Insomnia and potential risk factors during pregnancy

Original paper

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K N Kumarasinghe[a], C V Jayawickrama[a], T S Karunasekara[a], S Jayashani[a] C V Senaratna[b]

Abstract

Background: Insomnia during pregnancy adversely affects both mother and newborn, but evidence for its proportion and potential risk factors in Sri Lankan pregnant women is limited. Therefore, this study aimed to determine the proportion and factors associated with insomnia during pregnancy.

Methods: A descriptive cross-sectional study was conducted among 404 antenatal women who participated in pregnancy-support groups on Facebook during the COVID-19 pandemic. They responded to a self-administered questionnaire that included the Insomnia Severity Index (ISI) to detect insomnia and questions adapted from the Stanford Sleep Questionnaire and an abbreviated version of the Penn State Worry Questionnaire to determine associated factors. Habitual sleep efficiency was calculated using the Pittsburgh Sleep Quality Index (PSQI). Logistic regression models were used to determine the associations of risk factors with insomnia.

Results: The proportion of insomnia overall was 32.7%, with proportions of moderate and severe insomnia being 28% and 1.5%, respectively. The proportion of insomnia was lowest in the 1st trimester (19.2%) and highest in the 3rd trimester (42.8%). The risk factors that were associated with insomnia included age ≥30 years (OR = 1.6, 95% CI 1.09-2.52), third trimester (OR = 3.1, 95% CI 1.49-6.56), overweight or obesity in early pregnancy (OR = 1.8, 95% CI 1.04-3.16), irregular sleep routine (OR = 5.2, 95% CI 3.28-8.42), sleeping on lateral position (OR = 1.6, 95% CI 1.03-2.71), trait of worry (OR = 2.4, 95% CI 1.50-4.02), night back pain (OR = 1.7, 95% CI 1.01-2.91), difficulty in breathing (OR = 2.4, 95% CI 1.37-4.39), heart burn and regurgitation (OR = 1.9, 95% CI 1.24-2.99), and awakening due to foetal movements (OR = 1.8, 95% CI 1.14-2.96).

Conclusion: Insomnia during pregnancy was high and may have clinical implications for primary antenatal care practice. Many factors associated with insomnia during pregnancy are modifiable and can form the basis for prevention and management.

Key words: pregnancy, insomnia, risk factors

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[a] *Faculty of Medical Sciences, University of Sri Jayewardenepura, Nugegoda, Sri Lanka.*

[b] *Department of Community Medicine, Faculty of Medical Sciences, University of Sri Jayewardenepura, Nugegoda, Sri Lanka.*

Correspondence: KNK, e-mail: kasuni123nim@gmail.com

https://orcid.org/0000-0003-3591-3590

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Introduction

Insomnia is the most common sleep disorder[1]. It is characterised by difficulty in initiating and/or maintaining sleep, including waking up frequently during the night or waking up too early with being unable to go back to sleep[2]. Its prevalence in the general population varies from 10% to 30%[1]. In pregnant women, this varies more widely from 17% in USA[3], through 20% in China[4], 32.5% in Nigeria[5], and 52.2% in Turkey[6], to 61.9% in Norway[7]. This significant variation in prevalence suggests that there could be country- or culture-specific elements that drive this high prevalence. Furthermore, insomnia prevalence in pregnant women progressively increases during pregnancy[8] from 40-44% in first trimester to nearly 64% in third trimester[8,9]. Insomnia during pregnancy causes endocrine, cardiovascular, neurological, and psychiatric disorders among pregnant women[2,10] and preterm and prolonged labour[10]. Despite insomnia's role in increasing maternal and foetal disease burden in a country[10], there is limited evidence on insomnia during pregnancy in the South Asian region[4,10] including Sri Lanka.

Knowledge on risk factors for insomnia during pregnancy could be used to flag high-risk women for early diagnosis, and any knowledge on modifiable risk factors could be additionally useful in management of insomnia during pregnancy. These factors include comorbidities such as depression[3,4,6,7,11], lower back pain (REF)[7], pelvic girdle pain[7], high blood pressure[12] and restless-leg-syndrome[6] and pregnancy related factors such as awakening due to foetal movements[13,14], frequent nocturia[6], uncomfortable sleeping postures[6] and pre-gestational insomnia[8]. Maternal sleep efficiency also declines[15] throughout the pregnancy[16] due to negative sleep environment[4] and environmental temperature[13]. However, the evidence for many other factors associated with insomnia during pregnancy are equivocal, including for advanced maternal age[3-5,7,10,12,17], educational level[3,18], having other living children[5,7,8] and disturbed relationship with bed partner[4,13]. Such equivocal evidence also exists for the association of gestational trimester[3-5,8] and pre-gestational obesity[5,8] with insomnia.

Given the highly variable prevalence of insomnia during pregnancy in various settings, limited evidence available on the factors associated with it, especially in the South Asian region, and the uncertainty of their significance, we aimed to describe these among Sri Lankan pregnant women.

Methodology

Study design and data collection

This descriptive cross-sectional study was conducted in Sri Lanka from 18 December 2020 to 31 January 2021. We initially planned this study to be conducted in a clinic-based representative sample using cluster sampling but this was made impossible by COVID-19 related access restrictions imposed in Sri Lanka at the time of the study. We considered using telephone surveys in a community or clinic-based sample accessed through hospital or field antenatal clinics to overcome these restrictions. However, this was impossible due to ethical, health, administrative, financial, and logistic considerations. The alternative was an online survey. The feasible options for recruitment for an online survey during that period were through social media such as Whatsapp groups and Facebook groups. The most pragmatic access to a large sample of antenatal women with minimal systematic bias was through Facebook. Therefore, we identified Facebook groups that functioned as platforms intended for antenatal women in Sri Lanka to recruit the participants from. We found five such groups. Each group had around 500 to 800 active participants, as shown by reaction rates in those groups. We then contacted the administrators of those Facebook groups for their support, who facilitated inviting all group members to participate in our study. The eligibility criteria were being pregnant and conversant in Sinhala or English. The only exclusion criterion was being younger than 18 years.

We designed a self-administered questionnaire as a Google form and posted it in these Facebook groups with endorsements of the administrators, inviting all women who fulfil eligible criteria to respond. The invitation and the link to the Google form were also group-messaged to individual women. The first part of the form assessed the eligibility criteria and terminated the form-filling for those ineligible. The eligible participants provided informed written consent before proceeding to complete the questionnaire.

This questionnaire included the insomnia severity index (ISI)[19] to determine insomnia by night sleep, questions on socio-demographic characteristics and obstetric history, past medical history, and sleep history, and questions on factors associated with insomnia adapted from the Stanford sleep questionnaire[20]. Questions to assess the state of worry were adapted from an abbreviated version of the Penn State Worry Questionnaire (PSQW-A)[21]. Questions in the Pittsburgh Sleep Quality Index (PSQI) were used to obtain information for the calculation of habitual sleep effi-

ciency[15], and a question on having pregestational insomnia was included additionally. The participants were instructed to refer to their pregnancy health record mandatorily provided to all pregnant women in the country to report the body mass index (BMI) at booking visits.

Data analysis

The presence of insomnia was determined using ISI cut-off score of 10[19]. Mild insomnia was defined as ISI score of 10-14, moderate insomnia as ISI score of 15-21, and severe insomnia as ISI score of 22-28[22].

BMI was classified as normal (18.5-22.9kgm^{-2}), overweight (23-24.9kgm^{-2}), and obese (>24.9kgm^{-2}) using the cut-off scores recommended for Asian populations[23]. The level of habitual sleep efficiency was calculated using the Pittsburgh Sleep Quality Index (PSQI)[17]. Any presence of worry was defined as having a PSWQ-A score of 22 or more[21].

The data was analysed using Statistical Package for the Social Sciences (SPSS) version 26. Descriptive data were presented as frequency and percentage, mean and standard deviation (SD), or median and interquartile range (IQR) as appropriate. Regression models were used to determine the association of selected factors with insomnia during pregnancy. A directed acyclic graph was used to determine the minimum sets of covariates to be included in the regression models.

Ethical clearance was obtained from the Ethics Review Committee of the Faculty of Medical Sciences, University of Sri Jayewardenepura (ERC ref: CM/43/2020).

Results

A total of 404 eligible women responded to the questionnaire. Their basic characteristics are given in Table 1. Their median (IQR) age was 29(4) years. The majority were in the second trimester (51.2%), employed (57.7%), and had no living children (75.2%). The median (IQR) BMI of the sample was 23.7 kg/m^2 (5.9 kg/m^2).

Table 1. Basic characteristics of the sample

		Frequency (%)
Age[*a] (years)	< 30	227 (56.2)
	≥30	177 (43.8)
Education	Grade 1 - Grade 5	1 (0.2)
	Grade 6 - Grade 11	9 (2.2)
	G.C.E. O/L pass	35 (8.7)
	G.C.E. A/L pass	101 (25.0)
	Tertiary education	258 (63.9)
Trimester	First	57 (14.1)
	Second	207 (51.2)
	Third	140 (34.7)
Employment status	Employed	233 (57.7)
	Unemployed	171 (42.3)
Number of living children	None	304 (75.2)
	1	75 (18.6)
	2	24 (5.9)
	3	1 (0.2)
BMI[**] (kg m^{-2})	Underweight	23 (5.7)
	Normal	100 (24.8)
	Overweight	39 (9.7)
	Obese	110 (27.2)
	Not responded	132 (32.7)

[a:24], G.C.E.: General Certificate of Education, O/L: Ordinary Level, A/L: Advanced Level, BMI: Body Mass Index,
[*] Median age = 29 years (IQR = 4), [**] Median BMI=23.7 kgm^2 (IQR=5.9).

The proportion of insomnia (ISI score 10 or more) was 32.7% (n=132). The proportions of mild, moderate, and severe insomnia were 3.2%, 28.0%, and 1.5%, respectively. The proportion of insomnia increased from 19.2% in the 1st trimester through 29.5% in the second trimester to 42.8% in the 3rd trimester. Those with insomnia spent more time in bed awake leading to low sleep efficiency compared with those without insomnia (Table 2).

After adjusting for the confounding variables, insomnia was associated with age ≥30 years (OR=1.6, 95% CI 1.09-2.52), third trimester (OR=3.1, 95% CI 1.49-6.56), overweight or obesity early in pregnancy (OR=1.8, 95% CI 1.04-3.16), irregular sleep routine (OR=5.2, 95% CI 3.28-8.42), sleeping on lateral position (OR=1.6, 95% CI 1.03-2.71), trait of worry (OR=2.4, 95% CI 1.50-4.02), night back pain (OR=1.7, 95% CI 1.01-2.91), difficulty of breathing (OR=2.4, 95% CI 1.37-4.39), heart burn and regurgitation (OR =1.9, 95% CI 1.24-2.99), and awakening due to foetal movements (OR=1.8, 95% CI 1.14-2.96) (Table 3).

Table 2. Sleep characteristics of the sample

	Total sample n = 404 Median (IQR)	**Women with insomnia n = 132 Median (IQR)**	**Women without insomnia n = 272 Median (IQR)**
Bed time (hour: minutes)	10:00 pm (1:00)	10:00 pm (1:00)	10:00 pm (1:00)
Sleep onset latency (minutes)	30 (30)	45 (38)	30 (30)
Number of awakenings in the night	3 (2)	3 (2)	2 (2)
Time of waking up in the morning (hours: minutes)	6:00 am (1:30)	6:00 am (1:11)	6:00 am (1:15)
Time of getting out of bed (hour: minutes)	6:30 am (1:15)	6:30 am (1:30)	6:30 am (1:07)
Duration between awakening and getting out of bed (minutes)	12.5 (30)	15 (29)	10 (30)
Total Sleep Duration (hours: minutes)	6:50 (1:45)	6:00 (1:59)	7:05 (1:36)
Time duration in bed (hours: minutes)	8:30 (1:30)	8:52 (2:00)	8:39 (1:30)
Habitual sleep efficiency (%)	80.95 (15.47)	71.43 (20.41)	84.44 (10.56)

IQR: interquartile range.

Table 3. Association of potential risk factors with insomnia during pregnancy

	Adjusted OR	(95% CI)	P value
Age ≥30 years	1.6	1.09-2.52	0.017
Trimester			
Second trimester	1.7	0.84-3.59	0.130
Third trimester	3.1	1.49-6.56	0.002
Booking visit BMI			
Underweight	0.5	0.18-1.92	0.390
Overweight and obese	1.8	1.04-3.16	0.035
Irregular sleep routine	5.2	3.28-8.42	0.000
Occupational physical activity level			
Moderate physical activity	0.9	0.47-1.79	0.819
Vigorous physical activity	1.1	0.41-2.82	0.869
Number of living children			
1	0.7	0.44-1.34	0.358
2 or more	1.2	0.50-2.80	0.694
Back pain at night	1.7	1.01-2.91	0.043
Difficulty of breathing at night	2.4	1.37-4.39	0.003
Heart burn or regurgitation at night	1.9	1.24-2.99	0.003
Hypertension	1.1	0.20-6.29	0.890
Gestational diabetes	0.8	0.38-2.02	0.765
Predominantly sleeping in lateral position	1.6	1.03-2.71	0.034
Bedroom environment perceived as uncomfortable	1.3	0.63-2.71	0.466
Pets in the bedroom	0.6	0.13-3.42	0.642
Watching television before sleep	0.9	0.50-1.84	0.906
Using mobile phones/electronic devices before sleep	0.9	0.51-1.70	0.829
Reading/studying any books/notes/newspapers before sleep	0.7	0.42-1.21	0.216
Having a snack before sleep	1.2	0.76-2.11	0.350
Drinking coffee/tea before sleep	1.0	0.49-2.13	0.930
Doing exercises	0.8	0.52-1.50	0.658
Shortening of sleep due to other children	1.4	0.68-3.23	0.321
Pre-gestational insomnia	1.0	0.16-6.57	0.961
Trait of worry*	2.4	1.50-4.02	0.000
Awakening due to foetal movements at night	1.8	1.14-2.96	0.012
Awakening due to nocturia	1.2	0.65-2.45	0.487
Worries about COVID-19 related social restrictions	1.3	0.85-2.01	0.208

*Trait of worry was calculated using the abbreviated version of Penn State Worry Questionnaire (PSQW-A), [a:24]

Discussion

Using a cross-sectional online survey, we found a high proportion of insomnia during pregnancy and several potential risk factors. Overall, the women in our sample spent 8 hours and 30 minutes in bed, but the median total sleep time was 6 hours and 50 minutes. As expected (Table 2), those with insomnia spent a longer time in bed (8 hours and 52 minutes) but slept for only 6 hours on average.

The substantially high proportion (32.7%) of clinically significant insomnia (ISI score 10 or more) detected in our sample is higher than what has been reported in most countries in previous studies[3-5], but higher proportions have also been reported[6,7]. Cultural differences that influence various aspects of women's lives and strategies used in coping with life issues likely explain these differences in proportions[25]. Despite the potential of the COVID-19 pandemic to change daily lifestyles and mental health status[26] of the individuals due to social isolation that could affect sleep, our study showed no significant association of COVID-19 related social restrictions with insomnia (p=0.208), possibly due to strong social support available within the local culture. Although severe insomnia of 1.5% that we found in our sample compares with 2.4% previously found in Bangladesh, it has a similar socio-economic background. The proportion of moderate insomnia in our sample is much higher than that found in Bangladesh (28% vs 19%)[10]. Given that both studies used ISI to determine insomnia, this difference is difficult to explain but could be due to the effect of latent socio-economic and cultural variables[25]. Our finding of a progressive increase in the proportion of insomnia over the course of pregnancy confirms existing evidence[8,9].

The high proportion of insomnia may have significant clinical implications given that insomnia during pregnancy is associated with adverse pregnancy outcomes such as endocrine, cardiovascular, neurological and psychiatric disorders in pregnant women[2,10] and preterm and prolonged labour[10]. Currently, there is no routine mechanism to identify insomnia during pregnancy and sleep complaints of pregnant women often do not receive much attention during routine clinical encounters. If this high proportion of clinically significant insomnia can be confirmed in population-based studies, it would flag the need for healthcare interventions during the antenatal period.

Any primary or secondary preventative intervention for insomnia during pregnancy requires identification of its risk factors, in particular, the modifiable risk factors. Many associations that we found in our study add to the current equivocal evidence. We found that advanced maternal age (≥30 years) to be a risk factor, confirming what was previously found in South West Nigeria[5], Spain[3] and Turkey[6], although other studies done in China[4], Poland[17], Norway[7] and Bangladesh[10] had found no such association. These studies that found no association between age and insomnia used scales different from ISI to identify insomnia, including a combination of the Diagnostic and Statistical Manual of Mental Disorders (4th edition; DSM-4) and International Classification of Diseases (10th Revision; ICD-10) criteria[4] and Athens Insomnia Scale (AIS)[27], which could, at least partially explain these differences. Similarly, our finding of third trimester as a significant risk factor for insomnia differs from the finding of no association in a Nigerian study[5] using ISI. Other studies that used the Women's Health Initiative Insomnia Rating Scale[9] and Athens Insomnia Scale (AIS)[8], however, have found the third trimester to be a risk factor. Mental stressors, physical changes, and co-morbidities likely stack up towards the late stages of pregnancy with potential worsening of insomnia during these stages. Our finding of overweight or obesity as a risk factor confirms what was reported in Turkey, where women with a BMI of >25kgm^{-2} had a higher risk of insomnia[6]. On the other hand, no significant association was seen between BMI and insomnia during pregnancy in China[4,18] and Spain[12]. The debate on the association (or the lack of it) between insomnia and BMI is complex[28], and the role of reverse causation cannot be excluded, given our study design.

The association that we found between back pain and insomnia confirms what was reported from Norway[7], USA[13] and Poland[14]. Difficulty of breathing, heart burn and regurgitation at night could also wake people up leading to insomnia[13,29]. Gestational diabetes mellitus or pregnancy-induced hypertension could lead to anxiety and thereby cause insomnia[12], but we found no association between these conditions and insomnia[17]. This lack of association is consistent with what was reported from Poland[17] but contradicts findings from Spain[11] and may arise from poor awareness of the consequences of these comorbidities, perceived better control of the comorbidities, or better coping with mental stress[11] and may arise from poor awareness of the consequences of these comorbidities, perceived better control of the comorbidities, or better coping with mental stress. The association that we observed between sleeping on lateral position and insomnia could potentially be due to discomfort

associated with that position, as shown in a Turkish study[6]. An uncomfortable sleeping position also increases the number of awakenings as the pregnancy progresses[30]. Worry was associated with insomnia in our study, similar to what was previously reported from Lebanon[18] and Iran[30]. Although our findings confirm existing evidence of foetal movements as a risk factor for insomnia[13,14], the lack of association that we found between frequent nocturnal urinations and insomnia contradicts strong associations detected in studies done in Turkey[6], USA[13,32], Poland[16], and Japan[33]. This is an unusual finding that is difficult to explain but could be due to the low statistical power in our sample to detect this association.

Strengths and limitations

The main strength of our study is the use of validated questionnaires to detect insomnia during pregnancy and other sleep and comorbidity related factors that improve the validity of the findings and their comparability. To overcome the limitations imposed by the COVID-19 pandemic, we used the method that was expected to capture the highest possible variability of the target population; the other online access methods, such as Whatsapp groups, would have limited this variability. We collected anonymised data that improved the responsiveness and accuracy of responses to culturally sensitive questions. We included all antenatal support groups intended for Sri Lankan women on Facebook, thereby not missing anyone who participated in such groups.

Our study had several limitations. Given the recruitment method, our sample is biased towards those who use online social media and participate in antenatal support groups. However, due to the COVID-19 pandemic, many Sri Lankans used Facebook during the study period, and given the restrictions related to the COVID-19 pandemic, many users were likely to have sought support within the support groups similar to the ones that we used. Nevertheless, our findings must be corroborated using population- or field clinic-based samples. Our study may also be underpowered to detect some associations between potential risk factors and insomnia during pregnancy, as our findings show. We were unable to verify the eligibility criteria other than from the responses provided by the respondents. Furthermore, due to the nature of the study, use of clinical assessment that would have better identified outcome measures and a more reliable method of data extraction from clinical records could not be performed.

Conclusions

The proportion of insomnia among pregnant women was high and increased throughout the duration of pregnancy. This high proportion could have clinical implications for both women and their offspring, but our findings must be corroborated from population-based studies to inform any public health initiatives. In the meantime, the associations that we found between potential risk factors and insomnia during pregnancy can be used by clinicians who provide routine care to pregnant women to identify those who are at risk of insomnia so the presence of the disease can be actively explored and relevant actions taken to minimise harm to women and their offspring.

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