

Lifetime prevalence and incidence of parasomnias in a population of young adult Nigerians

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Abstract Lifetime prevalence, incidence, and risk factors for parasomnias were determined. Past experiences of non-REM, REM, and sleep-transition parasomnias were recorded. Diaries of night sleep duration, parasomnias, perception of aliens, levels of physical activity, headaches and intake of all substances, drugs, and tobacco were kept for 14 consecutive days. A total of 276 subjects were studied. Lifetime prevalences ‰ (95% CI) were 725 (668–776) for occurrence of any parasomnia, 43 (25–74) for sleepwalking, 112 (80–155) for sleep terror, 475 (416–533) for nightmares, 225 (179–277) for sleep paralysis, 43 (25–74) for sleep starts, 322 (270–380) for sleep talking, and 344 (291–402) for enuresis. Incidences ‰ (95% CI) were 210 (166–262) for occurrence of any parasomnia, 14 (6–37) for sleepwalking, 11 (4–31) for sleep terror, 170 (131–219) for confusional arousal, 18 (8–42) for nightmares, 14 (6–37) for sleep paralysis, 33 (17–61) for sleep starts, and 4 (1–20) for sleep enuresis. Multivariate analysis showed associations of increase occurrence of parasomnias and duration of sleep >7 h ($p < 0.05$) and intake of alcohol ($p < 0.001$), but heavy workload before sleep was associated with decreased occurrence of parasomnias ($p < 0.01$). Gender, smoking, caffeinated drinks, hypnotics, and headaches were not associated with parasomnias. Incidence of presence of aliens (95% CI) in the room was 25‰ (12–51). This study shows that more than 70% of the population have experienced parasomnias at any time in the past. Nightmares, enuresis, sleep paralysis and night terrors are the commonest parasomnias experienced in the past, while confusional arousal, sleep starts, and nightmares are the

commonest parasomnias currently experienced. Incidence estimates show that all parasomnias persist into adulthood at reduced rates, but reduction of occurrence was greatest for enuresis. Long duration of night sleep and intake of alcohol predisposed subjects to higher occurrence of parasomnias.

Keywords Parasomnias · Sleep · Nightmares · Sleepwalking · Enuresis · Aliens · Nigeria

Introduction

Parasomnias are unpleasant or undesirable behavioural or experiential phenomena which occur predominantly or exclusively during sleep [1]. They occur during REM sleep, any of the four stages of non-REM sleep, and during transitions between sleep and wakefulness [2, 3]. Sleepwalking, sleep terrors, and confusional arousals are associated with non-REM sleep, nightmares and sleep paralysis are associated with REM sleep, while sleep starts and sleep talking are associated with sleep-wake transitions. Sleep enuresis has been observed with all sleep types [3]. Generally parasomnias, particularly those that are associated with non-REM sleep [4], are commoner in childhood, but a study of the general population in the UK showed that non-REM parasomnias are not uncommon in adults [5].

Parasomnias may have genetic basis [6], but occurrence is usually triggered by physical activity, excessive caffeine drinks, hypnotics, and emotional stress [3]. This study was done to determine lifetime prevalence and incidence of parasomnias in a population of young adults in Nigeria, and to describe the relationship of its occurrence with duration of sleep, gender, level of physical activity, and with intake of hypnotics, caffeinated drinks, and alcohol.

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Subjects and methods

Study site and subjects

Subjects were recruited from a Hall of Residence in a large University in Nigeria, where 895 eligible subjects lived. The objective was to include 250 subjects in the study, but 289 subjects were enrolled inclusive of an anticipated 15% drop-outs. This study, which was part of a larger sleep project [7], was carried out at a time of the academic calendar when students were not preparing for examinations or engaged in activities that could disrupt usual sleeping patterns. Details of the questionnaires and methods have been described [7].

The definitions of parasomnias that were used in this study were derived from the International Classification of Sleep Disorders, Revised [3]. Disorders of REM sleep include nightmares and sleep paralysis, disorders of non-REM sleep include sleep terrors, sleepwalking, and confusional arousal, while disorders of sleep-wake transition include sleep talking and sleep starts [3]. Enuresis is classified as other parasomnias [3].

Briefly, two questionnaires, one background, which was used to collect data about all previous experiences of parasomnias, and the other incidence, which was used to collect data about all new experiences of parasomnias over 14-day period, were designed, tested, revised, re-tested, and finally re-revised. The background questionnaire had 29 items, while the incidence questionnaire had 41 items. All previous experiences of nightmares, night terrors, sleep paralysis, sleep walking, sleep starts, sleep enuresis, and sleep talking at any time in the past were collected in the background questionnaire. The age of onset of occurrence, and frequency of occurrence of the parasomnias were also recorded. Diaries of time of going to bed and of waking up in the morning, all occurrences of sleep starts, sleep paralysis, sleep walking, night terror, nightmares, sleep enuresis, and feeling of the presence of aliens in the room during sleep for 14 consecutive night sleep periods were kept in the incidence questionnaire. Subjects also recorded if they felt well rested after the night sleep, or if they desired more sleep. All experiences of headaches during the day were recorded. Subjects rated the levels of activity during the day as very heavy, heavy, light or very light. All drinks during the day, alcoholic or non-alcoholic, tobacco use, drugs, hypnotics, sedatives, neuroleptics and others, were recorded.

The study was approved locally, and informed consent was obtained from all subjects. The background questionnaire was administered to all subjects at enrolment during which the parasomnias were defined and explained to them. They were then given the incidence questionnaires to complete daily for 14 consecutive days.

Statistics

Prevalence and incidence estimates were calculated for occurrence of parasomnias. Odds ratios were calculated to measure association of occurrence of parasomnias and risk factors. Night sleep was the unit of analysis since each night sleep and exposure to risk factors vary from day to day. The *epicalc* [8] and *epiR* [9] packages of R Statistical Programming and Environment Software [10] were used for statistical calculations.

Results

Of 289 subjects who were recruited into the study and completed the background questionnaires, 13 subjects did not return the incidence questionnaire. Sleep records were kept for 3,864 night sleep periods in 14 consecutive days. The mean age of 276 subjects, 115 females and 161 males, who completed both background and incidence questionnaires was 25 years (sd 3, median 24, range 19–35), 25 years (sd 3, median 25, range 20–35) for males and 24 (sd 2, median 24, range 19–34) for females.

Lifetime prevalence of parasomnias

A total of 200 subjects, 114 males and 86 females, had experienced parasomnias at any time in the past. Lifetime prevalence (95% CI) for the occurrence of any parasomnia was 725‰ (668–776), 413‰ (354–474) for males and 312‰ (275–370) for females. Disorders of non-REM sleep, sleep walking and sleep terrors were experienced by 41 subjects (15%), 16 females and 25 males; disorders of REM sleep, nightmares and sleep paralysis, were experienced by 163 subjects (59%), 70 females and 93 males; while disorders of sleep-transition, sleep talking and sleep starts, were experienced by 99 subjects (36%), 43 females and 56 males. Sleep enuresis was experienced by 95 subjects, 34 females and 61 males. Lifetime prevalences were 149‰ (109–196) for occurrence of disorders of non-REM sleep, 591‰ (530–649) for occurrence of disorders of REM sleep, 359‰ (302–418) for occurrence of disorders of sleep-wake transition, 344‰ (288–404) for occurrence of sleep enuresis.

The distributions and occurrences of individual parasomnias among the subjects and lifetime prevalences are shown in Table 1. Twelve subjects, 2 females and 10 males, had experienced sleepwalking. Thirty-one subjects, 14 females and 17 males, had experienced night terror. One hundred thirty-one subjects, 56 females and 75 males, had experienced nightmares. sixty-two subjects, 27 females and 35 males, had experienced sleep paralysis. Twelve subjects, 8 females and 4 males, had experienced sleep starts.

Table 1 Distribution of parasomnias among subjects

Parasomnia	Life-time Prevalence			Incidence		
	<i>n</i>	%	(95% CI)	<i>n</i>	%	(95% CI)
Non-REM parasomnias						
Sleepwalking	12	43	(25–74)	4	14	(6–37)
Sleep terror	31	112	(80–155)	3	11	(4–31)
REM parasomnias						
Nightmares	131	475	(416–533)	5	18	(8–42)
Sleep paralysis	62	225	(179–277)	4	14	(6–37)
Sleep-wake transition						
Sleep starts	12	43	(25–74)	9	33	(17–61)
Other						
Sleep enuresis	95	344	(291–402)	1	4	(1–20)

Eighty-nine subjects, 36 females and 53 males, had experienced sleep talking. The lifetime prevalence of sleep talking is 322‰ (270–380).

Incidence of parasomnias

During 14 consecutive days of sleep records 58 subjects (21%), 33 males and 25 females, experienced parasomnias. The incidence of any parasomnias (95% CI) is 210‰ (166–262), 120‰ (86–163) for males, and 91‰ (62–130) for females.

Five subjects, four males and one female, experienced sleepwalking and night terrors; 8 subjects, 6 males and 2 females, experienced nightmares and sleep paralysis. Sleep enuresis was experienced by 1 male subject. Incidences were 18‰ (6–42) for occurrence of sleepwalking and night terrors, 28‰ (13–56) for occurrence of nightmares and sleep paralysis, and 4‰ (0–20) for enuresis.

The incidences of individual parasomnias are shown in Table 1. Four subjects, all males, experienced sleepwalking; 3 subjects, 2 males and 1 female, experienced night terror; 47 subjects, 28 males and 19 females, experienced confusional arousal; 5 subjects, 4 males and 1 female, experienced nightmares; 4 subjects, 3 males and 1 female, experienced sleep paralysis; 9 subjects, 5 males and 4 females, experienced sleep starts. The incidence of confusional arousal was 170‰ (131–219).

The experience of strange fear of the presence of aliens in the room was reported by seven subjects, two males and five females. The incidence of experience of presence of aliens (95% CI) was 25‰ (12–51), 7‰ (2–26) in males, and 18‰ (8–42) in females.

Parasomnias and duration of sleep

The mean duration of sleep periods that were associated with parasomnia was 6.5 h (median 6.3), but 6.2 (median

Table 2 Risk factors for parasomnias

Risk factors	Parasomnias ^a		Odds ratios (95% CI)	
	Yes	No	Univariate	Multivariate
Duration of sleep				
<5	31	425	2.0 (1.3–3.0)*	1.1 (0.7–1.7)
5– 7	95	2,551	1.0 (ref.)	1.0 (ref.)
>7	69	693	2.7 (1.9–3.7)**	1.6 (1.1–2.2)***
Sex				
Female	84	1,512	0.9 (0.7–1.2)	1.1 (0.8–1.5)
Male	109	2,131	1.0 (ref.)	1.0 (ref.)
Caffeinated drinks				
Yes	62	689	2.0 (1.5–2.8)****	1.3 (0.9–1.8)
No	133	2,980	1.0 (ref.)	1.0 (ref.)
Alcoholic drinks				
Yes	14	37	7.6 (3.7–14.7)****	4.6 (2.3–9.1)**
No	181	3,632	1.0 (ref.)	1.0 (ref.)
Smoking				
Yes	2	20	1.9 (0.2–7.9)	0.7 (0.2–3.4)
No	193	3,649	1.0 (ref.)	1.0 (ref.)
Hypnotics				
Yes	1	20	0.9 (0.0–6.0)	0.5 (0.1–4.1)
No	194	3,649	1.0 (ref.)	1.0 (ref.)
Physical activity				
Heavy	82	1,286	0.6 (0.5–0.9)**	0.6 (0.5–0.9)*
Normal	103	1,035	1.0 (ref.)	1.0 (ref.)
Headaches				
Yes	25	318	1.6 (1.0–2.4)	0.9 (0.6–1.5)
No	170	3,351	1.0 (ref.)	1.0 (ref.)

^a Night sleep was the unit of analysis for the parasomnias

* $p < 0.01$, ** $p < 0.001$, *** $p < 0.05$, **** $p < 0.0001$,

6.0) for sleep periods that were not associated with parasomnia, $p = 0.02$. Of 3,864 night sleep periods 456 were <5 h, 2,646 were 5–7 h, and 762 were >7 h in duration. Parasomnias were reported during 195 (5%) night sleep periods. The number of parasomnias which occurred during sleep periods were 31 during sleep <5 h, 95 during sleep periods 5–7 h, and 69 during sleep periods >7 h. Sleep <5 or >7 h were associated with parasomnias in univariate analysis, but only sleep >7 h were associated in multivariate analysis. The odds ratios are shown in Table 2.

Parasomnias, hypnotics, and other substances

Hypnotics were used to induce 21 (0.5%) sleep periods, caffeinated drinks were taken before 751 (19%) sleep periods, alcoholic drinks were taken before 51 (1%) sleep periods, while cigarettes were smoked before 22 (0.6%) sleep periods. Intake of caffeinated and alcoholic drinks

were associated with occurrence of parasomnias in univariate analysis, but only intake of alcoholic drinks was associated in multivariate analysis. Odds ratios are shown in Table 2.

Parasomnias, physical exertion, and headaches

Physical activity was heavy before 1,368 (35%) sleep periods, while headaches were reported before 343 (9%) sleep periods. Less parasomnias occurred during sleep which followed heavy physical activity in both univariate and multivariate analysis. There was no association of headaches and occurrence of parasomnias (Table 2).

Parasomnias and nonrestorative sleep

Of 195 night sleeps that were associated with parasomnias 77 (39%) were nonrestorative, while of 3,669 that were not associated with parasomnias 891 (24%) were nonrestorative. Occurrence of parasomnias was associated with nonrestorative sleep, odds ratio 2.0 (95% CI 1.5–2.8), $p < 0.0001$.

Discussion

Parasomnias, which have been shown in epidemiological studies to be common in childhood [11, 12], are not rare in adults [5]. Lifetime prevalence of 725 per 1,000 for occurrence of any parasomnia in this study shows that a majority of subjects in this population have experienced at least one parasomnia in the past. Incidence of 211 per 1,000 for the occurrence of any parasomnia, however, shows that a smaller proportion of subjects continue to experience parasomnias in adulthood. The finding that none of the parasomnias that were experienced in the past have disappeared in the adult population indicates that all the parasomnias persist into adulthood in some subjects.

Cultural factors, race, and life experiences have been associated with occurrence or interpretation of the phenomenon of parasomnias [13]. Occurrence of sleep paralysis was higher in African Americans than in white Americans in a study [13]. The influence of cultural background on the interpretation of the phenomenon of sleep paralysis was shown in a case series study [14]. A study, which compared occurrence of sleep paralysis in Canadian and Japanese populations [15], and a study which compared a population in Boston and in Shanghai [16], however, show similar magnitude of occurrence and interpretation of the phenomena. This study, however, shows that occurrence of parasomnia may be high in a black population that is not low in educational background. Thus, biological factors may be more important

determinants of occurrence of parasomnias than social or cultural factors, although the cultural background of subjects in some populations may influence their interpretation of occurrence.

Disorders of non-REM sleep

Prevalence of sleepwalking, which consists of a series of complex behaviours that are initiated during slow wave sleep and result in walking during sleep [3], varies from 10 per 1,000 [3] to 145 per 1,000 [17]. In a population of adults prevalence of sleep walking was 20 per 1,000 [5]. In this study lifetime prevalence of 43 per 1,000 shows that this parasomnia is relatively uncommon in this population, while incidence of 14 per 1,000 shows that a small proportion of subjects continue to experience this parasomnia into adulthood.

Sleep terrors, which are characterized by sudden arousal from slow wave sleep with a piercing scream or cry, accompanied by autonomic and behavioral manifestations of intense fear [3], is a common parasomnia in childhood [4, 18]. Its prevalence in children varies from 30% [3] to 398 per 1,000 [17], but prevalence of 22 per 1,000 [5] was found in an adult population. In this study lifetime prevalence of 112 per 1,000 for night terrors shows that about one tenth of the population have experienced this parasomnia, while incidence of 11 per 1,000 shows that this parasomnia persists into adulthood in this population.

Confusional arousals consist of confusion during and following arousals from sleep, usually from deep sleep in the first part of the night [3]. Confusional arousal is usually described in childhood [3]. This parasomnia was the commonest non-REM parasomnia that was found in a study of adult population in the United Kingdom at prevalence of 42 per 1,000 [5]. In this study incidence of 170 per 1,000 shows that confusional arousal is the commonest parasomnia that is experienced in adults in this population. The lifetime prevalence of the combination of sleepwalking and sleep terrors is less than that of the combination of nightmares and sleep paralysis in this population.

Disorders of REM sleep

Lifetime prevalence of 591 per 1,000 for occurrence of nightmares and sleep terrors in this study shows that this is the commonest group of parasomnias that occurs in this population. Incidence of 28 per 1,000 for this group of parasomnias shows that a small proportion of the subjects in this population continue to experience this group of parasomnias.

Nightmares are frightening dreams that usually awaken the sleeper from REM sleep [3]. Between 10 and 20% of children experience nightmares that disturb their parents,

while 50% of adults have occasional nightmares and 1% have one or more nightmares per week [3]. In this study lifetime prevalence of 475 per 1,000 for nightmares shows that this is the commonest parasomnia that has been experienced in this population. However, incidence proportion of 18 per 1,000 show that incidence of nightmares is low in this population. High occurrence of nightmares in adult populations has been associated with traumatic environmental events [19, 20]. In the USA occurrence of nightmares was shown to increase after the September 11th event in the USA [21]. Thus, the low incidence of nightmares in this population may be attributed to absence of environmental disasters or social traumas.

Sleep paralysis consists of a period of inability to perform voluntary movements at sleep onset, hypnagogic or predormital form, or upon awakening, either during the night or in the morning, hypnopompic or postdormital [3]. Lifetime prevalence of isolated sleep paralysis in the general population in Germany and Italy was shown to be 62 per 1,000 [5]. A study of sleep paralysis in the Nigerian general population shows lifetime prevalence of 67 per 1,000 [18], prevalence in the past 1 year of 20 per 1,000 [18], and prevalence in the past month of 5 per 1,000 [18]. Although occurrence of sleep paralysis is higher in blacks in some studies [22, 23], findings may be due to differences in methodology. A study of comparative prevalences of isolated sleep paralysis showed prevalence of 299 per 1,000 in Sudanese, 288 per 1,000 in Kuwaiti, and 245 per 1,000 in American college students [22]. In Nigerian medical students prevalence of isolated sleep paralysis was 261 per 1,000 [24]. In this study lifetime prevalence of 225 per 1,000 for sleep paralysis, which is in the range that was found in an early study of Nigerian medical students [24], shows that this parasomnia has been experienced by nearly a quarter of the population. Although lifetime prevalence may be high for sleep paralysis in the community, prevalence of 8 per 1,000 for weekly occurrence in the German and Italian populations [5], and prevalence of 5 per 1,000 for occurrence in the past month in the Nigerian study [18] showed that the rate of occurrence of this parasomnia in adult population is low. The finding of incidence of 14 per 1,000 in this study shows that this parasomnia persist into adulthood in only a small proportion of the population.

Disorders of sleep-wake transitions

Lifetime prevalence of 359 per 1,000 for occurrence of sleep starts and sleep talking shows that this is the second commonest group of parasomnias that have been experienced in the past in this population.

Sleep starts, which are sudden brief contractions of the legs, sometimes also involving the arms and head, at sleep onset [3], occur at prevalence of 600–700 per 1,000 in

normal population [3]. Sleep starts can be sensory or motor, but motor sleep starts are more common [25]. Lifetime prevalence of 43 per 1,000 for sleep starts in this study shows that this parasomnia is relatively uncommon in this population. Incidence of 33 per 1,000, however, show that a large proportion of subjects continue to experience this parasomnia into adulthood.

Lifetime prevalence of 322 per 1,000 for sleep talking shows that this parasomnias has been experienced by a third of the population. This parasomnia was not included in the incidence questionnaire because the majority of the subjects lived alone at the time of the study.

Other parasomnias

Sleep enuresis is characterized by recurrent involuntary micturition that occurs during sleep [3]. In children prevalence of sleep enuresis could be up to 250 per 1,000 [17]. In adults prevalence of nocturnal enuresis varies from 2 to 38 per 1,000 [26, 27]. A study of 18 to 64 year old in the Netherlands showed prevalence of 5 per 1,000 for subjects who had bedwet at least once in the past month [28]. Lifetime prevalence of 344 per 1,000 for occurrence of enuresis shows that this is the second commonest parasomnia that have been experienced at any time in the past in this population. Incidence of 4 per 1,000 shows, however, that persistence into adulthood is least for this parasomnia.

Risk factors

The risk factors for specific parasomnias were not investigated in this study, but the risk factors that are associated with occurrence of any parasomnia during night sleep were. Intake of alcohol increased occurrence of confusional arousal, night terror, and sleepwalking, while heavy intake of caffeinated drinks, ≥ 6 cups per day, increased occurrence of sleep walking in a population study [5]. In this study univariate analysis shows that parasomnias are more likely to occur during the night which followed intake of alcohol and caffeinated drinks. In multivariate analysis, however, only intake of alcohol is associated with parasomnias.

Heavy physical activity has been associated with occurrence of parasomnias [3]. In this study, however, heavy workload during the day was associated with less occurrence of parasomnia in both univariate and multivariate analysis.

Gender, smoking, use of hypnotics, and headaches were not associated with occurrence of parasomnias in univariate or multivariate analysis in this study. Gender has also been shown not to be associated with occurrence of parasomnia [29].

The finding that only 5% of all sleep periods in this study are associated with parasomnias shows that most of the sleep periods are free of parasomnias. When the duration of sleep is long, however, there is increase occurrence of parasomnias, which is shown in both univariate and multivariate analysis. Thus short or long duration of sleep, relative to the average duration of sleep of the subjects, may induce occurrence of parasomnias.

Increased occurrence of parasomnias have been associated with nonrestorative sleep [30]. In this study also occurrence of parasomnias is associated with nonrestorative sleep. This association may be related to intra-night awakenings that accompany parasomnias.

Perception of aliens

Perception of aliens during night sleep describes the experience of the presence of beings in the room, which induces fear or panic. This has been reported in several cultural settings [31, 32] where subjects attributed the experience to assault from demons or other extraterrestrial beings [33]. This experience occurs commonly in association with sleep paralysis [32, 33], but suggestions of possible associations with abnormal temporal lobe activity, false memories, and psychopathology have been made [31]. Unusual experiences during night sleep in Nigeria is often attributed to *nocturnal warfare* with spiritual enemies [34]. The findings of this study shows that perception of aliens in the absence of sleep paralysis is not rare in this population.

Conclusions

This study shows that more than 70% of the population have experienced parasomnias at any time in the past. Nightmares, enuresis, sleep paralysis and night terrors were the commonest parasomnias experienced in the past, while confusional arousal, sleep starts, and nightmares are the commonest parasomnias currently experienced. Incidence estimates show that all parasomnias persist into adulthood at reduced rates, but reduction of occurrence was greatest for enuresis. Long duration of night sleep and intake of alcohol predisposed to higher occurrence of parasomnias.

Acknowledgments The study in this manuscript, which involves humans, was approved by local authority, and have been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki. All subjects gave their informed consent prior to their inclusion in the study.

Conflict of interest statement There is no financial relationship with any organization with respect to the concept of this study, or the generation, analysis, and interpretation of data that is submitted in this manuscript. Thus, no conflict of interest is declared.

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