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Prevalence of Tinnitus and Associated Factors during Pregnancy: A Cross-Sectional Study Conducted in Saudi Arabia

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Abstract: ***Ear, nose, and throat manifestations in pregnancy vary. Pregnancy initiates a distinct set of physiologic changes in the female body, many of which manifest as otolaryngology issues. One such common presentation is tinnitus. In this study, we aimed to analyze the prevalence of tinnitus and its associated risk factors in pregnancy .An observational descriptive cross-sectional study was conducted at the National Guard Hospital Al-Ahsa; we included 199 participants ranging in age from 19 to 42 years old, between 2021 and 2022. We investigated the prevalence of tinnitus using a questionnaire and analyzed the possible factors associated with tinnitus using simple and multiple logistic regression analysis with complex sampling. : The prevalence of tinnitus in pregnancy was 16.08% among the pregnant women (gestational age: of 35±8.5 weeks) Anemia was reported in 68.75% of the participants with tinnitus p<0.0001). Tinnitus was not related to coffee intake, stress, or sleep habits (p< 0.05). Most of the participants' tinnitus relief spontaneously without any medical treatment. In conclusion, tinnitus was significantly prevalent among pregnant women, especially in the third trimester. Tinnitus was significantly associated with anemia. Further studies are required to evaluate any causal associations between tinnitus during pregnancy and other factors.***

Keywords: tinnitus, pregnancy, prevalence, risk factors, Saudi Arabia

1. Introduction

Ear, nose, and throat (ENT) manifestations during pregnancy are varies. Pregnancy initiates a distinct set of physiologic changes in the female body. Many of these changes manifest as otorhinolaryngological issues. One of the common ENT presentations is tinnitus. The prevalence of tinnitus varies between countries. A national study of hearing in England (n=48,313) published in 2000 revealed that 10.1% of the adult population exhibited tinnitus and that this incidence increased with age (7).

The prevalence of tinnitus in South Korean adults is estimated to be 19.7% 29.3% of tinnitus patients experience significant symptoms that affect the quality of their daily lives (8).The prevalence of tinnitus is higher in women than in men (9). Severity of tinnitus is not necessarily related to its loudness or psychoacoustic characteristics (10). Most patients with tinnitus are not significantly affected by the symptoms, though some patients experience anxiety, depression, and extreme life changes (11).

Tinnitus has been classified subjective objective, with Subjective tinnitus is audible only to the affected individuals, whereas objective tinnitus can be heard by an external observer as well (11). Tinnitus can also be categorized based on the nature of sound being either pulsatile or non-pulsatile. Non-pulsatile tinnitus is often associated with age-related hearing loss, noise exposure(12),eurological disorders such as brainstem infarction and cerebellopontine-angle tumors. Pulsatile tinnitus often has vascular origins and is caused by conditions such as arterial bruits, high jugular bulb with or without diverticulum, systemic hypertension, venous hums, arteriovenous malformation, and vascular tumors(14). Intracranial hypertension is one of the most common causes of subjective pulsatile tinnitus (13).

The risk factors for tinnitus . However, it is clear that hearing impairment is associated with tinnitus other well-known risk factors are noise exposure, autoimmune disorders, depression, lack of sleep, dyslipidemia, hypertension, sleep apnea, and smoking (156- 17). Many drugs are linked to tinnitus, and salicylate containing drugs such as aspirin are among the most-well-known drugs that induce tinnitus (18) (19).

Treatment of tinnitus must aim resolve the underlying causes and their symptoms. Treatment for tinnitus may include education, counseling, ognitive-behavioral therapy (CBT), hearing aid prescription, sound therapy, and pharmacotherapy. Given the complexity of this condition, there is no definitive cure (20).

The aim of this study is to analyze the prevalence of tinnitus and it is associated risk factors in pregnancy.

2. Literature Survey

In a previous study, the prevalence of tinnitus among pregnant women visiting the Royal United Hospital in Bath was investigated by a postal questionnaire survey; 25% of the pregnant women reported tinnitus compared with 11% of participants in the control group. The result revealed significant prevalence of tinnitus among pregnant women compared with the non-pregnant control group (1).

In cross-sectional study using data from the Korea National Health and Nutrition Examination Survey between 2009 and 2012 19,290 participants ranging from 20 to 98 years old were included. The estimated prevalence of tinnitus was

20.7%. The associated factors were identified to be female sex, stress, hearing impairment, sleep disorders, smoking, dyslipidemia, osteoarthritis, bronchial asthma, thyroid disease, rheumatoid arthritis, and presence of depression (15).

In addition, a systematic review investigated the prevalence of tinnitus in adults from January 1980 to July 2015 and reported that the estimated prevalence ranged from 5.1% to 42.7% (3). Another cross-sectional study investigated a total of 4633 premenopausal women in Korea between 2010-2012. The overall prevalence of tinnitus was 21.6%. Women with tinnitus and irregular menstrual cycles had significantly highest rates of depression, stress, and suicidal ideation (4).

3. Significance of the study

Tinnitus is a common problem among pregnant women, and the reported prevalence is variable. Despite the importance and devastating consequences of tinnitus, this problem remains under-reported in Saudi Arabia. Based on our literature review, there are no studies in Saudi Arabia about tinnitus and its risk factors in pregnancy. This study aims to estimate the prevalence of tinnitus and its associated factors in pregnancy at a tertiary hospital in Saudi Arabia. In addition, we will review the pathophysiology and the most common treatment methods of tinnitus in pregnancy.

4. Methods

1) Study design
This study is a cross-sectional survey of the prevalence of tinnitus and its associated factors among pregnant women visiting National Guard Hospital Al-Ahsa, Saudi Arabia. The study was conducted in the period 2021-2022.

2) Study area and setting
This study was conducted at the pregnancy and antenatal care department of the National Guard Hospital, Al-Ahsa, Saudi Arabia, after approval by King Abdullah International Medical Research Center, in addition to Management of Education in Al-Hassa.

3) Study subjects
Pregnant women receiving antenatal care aged 18-50 years at the National Guard Hospital, Al-Ahsa, Saudi Arabia were eligible for inclusion in this study. Eligible individuals who declined participation or refused to sign the consent document were excluded.

4) Sample size
With an assumed 95% confidence interval, a 5% error margin, and a total 400 expected deliveries per month, the required sample size was calculated to be 197 (using http://www.raosoft.com/samplesize.html).

5) Sampling technique
A systematic sampling approach was adopted according to the patient flow at the antenatal care division. The study proceeded to screen the next patient when the selected patient failed to fulfill the inclusion criteria.

6) Data collection
In this study, self-administered questionnaires were distributed to pregnant patients the National Guard Hospital, Al-Ahsa after patient consent was obtained Variables is the ment. The first part of the questionnaire included items on demographic characteristics and the past medical, surgical, and clinical history the second part addressed pregnancy status and associated medical issues, and the third part included items on tinnitus, associated factors, and possible treatment options.

7) Data management and analysis
Data were entered into a personal computer and analyzed using the Statistical Package for the Social Sciences (SPSS) software. All variables were coded before entry and examined for accuracy before analysis. Descriptive statistical analysis presented mean and standard deviation for continuous variables and as percentages and frequencies for categorical data.

Significance determined at a p-value of 0.05 and a confidence interval of 95%. A T-test applied to compare continuous data and a chi-square test to compare categorical variables. Mann-Whitney Test and Fisher‘s exact test was were used to compute the p-value P-value was computed using chi-square proportion equality test with a p value of<0.001 considered statistically highly significant

5. Results

A total of 199 questionnaires were sent to study group of including pregnant women attending ante-natal clinic. Statistical analysis of the results was performed using SPSS. P-value was computed using chi-square proportion equality test with a value of<0.001 considered statistically highly significant.

Analysis of all questionnaires retuned showed the age ranged from 19 years to 42-years to 19-years with a median age of 26 years. (Table 1 The gestational age ranges between 10 weeks and 39 weeks. Gravity is 2 ± 2. Tinnitus was reported by 32 of 199 pregnant women (16.08%); the prevalence of tinnitus in this pregnant population is significant (p<0.0001).

Of those with tinnitus, 75% did not have current nor past ear complaints nor positive past medical history of chronic illnesses.
Around Approximately 69 % (p <0.0001) of pregnant women with tinnitus have exhibited anemia, which that indicates the presence of a significant correlation between development of tinnitus & anemia and the development of tinnitus.(Table 3).

Gestational diabetes was reported by 44% of the women who with have tinnitus with the p-value of 0.0004.

With regards to gestational age, it was found that most of women developed tinnitus during the 3rd trimester (35 ±8.5 weeks) with p-value of <0.0001 indicating high significance.

There is no statistically significant correlation between tinnitus during pregnancy and irregular menstrual cycle, napping, daily life activities, development of headache, neck movement, coffee consumption, or stress (p-value >0.001) (Table 4).

With regards to tinnitus characteristics, Most tinnitus cases were bilateral, intermittent, moderately loud, and the tinnitus was described as a wheezing sound (Table 2).

Most participants of the subject did not use any medication for their tinnitus.

Table 1: Demographic data

Descriptive statistics for questions	Median±IQR	Maximum	Minimum
Age	26±6	42	19
Gestational age	26±14	39	10
Gravidity	2±2	7	1
HGB (hemoglobin)	12±1	13	7
Number of fetuses	1±1	2	1

Table 2: Prevalence & and descriptionve of tinnitus.

Prevalence and description of tinnitus	F (%)
Tinnitus	
Yes	32 (16.08%)
No	167 (83.92%)
Laterality	
Both	14 (43.75%)
Left	9 (28.13%)
Right	9 (28.13%)
Duration	
1 Week	1 (3.13%)
2 Weeks	9 (28.13%)
1 Month	16 (50%)
1 Year	5 (15.63%)
2 Years	1 (3.13%)
Frequency	
Continuous	.
Intermittent	32 (100%)
Severity score	
1	.
2	7 (21.88%)
3	12 (37.50%)
4	10 (31.25%)
5	3 (9.38%)
Characteristics	
Crinkle	4 (12.5%)
Pulsation	10 (31.25%)
Wheezing	18 (56.25%)
Effect on daily life	
Yes	.
No	32 (100%)
Neck pain/limitation of movement	
Yes	.
No	32 (100%)
Dizziness	
Yes	10 (31.25%)
No	22 (68.75%)
Headache	
Yes	10 (31.25%)
No	22 (68.75%)
Hearing loss	
Yes	8 (25%)
No	24 (75%)
Use medication for tinnitus	
Yes	1 (3.13%)
No	31 (96.88%)

Table 3: Associated conditions with tinnitus

Descriptive statistics for associated conditions	F (%)	p-Value
Presence of history of illness		
Yes	31 (15.58%)	<0.0001
No	168 (84.42%)	
Anemia		
Yes	55 (27.64%)	
No	144 (72.36%)	<0.0001
Hearing loss with hearing aid fitting		
Yes	.	
No	199 (100%)	.
Gestational diabetes		
Yes	41 (20.60%)	
No	158 (79.40%)	<0.0001
Pre-eclampsia		
Yes	5 (2.51%)	
No	194 (97.49%)	<0.0001

*P-value was computed using chi-square proportion equality test

Table 4: Aggravating factors of tinnitus

Descriptive statistics for aggravating factors	F (%)	p-Value
Stress		
Yes	2 (6.25%)	
No	30 (93.75%)	<0.0001
Coffee consumption		
Yes	1 (3.13%)	
No	31 (96.88%)	<0.0001
Insomnia		
Yes	5 (15.63%)	
No	27 (84.38%)	0.0001
Anemia		
Yes	22 (68.75%)	
No	10 (31.25%)	<0.0001

Table 5: Association between tinnitus and various factors analytics study

Questions	Reported Tinnitus	Did not Report Tinnitus	p-Value
Gestational diabetes			
Yes	14 (43.75%)	27 (16.17%)	0.0004
No	18 (56.25%)	140 (83.83%)	
Pre-eclampsia			
Yes	5 (15.63%)	.	
No	27 (84.38%)	167 (100%)	<0.0001[a]
Age	28.5±8.5	26±6	0.0065*
Gestational Age	35±8.5	24±19	<0.0001*
Gravidity	4±2	2±1	0.0017*
HGB	10.5±2	12±0.2	<0.0001*

Table 5 : analytics study , *Mann-Wwhitney Test was used to compute the p-value.
[a]Fisher's exact test was used to compute the p-value.

199 questionnaires were sent to study group of pregnant women attending ante-natal clinic. Statistical analysis of the results was performed using SPSS. P-value was computed using chi-square proportion equality test with a value of<0.001 considered statistically highly significant.

Analysis of all questionnaires retuned showed the age range 42-years to 19-years with a median age of 26 years. Gestational age ranges between 10 weeks and 39 weeks. Gravity is 2 ±2. Thirty-Two pregnant women reported tinnitus.

Such prevalence of tinnitus in pregnancy is significant ($p<0.0001$).

Of those with tinnitus, 75% did not have current nor past ear complaints nor positive past medical history of chronic illnesses.
Around 69 % ($p <0.0001$) of pregnant women with tinnitus have anemia that indicates significant correlation between development of tinnitus & anemia.

Gestation diabetes was reported by 44% of women who have tinnitus with the p-value of 0.0004.

With regards to gestational age, it was found that most of women developed tinnitus during the 3rd trimester (35 ± 8.5) with p-value of <0.0001 indicating high significance.

There is no statistically significant correlation between tinnitus during pregnancy and irregular menstrual cycle, napping, daily life activities, development of headache, neck movement, coffee consumption, or stress (p-vlaue >0.001).

With regards to tinnitus characteristics, Most tinnitus cases were bilateral, intermittent, moderately loud, and described as a wheezing sound.

Most of the subject did not use any medication for their tinnitus.

6. Discussion

Tinnitus or ringing sound in the ear is a frequent auditory symptom during pregnancy. Different pathophysiological causes have been proposed for this condition including hyperdynamic circulation, raised perilymphatic fluid pressure and hormonal changes in the body of the pregnant women (Singla et al., 2015; Nappi et al., 1992) (2).

In our survey, the prevalence of tinnitus in pregnant women was high, a and this finding which is consistent with that reported by Bath et al.-Gurr P(1).

Another study conducted in eastern India showed that auditory and vestibular complaints such as hearing loss, vertigo and tinnitus are not uncommon among pregnant women and they are often caused by due to alterations of sex hormones during pregnancy (22).

A similar finding was reported from by a study conducted in *Brasil* (do u mean Brazil?). In that study, in which pregnant women during gestation were frequently have experience dizziness & tinnitus (23).

Similar Study in India report that 14.28% of the study population (12 women (14.28%) presented with tinnitus (27).

It has been reported that Severe tinnitus in pregnancy can lead to early cesarean delivery with a subsequent complete resolution of tinnitus afterwards (Mukhophadhyay et al., 2007) (28).

In our study, there is was a statistically significant correlation between tinnitus during pregnancy and anemia as measured by the hemoglobin level. Similar findings were was published in a case report of pernicious anemia patient who presented with tinnitus which where tinnitus disappeared after the patient received treatment of for the anemia (25)

In contrast, a study done conducted in Korea between 2010 and 2011 reported no significant correlation between anemia and tinnitus ($p=0.064$) (24).

A study published in 1999 reported that Bell's palsy and tinnitus occur more frequently during the third trimester of pregnancy & may represent prodromal signs of underlying early pre-eclampsia (26). In our study, as well, most pregnant women who reported tinnitus were in the third trimester with an average gestational age of if 35 ±8.5 weeks. However, we couldn‘t did not establish observe a significant correlation between tinnitus in pregnancy & and the presence of pre-eclampsiaeclampsia.

A cross-sectional study investigated in premenopausal Korean women between 2010–2012, shows reported that there is a positive association between menstrual cycle irregularity and tinnitus (4). Similar study performed done in UK & published in 2013 reported that menstrual phase plays a significant part in fluctuation of tinnitus severity (29). However, On the other hand, we couldn‘t establish similar relationship between tinnitus and irregular menses and majority of pregnant women we survey questioned reported having regular menstrual cycle.

The characteristic of tinnitus in our study varies between wheezes, crinkles, and pulsations with variation in loudness. We did not find association between development and loudness of tinnitus and head or neck movement, daytime napping, coffee consumption, nor stress.

Interestingly, several reports showed that coffee has protective effect against hearing loss and tinnitus especially in women (30-31).

Although we couldn‘t establish an association between tinnitus and stress, other studies showed that patients tend to report louder and more bothersome subjective tinnitus when they are stressed (32-33). Additionally, an experimental study in rats concluded that tinnitus can develop after stress due to the imbalance in excitatory and inhibitory neurotransmitters in the hippocampus (34).

Almost all women in our study reported that they did not use any medications or other treatment for their tinnitus. According to Sujoy, the overall level of evidence in supporting the need for treating treatment of tinnitus is equivocal(37). Experts agreed that treatment of tinnitus is individualized and usually disease-specific based on specific

disease entity. There are various forms of treatment for treatment modalities for tinnitus that have been tested in properly controlled trials and; these treatments can be are classified as pharmacological, acoustic-physical, and psychological (354-365). In several clinical trials, have been conducting using various no pharmacological agents; the results of these trials showed that none of these agents has been shown to have lasting effect on the presence or severity of tinnitus. Acoustic devices do have been reported to be ineffective in not seem to ameliorating influence tinnitus, although appropriately fitted hearing aids may slightly reduce its prominence. Of With reference to physical treatments, cortical implantation may is promising hold some promise of being effective for tinnitus suppression in selected cases. CBT is A psychological treatment modality, and that has emerged as consistently beneficial is cognitive-behavior therapy (CBT) in terms of affecting overall well-being and reducing level of discomfort due to tinnitus annoyance (36). A combined approach of masking, counseling and attention diversion appears to be the most promising strategy for the future management of tinnitus for audiologists (37). According to a study by Sarah, cognitive behavior therapy CBT is the only treatment that has been shown to improve quality of life in patients with tinnitus. Melatonin, antidepressants, and cognitive training may help with sleep disturbance, mood disorders, and cognitive impairments, respectively. Avoidance of noise exposure may prevent the progression of tinnitus (38).

7. Conclusion

This study demonstrated a significant prevalence of tinnitus during pregnancy especially in the third third trimester. In addition, tinnitus was highly associated with anemia but no association was found between tinnitus andwith coffee intake or stress. Further studies are required to evaluate any causal associations between those these and& other risk factors & and tinnitus.

On the other hand, our study has several limitations, including lack of clinical assessment of participants and their tinnitus follow-up after delivery. It is a cross-sectional study which is vulnerable to recall bias and precluding any causal inference. Further studies are needed to investigate the mechanism of tinnitus in pregnancy & its treatment options

8. Future Scope

On the other hand, our study has several limitations, including lack of. We did not include a clinical assessment of participants and their did not collect follow-up data on the tinnitus follow-up after delivery. It is a cross-sectional study and thus we could not rule out which is vulnerable to recall bias and this study design also precluding the establishment of any causal inference. Further studies are needed to investigate the mechanism of tinnitus in pregnancy & establish effective its treatment options

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