increase in pain frequency relative to sleeping 6–9 hours [61]. A study demonstrated that transparent dose-response relationships exist between perceived stress and poor sleep and between pain intensity and poor sleep among hospital workers [62]. In contrast, a similar study showed that poor sleep constitutes a potent risk factor for low back pain among healthcare workers, with strong associations in all subgroup analyses [63]. This could be explained by the role of sleep deficiency in de-activating several systems/mediators with predominantly analgesic properties, including the opioid system, the orexinergic system, the melatonin system, and dopamine signalling, while activating systems/mediators with predominantly hyperalgesic properties, including Nitic Oxide and adenosine signalling, and inflammatory mediators of the immune system [64].

These findings align with the literature, implying that other factors, such as age, lifestyle, or underlying health conditions, may significantly influence health outcomes than sleep quality alone. However, it is essential to consider that while this data might suggest a limited immediate impact of sleep deprivation on physical health, the long-term effects of inadequate sleep could manifest differently over time and may not be fully captured in this snapshot. Therefore, further research could be valuable in understanding the comprehensive effects of sleep deprivation on physical health.

In terms of mental health, sleep deprivation has negative impacts in various spheres. The findings from Table 4 show an association between sleep duration and forgetfulness, trouble

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concentrating, annoyance, irritability, and difficulty making decisions. Furthermore, sleep deprivation may be associated with increased forgetfulness, with 24.2% (65) reporting difficulty remembering things and an increased frequency of forgetfulness. A p-value of 0.5 indicates that the relationship between sleep duration and forgetfulness is not statistically significant in our study. In literature, sleep deprivation has been associated with impaired cognition with an effect on memory and attention [66]. It has been noted that adequate sleep is required to consolidate memories, and the lack of sleep may result in poor memory [65]. Sleep deprivation was shown to alter synaptic structure in the hippocampus and thus play a role in disrupting long-term memory acquisition and consolidation. Furthermore, it was observed that sleep deprivation contributes to impaired memory function by affecting levels of required neurotransmitters [67].

Additionally, 28.4% (27) of sleep deprived individuals reported frequent trouble concentrating with a p-value of 0.04, indicating that the relationship between sleep duration and difficulty in concentration is statistically significant in our study. This is similar to what has been reported in the literature. Sleep deprivation is linked to impaired cognitive functioning due to its effects on the prefrontal cortex, extending its effects on attention and concentration. [66].

The results of our study suggest that around 30% of the sleep deprived individuals reported feeling annoyed or irritable by minor issues, with a p-value of 0.277. This suggests that there is no statistically significant link between sleep duration and irritability, similar to the outcomes of several meta-analyses on the effects of sleep loss on emotions. Some individual studies within these meta-analyses also found nonsignificant results (68). However, further research should be carried out to understand better the effects of sleep duration on mood and emotional regulation using a larger global sample size.

Our study found that individuals with adequate sleep (21%) reported more frequent struggles with decision-making compared to sleep-deprived individuals (8.7%), though the difference was not statistically significant (p-value = 0.211). This contrasts with previous research [69,70], which shows that partial sleep deprivation increases risk-taking during decision-making. In the referenced study, participants who gathered more information when well-rested relied on less evidence of sleep loss, leading to riskier decisions. The discrepancy between our findings and prior studies may be due to differences in how decision-making is measured or the complexity of factors influencing decision performance beyond sleep alone.

The data presented in Table 5 explores the relationship between sleep duration and engagement in risky behaviours, feelings of depression/hopelessness and microsleep episodes. 5% of sleep deprived individuals reported frequently engaging in risky behaviours, compared to 7% in the adequate sleep category, with a p-value of 0.539. This suggests that there is no statistically significant association between sleep duration and engaging in risky behaviours. This discrepancy could be due to the complexity of factors influencing risk-taking behaviours beyond sleep alone and differences in how risky behaviour is measured. Additionally, this could also be influenced by struggles in decision making among sleep deprived individuals, as discussed above.

This contrasts with other studies that suggest sleep deprivation impairs judgment and increases impulsivity, potentially leading to more frequent risky behaviours [71,72]. While previous research emphasizes that sleep loss affects the brain's ability to process risk and reward, thus increasing impulsive decision-making, the current study does not support this relationship.

According to the literature, sleep deprivation can increase risk-taking behaviour because it reduces the ability to inhibit inappropriate behaviours. Without appropriate inhibitory control, an individual may unintentionally evoke risky behaviours [73].

This study also focuses on using the Iowa Gambling Task (IGT) to measure risk-taking behaviour and risky decision-making. It discusses several studies that have consistently demonstrated that sleep deprivation is associated with a shift in performance on the IGT toward showing a pattern of risky behaviour focused on short-term rather than long-term gains. This shows that complex factors influence risk-taking behaviours, which warrants further investigation.

Sleep deprivation was statistically significant and associated with feelings of depression and hopelessness. About 22% of participants in the sleep deprived category reported experiencing

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frequent feelings of depression and hopelessness, with a p-value of 0.016. This is similar to the existing studies. A prospective study done in the US among 4,175 youths to find an association between Sleep Deprivation and Depression found that sleep deprivation increased the risk of depressive symptoms at follow-up by 25% to 38%. Further, they found that sleep deprivation increased the risk for subsequent major depression by a factor of more than 3. This association was much stronger than for depressive symptoms, as mentioned above.[34].

Several studies have highlighted a possible association between sleep deprivation and burnout across occupations. A cross-sectional study on finding a possible association between sleep duration and burnout in healthcare professionals revealed a statistically significant association between the two, where ~39% of participants reported a sleep duration of < 7 h and those reporting high burnout represented 21.7% [74]. Another study done on 61 participants found a significant correlation between sleep deprivation as a risk factor for academic burnout ($r(59) = 0.43$, $p < 0.001$, $R2 = 0.18$) [74] This study also found that sleep deprivation, poor sleep quality, and perceived stress also have positively correlated with academic burnout.

In the literature, sleep deprivation has also been significantly associated with suicide ideations, suicide attempts and suicide. This has been attributed to suicidal patients averaging a shorter REM sleep latency, a higher REM percentage, and a more negative dream-like quality of REM.[75]. A recent study done in the US among high school students showed that compared with students reporting sufficient sleep, those with insufficient sleep were more likely to feel sad or hopeless (42.7% vs 28.1%), have considered suicide (19.1% vs 12.5%), or have made a suicide plan (14.8% vs 9.6%). [76]. Another study found that short sleep duration (<5 h/day) increased the odds of suicidal ideation and suicide attempts by 1.43 (95 % Confidence Interval = 1.29–1.58) and 1.78 (95 % Confidence Interval = 1.41–2.25), respectively. [77]

Microsleep episodes are defined as extremely short periods of sleep. These episodes last for a few seconds. In these episodes, brain waves that can be measured using an electroencephalogram (EEG) are noted to slow down. While microsleep episodes are usually associated with sleep deprivation, they have also been associated with performing monotonous tasks [78]. Our study determined that 7.36% of individuals in the sleep-deprived category report **falling asleep while performing daily tasks** like cooking, driving, and reading, which account for possible micro-sleep episodes. This is in contrast to only 4% in the category of adequate sleep, with a p-value of 0.08. Our study results are not statistically significant due to a possibility of study results being biased due to possible biases that may have risen due to it being self-reported and under-recognised among people.

A study conducted amongst drivers with obstructive sleep apnea, and thus sleep deprivation, revealed that individuals go at slower speeds during microsleep episodes. This indicates lesser control over the acceleration and required speed of the vehicle [79]. In Japan, research was done in a single truck company determining the association of sleep with road collisions. This study revealed that 75% of the individuals involved in truck collisions on the road depicted experiencing microsleep episodes just before their accidents. [80]

Sleep deprivation was statistically significant and associated with feelings of anxiety and nervousness. About 22% of participants in the sleep deprived category reported experiencing frequent feelings of anxiety and nervousness, with a p-value of 0.040(Table 6). This is like previous studies [[81] [82]. Some researchers have described emotional dysregulation as a cause of anxiety and nervousness. They found that maladaptive emotional regulation strategies, like rumination and catastrophizing, can negatively impact mental health and make individuals more susceptible to anxiety[81]. A study that examined the direct effects of sleep deprivation on the symptoms of anxiety of 4325 college students in China's Xizang region reported that individuals who experience sleep deprivation are more likely to have increased levels of anxiety [81]. Another study done in Iran on 471 participants showed moderate anxiety in individuals with inadequate sleep (sleep duration of <7 hours) was three times higher than in individuals with adequate sleep. This study also attributed these findings to sleep deprivation, which negatively affects cognitive functions and motor activity.[82]

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As shown in Table 7, 5% of sleep-deprived individuals were involved in road traffic accidents, compared to 3.5% who had adequate sleep. The p-value was noted to be 0.64, which is not statistically significant. This is contrary to most findings in the literature[83],[84]. The Institute of Medicine estimates that 20% of serious motor vehicle crash injuries are attributable to sleep disorders and sleep deprivation [83]. A systematic review and meta-analysis of fourteen articles on previous studies of sleepiness and the risk of road traffic accidents showed a significant association between crash involvement and drowsy driving due to sleep deprivation. [83] Research conducted in the United Arab Emirates (UAE) revealed essential data related to sleepiness and road traffic accidents. Sleepiness was identified as a contributing factor in at least 5% of road traffic collisions (RTCs). [84] Our study showed that around 40% of sleep-deprived individuals are interested in seeking help with sleep patterns. However, research on this willingness to seek help is minimal. Hence, more studies should be conducted to assess the roadblocks to achieving adequate sleep, and policymakers should provide opportunities for individuals to improve sleep duration and quality.

5. Conclusions

In conclusion, the study's findings implicate the crucial role of adequate sleep in maintaining both physical and mental health while underscoring the significant health challenges posed by sleep deprivation among adults in the UAE. Several key insights and observations emerged from the study, providing actionable points for researchers, clinicians, and policymakers.

The study revealed several statistically significant associations between sleep deprivation and mental health outcomes. For instance, individuals experiencing sleep deprivation were more likely to report difficulties in concentration ($p = 0.04$) and feelings of depression or hopelessness ($p = 0.016$). This aligns with global research indicating that lack of sleep impairs cognitive functions such as attention and memory while also increasing the risk of mood disorders like anxiety and depression. These mental health impacts are of particular concern, as they can affect daily functioning, work productivity, and overall quality of life.

Conversely, the study did not find statistically significant associations between sleep deprivation and several physical health conditions, such as diabetes ($p = 0.88$), high cholesterol, hypertension, or obesity ($p = 0.77$). While sleep deprivation is often linked to metabolic and cardiovascular issues in global literature, the lack of statistical significance in this study could be attributed to factors like the relatively young age of participants. However, despite the lack of significant p-values, trends still suggest that sleep-deprived individuals may be more prone to physical health conditions, particularly in the long term. Research with larger sample sizes or longitudinal studies could provide more conclusive evidence.

One of the significant limitations of this study is the relatively small and geographically biased sample size, with 45.8% of participants coming from Dubai and most respondents being female (76.3%). This demographic distribution may not fully capture the sleep patterns and associated health risks across the UAE population. Furthermore, the study relied on self-reported data, which can be prone to reporting biases, particularly in the subjective assessment of sleep quality and health conditions. Additionally, the study did not account for certain confounding factors such as diet, physical activity levels, genetic predispositions, etc., which may influence sleep patterns and health outcomes.

A key finding in the study is that 44.2% of sleep-deprived individuals expressed a willingness to seek help for their sleep problems, while 33.7% reported that they did not perceive the need for assistance, and 22.1% were unsure. This suggests that much of the population is open to interventions, presenting an opportunity for public health programs to promote sleep hygiene and mental health services.

For policymakers, these findings highlight an urgent need to integrate sleep health into national health strategies. Given the strong association between sleep deprivation and mental health issues like depression, anxiety, and cognitive impairments, sleep should be considered a critical factor in mental health promotion and disease prevention initiatives. Public health campaigns that raise awareness of sleep's importance—alongside interventions like workplace wellness programs, sleep

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education in schools, and sleep disorder clinics—could help mitigate the negative impacts of sleep deprivation across society.

Moreover, addressing sleep deprivation could have far-reaching benefits in reducing healthcare costs related to chronic conditions, improving work productivity, and enhancing the overall quality of life in the UAE. Policies should encourage collaboration between healthcare providers, employers, and educational institutions to implement practical solutions that foster better sleep environments. For instance, offering flexible work hours, reducing shift work where possible, and promoting the use of relaxation techniques could be effective interventions to enhance sleep quality.

Given the current study's limitations, future research should involve more extensive and diverse samples, including participants from all seven emirates. Additionally, investigating the specific lifestyle factors contributing to poor sleep, such as screen time, caffeine consumption, and stress levels, could provide further insights into modifiable behaviours that can be targeted in public health interventions.

In conclusion, while the study establishes a clear link between sleep deprivation and mental health outcomes, it highlights the need for further research to clarify the relationship between sleep and physical health conditions. The willingness of many sleep-deprived individuals to seek help offers a promising avenue for intervention, and policymakers have an opportunity to integrate sleep health into broader public health initiatives aimed at improving the well-being of UAE residents. By addressing the root causes of sleep deprivation and promoting healthy sleep habits, policymakers can play a pivotal role in enhancing both mental and physical health across the population.

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