

Prevalence and correlates of excessive fatigue among Moroccan school adolescents: A cross-sectional study

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Abstract. Excessive fatigue in adolescents is a growing concern as it impacts various aspects of their lives. Research on its prevalence and contributing factors in specific populations, especially in developing countries, is scarce. This study examines the prevalence of excessive fatigue among Moroccan adolescents and its association with demographic characteristics, parasomnias, depressive symptoms, and academic performance. In this cross-sectional study, we assessed excessive fatigue among 800 Moroccan adolescents (aged 12-20 years) in Settat province, using a comprehensive questionnaire including Pichot's Fatigue Scale (PFS), Patient Health Questionnaire 9 (PHQ-9), parasomnia questionnaire, and demographic questionnaire. The primary outcome was excessive fatigue, while covariates included demographic factors, physical health, regular exercise, depressive symptoms, and specific parasomnias. Associations were analyzed using cross-tabulation analysis, chi-squared tests, and correlation analysis. Excessive fatigue was prevalent in 8.4% of participants. Female adolescents had significantly higher adjusted odds of experiencing excessive fatigue than male adolescents, with an adjusted odds ratio (AOR) of 3.07 [95% CI (1.48, 6.37), $P=0.003$]. Excessive fatigue was significantly associated with nightmares, sleep paralysis, and hypnagogic hallucinations. A strong positive linear correlation was observed between fatigue and depressive symptoms ($r=0.746$, $P<0.001$). This study highlights the prevalence of excessive fatigue among

Moroccan adolescents, emphasizing the importance of addressing gender-specific issues, sleep habits, and mental health support. Further research is needed to understand the underlying mechanisms and explore the role of lifestyle and socio-cultural contexts.

Introduction

Adolescence, a critical developmental period, is characterized by significant physiological, psychological, and social changes (1). Among the numerous challenges faced by adolescents, excessive fatigue has emerged as a major concern due to its potential impact on cognitive function, academic performance, emotional well-being, and overall health (2). Several demographic, behavioral, and health factors have been identified as contributors to excessive fatigue in this age group (3).

Excessive fatigue, often referred to as chronic or persistent fatigue, is a subjective sensation of persistent tiredness, lack of energy, or exhaustion that is not alleviated by rest and disproportionately impacts an individual's daily functioning (4). In adolescents, excessive fatigue has been recognized as a significant health concern, with prevalence estimates varying widely depending on the population studied and the criteria used. Generally, the prevalence of excessive fatigue among adolescents has been reported to range from 4 to 30% (5-9).

Excessive fatigue in adolescents has been associated with a variety of negative outcomes, including impaired cognitive and academic performance, compromised emotional well-being, poorer physical health, and difficulties in social functioning (7,10,11). Several demographic, behavioral, and health factors have been identified as potential contributors to excessive fatigue among adolescents, such as age, gender, regular exercise, dietary habits, and sleep disturbances (3,6,9).

Among sleep disturbances, parasomnias have been consistently associated with excessive fatigue in adolescents (12-14). Parasomnias are a group of sleep disorders characterized by undesirable behaviors or experiences that occur during sleep or sleep-wake transitions, including sleepwalking, night terrors, and hypnagogic hallucinations (13,14). Parasomnias have been associated with fragmented sleep and poor sleep quality, both of which may contribute to excessive fatigue in adolescents (15).

To our knowledge, data on the prevalence of excessive fatigue in the general pediatric population in Morocco is

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absent. In this context, the first aim of this article was to investigate the prevalence of excessive fatigue in a sample of school-aged adolescents from the central region of Morocco. The second aim was to describe how some demographic and clinical factors are associated with fatigue. The third aim, as a key aspect of this study, was to examine the relationship between different types of parasomnias and excessive fatigue in this population. We hypothesized that adolescents with excessive fatigue would have greater depressive symptoms and a higher prevalence of parasomnias. By exploring these associations, our findings may contribute to a better understanding of the complex interplay between parasomnias and excessive fatigue, which could potentially inform targeted interventions and support strategies for adolescents in Morocco and other developing countries.

Materials and methods

Ethical considerations. This study, which focused on public behavior, employed a purely observational approach involving only the collection and analysis of data, with no intervention on human participants required. To ensure ethical compliance, we sought approval from the regional educational directorate, as well as authorization of the parental association in each participating school. For any inquiries regarding this process, please contact the regional directorate of education at the following phone number: (+212) 5234-02704, or via email at dp.settat@gmail.com. Participation in the study was voluntary, and no financial compensation was provided. To maintain anonymity and confidentiality, no personal identifiers were included in the questionnaires, and these protections were upheld throughout data collection, storage, and analysis stages.

Study design. We performed a school-based, observational, analytical cross-sectional study. Cross-sectional studies are relatively quick and inexpensive and can examine multiple outcomes. They are useful for identifying associations that can then be more rigorously studied using a cohort study or randomized controlled study (16).

Setting. We carried out the study between December 2019 and February 2020 in the Settat province. Settat is a province in the region of Casablanca-Settat in Morocco. According to the regional directorate of education, there was a total of 23755 in-school adolescents, enrolled in 79 registered secondary schools.

Study population. We included students between the ages of 12 and 20 from middle and high schools in the research. Children assent and engagement were a vital part of the study inclusion criteria. The regional directorate of education in Settat provided us with a list of all secondary schools and the student population in the province.

Sampling. Sample size calculation was done using a free online tool, G-Power software (2020, version 3.1, Düsseldorf, Germany) (17). A confidence level of 0.95 and a power of 0.80 was assumed. The expected proportion of excessive fatigue among the participants was approximately 10%, based on previous studies (6). The results of the power analysis

revealed that a sample size of approximately 700 participants was necessary for the study. In order to achieve a balanced representation of both rural and urban adolescents, a proportional stratified sampling design was employed (18). Under this calculation, seven urban and two rural schools were selected by probability proportional to size. Within stratum 1, seven urban schools were selected. Within stratum 2, two rural schools were selected. Subsequently, 800 adolescents were randomly drawn from student lists of the 9 selected schools to participate in the study.

Measures. We developed a tool in Arabic that included four questionnaires:

- Pichot's Fatigue Scale (PFS): is a self-reported measure of fatigue that was developed to assess the physical and mental aspects of fatigue in patients with chronic conditions. The PFS is an 8-item scale that ranges from 0 to 32, with higher scores indicating excessive levels of fatigue (19,20). The PFS items are designed to assess the degree of fatigue as well as the impact of fatigue on daily life activities. For the purposes of our study, the PFS was translated into Arabic. The internal consistency of the Arabic version of the scale, as measured by Cronbach's alpha, was found to be good ($\alpha=0.86$), suggesting that the items on the scale reliably measure the same construct. However, specific information about the validity of this Arabic version of the PFS in an Arabic-speaking population was not available, representing a potential limitation of our study.

- Demographic questionnaire: We used a demographic questionnaire to collect information about the participants' characteristics and personal habits. The questionnaire included a range of demographic variables, such as gender, age, region, body mass index (BMI), and grade point average (GPA) as a measure of student performance. Among these, we included a question about participants' engagement in regular exercise or sport activities. Specifically, we asked participants whether they had been involved in any form of sport or exercise on a regular basis during the month preceding the study. We intentionally did not provide a precise definition of 'regular exercise' in the survey, allowing participants to interpret this term based on their own understanding. While this approach catered to a broad range of exercise habits, it also introduced potential variability in responses, as participants may have different interpretations of what 'regular exercise' entails.

In addition to these demographic and lifestyle-related questions, the questionnaire included seven items explicitly inquiring whether participants had one or more of the following health conditions: chronic cough, asthma, heart disease, diabetes, chronic pain, chronic dermatitis, and epileptic seizures.

- Parasomnias: We utilized a questionnaire consisted of 7 items, each addressing a specific type of parasomnia, including nightmares, sleepwalking, sleep paralysis, somniloquy (sleep talking), sleep kicking and punching, teeth grinding during sleep, and hypnagogic hallucinations. The presence of a specific parasomnia was considered when the participant reported that the occurrence was at least once a month.

- Patient health questionnaire 9 (PHQ-9): a 9-item self-report questionnaire, with the aim of assessing the severity of depression symptoms (21). The total score obtained through

this assessment can range from 0 to 27, with higher scores indicating a greater severity of depression symptoms. A global score of over 10 is indicative of moderate-to-severe depression symptoms. Face validity process and internal consistency reliability was measured using Cronbach's alpha for the PHQ9, the result was 0.85. Patient Health Questionnaire (PHQ) is a clinical diagnostic tool that is widely utilized worldwide because it provides a practical in clinic tool to screen for psychological disorders. A PHQ-9 score ≥ 10 has a sensitivity of 88% and a specificity of 88% for major depression (21,22).

Data collection. The present study was conducted at the convenience of the participating schools. Upon providing the necessary instructions, a period of 30 min was allocated for the completion of the questionnaires. Most participants were able to complete the questionnaires within 20-30 min.

Outcome variable. The primary outcome variable of interest in this study was the level of fatigue as measured by Pichot's Fatigue Scale (PFS). To calculate the score, the individual ratings for each item were summed and the total score ranged from 0 to 32, with higher scores indicating greater fatigue (20). The PFS scores were subsequently categorized into a dichotomous variable using a cut-off value of 22. Scores ranging from 0 to 22 were classified as indicating 'low-level fatigue' and scores of 23 to 32 were classified as indicating 'Excessive fatigue' (20).

Co-variables. This study assessed individual characteristics using various demographic and personal habit variables. Gender was dichotomously categorized as male or female, while age was grouped into three categories: 12-14, 15-17, and 18-20. Region was classified as either rural or urban adolescents. Health status was determined using seven items in the questionnaire, which were recoded into a dichotomous variable. Participants with one or more chronic conditions were classified as unhealthy, while others were categorized as healthy.

In the questionnaire, participants were asked if they had engaged in any exercise or sport activities outside of their school commitments during the month preceding the study. Their responses were recorded as 'yes' or 'no'. In terms of academic achievement, participants' Grade Point Average (GPA) was classified into three categories: low, average, and excellent. PHQ-9 scores were then dichotomized using the previously established cut-off value and Parasomnias variables were analyzed separately as binary variables (present or absent).

Statistical analysis. We conducted statistical analyzes using IBM SPSS (IBM Corp. 2012. version 21.0. NY, EUA). To determine the prevalence and general characteristics of the population sample, we used frequencies and percentages. We described age as a numerical variable and calculated the means and standard deviations. To address missing data, we employed the pairwise deletion method.

To explore the associations between excessive fatigue and various demographic, clinical, behavioral, and educational factors, we performed a multivariable logistic regression analysis. The independent variables included in the model were

gender, region, age group, BMI, physical health status, regular exercise, and academic achievement. The dependent variable was the presence of excessive fatigue. The associations between these factors and excessive fatigue were expressed as adjusted odds ratios (AORs) with 95% confidence intervals (CIs). Each AOR represented the effect of a particular factor on the likelihood of excessive fatigue, adjusting for all other factors in the model. We separately included each type of parasomnia into a binary logistic regression model along with gender and physical health status to obtain the adjusted odds ratios. These models allowed us to estimate the association between each specific parasomnia and excessive fatigue, after controlling for potential confounding by gender and physical health status. The interpretation of the effect size was based on the guidelines by Chen, Cohen, and Chen (2010): an AOR of less than 1.68 was considered very small; an AOR of 1.68 to less than 3.47 was considered small; an AOR of 3.47 to less than 6.71 was considered medium; and an AOR of 6.71 or more was considered large (23). Additionally, we conducted a correlation analysis that included both PFS and PHQ-9 scores. The level of statistical significance was set at $P < 0.05$.

Results

The study recruited 800 middle and high school students, with 739 meeting the inclusion criteria and completing both the PFS and the PHQ-9, resulting in a response rate of 92.4%. The participants consisted of 53.2% males and 46.8% females, with a mean age of 15.67 ± 1.69 years.

A total of 8.4% (N=62) of the sample reported experiencing excessive fatigue symptoms, while 43.8% reported moderate-to-severe symptoms of depression. Table I provides a comprehensive presentation of the socio-demographic, academic, and clinical characteristics of the participants.

Results from the statistical analysis revealed significant differences in the prevalence of excessive fatigue symptoms based on gender, age group, and physical health status. Female participants were 3.07 times more likely to experience excessive fatigue compared to male participants in the sample (OR=3.07, 95% CI=1.48-6.37, $P=0.003$), suggesting a small to medium effect size. We compared the prevalence of excessive fatigue symptoms among participants categorized by region (rural vs. urban), age groups (12-14, 15-17, 18-20), and BMI status (normal, underweight, overweight) to explore potential differences in symptomatology. The likelihood of excessive fatigue did not significantly differ between urban and rural residents, though urban adolescents exhibited 1.71 times the odds [95% CI (0.84, 3.47), $P=0.138$], which corresponds to a small effect size. Adolescents aged 15-17 were 3.39 times as likely to report excessive fatigue than their counterparts from other age groups [95% CI (1.23, 9.34), $P=0.018$], indicating a small to medium effect size. The study examined the prevalence of excessive fatigue in relation to the participants' health status. Adolescents who reported an unhealthy physical status experienced excessive fatigue 3.21 times more often than their healthy counterparts [95% CI (1.65, 6.27), $P=0.001$], which corresponds to a small to medium effect size. This study examined the prevalence of excessive fatigue in participants who reported doing regular exercises and sports compared to those who did not. Regular

Table I. Demographic, clinical, behavioral, and academic characteristics of adolescent participants in the study.

Age (M; SD)	15.67 Count	1.69 (%)	Missing data
Gender			
Male	393	53.2	0
Female	346	46.8	
Region			
Rural	397	53.7	0
Urban	343	46.3	
Age in groups			
12-14	221	29.9	0
15-17	406	54.9	
18-20	112	15.2	
BMI			
Normal	425	71.8	147
Underweight	152	25.7	
Overweight	15	2.6	
Health conditions			
Chronic cough	60	8.2	7
Asthma	51	7.0	6
Heart disease	10	1.4	9
Diabetes	5	0.6	7
Chronic pain	81	11.1	6
Chronic dermatitis	44	6.1	6
Epileptic seizures	26	3.6	14
Physical health status			
Healthy	535	74.5	21
Unhealthy	183	25.5	
Regular exercise			
Yes	76	10.4	1
No	662	89.6	
Academic achievement			
Excellent	196	27.1	16
Average	480	66.4	
Poor	47	6.5	
Parasomnias			
Nightmares are frequent at night	384	52.7	12
Sleepwalking	82	11.3	19
Sleep paralysis	114	15.7	14
Somniloquy	222	30.5	11
Sleep kicking and punching	139	19.2	14
Teeth grinding during sleep	61	8.4	17
Hypnagogic hallucinations	263	36.2	13
Clinical characteristics			
Excessive fatigue	62	8.4	0
Moderate to severe symptoms of depression	323	43.8	0

exercise did not show a significant association with excessive fatigue [OR=0.83, 95% CI (0.26, 2.68)]. The prevalence of excessive fatigue symptoms was compared between the three academic achievement groups. The results showed

that there were no statistically significant differences in the prevalence of excessive fatigue among the three groups. Table II presents detailed results of the odds ratios for the association between excessive fatigue symptomatology and

Table II. Adjusted odds ratios and prevalence of excessive fatigue across demographic, behavioral, and academic characteristics in adolescents.

Variable	Excessive fatigue (%)	No excessive fatigue (%)	Total (%)	AOR	95% C.I.AOR		P-value
					Lower	Upper	
Gender							
Male	16 (4.1)	377 (95.9)	393 (100)	1.00	-	-	
Female	46 (13.3)	300 (86.7)	346 (100)	3.07	1.48	6.37	0.003 ^a
Region							
Rural	31 (7.8)	365 (92.2)	396 (100)	1.00	-	-	
Urban	31 (9.0)	312 (91.0)	343 (100)	1.71	0.84	3.47	0.138
Age in groups							
12-14	12 (5.4)	209 (94.6)	221 (100)	1.00	-	-	
15-17	42 (10.3)	364 (89.7)	406 (100)	3.39	1.23	9.34	0.018 ^a
18-20	8 (7.1)	104 (92.9)	112 (100)	3.12	0.83	11.82	0.093
BMI							
Normal	33 (7.8)	392 (92.2)	425 (100)	1.00	-	-	
Underweight	14 (9.2)	138 (90.8)	152 (100)	1.63	0.77	3.42	0.201
Overweight	0 (0.0)	15 (100.0)	15 (100)	0.00	0.00	0.00	0.998
Physical health status							
Healthy	26 (4.9)	509 (95.1)	535 (100)	1.00	-	-	
Unhealthy	30 (16.4)	153 (83.6)	183 (100)	3.21	1.65	6.27	0.001 ^a
Regular exercise							
Yes	4 (5.2)	73 (94.8)	77 (100)	1.00	-	-	
No	58 (8.8)	603 (91.2)	661 (100)	0.83	0.26	2.68	0.758
Academic achievement							
Excellent	13 (6.6)	183 (93.4)	196 (100)	1.00	-	-	
Average	43 (9.0)	437 (91.0)	480 (100)	0.90	0.41	1.97	0.794
Poor	3 (6.4)	44 (93.6)	47 (100)	0.78	0.17	3.54	0.745

AOR adjusted odd ratio. ^aSignificant at 5% level of significance/95% Confidence interval.

various factors, including socio-demographic characteristics and academic achievement.

In relation to specific types of parasomnias, (Table III) provide adjusted odds ratios for excessive fatigue among adolescents, controlling for gender and physical health status. The study showed that participants who reported experiencing nightmares had a higher prevalence of excessive fatigue compared to those who did not. The odds ratio of 1.92 indicates a small positive association between having nightmares and experiencing excessive fatigue, which was statistically significant [CI: 1.00-3.68, P=0.050]. In terms of sleepwalking, although sleepwalkers tended to have a higher odds ratio for excessive fatigue compared to non-sleepwalkers, the difference was not statistically significant [AOR=1.51, 95% CI: 0.69-3.33, P=0.303]. Sleep paralysis was associated with a higher odd of excessive fatigue among adolescents [AOR=2.24, 95% CI: 1.17-4.29, P=0.015]. The effect size of this association is small. No significant associations were observed between excessive fatigue and the presence of somniloquy [AOR=0.61, 95% CI: 0.32-1.17, P=0.138], sleep kicking and punching [AOR=1.54, 95% CI: 0.81-2.92, P=0.188], or teeth grinding [AOR=1.15, 95%

CI: 0.48-2.75, P=0.750] in the adolescent study population. Finally, adolescents who experience hypnagogic hallucinations had significantly higher odds of experiencing excessive fatigue compared to those who did not [AOR=2.12, 95% CI: 1.17-3.85, P=0.014], representing a small effect size.

We conducted a correlation analysis to examine the relationship between fatigue levels based on PFS scores and depression symptomatology based on PHQ-9 scores. The correlation analysis results showed that there was a significant strong positive linear correlation [$r=0.746$, $P<0.001$] between the intensity of depressive symptoms and the evaluation of fatigue. Fig. 1 shows the scatter plot illustrating the relationship between fatigue levels and depression symptomatology based on PFS and PHQ-9 scores, respectively.

Discussion

The current study aimed to estimate the frequencies of excessive fatigue in a Moroccan sample of adolescents. The prevalence of excessive fatigue symptoms among in-school adolescents was 8.4%. Female participants had significantly higher odds of experiencing excessive fatigue compared to

Table III. Adjusted odds ratios for excessive fatigue among adolescents by parasomnia type, controlling for gender and physical health status.

Parasomnias variable	Excessive fatigue (%)	No excessive	Total (%)	AOR	95% C.I.AOR		P-value
					Lower	Upper	
Nightmares							
No	18 (5.2)	326 (94.8)	344 (100)	1.00	-	-	
Yes	43 (11.2)	340 (88.8)	383 (100)	1.92	1.00	3.68	0.050 ^a
Sleepwalking							
No	52 (8.1)	587 (91.9)	639 (100)	1.00	-	-	
Yes	9 (11.1)	72 (88.9)	81 (100)	1.51	0.69	3.33	0.303
Sleep paralysis							
No	42 (6.9)	568 (93.1)	610 (100)	1.00	-	-	
Yes	18 (15.8)	96 (84.2)	114 (100)	2.24	1.17	4.29	0.015 ^a
Somniloquy							
No	44 (8.7)	463 (91.3)	507 (100)	1.00	-	-	
Yes	18 (8.1)	204 (91.9)	222 (100)	0.61	0.32	1.17	0.138
Sleep kicking and punching							
No	44 (7.5)	542 (92.5)	586 (100)	1.00	-	-	
Yes	18 (12.9)	121 (87.1)	139 (100)	1.54	0.81	2.92	0.188
Teeth grinding							
No	53 (8.0)	608 (92.0)	661 (100)	1.00	-	-	
Yes	8 (13.1)	53 (86.9)	61 (100)	1.15	0.48	2.75	0.750
Hypnagogic hallucinations							
No	25 (5.4)	439 (94.6)	464 (100)	1.00	-	-	
Yes	37 (14.1)	226 (85.9)	263 (100)	2.12	1.17	3.85	0.014 ^a

AOR adjusted odd ratio. ^aSignificant at 5% level of significance/95% Confidence interval.

male participants. Adolescents aged 15-17 had significantly higher odds of reporting excessive fatigue compared to other age groups. The study analyzed the occurrences of different parasomnia during the past month. The most reported parasomnia were Nightmares and hypnagogic hallucinations. Participants who reported experiencing nightmares, sleep paralysis, and hypnagogic hallucinations had higher odds of experiencing excessive fatigue than those who did not report having these parasomnia disorders. The study also examined the relationship between fatigue levels and PHQ-9 scores. The results indicated a significant positive correlation between excessive fatigue symptoms and PHQ-9 scores.

The results of our study revealed that a considerable proportion of in-school adolescents in Serrat province, Morocco reported experiencing excessive fatigue symptoms, with a prevalence of 8.4%. This finding is consistent with previous research results across different populations and countries (6-8). For instance, one study conducted in the United States reported the lowest prevalence rate of chronic fatigue at 4.17%, while another study conducted in the Netherlands reported the highest prevalence rate at 30.5% (8). The average prevalence rates of chronic fatigue in the UK and the USA were 11.1 and 10.4%, respectively (8). These findings suggest that chronic fatigue is a common health issue across different populations and countries, with varying prevalence rates that

may be influenced by cultural, environmental, and genetic factors.

Our study has found a significant gender difference in the prevalence of excessive fatigue, with females reporting a higher prevalence than males. This finding is consistent with previous literature, which suggests that biological and social factors may contribute to this gender discrepancy (24). Additionally, gender differences in societal expectations and roles may also play a role in the experience of fatigue (25,26). The gender-based social norms and expectations in patriarchal societies like Morocco may impose a heavier burden on girls, particularly regarding their domestic responsibilities, leading to increased fatigue levels.

Unlike previous studies conducted in Western countries, which reported a significant increase in fatigue with advancing age, our study revealed that adolescents in the 15-17 age group exhibit a significantly higher prevalence of excessive fatigue compared to their younger counterparts in the 12-14 age group, with an odds ratio of 3.39 [95% CI (1.23, 9.34), P=0.018]. This could suggest that the transition from early to middle adolescence in this cultural context may coincide with an increased risk of experiencing excessive fatigue (27,28).

However, this trend did not extend to the older adolescent group of 18-20 years. Although the odds ratio for this group was 3.12 [95% CI (0.83, 11.82)], the finding was not statistically

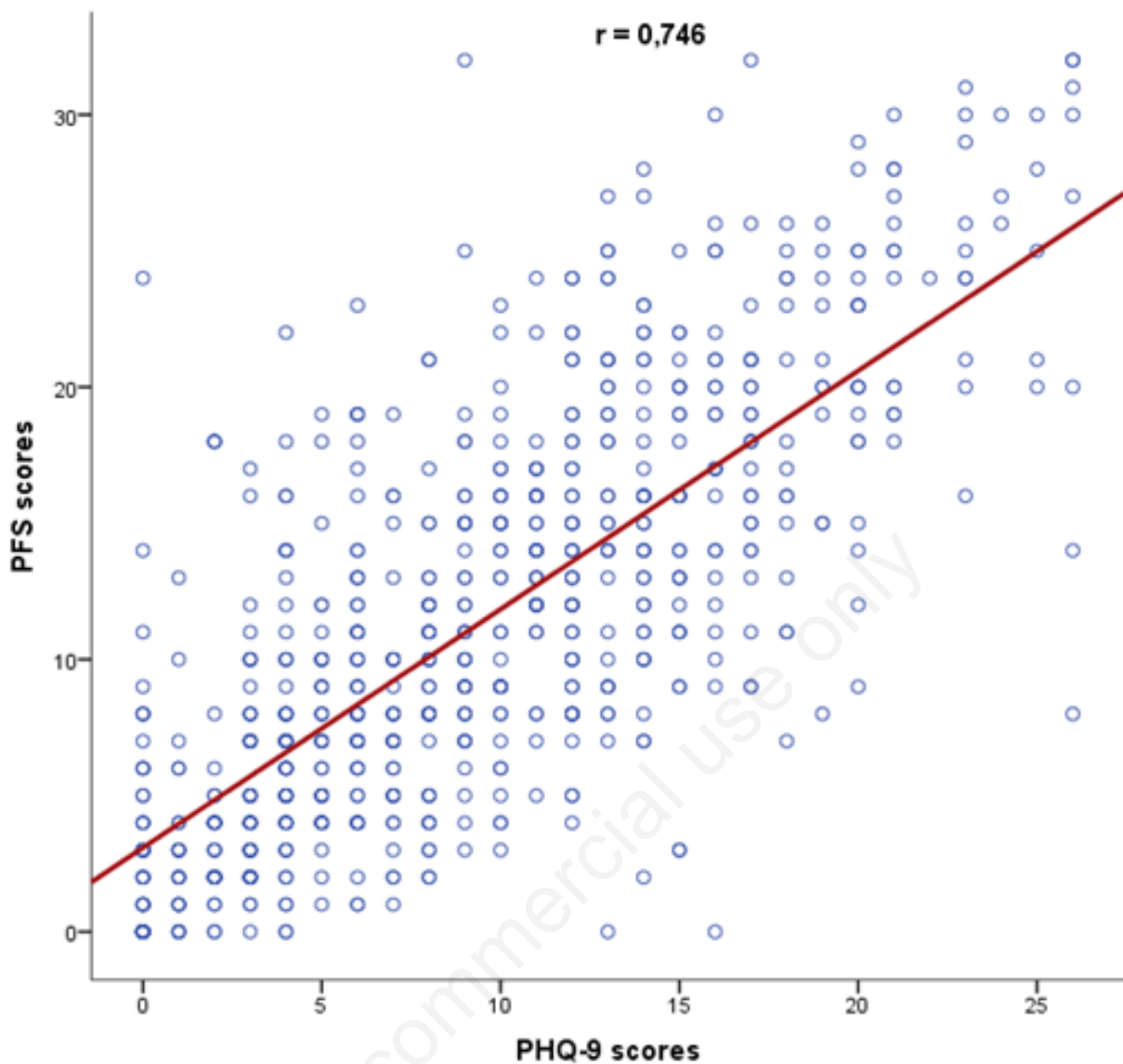


Figure 1. Relationship between fatigue levels and depression symptomatology scores in adolescents.

significant ($P=0.093$). This difference could be due to several factors. A possible reason might be the smaller sample size for the 18-20 age group, which could limit the statistical power to detect significant differences.

Additionally, as adolescents grow older, they may develop more effective coping mechanisms to manage fatigue or their lifestyle habits may change, influencing their perceived fatigue levels. The uniqueness of the Moroccan cultural and social context, including different diet, sleep patterns compared to Western adolescents, may also contribute to these variations.

The current study found a higher prevalence of subjective excessive fatigue complaints among adolescents experiencing sleep paralysis. Previous studies have demonstrated that individuals experiencing sleep paralysis exhibit increased subjective fatigue, poorer performance, and more complaints of physical, mental, and neurotic symptoms compared to those without sleep paralysis (31). Moreover, we found a significant relationship between hallucinations and excessive fatigue among adolescents. Interestingly, results

from a study on patients with psychosis also highlight the impact of sleep problems on individuals with delusions and hallucinations (32). These patients experienced various sleep disturbances, including hypnagogic hallucinations, which in turn led to emotional distress, fatigue, and a reduction in daytime activities (32). Additionally, our study found a significant relationship between parasomnias, such as nightmares and excessive fatigue among Moroccan adolescents. Brand *et al* investigated sleep disturbances, including nightmares, among adolescents and their parents, suggesting similarities in sleep patterns between the two groups (33). Similarly, Koffel and Watson examined the relationship between sleep complaints, including nightmares, and depression and anxiety in adolescents, which could contribute to fatigue (34).

Our study found that people who experience depression symptoms are more likely to suffer from excessive fatigue. This is consistent with many previous studies showing a connection between fatigue and depression, both in the general population and in those who have chronic fatigue (6,34-36).

However, epidemiological samples suggest that the heritability of fatigue and depression may be independent, despite their frequent co-occurrence in clinical populations (6).

The findings of our study on excessive fatigue symptoms among Moroccan adolescents have significant implications for interventions. Such interventions could include education on gender equity and resources to reduce the burden of domestic responsibilities for females. Additionally, promoting healthy sleep habits could help reduce fatigue levels in adolescents. Moreover, counseling services or mental health screening programs could provide support and resources for adolescents with depression, mitigating the impact of depression on fatigue levels.

Limitations

Although this study provides valuable insights into the prevalence and factors associated with excessive fatigue among adolescents, several limitations should be acknowledged. First, the cross-sectional design of the study limits the ability to establish causality or the temporal sequence of events. Future research may benefit from adopting a longitudinal design to better understand the causal relationship between excessive fatigue and different factors.

Secondly, our measure of regular exercise was based on self-reported data and lacked a specific definition for 'regular'. We asked participants if they engaged in any type of sport regularly, but 'regularly' was left open to the participants' interpretation. This may have introduced some variability into our data, as different participants might have different perceptions of what constitutes 'regular' exercise. Future research could provide a clear, standardized definition of 'regular exercise' to improve the consistency and reliability of responses. Additionally, the reliance on self-reported data for regular exercise might have led to recall bias or social desirability bias, potentially affecting the accuracy of our results. Future studies could consider implementing more objective measures of exercise behavior, such as accelerometers or activity trackers, to provide a more accurate representation of individuals' exercise routines.

Lastly, while the internal consistency of the Arabic version of the Pichot's Fatigue Scale (PFS) was found to be good, its validity has not been thoroughly established. This represents a potential limitation of our study. Future studies are recommended to further evaluate the validity of the Arabic PFS in various populations.

Conclusion

In conclusion, the current study provides evidence that excessive fatigue is a common health problem among school-age adolescents in the Settat province of Morocco. Gender, and the presence of parasomnias and depressive symptoms were identified as significant factors associated with excessive fatigue symptoms. The study highlights the need for interventions to address gender inequalities and promote healthy sleep habits among adolescents. Moreover, the findings suggest the importance of screening for depression and providing appropriate support and resources for adolescents. Future research may benefit from adopting a longitudinal design to establish

the causal relationship between excessive fatigue and different factors.

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Authors' contributions

Marouane Moustakbal contributed in the conceptualization, data collection, data analysis and wrote the manuscript.

Soud Belabbes Maataoui contributed in the conceptualization, design, obtaining permissions to collect data and manuscript write-up.

Both authors approved the final manuscript.

Conflict of interest

The authors declare that they have no competing interests.

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